

Urban Wildlife

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CHAPTER

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Introduction

Humans have been experimenting with “urban living” for at least the last six millennia. The scope of this experiment has been described as “massive” and “unplanned” (McDonnell and Pickett 1990), an apt characterization of a phenomenon that is also known by such terms as “sprawl” and “blight.” Urbanization is both a biophysical and a social phenomenon. Among its many measurable physical characteristics are greater concentrations of airborne dust, carbon dioxide, and sulfur compounds and slightly higher precipitation, annual mean temperature, and ultraviolet radiation at ground level than is typical in surrounding hinterlands (Trefil 1994). Among its social consequences are the inhabitants’ alienation and disassociation from natural environments, juxtaposed with attitude and value scales that indicate greater concern for the protection and preservation of such environments and the wildlife that inhabit them than is the case among nonurbanites (Kellert 1996).

While cities cover no more than 1 or 2 percent of a typical habitable land mass, they have an impact that far exceeds their physical presence. In much of the world (and soon in all of it), the urban populace outnumbers the rural. Today, eight of every ten Americans live in towns of fifty thousand or more, with more than half of

the population living in cities of a million residents or more. If projected trends hold true, the majority of all humans on Earth will be urbanites sometime early in the twenty-first century (United Nations 1987). Urban ecosystems demand natural resources and raw materials far in excess of what they can produce and thus have the potential to influence the global ecology. Rees (1996) defines the “ecological footprint” of the city as the area required to supply raw materials, resources, and other opportunities, such as recreation, for urbanites. Direct and indirect ecosystem impacts of cities, varying from air pollution to nitrogen loading, have reached the point at which human influences now extend to the most remote and previously pristine global reaches (Vitousek et al. 1997).

Despite the dominance of humans in the urban environment, other animals flourish there as well. It is almost certain that when humans first began to aggregate in urban communities, specific conditions were established that favored certain plants and animals, which joined humanity in colonizing what were, for them, preferred habitats. These synanthropes have been far less studied than their counterparts elsewhere, and it is tempting to suggest that this is because those who pursue such knowledge have been biased to regard

urban ecosystems and habitats as “artificial” when compared with “natural” ones found outside the human-built environment. Of course, the same ecological processes that affect the “natural” world “out there” affect the “artificial” world of cities “in here.” Undoubtedly, their form, rate, and effects vary with the influence of the built environment, but this may only make their study more relevant and interesting.

Indeed, urbanization may be better understood from an ecological perspective than it is from a socioeconomic one, as is much more common. That said, the consequences of urbanization on natural communities of plants and animals remain largely unknown and may be difficult to understand at all, given the rapidity with which cities and the areas they influence are changing.

Despite the potential for difficulty, there are several reasons why urban wildlife should be valued and better understood. First is its scientific and heuristic value. Urban wildlife populations are essentially parts of ongoing natural experiments in adaptation to anthropogenic stress. How urban animals are affected by human activities—and how they cope with them—can represent, on a highly accelerated scale, a model of what is happening to species in other biomes. No other wild animals live in such intimate contact

and under such constant constraint from human activities as do synanthropes. Second, urban animals are exposed to many environmental hazards and should be considered sentinels on our behalf. Additionally, wildlife in urban environments is apparently quite important to people (Adams 1994; Kellert 1996; Reiter et al. 1999). It may be critical that these coinhabitants maintain a connection between people within the most densely settled human developments and the natural environment. Finally, we argue that there is an inherent value and right for wildlife species to exist, in whatever type of environment they are found. Human beings have a moral obligation to recognize and appreciate the diversity of life and celebrate it by acknowledging the rights of others.

Historical Background

The formal study of urban wildlife is of quite recent origin, although human involvement with wild animals in cities and towns is deeply rooted in history. The Roman historian Josephus, for example, in the first century A.D., mentioned the use of metal spires on the rooftops of Jerusalem to deter birds (possibly storks) from nesting there. Wild animals were undoubtedly tolerated, controlled, or ignored in cities and towns for many centuries without a Josephus to take note. Occasional records surface to detail events as well as afford us a glimpse into changing social mores. In at least two cases, documented from medieval times, efforts were made to use the device of excommunication to control unruly sparrows around places of worship, in the one case for defecating on pews and in the other for “scandalous unchastity” that occurred during the delivery of a sermon (Evans 1906; Ryder 1989). The development of an interest in life’s diversity during the Age of Discovery fueled an understanding of animal lives as phenomena worthy of study, an understanding that previous-

ly had not occurred (Thomas 1983). The subsequent heyday of natural history (Barber 1980) coincided with the onset of the Darwinian revolution and led to increasingly objective, scientific study of animals as well as to a heightened interest in and sympathy for human impact on animals and their habitats. Representative of many general works arising from the increased interest in natural history is Ernest Ingersoll’s *Wild Neighbors* (1899), a combination of natural history, anecdote, and scientific speculation about common urban, as well as decidedly nonurban, species.

In one of the first scientific publications on any aspect of urban wildlife, Shenstone (1912) described the flora of building sites in London, including the role of both wild and domestic animals in transporting seeds to various locations within the city. Probably the first comprehensive description of an urban fauna is Richard S. R. Fitter’s *The Natural History of London* (1945). John Kieran’s *A Natural History of New York City* (1959), is the American counterpart to Fitter’s work. The French geographer Jean Gottman (1961) devoted a chapter in his seminal description of the urban future, *Megalopolis*, to wildlife and forests, but restricted his discussion largely to the role of game species and the conflicts that were caused by the overabundance of animals such as white-tailed deer.

More concerted and focused interest in urban wildlife arose in the late 1960s. The first technical session among wildlife professionals that focused specifically on urban wildlife was organized in 1967 at the Thirty-second North American Fish and Wildlife Conference (Scheffey 1967). That session, “Farm and Urban Resources,” included papers by Stuart Davey (1967) on the role of wildlife in an urban environment, Forest Stearns (1967) on wildlife habitat, and Robert Twiss (1967) on wildlife in the metropolitan environment. The first truly national conference on the subject was convened under the auspices of the U.S. Fish and Wildlife Service (then the Bureau of Wildlife and

Sport Fisheries). “Man and Nature in the City,” held in Washington, D.C., in 1968, marked the emergence of the field of urban wildlife from its previous anonymity. It was followed in 1974 by a symposium organized in Great Britain around the theme of the place of nature in cities and towns, and Laurie (1979) summarized the two events in a collection of papers on the idea of urban green space. Over the next decades, a number of conferences were held (Noyes and Progulské 1974; Euler et al. 1975; Stenberg and Shaw 1986; Adams and Leedy 1987, 1991), each broadening the basis for the discipline. Texts or collected works on urban wildlife were not so forthcoming, although Gill and Bonnett (1973) co-authored an early general work on urban ecosystems that emphasized urban wildlife. Gilbert (1989) published a general work on the ecology of urban habitats that included much information on wildlife, and Adams (1994) issued a general text on urban wildlife habitats that went into almost immediate use in college courses in wildlife management. Platt et al. (1994) contributed a broad overview of the “ecological” city to introduce and emphasize the preservation and conservation of urban biodiversity, thus continuing a tradition of looking at wildlife as a component of the larger urban ecosystem. This tradition has been even better observed in Europe, where studies of urban ecosystems (e.g., Marcuzzi 1979; Sukopp et al. 1995) have probably been more comprehensive, longstanding, and widespread than have those in the United States, if less available.

Works on urban wildlife intended for the general public have long constituted their own literary genre. In the United States, these have ranged from popular works and general natural histories (Beebe 1953; Kieran 1959; Garber 1987) to backyard field guides (Villard 1975; Mitchell 1985) and works that focus on specific urban species (Rublowsky 1967; Kinkead 1974, 1978). Goode (1986) published in England a general description of

the wildlife of London and its environs and Shirley (1996) a general natural history of urban wildlife, both of which, while written for lay audiences, were more science based than many earlier works. Baines (1986) combined a more popular account of English urban wildlife with advice for improving the habitat in backyards to encourage and support wildlife. An interesting variation on the general theme of urban natural history is provided in both English and American examples of the ecological history of a single human dwelling over the passage of several centuries for each (Ordish 1959, 1981).

Although academic interest and focus on urban wildlife is gradually increasing, the field clearly remains under-emphasized in comparison with traditional (resource management, consumptive use) orientations in university curricula. Adams et al. (1985) surveyed ninety-five colleges and universities that offered a wildlife sciences curriculum to determine their involvement in urban wildlife issues. Of the eighty responding, most (92 percent) did not have a recognized urban wildlife program. Of those that did, only 5 percent of all wildlife projects ongoing in the questionnaire year focused on urban wildlife; they devoted only 2 percent of their research budgets to urban wildlife studies. Follow-up surveys have not been conducted, but change, if any, over the intervening fifteen years appears to have been slight. A quick review of articles in the *Journal of Wildlife Management*, the foremost American journal dealing with wildlife study, shows only one of more than three hundred articles published in 1999 containing the words "urban" or "suburban" in its title (it is a study of a nesting raptor population).

The efforts of state and federal agencies to recognize and deal systematically with urban wildlife issues have not seemed equal to the need of urban residents (San Julien 1987). The federal government had launched the field of urban wildlife as a formal pursuit in 1968 and followed with a series of publications on urban eco-

systems (Sudia 1971 et seq.), including one focusing specifically on urban wildlife (Sudia 1978). A National Park Service research facility (the Center for Urban Ecology) was dedicated in 1985, praised six years after that opening (Hester 1991) and closed four years later. The only private-sector nonprofit urban wildlife organization, the National Institute for Urban Wildlife, also closed its doors in the mid-1990s. A few years later, Babbitt (1999) suggested that urban ecology was being "rediscovered" at high levels in American government. State involvement with urban wildlife programs appears to have been minimal as well, although it certainly was increasing faster than were university programs. Lyons and Leedy (1984) asked state wildlife agencies in 1983 if they had urban wildlife programs. Only six responded positively, noting programs whose principal functions were identified as extension, public education, and management. Only three states reported research as part of their activities, and only 8 percent of staff time and 5 percent of budget were devoted to this activity.

Federal and state involvement in urban wildlife issues and programs has been complicated by at least three factors. First, tradition has dictated that wildlife agencies and wildlife professionals looked to rural areas and their constituencies as the places where wildlife work should be done (San Julien 1987). Funding mechanisms, such as federal Pittman-Robertson Act monies, which stem from a federal excise tax on firearms and ammunition, have focused on projects more of service to rural than to urban constituencies and for consumptive more than for nonconsumptive wildlife users. Finally, the unspoken but apparently real bias against urban areas as suitable for research has tended to focus academic interest and resources away from our demographic centers. With increasing environmental awareness and activism, ecological understanding, and the demands of the urban populace for help in resolving wildlife conflicts, this situation is slowly changing. Unfortu-

nately, many unique opportunities to conduct definitive research on wild animals in urban and suburban environments during periods where colonization, population growth, and diversification were under way have been lost, to the detriment of future understanding.

Cities as Wildlife Habitat

Cities, as well as suburbs, encompass diverse and complex habitats to which many wild animals show affinity. What to the observer may seem to be a "biological desert" (the inner city) may in fact be suitable habitat for even such highly specialized predators as peregrine falcons (*Falco peregrinus*). Less noticed, but of equal or greater biological significance, would be the microfauna of these places, such as the detritus feeders that might live upon organic material blown into and stopped by the building faces. Generally, the biota of urban places have not been documented as well as they have been for other systems, but inventories and descriptions clearly tell us that even such "waste" places as vacant lots can have complex biological communities adapted, and adapting still, to the special biophysical characteristics of the sites they occupy (Vessel and Wong 1987). The complex, varied, and changing landscapes of cities and towns must certainly constrain attempts by many animals to successfully colonize them and maintain viable populations. Urban wildlife habitats are characterized by dynamic and changing environmental conditions in which both natural changes (e.g., the maturation of vegetation) and anthropogenic changes (e.g., the clearing of vegetation) constantly impose demands for accommodation. Thus, if urban landscapes have any defining characteristic as wildlife habitat, it must be their heterogeneity and variability.

Numerous schemes have been proposed to identify the various components of the urban landscape and describe its ecological properties.

Brady et al. (1979) proposed a hierarchical landscape scheme based on biogeographical units to help visualize both the richness of urban habitats and the landscape scales that could be imposed on urban areas, from regional to highly local and site-specific perspectives. Dickman (1987) proposed a structural classification of the urban lands of Oxford, England, in a scheme that included woodland, scrub (regenerating woodland), orchard, long grass, short grass (lawns, parks, playing fields), allotments, churchyards, and gardens of detached and semi-detached houses. Other possible habitats in the urban environment include cemeteries, utility corridors, university and corporate campuses, storm sewers, waterfronts, and garbage disposal sites (Stearns 1967). To these areas Davis and Glick (1978) add roadsides and median strips, city-center highrises, apartment blocks and condominiums, parking lots, golf courses, railroad tracks, and old residential neighborhoods. A basic dichotomy of urban habitats distinguishes between "open space," such as parklands and woodlots, and "built areas," such as residential housing, commercial buildings, and industrial areas (Foreman 1995).

Some generalizations about urban habitats are possible, although they may not hold true everywhere. Urban areas tend to sustain low species diversity (Dickman 1987; Gilbert 1989). This may be attributable to anthropogenic impacts, low habitat diversity, missing habitat types, species sensitivity, fragmentation, absence of successional stages, or simply the altered "geometry" (Goldstein et al. 1981) of vegetation in urban and suburban areas. The species that do adapt to and survive in urban areas tend to be present at greater concentrations than is typical for them in other types of habitats (Gilbert 1989; Riley et al. 1998). This could be attributed to relatively greater food abundance, absence of competitors, absence of predators, or a combination of these factors. The extreme fragmentation of the landscape in

cities tends also to create habitat "islands" (Davis and Glick 1978) that may promote some species while suppressing others.

Ecology of Urban Wildlife

Wildlife inventories for urban areas are generally lacking, although specialty groups, such as birds, have been fairly well documented for some cities (Montier 1977; Guth 1979; Cousin 1983; Hadidian et al. 1997b). Large animals undoubtedly tend to disappear with increasing urbanization, as do habitat specialists or species sensitive to habitat fragmentation, such as many reptiles and amphibians (Campbell 1974). The survival and extinction rates of local and regional populations under various forms of anthropogenic stress need to be better studied, as do virtually all aspects of genetic change and variation within populations of "urban" organisms.

Even less studied than the biophysical effects of urbanization on animal distribution and abundance are the life histories and general ecological relations of urbanized species. Perhaps the best-studied urban mammal is the red fox, *Vulpes vulpes* (Harris 1977, 1981, 1994; MacDonald and Newdick 1982; Lloyd 1981; Page 1981; Kolb 1984). The studies conducted by Stephen Harris on the urban fox population of Bristol, England, span more than twenty years of observation and research and are unquestionably the most comprehensive study of any urban species. Harris found that this urban fox population was heavily provisioned by human residents, many of whom deliberately engaged in feeding programs. Bristol fox population densities were found to be extremely high, while territory sizes were small, and fox groups with multiple adult members were observed in a species that elsewhere was classically identified as solitary. Profound changes in the population density and, concurrently, the social organization of Bristol foxes occurred as a result of an outbreak in 1994 of sar-

coptic mange, a disease that in foxes can lead to high mortality. The outbreak led to more than 80 percent annual mortality in the Bristol fox population until by 1996 nearly all the foxes in the study population were dead. Four years later the population recovery was still proceeding slowly, with social behavior, territory size, movement and activity patterns, and virtually all other aspects of fox life reverting toward the norm described in other studies (Harris 2000). Beyond demonstrating the extreme adaptability and social flexibility of fox populations, the long-term studies by Harris and colleagues challenge preexisting assumptions concerning the "normal" behavior of wildlife populations and call into question the meaning of "normal" itself.

Wildlife and Land Development

The urban population of Earth increased tenfold in the last century (Platt 1994). One consequence has been the rapid transformation of land from agricultural and undeveloped natural zones to expanding suburbs and the consumption of open space within existing urban zones. The term "sprawl" has been coined to describe the haphazard and chaotic pattern of suburban expansion, although long before that name appeared the issue had been identified and described (Dassmann 1972). The impacts of development on wildlife range from the direct physical destruction of animals and their habitats as land is cleared to the loss of habitat "values" such as size and connectivity, which can lead to local extirpations or failure of some fauna to be able to recolonize an area that has been isolated. Although there may be ways to indirectly measure the effects of development activities on wildlife, such as through estimates of change in the amount of available wetlands habitat, there is little that can be done to more than guess at the overall magnitude of

impacts. Enough concern exists for the deleterious short- and long-term impacts of development, however, to have created professional responses in the form of alternative development schemes, mitigation strategies, and an emerging body of scientific information that addresses the value of landscape features such as patch size, habitat mosaics, and corridors to link natural areas and open space (Foreman and Godron 1986). The concept of linking design and environment is personified historically by the seminal work of Ian McHarg (1969), whose *Design with Nature* ushered in an era of attention to the greater schemes of nature and human interaction with landscapes.

Loss of habitat and habitat fragmentation are critical issues in urbanizing environments and are cited as the most common reasons for population reduction or loss of species in such places (Davis and Glick 1978; Adams 1994). Because private land ownership decentralizes the planning process, habitat destruction and alteration can occur on a parcel-by-parcel basis, with little attention paid to such needs as preserving habitat connectivity. The results are truncated corridors, habitat islands, and mosaics of different types of land at different stages of development. By the theory of island biogeography (MacArthur and Wilson 1967), the larger islands of habitat should contain greater species diversity and experience lower rates of "extinction" as populations within them dip below thresholds of sustainability. Under such configurations habitat areas can also function as population sinks, demanding a constant influx of animals from outside to sustain themselves (Pulliam 1988). The same effect can be caused by human activities such as trapping and removal of "nuisance" animals or culling of local populations. Isolated urban habitat areas also should adversely affect the genetic interchange between populations, although the consequences of this are as yet little understood (Davis and Glick 1978).

Another consequence of fragmenta-

tion is that it leads to an increase in landscape edge. Edges, or ecotones, provide critical habitat for some wildlife species, such as deer, allowing access to cover within one habitat type (e.g., forest) and food in another (e.g., fields). Such edge habitat may favor nonnative species, particularly plant species, with corresponding changes in animal community structure. Roads can create significant edge across a landscape and can be a major factor in causing habitat fragmentation. They also can burden animal populations as a direct cause of mortality. For some groups, such as amphibians, arthropods, and small mammals, roads may essentially be complete barriers (Mader 1990; Richardson et al. 1997). Wildlife mortalities from roadways are documented for only a few of the larger and economically more important species, but those that are known are considerable. Conover et al. (1995) estimated more than a million deer-vehicle collisions annually for the United States, with approximately two hundred people killed and a billion dollars in property damage as the consequences.

The process of land development includes such activities as clearing, grading, soil compression, lake draining, and infill, all of which profoundly affect everything that lives on sites in the pre-development stage. Surprisingly, there seem to be no studies on such sites in which total species composition and pre- and post-development distribution and abundance of species have been documented over time. On-site impacts on nonvolant species—for example, small- and medium-sized mammals, invertebrates, amphibians, and reptiles—will be immediate and direct and typically end in almost complete destruction. Larger mammals and volant species will be displaced, with potential for increased mortality as well as conflict and competition with conspecifics, as those displaced attempt to become re-established elsewhere. The effects of displacement will be difficult to measure and depend on so many external factors and conditions that it may be

some time before a body of information sufficient to identifying trends could be collected. This complexity is similar to that faced by investigators seeking to understand the effects and consequences of wildlife translocation (Craven et al. 1998), and it is possible that studies of such phenomena could be approached under the same conceptual framework.

Certainly, the timing of land clearing would be critical to determining whether animals with dependent young were affected. However, decisions to schedule an event to avoid birth or weaning periods in any wildlife species would be entirely voluntary under most development schemes, excepting those in which state or federally protected threatened or endangered species are involved. Few laws exist to curb or shape the development process in ways that mitigate or minimize impact on wildlife. Those that do exist, such as the Migratory Bird Treaty Act (MBTA), could theoretically be used to afford protection to some species, but are probably so little known to developers that they might as well not be there. The MBTA makes it unlawful for anyone to "pursue," "take," or otherwise harm any migratory bird or to destroy nests or eggs unless under a federal permit, but it is clearly abrogated on a large scale when development incidentally "takes" birds, their nests and eggs, or their flightless young as land is cleared. To bring a claim on such activities under the MBTA it would be necessary to prove a willful violation of the act, beyond simple knowledge of the presence or potential presence of nesting birds.

Land clearing can be timed to minimize impact on specific species' nesting, birthing, and weaning schedules, and pre-development surveys and efforts to conduct "salvage" operations to remove specific species can be conducted. It may simply be that a greater awareness and more information about these practices could lead to some voluntary compliance or that local ordinances could be crafted that would allow such factors to be taken into account during the development

permitting process. Few wildlife professionals or organizations, however, have focused on wildlife in these contexts or attempted to communicate with developers about these needs. Little is known about the attitudes of the public on these issues or whether such consequences as increased expense would be supported if developers were engaging in salvage or rescue efforts.

Much of today's land-use policy is determined within a utilitarian framework in which economic considerations predominate (Beatley 1994). The potential economic benefits of development schemes that include wildlife habitat (more frequently termed open space or conservation areas) as part of the overall planning concept have been gaining attention and where examined indicate some positive influences on property value (King et al. 1991). Beyond that, with the public moving toward a greater environmental consciousness, the preservation of ecosystems, conservation of biological diversity, and protection of small and unique habitats and their wildlife are receiving more advocacy (Nash 1989). Arguments are being made for planners to anticipate and counteract threats to vulnerable wildlife populations (Hough 1994). Still, despite twenty of the forty national policies of the American Society of Landscape Architects focused on environmental issues, there is no policy regarding wildlife (Wacker 1987).

In an ideal world for urban wildlife, development sites would be assessed by qualified personnel to determine what species occur on year-round and seasonal bases, how development is likely to affect resident wildlife or transients (e.g., neotropical migratory songbirds), and what can be done, at all stages of development, to minimize the impacts that might occur (SCWF 1997). To some extent, experiments in this approach have begun, as in the King County, Washington, effort to identify significant wildlife habitat and review development plans to ensure that critical amenities and values are maintained under zoning

prescriptions. Another approach to determining wildlife presence and potential, rather than focusing on biological inventories of fauna, involves an inventory and assessment of habitat (Burns et al. 1986; Geis 1986; Matthews 1986; Houck 1987). Once identified, such areas can be manipulated within a landscape ecological scheme to determine how physical factors such as patch size and connectivity interact with specific faunal groups, such as songbirds, to create predictive models that help prioritize land units from which maximum conservation value will be realized (Darr et al. 1998).

The concept of urban open-space management from an ecological perspective is widely recognized by urban wildlife specialists as both critical to conserving wildlife in urbanizing environments and beneficial to enjoyment by human residents (Adams and Dove 1989; Gilbert 1989; Hough 1994). Ecological landscape planning and design intends to integrate known concepts of landscape design and ecological process to understand and manage land-human relationships on a broad scale. It is characterized by viewing nature as a partner from a bioregional vantage point, integrating design with soils, vegetation, topography, and human culture. It embraces an inclusive process of discussion and debate, challenging the notion that architecture and design are pure processes that "should not be 'contaminated' by any real-world constraints or needs: social, environmental, or economic" (Van der Ryn and Cowan 1996).

The historical development of the field has been traced by Richard Foreman (1995) through three broad phases. The first, which extended to about 1950, encompassed a period of emphasis on natural history and the environment in which identification of many of the underlying principles and factors of landscapes and animal populations was a necessary prerequisite to a synthesis of information into a conceptual framework. A second, so-called "weaving" phase, between 1950 and 1980, involved the drawing

together of previously established threads to set the stage for the current "land mosaic" or "coalescence" phase. The current period is marked by the attempt to create an overall conceptual framework that explains landscapes from a regional perspective, incorporating the ecological processes and ecosystem functions subsumed at that scale. It is made possible by advances in our understanding of ecological process and functioning and by tools, such as the Geographic Information Systems (GIS), that allow regional perspectives to be drawn on what are complex and interconnected landscape elements.

In a broad sense, ecological design is a process whereby each community member can be considered a "participant-designer," and the balance of knowledge is shifted from the experts to all. Ecological design advocates the identification and protection of core reserves of habitat that are off-limits to human disturbance, surrounded by expanding buffer zones that allow a range of uses, from nature trails to low-density housing to more-intense land use. These core reserves ought to be connected by wildlife corridors (Adams and Dove 1989; Van der Ryn and Cowan 1996). Employing techniques such as following the natural contour of the land, clearing and grading less, retaining and replacing topsoil, reducing impervious surface coverage, and retaining as much natural vegetation as possible will go far in reducing the immediate destruction of animals from construction practices and subsequent loss of populations and communities as a result of habitat loss.

By recognizing the need to better understand and plan development, not only to maximize benefits to wildlife but also to provide amenities for humans, both theoretical and practical models can be developed to predict the outcome of various approaches. From a landscape perspective, an overriding principle to seek maximum environmental benefits during development can be subsumed under the concept of "aggregate-with-outliers" (Foreman 1995). This principle states

that “one should aggregate land uses, yet maintain corridors and small patches of nature throughout developed areas, as well as outliers of human activity spatially arranged along major boundaries” (437).

In general, the understanding of the landscape-ecological factors involved in this principle, ranging from patch size to landscape mosaic grain, is better established than the responses of wildlife to the various landscape categories that have been identified.

Several types of development have been planned to enhance natural area and corridor presence. They include (1) planned unit development (PUD), usually applied to a large site, often allowing for more-flexible design, housing variety, and compatible commercial uses; (2) cluster zoning, which permits groups of homes on one portion of the property, with the remainder left as open space; and (3) conservation subdivisions, which in their purest form, can be defined as residential developments in which half or more of the buildable land area is designated as undivided, permanent open space (Arendt 1996). All three are zoning alternatives that involve density transfers. Normally, if a developer were to set aside a portion of the developable land, it would reduce his yield (the number of lots that he could build under current zoning), which translates into less profit. Density transfer addresses this financial disincentive by allowing the developer to site the same or greater number of homes onto smaller lots in a more compressed area, with the remaining open space left undeveloped and serving as a community and natural resource. The natural area can be put into a conservation easement (a legal agreement between the property owner and a nonprofit organization or government agency that permanently restricts the uses of the property) with the developer or the homeowners' association retaining ownership of the land and the right to use it consistent with the easement.

Human-Wildlife Interactions in Urbanizing Environments

Human-wildlife interactions in urbanizing environments can be positive or negative. Conflicts between humans and wildlife in suburban and urban areas are inevitable. Human-altered landscapes create highly suitable habitats for some species of wild animals. Absent hunting and trapping, many urban areas may harbor species that elsewhere occur below ecological carrying capacity (Robinson and Bolen 1984). Other human activities—such as poor trash management, landscaping that provides food resources, and structures that increase available harborage—can affect local wildlife populations. Many urbanites seeking interaction with wild animals deliberately feed and provision them, which can cause problems such as localized concentrations of animals.

The conflicts that arise between people and wild animals in urbanizing environments can involve individual animals, local groups of animals, or increasingly, regional populations of some species. A homeowner may have a problem with an individual animal that has taken up residence in a chimney, leading to action to resolve an immediate and highly site-specific issue. A municipal park may have a population of animals, such as gray squirrels, that is causing damage to plantings (Manski et al. 1981). A neighborhood or community may have widely distributed conflicts (with animals such as white-tailed deer or Canada geese) that affect multiple households and involve public lands and buildings, corporate parks, or specific sites such as golf courses. The conflicts experienced by urbanites range from “nuisance” situations (that aren't really problems at all) to situations in which measurable damage to homes or yards is occurring, to circumstances where complex types of impacts (e.g., deer browsing on

sensitive plant species on public lands) or human health and safety concerns are claimed (e.g., Ankney 1996). Problems with individuals or local groups may be self-correcting or resolvable with a small commitment of time and effort. Problems with larger populations may not be resolvable without a considerable commitment of time and effort through a coordinated regional planning approach.

The type and variety of human-wildlife conflicts in urban and suburban environments, as well as their economic consequences, are little documented, but what studies have been conducted are suggestive of trends. Overall, less than a third of the general population has reported experiencing problems with urban wildlife. In one survey of the six metropolitan areas in New York City, 20 percent of all respondents said they had wildlife problems (Brown et al. 1979), while in the upstate population of metropolitan Syracuse about 30 percent had experienced problems (O'Donnell and VanDruff 1983). Another study focused on three metropolitan areas in Missouri, where about 13 percent of the respondents indicated they had experienced wildlife problems (Witter et al. 1981). More recently, Mankin et al. (1999) reported that 18 percent of both urban and rural respondents to a questionnaire about wildlife conflicts in Illinois reported damage within the past year. Problems in metropolitan Syracuse varied from one neighborhood area to another (O'Donnell and VanDruff 1983), suggesting site- and area-specific factors contributing to the type and intensity of wildlife problems at the local level. Where it has been surveyed, measurable damage by wildlife, usually as structural damage to buildings or landscape plantings, ranges from about 20 to 50 percent of the complaints reported (Brown et al. 1979; O'Donnell and VanDruff 1983; Mankin et al. 1999).

The most frequently reported complaint regarding wildlife in urban and suburban areas is that an animal has become a general “nuisance” around a primary residence (Brown et al.

1979; Witter et al. 1981; O'Donnell and VanDruff 1983). The use of the term "nuisance" in characterizing human-wildlife encounters is problematic, however, since it predefines an emotional condition that can range from the imagined to the very real. Often, what constitutes an animal's being termed a "nuisance" may simply be misunderstanding or ignorance. Almost 40 percent of the complaints about wildlife received by two suburban Maryland wildlife offices resulted from a misunderstanding of wildlife activity and an unnecessary fear of wildlife itself (Hotten and McKeegg 1984). Such findings almost certainly forebode that many wild animals are "controlled" in urban habitats for no offense other than simply being considered "nuisances."

As dramatic as wildlife conflicts may be, by far the most frequent and substantive interactions between people and wild animals are positive ones. People value, and often cherish, contact with other living things (Kellert 1996), and it may be especially compelling and urgent that such opportunities occur for urbanites, who are most likely to be divorced from contact with the natural world. Mankin et al. (1999) report that nearly all respondents to their questionnaire of urban and rural residents of Illinois indicated that wildlife was important to them, with nearly 60 percent indicating that it was very important. Nearly half of the urban respondents indicated they valued wildlife as much as pets, with a quarter assigning equal value to humans. Goode (1993) notes that urban wildlife programs and natural-area conservation in Great Britain give considerable weight to the "value and benefits of ordinary wildlife to local people," an extremely important concept that is often overlooked in this time when wildlife's scarcity, rarity, and disappearance command such attention.

Attributing value to wildlife or to wildlife habitat can be difficult. Concepts regarding wildlife valuation range from the idea of inherent or intrinsic value (Norton 1987), through those addressing the legal rights and

status of animals (e.g., Singer 1975), to the notion that human well-being is enhanced by contact with animals. Benefits provided by wildlife may be simple pleasure and enjoyment, enhanced health and well-being, educational opportunities for adults and children, and increased economic returns through recreational, non-consumptive pursuits, such as bird-watching, and functions that enhance ecosystem-level stability (Shaw and Magnum 1984; Rolston 1986; Beatley 1994; Kellert 1997; Warren 1997). Improved psychological and even physical health is often associated with contact with natural environments and with wild animals themselves (VanDruff et al. 1995). Better environmental health has long been associated with juxtaposition of natural areas with human-built environments (e.g., Foreman 1995); and because of the position of most species at higher trophic (or distance from plant food source) levels, wildlife has been suggested as a good indicator of environmental quality (Evenden 1974). In fact, wild animals are often used as sentinels to detect and monitor environmental contaminants (National Academy of Sciences 1991).

The benefits of working with wildlife species to maintain or complement environmental factors important to humans has only recently begun to be explored. Beavers, for example, can improve watersheds negatively affected by human activity, but because of their early and near-complete extirpation from most of North America (Novak 1987), few people recognize their potential contributions. Among these are reduction in the extent and severity of floods due to the buffering effect of beaver impoundments; settling of turbid, sediment-laden urban runoff to include the precipitation of harmful industrial products such as heavy metal residues; a net increase in the area of urban wetlands; the creation of new wetlands; and the addition of habitat for sensitive and threatened plant and animal species (Hammerson 1994). Public attitudes concerning conflicts with such animals could change dra-

matically were their contribution to urban ecosystems better known. Better public education and understanding lies at the heart of much of the effort to deal with human-wildlife conflicts in urban areas.

Attitudes toward Urban Wildlife

American attitudes toward, and knowledge and perception of, animals have been measured in a series of pioneering studies by Stephen Kellert and his colleagues (cf. Kellert 1996). Historically, the predominant attitude toward animals in the United States has been a utilitarian one, focusing on the practical and material value people derive from animals or their products (Kellert and Westervelt 1982). Roughly contemporaneous with the population shift to urbanized areas has been the growth of humanistic feelings, defined as a strong interest in and affection for individual animals (Kellert 1980) and, in cities with a million or more residents, high moralistic sentiments characterized by a primary concern for the right or wrong treatment of animals (Kellert and Berry 1980). These changing values have influenced how Americans view such activities as hunting and trapping (Gentile 1987); non-consumptive uses of wild animals (Shaw and Mangun 1984); wildlife education (Adams and Leedy 1987); wildlife conservation (Hunter 1989); and wildlife damage control (Flyger et al. 1983). Urbanites can be selective, however. Some animal groups, such as songbirds, are held in high esteem (Dagg 1974; Szot 1975; Brown et al. 1979), while others, such as coyotes and snakes, are much less appreciated and sometimes even completely untolerated (Flyger et al. 1983; Kellert 1996).

However urbanites feel about specific wildlife species, their attitudes toward control practices tend to strongly favor nonlethal approaches. Marion (1988) found in a survey of

state extension service offices that 55 percent of the public contacted regarding urban wildlife conflicts did not want animals to be harmed by control procedures. An even higher percentage (78 percent) were willing to implement prevention and control measures. Braband and Clark (1992) found that 89 percent of the customers they contacted in conjunction with a private wildlife control business felt that humane treatment (i.e., people's feelings about the reduction of pain felt by an animal in a nuisance control situation) was either "very" or "moderately" important. Almost half (44 percent) of those responding indicated they would pay more for services that ensured this sort of treatment. However, attitudes about lethal control as an appropriate means of resolving conflicts was high for many species, including rats and mice (95 percent), bats (71 percent), pigeons (60 percent), and skunks (57 percent), indicating that negative feelings about some species overrode any broader concept of animal welfare. Marion et al. (1999), while not specifically querying for lethal versus nonlethal control, found more than 80 percent of respondents indicating that they tolerated the "nuisance" presented by wildlife during conflict situations, with fewer than 10 percent of the urbanites questioned having tried lethal control for an offending animal.

The relationship between positive feelings about an individual animal species and its status as a "problem" or "nuisance" animal should be intuitively an inverse one, but this is apparently not always the case. The gray squirrel (*Sciurus carolinensis*), for example, ranks very high as a nuisance species while maintaining a position as an animal for which affection remains high (Dagó 1973; Brown et al. 1979; Witter et al. 1981; O'Donnell and VanDruff 1983; Gilbert 1989). This suggests that public opinion is strongly situational, at least for some species. Rapid change in public sentiment may be indicated by shifting attitudes toward species such as deer and geese. While they were not

mentioned as problems in most urban wildlife damage surveys conducted throughout the 1970s, white-tailed deer increasingly have been mentioned as an emerging problem in urban areas (Witham and Jones 1990; Decker and Gavin 1987), and public attitudes seem to be shifting to more negative sentiments as a consequence. Canada geese, as well, seem to be attracting more widespread disapproval as they enter into greater contact with urban and suburban residents (Addison and Amernic 1983; Conover and Chasko 1985; Ankney 1996; Hope 2000). The rapidity with which animals such as geese and deer have not only accommodated to urban and suburban living but also become problematic suggests that other species may rapidly follow suit. Every effort should be made at an early stage in urban wildlife planning to anticipate and head off such situations. Given the physical and socioeconomic heterogeneity of cities, as well as the social and cultural variation within urban populations, the existing attitude surveys on urban wildlife probably reflect only a small part of the range of potential values and sentiments about urban wildlife and human-wildlife conflict-resolution strategies. More contemporary and comprehensive surveys must be conducted to explain both this variability and the potential for rapid change in the nature of, and attitudes toward, future conflicts.

Urban Wildlife Management

Interest in wildlife conservation—as well as recognition that good scientific information was needed to achieve conservation goals—arose around the turn of the twentieth century as a response to the near-complete destruction of many animal species and their habitats on a continent-wide basis (Matthiessen 1987). Nonetheless, traditional wildlife management perspectives grew out of a view of wild animals as a renewable resource and emphasized management from utili-

tarian and materialistic perspectives (e.g., Robinson and Bolen 1984). The consumptive use of animals superseded other concerns. "Surplus," "excess," or "expendable" segments of wildlife populations were to be "taken" under regulated hunting and trapping protocols that did not influence the overall health of the population but maintained numbers at desired levels. Those levels were typically set at a point where harvesters and recreational users had a maximum number of animals available to them, while commercial interests, typically agriculture, suffered a minimum of economic damage from those animals.

This traditionalist orientation in the United States led to wildlife management being considered synonymous with "game management," the title of the first text on the subject (Leopold 1933). "Nongame management," a term that came into use during the 1970s (Clawson 1986), refers to managers' activities that involve species not typically pursued for commercial or utilitarian purposes.

Temple (1986) recognizes four categories of animals within a nongame classification scheme: pest species, endangered species, rare species, and species that do not require management. Pest species largely included animals found in urban and suburban environments. Unlike funding for game programs, which is largely supported through the federal Pittman-Robertson initiative, funding for nongame species comes from voluntary contributions, income-tax check-offs, and a variety of special taxes (Robinson and Bolen 1984). Federal legislation to fund comprehensive conservation planning was enacted as the Fish and Wildlife Conservation Act of 1980. Unlike Pittman-Robertson monies, which are funded through excise taxes, this initiative was to be funded through appropriations from the federal budget—appropriations that were never approved (Manville 1989). Both endangered and rare species are the focus of special funding efforts and regulatory and statutory attention, but little if any attention is

focused on the “pest” and “other” species categories, into which a majority of urban wildlife would fall.

Once urban species become more noticeable, they may be branded “overabundant” and subjected to calls for management from a traditionalist perspective (e.g., Ankney 1996; McCombie 1999). However, by far the majority of calls for management of urban wildlife comes from concern over “nuisance” or “pest” species near individual houses. Ironically, this may be one of the reasons that traditional wildlife managers have eschewed involvement in urban wildlife issues (Lyons and Leedy 1984). Another may be that traditional approaches in wildlife management may not be applicable to urban settings (San Julian 1987; Hadidian et al. 1997a). A shift to “problem-oriented” management of urban wildlife means that other factors have to be taken into consideration, including human health and safety issues, environmental damage, biological diversity, and protection of private property. The “control” of “problem” urban wildlife is likely to be needed at times that don’t coincide with hunting and trapping seasons.

Conflicts with urban species may, in fact, be greatest at such biologically sensitive times as when young are being reared, raising moral and ethical questions concerning how management programs are implemented. In the past, private citizens (animal rescuers and rehabilitators), law enforcement personnel, university extension specialists, and nature centers were often the only resources available to guide urbanites in resolving conflicts with wildlife or responding to wildlife emergencies. Forces are now emerging to address human-wildlife conflict resolution in urban areas: animal shelter and control agencies, wildlife rehabilitators, the private wildlife control industry, and others.

Municipal animal shelters and animal control agencies, as well as law enforcement agencies, typically do not have a mandate to deal with wildlife issues but become involved in handling significant numbers of wild

animals (Kirkwood 1998). Shelter personnel are often the first to respond to wildlife emergencies or to be called to a scene by law enforcement. Shelters may routinely handle sick and injured wild animals, respond to road fatalities, and extricate animals roaming at large in buildings. Shelter personnel often are untrained for these tasks, but may be highly skilled and motivated to learn; have law enforcement authority, and can work from within established infrastructures. Although funding and resource limitations might be seen as obstacles to such individuals’ involvement, they are concerns for which solutions can readily be found. For example, a local animal shelter might run a wildlife control advice and response service as a for-fee option under its larger nonprofit operation. Costs for both advice and service could be covered by service charges competitive with private-sector rates.

The private-sector nuisance-wildlife control industry will also increasingly play a role in urban wildlife conflict resolution. This industry has developed partly from within and partly from outside the context of traditional wildlife management (Braband and Clark 1992; Barnes 1993; Curtis et al. 1995). The growth of the industry has been rapid. In New York private wildlife control operations grew by 309 percent over a six-year period in the mid-1980s, with more than eleven thousand wildlife complaints handled in 1989–90 alone (Curtis et al. 1995). Little is known of the nature, scope, and extent of the activities of nuisance-wildlife control operators, and virtually nothing can be said yet of the biological and ecological consequences of this industry’s activities. Thousands, perhaps tens of thousands, of “nuisance” animals are taken by trapping businesses in hundreds of municipal areas annually, but virtually nothing is done to document and publish summary statistics regarding this activity.

The “nuisance” wildlife control industry is in a formative period in which its “professionals” range from

recreational wildlife trappers, with little understanding of the behavior and ecology of urban wild animals beyond what is needed to capture them, to highly skilled wildlife professionals, who often hold advanced academic degrees. Organization of these businesses through franchising operations places many practitioners on a solid footing in a business sense, while “fly-by-night” operators engage in irresponsible business practices such as price-gouging. The fly-by-nighters are of particular concern to animal protection interests, since the wildlife control industry is particularly susceptible to profiting from the provision of incomplete or inadequate services. A practitioner may not recommend that a chimney be capped to permanently seal out future occupancy by a raccoon or squirrel, for example, virtually guaranteeing that another visit (and payment for service) will be necessary. Eventually, state and municipal oversight, public vigilance, better public education, and peer influence, should force standardization and policing of the industry. Animal protection interests and the private wildlife control industry will always argue over whether a majority of “nuisance” complaints can be resolved without handling, much less killing, the animal. Private operators will always be torn between earning a service fee and providing free advice that allows homeowners to resolve conflicts themselves.

Another emerging resource is the wildlife rehabilitation community. Wildlife rehabilitators range from individuals with little or no background and training with wild animals to highly skilled professionals with advanced degrees in wildlife science or veterinary medicine. Once a “kitchen operation” in which injured and orphaned animals were taken into private homes and given compassionate, if sometimes misguided, care, wildlife rehabilitation is now emerging as an organized discipline. An established body of knowledge is applied to diverse species and situations, sometimes through “kitchen operations” but increasingly through professional-

ly staffed wildlife centers. Rehabilitators are increasingly at the center of “nuisance” wildlife control, even though the only reason may be their inherent interest in limiting the number of “orphaned” animals that come to them for care. Many such orphaned young are by-products of wildlife control activities during which adult animals are either forcibly separated from dependent offspring or euthanized under state law. As a result, rehabilitation facilities are often swamped with incoming floods of orphans. Larger centers, especially, may decide to solve problems for homeowners in self-defense. Wildlife hotlines that provide advice or referrals to “humane” wildlife control operators are providing such proactive outreach.

Regulatory authority and programmatic responsibility for urban wildlife remain with federal, state, and municipal agencies and wildlife organizations. Absent a funding breakthrough, it is unlikely that state wildlife agencies will greatly augment their urban wildlife programs and activities in the near future. Instead, their role in regulatory oversight and program planning appears to be where they will have the most impact. Current regulations in most states are insufficient to ensure either the protection of public interest or the humane treatment of animals themselves. Several surveys of state regulatory and statutory oversight of the wildlife-control industry suggest that regulations or statutes advising operators to humanely handle, transport, or euthanize “problem” wild animals generally don’t exist, and that even licensing and reporting requirements are absent in many of the states (Brammer et al. 1994; LaVine et al. 1996; Barnes 1997; Hadidian et al. in press). In a recent poll of the fifty states by The Humane Society of the United States (HSUS) (Hadidian et al. in press), a rating of 1 or 0 was given in each of ten categories (license and permit requirements; training, examination, and related requirements; re-certification; reporting; translocation¹; humane treatment;

euthanasia²; consumer education and protection; threshold of damage; and use of integrated pest management [IPM]³ strategies) to yield an ideal score of 10 for any state that provided regulatory oversight for each category. The mean score for states was 2.16 (range 0–7), with a mode of 0 (fourteen states received this score) and a median of 1.75.

Changes in the social acceptance of animal damage management and vertebrate pest control require reexamination of the structure of federal and state programs and more input from these programs into private-industry initiatives. Traditional wildlife damage control programs must ask fundamental questions with greater scientific rigor (Hone 1996); address growing public demand for accountability in the use of chemicals, particularly toxicants; and satisfy growing public demand for solutions that include nonlethal options before lethal alternatives are considered. Borrowing from IPM, many specialists are acquiescing to this demand. They advocate approaches to wildlife damage management that, depending on the species and nature of the problem involved, move from nonlethal to lethal control only when circumstances dictate no other recourse (Dent 1995; Hone 1996). Federal agencies are directed to use IPM approaches (U.S. Government 1979), and the principal federal agency responsible for wildlife damage control, the U.S. Department of Agriculture’s Wildlife Services (WS) has created an Integrated Wildlife Damage Management concept to direct its activities (USDA 1994). Slate et al. (1992) describe a decision-making model to determine the need for action and appropriate responses that emphasize nonlethal methods.

Relatively few case histories demonstrating the IPM approach in urban areas can be found outside of commensal rodent management, but there is information on the use of such an approach to relieve a gray squirrel (*Sciurus carolinensis*) problem. Substantial damage had been claimed to bulbs, flowers, and histori-

cally valuable trees in a downtown Washington, D.C., park, and efforts to trap and relocate squirrels had been under way for some time before local and national humane organizations challenged the National Park Service to document and authenticate its claims (Manski et al. 1981). This was done, and a management plan was created under which a one-time removal of squirrels was to be coupled with the removal of older den trees and some artificial nest boxes that provided harborage (Hadidian et al. 1987). These actions, together with voluntary reduction in feeding activities by a small but active group of individuals, led to a long-term stabilization of the population that left damage at an acceptable level. Unknown, however, are the consequences of “humane” control of populations through limiting access to food, water, and shelter. Did the stabilization of the squirrel population in this small park cause increased mortality in subsequent litters? Were “surplus” squirrels forced to leave the area, at greater risk for mortality? To date, relatively little attention has focused on such questions.

As such issues remain, The HSUS has begun to identify a multi-step process of problem evaluation and response (Hadidian et al. 1997) for homeowners and the general public. The approach is based on using solutions to conflicts that are “environmentally sound, lasting, and humane.” It is fundamentally hierarchical, moving from least to most invasive in its applied procedures.

Understanding is an important component in any wildlife conflict, since the magnitude of the problem must be weighed against the consequences of human intervention. Tolerance of a wild animal’s presence—and the ability to accept some “damage”—should always be the first option considered. If tolerance clearly is not enough of a response, then other nonlethal approaches should be considered. These range from changing human activity (such as trash management), modifying habitat, and using scaring and mild harass-

ment strategies to employing repellents and exclusionary strategies. Trapping and relocating or killing offending animals is far more problematic and always unacceptable when it is the sole response to a wildlife conflict. Lethal approaches should never be employed unless all other practicable options have been considered and/or tried or unless conditions can be changed to modify or eliminate the circumstances that led to the problem. Even then, killing as a means of “solving” a wildlife conflict is offensive to large segments of the public (Reiter et al. 1999) and will be opposed by animal protection interests.

With more than eight of every ten Americans living in urban and suburban areas, public and private resources and attention must be focused on their issues with wildlife. Currently, no clear responsibilities or roles exist for any private or public entities to address urban wildlife issues. The conflict that often accompanies issues should therefore be of no surprise. Clearly, better understanding of the issues and the positions of stakeholders is needed, and compromise and synthesis will be important in determining the outcome of future programs.

The core elements of one such approach have been outlined by Robert Dorney (1989) as the framework for a new field, environmental management. It is envisioned as a consulting practice that combines elements of the “social, natural, engineering, design, and geographic services” working under a shared conceptual framework based on “a systems approach, a human ecology view, an environmental ethic, and a willingness to work for private, government, or community groups in a political and legal context” (p. 5). Given the need in many emerging human-wildlife conflicts for coordination among planners, public health specialists, wildlife specialists, technical personnel, and the public, it is difficult to envision how the urban wildlife specialist of the future could successfully operate with as narrow a focus as the field now has. The more than a dozen specializations, ranging

from hydrologist to social scientist, proposed by Dorney as necessary to environmental management, combined with the need for political support, suggest a new approach may be in order.

Animal Welfare and Protection Concerns

In the nineteenth century, Henry Bergh founded the American Society for the Prevention of Cruelty to Animals, the first animal welfare organization in the United States, in response to the treatment of the horses used as draft animals in New York City (Zawistowski 1998). Once he was given the power under law to prosecute cases of animal abuse, however, one of the first cases he brought to court was against a sea captain and his crew for the mistreatment of sea turtles kept alive as food aboard ship. The judge threw the case out of court, ruling that turtles were not animals and thus not covered in the newly promulgated cruelty statutes. Not a great deal has changed in the treatment of many wildlife species since then. Although the welfare of domestic and companion animals is an ongoing concern, any such consideration for wildlife has barely begun.

Potential topics range from the highly specific, such as the humanness of capture and handling techniques for “nuisance” animals, to the very broad, such as conservation of biological diversity in urbanizing areas. Several animal protection organizations—The HSUS, the Fund for Animals, People for the Ethical Treatment of Animals, Animal Alliance of Canada, the Massachusetts Society for the Prevention of Cruelty to Animals, and the Progressive Animal Welfare Society, in Washington State—staff programs on wildlife issues. Clifton (1992) expressed what were some of the first published concerns from this perspective. Numerous activist and local groups have formed around particular issues, often incor-

porating themselves as nonprofit organizations.

It is often said that urbanites are so ignorant of wildlife ecology that their concerns for the protection of urban wildlife and the humane treatment of wild animals are misplaced (Howard 1990). Where measured, this ecological ignorance does seem to exist; however, it can be found among people living in rural areas as well (Kellert 1996). This ignorance can lead to unrealistic and misguided attempts to impose “humane” solutions, such as wildlife translocation, on wildlife problems (Craven et al. 1998). But attention should first be placed on obvious human mistreatment of wild animals. Wild animals may be mistreated by people (including animal damage professionals or animal control professionals) out of ignorance or through deliberate acts of cruelty or indifference. They may be mistreated on an institutional level by instruments of policy or regulation that allow mass poisoning or lethal control on a recurring and cyclical basis.

It is hardly surprising that we have little information on how wild animals and people interact in urban environments. What happens even in the average backyard may always be a mystery, but increased attention to the links between childhood and adult violence toward animals and violence toward humans (Lockwood and Ascione 1998) may result in better efforts to collect information on extremely negative human-wildlife interactions, at the least.

Few in the professional communities have called for better understanding of animal welfare in the context of wildlife damage or management concerns (but see Schmidt 1989a,b). Even among regulatory agencies, such as state wildlife departments, oversight may be lacking. Of the states polled by The HSUS for a recent survey of state oversight of the wildlife control industry (Hadidian et al. in press), only thirty-two (slightly more than 60 percent) required individual homeowners or their agents to apply for permits to

“control” wildlife on their property. Fewer (seventeen) required private nuisance-wildlife control businesses to be licensed, and only three states required licensed nuisance-wildlife control operators to comply with established handling, transportation, and care standards.

Beyond animal protection advocates’ concern for the fate of individual animals in urban and suburban environments lies the broader need to consider the fate of entire animal populations and communities of organisms. The example of government oversight of Canada geese is illuminating. Early in the last century, giant Canada goose (*Branta canadensis maxima*) populations were so victimized by overhunting and exploitation for market that there was concern that they had been driven to extinction (Hansen 1965). When a few small breeding populations were discovered in the mid-1960s, extensive efforts were undertaken to repatriate this race of Canada goose to its former—and to new—ranges. These restocking programs proved successful, and goose populations grew to the point where, by the mid-1980s, many were considered problematic (Conover and Chasko 1985). As year-round residents, geese quickly adapted to the prime urban and suburban sites that provided shelter and food, including golf courses, playing fields, and public open space where humans and geese were bound to come into conflict. The debate over the extent of goose “damage” to landscapes, the potential for human health and safety issues associated with growing populations of these birds, and the extent to which nonlethal strategies (including habitat management) have been attempted prior to adoption of lethal-control programs has led to confrontations between wildlife management agencies and animal protection groups. A complex interplay between federal authority (largely derived from the MBTA) and federal and state responsibilities (largely derived from statutory trust or tradition) appears to be unfolding. Federal managers are struggling with adhering to the MBTA

while at the same time allowing “nuisance” geese to be taken under permit. Some states have assumed responsibility for overseeing “nuisance” goose programs, some of which involve capturing geese that are molting and killing them in commercial poultry houses. Others are allowing private nuisance wildlife control businesses and federal animal damage control agents to engage in lethal control programs without state involvement. With the increasing interest in urban wildlife management, the reluctance of many regulatory and oversight agencies to engage more immediately in emerging programs will set precedents that will affect them for years to come.

Concern for land and ecosystem protection has traditionally been an interest of conservationists and environmentalists. Clearly, however, the animal protection community’s wildlife concerns cannot be addressed without considering ecosystem and environmental concepts. Aldo Leopold’s 1949 articulation of the concept of a land ethic marks the emergence in contemporary environmental thinking of a holistic concept that embraces people, animals, and land. Largely neglected for two decades, the concept of a land ethic was joined in the mid-1970s by the concern for environmental injury that had been articulated in Rachel Carson’s *Silent Spring* (1962).

Leopold (1949) called for a land ethic as a revolutionary shift in the way humans viewed their relationship to the land and the animals and plants supported by it. He lamented that the relationship between people and the land was primarily economic and entailed “privileges, but not obligations.” Leopold was a hunter, and his concern for the land and its biotic community has been called antithetical to that of the movement for individual animals and extending rights to nonhumans. In fact, Regan (1983) went so far as to suggest that Leopold’s biotic community viewpoint could be dubbed “environmental fascism” (p. 362). This characterization springs from the premise that,

even when nonhuman members of the biotic community are accorded rights, those rights become prioritized based on the contribution of each to that community. Thus a rare wildflower could be accorded higher priority within the community than would a human, since humans are plentiful. But the concept of biotic right as a cornerstone of the land ethic advocated by Leopold, and the environmental ethic that derives from it, is not so estranged from the animal rights concepts advocated by Regan and others that common ground cannot be reached. A Leopold essay written in 1923 but published only recently argued that the earth is an “organism possessing a certain kind and degree of life” (1979), suggesting common ground between Leopold and much of the thinking that comes from the Deep Ecology and animal rights movements (Nash 1989).

It is the concept of biocentrism (Nash 1989) that provides proponents of the environment and advocates of those parts of the environment that exhibit unusually high levels of sentience and sensitivity (i.e., animals) with common ground. Biocentrism seeks the extension of the rights, privileges, and protection given as our moral responsibility to fellow humans to other living things and, potentially, to the nonliving as well. Biocentric thinking incorporates the idea of recognizing the rights of every form of life to function normally in an ecosystem (Nash 1989). It understandably conflicts with traditional conceptions of humans as preeminent over other living things (e.g., Bidinotto 1992). From this derives the fundamental, underlying tenet of an animal welfare perspective on urban wildlife: to seek and advocate life-affirming solutions to conflicts with wild animals.

Prognosis: Cities and Wildlife

The demands and requirements of the urban human population control the global ecosystem (Vitousek et al. 1997). Wildlife is a preferred component of natural systems, one in which humans typically vest more interest and attention than they do to physical environments or even other living communities. How the quality of the human environment is improved and enhanced by wildlife is an issue that will engage much attention as human populations become increasingly urban. It would be truly unfortunate if we could not resolve the paradox raised by Raymond Dassmann: "...Cities, man's greatest creation and the place where most people must live, are in many ways becoming least suited for human occupancy" (1972, 339).

It may be that as we begin to understand ourselves better and explore our deepest roots in affiliation with nature—our "biophilia" (Kellert 1997)—we are becoming isolated from and inured to the natural world in perhaps irreversible ways. It is no coincidence that the converging streams of contemporary thought in environmentalism, animal welfare and protection, ecological understanding and human affinity for nature are all focused within the prism of urban wildlife. It is not surprising that the visionary efforts to resolve human-wild-animal and human-natural-world conflicts would be addressed within new fields such as Dorney's discipline of environmental management, which was to be founded on an "ethical triad" of "reverence for land, life, and diversity" (Dorney 1989, 37).

If one promise of urbanization is to facilitate greater concern for the welfare and treatment of animals, then its peril may lie in the possibility of large segments of the urban population losing their connection to wild things and becoming indifferent and

uncaring. Urban wildlife problems must be approached as ecosystem problems where, along with the goal of controlling animal damage, successful strategies will stress the development of harmonious relationships within which the needs of all species are properly balanced. We stand at that crossroads.

Notes

¹Translocation is defined as the transport and release of wild animals from one location to another (Craven et al. 1998).

²Euthanasia literally means "good death" and is a term frequently used to describe veterinary-approved methods of killing companion animals.

³IPM is defined as a decision-making process that emphasizes monitoring and action when needed using a blend of cultural, physical, and chemical methods to keep pest problems at an acceptable level of management (Dent 1995).

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