

Coyotes and Humans: Can We Coexist?

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ABSTRACT: Coyotes have expanded their range throughout much of North America, aided by the extirpation of wolves, alteration and transformation of habitat, and urban sprawl. Humanized landscapes have worked to the coyote's advantage by offering an abundance of food, water, and shelter. Unfortunately, intentional and unintentional feeding of coyotes has also resulted in increased encounters and conflicts. How communities address such conflicts generates impassioned debate. Many state wildlife agencies and local municipalities lack the resources to effectively implement proactive strategies before encounters escalate to conflicts. Moreover, lack of agency coordination, combined with a largely uneducated populace, hinders effective conflict resolution. Consequently, responses to coyote conflicts are usually reactive and fail to address the root causes of most conflicts, i.e. a constant food source. Failure to address these root causes often leads to a vicious cycle of trapping and killing. Moreover, inconsistent and exaggerated reports of coyote attacks can lead to heightened public fears, which may limit the opportunity for establishing long-lasting proactive coexistence strategies. This paper provides an overview of coyote ecology in urbanized landscapes and considers several case studies of communities that have developed effective coyote coexistence programs.

KEY WORDS: *Canis latrans*, coyote, coyote coexistence, coyote-human attacks, coyote trapping, non-lethal, trapping, urban coyotes

Proc. 22nd Vertebr. Pest Conf. (R. M. Timm and J. M. O'Brien, Eds.)
Published at Univ. of Calif., Davis. 2006. Pp. 287-293.

INTRODUCTION

Coyotes (*Canis latrans*) have expanded their range and populations throughout much of North America, largely in response to habitat changes and the extirpation of their largest competitor—the wolf (*Canis lupus*) (Parker 1995). Their adaptability has allowed them to adjust to and tolerate humanized landscapes, bringing them into greater contact with people in the expanding cities and suburbs of North America. For example, in recent years two coyotes made their way into New York City's Central Park—likely crossing highways, bridges, and other densely populated residential neighborhoods to get there. While coyotes have little trouble living in human-dominated areas (Tigas *et al.* 2002), some people show little patience for coyotes in their neighborhoods (Battiata 2006). Many people who move to the outskirts of urban areas forget that with wild lands comes wildlife (Adams *et al.* 2006).

Anthropogenic sources of food and water in the form of unsecured garbage, pet food, free-roaming cats and small dogs, rodents, fruit trees, fruits of ornamental plants, ponds, and irrigation systems can attract coyotes, particularly in times of drought or natural-food scarcity. The food, water, and shelter available in urbanized areas enable coyotes to meet their nutritional requirements within a much smaller area than in their natural habitat, which allows for greater densities of coyotes in urban landscapes (Fedriani *et al.* 2001, Riley *et al.* 2003). With increased coyote activity in urbanized areas come increased interactions with people. Most people are unaware that there are coyotes in their midst, as coyotes tend to keep a low profile and avoid humans (Gehrt 2004*b*). The vast majority of human-coyote encounters are merely sightings. Coyotes may prey on cats and small dogs, since these animals are similar in size to their natural prey. In rare cases, coyotes have attacked people (Carbyn 1989, Timm *et al.* 2004); and most often, such

attacks are associated with intentional or unintentional feeding (Bounds and Shaw 1994).

How communities address increasing coyote interactions in urban environments is a question facing many wildlife managers today. Yet, relatively few long-term studies have focused on coyote ecology in urbanized environments. The longest urban coyote study to date is in its seventh year and is focused on coyotes living within the Chicago metropolitan area of Cook County, Illinois, an area with more than 9 million people and 128 cities and towns. The aim of the Cook County Coyote Ecology Project is to provide a comprehensive study of coyote ecology within the area and develop a greater understanding of how coyotes are able to adapt to densely populated human settlements. Since 2000, 243 coyotes have been marked (175 of these were radio-collared) to determine diet preferences, social structure, home range size, habitat use, mortality factors, dispersal patterns, and prevalence of disease. Discussing some preliminary findings, Gehrt (2004*a*:25) wrote: "...it was obvious almost immediately after starting the fieldwork that we had underestimated the ability of coyotes to exploit an urban environment, and they have shared a story with us that continues to amaze us."

THE BIOLOGY, ECOLOGY, AND ETHOLOGY OF COYOTES IN URBANIZED ENVIRONMENTS

Coyotes living in urbanized areas retain social structures similar to those found in rural areas and may live as solitary individuals, transients, monogamous pairs, or in packs dominated by an alpha male and female (Schwarz *et al.* 2001; Way *et al.* 2002, 2003; Morey 2004, Gehrt 2004*a,b*). A coyote "pack" may consist of an alpha pair or a pair with 1 to 5 subordinates that are most often family members (Gehrt 2004*b*). Most large patches of green space within the Chicago metropolitan area are occupied by coyote packs, the largest of which consists of

12 individuals. Way (2003) provides data of a group of six adults living together in a family pack on suburban Cape Cod, Massachusetts.

Coyote populations in urbanized landscapes typically exist in higher densities and have smaller territories than those in rural landscapes due to a greater availability of food (Shargo 1988, Fedriani *et al.* 2001, Tigas *et al.* 2002, Riley *et al.* 2003). In the fragmented areas of southern California, mean coyote home range sizes were 2.84 km² for females and 6.17 km² for males (Riley *et al.* 2003). In Cook County, Illinois, coyote packs had a mean home range size of 9 km², whereas mean home range size for solitary coyotes was 59 km² (Gehrt 2005). Even within these highly developed regions, coyotes sought natural undeveloped lands (Riley *et al.* 2003, Gehrt 2005) and expanded their home range size in response to habitat fragmentation (Riley *et al.* 2003).

Solitary coyotes may travel extensively using power-line corridors, train tracks, dikes, residential areas, sidewalks, roads, large interstates, shopping malls, and parking lots. In Cook County a 3-legged solitary male coyote had a home range extending over 104 km² and 3 municipalities (Gehrt 2004a). According to Gehrt (2004a:26), this finding was important because, "until we marked this individual, few people would have suggested that conflicts extending over three cities could be the work of one solitary, three-legged coyote." Similarly, Way *et al.* (2004) revealed that coyote packs can cover 75-100 km in a single night in Cape Cod, Massachusetts with individuals moving 20-25 km per 24-hr period. The authors suggest that this may lead to more sightings by the general public and an overestimation of the numbers of coyotes in a given area.

Most observed coyote deaths in urban areas have anthropogenic causes, with vehicle collisions the number one source of mortality in most studies (Grinder and Krausman 2001, Tigas *et al.* 2002, Riley *et al.* 2003, Gehrt 2005). Riley *et al.* (2003) also identified secondary poisoning (from consuming rodents that had ingested anticoagulant rodenticides) as a source of mortality for coyotes in urbanized landscapes. While it appears that coyotes adjust behaviorally to fragmented habitats caused by roads and increased development, Riley *et al.* (2003) and Way *et al.* (2004) suggest that better land-use planning and public education could help to reduce human-caused deaths.

As opportunistic carnivores and scavengers, coyotes living in urbanized environments have been found to consume a wide variety of foods (Shargo 1988, Atkinson and Shackleton 1991, McClure *et al.* 1995, Parker 1995, Fedriani *et al.* 2001), which may reflect relative availability of food sources, access to open space, and waste management efforts. In Cook County, analysis of 1,429 coyote scats from both dense residential and undeveloped areas revealed that small rodents, rabbits, and fruit were the most common foods, while the frequency of anthropogenic-related food sources was 1.9% (Morey 2004). Fedriani *et al.* (2001) found that, at most, 25% of the diet of coyotes in southern California consisted of human-related food, indicating that even in heavily urbanized areas, natural foods such as rodents and rabbits continue to comprise the bulk of a coyote's diet.

ECOLOGICAL ROLE OF COYOTES

As the largest carnivore in some ecosystems, coyotes may play an ecologically important role in these environments. Coyotes can have a top-down effect on ecosystems by regulating the numbers of smaller predators, such as foxes, raccoons, skunks, and feral cats through competitive exclusion and direct killing (Crooks and Soulé 1999). Research in the fragmented urban habitats of coastal southern California showed that the absence of coyotes allowed smaller predators to proliferate, leading to a sharp reduction in the number and diversity of scrub-nesting bird species (Crooks and Soulé 1999).

Studies conducted in more rural areas have found that coyotes have similar indirect effects on songbirds and waterfowl (Sovada *et al.* 1995, Rogers and Caro 1998) where coyote predation on, or competitive exclusion of, mesocarnivores leads to increases in bird abundance and diversity. In Texas, Henke and Bryant (1999) found that intense coyote removal led to an increase in mesocarnivores and jackrabbits and a significant decline in the diversity of rodent species.

Approximately half of all Canada goose (*Branta canadensis*) nests are actively depredated by coyotes within the Chicago region (S. Gehrt, pers. commun.). In the northeastern U.S., at least one researcher speculates that coyotes may help control overabundant white-tailed deer (*Odocoileus virginianus*) populations in suburban areas and "represents to wildlife managers a possible opportunity in some areas to reduce the need for controversial and expensive management decisions" (Gompper 2002b:188). While research is beginning to elucidate the important and complex role coyotes can play in maintaining ecological health and species diversity within a variety of ecosystems (Crooks and Soulé 1999, Henke and Bryant 1999), more research is needed to understand the role of coyotes in urbanized environments.

URBAN COYOTE MANAGEMENT

In many communities, the first response to sightings of coyotes is fear and a knee-jerk decision to trap whatever coyotes may be living in the area (Battiata 2006). Often such decisions are made by local public officials with little input from those knowledgeable of wildlife ecology. State wildlife agencies tend not to become directly involved in coyote management at a local level unless there is a documented public safety issue. Because many states classify the coyote as a "non-game," "predator," or "furbearer" species, they can often be killed year-round in unlimited numbers (Fox and Papouchis 2005). Oftentimes municipalities or homeowners associations will contract with a private nuisance wildlife control firm or with the U.S. Department of Agriculture's Wildlife Services agency to kill coyotes. While trapping programs allow public officials to tell the public that they are doing something about the situation, their effectiveness is questionable because of the coyote's ability to rebound and recolonize vacant territories (Knowlton *et al.* 1999; Sacks *et al.* 1999a,b; Gompper 2002a).

Summarizing some of the findings in the ongoing study of coyotes in Cook County, Illinois, Gehrt (2004b)

concludes that removed coyotes are likely to be quickly replaced by “floaters” from the larger coyote population; removal of non-problem coyotes may result in their replacement by coyotes with less fear of humans, thus potentially increasing conflict; and, in the absence of conflict, coyotes should not be removed. These results underscore the importance of determining and addressing the ultimate causes of human-coyote problems (e.g., direct or indirect feeding) and the potential negative repercussions of indiscriminate removal (Gehrt 2004b). Gehrt (2004b) adds that public education should be a prominent component of any urban coyote management plan.

Moreover, research suggests that to suppress a coyote population over the long-term, more than 70% of the coyotes would need to be removed annually (Connolly and Longhurst 1975). Aside from the ethical questions such intense control efforts raise (C. Fox 2001, M. Fox 2001, Fox and Papouchis 2005), such practices may not be effective over the long-term, since lethal removal may stimulate improved reproductive success and pup survival in the remaining coyote population, thus compensating for the human-caused mortality (Connolly and Longhurst 1975, Connolly 1978, Davison 1980, Sterling *et al.* 1983, Stephenson and Kennedy 1993, Parker 1995, Crabtree and Sheldon 1999).

COEXISTING WITH COYOTES IN URBANIZED LANDSCAPES

Key to successful coexistence between humans and coyotes is the accurate assessment by wildlife managers of coyote behavior and how it is affected by human activity. Accordingly, managers need accurate definitions of dangerous coyote behavior and clear guidelines for when such behavior warrants direct intervention. Equally important is the need for the public to have a realistic understanding of the potential danger posed by coyotes and how their own behavior can exacerbate or mitigate the risk of negative encounters. An educated public should be more tolerant of the presence of coyotes and less apt to report general sightings as “conflicts” when in fact no real conflict has occurred; and “false alarm” responses by wildlife managers should be reduced.

Attacks on humans by coyotes are rare and are most often associated with anthropogenic sources of food and/or the presence of pets (Carbyn 1989, Bounds and Shaw 1994). Unfortunately, media coverage of coyote attacks generally serves to heighten public fears but does little to promote effective and long-lasting solutions to conflicts. While it is imperative that the public receive accurate information about the relative risks of human injuries by coyotes, such risks should not be exaggerated so as to create unnecessary fear. For example, about 17 people are killed annually by domestic dogs in the United States (CDC 1997), while only one person has been reported killed by a coyote in recorded history (Howell 1982).

Most experts on large carnivore attacks on humans define an attack as an aggressive action initiated by the animal that involves physical contact with a human. For example, Beier’s (1991:403) review of cougar attacks on

humans defined attack “as an incident in which the cougar bit, clawed, or knocked down a human.” He explicitly excluded “near-attacks” which he defined as “a cougar advancing toward a person at close range without making contact, or crouching beside a trail as if to pounce” (Beier 1991:403). In contrast, the most frequently cited paper on coyote attacks defines attack as “when one or more coyotes made physical contact with a child or adult, or *attacked a pet while in close proximity to its owner*” (Timm *et al.* 2004:47; emphasis added). This definition is problematic because it is overly broad and inconsistent with the common understanding of the term “attack,” which generally involves physical contact with a human as the result of aggressive behavior by the predator. For example, Timm *et al.* (2004) identified 48 incidents from 1998 to 2003 as coyote “attacks on children and adults.” Of these, 9 (19%) involved a coyote attacking a pet in the presence of a human with no physical contact between the coyote and human; and 11 (23%) incidents involved a human being bitten/scratched while defending their pets from coyotes. Unfortunately, the descriptions of the incidents are sometimes vague, thus making it unclear whether the coyote’s behavior was aggressive towards humans.

Distinguishing between attacks that are aggressive towards humans and those that are incidental to a person defending a pet or food source provides a more useful and accurate measure for assessing attacks and their risks to humans. Quigley and Herrero (2005:33, 29) distinguish between unprovoked and provoked attacks, defining unprovoked attacks as “those where the animal approached and attacked with the principal attraction being the person(s), not people’s food or other attractants” and provoked attacks as “when a person(s) enters an animal’s personal space or purposely tries to touch, injure or kill the animal and the animal attacks, or the person(s) had human food or garbage attractants that brought the animal nearby, again, within the animal’s personal space.”

If Timm *et al.* (2004) had differentiated between attacks and near attacks as per Beier (1991) and between provoked and unprovoked attacks as per Quigley and Herrero (2005), we could more accurately assess the causal and situational factors surrounding the coyote/human/pet incidents they describe, which would help to better inform management decisions. By overstating the dangers coyotes pose to humans, we limit the opportunity for establishing long-lasting proactive coexistence plans. These issues highlight the need for wildlife managers and researchers to ensure rigor and consistency in how coyote /predator attacks are defined, assessed, and reported.

When serious conflicts do arise, they are often directly linked to people intentionally or unintentionally feeding coyotes (and other wild animals). Feeding is often the source of bold coyote behavior, which almost inevitably leads to the killing of that animal (Bounds and Shaw 1994). If local ordinances or bylaws exist that restrict the feeding of wildlife, law enforcement officials must prosecute violators. If such laws do not exist, then concerned citizens and public officials should enact legislation and enforce it. Aversive conditioning— the use of negative stimuli such as pellet or paintball guns, rubber

slugs, or horn blasting to stop certain behaviors— has also been employed by some municipalities and agencies (Timm *et al.* 2004) and deserves further study. Ultimately, proactive and consistent public education and outreach to residents through community newsletters, television and radio public service announcements, signage, utility bill inserts, and public educational forums is imperative to establishing an effective coyote coexistence program.

**CASE EXAMPLE:
VANCOUVER, BRITISH COLUMBIA –
STANLEY PARK ECOLOGY SOCIETY’S
‘COEXISTING WITH COYOTES’ PROGRAM**

The most comprehensive urban coyote coexistence program established to date is in the city of Vancouver, British Columbia. The program was developed in 2001 after several attacks by coyotes on humans and pets led to a fierce city-wide debate about how the issue should be addressed. It is a cooperative endeavor among the Stanley Park Ecology Society, the Vancouver Park Board, and the Ministry of Environment (formerly Ministry of Environment, Lands and Parks). The stated aim of the program is to reduce conflicts between people, pets, and coyotes (Adams *et al.* 2006).

Central to the program is proactive public education and outreach. According to R. Boelens (Urban Wildlife Specialist of the Stanley Park Ecology Society; pers. commun.), between 8 to 10 thousand elementary school students in the Vancouver area see the Society’s coyote awareness presentations each year. Pet care centers, veterinary clinics, and child care centers are targeted for outreach and help distribute the Society’s coyote brochures throughout the community. Educational signs have been placed in hot-spot areas, particularly in golf courses and green space areas that are frequented by people and their dogs. The Society’s comprehensive website (<http://www.stanleyparkecology.ca/programs/urbanWildlife/coyotes/>) provides detailed on-line resources including downloadable brochures and posters in 11 languages, education kits for teachers and parents, monthly coyote sightings, and community-specific conflict statistics.

In addition to public outreach, the Society provides, through a coyote hotline, a prompt and situation-specific response to residents who have encountered a coyote and, when needed, site visits. Since inception of the program, the Society has provided a non-lethal response to coyote conflicts in 75-100 neighborhoods where patterns of conflict were emerging, and in so doing, has prevented conflicts from escalating in a majority of these neighborhoods. Although no scientific analysis has been carried out to measure the effectiveness of the program to date, fewer coyotes have had to be removed since implementation of the program in 2001 (R. Boelens, pers. commun.). That no children have been attacked since full implementation of the program suggests it has been successful in reducing conflicts and fostering coexistence.

**CASE EXAMPLE:
MARIN COUNTY, CALIFORNIA**

Just north of San Francisco, Marin County provides an example of a community that has proactively addressed coyote conflicts in both agricultural areas and at the urban/wildland interface. Coyotes were extirpated from most of Marin County approximately 50 years ago as a result of trapping and poisoning programs. The species has steadily recolonized the county over the past 20 years, first in west Marin, which is largely agricultural, and more recently into southern Marin, which is more developed. With an abundance of protected open space and agricultural lands, Marin County is an ideal place for wildlife.

As with most other agricultural counties in California and other western states, Marin County contracted with the USDA Wildlife Services program and paid a federal trapper to assist ranchers with predator conflicts. In 2000, as a result of public controversy over USDA Wildlife Services use of Compound 1080 and other lethal control methods, the Marin County Board of Supervisors replaced the Wildlife Services program with a locally-run non-lethal predator management plan (C. Fox 2001). Through this program, qualified ranchers are able to receive financial assistance for implementing non-lethal animal husbandry methods including guard dogs, llamas, improved fencing, and lambing sheds. A cost-share indemnification program was later added to the program to compensate qualified ranchers for verified livestock losses resulting from predation by coyotes. The program has garnered national attention, and initial data from the County Agricultural Commissioner’s office indicate it has been effective at helping to reduce livestock losses for some ranchers (Brenner 2005, Carlsen 2005). While the program ended funding for a federal trapper, it does not preclude ranchers or their agents from removing problem coyotes on their own ranches.

In suburban southern Marin, encounters between people, pets, and coyotes have increased as coyotes have recolonized the area. To better understand where conflicts were occurring and to facilitate communication between local and state agencies responsible for responding to wildlife conflicts, the Animal Protection Institute and the Marin Humane Society convened a task force in 2002 with the aim of developing a plan to increase public outreach and centralize the County’s response to coyote conflicts. Increased public education focused on identified conflict “hot spots” and included distribution of brochures about coexisting with coyotes, articles in community newsletters, public forums, coyote encounter observation reports, and site visits from the Marin Humane Society. A researcher with the USGS Biological Resources Division began radio-collaring and tracking coyotes within one of the hot spot communities, providing valuable data and information that helped to identify when coyote conflicts were likely to increase (e.g., pupping, mating, and dispersal seasons). These data were used to inform residents of when to keep their pets indoors and avoid certain locations where adults were denning with pups.

Wildlife feeding was identified as a problem in parts of the county, and in 2004, a county ordinance was adopted prohibiting the practice. According to the Marin Humane Society, which is the primary enforcer of the ordinance, the new law has been very effective, particularly as an educational tool for animal service officers who can warn people that they may be cited if they do not cease intentional wildlife feeding (C. Machado, pers. commun.). Also in 2004, the National Park Service (NPS) erected educational signs in the Golden Gate Recreational Area of southern Marin when coyotes started frequenting picnic areas. In addition, the NPS decided to try aversive conditioning to stop one particular coyote from approaching people. Using non-lethal paintball guns, the coyote was shot 4 times over the period of approximately 40 days. According to the U.S. Park Ranger overseeing the effort, the aversive conditioning was “very successful” and stopped the coyote’s undesired behaviors (Bill Merkle, NPS, pers. commun.).

Since 2000, Marin County has held a number of public education forums aimed at educating residents about how to mitigate conflicts with coyotes, mountain lions, and other wildlife. These have been sponsored by agencies including the Marin County Open Space District and the Marin Humane Society and have addressed conflicts in both agricultural and urban areas. In addition, several county government agencies regularly distribute the Animal Protection Institute’s “Coexisting with Coyotes” brochures, door hangers, and the comprehensive publication *Coyotes in Our Midst* (Fox and Papouchis 2005).

As a community known for its environmental awareness and strong support of agriculture, Marin County has faced many challenges in addressing coyote conflicts with sometimes polarized viewpoints about how conflicts should be addressed (C. Fox 2001). But through collaboration, dialogue, and community outreach, the county has provided a model for other communities facing similar challenges. The county’s vision is to promote coexistence between people and wildlife by emphasizing practical, non-lethal solutions.

COYOTES ARE HERE TO STAY

That coyotes have withstood and even thrived under intense persecution over the last century is a testament to their adaptability, resilience, and intelligence. At least 19 subspecies of coyote now roam throughout North America, from California to Newfoundland and from Alaska to Panama (Bekoff and Gese 2003). Whether we like it or not, the coyote has become an urban denizen, and we must learn to coexist if for no other reason than that the coyote has proven time and time again she will persist.

As the Marin and Vancouver examples demonstrate, coexistence requires proactive public education and active participation on the part of individuals, community leaders, and local and state agencies. Communities must develop a coyote coexistence plan that includes, but is not limited to:

- Educating residents about how to behave in coyote habitat and how to mitigate conflicts with coyotes

and other wildlife by reducing wildlife attractants/den sites around their homes;

- Notifying residents when coyote activity may be high (during coyote pupping, mating, and dispersal seasons) and recommend that cats be kept indoors and dogs walked on leashes;
- Adopting, implementing, and enforcing wildlife feeding ordinances and bylaws; and
- Posting “no-feeding”/educational signs in high-use recreational areas.

Ongoing research continues to reveal more about the coyote, including its importance in maintaining healthy ecosystems. Wildlife managers should look to this research to better inform management decisions and consider the following:

- Quick-fix population reduction efforts may reduce the numbers of coyotes in a given area over a short period of time and temporarily quell public concerns, but such efforts generally fail to address the systemic source of conflicts, which is most often readily accessible food. Vacant territories will likely be recolonized by transient coyotes in a short period of time.
- Maintaining resident coyotes and ensuring that they do not become habituated should be a primary objective for a long-term coyote coexistence plan.

Wildlife managers will be faced with increasing challenges in addressing urban wildlife conflicts as the human populace becomes more urbanized and as agencies face increasing financial and staffing shortages. Collaborative strategies may be necessary to address this shortfall, particularly in the development of urban wildlife programs, which are chronically under-funded at the state level, and to ensure buy-in and participation from community members. For example, Arizona Game and Fish has implemented a program to involve community members in fostering urban wildlife coexistence in Tucson. The California Department of Fish and Game, in collaboration with nonprofit animal and conservation organizations, local businesses, and other local, state, and federal management agencies, has formed the Tahoe Council for Wild Bears, which is aimed at reducing human-bear conflicts and promoting the coexistence of humans and bears in the Lake Tahoe Basin. Such models provide examples of collaborative efforts to address increasing urban wildlife by involving local residents, businesses, and non-profit wildlife organizations.

Ultimately, the choice to coexist with coyotes and other wild animals in urbanized landscapes is up to us. The question is not whether we can so much as whether we want to, and if so, how we will go about making this happen. While Marin and Vancouver provide models of proactive coyote coexistence programs, they also highlight the need for more studies in the following areas:

- Coyote demographics and ethology in urbanized landscapes, which will help in the development of conflict mitigation measures;
- The role of coyotes in structuring biotic communities;
- The efficacy of aversive conditioning techniques in altering undesired coyote behavior and decreasing conflicts;

- The efficacy of different public education and outreach methods in increasing public understanding of coyote ecology and in changing human behaviors to mitigate conflicts.

By increasing our knowledge and understanding of this adaptable species, we can help support the development of effective, long-lasting approaches to human-coyote conflicts, and can shape a future in which informed conservation planning and educated coexistence is a reality.

ACKNOWLEDGEMENTS

I thank Christopher M. Papouchis, Dave Parsons, Dr. John Hadidian, Dr. Jon Way, Dr. William Lynn, and Dr. Stanley Gehrt for providing comments on sections of this paper, and the Wendy P. McCaw Foundation for their support of the Animal Protection Institute's "Coexisting with Coyotes" programs.

LITERATURE CITED

- ADAMS, C. E., K. J. LINDSEY, AND S. J. ASH. 2006. Urban Wildlife Management. Taylor & Francis, CRC Press, Boca Raton, FL. 311 pp.
- ATKINSON, K. T., AND D. M. SHACKLETON. 1991. Coyote, *Canis latrans*, ecology in a rural-urban environment. *Can. Field-Nat.* 105:49-54.
- BATTIATA, M. 2006. Among us. *The Washington Post Magazine*, April 16 issue, p. W06, Washington, DC.
- BEIER, P. 1991. Cougar attacks on humans in the United States and Canada. *Wildl. Soc. Bull.* 19:403-412.
- BEKOFF, M., AND E. M. GESE. 2003. Coyote (*Canis latrans*). Pp. 467-481 in: G. A. Feldhamer, B. C. Thompson, and J. A. Chapman (Eds.), *Wild Mammals Of North America: Biology, Management and Conservation*. The Johns Hopkins University Press, Baltimore, MD.
- BOUNDS, D. L., AND W. W. SHAW. 1994. Managing coyotes in U.S. national parks: human-coyote interactions. *Nat. Areas J.* 14:280-284.
- BRENNER, K. 2005. Coyotes get a reprieve: West Marin ranchers cut damage from predators the humane way. *Marin Independent Journal*, Nov. 13 issue, Marin County, CA.
- CARBYN, L. N. 1989. Coyote attacks on children in western North America. *Wildl. Soc. Bull.* 17:444-446.
- CARLSEN, S. 2005. Marin County Livestock Protection Program: Presentation to the Board of Supervisors by Marin County Agricultural Commissioner's Office. PowerPoint presentation, November 8, 2005, audio available at <http://www.co.marin.ca.us/depts/BS/main/index.cfm>.
- CDC. 1997. Dog bite-related fatalities—United States, 1995-1996. Centers for Disease Control, Atlanta, GA. *Morbidity and Mortality Weekly Rep.* 46:463-467.
- CONNOLLY, G. E. 1978. Predator control and coyote populations: a review of simulation models. Pp. 327-345 (Ch. 14) in: M. Bekoff (Ed.), *Coyotes: Biology, Behavior, and Management*. Academic Press, New York, NY.
- CONNOLLY, G. E., AND W. M. LONGHURST. 1975. The effects of control on coyote populations: a simulation model. *Div. of Agricultural Sciences, University of California, Bulletin* 1872. 37 pp.
- CRABTREE, R. L., AND J. W. SHELDON. 1999. Coyotes and canid coexistence in Yellowstone. Pp. 127-163 in: T. W. Clark, A. P. Curlee, S. C. Minta, and P. M. Kareiva (Eds.), *Carnivores in Ecosystems: The Yellowstone Experience*. Yale University Press, New Haven, CT.
- CROOKS, K. R., AND M. E. SOULÉ. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. *Nature* 400:563-566.
- DAVISON, R. P. 1980. The effect of exploitation on some parameters of coyote populations. Ph.D. dissert., Utah State University, Logan, UT. 139 pp.
- FEDRIANI, J. M., T. K. FULLER, AND R. M. SAUVAJOT. 2001. Does availability of anthropogenic food enhance densities of omnivorous mammals? An example with coyotes in southern California. *Ecography* 24:325-331.
- FOX, C. H. 2001. Taxpayers say no to killing predators. *Animal Issues* 31:27.
- FOX, C. H., AND C. M. PAPOUCHIS. 2005. Coyotes in our Midst: Coexisting with an Adaptable and Resilient Carnivore. Animal Protection Institute, Sacramento, CA. 64 pp.
- FOX, M. W. 2001. Bringing Life to Ethics: Global Bioethics for a Humane Society. State University of New York Press, Albany, NY. 251 pp.
- GEHRT, S. D. 2004a. Chicago coyotes part I. *Wildl. Control Technol.* 11(3):24-26.
- GEHRT, S. D. 2004b. Chicago coyotes part II. *Wildl. Control Technol.* 11(4):20-21, 38-9, 42.
- GEHRT, S. D. 2005. Cook County coyote ecology project. Annual Project Report, Cook County Animal and Rabies Control, Bridgeview, IL. 14 pp.
- GOMPPER, M. E. 2002a. The ecology of northeast coyotes: current knowledge and priorities for future research. *Wildl. Conserv. Soc. Working Paper* 17:1-48.
- GOMPPER, M. E. 2002b. Top carnivores in the suburbs? Ecological and conservation issues raised by colonization of northeastern North America by coyotes. *BioScience* 52: 185-190.
- GRINDER, M. I., AND P. R. KRAUSMAN. 2001. Morbidity-mortality factors and survival of an urban coyote population in Arizona. *J. Wildl. Dis.* 37:312-317.
- HENKE, S. E., AND F. C. BRYANT. 1999. Effects of coyote removal on the faunal community in western Texas. *J. Wildl. Manage.* 63:1066-1081.
- HOWELL, R. G. 1982. The urban coyote problem in Los Angeles County. *Proc. Vertebr. Pest Conf.* 10:21-23.
- KNOWLTON, F. F., E. M. GESE, AND M. M. JAEGER. 1999. Coyote depredation control: an interface between biology and management. *J. Range Manage.* 52:398-412.
- MCCLURE, M. F., N. S. SMITH, AND W. W. SHAW. 1995. Diets of coyotes near the boundary of Saguaro National Monument and Tucson, Arizona. *Southwest. Nat.* 40:101-104.
- MOREY, P. S. 2004. Landscape use and diet of coyotes, *Canis latrans*, in the Chicago metropolitan area. M.S. thesis, Utah State University, Logan, UT. 119 pp.
- PARKER, G. R. 1995. Eastern Coyote: The Story of its Success. Nimbus Publishing, Halifax, Nova Scotia, Canada. 254 pp.
- QUIGLEY, H., AND S. HERRERO. 2005. Characterisation and prevention of attacks on humans. Pp. 27-48 in: R. Woodroffe, S. Thirgood, and A. Rabinowitz (Eds.), *People and Wildlife: Conflict or Coexistence?* Cambridge University Press, Cambridge, England, U.K.
- QUINN, T. 1997. Coyote (*Canis latrans*) habitat selection in urban areas of western Washington via analysis of routine

- movements. *Northwest Sci.* 71:289-297.
- RILEY, S. P. D., R. M. SAUVAJOT, T. K. FULLER, E. C. YORK, D. A. KAMRADT, C. BROMLEY, AND R. K. WAYNE. 2003. Effects of urbanization and habitat fragmentation on bobcats and coyotes in southern California. *Conserv. Biol.* 17:566-576.
- ROGERS, C. M., AND M. J. CARO. 1998. Song sparrows, top carnivores and nest predation: a test of the mesopredator release hypothesis. *Oecologia* 116:227-233.
- SACKS, B. N., K. M. BLEJWAS, AND M. M. JAEGER. 1999a. Relative vulnerability of coyotes to removal methods on a northern California ranch. *J. Wildl. Manage.* 63:939-949.
- SACKS, B. N., M. M. JAEGER, J. C. C. NEALE, AND D. R. MCCULLOUGH. 1999b. Territoriality and breeding status of coyotes relative to sheep predation. *J. Wildl. Manage.* 63:593-605.
- SCHWARZ, P. A., T. J. FAHEY, C. W. MARTIN, T. G. SICCAMI, AND A. BAILEY. 2001. Structure and composition of three northern hardwood-conifer forests with differing disturbance histories. *For. Ecol. Manage.* 144:201-212.
- SHARGO, E. S. 1988. Home range, movements, and activity patterns of coyotes (*Canis latrans*) in Los Angeles suburbs. Ph.D. dissert., Univ. Calif.-Los Angeles, CA. 76 pp.
- SOVADA, M. A., A. B. SARGEANT, AND J. W. GRIER. 1995. Differential effects of coyotes and red foxes on duck nest success. *J. Wildl. Manage.* 59:1-9.
- STEPHENSON, S. W., AND M. L. KENNEDY. 1993. Demography of a coyote population in western Tennessee. *J. Tenn. Acad. Sci.* 68:122-124.
- STERLING, B., W. CONLEY, AND M. R. CONLEY. 1983. Simulations of demographic compensation in coyote populations. *J. Wildl. Manage.* 47:1177-1181.
- TIGAS, L. A., D. H. VAN VUREN, AND R. M. SAUVAJOT. 2002. Behavioral responses of bobcats and coyotes to habitat fragmentation and corridors in an urban environment. *Biol. Conserv.* 108:299-306.
- TIMM, R. M., R. O. BAKER, J. R. BENNETT, AND C. C. COOLAHAN. 2004. Coyote attacks: an increasing suburban problem. *Proc. Vertebr. Pest Conf.* 21:47-57.
- WAY, J. G., I. M. ORTEGA, AND P. J. AUGER. 2002. Eastern coyote home range, territoriality and sociality on urbanized Cape Cod. *Northeast Wildlife* 57:1-18
- WAY, J. G. 2003. Description and possible reasons for an abnormally large group size of adult eastern coyotes observed during summer. *Northeast. Nat.* 10:335-342.
- WAY, J. G., I. M. ORTEGA, AND E. G. STRAUSS. 2004. Movement and activity patterns of eastern coyotes in a coastal, suburban environment. *Northeast. Nat.* 11:237-254.