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Assessment of Human-Coyote Conflicts: City and County of Broomfield, Colorado

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MEMORANDUM

Open Space and Trails Division

TO: Charles Ozaki, City and County Manager

FROM: Kristan Pritz, Director of Open Space and Trails

SUBJ: Final Report: Assessment of Human-Coyote Conflicts: City and County of Broomfield, Colorado

In January 2012, three researchers, Dr. Stan Gehrt of Ohio State University, Dr. Julie Young of USDA-Wildlife Services Predatory Research Facility and Utah State University, and Dr. Seth Riley of the National Park Service and University of California Los Angeles visited the Anthem neighborhood to identify management approaches or improvements to existing management protocols to reduce the likelihood of future human-coyote conflicts. This research project was conducted because of the concern about the bites to three young children that occurred in Broomfield in July and August 2011. A copy of the report is attached for your review.

The researchers: 1) Met with the Mayor, Councilmember Jurcak, Colorado Parks and Wildlife and Broomfield staff involved with coyote management, the families of the children that experienced the bites, and citizens; 2) Attended an Open Space and Trails Advisory Committee (OSTAC) public meeting; and 3) Reviewed the Anthem area in detail through on-site field work, videos and photos. In general, their report indicates that many positive management and education programs are in place in Broomfield. As requested, they provided recommendations for increasing the effectiveness of Broomfield's work to lessen human-coyote conflicts. The staff and Colorado Parks and Wildlife believe most of the recommendations are helpful and easy to implement. Work to implement the simpler recommendations has begun.

Staff will work with City Council and OSTAC on the recommendations related to our coyote response policy, any potential ordinance modifications and future development.

Below is a summary of the recommendations:

-Education: Continue to seek novel ideas to provide public outreach even when public interest is low.

-Inter-agency Cooperation: Establish better lines of communication between agencies following an incident.

-Regulations: Broomfield may want to consider developing its own ordinance to prohibit feeding wildlife, in addition to state regulations. Continue to enforce the leash law.

-Habitat Modification: Continue to mow buffers along trails and play areas and avoid landscape materials that attract coyotes.

-Hazing: Use outreach to teach citizens appropriate hazing actions and when hazing should be used. Document the types of hazing used.

-Research: Continue participation in the Denver Metro Area Coyote Behavior Study as this will help to understand the impacts of hazing.

-Lethal Removal: Although the panel recognizes that each community must determine when lethal control should be used, the panel suggests that Broomfield use multiple reports of human incidents or attacks on attended pets in a specific area or timeframe (days or weeks) as a criterion for consideration for lethal control. Full necropsies and genetic tests should be conducted if possible after a coyote is removed. Open communication with the public regarding removals is suggested.

- Future Residential Development: Location of public facilities/amenities should be carefully considered when reviewing development plans.

-Final Point: No single technique or strategy will be 100% effective in coyote management. The key to success in managing human-wildlife conflicts is to implement a variety of techniques whenever possible. Successful techniques may also have temporary effectiveness and therefore new approaches should be considered and developed.

The full report is attached for your review. I look forward to any questions or comments you may have regarding the report.

CC: Kevin Standbridge
Tom Deland

FINAL REPORT

Assessment of Human-Coyote Conflicts: City and County of Broomfield, Colorado



Submitted To: Open Space and Trails
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EXECUTIVE SUMMARY

In the summer of 2011, the Anthem Highlands neighborhood of the City and County of Broomfield (Broomfield), Colorado experienced multiple serious incidents between humans and coyotes. Broomfield has a detailed policy about coexisting with wildlife in general, and coyotes in particular, that includes extensive public education and outreach. Because of the serious nature of the incidents, the Colorado Division of Parks and Wildlife, with assistance from USDA-Wildlife Services and in collaboration with Broomfield, engaged in coyote removal efforts. One coyote was lethally removed after the first incident, another was shot after the second incident, 8 coyotes were lethally removed (7 shot and 1 captured by foothold trap) after the third incident, and 1 adult male coyote was shot after the last incident.

In the fall of 2011, the City solicited proposals from coyote researchers and experts to come to Broomfield, investigate the circumstances surrounding the incidents, and evaluate the policies and practices in place with the intent of making recommendations for future management, outreach, and research. A panel of three researchers, Dr. Stan Gehrt of Ohio State University, Dr. Julie Young of USDA-WS-NWRC-Predator Research Facility and Utah State University, and Dr. Seth Riley of the National Park Service and University of California Los Angeles, were selected for the project. The Panel visited Broomfield on 18 and 19 January 2012 and held meetings and conducted interviews with the different agencies involved with coyote management and families involved in the 2011 incidents.

The incidents during the summer of 2011 likely all involved one coyote, specifically the red adult male that was removed on 22 September 2011. The Panel believes this coyote was responsible for all of the incidents for several reasons: (1) the incidents occurred over a short time period; (2) they occurred in close proximity to one another with three of them being along the same school channel path and stream; and (3) the pattern was similar in that they involved a child between 2 and 6 years old, most occurred in the evening between 19:00 and 19:45, and in all cases the coyote approached quickly from cover, attacked with a fast initial bite, and then backed or ran away quickly, especially after attention from an adult. The bites were likely attempted predatory attacks, with the movement and sounds of the children mistaken as those of potential prey items. These incidents were similar to predatory attacks that have occurred in other cities in that they were aimed at children, involved minor wounds, occurred in residential areas, and were carried out by an apparently healthy coyote. As far as the Panel could determine, intentional food provisioning was not a factor in the incidents, as it has been in many other urban incidents.

The Panel has a number of recommendations for future management, communication, education, and research efforts. The Panel was quite impressed by the current education programs and materials related to coyotes and the communication among agencies. We recommend continuing education efforts and working to find new ways to provide information to the public. Finding novel approaches to education is especially important when there are no conflicts and public interest is low. We think the "Coyote Crew" program is a good educational tool and resource, although it is important for the volunteers involved to have a solid understanding of what they should be doing after their initial training. The Panel found good communication among agencies. Communication could be further enhanced by clearly defining roles of each agency specifically in relation to education/outreach efforts and negative human behaviors such as intentional feeding, increasing release of information to the

public about responses to incidents, and creating even more lines of communication. Enhancing communication will also benefit agencies called upon to enforce existing or newly created policies and regulations aimed at preventing coyote-human conflict.

Because attacking from cover was an issue in these incidents and because food provisioning, both intentional and unintentional, is an important factor in many coyote-human conflicts in urban areas, we believe that habitat modifications and preventing feeding will be important in reducing future risk. Specifically, it is important to regularly mow vegetation near walking trails, as was done after some of the earlier incidents, on a regular basis. If possible, reducing or eliminating fruit-bearing trees or bushes in residential areas would also be valuable. Fruit is an important part of the coyote diet in the summer and fall, and fruit in yards can lead to increased interaction between coyotes and people, including children. Developing, enacting, and enforcing a city regulation banning the intentional feeding of coyotes in Broomfield would be valuable.

Finally, the Panel was encouraged to see multiple management tools being applied in Broomfield to resolve conflict, including hazing, lethal removals, and research. We recommend Broomfield clearly define unacceptable coyote behaviors that require hazing or lethal removal and inform the public through education programs about these definitions. Hazing programs could then utilize community members when unacceptable behaviors are observed, while lethal removal programs should be more accepted by the public if clearly defined in advance of need. Lacking from current hazing and removal programs is data collection that could be used by researchers to better understand patterns of coyote behavior and movement that may lead to conflict. The Panel suggests Broomfield uses a single reporting form that is specific to coyote incidents. The Panel encourages the involvement and support of Broomfield in the Denver Metro Area Coyote Behavior Study.

In summary, Broomfield already has good management and education programs. Recommendations by the Panel reflect modifications and additions that will serve to further improve these efforts.

INTRODUCTION

Purpose of the Report

During the summer of 2011, the City and County of Broomfield (Broomfield) experienced a series of coyote attacks on children. Following these actions, the city solicited potential consultants during the autumn of 2011 to conduct comprehensive research into the nature of the incidents, to review pre- and post-incident management strategies, and interview all participants. Subsequently, a panel of three consultants (hereafter referred to as 'Panel') was contracted by Broomfield, and the Panel visited Broomfield on 18-19 January 2012. During their research, the Panel visited the sites of the incidents, as well as other parts of Broomfield, inspected educational materials, documents and maps, and conducted extensive interviews with city, state, and federal agency personnel, local residents, and families of the victims. The Panel also attended a municipal meeting to answer questions from city administrators and the public and conducted media interviews.

Following the interviews and visits to sites, the Panel began to discuss their findings and compare observations. After consultations with Kristan Pritz, it was decided that an efficient approach would be for the Panel members to collaborate and develop a single report of findings and recommendations. In areas where Panel members may disagree, the differing opinions would be made clear in this document. Panel members continued to interact over the next month regarding the research and development of the report. The following report represents the findings of the Panel, as it pertains to human-coyote conflicts in Broomfield, Colorado, with a specific focus on the incidents during the summer of 2011. Our purpose is to revisit the incidents with first-person interviews and our interpretations of the evidence provided to us, to evaluate pre- and post-incident coyote programs, and provide recommendations for management strategies going forward. **The overall goal of this report is to identify management approaches or improvements to existing management protocols that reduce the likelihood of future human-coyote conflicts.**

The report is organized in the following manner. As part of the introduction and to set the stage for discussions later in the report, we provide a brief description of the coyote, with a particular emphasis on current knowledge of its behavior, urban ecology, and the nature of conflicts with people. After a short description of the Broomfield area, we outline details about the coyote incidents that occurred in the Anthem area of Broomfield in 2011. Because these incidents were the catalyst for this review as well as any changes in management program, we believe it important to clearly state the facts that are known, and to share any particular details we recorded in our interviews that may not be available in existing reports. We also outline the management responses to the incidents. Following our interpretations of the incidents, we identify various management techniques and their possible efficacy for Broomfield. The conclusion is an itemized list of recommendations from the Panel.

General Coyote Characteristics

The coyote is a medium-sized member of the family Canidae (including wolves, foxes, and the domestic dog) and closely resembles some dog breeds because of their upright ears, long snout, and long, bushy tail. Most coyotes are approximately 54 inches in body length and typically

weigh about 35 pounds (Bekoff and Gese 2003). Coyotes are native to Colorado. Their range has increased dramatically in recent years and currently extends to nearly all parts of North America except the northernmost parts of Canada (Gehrt and Riley 2010). They are capable of using a wide range of habitats, but are most closely identified with grasslands or open landscapes.



Coyotes can hybridize with wolves and dogs but rarely do so. Eastern coyotes located in the northeastern United States and parts of Canada are the product of wolf-coyote hybridization (Wilson et al. 2009, Kays et al. 2010), but this has not been documented for western coyotes. Despite the constant proximity of coyotes to dogs in urban areas, there is little indication that coyotes living in urban areas are more genetically intermingled with dogs than has occurred historically in nonurban areas (Adams et al. 2003, Gehrt and Riley 2010).

Social Organization - The typical coyote population comprises resident groups, or packs, maintaining exclusive territories across the landscape, with solitary individuals of both sexes inhabiting large home ranges that overlap one another and group territories (Bekoff and Wells 1980; Gese and Ruff 1997, 1998; Gese 2001). However, group sizes and internal pack dynamics may vary across areas depending on food supply and habitat characteristics. Packs are formed for territory defense (Bekoff and Wells 1980; Bowen 1982), but pack size is affected by food abundance, mortality rates, and population density (Andelt 1985; Bekoff and Gese 2003). Packs of rural and urban coyotes are typically composed of an alpha pair (adult male and female) that breed and are dominant over one or more associates that help defend territories and provision the young of the alpha pair. Genetic analysis of coyotes in Chicago revealed that: (1) with very few exceptions pups of each litter were the product of a single alpha pair, (2) the male and female of alpha pairs were not closely related, and (3) pack members were usually (>85% of associate pairs) closely related to one another and to the alpha pair (probably as offspring from previous litters; Hennessy 2007). Coyotes born into a pack stayed as an associate in the pack, left to become a local, solitary nomad, or dispersed from the area altogether. Nomads are usually young coyotes that have left their natal groups and are searching for vacant areas or possible mates. Occasionally, older individuals would leave territories and become nomads, including previous alpha adults, upon the death of their mate.

Disease - One concern that agencies and the general public have when coyotes appear in suburban and urban areas is the threat of disease transmission. Coyotes host or carry a variety of transmissible diseases in urban areas. These include heartworm, canine parvovirus, canine distemper virus, canine herpesvirus, canine adenovirus, and *Leptospira interrogans* (Grinder and Krausman 2001; National Park Service, unpublished data). Mortality due to these diseases is generally low, and there have been few records of these presenting health issues for people or pets (Gehrt and Riley 2010). Although coyote-strain rabies is restricted to Mexico and south Texas, other strains of rabies have occasionally spilled over into coyotes. A coyote attack on a man in an urban park in Cleveland, Ohio, was the result of spillover from rabies in raccoons (Ohio Department of Public Health, unpublished data). Sarcoptic mange can be present in urban

populations (Grinder and Krausman 2001), and 10% of mortalities in Chicago were due to mange (Gehrt et al. 2011). Although mange has been present in the Chicago population for nearly 10 years, there have been no reports of transmission to pets or people (Gehrt, unpublished data).

Behavior - Coyotes have unique behavioral profiles. Some coyotes display more bold behaviors than others. Bold animals are categorized as those coyotes more likely to approach other, unrelated coyotes and unfamiliar objects. Some bold coyotes are more food-driven; they will take greater risks to obtain a food reward. Studies of captive coyotes suggest that behavior profiles may be more influential than previous interactions with humans in determining how coyotes respond to positive and negative (e.g., hazing) interactions with objects or people (Young, unpublished data). Behavioral responses are variable among coyotes and change over time as coyotes become habituated to an object or person. For example, in one study where captive coyotes were provided food near a motion-detector strobe light, some coyotes were frightened and ran away from the strobe light, some coyotes were frightened at first but habituated to the light over time, and others continued to eat on the first trial (Darrow and Shivik 2009). The coyotes that continued to eat did not even show signs that they were startled the first time the strobe light was activated. This study illustrates that coyote behavior profiles, especially of food-driven coyotes, will affect their behavioral response to an object or person.

In wild coyotes, such a bold-shy continuum is likely to be associated with social status. Alpha coyotes are more likely to take larger prey items and are often responsible for livestock depredation conflict. Alpha animals have been observed attacking larger dogs in urban areas.

Urban Coyote Ecology

Coyote colonization of cities is a relatively new phenomenon, with their appearance occurring within the past 15-20 years for most metropolitan areas across North America. An exception is the Los Angeles area, where coyotes appear to have always been resident. Research is still lagging for many aspects of how coyotes adapt to urban areas and the implications their presence has for people and pets. Some consistent patterns have been reported in various cities where research has been conducted, and they are likely relevant for coyotes within the City and County of Broomfield.

Studies repeatedly report relatively small home ranges or territories for coyotes residing within urban and suburban areas (Riley et al. 2003; Gehrt et al. 2009; Grinder and Krausman 2001). The small size of home ranges is likely due to a combination of concentrated resources (most likely food) and the fragmented nature of the urbanized landscape. Essentially all studies have reported a shift of coyote activity to nocturnal hours as they move into more developed areas (McClennen et al. 2001; Riley et al. 2003; Gehrt et al. 2011), although there is considerable individual variation in the degree to which coyotes do this. Coyotes are more active during the day in areas with more open space and less human activity, just as they would be if they were in a rural landscape. Focusing their activity during nocturnal hours in more populated areas allows coyotes to more easily avoid people and cross roads with heavy daytime traffic (Gehrt and Riley 2010).



Coyotes are capable of residing in any part of the urban landscape, including downtown areas (Gehrt et al. 2009, 2011), but are most abundant in suburbs with available open space. The degree to which coyotes saturate the landscape varies across cities and probably reflects the length of time (and the number of generations) since coyotes have colonized the area. Any community within the range of coyotes should anticipate the presence of resident coyotes and take appropriate measures to prevent conflicts regardless of the degree of development or the location within the larger metropolitan area. Although coyotes reside throughout the urban landscape, the majority make efforts to avoid or minimize their use of developed properties such as residential areas (Grinder and Krausman 2001; Gehrt et al. 2009). Most coyotes select fragments of natural areas or other undeveloped habitats for refuge and hunting. Often they may have to traverse neighborhoods because of the composition of

their home range, but they typically move through these areas quickly at night. Coyotes often prefer to use the same trails, sidewalks, or lesser roads that people use, but they usually use them during hours with minimal human traffic. Urban coyotes are able to maintain the same kind of social system that rural coyotes exhibit, with social groups or packs and territorial defense of home ranges from other, unrelated, coyotes.

Survival rates and reproductive rates may be higher for urban coyotes than for rural coyotes because hunting and trapping is limited or absent in the city (Gehrt et al. 2011). Studies have consistently reported that urban coyotes typically feed on the same diet items preferred by rural coyotes, principally rodents, rabbits, fruit, and a wide assortment of other items (Morey et al. 2007; Gehrt and Riley 2010). Some coyotes may seek human-related foods, such as garbage, but this is rare or otherwise highly individualistic (Gehrt, unpublished data).

Human-Coyote Conflicts

Human-coyote conflicts in urban areas include perceived threats from the increased presence of coyotes, direct attacks by coyotes on pets, and direct coyote attacks on people. Despite the generally low potential for conflict, constant non-threatening interactions with humans may reinforce behaviors that lead to habituation of coyotes to humans and ultimately result in conflict. Moreover, positive interactions (e.g., feeding coyotes) may cause a faster rate of habituation and possibly more severe consequences (e.g., human attacks). Conflict behavior of coyotes towards humans appears to differ if the humans are adults or children. These factors suggest conflict may not be associated with human density or interaction rates. Instead, conflict may be related to behavioral characteristics of coyotes and humans and how we manage interactions.

Attacks on pets

Coyotes may kill cats for food or to remove them as potential competitors for prey such as rodents and rabbits. Members of the public who own cats or are otherwise interested in their

well-being view this function of coyotes as strongly negative. It is difficult to assess the true impact of coyotes on cat populations; in many cases it is hard to identify the cause of missing cats and coyotes may incorrectly be accused as the source. The easiest solution to minimizing coyote predation on cats is to reduce the number of free-ranging cats, or reduce the amount of time they spend outdoors. Few communities initiate coyote removal in response to cat losses, largely because this type of conflict is not necessarily the result of changes in coyote behavior.

Coyote attacks on pet dogs are generally considered a more extreme form of conflict because most communities discourage free-ranging dogs. Consequently, attacks on dogs usually occur in the presence of people, or on residential properties associated with people. Small dogs may be taken at any time of year, but attacks on larger dogs are usually associated with the mating and breeding season (January through April). Most reported dog attacks have occurred while outside in their backyard (both alone and in the presence of their owner) and also while being walked by their owner in a park, especially if dogs are off leash. Some communities initiate lethal coyote removal when multiple coyote attacks on dogs are reported, especially from a localized area.

Attacks on Humans

The most extreme, and relatively rare, type of conflict is the direct coyote attack on a person. A majority of these cases involve younger children and most attacks have occurred in the Southwest, especially in southern California, where coyotes have lived in suburbs for decades. Injuries from coyote attacks are primarily minor, with few life-threatening. There have been two recorded fatalities from coyote attacks: a 3-year-old child from southern California in 1981, and a 19-year-old woman in Nova Scotia in 2009.

Coyote attacks on people generally fall into five categories (White and Gehrt 2009):

- *Predatory* (the coyote directly and aggressively pursued and bit the victim);
- *Investigative* (the coyote bit a sleeping or resting person, testing it as a possible prey source);
- *Rabid* (the coyote was captured, tested, and diagnosed with rabies);
- *Pet-related* (the coyote attacked a person that was walking a pet, trying to save a pet from a coyote attack, or was near a domestic pet at the time of attack); and
- *Defensive* (the coyote felt threatened and was defending itself, pups, or a den).

Coyote attacks on people are generally committed by seemingly healthy coyotes, with less than 8% of attacks confirmed by rabid coyotes. Most attacks on humans occur between May and August (pup-rearing season) and attacks may occur equally during daytime and nighttime. Predatory attacks are often carried out during daytime.

Prior to attacks, victims are commonly engaged in some type of recreational activity, such as jogging, hiking, bicycling, or playing golf. Other common activities prior to attack are sleeping and resting outside. A majority of attacks on children occur while the victims are playing outside in their yard or driveway.

Most victims do not suffer serious injuries from coyote attacks, and many victims are able to run away or scare off the coyote by yelling or throwing objects at it. However, children are the primary targets of predatory attacks, which result in the most serious injuries and account for approximately 37% of all reported attacks. Coyotes may view small children as potential prey

and may also be stimulated to attack children that are running or engaging in playful behavior (White and Gehrt 2009).

Sources of Conflicts

In almost one third of reported coyote attacks on people, it was known that coyotes were being fed (either intentionally or accidentally) near the attack site (White and Gehrt 2009). It is likely this was underreported, as there is no standardized reporting form and feeding is not always evident near attack sites. Often, feeding can be inferred from coyote behavior prior to attacks, such as increasing boldness over time, begging, or following people.

Easily obtained food that is common in many backyards, such as pet food, bird seed (attracting rodents), fallen fruit, and meat or fish scraps in garbage cans or compost piles, can be the source of many conflicts, luring coyotes into human settlements and teaching them to associate backyards with easily-acquired meals. In neighborhoods where cooking or eating outside is common, coyotes may be attracted into backyards by food scraps left outside.

Regardless of whether feeding is intentional or accidental, leaving food sources outside in areas of high human activity may teach coyotes to either lose fear of people (called *habituation*) or to associate the site of feeding with positive food rewards (called *food conditioning*).

Food conditioning/provisioning occurs when food rewards, such as accessible pet food or meat scraps, encourage undesirable behaviors, like coyotes exploring backyards. Food conditioning is a simple association made between people or human places and food and does not mean that the animal has lost its fear of people. Food conditioning did not appear to be an issue in the Broomfield incidents.

Habituation occurs when a coyote has repeated innocuous interactions with people, resulting in the eventual loss of fear and avoidance of people. Habituation is not an all-or-none response, but may vary widely among individuals within the same population. Habituated coyotes often become nuisances in metropolitan areas— as they lose fear of humans, they may become bolder and more aggressive towards people, often in search of food (Geist 2007). Habituation of coyotes towards people may have been an issue in the Broomfield incidents.

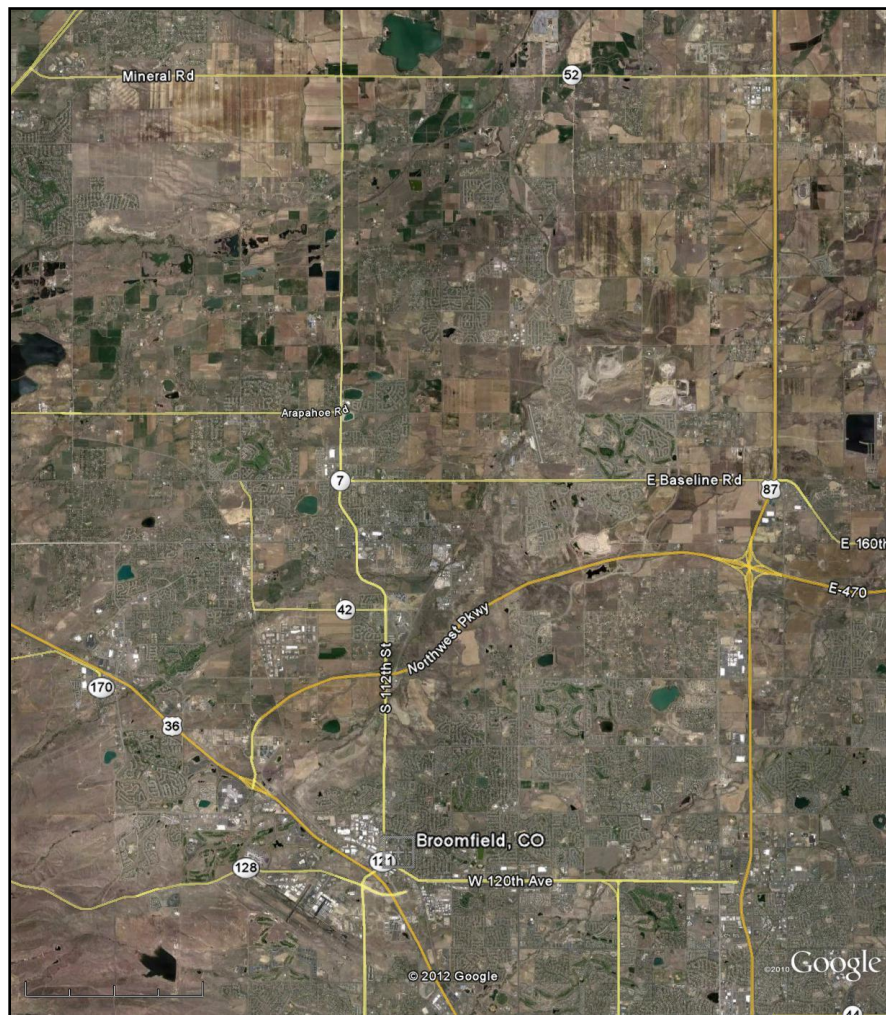
In other cases, disease may contribute to conflicts. Rabies has caused attacks on people, and mange has caused shifts in coyote behavior to the point that they do not avoid people, but are not necessarily aggressive (Gehrt et al. 2009, Gehrt and Riley 2010). Disease did not appear to be an issue in the Broomfield incidents, and disease is relatively rare as a factor in conflicts.

STUDY AREA

The City and County of Broomfield, Colorado, is a suburb at the northwestern edge of the larger Denver metropolitan area (39°55'55"N 105°3'57"W; 39.93194°N 105.06583°W). The city is located in Broomfield County, and Broomfield operates under a consolidated government under Article XX, Sections 10-13 of the Constitution of the State of Colorado. The population was 55,889 in 2010 (as reported by the 2010 US Census Bureau), and has experienced tremendous population growth in recent years (i.e., a nearly 50% increase since the 2000 Census), with new

developments and active construction a prominent feature of the city's periphery. The city covers 27.5 square miles, yielding a population density of 1,640 per square mile.

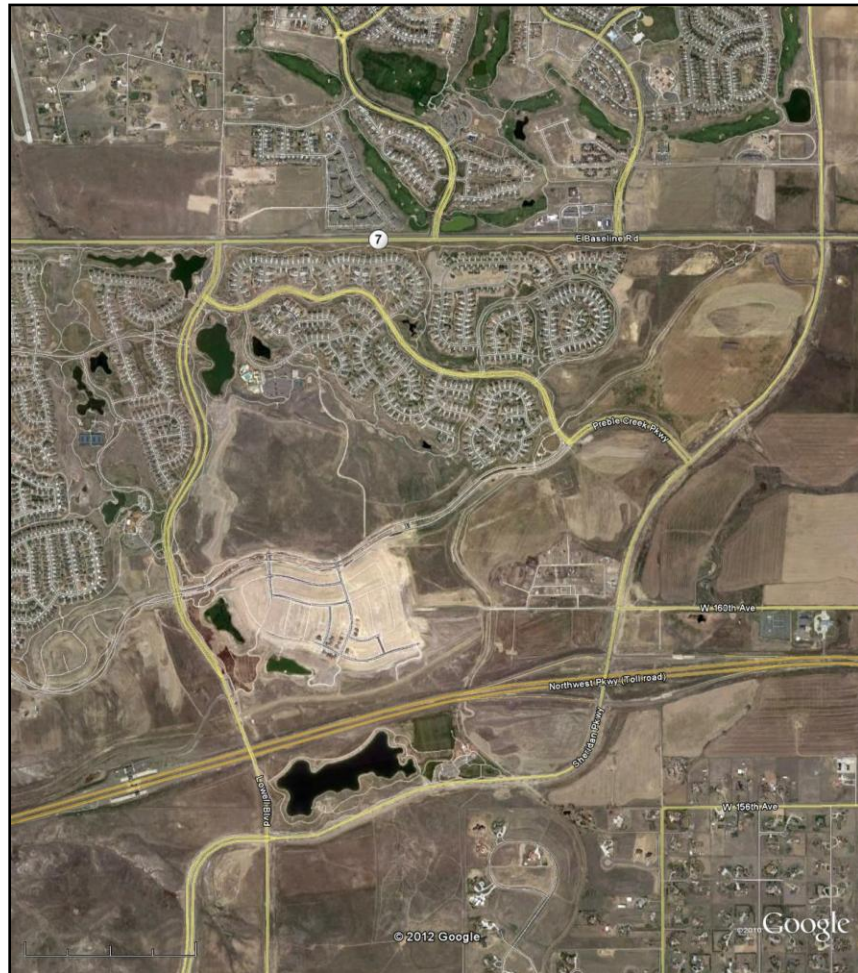
Another prominent feature of Broomfield's landscape is the abundant open space in the various forms of undeveloped property, patches of preserved habitats, and maintained parklands. This open space is a result of the location of the city at the edge of the larger Denver metropolitan area, affording the community space to grow, and the relatively young age of the community. Indeed, some parts of Broomfield are nearly surrounded by open space and share many of the qualities of exurban sites, in which the surrounding rural landscape is the dominant landscape feature.



Within view of the Front Range of the Rockies and at an elevation of 5,420 feet, Broomfield lies at the interface between two major ecoregions: the High Plains and the Front Range Fans (source: Colorado EPA). The climate is semi-arid, which is reflected in the predominant vegetation communities. Both ecoregions are dominated by rangeland and cropland land uses, and the native vegetative community is largely shortgrass prairie represented by blue grama, western wheatgrass, buffalograss, and some pockets of little bluestem. Woody plants are less common and occur in riparian areas, with cottonwoods the dominant tree species. The

surrounding prairie-agricultural mixed landscape could be characterized as excellent habitat for coyotes.

The community of focus for this investigation is the Anthem Highlands area, located at the periphery of Broomfield, where the incidents occurred during the summer of 2011; however, coyotes have also been reported in other parts of the city and the findings from this report should be applicable to the city proper. Relevant regulations pertaining to human-coyote conflicts for this community are presented in the appendix.



DETAILS OF INCIDENTS

Incident # 1

The first incident was a bite of a 2-year old boy on 18 July 2011. The incident occurred in the Anthem Highlands Neighborhood, North-Central region, between Trinity Loop and Traver Drive, along a walking path.

From the parents of the child: The incident occurred at approximately 19:45, when it was still daylight. The father was on a walk with his two children, his 2-year old son and younger daughter, on the walking path that runs between Trinity Loop and Traver Drive. They regularly walked on the path, and their backyard abuts it. The father was pulling the younger girl in a wagon, and the boy was running and walking about 10 feet ahead. The coyote came out suddenly from tall grass next to the trail. The father thought the coyote may have been sitting in the grass. The coyote bit the boy on the bottom of his back and top part of his buttocks, grabbing the boy and shaking its head a bit. Both the father and the son yelled; the son yelled in surprise and the father yelled at the coyote. The coyote looked at the father for 2-3 seconds, and the coyote ran off about 30 feet before stopping. The coyote looked at the father and then ran out of sight. The bite went through the boy's shorts and diaper, resulting in four bite marks. It is likely the bite marks were from the four canine teeth. The father assumed the coyote was a juvenile because of its small size at first, but has since seen other coyotes and realized this coyote was likely of normal adult size. The boy received rabies shots, but the wound itself was relatively minor. The parents said that at the time the boy was mostly scared, i.e. not much affected physically. They said that they thought he was relatively unaffected by the event and that he thought it was a rabbit that had bitten him.

Background: The parents said they had not seen coyotes at all before and have seen them only once since. Although the family knew coyotes existed in the area, they assumed coyotes avoided developed areas. They said that 3-4 homes across the path from them feed birds. They also said that people who lived further south and east, around the corner on Indian Peaks Parkway, had been regularly seeing a coyote hanging around, and when they threw rocks at it, it did not leave. These neighbors had seen this coyote many days in a row, between 18:00-20:00, before and after this incident.

From other parties: The Panel received conflicting information on the reaction of the family to the incident. Donna Shimic, Animal Control Officer for Broomfield told the Panel that the family seemed pretty calm about it and understood that coyotes are native to the area. The family was willing to provide information for the report. Kris Middledorf, Colorado Parks and Wildlife officer, told the Panel that he had a 90-minute phone call with the mother several days after the incident, and that she was very upset.

Response: Donna Shimic spoke to the father on the phone because he was already at the hospital. Donna Shimic visited the site for photos the following day and filed an incident report, the same type used for domestic pet conflicts. Efforts were already being undertaken by the city of Broomfield and Colorado Parks and Wildlife to increase awareness about coyotes and prevent conflicts. These efforts increased and included informational mailings, increased signage, public meetings, educational presentations, videos on public television, and announcements in the Broomfield newspaper. One coyote was lethally removed in response to this incident. Specifically, a juvenile female coyote was shot by Colorado Parks and Wildlife officers, two days after the incident.

Incident # 2

A coyote approached a 4-year old girl on the playground on 4 August 2011. The playground is within the Anthem Highlands Neighborhood, Southwest region, just south of Promontory Way,

east of the Parkside Recreation Center, along a stream corridor and a walking path that runs along it. This path is informally called the "school channel path."

From the parents of the child: The Panel did not interview the parents of this child or anyone who directly witnessed this incident.

From other parties: The coyote entered the playground with several children present and trotted up to a 4-year old girl who had just come down the slide. According to the report, the coyote came out of nearby bushes, heading directly towards the girl on the slide, and came within two feet of the girl, staring at her. The girl's mother ran over and the coyote was scared away.

Response: The playground was temporarily closed by the city. The same ongoing efforts (see Incident #1) were continued. One coyote was lethally removed in response to this incident. Specifically, an adult female coyote that was bedded down about 400-500 yards away from the playground was shot by a USDA Wildlife Services (WS) officer on the same day.

Incident # 3

A 6-year old boy was bitten on 16 August 2011. The incident occurred in the Anthem Highlands Neighborhood, Southwest region, just west of the cul-de-sac at the end of Red Rock Lane, less than 300 feet southwest of Incident #2, on the school channel path.

From the parents of the child: The incident occurred at about 19:30, when it was still "broad daylight," and there were many children at the pool and at the playground, including unattended kids (i.e. not with parents). The father was on the walking path next to the stream corridor with his 6-year old son and his younger daughter. The family had not yet moved to the neighborhood but was visiting; the mother was out of town. They were walking on the school channel path from the end of Red Rock Lane, going northwest towards the playground. Another woman had been at the pool with her kids, and she had seen a coyote peering through the fence and bushes, with people commenting "look at the coyote." She followed the coyote from the pool, north across Promontory Way towards the pond, near the playground, and then east along the stream and fence line. There was lush vegetation, including tall grass and mature shrubs in bloom, right up to the walking path. The woman was able to take photos of the coyote with her cellular phone camera. As the father and his children were walking west, at some point the son started running towards the playground. At the same time, the woman came toward them on the paved path, yelling "there's a coyote!" The son stopped, and a coyote jumped off the 4.5 foot retaining wall along the path, onto the boy, biting him at the same time. The coyote shook its head a bit, had its hair up in an aggressive posture, and looked at the father and snarled. The child was knocked down by the impact and screamed. The bite penetrated his shirt and shorts. There were four teeth marks but only one puncture wound to the buttocks. The father started to chase the coyote, but it had already run off to the south, across the path and into the marsh area when the father lost sight of it momentarily. The suspected coyote was later seen sitting on the nearby hill for approximately 20 minutes, "glaring at them." The father said the coyote looked small, like a younger one, and he has seen larger ones since then. The father said that his son seemed generally unfazed by the incident.

Background: The parents said that lots of people in the area have fruit trees. They also said that a neighbor had told them about the playground slide incident (*Incident #2*) but they thought it happened before any bite (*Incident #1*). The parents also mentioned that lots of coyote tracks are seen near the playground, along the school channel path where the woman followed the coyote.

From other parties: Donna Shimic arrived very quickly for this incident; she left just a few minutes after the call came in, which was at 19:07, and she arrived on the scene at 19:15 or 19:20. The witness heard the coyote growl before it jumped. She was following the coyote from the Parkside Recreation Center, by the pool, at a distance, including taking some pictures. The coyote was behind a pine tree, she alerted them, it growled and jumped, the father yelled and raised his arms, the coyote ran off and then sat on top of the hill. The coyote ran away before they could take a shot at it. From the injury photos, it looked like very light canine marks.

Kris Middledorf, Colorado Parks and Wildlife officer, said that after this incident, Colorado Parks and Wildlife staff thought maybe this was a learned behavior and that there was potentially a family group that was behaving this way. Colorado Parks and Wildlife decided they needed to take more aggressive action in terms of removal. At this point Colorado Parks and Wildlife worked collaboratively with Broomfield to obtain permission for trapping from Broomfield's Health and Human Services Department. USDA-Wildlife Services (WS) was the contractor for the trapping.

Response: Donna Shimic was first on the scene, followed by a fire truck. The coyote stayed visible on the hill during this activity. Donna Shimic filed an incident report and Broomfield continued its educational and informational efforts, as after the first two incidents. But after this third incident, and second bite, the response was stepped up. Colorado Parks and Wildlife applied for and received permission to use traps, specifically foothold traps, to catch coyotes. Eight coyotes were removed during this period, one that was trapped, and seven that were shot. These were from a variety of different areas in and around the Anthem Highlands area, including across Preble Creek Parkway. The removed coyotes included a juvenile on 21 August (no sex given), two juvenile females and a juvenile male on 23 August, a juvenile male on 24 August (captured in a foothold trap), an adult female on 26 August, an adult male on 29 August, and a juvenile male on 31 August.

WS Operations officer, Shane Koyle, who had been in charge of the removal efforts, also told us that they had been seeing a particular coyote frequently. This "redder" animal was believed to be an adult male using the area around the last two incidents, along the border of Anthem Highlands and the large open area to the South. USDA-Wildlife Services and Colorado Parks and Wildlife were trying to remove this male, but had been unsuccessful to that point. Shane Koyle reported that he and other WS personnel had at least four interactions with this coyote.

Colorado Parks and Wildlife explained that its effort in Anthem required significant expenditure of its agency's resources for educational and control activities that were taken, impacting personnel time and budgets. Colorado Parks and Wildlife noted that in the future, Colorado Parks and Wildlife's incidents costs of action and how they will be covered should be a matter of discussion and agreed to between the local community and the State of Colorado.

Incident # 4

A 3 year-old girl was bitten on 19 September 2011. The incident occurred in Anthem Highlands Neighborhood, South-Central region, just northwest of the cul-de-sac at the end of Chapin Place, in the backyard of her house, north of the cul-de-sac. This incident was about 300 feet southwest of Incident #3 and about 600 feet from Incident #2, and again just off the school channel path that runs along the stream corridor.

From the parents of the child: The incident occurred at about 19:00, about 20 minutes after sunset. The two children, a 7-year old girl and a 3-year old girl, were wrestling in the grass of the backyard, just below the patio, making noise and squealing. The parents were on the patio, and they had all been eating pizza for dinner. Their 12-year old Labrador was in the front of the house. The 7-year old girl came up to the table on the patio, and the 3-year old girl was lying on the ground and laughing about seven feet away. Less than a minute after the 7-year old girl came up, the coyote "came out of the blue" and attacked the 3-year old girl. She started screaming, and both parents ran over right away. The coyote was backing away, about 10 feet, with its back hunched. Defensive threat displays by coyotes include a wide open mouth gape-threat and arched back posture, much like that described by the father as the coyote backed away from the child and towards the fence. The coyote was backed up to the vegetation at the edge of the yard, somewhat cornered, and it crouched down to the ground and stared at the parents before running off. The coyote was described as very red, and the family thought it was a dog or fox initially. The coyote was backed up against the boulders surrounding the backyard, looked down, looked up again, and then was gone. The parents took the 3-year old girl to the hospital, where she was treated for three puncture wounds to her leg with rounds of platelets and rabies shots. They did not stitch the wounds to reduce the risk of infection. The 3-year old girl is a bit concerned about being outside, on her own, at night. She has some scars from the bite.

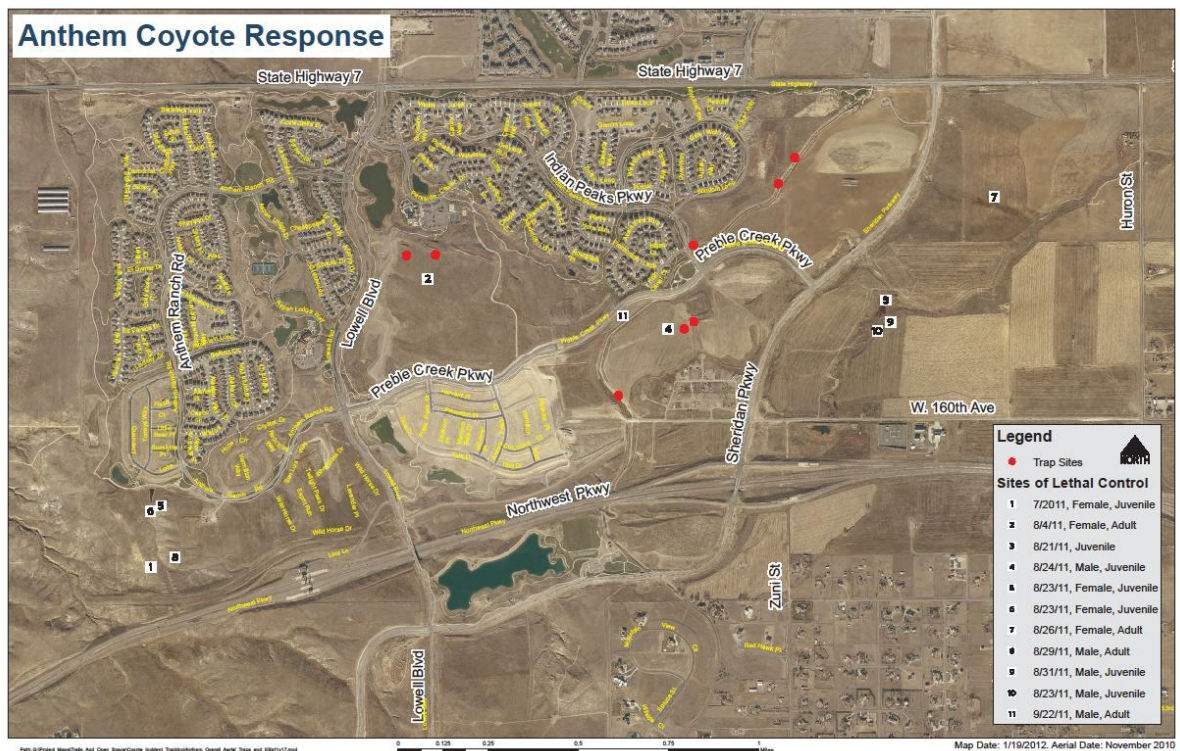
Background: The family had moved to the home over three years earlier, they had seen a pack of coyotes soon after moving in and others since then. However, this was their only "aggressive" encounter. The parents explained that a neighbor knew a coyote moved through their yard and that community members knew of a den on the nearby hill. People had also seen pups near the den. The parents said they had been getting information about hazing and other management actions but not about what to do if someone was bitten. They did not go to the press after the attack, although they had the opportunity, in part because of the potential effect on housing values. The parents mentioned that in previous years, the grass had been mowed lower along the trail and the stream corridor, but that that in the summer of 2011, the grass was very high still at the time of the incident. They noted it was cut back afterwards.

From other parties: Donna Shimic said the call came in late, around 22:00, and she talked to the mother. She described the incident as the family did, except that she reported that the father did not see the coyote; the coyote was gone before he could react. We saw the photos of the injury; the marks were light, although a bit redder and deeper than the previous bites. It looked like two canine marks.

Broomfield officials shared information on mowing. Pulte, the developer, maintained the school channel path and mowed this area up to November 2010. Broomfield took over the mowing from Pulte after November 2010. Broomfield standard requirements for mowing are 6 feet on

either side of a trail and 6 feet behind homes. The buffers are mowed to a height of 4 inches. In August 2011, after the second bite, the City Manager's Office directed Parks Maintenance to mow a wider swath on either side of the trail in the school channel path as two bites involved coyotes coming out of the grasses on the sides of the trail corridor. Broomfield has its own mowing standards and Pulte may have been mowing a wider area when they were in charge of maintenance. Pulte may also have mowed this area more frequently than Broomfield.

Response: The parents filled out a police report at the hospital. Animal Control then contacted them in response to the police report. Again, the City was continuing its educational and informational efforts as after the first three incidents. After this fourth incident, a "red" adult male coyote (the one they had been trying to get for a while) was finally removed by shooting on September 22, 2011, just south of Preble Creek Parkway near the southeast corner of Anthem Highlands. No other incidents were reported after this removal.



Panel Conclusions and Commonalities

All of the families involved in the bites seemed to believe, understand, and generally appreciate, that they lived near open space and therefore in close proximity to wildlife. They seemed to appreciate Broomfield for that, and often had moved there specifically for those reasons. However, they also did not seem to think that wildlife would be in their backyards and along the trails by their houses. None of the incidents involved particularly unusual behavior by the families, or any kind of behavior that we would anticipate a bite or aggressive encounter (e.g. feeding coyotes, holding out a hand to a coyote as in the January 2009 incident, getting among dogs and coyotes chasing each other, as in the February 2009 incident, harassing coyote pups, etc.).

The four incidents from 2011 had some strikingly similar characteristics, and we believe they were likely associated with the same coyote, the "red male" that was removed on 22 September 2011. Multiple lines of evidence lead us to this conclusion. All four incidents occurred very close to each other, geographically, and the last three in particular occurred within about 600 feet of each other along the same school channel path and stream corridor. The incidents also occurred within a short window of time, all within a total of two months. The incidents displayed a similar pattern, in that they all (1) involved a child between the ages of 2 and 6, (2) were over very quickly, with the coyote backing away or running away after a fast initial bite, (3) bite injuries were remarkably similar among victims, (4) the incidents occurred on or near one of the walking trails through the Anthem Highlands neighborhood, and (5) the majority occurred in late daylight hours between 19:00 and 19:45. Finally, the incidents stopped as soon as the "red male" coyote was lethally removed, an animal that had been seen multiple times by USDA-Wildlife Services personnel along the school channel path. Also, the family involved in the 19 September incident specifically mentioned the coyote looking "very red," almost like a fox.



The 2011 incidents conformed to typical predatory attacks that have been reported in other cities (see Human Attacks above). The similarities of the Broomfield incidents to most predatory attacks in other cities include: children as victims, minor bite wounds, most attacks during daylight, and the attacks occurred in residential areas, including backyards (White and Gehrt 2009). Finally, the Broomfield incidents were presumably carried out by a healthy coyote(s), which is typical of predatory attacks. There was no evidence of disease, starvation, or other types of stress that provoked the attacks.

The Broomfield incidents differed from some incidents in that food conditioning was not an obvious contributing factor to the aggressiveness of the coyote(s). The Panel did not find obvious evidence of intentional wildlife feeding in the neighborhood, which is consistent with the coyote behavior. When conflicts occur as a result of food provisioning, coyotes often go through a process of increasing boldness or habituation, and often become a nuisance prior to a direct attack. In other words, habituation and aggressiveness as a result of food conditioning does not usually happen overnight. We did not detect this pattern of behavior by coyotes from the interviews of agency personnel or residents. There is a strong possibility that the predatory

behavior initiated by the coyote(s) was stimulated by the movement and sounds of the children prior to the attack (all victims were walking, running, rolling on the ground or otherwise playing, and making some type of vocalizations). These stimuli, introduced to a relatively bold coyote that was in close proximity to people, may be the most likely explanation for the cause of the incidents. However, this is speculation guided by evidence, but it is not definitive (in contrast to attacks as a result of clear food provisioning).

MANAGEMENT RECOMMENDATIONS

There are many techniques available for reducing coyote depredations, from deterring problems before they occur to removing individual animals or populations posing risks to human endeavors. We review several potential management techniques and recommend which are likely to be most appropriate to implement in Broomfield.

Habitat Modification

Habitat modification is likely to be an important strategy to minimize human-coyote conflicts in Broomfield given the preponderance of open spaces and the location of the city on the periphery of the metropolitan area. Further, habitat within the residential areas and other developments differs from the surrounding rural landscape, which produces edges and habitat patches for coyote prey. The surrounding native habitat is semi-arid shortgrass prairie or agricultural fields, and urban/suburban developments produce habitat that contrasts markedly with the larger rural landscape, with more varied and lush vegetation and relatively more water. The result is the creation of potential islands of habitat for coyote prey, specifically rodents and rabbits. Habitat modification to reduce human-wildlife conflicts typically involves removing habitats or structures that might be attractive to undesirable wildlife species.

In the case of Anthem, the Panel inspected the local sites, looked at photographs and video taken at the scene following attacks, and conducted interviews with residents and agency personnel. It was evident that grass had grown relatively high and had been allowed to grow high near trails and playgrounds. As a response to the incidents, Public Works-Park Maintenance mowed a wider buffer along each trail, and this should be continued as a preventative measure. Tall grass and woody shrubs not only provide habitat for prey, but they also provide cover for coyotes such that people may not see coyotes nearby. In some cases coyotes may mistake children for prey due to limited visibility. The attraction of these types of developments for prey and coyotes alike is largely due to the surrounding landscape consisting of shortgrass prairie and agriculture. Thus, developments may serve as habitat islands for prey such as rabbits and rodents, and consequently as attractants for coyotes.

Coyotes will readily consume some types of fruits; therefore property owners should be discouraged from planting or maintaining certain fruit-bearing plants that might attract coyotes, such as apple and peach trees. The Panel suggests continuing and creating additional efforts that discourage homeowners from planting these types of plants.

The Panel recommends keeping buffer strips (~6 feet) mowed to a short length along trails and playgrounds throughout the growing season, continuing to discourage the planting of ornamental plants that produce edible fruit, and removing habitat structures that provide

refuge for coyotes or their prey (e.g., rodents, rabbits), such as brushpiles, openings under decks, and uncontained compost piles.

Education

Education programs for the public as well as decision makers are critical components of any urban coyote management plan. Education goals usually center around two aspects: (1) providing a better understanding of how coyotes behave and their role in ecosystems and (2) promoting an understanding of how people can minimize conflicts by altering their own behavior, especially preventing coyote habituation, usually through food conditioning. The public's tolerance for wildlife, especially predators, often increases as they become more knowledgeable about the species. This, in effect, decreases conflict by influencing the level of public acceptance, especially given that the coyote is virtually impossible to remove permanently from any area, urban or otherwise. Conflict is further reduced by educating people so that they become aware of and stop engaging in behaviors that promote coyote interactions. In the majority of cases of human-coyote conflicts, habituation from food provisioning has been documented or suspected as the root of the problem.

Education programs in most cities include signs at sites where conflicts have occurred, printed materials in the form of bulletins or fact sheets, public presentations or workshops, videos, and electronic media such as websites. Some cities also include formal school programs and interactive maps of coyote activity in their education programs.

The Panel reviewed the education materials offered by Open Space and Trails and Colorado Parks and Wildlife. We assessed educational materials to determine the accuracy and appropriateness of the content, and the extent to which this information was delivered or available to the public.

Education materials and their availability were quite good. Print materials, either produced by Open Space and Trails, Colorado Parks and Wildlife, or other sources, were appropriate and reflect current knowledge regarding urban coyotes and their management. The panel noted that multiple public presentations have been delivered by Open Space and Trails and Colorado Parks and Wildlife staff and other agency personnel, and even presenters from other cities were invited to give public programs.

Virtually all of the information provided by Open Space and Trails is available on their website, which is easy to find and readily accessible. Information on the website includes printed materials to download, educational videos, and even slides of previous public presentations. The schedule of presentations also indicates that educational programs were being provided by Open Space and Trails prior to the 2011 incidents, as early as 2008, and continuing to December 2011. Interagency cooperation on this front is also evident, given that presentations at various times were delivered by representatives of Colorado Parks and Wildlife, Broomfield Animal Control, and Broomfield Open Space and Trails. The web page for Open Space and Trails also links to the Co-existing with Coyotes web page of the Colorado Parks and Wildlife website.

The Colorado Parks and Wildlife Coyote Crew program offers an excellent opportunity to provide additional education and outreach materials to community members with a keen

interest in coyotes and reducing human-wildlife conflict. The program benefits participants by providing them with more information and training and benefits Broomfield by creating a volunteer army that can be called upon for outreach and education purposes. The Panel encourages the continuation of this program.

The Panel found few areas for improvement. First, it is important that the agencies continue to provide educational programs using novel strategies for outreach even during periods when public interest is low. Open Space and Trails should consider ways to incorporate the cooperation with the Denver Metro Area Coyote Behavior Study into the educational materials as the project moves forward. Open Space and Trails and Colorado Parks and Wildlife may be able to use the Denver Metro Area Coyote Behavior Study as a means to continue public interest in coyote programs, perhaps with regularly scheduled updates. Second, education and outreach should include information on what to do if bitten by a coyote. Information should include actions to be taken, such as who to report the incident to and what medical treatment is suggested. Third, the “Coyote Crew” program needs to clearly define what participants should be doing after training. Participants the Panel met with showed strong enthusiasm for being involved in the “Coyote Crew” but remained unclear as to what happened next - what actions they were to take after the training. This program offers a potentially valuable resource to the community to increase education and outreach capacity and offers a method to keep interest and awareness piqued during periods when public interest is low.

Hazing

Hazing is a form of aversive conditioning used to change the behavior of habituated animals or change their use of space by eliciting avoidance of certain areas. Types of hazing include: 1) human behavior, such as waving arms, yelling, and running directly at coyotes, 2) projectiles, such as throwing objects or using slingshots, 3) sound devices, including cap guns (starter guns), whistles, radios, 4) motion-activated devices, such as spotlights, strobe lights (e.g., electronic predator guards), or water hoses, 5) nonlethal firearms, such as paintball guns, pellet rifles. Some methods, such as motion-activated devices, are most useful for affecting coyote space use, such as avoidance of residences or parks. Other types, such as human behavior or projectiles, are more useful for maintaining wariness toward people. Hazing may be an important tool to change coyote behavior, or to reinforce appropriate behavior, in urban areas. Some of these techniques have been used successfully to minimize conflicts in rural settings, such as managing livestock depredation. However, virtually no data exist from controlled studies of urban coyotes as to the effectiveness of hazing in preventing or reversing habituation. Important questions, such as which techniques are more effective, how often do they need to be applied to a coyote, how long is the effectiveness, and to what extent can hazing reverse habituation (or boldness/aggressiveness) remain unanswered.

There is uncertainty among professionals as to the effectiveness of hazing on altering the behavior of urban wildlife. Hazing has been used in an attempt to reverse habituation in food-provisioned black bears, but has been largely unsuccessful (McCullough 1982). Black bears may respond quite differently than coyotes, but there is little information available for coyotes. Giest (2007) questioned the effectiveness of hazing for canids (wolves, coyotes, dogs), particularly for more extreme forms of habituation. Likewise, Baker (2007) doubted the effectiveness of hazing for coyotes exhibiting aggressive or habituated behavior. Timm et al. (2007) stated that hazing is ineffective for coyotes in urban settings, but Schmidt and Timm

(2007) wrote: "If the majority of residents would undertake hazing efforts, such as making threatening movements toward coyotes that come toward residences, squirting them with a garden hose, or throwing rocks or sticks at them, it is possible that some degree of wariness toward humans could be maintained." Used regularly and consistently, hazing may be a useful preventative tool. But again, currently these assessments of the effectiveness of hazing on coyotes are based more on speculation than data. This is not to minimize the potential importance of hazing strategies for prevention, but only a caution that the effectiveness for urban coyotes is unknown.

The City and County of Broomfield has trained several Public Works and Open Space and Trails employees to haze coyotes. These employees are authorized to use paint ball guns. Employees explained to the Panel their inability to shoot coyotes with the paint balls, typically because coyotes are rarely seen or have already moved away before a shot was available. This is common in urban areas. It is likely that coyotes recognize specific individuals or vehicles and associate them with negative interactions. Coyotes already learned to avoid them. In these situations, hazing is no longer effective by these employees because the coyote moves away from the humans.

In general, there are two common mistakes made in urban areas that use hazing: (1) hazing is employed regardless of the specific behaviors or actions of the coyote, and (2) lack of consistency in hazing. To prevent habituation by coyotes, hazing should only be used if a coyote is behaving in a way that is unacceptable to the public or is using an area that residents deem unacceptable (e.g. puts humans at risk). If a coyote is seen catching mice in an open field, and the field is an acceptable area for coyotes to use, then hazing should not be used. However, if a coyote is walking through residential streets at a time or location that is unacceptable to residents then hazing should be used. By limiting hazing to the incidents defined as unacceptable within a particular community, coyotes will learn what actions result in a negative action (response-stimuli). Based on captive coyote studies, if hazing is used too often or ineffectively, coyotes often become habituated to hazing events. Thus, hazing may be more effective as a reactive tool, to focus on coyotes showing negative behavioral signs (e.g., not fearful of humans) or continued use of inappropriate areas. This selective hazing strategy will likely reduce the potential for coyotes becoming habituated to its use. We suggest the City and County of Broomfield use hazing in this way.

Broomfield community members and city officials need to clearly define what coyote behaviors are deemed unacceptable. While some actions are clearly acceptable (e.g., hunting mice in an open field) or unacceptable (e.g., biting a child), other actions are less clearly categorized (e.g., coyote using trails after humans use it). Each community must decide its level of tolerance and risk for categorizing these types of coyote behaviors.

Consistency in stimuli-response actions is important for coyotes to learn what behaviors are not acceptable in urban areas. Because the city employees are the most frequent people to haze coyotes, coyotes have learned to avoid them. However, human conflict may still occur because the avoidance is associated with particular people instead of being generalized to all people. Hazing should be conducted by every person that encounters a coyote behaving in a manner defined as unacceptable within Broomfield. While the type of hazing (e.g., loud noise, throwing object) can vary to reduce risk of habituation, it is important in all cases to continue hazing until the unacceptable behavior or location of the coyote changes. We suggest the City and County

of Broomfield define unacceptable coyote behaviors and movement, use their education and outreach program to inform the community of these definitions, and teach community members appropriate hazing actions.

To improve upon hazing techniques, records should be kept about hazing activities. These records can then be used to identify areas where additional measures may be needed as part of a preventative program. Essentially, it is necessary to keep good records of hazing efforts to assess effectiveness. For example, if several employees note that hazing activity is increasing or coyotes are no longer responding in a particular area, than other management actions could be taken to reduce the risk of human-coyote conflict in that area. Further, such information can help researchers learn about patterns in coyote behavior in urban areas, how conflict arises, and what methods are effective at reducing conflict. Records should at least include date, time, location, number of coyotes, coyote behavior pre-hazing, hazing action, and coyote response.

Enforcement

Enforcement of relevant laws and ordinances is a critical part of any attempt to affect and reduce wildlife-human conflicts, in urban areas in particular. There are two issues involved in most situations and in the Broomfield situation specifically: (1) the enforcement of existing laws, and (2) the potential development and passage of new laws that would also require enforcement. In terms of coyote-human conflicts in urban areas, there are a number of different types of rules and regulations for which enforcement may be relevant. These include rules against having dogs off leash, trail closures during particular time periods (as was attempted during the summer of 2011 in Broomfield), regulations against certain kinds of attractants, such as unsecured garbage, fruit trees, or bird feeders, and most importantly, regulations about the direct feeding of wild carnivores, specifically coyotes.

For a short period in 2007, Animal Control for the City and County of Broomfield was mandated to write tickets for off-leash dogs without providing warnings. Public complaints were high, so the rules were modified so that upon the first documented offense of an off-leash dog, an animal control officer can instead give a warning and provide education about the leash law and the reasons for it. Providing a warning is at the discretion of the officer; a fine can still be given at first offense. Typically, the second documented offense results in a fine of \$50 that can be paid by mail. Subsequent offenses result in mandatory court appearances and the judge determines the amount of the fines, with a maximum fine of \$1,000. Animal Control officers are required to be present if the case goes to trial. Off-leash dogs chasing coyotes may be more a symptom of problems than the source of problems themselves. It is certainly better for the coyotes, the dogs, and the owners, if dogs are not chasing coyotes, and the bite that occurred in February 2009 at The Trails Park in the Westlake Neighborhood appears to be the result of a dog being off leash and chasing coyotes. Kris Middledorf, of Colorado Parks and Wildlife, believed off-leash dogs may contribute to human-coyote conflicts, and that increased enforcement of the leash law is important.

The City and County of Broomfield is limited in regulations that would reduce human-coyote conflict through law enforcement. Research on bears using garbage in the Aspen, CO area determined that enforcement was critical in effecting actual change in human behavior (Baruch-Mordo et al. 2011). There are no regulations on feeding wildlife specific to Broomfield but there are state regulations. There appears to be no way to enforce trail closures associated with

wildlife incidents since the closure of the school channel path during the incidents over the summer of 2011 was neither enforced nor obeyed, in many cases. Although the incidents in the summer of 2011 do not appear to be associated with food provisioning, intentional and unintentional food provisioning may contribute to aggressive coyote behavior and conflicts. Officials can currently enforce state ordinances related to feeding wildlife for coyote incidents, but more specific rules would be beneficial. For example, home owner's association type rules could be developed, which would presumably be enforced by the HOA, to ban fruit trees and other attractants that lead to unintentional coyote feeding. Of course increased enforcement requires the resources, in personnel and time, to do so. The Panel suggests the City and County of Broomfield produce specific regulations to reduce intentional and unintentional coyote feeding, maintain education programs to reduce wildlife feeding, and create a mechanism for enforcement of trail closures. While feeding did not appear to relate to the incidents in summer 2001, these management recommendations are particularly important in Broomfield because the area will likely always have coyotes using it and passing through backyards.

Removals

Lethal removal of coyotes should be conducted only after considering several factors, including the nature of the problem and the efficacy, selectivity, and efficiency of specific removal methods or procedures. Because lethal removal also has political and emotional factors tied to it, it is important that Broomfield has a clearly defined threshold for when lethal removal is implemented. Such a threshold should ideally be defined through the regulations. Once the decision is made that lethal control is the appropriate response, then an attempt should be made to use all available removal techniques. The goal is to remove the offending individual(s) as quickly as possible for many reasons, and not all capture or removal techniques will have the same effectiveness across individual coyotes.

Eleven coyotes were lethally removed in response to the Broomfield coyote incidents. One of these was removed with a foot-hold trap, with the other 10 being removed by sniper. Lethal removal is a practical technique for targeting a specific coyote(s) to stop repeated conflict, as was likely the case in the Broomfield coyote incidents.

The use of high-powered rifles to remove coyotes is the most selective lethal tool available in urban settings. This tool can be especially effective when trained personnel call and shoot coyotes, enabling the removal of coyotes at the site of an incident. The use of a spotting scope can assure this method is used in the most humane manner, with coyotes often being killed immediately with one shot. The disadvantage to this method is that coyotes must be visually located, and a clear and safe shot must be available. Coyotes are likely to learn which trucks and people to avoid if there is a missed shot or the animal is harassed (e.g., stalked) before a shot can be taken. In Broomfield, this method was challenging to employ because of the number of state employees patrolling the areas during nocturnal hours when Wildlife Services Operations staff were attempting to use the technique.

An alternative tool in areas where coyotes and dogs co-occur is to live-trap the animal before lethally disposing of it following humane methods approved by the American Veterinarian Medical Association. Traps remain one of the most effective tools in urban areas. Traps are also highly selective; if another animal is captured in a trap, it can be released. Traps are limited in

their use and deployment due to state laws in Colorado. For the Broomfield incidents, the Colorado Parks and Wildlife worked cooperatively with federal USDA-Wildlife Services and the City and County of Broomfield to issue capture permits. Foot-hold traps were set to capture coyotes in the area that were believed to be causing conflict. Foot-hold traps are an effective method for capturing coyotes. Dogs or other animals incidentally captured in leg-hold traps can be easily removed unharmed. However, persistent exposure to capture devices can reduce their effectiveness for coyotes.

The Panel noted in Broomfield there were limitations on where traps could safely be set, resulting in traps set away from the incidents and being covered during daylight hours. The set locations were based on a combination of working knowledge of coyote territories in the area and an attempt to avoid areas where dog traffic was high. Although several trails were closed so that traps could be placed, many community members continued to walk their dogs, most off-leash, in the areas where removals would have ideally been targeted, namely along the school channel path and stream corridor. Traps were set farther from the location of the incidents and covered during daylight hours to prevent captures of dogs. Colorado Parks and Wildlife believes it would have been beneficial to have left traps open during all hours of the day. Perhaps local law enforcement could have enforced trail closure to facilitate captures of coyotes closer to the location of the incidents and allow traps not be covered during the day so that less human scent and disturbance occurred at traps between captures.

Using multiple types of live traps is typically necessary to capture coyotes in urban areas, especially if coyotes need to be removed quickly (such as in the case of threats to human safety). Cable restraints, or neck snares, offer an alternative method, and have been used with a great deal of success in highly urbanized areas. Cable restraints are often a more preferred trap in areas with dogs, because they cause less injury and owners are able to easily extricate the dog. Also, cable restraints can be more selective regarding captures of nontarget species than foothold traps, depending on the type of set. The drawbacks to cable restraints are the training necessary to use them effectively (especially in urban areas), and the characteristic that all cable restraints, regardless of the presence of ‘stops’ or guards to protect captured animals, are potentially lethal traps if set inappropriately.

Other traps, such as the Collarum™, are also used to livecapture coyotes and should be considered if regulations permit them. The Collarum™ is essentially a hybrid between foothold traps and cable restraints, in which a cable is projected around the animal’s neck if they attempt to take a bait or lure. It has many of the same advantages and disadvantages of the previous trap types, although it is especially selective for coyotes (Shivik et al. 2005).

Box traps also offer an alternative live-capture method. Although not as efficient as foot-holds or snares, box traps have been used in urban areas where coyotes may be less wary of man-made objects. The benefits of box traps are that incidental captures of dogs or cats are easy to remove and injuries are unlikely. Negative aspects of box traps include a high rate of nontarget captures, expense of traps, and their obviousness. Their obviousness often results in capturing young or injured coyotes which typically are not the coyotes causing conflicts.

Once the decision is made to implement lethal removal, we recommend the use of multiple live-traps, combined with sharp shooting, whenever possible to quickly and selectively remove problem coyotes. Traps should be set in close proximity to where incident(s) occur to increase

the likelihood the problem animal is removed. We recognize that the selection of removal devices will reflect the familiarity of use by the people involved with the removal, but they should attend training sessions or workshops when possible to broaden the pool of removal techniques for the area.

Analysis of Incidents

Reports are taken by Animal Control officers, although the forms for these reports were designed for incidents with domestic pets, and passed on to Open Space and Trails and Colorado Parks and Wildlife personnel. Colorado Parks and Wildlife ensures that necropsies are performed on coyotes that are removed, which includes determining age class, examining stomach contents, and testing for rabies.

The Panel recommends collecting additional information and samples during necropsies. It would be helpful to collect more information and samples from each coyote that is removed. It would be valuable to know age, sex, body size (using typical morphological measurements), body condition, weight, and pelt condition. Females should also be analyzed for placental scars to determine the number of offspring produced. These data would provide information on the coyote's social status and whether the coyote was in poor, emaciated condition or good condition, appearing well-fed. It would also provide information on the potential for mange, or other external parasites and diseases. Samples should include blood (if possible) for potential disease analysis, and tissue, and multiple samples taken if possible for back-ups. Tissue can be useful for DNA analysis and stored frozen until analysis is possible. Genotyping of tissue could then be done and compared to DNA obtained at the incident to determine which specific animals were involved.

DNA samples could be acquired from incidents in a number of ways. The best way would be to acquire DNA directly from taking a swab of the area where a person or pet was bitten, or by obtaining some sample (hair, scat) recovered directly from the scene of the incident. If it is not practical or desirable (we understand that it can be a sensitive situation) to obtain a sample directly from a person that is bitten, then samples could very likely be obtained from the clothes that were worn when the person was bitten. To individually identify the particular coyote(s) involved would be valuable, both for the agencies and people involved in the specific incidents. It would also enhance scientific knowledge of coyote-human conflicts in urban areas in general.

Agency Communication

There is very good communication, at this point, between the various parties involved in coyote incidents in Broomfield, specifically among Open Space and Trails employees like Kristan Pritz and Peter Dunlaevy, Animal Control officers such as Donna Shimic and Steve Griebel, Colorado Parks and Wildlife officers, specifically Kris Middendorf, and USDA-Wildlife Services specialists such as Shane Koyle. Everyone seems to have positive and cordial relationships with each other and wants to and does communicate regularly and effectively. However, there are always ways to improve communication, specifically by defining what roles each group or person has when different types of incidents occur.

In the Coexistence with Wildlife Policy (Section 3.6), there are very clear protocols about how to respond when particular types of incidents occur, including human attacks. For attacks in progress, the police are notified immediately by calling 911. For recent attacks, police animal control officers are called. In both cases, Colorado Parks and Wildlife personnel are notified as soon as possible. Kris Middendorf, of Colorado Parks and Wildlife, specifically mentioned that he would like all conflicts enforcement and human health and safety issues to go directly to the City's police department and their animal control officers, followed by Colorado Parks and Wildlife. The panel agrees that these are the appropriate procedures and order of events. The protocols in Section 3.6 of the Policy seem organized and sufficiently explicit for reporting coyote incidents such as human attacks. The panel believes it is important to make sure that all relevant parties are aware of these protocols, to ensure they are followed in the event of an attack. The panel recommends that after incidents, attacks in particular, the sequence of events is reviewed to ensure that protocols were understood and followed.

Protocols related to other coyote activities, such as education efforts and dealing with problem human behavior such as intentional feeding seem to be less clear. There are three key agencies involved in coyote-human conflicts: Open Space and Trails, Animal Control, and Colorado Parks and Wildlife. In the case of intentional feeding of coyotes, specific protocols about who gets contacted, when, and in what order need to be established. Guidelines are also needed about who will follow up and how, to attempt to ensure that the behavior does not continue. It can be hard to enforce regulations about wildlife, particularly around feeding, because people can develop strong feelings and affection for wildlife and feel a sense of ownership and responsibility. For these reasons, consistent messages and a clear understanding of roles and responsibilities is important.

Similarly, with education and outreach efforts, it would also be valuable to have a clear understanding of the roles and responsibilities of the different agencies involved. All three agencies seem very committed to education and outreach about coyotes and coyote-human conflicts, which is excellent. The panel thinks an explicit understanding of which agencies are conducting what types of outreach and education activities, and how those activities are coordinated among agencies, will help to streamline efforts, reduce potential redundancy, and establish consistent messages.

Reporting

There are many ways that information could be collected about incidents of various types that would be valuable for understanding and managing coyote conflict issues in the City and the region (and beyond). We have already mentioned some ways in which more information and samples could be gathered for coyotes that are removed. There are two other areas where improved reporting would be valuable: with all types of incidents and with hazing efforts.

Incident reporting: Currently incidents are recorded by various agencies, including city and state personnel. It would be helpful if there was one central place where this information was being collected, and if it was being collected in a consistent way. For example, for animal control, the reports are collected on the same form as incidents involving domestic pets and lacks information specific to understanding why wildlife incidents occur. It would be valuable for all groups to use the same data collection form about wildlife incidents, and specifically coyote

incidents. Members of the Panel have helped develop a form, after soliciting input from coyote researchers and resource managers from throughout the country that can be used for coyote-human conflicts in urban areas (see Appendix). We suggest this could be used by all agencies.

If data is collected consistently, and for a range of incidents of all types, these could be mapped, as Open Space and Trails personnel have done. The City should decide what types of incidents are of particular concern and their current mapping techniques of partitioning human and pet incidents are well thought. Such consistent knowledge and reporting about incidents could then be used to target preventative measures such as habitat modification, education, and hazing.

Hazing reporting: As discussed in the recommendations on hazing above, considerably more standardization and reporting would also be extremely valuable for any hazing efforts. Hazing of urban coyotes is still a very young field, in reality, everywhere in the country. It is important to establish exactly how hazing is going to be performed and by whom. It is also important to report as much as possible about all hazing events, including all failed attempts, i.e. events where the coyote was gone when the personnel responded, or when the coyote did not respond to the hazing. Protocols of who is going to be doing the hazing, in what circumstances, and what exactly they are going to be doing should be established. This should be the case whether it is city and state personnel or members of the public. Whenever any kind of hazing attempt is made, including going to a potential hazing location or any kind of actual interaction with a coyote, detailed information should be recorded about what exactly the hazers did and saw, and how the coyotes responded. Any information about hazing programs would be very valuable to understand whether and how these programs work.

CONCLUSIONS

Recommendations

Education - programs are quite strong, delivering printed materials, videos, websites, and multiple public presentations. The Panel encourages the agencies to continue the excellent work in this area, especially providing presentations and workshops during periods when there are no conflicts. Staff should continue to seek novel ideas to provide outreach to the public even when public interest is low (which is typical when incidents are rare or coyotes are not in the news). Giving updates on the Denver Metro Area Coyote Behavior Study may be one way to do this. The Panel was impressed with the volume of materials Open Space and Trails and Colorado Parks and Wildlife have made available to the public.

Inter-agency cooperation - the Panel was impressed with the way different agencies worked together on incidents and coyote management in general. In many ways this cooperation could serve as an excellent model for other cities to follow. One suggestion for improvement would be to establish better lines of communication between agencies following an incident, and perhaps a clear partitioning of duties, with a particular focus on public interaction following incidents and the actions taken in response to incidents.

Regulations – the City and County of Broomfield may want to consider developing their own ordinance regarding wildlife feeding, in addition to the state regulation. The Panel recognizes that the Colorado Parks and Wildlife has a statewide regulation addressing this and consequent

enforcements responsibilities. However, wildlife feeding is difficult to identify and to enforce, and more agency involvement, especially local agencies, is better. The Panel also Broomfield continue enforcement of leash laws.

Habitat modification - this is potentially one of the most important preventative steps in a system such as Broomfield. We recognize the efforts that have already taken place, such as mowing buffers adjacent to trails, and reducing the planting of fruit-bearing plants in yards. Mowing buffers along trails and adjacent to play areas should be a regular maintenance protocol.

Hazing – the Panel suggests better documentation on what is used, by whom, when, and where. The Panel suggests the City and County of Broomfield define unacceptable coyote behaviors and movement, use their education and outreach program to inform the community of these definitions, and teach community members appropriate hazing actions when such behaviors and movement are observed.

Research – the Panel commends the City and County of Broomfield for participating in the Denver Metro Area Coyote Behavior Study, which will help understand the impacts of hazing and also increase opportunities for public education.

Lethal removal - the point at which lethal control is employed as a management tool is difficult to define, especially when the tolerance for risk may vary among communities. Unfortunately, it is unknown at what point habituation or boldness in coyotes can no longer be reversed through hazing or other negative stimuli, and lethal removal is necessary. Until more information becomes available, it is standard to employ lethal removal in response to attacks on people, and some communities implement lethal removal prior to attacks.

Broomfield provides a useful decision matrix in its Coexistence with Wildlife Policy (this matrix should be used by most communities), and the threshold for lethal removal is the point at which coyotes exhibit ‘dangerous’ behavior, as defined in Section 3.5.4 (a coyote that has attacked a human or exhibits unprovoked aggressive behavior...). In the Policy, lethal control is warranted following documented attacks on people (attacks are defined in the Policy), and will be considered as a response to ‘human incidents’ and ‘attended pet attacks’ if ‘dangerous’ coyote behavior is involved. Thus, lethal control may be used as a response to an attack, but it may also be used proactively under some situations when people are threatened.

Although each community must decide its own behavioral threshold to result in lethal removal, we suggest that Broomfield use multiple reports of human incidents or attacks on attended pets in a specific area or timeframe (days or weeks) as a criterion for consideration for lethal control. It is sometimes difficult to ascertain the severity of an incident, and whether a coyote exhibited ‘dangerous’ behavior from a single report, because individuals may not always be consistent in interpreting coyote behavior. However, multiple independent reports from a specific area within a relatively short time frame would indicate potentially dangerous coyote behavior that would warrant lethal removal prior to a human attack. Of course, the number of incidents and length of time are arbitrary and allow flexibility for decisions on lethal removal, and there may be instances when it is clear lethal removal is warranted from a single incident.

Regarding the importance of repeated incidents, the City and County of Broomfield may consider amending Section 3.6.4 and 3.6.5, No. 6 in each case: adding "...high-intensity hazing may be conducted, especially if multiple incidents are reported within the same general area within days or a few weeks." Likewise, for No. 11 for both sections, consider amending: "...lethal control may be utilized, particularly if multiple incidents are reported from the same locality."

A variety of removal techniques should be used to the extent the agency operators are comfortable. Those individuals that will be solicited for removal may want to consider attending workshops to become more familiar with traps devices or types of sets that have been successful in urban areas.

Upon an incident and removal, full necropsies and genetic tests should be conducted if possible. We strongly recommend swabs of victims or their clothing if another attack should occur, in the attempt to identify which coyote is responsible. We also suggest open communication with the public after removals are conducted.

Future residential development - There are potential ways to design residential developments, including recreational and open space areas such as playgrounds and parks, to reduce or minimize the potential for coyote-human conflict. For example, walking trails and recreational areas such as fields or playgrounds could be located away from natural features that attract wildlife, such as stream corridors. All of the incidents in Broomfield occurred when the coyote came quickly out of vegetated cover and two of them occurred near the school channel path along a riparian corridor and adjacent to undeveloped open space. Fencing could also be used to reduce the potential for coyote-human interactions. No reasonable fencing will keep all coyotes out, but an 8-foot tall chain-link fence, preferably with coyote rollers on the top, would reduce coyote access. However, such a fence is costly and viewed as unattractive by most people. It seems unlikely that most residents of Broomfield will be amenable to the idea of an 8-ft tall chain link fences surrounding their playgrounds or lining their walking paths. The Panel repeatedly and consistently heard people say they loved living in Broomfield because of the regular proximity to open space.

Final Point – A general principal in coyote management is no single technique or strategy will be 100% effective. The key to success in managing human-wildlife conflicts is to implement a variety of techniques whenever possible. Likewise, if a technique is found to be successful, managers need to consider that its effectiveness may be temporary, and new approaches should always be developed.

Acknowledgments

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REFERENCES

- Adams, J.R., J.A. Leonard, and L.P. Waits. 2003. Widespread occurrence of a domestic dog mitochondrial DNA haplotype in southeastern U.S. coyotes. *Molecular Ecology* 12:541-546.
- Andelt, W.F. 1985. Behavioral ecology of coyotes in south Texas. *Wildlife Monographs* 94:1-45
- Baker, R.O. 2007. A review of successful urban coyote management programs implemented to prevent or reduce attacks on humans and pets in Southern California. Pp. 65-70 in Urban Coyote Management, R. Timm, editor. The Wildlife Society, Bethesda, Maryland.
- Baruch-Mordo, S., S.W. Breck, K.R. Wilson, and J. Broderick. 2011. The carrot or the stick? Evaluation of education and enforcement as management tools for human-wildlife conflicts. *PLoS One* 6:e15681.
- Bekoff, M., and E.M. Gese. 2003. Coyote (*Canis latrans*), pp. 467-481 In Feldhamer, G.A., B. C. Thompson, and J. A. Chapman (Eds.). Wild mammals of North America: biology, management, and conservation. Second edition. Johns Hopkins University Press, Baltimore, Maryland.
- Bekoff, M., and M.C. Wells. 1980. Social ecology and behavior of coyotes. *Scientific American* 242:130-148.
- Bowen, W.D. 1982. Home range and spatial organization of coyotes in Jasper National Park, Alberta. *Journal of Wildlife Management* 46:201-215.
- Darrow, P.A., and J.A. Shivik. 2009. Bold, shy, and persistent: Variable coyote response to light and sound stimuli. *Applied Animal Behaviour Science* 116:82-87
- Gehrt, S.D. 2007. Biology of coyotes in urban landscapes. Pages 303-311 in D. L. Nolte, W. M. Arjo, and D. H. Stalman, eds. *Proceedings of the 12th Wildlife Damage Management Conference*. Corpus Christi, TX
- Gehrt, S.D., C. Anchor, and L.A. White. 2009. Home range and landscape use of coyotes in a major metropolitan landscape: conflict or coexistence? *Journal of Mammalogy* 90:1045-1057.
- Gehrt, S.D., and S.P.D. Riley. 2010. Coyotes (*Canis latrans*), pp. 79-95 In: Gehrt, S.D., S.P.D. Riley, and B.L. Cypher (Eds.). *Urban Carnivores: Ecology, Conflict, and Conservation*. The Johns Hopkins University Press, Baltimore, MD
- Gehrt, S.D., J.L. Brown, and C. Anchor. 2011. Is the urban coyote a misanthropic synanthrope? The case from Chicago. *Cities and the Environment* 4:Iss. 1, Article 3.
- Geist, V. 2007. How close is too close? Wildlife professionals grapple with habituating wildlife. *The Wildlife Professional* 1:34-37.

- Gese, E.M. 2001. Territorial defense by coyotes (*Canis latrans*) in Yellowstone National Park, Wyoming: Who, how, where, when, and why. *Canadian Journal of Zoology* 79:980-987.
- Gese, E.M., and R.L. Ruff. 1997. Scent-marking by coyotes, *Canis latrans*: The influence of social and ecological factors. *Animal Behaviour* 54:1155-1166.
- Gese, E.M., and R.L. Ruff. 1998. Howling by coyotes (*Canis latrans*): Variation among social classes, seasons, and pack sizes. *Canadian Journal of Zoology* 76:1037-1043.
- Grinder, M., and P.R. Krausman. 2001. Home range, habitat use, and nocturnal activity of coyotes in an urban environment. *Journal of Wildlife Management* 65:887-898.
- Hennessy, C.A. 2007. Mating strategies and pack structure of coyotes in an urban landscape: A genetic investigation. Master's thesis, Ohio State University, Columbus.
- Kays, R., A. Curtis, and J.J. Kirchman. 2010. Rapid adaptive evolution of northeastern coyotes via hybridization with wolves. *Biology Letters* 6:89-93.
- McClennen, N., R.R. Wigglesworth, S.H. Anderson, and D.G. Wachob. 2001. The effect of suburban and agricultural development on the activity patterns of coyotes (*Canis latrans*). *American Midland Naturalist* 146:27-36.
- McCullough, D.R. 1982. Behavior, bears, and humans. *Wildlife Society Bulletin* 10:27-33.
- Morey, P.S., E.M. Gese, and S. Gehrt. 2007. Spatial and Temporal variation in the diet of coyotes in the Chicago metropolitan area. *American Midland Naturalist* 158:147-161.
- Riley, S.P.D., R.M. Sauvajot, T.K. Fuller, E.C. York, D.E. Kamradt, C. Bromley, and R.K. Wayne. 2003. Effects of urbanization and habitat fragmentation on bobcats and coyotes in southern California. *Conservation Biology* 17:566-576.
- Schmidt, R.H., and R.M. Timm. 2007. Bad dogs: Why do coyotes and other canids become unruly? Pp. 10-19 in *Urban Coyote Management*, R. Timm, editor. The Wildlife Society, Bethesda, Maryland.
- Timm, R.M., R.O. Baker, J.R. Bennett, and C.C. Coolahan. 2004. Coyote attacks: an increasing suburban problem. *Proceedings of the Vertebrate Pest Conference* 21:47-57. White, L.A., and S.D. Gehrt. 2009. Coyote attacks on humans in the United States and Canada. *Human Dimensions of Wildlife* 14:419-432.
- Wilson, P.J., S.K. Grewal, F.F. Mallory, and B.N. White. 2009. Genetic characterization of hybrid wolves across Ontario. *Journal of Heredity* 100 (Supplement 1):S80-S89.

Appendix 1. Relevant regulations for the City and County of Broomfield and coyote conflicts

Colorado Division of Parks and Wildlife regulation relevant for attracting and feeding coyotes in Colorado:

WCR 021 (D) No person shall fail to take remedial action to avoid contact or conflict with black bears, coyotes or fox, which may include the securing or removal of outdoor trash, cooking grills, pet food, bird feeders or any other similar food source or attractant, after being notified by the Division of Wildlife that black bears, coyotes or fox are in the area and advised to undertake such remedial action. Further, after an initial contact or conflict with a black bear, coyotes or fox, no person shall continue to provide, or otherwise fail to secure or remove, any likely food sources or attractants, including, but not limited to, outdoor trash, grills, pet food or bird feeders.

Broomfield Municipal Code, Sections on Firearms, Fireworks, and Leash Laws

Firearms Prohibition:

9-72-020 Possession and use of weapons (relevant section).

(C) It is unlawful for any person to discharge or cause to be discharged any projectile from:

- (1) A firearm or gas or mechanically operated gun; or
- (2) A bow and arrow, crossbow, or slingshot.

(5) It is an affirmative defense to a violation of subsection (C) that the act occurred in the shop of a federally licensed gunsmith, for the purpose of test-firing a weapon, provided that any projectile is contained within a device specifically designed for such test-firing.

(6) It is an affirmative defense to a violation of subsections (B) through (D) that:

- a. The defendant was reasonably engaged in lawful use of force in defense of a person, premises, or property under state statutes;
- b. The act was committed for the purpose of presenting a public demonstration or exhibition or to participate in an organized school or class.

(7) It is an affirmative defense to a violation of subsections (B) and (C) that the act occurred within a "hunting area" designated by the city manager, provided that the weapon in question was a shotgun, gas or mechanically operated (pellet) gun, bow and arrow, or slingshot. "Hunting areas" designated by the city manager shall meet the following criteria:

- a. The area must not have been platted;
- b. The area must be nonurbanized; and
- c. The area must be of sufficient size and must be sufficiently isolated that any danger to the public is minimized. (Ord. 729, §2, 1987; Ord. 811 §1, 1989; Ord. 953 §1, 1993)

Fireworks Prohibition:

9-76-010 Definitions (only relevant definitions).

As used in this chapter, unless the context clearly indicates otherwise, the following words and phrases shall be as defined in this section:

(E) *Fireworks* means any article, device, or substance prepared for the primary purpose of producing a visual or auditory sensation by combustion, explosion, deflagration, or detonation, including, without limitation, the following articles and devices commonly known and used as fireworks: toy cannons or toy canes in which explosives are used, blank cartridges, the type of balloon which requires fire underneath to propel the same, firecrackers, torpedoes, skyrockets, rockets, Roman candles, dayglo bombs, and torches, or other fireworks of like construction, and

any fireworks containing any explosive or flammable compound, or any tablets or other device containing any explosive substance.

(F) *Fireworks* does not include:

- (1) Toy caps which do not contain more than twenty-five hundredths of a grain of explosive compound per cap;
- (2) Sparklers, trick matches, cigarette loads, trick noisemakers, toy smoke devices, and novelty auto alarms;
- (3) Highway flares, railway fuses, ship distress signals, smoke candles, and other emergency signal devices.

9-76-020 Sale and use prohibited (relevant section).

(B) Except as specifically provided in this chapter, it is unlawful for any person to use or explode any fireworks. (Ord. 719 §1, 1987)

Leash Law:

6-12-010 Running at large prohibited.

It is unlawful for any person owning or having charge of any animal, except an ordinary domesticated house cat and except for dogs used by the city for public health or public safety purposes, to permit the animal to run at large within the city. (Ord. 233 Art. V §1, 1975; Ord. 993 §3, 1993; Ord. 1696 §1, 2002)

Defined:

6-08-140 Running at large.

Running at large means any animal, unless specifically excepted by this title, off the premises of the owner and not under the direct and competent control of the owner or the owner's authorized agent by means of a leash, except an animal within the automobile or other vehicle of its owner. An animal shall also be deemed to be running at large when it is on an unfenced portion of the premises of the owner or keeper and the owner or keeper is not physically present and able to control the actions of said animal.

(A) For the purposes of this definition, *premises of the owner* shall not include common areas of condominiums, townhouses, and apartment buildings; and any animal not in the effective control of its owner by means of a leash within the common area of a condominium, townhouse, or apartment building, or the grounds thereof, shall be deemed to be running at large.

(B) For purposes of this definition, *direct or competent control* does not include leashes anchored to the real property of the animal's owner, keeper, or their authorized agent, if such leash extends beyond the property line of the owner, keeper, or authorized agent. (Ord. 233 Art. III §2(n), 1975; Ord. 993 §2, 1993)

Appendix 2. Urban coyote report form

Urban Coyote Report

Name of Reporting Party: _____

Email of Reporting Party: _____ Phone: _____-_____-_____

Name of Witness: _____ Phone: _____-_____-_____ Email: _____

Date of activity: ____/____/____ Time of activity: ____:____ Date/time of report: _____

UTM coordinates or address of event: _____

City: _____ State: _____ County: _____

Describe location of event: _____ Weather: _____

Select one:

- ☐ Observation - Act of noticing or taking note of tracks, scat, or vocalization (howl).
- ☐ Sighting - Visual observation of coyote(s).
- ☐ Encounter - Unexpected direct meeting between human(s) and coyote(s) with no physical contact and no aggressive behavior on behalf of coyote.
- ☐ Following - Meeting between human(s) and coyote(s) resulting in coyote following/tracking movement of human(s).
- ☐ Aggression - Meeting between human(s) and coyote(s) resulting in one of the following types of behaviors: growling, baring teeth, or lunging.
- ☐ Attack - Meeting between human(s) and coyote(s) resulting in direct contact, such as biting or scratching.
- ☐ Pet Encounter* - Unexpected direct meeting between pet(s) and coyote(s) with no physical contact and no aggressive behavior on behalf of coyote.
- ☐ Pet Following* - Meeting between pet(s) and coyote(s) resulting in coyote following/tracking movement of pet(s).
- ☐ Pet Aggression* - Meeting between pet(s) and coyote(s) resulting in one of the following types of behaviors: growling, baring teeth, or lunging.
- ☐ Pet Attack* - Pet is physically contacted, bitten, or killed by coyotes.

*If pet involved, what type of pet:

☐ Dog, breed: _____ weight: _____ ☐ Cat ☐ Other, describe: _____

*If pet involved, was human present or was pet unattended:

☐ Human present ☐ Pet unattended

*If pet involved, location of pet: ☐ Voice command ☐ On leash ☐ In kennel/run

☐ In fenced yard ☐ Invisible fence ☐ Close to human, distance: _____ ☐ Other: _____

Was there a known food source (any location where food is left outside, e.g., pet food, garbage, squirrel feeder, compost pile, or edible plants) at the location of activity?

☐ Yes, describe: _____ ☐ No

Were children present? ☐ Yes, how many? _____, age(s) _____ ☐ No

CONTINUED, Page 1 of 2

Activity of human: ☐ Sleeping ☐ Walking ☐ Jogging ☐ Bicycling ☐ Driving
(check all that apply) ☐ Eating ☐ Sitting ☐ Attempt to lure coyote ☐ Other

Explain other: _____

If coyote(s) observed, number observed: _____

Condition of coyote: ☐ Healthy ☐ Sick ☐ Emaciated ☐ Injured ☐ Distressed ☐ Unknown

Describe distinguishing features: _____

Investigative action taken (check all that apply):

☐ Phone ☐ Onsite visit ☐ Email ☐ Report confirmed ☐ Report not confirmed

Summary of action taken (check all that apply):

☐ Assist & Advise ☐ Referred to WS ☐ Referred to other, describe: _____
☐ Lethal removal ☐ Coyote relocation ☐ Coyote hazing ☐ Post signs
☐ Give citation ☐ Distribute educational material ☐ Other, describe: _____

Investigation additional recommendations:

☐ Remove food source ☐ Scare devices ☐ Trap ☐ Pet husbandry ☐ Secure trash
☐ Clear/clean brush ☐ Fence repair/modification ☐ Other: _____

Narrative/other information: _____

Post Mortem Follow Up

Conducted: ☐ Yes (continue form) ☐ No (end of form)

Stomach contents:

☐ Empty ☐ Full If full: ☐ Animal, type _____ ☐ Human food ☐ Other, describe: _____

Injuries revealed at necropsy: ☐ no ☐ yes, describe: _____

Tooth anomalies and wear (please mark and/or describe):



Reproductive condition of females: ☐ pregnant ☐ lactating ☐ other, describe: _____

Signs of disease: ☐ no ☐ yes, describe: _____

Please send a copy of report to:
USDA-NWRC-Predator Research Facility
ATTN: Julie Young
USU-BNR 163

Logan, UT 84322-5295

Email: julie.young@usu.edu; Fax: 435-797-0288; Phone: 435-797-1348