U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Wildlife Services

U.S. Government Publication

Human–Wildlife Interactions 11(2):146–155, Fall 2017

Using resident-based hazing programs to reduce human–coyote conflicts in urban environments

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Abstract: The concept of hazing (aversive conditioning) is often promoted as a tool for reducing human–coyote (*Canis latrans*) conflicts in urban environments. Little scientific evidence exists on the effectiveness of hazing, particularly hazing applied by residents (i.e., community-level hazing). Wildlife professionals question if residents will properly and consistently apply hazing techniques and if hazing impacts coyote behavior over short- and long-term periods. We describe 2 separate efforts designed to encourage residents to haze coyotes in the Denver Metro Area, Colorado, USA: a citizen science program and an open space hazing trial. Both efforts were intended to be management techniques that either could be deployed or are already commonly deployed by urban coyote managers. In addition to educating residents about how, when, and how to quantify individual coyote response to hazing efforts, the citizen science program measured methods used for, and short-term impacts of, resident-based hazing and the overall impact of resident involvement in the program. The open space hazing trial measured the impact of on-site education tools and begins to assess if posted signs and on-site education efforts change visitor acceptance and behavior around coyote hazing. The citizen science program targeted a highly engaged audience and required a significant investment of time and attention for both managers and residents. The open space hazing trial targeted the casual park visitor and required little to no investment of time and attention for both managers and residents. The citizen science program produced 207 trained citizen scientists that generated 96 documented hazing events. Voice, noise, and approach were the hazing methods most commonly deployed by participants. Citizen scientists recorded hazing responses varying from rapid fleeing of the area to approaching the person doing the hazing, with the most common response being the coyote leaving the area. In the presence of domestic dogs, hazing was less effective. Citizen scientists reported improved understanding and acceptance of coyote management tools as well as increased confidence and capacity to deal with human–coyote conflict in their community. For the open space hazing trial, we provided non-personal hazing education using signs, email, and social media as well as staffed education stations in 2 urban open space parks with highly visible coyotes and prior histories of coyote conflict. Based on self-reported (n = 495) results, most park visitors indicated they would haze a coyote in the future and that the educational effort influenced their decision to haze or not.

Key words: aversive conditioning, behavior, *Canis latrans*, citizen science, community engagement, Colorado, coyote, Denver Metro Area, hazing

Coyotes (*Canis latrans*) are often found in urban areas (Gehrt et al. 2009), in part because they are highly adaptable habitat generalists (Bekoff and Gese 2003, Morey et al. 2007) and because urban landscapes provide ample habitat for adaptable habitat generalists. As coyotes colonize and adapt to living in urban environments, they become tolerant of people (e.g., reduced wariness in the presence of people), with a resulting increase in human–coyote interactions and conflicts. For example, in the Denver Metro Area (DMA), Colorado, USA, the number of reported encounters, incidents, and attacks on humans and pets has risen dramatically in the last 8 years (Poessel et al. 2013). While this term is subjective, interactions with coyotes at the encounter, incident, and pet and human attack levels are generally defined as negative interactions by both residents and coyote managers in the DMA (Poessel et al. 2013). The general feeling is that, in the absence of real consequences for being in the presence of humans, coyotes have become tolerant of people and that this tolerance leads to more negative interactions between coyotes and people (Baker and Timm 1998, Timm et al. 2004, Schmidt and Timm 2007). In a sense, humans have become nothing more than

Table 1. Terms and definitions related to hazing, Denver Metro Area, Colorado, USA.

Term	Definition
Hazing	Deliberate negative conditioning. A training method that employs immediate use of deterrents or negative stimulus to move an animal out of an area, away from a person or discourage an undesirable behavior or activity. Hazing is conducted to sensitize coyotes to the presence of humans or human spaces such as backyards and play spaces. Hazing does not harm animals, humans, or property.
Community-level hazing	Hazing activity is conducted by individual residents or groups of residents at the community level. Intensity of community-level hazing is governed by local ordinances, which in urban areas, often prohibit the use of projectiles or the discharge of a firearm.
Harass	To unlawfully endanger, worry, impede, annoy, pursue, disturb, molest, rally, concentrate, harry, chase, drive, herd, or torment wildlife.
Hazing vs. harassment	Many agencies and organizations support and recommend hazing coyotes to instill or maintain acceptable coyote behavior. Hazing activities should not be misconstrued as harassment. Harassment is unlawful. It is lawful for residents to haze wildlife from their yard, just as it is lawful for people to haze wildlife away from them when wildlife approaches too closely, regardless of where they are.

"wallpaper" to the urban coyote. To change this neutral regard for the presence of humans, a high priority for managers throughout the DMA is understanding whether hazing coyotes can sensitize coyotes, decreasing their tolerance for people and reducing coyote conflict overall.

We surmised that a primary reason for the increase in human–coyote conflict is the way the public interacts with coyotes in urban environments, allowing coyotes to become more tolerant of people. We assumed that if people emerge from the wallpaper and sensitize coyotes, coyotes will become more fearful of humans and avoid them, thus decreasing conflict. If this premise is correct, educating the public to sensitize coyotes (i.e., create negative interactions with coyotes) when they encounter them will likely be an effective nonlethal means for empowering residents to provide immediate safety and relief from the presence of a coyote and help create a lasting decrease in coyote tolerance of people. We call our concept community-level hazing because residents, not resource managers, are responsible for the hazing in real time (Table 1).

In a DMA survey, 97% of coyote managers—public officials charged by their jurisdiction with responding to human–coyote conflict complaints—indicated they felt residents would find hazing an acceptable response to coyote conflict (DonCarlos 2013). Conceptually, community-level hazing as a coyote conflict management tool is appealing on many levels. Hazing is nonlethal; it can be applied in real time by residents of nearly any age and physical ability, is inexpensive or free to administer, and empowers residents to be in control of an interaction with a coyote (Schmidt and Timm 2007).

Residents tended to agree. Hazing was considered an acceptable management action by >70% of Adams County, Colorado residents (DonCarlos 2013). Wide appeal notwithstanding, the effectiveness of hazing as a tool to alter coyote behavior and reduce conflict is poorly understood and poorly researched despite claims to the contrary (Schmidt and Timm 2007). Additionally, if hazing proves to be an effective tool for changing coyote behavior, there are important questions about whether residents in any given community would be willing to change their behavior and actively haze coyotes. Fewer than 60% of residents surveyed indicated they would be willing to haze a coyote (DonCarlos 2013). We note the discrepancy between how many residents think hazing is acceptable (>70%) and how many indicate they are willing to do it (<60%). Fewer than 20% of residents indicated they thought hazing was the most effective action for minimizing the risk of negative interactions with coyotes near their home (DonCarlos 2013).

With this effort, our goal was to inform and improve community coexistence outreach programs specific to hazing by collecting information on which future research can build.

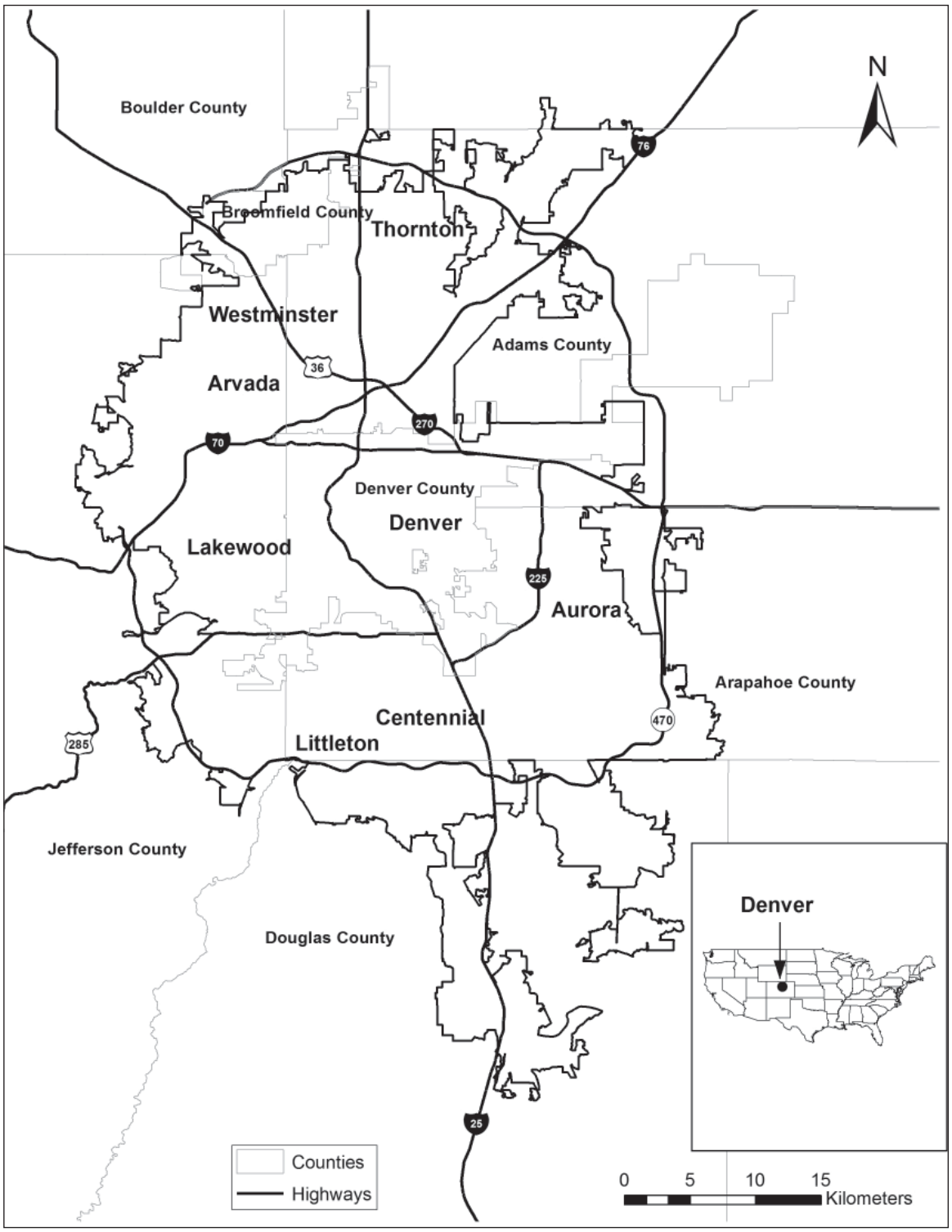

Figure 1. Map of Denver Metro Area, Colorado, USA.

We report on 2 separate efforts: a citizen science program and an open space hazing trial. Our objectives were to evaluate questions around the efficacy of hazing by residents to reduce human–coyote conflict, including: Are residents willing to try hazing? Which hazing methods/tools are they willing to try? What is the short-term coyote response to hazing? What factors, if any, impact individual coyote response to hazing? Do posted signs and other educational efforts change residents' acceptance of and likelihood to haze? And, does hazing education increase capacity to deal with conflict?

Study area

We conducted our work within the DMA. The DMA includes 7 counties (Adams, Arapahoe, Boulder, Denver, Douglas, Jefferson, and Broomfield) and >45 municipalities (Figure 1). The human population of the 7 counties is approximately 2.74 million (Denver Regional Council of Governments 2010). The DMA is located in the Front Range of Colorado and is situated between grasslands and agricultural lands to the east and the foothills of the Rocky Mountains to the west. The elevation in the DMA is approximately 1,600 m, and the climate is semi-arid with temperatures ranging from -34° to 38°C, and annual precipitation is <38 cm (Bruce and McMahon 1996). Historically, lands within the DMA consisted of primarily grassland habitat but now incorporate a variety of land cover types, including agriculture, grasslands, woodlands, parklands, and urban development.

Methods

Approval to undertake this project was granted by the United States Department of Agriculture National Wildlife Research Center Institutional Animal Care and Use committee (QA-1972), and the project was conducted in accordance with this approval. Methods are designed to be repeatable at the local coyote manager level. For this reason, program costs for each effort are included for implementation consideration.

Citizen science hazing program

Between October 2012 and December 2013, we recruited and trained 207 volunteer coyote observers (citizen scientists) throughout the DMA. Recruits were required to attend a 2.5-hour training session and sign a waiver to participate. A total of 15 training classes were offered. Training curriculum included sections on coyote identification, urban coyote ecology, coyote behavior, and human dimensions and coyotes, including coyote conflict and urban coyote conflict management. As part of the training, citizen scientists were educated on the concept and value of hazing in urban coyote conflict management.

We instructed citizen scientists to apply hazing techniques selectively (i.e., to haze only if a coyote was behaving in a way that was unacceptable or using an area that residents deemed unacceptable). We trained them to use metrics such as location and/or coyote behavior to determine if hazing was appropriate. Additionally, we instructed the citizen scientists to consider time of day. For example, spotting a coyote on a golf course or urban park at night, when these areas are generally closed and unoccupied by humans, was largely acceptable. A coyote in the same location during the day may not be acceptable due to heavy human use of these same areas. We also instructed citizen scientists to avoid hazing in these contexts: the animal was behaving normally in a normal habitat (e.g., coyote is hunting rodents in a field at a distance from humans); the individual was sick or injured; the animal was cornered; and/or when a coyote had pups or an active den site nearby.

When hazing was deemed appropriate, citizen scientists were instructed to use the following "SMART" hazing techniques: Stop and stand your ground; Make yourself look big; Announce yourself in a strong and forceful voice; Repeat and reinforce, if necessary; and Teach a neighbor or friend how and when to haze. Finally, the citizen scientists were encouraged to enhance hazing efforts with noise makers and objects such as an air horn, walking stick, or broom. They were encouraged to take a step, lunge, or run in the direction of the coyote (approach) as part of their hazing display. We also discussed throwing objects, with the reminder that the intent of hazing was not to harm the animal. Trainees were instructed, when they attempted hazing, to describe how they hazed the coyote and to use an objective scale to gauge the coyote's response to their effort (Table 2).

Citizen scientists recorded all coyote observations and any hazing activity on a standard form. Upon completion, they could turn in paper forms, email forms, or use a password-protected online portal to report their observations (<https://apps2.auroragov.org/CoyoteWatchMap/>). We used a 2 × 6 contingency table and Fisher's Exact Test to determine if there was a difference in coyote response to hazing between events involving a dog (*C. lupus familiaris*) and those events not involving a dog and used $P = 0.10$ as a cutoff for assessing significance.

Effects of the program on citizen scientists'

Table 2. Response coding of coyotes (*Canis latrans*) being hazed by citizen scientists in the Denver Metro Area, Colorado, USA. Citizen scientists used this table to rank individual coyote response to hazing from -4 (most averse) to 1 (coyote approaches), August 26, 2012 to December 26, 2015.

Rank	Description
-4	Coyote flees the area after input. Locomotion involves rapid directed movement with ears pinned back, tail position is stiff and down. Coyote does not stop or look back as it retreats.
-3	Coyote moves away from the area after input. Movement may be a mix of faster and slower movement. Coyote looks back as it retreats from the area.
-2	Coyote moves >10 feet away after input, stops and looks back at a distance >10 feet from original starting point.
-1	Coyote moves <10 feet away after input, stops and looks back in the direction of stimulus <10 feet from the original starting point.
0	No change in behavior, location, or movement direction following input.
1	Coyote approaches after input.

Figure 2. Coyote (*Canis latrans*) hazing educational sign (61 x 91-cm sandwich board graphic) for open space hazing trial in the Denver Metro Area, Colorado, USA.

understanding and subsequent behavior in the context of human–coyote conflict and broader program impacts were assessed through a before and after participation survey.

Open space hazing trial

Our objective for the open space hazing trial was to determine if hazing education materials such as signs, social media, and education stations in open space parks altered measurable behavioral attributes of people related to their willingness to participate in hazing treatments. We employed a treatment and self-report design to determine if our educational techniques effectively influence human attitudes and behavior.

For our hazing trials, we selected Bear Creek Greenbelt and Crown Hill Park, 2 urban open space parks with highly visible coyotes and prior histories of conflict. At both sites, we applied community-level hazing education/training techniques that could be deployed by wildlife and/or land managers in urban and suburban areas (protocols were approved via written communication by Jefferson County Open Space and City of Lakewood Department of Community Resources). The application lasted 3 weeks. At both trial sites, passive, non-personal hazing education signs were posted at major park access points and high-volume activity nodes. These full-color, 61 × 91-cm, 2-sided sandwich board signs (Figure 2) provided basic information about how to haze and encouraged park visitors to haze coyotes when observed. We augmented the signs with social media, community email blasts from local land managers, and staffed volunteer education stations at major park access points. As part of the application, we created a "How to Haze a Coyote" educational video and posted it on YouTube (<https://www.youtube.com/watch?v=7MOnDIx71Q0>) with a QR code link to the video on all educational signs. Hazing efforts were further encouraged by site visits from staff, volunteers, and citizen scientists who could model proper hazing techniques for residents and park visitors (Worcester and Boelens 2007). As part of the educational effort, park visitors were asked to report understanding of the hazing treatment, number of coyote sightings, hazing activity they performed, willingness to haze in the

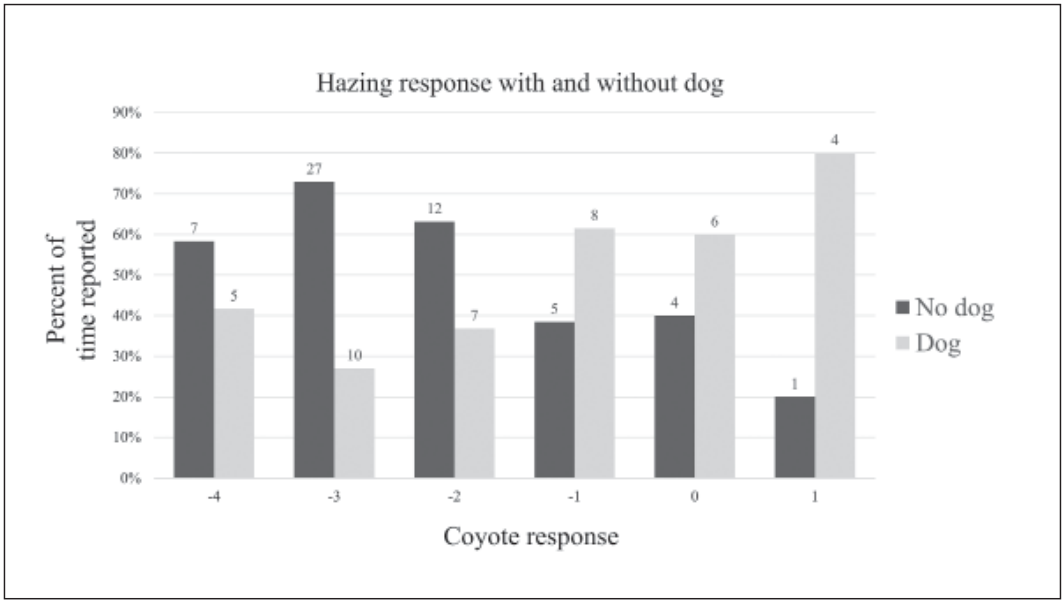

Figure 3. Coyote (*Canis latrans*) response to hazing by trained citizen scientists in the Denver Metro Area, Colorado, USA, comparing cases where a dog was or was not involved, August 26, 2012 to December 26, 2015. Details of the response coding is in Table 2, but generally -4 is the strongest fleeing response and 1 is an approach response. Sample size is on top of bars.

future, and if the signs and education efforts influenced their willingness to haze. Park visitors were polled through both on-site surveys and by email. In addition to measuring human responses, we also measured coyote responses to this open space hazing trial. Details of this component of the work are reported in Breck et al. (2017).

Results

Citizen science hazing program

From August 26, 2012 to December 26, 2015, citizen scientists recorded 739 observations of coyotes, 96 (13%) of which involved a person hazing a coyote, indicating that 87% of the time, citizen scientists determined the coyote was behaving normally and elected not to haze. Observation data is available at the City of Aurora, Colorado Coyote Watch coyote activity viewing page (https://apps2.auroragov.org/CoyoteWatchMap/). A score of -3 (coyote moves away from the area; Table 2) was the most common response by coyotes (n = 37), followed by -2 (coyote moves away…stops and looks back (n = 19). Domestic dogs were present 42% (n = 40) of the time citizen scientists hazed coyotes. The distribution of the responses changed when dogs were present compared to hazing attempts when no dog was present (Fisher's Exact Test, P = 0.074). Generally, when dogs were present, there were a greater number of responses coded 1, 0, or -1 (n = 15 for dog present vs. n = 10 for no dog present), indicating hazing impacts were lessened in the presence of a dog (Figure 3). A domestic dog was present 4 of 5 total cases where the coyote approached after the hazing attempt. In 2 cases where the coyote approached, the citizen scientist indicated there was an active den site nearby.

Of the 207 citizen scientists, 9 performed 74% of the hazing attempts. Voice was used 74 times and was the most frequently used hazing method (77%). Noise (clapping hands, whistle, air horn) and approaching (lunging or running at the target coyote) were each used 32 times or 33% of the time. Citizen scientists reported using their body (raised arms and/or exaggerated waving motions) to haze 27 times or 28% of the time. Fifty-three percent of the time (n = 51), citizen scientists combined methods and used >1 and up to 4 methods at a time in their hazing application. Four citizen scientists used objects such as a broom or shovel to enhance their appearance during their hazing effort. Four instances involved throwing objects such as rocks, sticks, or snowballs at the coyote. Several applications used noise such as clapping, banging pots, a car horn, shaking a bag of oranges, and shaking pennies in a can to

Table 3. Self-reported questions from the community-level hazing experiment conducted on coyotes (*Canis latrans*) in the Denver Metro Area, Colorado, USA, February to March, 2014. Results are presented in Figure 3.

Number	Question
1	Are you aware of the signs asking the public to haze coyotes at (park name)?
2	Do you understand why signs were put up asking park users to haze coyotes when they see them?
3	While the signs were up, did you see any coyotes at (park name)?
4	If you saw a coyote while the signs were up, did you haze it?
5	If you see a coyote at (park name) in the future, would you haze it?
6	Did the educational effort encouraging the public to haze coyotes influence whether or not you would do so?

enhance their hazing effort.

In a separate study designed to evaluate the effectiveness of the citizen science program (Adams 2014), 49% (n = 101) of the citizen scientists participated in both pre- and post-participation surveys to measure changes in attitudes, beliefs, behavioral intentions, and knowledge.

The total estimated cost for the citizen science program was $26,717, which included paid staff time, citizen scientists (volunteer) time, and Information Technology staff services.

Open space hazing trial

We received 495 responses from the public at our 2 hazing trial sites (128 at Bear Creek Greenbelt, and 367 at Crown Hill Park; Table 3). Responses suggested that most park visitors noted the educational signs (86%) and understood why the signs were there (85%). Most park visitors (76%) did not see a coyote during the 3-week hazing treatment period. Of those who observed a coyote during our trial period, only 23% indicated they tried to haze it. Most (78%) indicated they would attempt to haze in the future, and 75% indicated the educational effort influenced their decision to do so (Figure 4). The estimated cost for this hazing experiment was $9,000, which included the design and production of a hazing video, design and fabrication of full-color hazing signs, collaborating agency time and effort, and volunteer and paid staff time.

Discussion

Our results indicate that community-level hazing of urban coyotes can be an effective, immediate, short-term tool for establishing a safety buffer during a negative coyote encounter. As indicated by the citizen science effort, the most common response was for the coyote to move away from the area after hazing was applied. In >70% of the hazing attempts, the coyote moved >10 feet away from the person doing the hazing. Citizen scientists most commonly used a combination of voice, noise, body and/or approaching the coyote to haze, demonstrating that residents are willing to try these methods and that community-level hazing does not require specialized tools or effort to be effective. We recommend that resource managers in urban areas will improve hazing education efforts by focusing on how to effectively and safely combine and deploy the most commonly used tools (voice, noise, body, and approach) to haze coyotes in appropriate situations. We recommend that hazing education set reasonable expectations for results. Residents should not expect a highly visible urban coyote to completely flee the area after an initial hazing attempt. Residents may need to repeat or reinforce their hazing effort if the coyote does not respond or does not leave the area initially.

Analysis of the citizen science program indicated that engaging residents in community-level coyote conflict solutions such as community-level hazing has positive, empowering impacts; hazing education increased capacity to deal with conflict. In a separate study to evaluate the effectiveness of our citizen science project, Adams (2014) found participation in the citizen science hazing program changed behavioral intentions. Citizen scientists reported a change in attitude toward hazing as a management strategy for dealing with negative human–coyote interactions as they found frightening or hazing coyotes more acceptable after participation in the program. Citizen scientists indicated that knowledge of hazing and how to haze built confidence, provided a sense of control, and empowered them to protect themselves and their property.

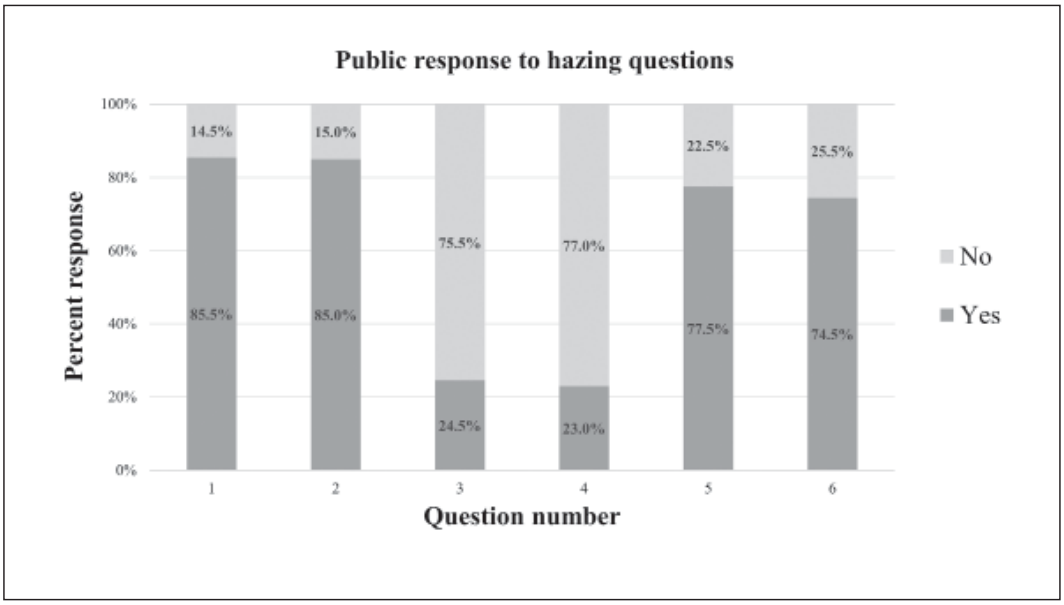

Figure 4. Public responses to questions (listed in Table 3) about the community-hazing effort focused on coyotes (*Canis latrans*) and conducted at 2 treatment sites within the Denver Metro Area, Colorado, USA, February to March 2014.

Program participants felt emboldened by the citizen science program and were more self-assured in being able to address potential conflict situations on their own and educate others in their communities.

From our work, we recognize 2 important limitations for community-level hazing. First, our results indicate that the presence of an active den site can impact hazing outcomes. In 2 instances where a coyote approached after a hazing attempt, an active den site was nearby. It is generally believed that urban coyotes show bolder behavior when people approach active den sites, particularly with dogs (M. A. Bonnell, personal observation). Although our sample size is small, our observations match other reports of coyote aggression near active den sites (City of Aurora, Colorado Coyote Tracking Reports, January 2007 to April 2014). We do not recommend residents intentionally approach an active den site and/or haze a coyote near an active den site or in the presence of pups. If hazing is determined to be appropriate near an active den site, we recommend a wildlife professional apply the hazing.

Second, we found that the presence of domestic dogs negatively impacted hazing outcomes. Coyotes moved ≥10 feet away from the person hazing 49% of the time when no dog was present, but only 23% of the time when a domestic dog was present (Figure 3). Additionally, dogs were present during 4 of 5 occasions when coyotes approached the person attempting to haze it. Our results indicated that when a dog was present, residents can expect a muted response to their hazing attempt. Helping residents understand how the presence of a dog can lessen a coyote's response to hazing will help set realistic expectations. This was important to note, as many negative coyote interactions in urban environments occur in the presence of a dog (M. A. Bonnell, personal observation). Despite lessened impacts, we recommend that residents dealing with a negative coyote encounter in the presence of a dog immediately shorten the dog's lead and attempt to haze anyway. In most cases, these actions create a zone of safety between the person and pet and the coyote.

Our study results demonstrated short-term benefits of hazing, but did not address if, in the long term, hazing can effectively change the behavior of a coyote exhibiting more severe conflict behavior (e.g., daylight chasing or taking pets, or attacking and taking pets on leash or adjacent to handlers; chasing joggers, bicyclists, and other adults; and/or coyotes acting aggressively toward adults; Timm et al. 2004). At severe conflict levels, community-level hazing may empower residents to safely

deal with a bad situation involving a problem coyote by affording a resident an immediate, short-term zone of safety, or to facilitate the rescue of a pet from an active or imminent attack. We emphasize that there is no reliable evidence (i.e., peer-reviewed research) showing community-level hazing or other forms of hazing will train a problem coyote out of severe conflict behavior. As 1 of many anecdotal examples from the DMA, repeated hazing attempts on a problem coyote at 1 of our treatment sites had no effect on conflict behavior, and the individual was removed from the population. Similar outcomes have been observed within the DMA where hazing a problem individual behaving at severe conflict levels was ineffective in changing conflict behavior (M. A. Bonnell and S. Breck, personal observation; Breck et al. 2017). For this reason, we do not recommend that community-level hazing be used as replacement for the targeted removal of an individual problem coyote behaving at severe conflict levels.

Generally, wildlife managers and safety officials can expect low community-level hazing participation when using non-personal media such as posted signs. Highly visible coyotes notwithstanding (24% of park visitors indicated they spotted a coyote during the trial period), most park visitors elected not to haze a coyote when they noted one during our trial. Sample comments related to willingness to haze included: "I am uncomfortable with yelling and clapping my hands out loud in public," "I think this is a VERY DANGEROUS thing to ask people to do!!!!!!," "I don't really approve [of hazing], but I guess that is better than hurting them." The majority of respondents, however, indicated they would haze in the future, suggesting that it may take time or a defining event such as a targeted removal of a problem animal to move hazing from something residents should do to something residents will accept and are willing to try.

Our results indicated that hazing is a complex concept and difficult to teach using non-personal media such as on-site signs. We know from the citizen science program that residents have numerous questions and often requested clarification about the proper context for hazing. It is difficult to address these nuances through non-personal education such as signs or flyers. Additionally, questions we received from the public during the open space hazing trial, as well as concerns expressed, indicate that the word hazing was a socially maligned word and may be getting in the way of educational efforts and community engagement. Sample comments on the word hazing included: "Hazing is a pretentious and confusing word to use," and "Did not like the term haze!" We suggest experimenting with more acceptable terms or descriptors such as "scare away," "shoo," and "tough love."

Community hazing education efforts need to deploy a multi-media presence. We suggest a multi-media and multi-modal approach that includes signs, social media, and email for non-personal educational effort and volunteers and staff on-site at education stations or at public meetings for meaningful, in-person educational effort.

Overall, we believe there are many positive benefits that result from community-level hazing, from short-term changes in coyote behavior to positive educational outcomes for the community. We note that managers and residents need to have and set realistic community expectations around hazing and coyote responses to hazing attempts, particularly in the presence of a domestic dog. We believe that with consistent and persistent educational effort over time, teaching residents how and when to haze coyotes is an essential tool in urban coyote conflict reduction. An individual coyote's response, or lack thereof, to community-level hazing may also serve as a valuable tool for the early detection of problem individuals before they get to severe conflict levels. For coyotes that have become exceptionally bold and demonstrated real aggression toward humans, we do not recommend hazing as a strategy to effectively deal with these problem individuals over the long term, but instead recommend the humane removal of these animals from the population (Breck et al. 2017).

Acknowledgments

We thank Adams County Open Space, S. Alexander, City of Aurora Information Technology Services, City and County of Broomfield, Colorado Parks and Wildlife, Colorado State University Warner School of Natural Resources, Foothills Parks and

Recreation District, Jefferson County Animal Control, Jefferson County Open Space, J. McKee, Ken Caryl Metropolitan District, USDA Wildlife Services, and 207 citizen scientists (in particular, L. White, N. Kranzow, R. Reiley, T. Hombs, D. Duke, R. Kelley, and S. Hoffman). We thank S. Poessel for reviewing this manuscript, providing a map of the Denver Metro Area, assisting with educational efforts, and tolerating angry ladies attempting to haze her.

Literature cited

Adams, M. 2014. Evaluating the role of citizen science in the context of human–wildlife conflict management. Thesis, Colorado State University, Fort Collins, Colorado, USA.

Baker, R. O., and R. M. Timm. 1998. Management of conflicts between urban coyotes and humans in southren California. Procedings of the Vertebrate Pest Conference 18:299–312.

Bekoff, M., and E. M. Gese. 2003. Coyote (*Canis latrans*). Pages 467–481 *in* G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, editors. Wild mammals of North America: biology, management, and conservation Second Edition. Johns Hopkins University Press, Baltimore, Maryland, USA.

Breck, S. W., S. A. Poessel, and M. A. Bonnell. 2017. Evaluating lethal and nonlethal management options for urban coyotes. Human–Wildlife Interactions 11:133–145.

Bruce, B. W., and P. B. McMahon. 1996. Shallow ground-water quality beneath a major urban center: Denver, Colorado, USA. Journal of Hydrology 186:129–151.

Denver Regional Council of Governments. 2010. 2007 population and household estimates. Denver Regional Council of Governments, Denver, Colorado, USA, <http://www.drcog.org/documents/Final%200607PopTableByCounty.pdf>. Accessed October 6, 2011.

DonCarlos, A. W. 2013. Reducing coyote conflict in Adams County: coyote behavior and human dimensions research. Unpublished report to Adams County, Colorado. Colorado State University, Fort Collins, Colorado, USA.

Gehrt, S. D., C. Anchor, and L. A. White. 2009. Home range and landscape use of coyote in a metropolitan landscape: conflict or coexistence? Journal of Mammalogy 90:1045–1057.

Morey, P. S., E. M. Gese, and S. D. Gehrt. 2007. Spatial and temporal variation in the diet of coyotes in the Chicago metropolitan area. American Midland Naturalist 158:147–161.

Poessel, S. A., S. W. Breck, T. L. Teel, S. Shwiff, K. R. Crooks, and L. Angeloni. 2013. Patterns of human coyote conflicts in the Denver Metropolitan Area. Journal of Wildlife Management 77:297–305.

Schmidt, R. H., and R. M. Timm. 2007. Bad dogs: why do coyotes and other canids become unruly? Wildlife Damage Management Conference 12:287–302.

Timm, R. M., R. O. Baker, J. R. Bennett, and C. C. Coolahan. 2004. Coyote attacks: an increasing suburban problem. Transactions of the North American Wildlife and Natural Resources Conference 69:67–88.

Worcester, R. E., and R. Boelens. 2007. The coexisting with coyotes program in Vancouver, B.C. Wildlife Damage Management Conference 12:393–397.

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