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Using Coyote Hazing at the Community Level to Change Coyote Behavior and Reduce Human-Coyote Conflict in Urban Environments

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ABSTRACT: The concept of hazing (aversive conditioning) is often promoted as a tool for reducing human-coyote conflict in urban environments. Little scientific evidence exists on the effectiveness of hazing, particularly hazing applied by residents (i.e., community-level hazing). Many 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 two efforts in the Denver Metro Area (a citizen science program and an open space experiment) in which we evaluate community-level hazing in the short term. We designed both efforts to engage residents in the issue of human-coyote conflict and encouraged them to apply hazing techniques on coyotes. For our citizen science program, we offered 15 classes between October 2012 and December 2013 and trained 207 volunteers to haze coyotes and to gauge the coyotes' short-term response to hazing. From 8/26/2012 to 12/26/2015, citizen scientists recorded 739 coyote observations of which 96 (13%) involved hazing. The most commonly used hazing method was voice (77%), followed by noise (33%), approach (33%), and body (28%). Fifty-three percent of the time, citizen scientists combined more than one and up to four methods at a time in their hazing application. Coyote response to hazing varied from rapid fleeing of the area to approaching the person doing the hazing. In the presence of domestic dogs, hazing was less effective. For the open space experiment, we selected four urban park and open space properties (two treatments and two controls) with prior histories of coyote conflict. Here, we report only on how people responded to our educational efforts at treatment sites where we provided passive, non-personal coyote hazing education via signs, email, and social media as well as education stations staffed by volunteers. Based on survey results, 23% of people that saw a coyote tried hazing it during our study trial period. Seventy-eight percent indicated that they would haze a coyote in the future, and 75% indicated the educational effort influenced their decision to haze or not. We conclude that hazing can be a useful tool for short-term relief from a coyote encounter, but the term "hazing" is confusing for some residents. We recommend that instead of using the term "hazing" that other terms such as "scare away" be incorporated into a proactive coyote conflict management strategy. 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.

KEY WORDS: aversive conditioning, behavior, *Canis latrans*, citizen science, community engagement, coyote, hazing

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INTRODUCTION

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), the number of reported encounters, incidents, and attacks on humans and pets has risen dramatically in the last eight years (Poessel et al. 2013). The general feeling is that, in the absence of real consequences for being in the presence of humans, bold-aggressive coyotes (coyotes that make a habit of being highly visible to humans) have become tolerant of people and that this tolerance leads to more negative interactions between these coyotes and people (Baker and Timm 1998, Timm et al. 2004, Orthmeyer et al. 2007, Schmidt and Timm 2007). In a sense, humans have become nothing more than "wallpaper" to the highly visible urban coyote. In an effort to change this disregard for the presence of

humans, a high priority for managers throughout the DMA is understanding whether hazing coyotes can sensitize coyotes (i.e., in bold-aggressive coyotes, decrease their tolerance for people) and reduce coyote conflict overall.

We surmise that a primary reason for the increase in human-coyote conflict is the way the public interacts with coyotes in urban environments, allowing bold-aggressive coyotes to become more tolerant of people. We assume 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 the most effective non-lethal means for empowering residents to provide immediate safety and relief from the presence of a bold-aggressive coyote and help create a lasting decrease in coyote tolerance of people. We call our concept community-level hazing (Table 1) because residents, not resource managers, are responsible for the hazing in real time.

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 non-lethal; 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 tend to agree. Hazing is considered an acceptable management action by over 70% of Adams County, CO 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 (over 70%) and how many indicate they are willing to actually do it (less than 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). Our goal was to address these important questions and evaluate if we could change public interactions with coyotes in ways that would result in reduced human-coyote conflict in urban environments. We report on two efforts: a citizen science hazing program and a community-level hazing experiment.

Table 1. Terms and definitions related to hazing used in this paper.

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 in an attempt to sensitize coyotes to the presence of humans or human spaces such as backyards and playspaces. 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 versus Harassment	Many agencies and organizations support and recommend hazing coyotes in order 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.

METHODS

We conducted our work within the Denver Metro Area (DMA), which includes seven counties (Adams, Arapahoe, Boulder, Denver, Douglas, Jefferson, and Broomfield) and more than 45 municipalities. The human population of the seven counties is approximately 2.74 million (DRCOG 2010). The DMA, located in the Front Range of Colorado, 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 less than 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.

Citizen Science Hazing Program

Between October 2012 and December 2013, we recruited and trained 207 volunteer coyote observers throughout the DMA. Recruits were required to attend a 2.5-hour training session and sign a waiver to participate. 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 trainees to apply hazing techniques selectively (i.e., to haze only if a coyote is behaving in a way that is unacceptable or using an area that residents deem unacceptable). We trained citizen scientists to use metrics such as location and/or coyote behavior to determine if hazing was appropriate. Additionally, we instructed participants 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, is 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 is behaving normally in a normal habitat (e.g., coyote is hunting rodents in a field at a distance from humans); the individual is sick or injured; the animal is cornered; and/or when a coyote has 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 a forceful voice; Repeat and reinforce, if necessary; and Teach a neighbor or friend how and when to haze. Finally, trainees 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 is not to harm the animal. Trainees were instructed, when they attempted hazing, to use an objective scale to gauge coyote 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 the forms, email forms electronically, or use a password-protected on-line 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 and those events not involving a dog.

Table 2. Response coding of coyotes being hazed by citizen scientists in the Denver Metro Area. Citizen scientists used this table to rank individual coyote response to hazing from -4 (most aversive) to 1(coyote approaches).

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 more than 10 feet away after input, stops and looks back at a distance greater than 10 feet from original starting point.
-1	Coyote moves less than 10 feet away after input, stops and looks back in the direction of stimulus less than 10 feet from the original starting point.
0	No change in behavior, location or movement direction following input.
1	Coyote approaches after input.

Hazing Experiment

Our objective for this experiment was to determine whether a community-level hazing treatment made coyotes less visible (i.e., wary of people) and altered measurable behavioral attributes of people related to their willingness to participate in hazing treatments. We employed a treatment and control design to determine if our education efforts were effective. Here, we report only on how effective our educational techniques were at altering human attitudes and behavior.

At both treatment sites, we applied community-level hazing education/training techniques that could be deployed by wildlife and/or land managers in urban and suburban areas. The application lasted three weeks. Passive, non-personal hazing education signs were posted at major park access points and high volume activity nodes at the treatment sites. These full color, 24 × 36-inch, two-sided sandwich board signs provided basic information about how to haze and encouraged park visitors to haze coyotes when observed. We augmented the signs with social media, email blasts from 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).

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. Observation data is available at the City of Aurora, CO Coyote Watch coyote activity viewing page (<https://apps2.auroragov.org/CoyoteWatchMap/>). A score of “-3” (“coyote moves away from the area”; see Table 2) was the most common response by coyotes followed by “-2” (“coyote moves away... stops and looks back...”) (Figure 1). Domestic dogs were present 42% of 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, indicating hazing impacts were lessened in the presence of a dog (Figure 2). A domestic dog was present four of five total cases where the coyote approached after the hazing attempt. In two cases where the coyote approached, the citizen scientist indicated there was an active den site nearby.

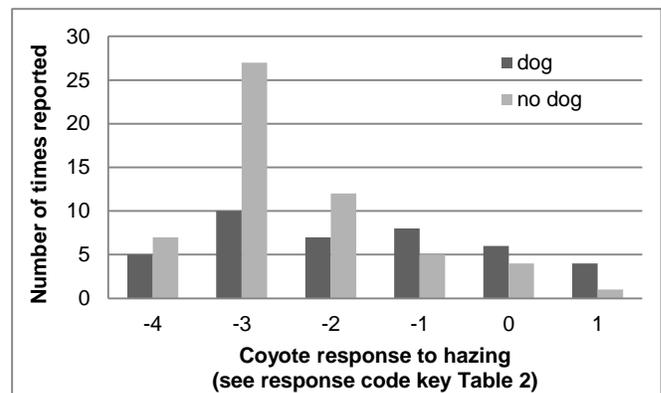


Figure 1. Hazing response.

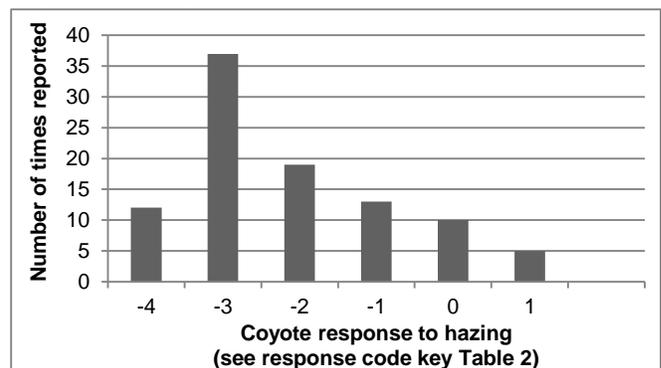


Figure 2. Hazing response with and without dog.

Out of a total of 207 citizen scientists, nine performed 74% of the hazing attempts. Voice 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 33% of the

time. Citizen scientists reported using their body (raised arms and/or exaggerated waving motions) to haze 28% of the time. Fifty-three percent of the time, citizen scientists used more than one and up to four 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 enhance their hazing effort. The total estimated cost for the Citizen Science Hazing Program was \$26,717 (Table 3) which included paid staff time, volunteer time, and Information Technology staff services.

Table 3. Estimated cost of implementing a citizen science program in the Denver Metro Area.

Description	Type	Amount
Paid staff time (research, design, development, trainings)	In kind	\$ 4,200
Volunteer time (training time only; observation time not accounted for)	In kind	\$20,117
Information Technology services (design and develop web-based mapping and observation)	In kind	\$ 2,400
	Total	\$26,717

Table 4. Survey questions asked of the public during the community-level hazing experiment conducted in the Denver Metro Area. Surveys were only conducted at the two treatment sites where the public was encouraged to haze coyotes.

Number	Question
1	Are you aware that the National Wildlife Research Center put up 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 effort of the National Wildlife Research Center encouraging the public to haze coyotes influence whether or not you would do so?

Hazing Experiment

We received 495 surveys at our two hazing treatment sites (128 at Bear Creek Greenbelt, and 367 at Crown Hill Park) (Table 4). Surveys indicated the majority of park visitors noted the educational signs (86%) and understood why the signs were there (85%). The majority (76%) of park visitors 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. A majority (78%) indicated they would attempt to haze in the future, and 75% indicated the educational effort influenced their decision to do so (Figure 3). Total estimated cost for

this hazing experiment was \$9,000 (Table 5). This includes 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.

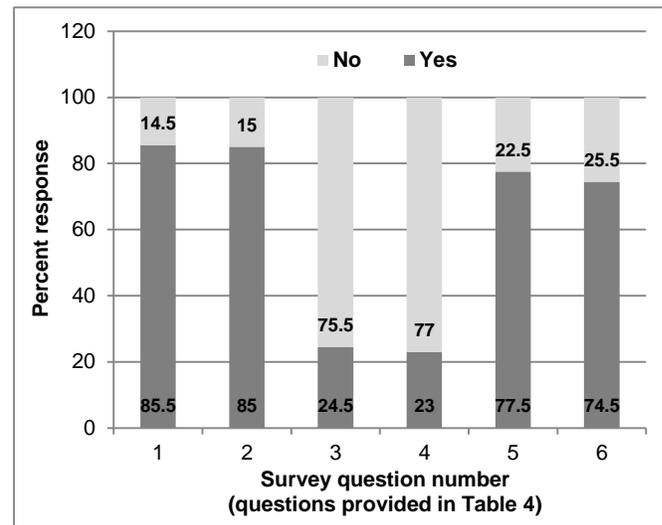


Figure 3. Hazing question responses.

Table 5. Estimated cost of implementing a community-level hazing experiment in the Denver Metro Area.

Description	Type	Amount
Hazing video (talent, filming and production)	Cash	\$ 5,000
Sign design and fabrication	Cash	\$ 1,800
Collaborating partner effort (volunteer and staff time)	In kind	\$ 1,000
Paid staff time (research, design, implementation)	In kind	\$ 1,200
	Total	\$ 9,000

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 over 70% of the hazing attempts, the coyote moved more than ten feet away from the person doing the hazing. Most citizen scientists used voice, noise and/or approaching the coyote to haze, showing that community-level hazing does not require specialized tools or effort to be effective. We recommend that resource managers in urban areas consider how to best encourage citizens to effectively and safely deploy these readily available tools (voice, noise, and approach) to haze coyotes in appropriate situations.

Analysis of the citizen science program indicates that engaging residents in community-level coyote conflict solutions such as community-level hazing has positive, empowering impacts. 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 indicated a change in attitude toward hazing as a management strategy for dealing with negative human-coyote interactions. Actions that became more acceptable after participation in the program included “frighten or haze the coyote away”. Citizen scientists indicated that knowledge of hazing and how to haze builds confidence, provides a sense of control, and empowers them to protect themselves and their property. Participants “gained the courage to haze if I ever get the chance.” Simply “knowing what to do if I see a coyote” replaced fear with confidence. One participant noted, “Since [my daughters] learned about the coyotes they are confident and not as scared.” Volunteers 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. These measurable changes in knowledge and attitudes indicate that engaging residents in coyote conflict resolution at the community level such as community-level hazing has an overall positive impact.

It is important to recognize the limitations of these management actions. From our work, we recognize two important limitations for community-level hazing: First, our results indicate that the presence of an active den site can impact hazing outcomes. In two 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, pers. observ.). Though our sample size is small, our observations match other reports of coyote aggression near active den sites (City of Aurora, CO Coyote Tracking Reports, January 2007-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 ten or more 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 2). Additionally, dogs were present four out of five occasions when coyotes approached the person attempting to haze it. Our results indicate that when a dog is present, residents can expect a muted response to their hazing attempt. Helping residents understand how the presence of a dog can lessen coyote response to their hazing effort is an important aspect of hazing education messages, as it will help set realistic expectations for hazing outcomes in the presence of a dog. This is important to note, as many negative coyote interactions in urban environments occur in the presence of a dog (M. A. Bonnell, pers. observ.). Even though hazing impacts were generally lessened in the presence of a dog, we still recommend that residents with dogs attempt to haze in a negative coyote interaction.

Our study showed short-term benefits of hazing, but it 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; attacking and taking pets on leash or in close proximity to

owners; 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 facilitate the rescue 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 one of many anecdotal examples from the DMA, repeated hazing attempts on a problem coyote at one of our treatment sites had no effect on conflict behavior, which resulted in the need to remove the individual from the population. A number of 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, pers. observ.). 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. However, 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.

Our results also indicate that hazing is a complex concept and is difficult to teach using non-personal media such as on-site signs. Citizen scientists had numerous questions and requested clarifications 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 community hazing experiment, as well as concerns expressed in the survey, indicate that the word “hazing” is a socially maligned word and may be getting in the way of educational efforts and community engagement. Sample comments on the word hazing from our hazing study survey include: “Hazing is a pretentious and confusing word to use”, “Did not like the term haze!”, and “What does haze mean?”. We suggest experimenting with different terms or descriptors such as “scare”, “shoo”, and “tough love” to describe the intent of hazing.

Generally, wildlife managers and safety officials can expect low community-level hazing participation, especially when using non-personal media. Most park visitors elected to not haze a coyote when they noted one during our trial. Sample hazing study survey comments related to willingness to haze include: “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.”, “Does not seem logical to me.”, “I think you are wrong. I like the coyotes.” and “While I understand the motivation, I’m afraid by telling people they can and should throw things at the animals, it will turn into an opportunity for abuse.” The majority of respondents, however, indicated they would haze in the future, suggesting that hazing as a proper management tool may take time or a defining event to move from something residents “should do” to something they will actually try.

Community hazing education efforts need to deploy a

multi-media presence. Posting a sign or hosting one community meeting is not enough. 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. It is our experience that public response to education is not immediate. Acceptance and a change in attitude toward certain management practices may take time or require a defining event such as the removal of a problem coyote that was attacking leashed pets in the daytime at one of our study sites.

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 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. Residents should not expect a highly visible urban coyote to completely flee the area after an initial hazing attempt. An important concept to teach is the idea that residents may need to repeat or reinforce their hazing effort if the coyote does not respond or does not leave the area initially. We believe that and 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.

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