Scampering in the city: Examining attitudes toward black-tailed prairie dogs in Denver, Colorado

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Abstract

The conservation of prairie dogs in the Western United States is contentious, as prairie dogs are often considered pests. This research addresses the ecological and social outlook for prairie dog colonies in Denver, Colorado. Remote sensing analysis was applied to identify potential locations for colony reintroduction. To assess the social outlook, knowledge and attitudinal surveys were distributed to residents living near existing colonies and potential colony sites. Statistical analysis of responses provided insight into relationships amongst ecological knowledge, access to educational literature, demographics, and attitudes toward prairie dogs. Results indicated that women view prairie dogs more favorably than men; ecological knowledge was strongly associated with favorableness toward prairie dogs; and residents living near existing colonies were more favorable toward prairie dogs. We conclude that prairie dogs have the potential to be sustained in Denver. This study may help wildlife managers in targeting neighborhood-level education efforts to specific demographics and (mis)conceptions.

Introduction

Cities are burgeoning in both extent and population (Potere, Schneider, Angel, & Civco, 2009). Edge cities and suburbs further contribute to an increasing dominance of the built environment (Garreau, 1992; Wolch, 2007). As concrete structures and asphalt thoroughfares annex the countryside, humans frequently come into contact and conflict with wildlife inhabiting the urban fringe. While some generalist species are more-or-less accepted as part of the urban landscape, many species seem entirely incongruous with contemporary conceptions of the metropolis. While the values placed on urban wildlife in general are shaped by the broader conditions of society (Manfredo, Teel, & Bright, 2003), most American cities are: “...culturally fragmented arenas in which values and attitudes towards nature in general (and wildlife in particular) are bound to be highly variable...” (Wolch, West, & Gaines, 1995, p. 737). Urban open space may be physically suitable for wildlife populations; yet, if residents do not support the wildlife, survival may be threatened. The outlook for urban wildlife thus depends upon both ecological and social factors.

Human-wildlife interactions in metropolitan settings are often contentious. Metropolitan environments largely remain hostile to many vertebrate species; it is especially difficult for mammals to thrive in an urban structure that limits their movement (Garden, McAlpine, Peterson, Jones, & Possingham, 2006). Nonetheless, even lacking corridors and habitat, shadow animal populations manage to survive in the city (Wolch, 2002). However, successful urban animal populations face another challenge—the fissure between urban residents’ perception of wilderness and the actual impacts of urban wildlife (Messmer, 2000; Wolch et al., 1995). While wild species may be perceived as charismatic—even iconic—from a distance, their local presence can generate intense conflict over concerns related to human safety and economic losses. Annually, over sixty percent of urban American households experience conflict with wildlife (Messmer, 2000). Human–wildlife conflicts are challenging to resolve because they are often caused by human behavior and expectations (i.e., that wild animals behave “appropriately” around humans); these expectations are difficult to change without extensive education or enforced regulations (Savrard, Clergeau, & Mennenech, 2000). Often, repeated animal intrusions become increasingly threatening, and the offending
animal may be killed in the interest of public safety. For example, each year, United States government agents kill an estimated 90,000 “problem” coyotes—a species that is increasingly thriving in suburbs and urban residential neighborhoods (Stark, 2009).

The dichotomy between wilderness and urbanization is even more evident for native wildlife species that have been designated as pests. A pest designation emerges from the widespread perception of harms. The threat may be real or perceived (Messmer, 2000); either way, the stakeholder perceives it as real. A pest designation may also perpetuate the association of harms and obscures benefits derived from a particular species. With a pest species, direct management such as culling or translocation is generally preferred by the public. Pest species are purposefully excluded from local landscapes; however, the ostracized animals may migrate to open space, find new marginal habitat, adapt to the altered landscape, and persist for lack of habitat (Wolch et al., 1995).

Despite such conflicts, urban wildlife can provide myriad benefits for urban residents and visitors (Wolch, 2006). A majority of Americans engage in non-consumptive wildlife recreation each year, select wildlife species are perceived as an amenity by urban homebuyers, and supporting urban wildlife fits in well with the rise in sustainability ethos (Wolch, 2007; Wolch et al., 1995). Urban wildlife species may promote a city’s identity; for example, salmon are designated as a critical species to the entire metropolitan area of Seattle (Wolch, 2002). The fish attract tourists, and also serves as a source of urban pride, which has resulted in the successful promotion of local habitat restoration (Wolch, 2002). Urban wildlife can create opportunities for ecological education and a tangible connection to local environments. Natural open spaces also lower stress and reduce crime in nearby urban areas (James et al., 2009).

Recognizing the benefits of urban wildlife, many communities are working to incorporate wildlife into their built environments (Wolch, 2006). Community-based efforts combined with regional policies will be critical in mitigating the impacts of rapid development on wildlife (Garden et al., 2006; Ricketts & Imhoff, 2003).

The City and County of Denver, Colorado, U.S.A, provides an example of an urban area that is protecting a historically unpopular species (in this case, prairie dogs) due to esthetic and practical benefits that result from the animals’ presence. Denver’s black-tailed prairie dogs (Cynomys ludovicianus, hereafter referred to as “prairie dogs”) currently experience severe ecological and social limitations to their distribution. However, the Denver Parks & Recreation Department is actively supporting current prairie dog colonies and in the process of identifying potential relocation sites. One of the driving motivations for supporting urban prairie dog populations is to maintain a source of prey for local predators—both for esthetic purposes, such as supporting local populations of golden eagles, ferruginous hawks, and red-tailed hawks, as well as for practical purposes, such as providing alternative food sources to coyotes, which are increasingly a threat to urban pets (DeLaup, personal communication, Feb, 2010; Hoogland, 2006).

An estimated five billion prairie dogs inhabited North America prior to the 1800s (Forrest, 2005). The natural habitat of these burrowing rodents consists of short grass and mixed grass prairie, and ecologists consider prairie dogs to be a keystone species in these biomes (Kotliar, Miller, Reading, & Clark, 2006; Slobodchikoff, Perla, & Verdolin, 2009). Their colonies were historically home to many imperiled species, including black-footed ferrets and burrowing owls (Lomolino & Smith, 2004). Ecologists estimate that prairie dog colonies currently cover only 1–2% of their original range as a result of extermination, habitat loss and fragmentation, recreational shooting, and outbreaks of sylvatic plague (Yersinia pestis) (Fox-Parrish & Jurin, 2008; Hoogland, 1995). Dwindling prairie poses another significant challenge to the species’ long-term survival. Rapid urban expansion, in addition to agricultural conversion, transforms prairie ecosystems and makes prairie dog colonies vulnerable to extermination (Magle & Crooks, 2007, 2009). The Denver—Aurora metropolitan area’s population alone has increased by 15% between 2000 and 2008 (U.S. Census Bureau, 2009). Prairie dogs are further limited in their urban habitat due to their need for stable colony sites. Unlike most urban wildlife (specifically birds and mammals), they are tied to a specific colony (with the exception of migrating juvenile males).

These colonies can be hot spots for conflict between residents and other stakeholders. Prairie dogs lack institutional protection; they are not listed as a federally-protected species and are, in fact, classified as vermin in many states (Slobodchikoff et al., 2009). Among the reasons for a historic animosity toward prairie dogs in the Western United States are two dominant misconceptions: first, the belief that prairie dogs transmit the plague to humans, and second, the belief that prairie dogs pose hazards to cattle, which can break their legs in the burrows. The plague is carried by fleas and, once transmitted to prairie dogs, quickly eradicates colonies. While the risk of transmission to humans is extremely low, fear of this disease is entrenched in local residents (DeLaup, Denver’s wildlife ecologist, personal communication, Feb. 2010). Cattle may occasionally break their legs in burrows; however, these perceived harms have been greatly exaggerated (Slobodchikoff et al., 2009).

While several previous works have addressed human perceptions toward prairie dogs, they lack a unifying theme. Urban residents have been found to display more positive attitudes toward prairie dogs than rural residents (Reading, Miller, & Kellert, 1999); however, one study that explored attitudes toward prairie dogs in Fort Collins, Colorado, concluded that residential proximity to prairie dog colonies significantly increased both knowledge of the species and an acceptance of controlling their population through poisoning (Zinn & Andelt, 1999). Yet another recent study conducted in the Denver metropolitan area found that public attitudes toward prairie dog management strategies were not affected by a resident’s proximity to a colony (Milley, 2008).

A study conducted in Montana found that knowledge was not correlated with values and attitudes toward prairie dogs (Reading et al., 1999). Another attitudinal survey, covering the eleven-state prairie dog range, found that those with direct experience with prairie dogs held more negative views of the species; the authors proposed that wildlife managers should educate the public on the keystone role of the prairie dog (Lamb & Cline, 2003). This may prove quite challenging, as despite year-long educational efforts, secondary school students in northern Colorado still described prairie dogs as nuisances, bad for ranchers, and disease-bearing (Fox-Parrish & Jurin, 2008). These myths and stereotypes about prairie dogs are perpetuated by friends, family, and newspaper articles (Reading et al., 1999). There are multiple challenges to sustaining prairie dogs over the long term in Denver. Suitable open spaces must be identified and preserved. However, successful restoration and maintenance of prairie dog populations does not depend on ecology alone—how society recognizes and values prairie dogs will play a pivotal role. Since historical stereotypes strongly influence the public sentiment against prairie dogs, social criteria must be evaluated as an additional limitation to prairie dog distribution in an urban landscape. If long-term success with urban prairie dog colonies is possible in the City & County of Denver, the city must cope with anticipated human—wildlife conflicts. In order to successfully implement a planned education campaign, managers need detailed information about trends in residents’ attitudes and (mis)perceptions toward urban wildlife, as well as knowledge of where these attitudes occur relative to specific colony locations.
In this study, our goal is to explore the relationships between demographics, ecological knowledge, educational information, and attitudes—in conjunction with the distribution of open spaces which meet criteria for potential prairie dog habitat—in order to comprehensively examine the prospects for Denver’s prairie dogs. This study illustrates how a very simple sampling framework, based on residents’ location within a city, provides leverage in interpreting attitudes toward a specific species of urban wildlife. Such results could inform local wildlife protection initiatives, especially those that rely on some form of ecological education.

Methods
Urban remote sensing & GIS methods

Prairie dogs inhabit short and mixed grass prairie as well as moderately barren land. They clear their burrow mounds of vegetation and clip nearby vegetation. As a result, soil and non-photosynthetic vegetation (NPV) land-cover components are the primary contributors to their habitat’s spectral signature (Assal & Lockwood, 2007). Because their habitat is not vertically complex, shade is not expected to be a significant spectral component. The difficulty in classifying prairie dog habitat occurs because colonies can be characterized by a range of compositions, from dominant soil cover to dominant NPV cover. Prairie dogs do not change the vegetation of their colony in a uniform way, so spectral mixing and habitat variability are problems even in rural colony detection (Assal & Lockwood, 2007). We applied remote sensing and GIS analysis to identify potential sites for prairie dog colonies. Our analysis was based on two assumptions: (i) built-up areas, i.e., pixels dominated with impervious surfaces—roads, parking lots, buildings, etc.—are not suitable for habitat, and (ii) the land-cover composition of potential habitat sites will be similar to that of currently existing colonies.

Two August 2002 Landsat Enhanced Thematic Mapper Plus (ETM+) images (P33/R32 and P33/R33) were mosaicked and geo-registered to the NAD 83 UTM Zone 13N projection, and the mosaic was clipped so that the bounding box included the City and County of Denver. Our first goal was to identify pixels that are dominated by natural land-cover components. Spectral mixture analysis (SMA), or spectral unmixing, is a method to effectively deconstruct a pixel into its proportional material components. Each pixel is modeled in terms of the fractional abundance of the “pure” spectra (or endmembers) of materials present (e.g., Adams et al., 1995; Powell, Roberts, Dennison, & Hess, 2007). We applied a spectral mixture model with four endmembers selected from the imagery: NPV, green vegetation, soil, and shade. Because we did not include an endmember to represent urban materials, pixels dominated by impervious surfaces were not modeled and were removed from further consideration as “potential habitat.” In addition, the shade component of the SMA model was constrained to 50% because we expected colony habitat to have low shade fractions; this constraint also minimized confusion with dark impervious surfaces, e.g., parking lots and composite shingle roofs, which can often be modeled using a high shade fraction (Powell, 2011). An additional constraint was applied to the model to guarantee a minimum “goodness-of-fit” for each pixel; pixels that failed to meet this constraint were left unmodeled (Powell & Roberts, 2010).

Our second goal was to categorize pixels as potential/existing habitat or non-habitat. Because the primary purpose of this analysis was to build a sampling framework for our attitudinal survey, we chose a binary classification. We applied supervised Mahalanobis distance classification (e.g., Chuvieco & Huete, 2010) to classify successfully modeled pixels into two categories: existing/potential prairie dog habitat and non-habitat. Training areas were obtained from known colony sites (545 pixels extracted from ~45 existing colonies). Digital maps of existing colony boundaries had been generated from ground-based surveys completed by the Denver Parks and Recreation Department (2007). Since prairie dog occupancy is also predicted by slope and patch size of suitable habitat (Proctor, Beltz, & Haskins, 1998), two additional criteria were incorporated. Prairie dogs generally occupy flat sites (Assal & Lockwood, 2007); therefore, areas with slope greater than 10% were excluded from the potential colony category. Areas less than one acre were excluded in order to identify larger patches of open prairie that would be viable for a prairie dog population over a relatively long period of time in a rapidly changing urban setting. Future research could focus on the quality of available habitat in order to facilitate the identification of high-priority habitat patches.

The final SMA fraction images and classified potential habitat map indicated that prairie dog colony habitat was distinguishable from human-built structures, impervious surfaces, irrigated vegetation, and other non-habitat areas. The constrained spectral mixture analysis modeled 48% of the pixels in the study area—those pixels in the scene composed of soil, NPV, green vegetation, and minimal shade. The unmodeled portions of the image (52%) were generally dominated by impervious surfaces and water bodies, and therefore not suitable as habitat. Within known colony boundaries, prairie dog habitat was dominated by NPV and soil, which together generally composed more than 75% of the fractional coverage of those pixels, similar to the findings of Assal and Lockwood (2007). Green vegetation composed a very small proportion of the known prairie dog habitat, with average pixel values around 5%. Supervised classification of SMA fractions assigned 39% of the pixels modeled by SMA to the existing/potential habitat class (Fig. 1). These sites could eventually serve as natural expansion or intentional relocation sites. The non-habitat class (61% of the modeled pixels) primarily contained irrigated urban vegetation, such as golf courses and parks. High-spatial resolution (2.4 m) Quickbird imagery from June/July 2007 was accessed through Google Earth and utilized as reference data to assess accuracy of the potential habitat classification. The overall classification accuracy, based on a comparison of 70 randomly selected points, was approximately 83%. Much of the classification error was due to urban development that had occurred since the date of image acquisition.

Attitudinal survey

This binary habitat/non-habitat classification provided the sampling frame that targeted two populations: residents within 0.5 miles of existing colonies and residents within 0.5 miles of potential colony sites. We distributed 1017 surveys to 11 of these residential areas in August 2009, in and around the City & County of Denver. The surveys were hand-delivered in order to verify the status of the open space as an existing or potential prairie dog colony. There was no incentive for survey completion. Six surveyed areas were within 0.50 miles of existing colony sites, and five were within 0.50 miles of potential colony sites (509 surveys and 508 surveys distributed, respectively). In 2007, approximately 907 acres within the city limits of Denver were occupied by prairie dog colonies, less than one percent of the city’s total area. Colony areas varied widely, from ~0.05 acres to ~100 acres; the mean colony area was 12.1 acres and median was 5.8 acres. Although the area occupied by individual colonies fluctuates over time, Denver’s colonies are consistently spread across the less-densely settled urban fringe. Due to the often-charged nature of prairie dog conservation, we began the survey with a cover letter, followed by demographic information (Morse, 2010). We excluded demographic markers
such as income and political affiliation which were likely to increase non-response (Dillman, 1978). The next section of the survey included seven multiple choice questions aimed at assessing ecological knowledge to evaluate what impact, if any, ecological knowledge would have on opinions. After the knowledge section, half of the surveys included an educational component discussing prairie dogs’ keystone species role, communication abilities, drastic population decline, and the low risk of plague transmission to humans, where the correct answers to the preceding section were provided along with short explanatory paragraphs. This allowed us to assess the impact of written ecological information on attitudes. The survey concluded with an attitudinal section employing a five-point Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) and a “No Opinion” option.

Prior to distribution, the surveys were pre-tested on volunteers consisting of graduate students and university staff in order to ensure clarity.

Statistical analysis

Categorical analysis was used to compare demographic variables to attitudinal responses (JMP 8.0, SAS Institute Inc., 2008). For each attitudinal statement, responses were grouped as “Strongly Agree/Agree” or “Disagree/Strongly Disagree,” while “Neutral” and “No Opinion” responses were not included in the analyses. The data were subsequently disaggregated into two subsets: respondents near existing colonies and respondents near potential colony sites. The attitudinal statements were again analyzed in relation to the major variables of interest for each subset: gender, knowledge levels, and inclusion of educational literature. While theoretically it is a possible that non-response bias could significantly influence measures of public opinion, there is increasing evidence that little to no relationship exists between response rates and survey errors (Keeter, Miller, Kohut, Groves, & Presser, 2000; Merkle & Edelman, 2002). This is important because people are increasingly non-responsive to surveys of any nature. Nonetheless, larger sample sizes still contribute to statistical power, and our sample size of $N > 200$ is useful and cost-appropriate in light of the costs of conducting surveys.

Results

We received 223 surveys for a 22% response rate (Table 1; Fig. 1); 68% ($n = 151$) came from residents living near existing colonies, 31% ($n = 69$) from residents living near potential colonies as determined by remote sensing classification, and 1% ($n = 3$) from other

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1 They also have the most advanced language documented in non-human mammals (Frederiksen & Slobodchikoff, 2007; Slobodchikoff et al., 2009).
Prairie dogs inhabit open space that would be better used for urban development.

Plague outbreaks in prairie dogs are a threat to human health.

Restoring native prairie habitat in Denver is important to me.

I support protecting prairie dogs in Denver.

Prairie dogs are harmful to ranching.

Lethal removal of prairie dogs should be the standard management practice on public lands.

Males

Near existing colony 64 30
Near potential colony site 39 17

Females

Near existing colony 126 57
Near potential colony site 39 17

No educational component 117 53
Educational component 103 47

Educational component

Near existing colony 69 31
Near potential colony site 34 16

No educational component

Near existing colony 82 37
Near potential colony 35 16

Educational component

Near existing colony 69 31
Near potential colony site 34 16

No educational component

Near existing colony 82 37
Near potential colony 35 16

There was only one significant difference for two statements (Table 3). Those living near colonies were significantly more likely than males to strongly agree, agree, or be neutral with two statements: Prairie dogs in Denver play an important role in keeping the natural prairie intact ($\chi^2 = 12.7, p = 0.013$) and I support protecting prairie dogs in Denver ($\chi^2 = 11.04, p = 0.03$). There was no relationship between gender and ecological knowledge.

Ecological knowledge and attitudes

Across all respondents, ecological knowledge levels (i.e., low was 0–1, moderate was 2–4, and high was 5–7 questions answered correctly) were significantly associated with all statements except Plague outbreaks in prairie dogs are a threat to human health (Table 3). For most statements, the pattern was consistent: those with low knowledge had the least favorable attitudes, those with moderate knowledge had favorable attitudes, and those with high knowledge had the most favorable attitudes toward prairie landscapes and prairie dogs. Two statements—Lethal removal of prairie dogs should be the standard management practice on public lands and Prairie dogs are harmful to ranching—deviated from this pattern, as respondents with moderate levels of knowledge showed the most favorable attitudes for these statements.

Individual questions about ecological knowledge were subsequently compared to attitudinal responses. Respondents who correctly answered that Prairie dog colonies are a very important part of prairie ecosystems were always more positive toward prairie dogs than those respondents who answered incorrectly ($p < 0.05$ for all ten attitudinal statements). Respondents who correctly answered that Prairie dogs have extraordinary communication abilities were more positive toward prairie dogs on eight out of ten attitudinal statements ($p < 0.05$).

Discussion

In the Colorado Front Range, limited habitat is an obvious constraint for urban prairie dogs. The goal of the remote sensing analysis presented here was to provide a location-specific framework for studying attitudes toward prairie dogs. This analysis determined that there is existing natural space that could be
dedicated to prairie dogs colonies within the Denver city limits. Given both ecological and social constraints, the long-term outlook for Denver’s prairie dogs is precarious. However, this research demonstrates that there is urban habitat for prairie dogs in Denver and that urban neighborhoods can be accepting of these animals.

The results of our attitudinal survey indicated that females were consistently more favorable toward prairie dogs and prairie landscapes than males. Ecological knowledge also appears to have a significant and positive effect on attitudes toward this species. As this survey was fairly simple and there was no follow-up with respondents, future studies should consider ways to add qualitative depth in an effort to better understand why these groups had more positive attitudes.

To promote acceptance of prairie dog colonies, our findings suggest that managers should educate residents about the minimal risks of plague, the important keystone role of prairie dogs, and their advanced communication abilities. In this study, the plague was more of an explicit concern to urban residents than prairie dogs. Residents who responded correctly to this question may be correspond with positive attitudes toward Denver’s urban prairie dogs. Residents who responded correctly to this question may be aware of the association between the presence of prairie dogs and the plague, although they do not believe that the risk to humans is low. Since increased perception of risk appears to negatively impact attitudes toward prairie dogs, a lowered perception of risk achieved through education could lead to more positive attitudes (Lybecker, Lamb, & Ponds, 2002).

Table 3
Categorical comparisons across all residents.

<table>
<thead>
<tr>
<th>Attitudinal statement</th>
<th>Residence type</th>
<th>Education info</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy or would enjoy having prairie dogs in my community</td>
<td>11.4</td>
<td>0.02*</td>
<td>1.7</td>
</tr>
<tr>
<td>I enjoy seeing hawks and eagles in my community</td>
<td>6.3</td>
<td>0.18</td>
<td>9.0</td>
</tr>
<tr>
<td>Prairie dogs in Denver play an important role in keeping the natural prairie intact</td>
<td>0.7</td>
<td>0.95</td>
<td>4.2</td>
</tr>
<tr>
<td>Lethal removal of prairie dogs should be the standard management practice on public lands</td>
<td>7.2</td>
<td>0.12</td>
<td>4.2</td>
</tr>
<tr>
<td>Prairie dogs are harmful to ranching</td>
<td>3.2</td>
<td>0.53</td>
<td>10.4</td>
</tr>
<tr>
<td>I support protecting prairie dogs in Denver</td>
<td>6.1</td>
<td>0.19</td>
<td>2.2</td>
</tr>
<tr>
<td>Restoring native prairie habitat in Denver is important to me</td>
<td>2.6</td>
<td>0.63</td>
<td>1.3</td>
</tr>
<tr>
<td>Plague outbreaks in prairie dogs are a threat to human health</td>
<td>1.5</td>
<td>0.83</td>
<td>4.3</td>
</tr>
<tr>
<td>I would consider a prairie dog colony to be a positive amenity in a Denver neighborhood</td>
<td>8.8</td>
<td>0.07</td>
<td>7.3</td>
</tr>
<tr>
<td>Prairie dogs inhabit flat, open space that would be better used for urban development</td>
<td>9.5</td>
<td>0.04*</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Significant results (p < 0.05) denoted with *.

Table 4
Categorical comparisons for residents based on gender and residential location.

<table>
<thead>
<tr>
<th>Attitudinal statement</th>
<th>Existing</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>I enjoy or would enjoy having prairie dogs in my community</td>
<td>7.9</td>
<td>0.10</td>
</tr>
<tr>
<td>Prairie dogs in Denver play an important role in keeping the natural prairie intact</td>
<td>0.7</td>
<td>0.85</td>
</tr>
<tr>
<td>Prairie dogs are harmful to ranching</td>
<td>12.2</td>
<td>0.03*</td>
</tr>
<tr>
<td>Lethal removal of prairie dogs should be the standard management practice on public lands</td>
<td>10.2</td>
<td>0.04*</td>
</tr>
<tr>
<td>Prairie dogs inhabit flat, open space that would be better used for urban development</td>
<td>7.2</td>
<td>0.02*</td>
</tr>
<tr>
<td>I support protecting prairie dogs in Denver</td>
<td>14.6</td>
<td>0.005*</td>
</tr>
<tr>
<td>Restoring native prairie habitat in Denver is important to me</td>
<td>15.2</td>
<td>0.004*</td>
</tr>
<tr>
<td>Plague outbreaks in prairie dogs are a threat to human health</td>
<td>6.6</td>
<td>0.16</td>
</tr>
<tr>
<td>I would consider a prairie dog colony to be a positive amenity in a Denver neighborhood</td>
<td>8.2</td>
<td>0.08</td>
</tr>
<tr>
<td>Prairie dogs are harmful to ranching</td>
<td>15.8</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

Significant results (p < 0.05) denoted with *.

Residents living near colonies were more likely to agree or strongly agree with the statement “I enjoy or would enjoy having prairie dogs live in my community.” In addition, they were more much more
Nonetheless, the results strongly suggest that even moderate
contribute to residents
maintain that bias. This is a supposition worth further exploration.

There are several possible underlying causes for this trend. The most
optimistic is that regardless of previous viewpoints, residents in
close proximity begin to accept their prairie dog neighbors and
minimized perceived and actual costs to landscaping and human
health. Because the residences classified as near a colony encom-
passed a 0.01 mile—0.50 mile range, many respondents did not find
prairie dogs literally in their backyard, and there may have been
equal amount of distance to minimize conflict. Another potential con-
foundering factor is that residents who do not like prairie dogs may
choose not to live near colonies. Yet another possible factor may be
the result of non-response bias, as residents living near colonies
were more likely to respond than residents living near potential
colonies. Those with frequent interactions with prairie
dogs—whether positive or negative—appear more interested in
the survey than the population at large, as represented by those
living near areas classified as potential colony sites. Another
potential non-response bias could be the higher proportion of
women who responded to the survey; however, a previous study in
the Denver metropolitan area that explored perceptions of prairie
dogs and open space fragments found only negligible differences
between respondents’ and non-respondents’ demographics and
attitudes (Milley, 2008).

Our study found that females were more overall positive toward
prairie dogs and prairie landscapes; previous studies have found
that women tend to hold more pro-environment attitudes
(Reading, Stern, & McCain, 2006). However, women who live near
potential colony sites exhibited less favorable attitudes toward
prairie dogs than women near existing colonies. This provides


tentative support for the postulation that women who live near
colonies are influenced by exposure to prairie dogs and develop
more favorable attitudes toward the species. However, this study
did not assess the underlying reasons behind the attitudes. Future
studies could address this need through a combination of surveys
and follow-up interviews.

This study uncovered patterns that directly contrast with atti-
dudal patterns found over a decade ago in Fort Collins, Colorado
(Zinn & Andelt, 1999). Unlike that case study, respondents living near
colonies were more likely to express unfavorable attitudes toward
prairie dogs. The authors even noted that “...long-term proximity
to prairie dogs may make negative aspects of the animals’ presence
more salient” (Zinn & Andelt, 1999, p. 1104). The authors of that
study claimed that, at that time, Fort Collins’s longer-term resi-
dents, who inhabited the urban-rural fringe where prairie dogs
were found, were potentially still connected to the area’s recent
agricultural past, while newer, suburban residents had not
embraced the view that prairie dogs were a nuisance and a threat to
human livelihoods. Knowledge was not strongly associated with
attitudes among the surveyed population in Fort Collins; however,
the current study found the opposite relationship in Denver. The
temporal difference between studies could be one explanation, as
urban growth tends to pull in many new residents with non-
utilitarian wildlife belief systems (Manfredo et al., 2003). This
may provide further support to the postulation that prejudice can
play a significant role in attitudes toward prairie dogs; if those who
grew up steeped in the vision of prairie dogs as vermin may
maintain that bias. This is a supposition worth further exploration.

This survey was not able to measure all variables that might
contribute to residents’ attitudes toward Denver’s prairie dogs.
Nonetheless, the results strongly suggest that even moderate

knowledge about prairie landscapes and prairie dogs improves
attitudes. Educational efforts should emphasize prairie dogs’ role as
a keystone species, especially with regard to birds of prey, and on
their advanced communication abilities. Consistent and persistent
education may progressively debunk fears of the plague among
urban residents. Furthermore, the gender gap in attitudes indicates
that outreach efforts by wildlife managers should focus on men.

Conclusion

The existing construct of nature in the United States bestows the
privileged status of wilderness and wildlife upon pristine envi-
ronments and charismatic animals, while local ecosystems are
often under-appreciated (Cronon, 1995). One consequence of this
division is that our cities have far too little space for urban wildlife,
and these creatures are rarely accepted as part of the urban land-
scape. Urban wildlife, and especially the conflict that often emerges
around its presence, therefore cannot be separated into ecological
and social components when considering the long-term outlook for a
species.

This urban wildlife case study shows that prairie dogs—which are a critical component of the native prairie ecosystem—have
the potential to be sustained in the City and County of Denver.
Information on public attitudes toward prairie dogs and potential
habitat sites is critical for successfully managing this species in
urban and suburban settings. Our results suggest that preservation of natural prairie lands and protection of prairie dogs is broadly
supported by Denver residents, especially among women and
residents with moderate ecological knowledge. Proximity of resi-
dents to existing colonies was also an important factor in this case
study; in contrast with previous work (Zinn & Andelt, 1999),
eexisting residents located near prairie dog colonies viewed them
more favorably than urban residents living near potential colony
sites.

The spatial aspect of attitudes toward wildlife merits further
attention, particularly in the urban fringe. In order to conserve open
space and native species, wildlife managers must have relevant and
detailed information about the ecological and social landscapes.
Attitudes may vary significantly based upon residents’ gender,
knowledge, and location within the city, as in this case study, or
attitudes may vary due to other demographic factors. Exploring
these relationships can provide wildlife managers and other
stakeholders with insight that may ultimately improve the outlook
for urban species or even an urban ecosystem.

This study, while preliminary, provides a template for deter-
minal if and where there is local support for wildlife initiatives.
Wildlife managers can use this spatial information to effectively
allocate limited educational resources to neighborhoods where
prairie dog colonies can be viably sustained. Future research should
include an in-depth, qualitative component which would explore
some of the suppositions made about the relationships between
gender, knowledge, and attitudes toward prairie dogs. Wildlife
managers would also benefit from a longitudinal study on resi-
dential attitudes, with a close examination of the educational
outreach, both before and after urban prairie dog reintroduction.

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