THESIS

APPLYING SOCIAL SCIENCE TO INFORM CONSERVATION SOLUTIONS REGARDING OWNED OUTDOOR CATS IN URBANIZING LANDSCAPES

Submitted by

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ABSTRACT

APPLYING SOCIAL SCIENCE TO INFORM CONSERVATION SOLUTIONS REGARDING OWNED OUTDOOR CATS IN URBANIZING LANDSCAPES

Free-ranging domestic cats (*Felis catus)* incur and impose risks on ecosystems and represent a complex issue of critical importance to wildlife conservation and domestic cat and human health. There is an inherent social dimension to the issue of owned free-ranging cats, as humans are their caregivers and can contribute to the cause as well as the solution to this issue. To address this social component, we examined public risk perceptions, attitudes, and beliefs towards owned free-ranging cats along a gradient of urbanization via a survey of residents in two study areas in Colorado. Residents did not view all types of risks uniformly; they viewed the risks of cat predation on wildlife and carnivore predation on cats as more likely than the risks of disease transmission to and from wildlife. Additionally, risk perceptions were related to such factors as attitudes and general beliefs about cats, prior experiences with cats and their interactions with wildlife, and cat owner behavior. These findings provide support for the notion that changes in risk perceptions can result in behavior change, and they offer insight for development of communication campaigns aimed at promoting risk aversive behaviors and cat management strategies that are both acceptable to the public and have direct conservation implications. Our study can also be used as a model for further research focused on integrating social and biological information to promote conservation of wildlife and habitats.

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INTRODUCTION

Rapid urbanization is a leading agent of fragmentation and cause of species endangerment (Czech et al. 2000; Mcdonald et al. 2008). In many regions urban sprawl, particularly exurban development in rural areas (Theobald 2003), intrudes on wildlife habitat and intensifies human-wildlife conflict (Conover 2002). Additionally, urbanization increases the risk of exotic species invasions due to accidental or intentional release by humans. Many of the mammalian exotics are free-ranging domestic species, including livestock and pets (Pimentel et al. 2000), and one of the most visible exotic species is the domestic cat, *Felis catus*. There are an estimated 86.4 million owned cats (APPA 2012) and at least 60-100 million unowned free-ranging cats in the U.S. (Dauphine & Cooper 2009).

Free-ranging domestic cats, including unrestrained feral, stray, and pet cats, represent a complex issue of critical importance to wildlife conservation and domestic cat and human health (Kays & DeWan 2004; van Heezik et al. 2010; Bevins et al. 2012). Globally, there is growing evidence of the ecological impacts of cats via direct predation on native prey such as birds, small mammals, and reptiles (Coleman & Temple 1993; Crooks & Soulé 1999; Baker et al. 2005; van Heezik et al. 2010). Cats may also indirectly alter prey foraging habits and survival by their mere presence in an ecosystem (Bonnington et al. 2013). In addition, cats may transmit diseases to native carnivores, particularly wild felids, and can transmit zoonotic disease agents such as rabies, *Toxoplasma gondii, Yersinia pestis,* and *Bartonella henslae* to humans (Brown et al. 2008; Gerhold & Jessup 2013). Conversely, free-ranging cats face a variety of risks, such as threats from vehicles, domestic dogs, other cats, and wildlife, including harassment or direct predation by native carnivores and contraction of diseases (Crooks & Soulé 1999; Grubbs & Krausman 2009; Bevins et al. 2012). The risks that cats both incur and impose (hereafter

"bidirectional" risks) are likely compounded when they roam along the wildland-urban interface (WUI) near natural areas (van Heezik et al. 2010; Bevins et al. 2012).

As with many of today's conservation challenges, there is an inherent social dimension to the issue of free-ranging domestic cats, in part because these animals are often owned or cared for by humans. Consequently, human behavior can contribute to the cause as well as the solution to the outdoor cat issue. For example, humans can perpetuate the occurrence of cats on the landscape by allowing their pets to spend time outdoors unrestrained and by feeding unowned free-ranging cats (Lord 2008). Alternatively, humans can minimize bidirectional risks by restricting their cats' outdoor activity, vaccinating and sterilizing cats, and using various anti-predatory devices such as CatBibs or belled collars (Calver et al. 2007; Gordon et al. 2010). Still, management of free-ranging cats remains a highly controversial topic that often pits wildlife advocates against animal rights organizations (Peterson et al. 2012).

Despite ubiquitous media attention on this topic, there is a paucity of literature regarding public perceptions of free-ranging cats and their interactions with wildlife. In particular, research is needed to determine how people perceive the risks associated with cat-wildlife interactions as well as management actions that may reduce those risks (Loyd & Miller 2010). Additionally, much of the prior social science research on this topic has focused on identifying public attitudes toward feral cats and their management (Lepczyk et al. 2003; Lord 2008; Loyd & Miller 2010; Lohr & Lepczyk 2013; Wald et al. 2013), with little attention devoted to perceptions regarding pet cats that spend time outside, despite the latter encompassing a large fraction of outdoor cat populations in some areas (Thomas et al. 2012). Public attitudes toward these two types of free-ranging cats and their subsequent management are likely different and therefore should be

examined as distinct areas of inquiry to inform management solutions and communication efforts (Farnworth et al. 2011).

To address these gaps in the literature, we examined public perceptions of owned free-ranging cats along a gradient of urbanization in Colorado. Specific objectives were to: 1) examine beliefs about the bidirectional risks associated with pet cats, and 2) explore differences in these beliefs based on other factors including attitude-related measures, prior experiences, and sociodemographic and cat ownership characteristics. Our ultimate goal is to employ this social information to develop communication and management strategies aimed at minimizing the bidirectional risks concerning pet cats in ecosystems. We conclude by illustrating how our data may be used to accomplish this goal.

Our study was grounded in theory and concepts from social psychology adapted for use in understanding wildlife and other natural resource-related issues. Specifically, our approach focused on the application of attitude theory (Ajzen & Fishbein 1980; Eagly & Chaiken 1993; Manfredo et al. 2004) and the concept of risk perceptions (Slovic 1987; Gore et al. 2009). In this context, attitudes, which guide individual behaviors, refer to one's overall evaluation (e.g., good/bad) of a particular entity or issue, such as cats being allowed outside. Beliefs refer to the specific cognitions that form the basis for attitudes, often representing how individuals feel about the outcomes of a given issue. This would include thoughts regarding the advantages and disadvantages of cats spending time outside (e.g., cats having a better quality of life or disrupting the balance of nature) as well as more specific beliefs about risks, or risk perceptions (e.g., threats to cat safety from predation or cats negatively impacting prey populations). Risk perceptions can influence wildlife-related attitudes and support for wildlife management programs (Riley & Decker 2000a; Gore 2004).

We expected residents with higher risk perceptions to have more negative attitudes toward outdoor pet cats and more positive attitudes toward cat management strategies. We also expected higher risk perceptions to relate to prior negative experiences, such as cats damaging property, capturing wildlife prey, or being injured or killed by wild carnivores. Further, we expected rural residents to have lower risk perceptions than urban residents since prior research has shown that rural residents have more positive attitudes towards feral cats and positive attitudes have been linked to lower risk perceptions (Coleman & Temple 1993; Riley & Decker 2000b; Lord 2008). Finally, we predicted that cat owners, particularly those who allow their cats outside without restrictions, would have lower risk perceptions than non-owners and owners who keep their cats indoors or somehow restrict outdoor activity.

METHODS

Sampling and Data Collection

Our study sites included two urbanizing areas in Colorado: 1) Western Slope: low-density exurban and rural development surrounded by natural habitat on protected and private land on the western slope of the continental divide between the cities of Montrose and Telluride, and 2) Front Range: high-density urban/suburban and low-density exurban development bordering natural areas along the WUI on the eastern slope of the continental divide, west of the city of Boulder. We targeted residents in rural, exurban, and urban/suburban locations to capture the range of urbanization across the two study areas and facilitate exploration of variation in resident perceptions along a gradient of urbanization (Appendix II).

Data were collected via a mail survey administered to residents in both study areas from November 2011 through January 2012. The sampling frame was identified using GIS-based county tax parcel data that allowed for mailing addresses to be linked to spatial information. We targeted for at least 400 completed surveys within each study area to allow for population estimates within +/- 5% at the 95% confidence level (Schaeffer et al. 1996).

We used a modified Dillman et al. (2009) approach to survey administration that consisted of two survey mailings and a reminder postcard. Survey development was informed by an elicitation phone survey (n=42) designed to identify salient beliefs of the target population regarding the advantages and disadvantages of cats spending time outdoors and factors that would encourage or discourage cat owners from allowing cats outside. The survey was also pre-tested with a small sample of residents (n=36) similar in demographics to the target population to confirm the effectiveness and comprehension of question wording. The final survey (see Appendix I) and administration procedures were approved for use with human subjects by

Colorado State University's Institutional Review Board (Protocol #: 10-2330H). To test for nonresponse bias, we conducted a phone survey of nonrespondents (n=193) in each study area following data collection. The phone survey contained a sample of key questions from the mail survey, including items to assess levels of interest, attitudes, and beliefs regarding free-ranging pet cat issues as well as cat ownership characteristics and sociodemographics.

Measurement

We measured attitudes by asking respondents on a 7-point scale to indicate whether "having outdoor pet cats in your neighborhood" is good, bad, or neither, and their overall level of approval of "people allowing their cats to spend time outdoors". Attitudes toward cat management strategies were measured on a 7-point scale from highly unacceptable to highly acceptable. Management actions included the legal mandate of certain outdoor cat restrictions (e.g., leash laws or prohibition of cats being allowed outdoors), sterilization, vaccination, and licensing. We measured beliefs using a series of statements representing possible outcomes of cats spending time outdoors (Tables 1-2). These included *basic beliefs* about overall advantages and disadvantages identified in the elicitation survey as well as *risk perceptions* about bidirectional risks regarding cats in the ecosystem. Basic beliefs were recorded on a 7-point scale from strongly disagree to strongly agree, and risk perceptions were recorded on a 7-point scale from extremely unlikely to extremely likely.

We used fixed response options to measure sociodemographic variables, including gender, income, education, and type of community where respondents were raised (urban or rural). Age was recorded in number of years. As per our sampling strategy, respondents were also grouped by study area (Front Range or Western Slope) to facilitate comparisons by level of urbanization. We measured prior experience by asking respondents if they had experienced

problems with neighborhood cats in the last 12 months (yes/no, and an open-ended area for type of problem). We also asked current cat owners about their experience with cat predation on wildlife (frequency of cats bringing home different categories of wild prey; collapsed to yes/no) and whether they had ever owned a cat that was injured or killed by wildlife or contracted a disease from wildlife (yes/no).

Cat ownership factors included: current cat ownership (yes/no), vaccination (percent of respondents who vaccinate any of their cats), veterinary care (percent of respondents who regularly seek veterinary care for at least one of their cats), and outdoor restrictions (fixed choices such as keeping cats indoors at night, allowing cats outdoors only under human supervision, and an open-ended "other"). Outdoor restriction behavior was further operationalized by combining cat ownership and restriction behavior to classify respondents along a continuum from 0 to 3, where 0 = respondent does not currently own a cat; 1 = respondent keeps all cats indoors; 2 = respondent allows at least one cat outdoors with restrictions; and 3 = respondent does not employ any outdoor cat restrictions.

Data Analysis

We analyzed survey data in SPSS (IBM Corporation 2013) in a series of stages. First, we performed principal components analysis (PCA) to explore the unique patterns of thought, or dimensions, represented by the risk perception items. Next, we conducted reliability analysis to examine the internal consistency of risk perception scales, using dimensions identified in the PCA, and to assess internal scoring consistency among basic belief items. For scales yielding a Cronbach's alpha greater than 0.75, indicating sufficient measurement reliability (Vaske 2008), we computed composite scores by averaging responses for items comprising each scale.

We then performed K-means cluster analysis to identify the existence of unique groups of respondents based on their responses to risk perception items. We used the full suite of risk perception items (n=16; Table 1) instead of the risk dimensions identified from the PCA to maximize variability and preserve the diversity of responses, and to avoid constraining the structure of the clusters. This analysis was intended to facilitate segmentation of the target audience for development of a future risk communication program as well as to provide a foundation for exploring relationships with other factors theorized to influence risk perceptions. We used chi-square tests of successive cluster numbers to help determine the best cluster solution that yielded both conceptually-meaningful groupings and group sizes large enough to encompass a substantial number of respondents. We validated the final risk cluster solution and further explored the distinctiveness of resulting groups by performing an analysis of variance (ANOVA), along with post-hoc tests (Scheffe's and Dunnett's T3), on risk dimensions resulting from the PCA.

We also used ANOVA (with post-hoc comparison procedures) and chi-square tests to explore differences among risk clusters in attitudes, basic beliefs, prior experience, cat ownership characteristics, and sociodemographics. We used an alpha level of $p < 0.05$ to designate statistical significance and computed effect size measures (eta and Cramer's V), as indicators of practical significance, to account for a higher likelihood of finding statistical significance with a large sample size (Vaske 2008). We used accepted criteria (Vaske 2008) to determine small, medium, and large effects (eta > 0.10, 0.24, 0.37; Cramer's V > 0.1, 0.3, 0.5).

RESULTS

We mailed 4872 surveys, of which 1398 (over 400 per study area) were returned completed and 599 were undeliverable, yielding a 33% overall response rate. The follow-up phone survey revealed only marginal variation between respondents and nonrespondents on most items, with the exception of interest in outdoor pet cat issues (eta = 0.31, indicating a moderate effect size); respondents (mean = 4.15) expressed greater interest in these issues than nonrespondents (mean = 2.39). This salience difference is consistent with prior research (Connelly et al. 2003), and although it poses a limitation, we decided not to weight the data because interest was not significantly correlated with other predictor variables.

The PCA revealed four distinct dimensions of risk perception that explained 67% of the variance in responses (Table 1). Dimensions were defined by factors representing disease risk; predation risk *from* wildlife to cats; predation risk from cats *to* wildlife; and anthropogenic risk, which included items related to human development such as cats being injured by other pets or cars. While the 'cat predation on small farm animals' item loaded equally on anthropogenic and disease risk factors (0.41), we chose to include it under the former given the greater likelihood of this event in human-dominated landscapes. Reliability analyses indicated high internal consistency for risk perception (Cronbach's alpha range: 0.77 to 0.88; Table 1) and basic belief composite scales (Cronbach's alpha = 0.84; Table 2). Overall means for risk perception scales indicated respondents perceived the risk of cats contracting or transmitting diseases to be the most unlikely of all risks, and the risk of carnivores injuring or killing cats to be the most likely (Table 3).

Cluster analysis showed strong evidence for a conceptually-meaningful 6-cluster solution based on individual risk perception items (Table 3). Solutions with greater than six clusters

resulted in group sizes (< 60 respondents) too small to reflect meaningful groups of respondents. Clusters differed across risk perception dimensions, with substantial effect sizes (eta > 0.70), and final clusters ranged from a group who believed all risks were unlikely (low risk cluster) to a group who believed that all risks were likely (high risk cluster; Table 3). The other four clusters included groups who thought: only the risks from wildlife to cats were likely (risk *from* wildlife cluster); only the risks to wildlife from cats were likely (risk *to* wildlife cluster); bidirectional risks between wildlife and cats were likely (risk to and from wildlife cluster); and all risks were moderately likely (moderate risk cluster). The majority of respondents (71%) belonged to the risk to and from wildlife, moderate risk, and high risk clusters. The separation of three clusters into groups who viewed only bidirectional predation-related risks as high (either singly or together) revealed that respondents felt strongly about these risks and could distinguish them from other risk dimensions. Conversely, respondents viewed the probability of anthropogenic or disease risks similarly (as likely or unlikely) and clusters didn't separate based on either of these risks alone or together.

Attitude and basic beliefs markedly differed among risk clusters (Table 4). As predicted, respondents in the low risk cluster generally had more positive attitudes and correspondingly positive beliefs regarding outdoor pet cats than respondents in the moderate and high risk clusters. Also as predicted, acceptability of cat management strategies increased with perceived risk, with the high risk cluster finding these strategies more acceptable than low risk groups. The most invasive strategies, such as legally requiring cats to be kept indoors or restrained while outside, had the lowest overall approval ratings (slightly to moderately unacceptable, on average). Conversely, legally requiring cats to be vaccinated and sterilized had the highest mean ratings (slightly to moderately acceptable). With the exception of attitudes toward sterilization

and vaccination requirements, which had small to medium effect sizes, all of the attitude and belief variables included in our comparisons yielded large practical differences (eta > 0.37) between risk clusters.

Cat ownership characteristics and prior experience also differed among clusters (Table 5), although these variables did not explain as much variation as the attitude and basic belief variables discussed above as measured by effect sizes. With the exception of vaccination, all differences among clusters were statistically significant. However, the largest effect sizes, noted for outdoor restriction behavior and experiences in the form of recent problems with neighborhood cats and cats bringing home small mammals, were small to moderate. The high risk cluster and risk *to* wildlife cluster contained the highest percentage of people reporting problems with outdoor pet cats in the prior year. The most commonly reported problems gleaned from the open-ended question on the survey included cats urinating and defecating on property, cats killing wildlife, and other outdoor cats fighting with respondents' cats. Consistent with our predictions, the high risk cluster contained the highest number of non-owners and owners with indoor-only cats, and the low risk group consisted of the highest number of owners who impart no restrictions on their cats' outdoor activity. Contrary to our prediction, however, the highest percentage of respondents with cats bringing home small mammals belonged to the low risk cluster. The highest percentages (per cluster) of respondents who had cats that brought home birds and other prey items belonged to the risk *to* wildlife cluster.

All sociodemographic factors, except age, significantly differed among risk clusters (Table 4). However, with the exception of study area, which had close to a moderate effect size (Cramer's V = 0.28), differences among clusters were not substantial. Gender, income, education, and community where respondents were raised all had small effect sizes, with risk

perceptions generally increasing with the percentage of women, income, education, and urban upbringing. Consistent with our predictions, the low risk cluster was comprised of a lower percentage of respondents from the more urban Front Range (42%) than from the Western Slope. Similarly, fewer Western Slope residents (35%) were found in the high risk cluster. The cluster with the lowest percentage of Front Range residents was risk *to* wildlife (38%), and clusters with the highest percentages of Front Range residents were risk *from* wildlife (79%) and moderate risk (74%).

DISCUSSION

Allowing cats unrestricted outdoor access can have considerable effects on wildlife populations and cat welfare (van Heezik et al. 2010; Thomas et al. 2012). Because human behavior change is the ultimate solution to this issue, communication aimed at addressing cat owner behavior and promoting alternative forms of action is needed. However, effective communication programs are difficult to develop because various factors (such as information source and pre-existing attitudes) confound the ability to persuade someone with informational messages (Wood 2000; Jacobson 2009). Creating such programs begins with a better understanding of target audiences, including their pre-existing attitudes and beliefs. Toward this end, the purpose of our study was to better characterize public perceptions regarding owned outdoor cats and their interactions with wildlife and to consider how this information could be used to design future communication strategies.

Our study determined that individuals do not perceive the risks associated with outdoor pet cats equally. Although some people assigned a low probability to risks cats both incur and impose in the environment, and others believed all risks were highly probable, 73% of our sample was classified in groups between these two extremes. The defining characteristic that distinguished these intermediate groups was their perception of predation-related risks, which were also viewed as the most likely of all risks by respondents as a whole. Three of the six respondent clusters we identified indicated a high level of concern for cat predation on wildlife, wildlife injuring or killing cats, or both. In contrast, perceptions of disease and anthropogenic-related risks (e.g., cats being injured by other pets or cars) varied less across respondents and were generally seen as less likely. The risks of wildlife predation on cats and cats preying on wildlife have been confirmed by numerous studies worldwide (Crooks & Soulé 1999; Baker et

al. 2005). Similarly, studies have shown that cats can both contract diseases from and transmit diseases to wildlife (Brown et al. 2008; Gerhold & Jessup 2013). In this case, while the likelihood of predation risks seems to align with public perceptions, there appears to be a disconnect regarding disease risk. This finding is consistent with other studies that have shown that risk perceptions do not often coincide with actual risk potential (Slovic 1987; Gore 2004; Gore et al. 2009), and it suggests a need to target misperceptions related to disease transmission in communication programs about outdoor pet cats.

We identified several underlying factors that related to differences in risk perceptions. Consistent with our hypothesis and prior research (Riley & Decker 2000b), respondents with lower risk perceptions had more positive attitudes toward cats being allowed outside. Similarly, individuals with higher risk perceptions showed greater support for cat management strategies. The most acceptable strategies were those requiring sterilization and vaccination, suggesting it may behoove local municipalities to focus management efforts on these measures as well as funding them if cost has a large bearing on compliance. Adopting management strategies that are acceptable to the public can minimize conflict (Teel & Manfredo 2010) while simultaneously reducing the risk of negative interactions between cats and wildlife. Additionally, promoting these measures and raising awareness about risks through communication may increase the acceptability of and compliance with cat management strategies as a whole (Cho 2003).

We also found evidence for our predicted relationship between risk perceptions and outdoor restriction behavior. Cat owners who do not restrict their cats' outdoor activity had lower risk perceptions than owners with indoor-only cats and owners who employed restrictions such as using outdoor cat enclosure or letting cats outside only during daylight hours. These findings provide further support for the notion that changes in risk perceptions could result in

behavior change (Cho 2003). Therefore, local, targeted information that can increase risk perceptions regarding outdoor cats may be helpful in promoting adoption of risk mitigation behaviors.

Previous studies on the social aspects of natural resource issues have shown that sociodemographics are not strong predictors of cognitive variables such as attitudes and beliefs (Teel & Manfredo 2010). Likewise, we did not find practically meaningful differences between risk clusters based on sociodemographic measures, with the exception of urban versus rural residence with urban residents in the Colorado Front Range holding higher overall risk perceptions than rural residents on the Western Slope.

As with previous research (Riley & Decker 2000a), certain prior experiences helped explain differences among risk clusters. As expected, having recent problems with cats was related to heightened risk perceptions. However, the relationship between experience and risk perceptions was not always in the predicted direction. For example, experiences with cats preying upon small mammals did not result in greater overall perceptions of risks, but these experiences did seem to increase risk perceptions that directly corresponded to these events (i.e., more people in the risk *to* wildlife cluster and risk *to* and *from* wildlife cluster). A large percentage of respondents with cats bringing home small mammals in the low risk cluster may be due to owner de-sensitization to these predation events or the role of affective evaluations, defined as the positive or negative feelings associated with risks (Needham et al. 2006). Because small mammals are often considered pests, these owners may hold a positive view of cat predation and not consider it a risk (Coleman & Temple 1993). Surprisingly there was no strong trend evident across the risk clusters in terms of experiences with cats contracting diseases from wildlife, getting injured/killed by predators, or bringing home bird and other prey items. This

finding could in part be due to the difficulty in detecting these cryptic events. For example, owners might not know why their cat disappeared or was ill; additionally, cats do not always bring home their kills (Kays & DeWan 2004). Since respondents in our study were generally aware of predation risks, simply providing statistics regarding the rates of cat predation on wildlife may be unlikely to change risk perceptions and subsequent risk mitigation behavior. However, discussing common problems that result from cats may also increase risk perceptions and receptivity to risk mitigation strategies.

The findings from our study can serve as a guide to inform future social and biological science research that sheds more light on outdoor domestic cat issues. Future research should focus not only on risk likelihood but on the affective or emotional components of risk perceptions such as feelings of dread or happiness associated with risks. While our findings showed a strong connection between perceptions of risk likelihood and cat owner behavior as well as support for cat management strategies, it would be worth exploring whether certain risks, while perceived as likely, are less influential because they are viewed in a more positive or neutral light. Future research could also benefit from exploring whether there are other factors that might contribute to cat owner decisions regarding restrictions on outdoor activity, sterilization, and vaccination. Additionally, it would be useful to determine reasons why people abandon unwanted cats or feed cats that do not belong to them (Finkler & Terkel 2012). A better understanding of these factors would allow conservation educators to target the root of the problem rather than simply managing the effects.

We also recommend further research on the actual likelihood of negative interactions between cats and wildlife that would allow for direct comparisons of perceived and actual risks and thus facilitate improved messaging to raise awareness regarding risk potential. Although

communication is unlikely to change the perceptions and behavior of individuals with extreme attitudes or beliefs, most respondents in our study belonged to intermediate risk clusters which are groups that would likely achieve the greatest results if targeted (Teel et al. 2006). As we have suggested, catering messages to the background and pre-existing perceptions (or misperceptions) of the target population is critical for development of effective communication programs that promote desired behaviors among cat owners. Targeted messaging, informed by our findings and future social science inquiry, is also needed to help build support for cat management strategies that have a higher likelihood of success due to public acceptance. Ultimately, the conservation implications of these efforts are clear. For example, restricting cat outdoor activity in any way that limits interactions between cats and wildlife can reduce predation events and disease transmission. Furthermore, developing communication programs that integrate social and biological science information can promote the risk mitigation behaviors mentioned above. These methods can be used to conserve other wildlife species as well, especially the species most affected by human behavior and opinions. Therefore, our study can be used as a model for further research aimed at integrating social and biological information to promote conservation of wildlife and wildlife habitats.

Table 1. Reliability and principle components analysis (PCA) results for risk perceptions regarding outdoor pet cats from a 2011-2012 survey of Colorado residents.

Risk perception items [Pet cats spending time outdoors in my neighborhood would result in...] [a]	Risk dimension factor loading [b]				
	Disease	Predation *from* wildlife	Anthropogenic	Predation *to* wildlife	Combined risk scale
Cats giving diseases to other pets.	0.85				
Cats getting diseases from other pets.	0.79				
Cats giving diseases to wildlife.	0.78				
Cats giving diseases to humans.	0.73				
Cats getting diseases from wildlife.	0.72				
Cats being injured or killed by mountain lions.		0.88			
Cats being injured or killed by bobcats.		0.85			
Cats being injured or killed by foxes.		0.81			
Cats being injured or killed by coyotes.		0.76			
Cats being hit by cars.			0.84		
Cats being injured or killed by other pets.			0.71		
Cats being lost or stolen.			0.65		
Cats damaging people's property.	0.43		0.53		
Cats injuring or killing small farm animals.[c]	0.41		0.41[c]		
A decrease in populations of small mammals.				0.90	
A decrease in populations of birds.				0.85	
Eigenvalues	5.86	2.32	1.35	1.24	
% Variance explained	36.60%	14.51%	8.41%	7.74%	
Cronbach's alpha	0.87	0.87	0.77	0.80	0.88

[a] Item responses coded on a 7-point scale from 1 “extremely unlikely” to 7 “extremely likely”.
[b] Only factor loadings greater than 0.40, denoting practical significance, are shown.
[c] Since ‘cats injuring or killing small farm animals’ loaded equally on disease and anthropogenic risk factors, we placed it in the latter for scale creation because it has greater construct validity in that scale.

Table 2. Basic belief items and scale reliability results from a 2011-2012 survey of Colorado residents about outdoor pet cats.

Basic belief items [a] [Outdoor pet cats in my neighborhood...]	
Are a nuisance (cause problems).[b]	
Are enjoyable to have around.	
Play a useful role as predators in the natural environment.	
Are harmful to wildlife.[b]	
Disrupt the balance of nature.[b]	
Are at risk of being harmed while outdoors.[b]	
Live happier lives than cats that remain indoors.	
Live shorter lives than cats that remain indoors.[b]	
Should be protected by their owners from possible harm while spending time outdoors.[b]	
Should be allowed to roam freely without restrictions.	
Cronbach's alpha	0.84

[a] Item responses coded on a 7-point scale from 1 “strongly disagree” to 7 “strongly agree.”
[b] Item was reverse coded prior to analysis.

Table 3. Mean scoring of risk clusters on risk perception scales from a 2011-2012 survey of Colorado residents about outdoor pet cats.

	Clusters[a]								
Risk perception dimensions	Low risk *n*=90	Risk *from* wildlife *n*=134	Risk *to* wildlife *n*=142	Risk to and from wildlife *n*=245	Moderate risk *n*=418	High risk *n*=255	Overall means	F^b (*df*)	Eta
Disease	1.73a	2.80b	3.81c	2.60b	4.14d	5.31e	3.71	449.09 (5, 1278)	0.80
Predation *from* wildlife	2.73a	5.95b	3.61c	5.93b	5.80b	6.37d	5.50	466.62 (5, 1278)	0.80
Anthropogenic	2.19a	3.56b	4.19c	3.36b	4.64d	5.76e	4.28	389.09 (5, 1278)	0.78
Predation *to* wildlife	3.52a	2.37b	5.39c	5.50c	5.27c	6.08d	5.08	259.19 (5, 1278)	0.71

[a] Cell entries represent mean scoring on composite scales derived from individual items measured on a 7-point scale from 1 "extremely unlikely" to 7 "extremely likely". Means with different letters denote statistical difference ($p < 0.05$), as indicated by post-hoc tests. Due to violation of the equal variances assumption in ANOVA, we used Dunnet's T3 post-hoc test for all risk perception dimensions.
[b] All values were statistically significant at $p < 0.001$.

Table 4. Comparison of risk clusters on attitude, belief, and sociodemographic factors from a 2011-2012 survey of Colorado residents about outdoor pet cats.

	Cluster[a]								
	Low risk	Risk *from* wildlife	Risk *to* wildlife	Risk to and from wildlife	Moderate risk	High risk	X^2 or F (*df*)	Mean	ES[b]
Attitudes[c]									
General attitude toward outdoor pet cats	5.39a	4.05b,c	4.00b,c	4.26b	3.67c	2.48d	54.72 (5, 1270)**	3.74	0.42
Overall approval of allowing cats outside	6.06a	4.70b,c	4.38b,c	4.89b	4.15c	2.82d	51.55 (5, 1271)**	4.24	0.41
Attitudes toward cat management[c]									
Require indoors	1.31a	1.75a,b	2.51c	1.80b	2.42c	3.91d	55.13 (5, 1275)**	2.46	0.42
Require restraint	1.42a	2.02b	2.89c	1.97b	2.76c	4.27d	54.73 (5, 1271)**	2.75	0.42
Require sterilization	4.92a	5.33a	5.74a	5.52a	5.67a	6.38b	11.20 (5, 1274)**	5.70	0.21
Require vaccination	4.62a	5.20a,b	5.44a,b	5.25a,b	5.60b	6.23c	13.15 (5, 1272)**	5.53	0.22
Require license	2.15a	2.87a,b	3.58b,c	2.93a,b	3.80c	5.09d	40.96 (5, 1271)**	3.65	0.37
Basic beliefs[d]	5.10a	4.25b	3.86b,c	4.18b	3.67c	2.69d	100.61 (5, 1277)**	3.75	0.53
Sociodemographics									
Gender - % male	68.18	66.41	46.38	63.37	57.46	56.35	18.16 (5)*	58.84	0.12
Study Area - % living in Front Range	42.22	79.10	38.03	71.78	73.98	65.08	98.02 (5)**	66.09	0.28
Community where raised[e]	5.21a	4.16a,b	4.49a,b	4.12b	3.97b	4.09b	3.75 (5, 1218)*	4.19	0.12
Household income[f]	5.24a	6.15c	5.28a,b	6.12c	6.07b,c	6.12c	5.66 (5, 1072)**	5.95	0.16
Education[g]	3.65a	4.16b	3.64a	4.07b	4.14b	4.03b	7.28 (5, 1232)**	4.02	0.17
Age	60.57	56.40	58.52	58.67	56.81	57.97	1.82 (5, 1239)	57.80	-

[a] Cell values indicate cluster means or percentages (per cluster) for each variable. Means with different letters denote statistical difference ($p < 0.05$), as indicated by post-hoc tests. Due to violation of the equal variances assumption in ANOVA, we used Dunnet's T3 post-hoc test for general attitude toward outdoor cats, education, and management action variables. Means for all other variables were compared using Scheffe's post-hoc test.

[b] Effect size measures. Cramer's *V* was used for chi-square analysis and eta was used for ANOVA.

[c] Cell entries are mean scores on a 7-point scale with higher values indicating more positive attitudes.

[d] Cell entries are mean scores on a composite scale derived from items measured on a 7-point scale from 1 "strongly disagree" to 7 "strongly agree". Negatively worded items were reverse coded (see Table 2 for list of reverse coded items).

[e] Cell entries are mean scores on an 8-point scale from 1 "large city with >25,000 people" to 8 "farm or rural area".

[f] Cell entries are mean scores on a 9-point scale from 1 "less than $10,000" to 9 "$200,000 or more".

[g] Cell entries are mean scores on a 5-point scale from 1 "less than high school diploma" to 5 "advanced degree beyond 4-year".

** p-value < 0.001

* p-value < 0.05

Table 5. Comparison of risk clusters on cat ownership factors and prior experience from a 2011-2012 survey of Colorado residents about outdoor pet cats.[a]

	Cluster[b]								
	Low risk	Risk *from* wildlife	Risk *to* wildlife	Risk to and from wildlife	Moderate risk	High risk	X^2 or F (df)	Mean	ES[c]
Cat ownership factors									
% current cat owner	58.89	51.49	45.00	46.72	40.00	31.50	30.06 (5)**	42.68	0.15
Outdoor restriction behavior[d]	1.47a	0.98a,b	1.00a,b	1.00a,b	0.76b,c	0.57c	11.31 (5, 1248)**	0.87	0.21
% of people that vaccinate at least one cat	77.55	84.85	85.00	84.40	92.86	89.87	10.38 (5)	87.23	-
% of people that take at least one cat to the vet regularly	49.98	72.06	49.18	59.26	67.92	62.03	13.39 (5)*	61.83	0.16
Prior experiences[e]									
Problems with outdoor pet cats in last 12 months	11.24	7.46	31.91	11.89	20.96	43.82	111.53 (5)**	22.84	0.30
Cat injured by predator ever	36.84	39.60	26.21	49.48	31.89	32.91	22.68 (5)**	36.44	0.16
Cat getting a disease from wildlife ever	2.44	2.86	3.09	2.02	3.72	9.93	16.56 (5)*	4.10	0.14
Cats preying on....[f]									
Small mammals	81.25	58.18	75.86	74.51	54.81	55.88	22.41 (5)**	65.02	0.22
Birds	60.42	41.82	64.81	60.61	47.37	43.75	13.00 (5)*	52.54	0.17
Other	19.15	20.00	21.15	16.33	4.62	15.63	14.86 (5)*	14.13	0.18

[a] With the exception of the variables "% current cat owner", "cat ownership behavior", and "problems with cats in the last 12 months", all variables in this table represent only cat owner responses.

[b] Cell values indicate cluster means or percentages (per cluster) for each variable. Means with different letters denote statistical difference ($p < 0.05$), as indicated by post-hoc tests. Due to violation of the equal variances assumption in ANOVA, we used Dunnet's T3 post-hoc test for outdoor restriction behavior. All other variables were compared using Scheffe's post hoc test

[c] Effect size measures. Cramer's V was used for chi-square analysis and eta was used for ANOVA.

[d] Cell entries are mean scores on a 3-point continuum where 0 = do not own cats, 1 = indoor only cat owner, 2 = owner who allows at least one cat outdoors with some restrictions, and 3 = owns only outdoor cats and uses no restrictions.

[e] Percent of respondents who answered yes to each event (per cluster).

[f] Percent of respondents who answer yes to their cat bringing home each type of prey (per cluster).

** p-value <0.001

* p-value < 0.05

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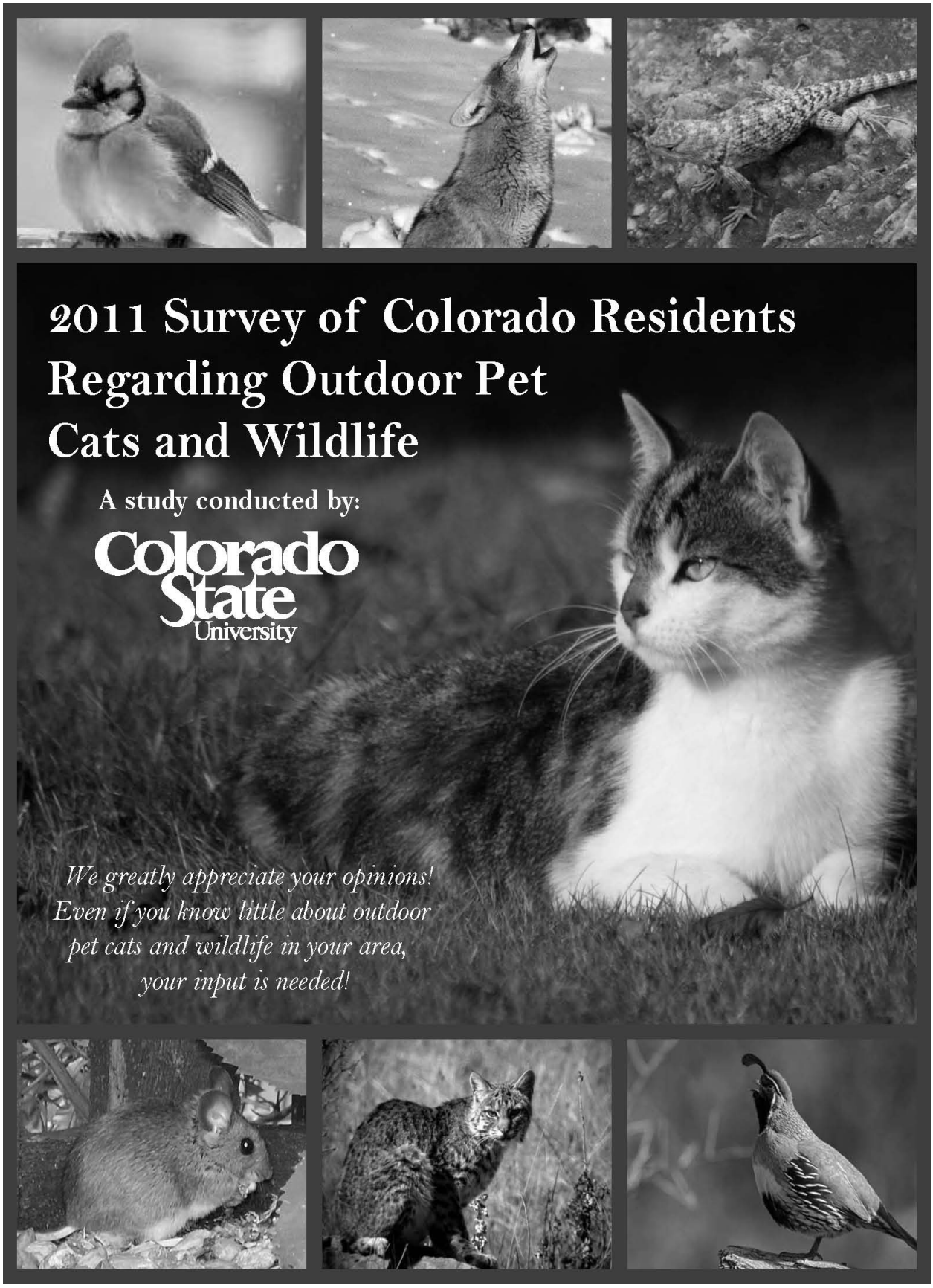
APPENDIX I: Survey Instrument


2011 Survey of Colorado Residents Regarding Outdoor Pet Cats and Wildlife
A study conducted by:
Colorado State University
We greatly appreciate your opinions! Even if you know little about outdoor pet cats and wildlife in your area, your input is needed!

The purpose of this study is to better understand how people feel about ***outdoor pet cats*** in their neighborhoods and how these cats and their interactions with the local environment, including wildlife, should be managed. In this survey, when we refer to ***outdoor pet cats***, we mean pet cats that spend at least some of their time outdoors.

SECTION 1.

There is a wide range of opinions about outdoor pet cats. For example, some people feel that pet cats live happier, healthier lives outside, while others feel that outdoor pet cats have negative effects on wildlife and the environment. Even if you are uninterested or unaware of the topic of outdoor pet cats, we're interested in knowing how *you feel* about these issues. (*Please circle the number that best represents your response for each question below.)*

How well informed are you on the topic of outdoor pet cats?

Not at All Informed			**Somewhat Informed**			**Extremely Informed**
1	2	3	4	5	6	7

How interested are you in outdoor pet cat issues in your neighborhood?

Not at all Interested			**Somewhat Interested**			**Extremely Interested**
1	2	3	4	5	6	7

Overall, do you think having outdoor pet cats in your neighborhood is good, bad, or neither?

Extremely Bad	**Moderately Bad**	**Slightly Bad**	**Neither**	**Slightly Good**	**Moderately Good**	**Extremely Good**
1	2	3	4	5	6	7

Please rate your overall level of approval of people allowing their cats to spend time outdoors in your neighborhood.

Strongly Disapprove	**Moderately Disapprove**	**Slightly Disapprove**	**Neither**	**Slightly Approve**	**Moderately Approve**	**Strongly Approve**
1	2	3	4	5	6	7

On the lines below, please briefly explain *why* you disapprove or approve of people allowing their cats to spend time outdoors in your neighborhood:

_____

_____

Below are statements representing different ways that people might think about outdoor pet cats. We are interested in knowing *your opinions* about outdoor pet cats in your neighborhood. (*Circle one number for each statement.*)

Outdoor pet cats in my neighborhood…	**Strongly Disagree**	**Moderately Disagree**	**Slightly Disagree**	**Neither**	**Slightly Agree**	**Moderately Agree**	**Strongly Agree**
…are a nuisance (cause problems).	1	2	3	4	5	6	7
…are enjoyable to have around.	1	2	3	4	5	6	7
….play a useful role as predators in the natural environment.	1	2	3	4	5	6	7
…are harmful to wildlife.	1	2	3	4	5	6	7
…disrupt the balance of nature.	1	2	3	4	5	6	7
...are at risk of being harmed while outdoors.	1	2	3	4	5	6	7
...live happier lives than cats that remain indoors.	1	2	3	4	5	6	7
...live shorter lives than cats that remain indoors.	1	2	3	4	5	6	7
…should be protected by their owners from possible harm while spending time outdoors.	1	2	3	4	5	6	7
...should be allowed to roam freely without restrictions.	1	2	3	4	5	6	7

SECTION 2.

We are now interested in learning more about your opinions regarding the possible risks associated with pet cats spending time outdoors in your neighborhood. These could include risks that pet cats may pose to wildlife, people, and other pets, as well as risks that pet cats may encounter while they are outdoors.

How unlikely or likely do you think it is that the following would occur as a result of pet cats spending time outdoors in your neighborhood? (*Circle one number for each statement.*)

Pet cats spending time outdoors in my neighborhood would result in…	**Extremely Unlikely**	**Moderately Unlikely**	**Slightly Unlikely**	**Neither**	**Slightly Likely**	**Moderately Likely**	**Extremely Likely**
…a decrease in populations of small mammals (examples: mice, squirrels, rabbits).	1	2	3	4	5	6	7
…a decrease in populations of birds.	1	2	3	4	5	6	7
...cats **getting** diseases *from* wildlife.	1	2	3	4	5	6	7
...cats **getting** diseases *from* other pets (examples: other cats, dogs).	1	2	3	4	5	6	7
...cats **giving** diseases *to* other pets.	1	2	3	4	5	6	7
...cats **giving** diseases *to* wildlife.	1	2	3	4	5	6	7
...cats **giving** diseases *to* humans.	1	2	3	4	5	6	7
...cats being injured or killed by **coyotes**.	1	2	3	4	5	6	7
...cats being injured or killed by **foxes**.	1	2	3	4	5	6	7
...cats being injured or killed by **mountain lions**.	1	2	3	4	5	6	7
...cats being injured or killed by **bobcats**.	1	2	3	4	5	6	7
…cats being injured or killed by **other pets** (examples: other cats, dogs).	1	2	3	4	5	6	7

Pet cats spending time outdoors in my neighborhood would result in…	**Extremely Unlikely**	**Moderately Unlikely**	**Slightly Unlikely**	**Neither**	**Slightly Likely**	**Moderately Likely**	**Extremely Likely**
…cats being hit by cars.	1	2	3	4	5	6	7
...cats being lost or stolen.	1	2	3	4	5	6	7
...cats damaging people's property (examples: going to the bathroom in yards, digging up gardens).	1	2	3	4	5	6	7
...cats injuring or killing small farm animals (example: chickens).	1	2	3	4	5	6	7
....cats using natural areas/open space.	1	2	3	4	5	6	7

On the lines below, please list any other outcomes (not listed above) that you believe are associated with pet cats spending time outdoors in your neighborhood:

_____

_____

In the past 12 months, have you experienced problems with outdoor pet cats in your neighborhood? (*Check one.*)

❒ Yes ❒ No

If yes, please briefly explain the problem(s) and how often it occurred (once during the year, once a month, once a week, etc.) on the lines below:

_____

_____

Now, we want to know how you feel about certain actions to address possible risks associated with pet cats spending time outdoors in your neighborhood. (*Circle one number for each statement.*)

Is it unacceptable or acceptable to…	**Highly Unacceptable**	**Moderately Unacceptable**	**Slightly Unacceptable**	**Neither**	**Slightly Acceptable**	**Moderately Acceptable**	**Highly Acceptable**
…legally require pet cats to be kept indoors at all times?	1	2	3	4	5	6	7
…legally require pet cats to be restrained when outdoors (example: on a leash)?	1	2	3	4	5	6	7
…legally require owners to obtain a license for outdoor pet cats?	1	2	3	4	5	6	7
…legally require owners to vaccinate outdoor pet cats?	1	2	3	4	5	6	7
…legally require owners to spay or neuter outdoor pet cats?	1	2	3	4	5	6	7

SECTION 3:

In this section, we are interested in knowing how you feel about unowned outdoor cats (*not* pet cats). Unowned outdoor cats are stray or feral cats that, although someone may feed them, have no owners and are not typically allowed indoors. (*Please circle the number that best represents your response for each question below.)*

Overall, do you think having unowned outdoor cats (stray or feral cats) in your neighborhood is good, bad, or neither?

Extremely Bad	**Moderately Bad**	**Slightly Bad**	**Neither**	**Slightly Good**	**Moderately Good**	**Extremely Good**
1	2	3	4	5	6	7

Please rate your overall level of approval of people *feeding* unowned outdoor cats in your neighborhood.

Strongly Disapprove	**Moderately Disapprove**	**Slightly Disapprove**	**Neither**	**Slightly Approve**	**Moderately Approve**	**Strongly Approve**
1	2	3	4	5	6	7

Below are statements representing different ways that people might think about unowned outdoor cats. We are interested in knowing *your opinions* about unowned outdoor cats in your neighborhood. (*Circle one number for each statement.*)

Unowned outdoor cats in my neighborhood…	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree
….play a useful role as predators in the natural environment.	1	2	3	4	5	6	7
…are harmful to wildlife.	1	2	3	4	5	6	7
...are at risk of being harmed while outdoors.	1	2	3	4	5	6	7

For the next set of questions, we want to know how you feel about certain management actions to address possible risks associated with unowned outdoor cats in your neighborhood. (*Circle one number for each statement.*)

Is it unacceptable or acceptable for local authorities (for example, wildlife agencies) to…	Highly Unacceptable	Moderately Unacceptable	Slightly Unacceptable	Neither	Slightly Acceptable	Moderately Acceptable	Highly Acceptable
…capture, spay/neuter, and re-release unowned outdoor cats?	1	2	3	4	5	6	7
…capture and euthanize unowned outdoor cats?	1	2	3	4	5	6	7
...capture unowned outdoor cats and take them to a local shelter?	1	2	3	4	5	6	7

SECTION 4.

In this section, we'd like to know how you feel in general about wildlife issues. Below are statements representing different ways that people might think about wildlife. Even if you don't know or care much about wildlife, we are interested in *your opinions*. *(Circle one number for each statement.)*

	Strongly Disagree	Moderately Disagree	Slightly Disagree	Neither	Slightly Agree	Moderately Agree	Strongly Agree
Humans should manage wildlife populations so that humans benefit.	1	2	3	4	5	6	7
I view all living things as part of one big family.	1	2	3	4	5	6	7
The needs of humans should take priority over wildlife protection.	1	2	3	4	5	6	7
Animals should have rights similar to the rights of humans.	1	2	3	4	5	6	7
Wildlife are on earth primarily for people to use.	1	2	3	4	5	6	7
Wildlife are like my family and I want to protect them.	1	2	3	4	5	6	7

Overall, how interested would you say you are in local wildlife issues?

Not at All Interested			Somewhat Interested			Extremely Interested
1	2	3	4	5	6	7

SECTION 5:

In this section, we ask questions about the factors you might consider when deciding whether or not to let your cat(s) spend time outdoors. Even if you do not currently own cats or let them go outdoors, please answer the questions until prompted to move to the next section.

Have you ever owned a cat? (*Check one.*)

❒ Yes

❒ No ****If you checked no, please skip to Section 6.****

There are two parts to this next question. Please answer BOTH parts.	**PART 1. Have any of the following situations EVER happened to cats you have owned in the past?** (*Check one box for each category below.*)	**PART 2. Have any of the following situations happened to cats you have owned in the past 12 months?** (*Check one box for each category below.*)
One or more of MY CATS have:	**Ever**	**In the Past 12 Months**
...been injured or killed by predators (examples: coyotes, foxes, mountain lions, bobcats).	❒ Yes ❒ No ❒ I don't know	❒ Yes ❒ No ❒ I don't know
...gotten a disease from wildlife.	❒ Yes ❒ No ❒ I don't know	❒ Yes ❒ No ❒ I don't know
...been injured or killed by other pets (examples: other cats, dogs).	❒ Yes ❒ No ❒ I don't know	❒ Yes ❒ No ❒ I don't know
...been hit by a car.	❒ Yes ❒ No ❒ I don't know	❒ Yes ❒ No ❒ I don't know
...been lost or stolen.	❒ Yes ❒ No ❒ I don't know	❒ Yes ❒ No ❒ I don't know

If you answered "yes" for any category above, please briefly explain the problem(s), including the animal or disease involved (if known) and how often it occurred (once during the year, several times, etc.).

_____

Have you ever owned a cat at your current residence? (*Check one.*)

❒ Yes

❒ No ****If you checked no, please skip to Section 6.****

How many cats do you **currently** own? (***if none, enter "0".***) _____ Cats

****If you entered "0" (indicating you do NOT CURRENTLY OWN CATS), please skip to Section 6.***

For each cat that you *currently* own, please provide the information requested in the tables below. If you own more than 4 cats, please fill out the information below for the first 4 cats, then provide this information for the remainder of your cats on a separate sheet of paper and include this information when you return your survey in the postage-paid envelope.

Cat	Sex of cat	Age of cat	Spayed or Neutered?	Has your cat been vaccinated for rabies and/or other diseases?	Do you take your cat to the veterinarian for regular check-ups?
1	❒ Male ❒ Female	_____ Years	❒ Yes ❒ No	❒ Yes ❒ No	❒ Yes ❒ No
2	❒ Male ❒ Female	_____ Years	❒ Yes ❒ No	❒ Yes ❒ No	❒ Yes ❒ No
3	❒ Male ❒ Female	_____ Years	❒ Yes ❒ No	❒ Yes ❒ No	❒ Yes ❒ No
4	❒ Male ❒ Female	_____ Years	❒ Yes ❒ No	❒ Yes ❒ No	❒ Yes ❒ No

In a typical week, how often does each of your cats go outdoors? *(Circle one number for each cat.)*

Cat	**Never**	**Rarely** (*less than once per week*)	**Occasionally** (*once or twice per week*)	**Often** (*3-5 times per week*)	**Very Often** (*more than 5 times per week*)
1	1	2	3	4	5
2	1	2	3	4	5
3	1	2	3	4	5
4	1	2	3	4	5

Approximately how many hours per day does each cat spend outdoors? (*For each cat, write response for each time period;* ***IF NONE, ENTER "0".***)

Cat	**Dawn (3 hours)** (*4 AM-7 AM*)	**Day (10 hours)** (*7 AM-5 PM*)	**Dusk (3 hours)** (*5PM-8 PM*)	**Night (8 hours)** (*8 PM-4 AM*)
1	_____ Hours	_____ Hours	_____ Hours	_____ Hours
2	_____ Hours	_____ Hours	_____ Hours	_____ Hours
3	_____ Hours	_____ Hours	_____ Hours	_____ Hours
4	_____ Hours	_____ Hours	_____ Hours	_____ Hours

How often are the following prey items (whether alive or dead) brought by your cat(s) to your house? (*Circle one response for each prey type listed below. If you own more than one cat that spends time outdoors, estimate an average for one cat.*)

	Never	**Rarely** (Once every 2-3 months)	**Occasionally** (Once per month)	**Often** (Once per week)	**Very Often** (More than once per week)	**Not Applicable** (Cat does not spend time outdoors)
Small mammals (examples: mice, squirrels, rabbits)	1	2	3	4	5	NA
Prairie dogs	1	2	3	4	5	NA
Birds	1	2	3	4	5	NA
OTHER (*describe*):_____	1	2	3	4	5	NA

We are now interested in knowing whether any restrictions apply to your cat(s) being allowed to spend time outdoors**.** Restrictions could include, for example, keeping your cat indoors or allowing your cat to spend time outdoors only under certain circumstances such as during the day, under your supervision, on a leash, etc. (*Check all restrictions that apply.*)

I only allow my cat(s) outside…

- ❒ …with an ID collar
- ❒ ...with a bell on the collar
- ❒ …under someone's supervision
- ❒ …during the daylight hours
- ❒ …in a fenced-in yard
- ❒ …in an outdoor enclosure (example: a cat run)
- ❒ …on a leash or harness
- ❒ OTHER (*describe)*: _____

❒ None of the above: my cat(s) can roam freely without restrictions

❒ Not applicable: I do not allow my cat(s) outdoors under any circumstances

We're also interested in knowing what factors might affect your decision to restrict or not restrict the outdoor activity of your cat(s). On the lines below, please briefly explain why you *currently* do or do not allow your cat(s) to spend time outdoors and, if applicable, why certain restrictions (examples: cat must be on a leash, under your supervision, etc.) apply to your cat(s) spending time outdoors:

_____

_____

_____

Please indicate how important each the following factors or "hypothetical scenarios" would be in influencing your decision to restrict or further restrict the outdoor activity of your cat(s) ***in the future***. (*Circle one number for each factor.*)

FACTORS	Extremely Unimportant	Moderately Unimportant	Slightly Unimportant	Neither	Slightly Important	Moderately Important	Extremely Important
A. Your cat getting a disease from wildlife.	1	2	3	4	5	6	7
B. Another cat in your neighborhood getting a disease from wildlife.	1	2	3	4	5	6	7
C. Your cat being injured or killed by predators (examples: coyotes, foxes, mountain lions, bobcats).	1	2	3	4	5	6	7
D. Another cat in your neighborhood being injured or killed by predators.	1	2	3	4	5	6	7
E. Predators being seen or known to live in your neighborhood.	1	2	3	4	5	6	7
F. Your cat being injured or killed by other pets (examples: other cats, dogs).	1	2	3	4	5	6	7
G. Another cat in your neighborhood being injured or killed by other pets.	1	2	3	4	5	6	7
H. Your cat getting hit by a car.	1	2	3	4	5	6	7
I. Another cat in your neighborhood getting hit by a car.	1	2	3	4	5	6	7
J. Your cat getting lost or stolen.	1	2	3	4	5	6	7
K. Another cat in your neighborhood getting lost or stolen.	1	2	3	4	5	6	7
L. Your cat killing or injuring wildlife (examples: small mammals, birds).	1	2	3	4	5	6	7

FACTORS	Extremely Unimportant	Moderately Unimportant	Slightly Unimportant	Neither	Slightly Important	Moderately Important	Extremely Important
M. Your cat killing or injuring small farm animals (example: chickens).	1	2	3	4	5	6	7
N. Your cat damaging your neighbors' property (examples: going to the bathroom in yards, digging up gardens).	1	2	3	4	5	6	7

Considering factors A through N listed above, write (inside the box to the right) the letter of the ONE MOST IMPORTANT FACTOR that would influence your decision to restrict or further restrict the outdoor activity of your cat(s) in the future.

Please tell us about any other factors (not listed above) that would influence your decision to restrict or further restrict the outdoor activity of your cat(s) in the future.

_____

SECTION 6.

The following **background information** will be used to help make general conclusions about residents in your area. **Your responses will remain completely confidential.**

How would you describe the community where you grew up? (*Check one.*) If more than one area, check the place where you lived the longest.

- ❒ Large city with 250,000 or more people
- ❒ City with 100,000 to 249,999 people
- ❒ City with 50,000 to 99,999 people
- ❒ Small city with 25,000 to 49,999 people
- ❒ Town with 10,000 to 24,999 people
- ❒ Town with 5,000 to 9,999 people
- ❒ Small town / village with less than 5,000 people
- ❒ A farm or rural area

About how long have you lived in… (*Write response or check box for less than one year.*)

Colorado?	_____ Years,	OR	❒ Less than one year.
Your current home?	_____ Years,	OR	❒ Less than one year.

Are you…? (*Check one.*) ❒ Male ❒ Female

What is your age? (*Write response.*) _____ Years

What is your approximate annual household income before taxes? (C*heck one.*)

- ❒ Less than $10,000
- ❒ $10,000 - $24,999
- ❒ $25,000 - $34,999
- ❒ $35,000 - $49,999
- ❒ $50,000 - $74,999
- ❒ $75,000 - $99,999
- ❒ $100,000 - $149,999
- ❒ $150,000 - $199,999
- ❒ $200,000 or more

What is the highest level of education that you have achieved? (*Check one.*)

- ❒ Less than high school diploma
- ❒ High school diploma or equivalent (GED)
- ❒ 2-year associate degree or trade school
- ❒ 4-year college degree
- ❒ Advanced degree beyond 4-year college degree

Please provide any <u>other comments</u> you may have about outdoor pet cat issues in the space provided below.

_____

Thank you for participating in this study!

Please return your completed survey in the enclosed postage-paid envelope or mail to:

Human Dimensions of Natural Resources Department
Attention: Tara Teel
Colorado State University
Fort Collins, CO 80523-1480

APPENDIX II: Sampling Methodology

We categorized the Front Range study area into two levels of urbanization: urban/suburban and exurban. Urban/suburban residences were defined as all residences within the city limits of Boulder that were also within 175 m of the WUI on the western edge of the city of Boulder. We defined the WUI as the boundary between designated City of Boulder Open Space and Mountain Parks and the western edge of Boulder city limits including either residential or commercial parcels. The 175-meter inclusion distance was intended to sufficiently sample residences along the WUI while encompassing the typical home range radius of an indoor-outdoor cat (ca. 100 meters as calculated by 100% minimum convex polygons, averaging across sex, region, and time of day: Barratt 1997; Kays & DeWan 2004; Schmidt et al. 2007; Morgan et al. 2009; Van Heezik et al. 2010). We assumed that residences within this buffer were particularly likely to have had experience with cats and wildlife along the WUI and thus were suitable subjects to examine attitudes about free-ranging pet cats and their interactions with wildlife in these natural areas. Exurban residences included all other parcels within Boulder County west of the city of Boulder that were outside the boundaries of cities with greater than 700 people and that were less than 40 acres in size (following Theobald 2005). Homes west of Boulder and outside of city limits were typically immersed in natural habitat, thus including the potential for residents or cat owners to have experience with cat-wildlife interactions.

We similarly categorized the Western Slope study area into exurban and rural categories. Exurban residences included all parcels in Montrose, Ouray, and San Miguel Counties that were less than 40 acres in size and outside the limits of cities greater than 700 people. Rural residences included parcels that were greater than 40 acres in size (following Theobald 2005). Exurban and rural homes on the Western Slope were typically surrounded by natural habitat, but unlike the Front Range.

APPENDIX II: LITERATURE CITED

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Morgan, S. A., C. M. Hansen, J. G. Ross, G. J. Hickling, S. C. Ogilvie, and A. M. Paterson. 2009. Urban cat (*Felis catus*) movement and predation activity associated with a wetland reserve in New Zealand. Wildlife Research **36**:574-580.

Schmidt, P. M., R. R. Lopez, and B. A. Collier. 2007. Survival, fecundity, and movements of free-ranging cats. Journal of Wildlife Management **71**:915-919.

Theobald, D. M. 2005. Landscape Patterns of Exurban Growth in the USA from 1980-2020. Ecology and Society **10**:32 [online] URL: http://www.ecologyandsociety.org/vol10/iss1/art32.

van Heezik, Y., A. Smith, A. Adams, and J. Gordon. 2010. Do domestic cats impose an unsustainable harvest on urban bird populations? Biological Conservation **143**:121-130.