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FERAL CAT MANAGEMENT:
PERCEPTIONS AND PREFERENCES (A CASE STUDY)

A Thesis

Presented to

The Faculty of the Department of Environmental Studies

San José State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Rachel L. M. Wilken

May 2012

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FERAL CAT MANAGEMENT:
PERCEPTIONS AND PREFERENCES (A CASE STUDY)

by

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APPROVED FOR THE DEPARTMENT OF ENVIRONMENTAL STUDIES

SAN JOSÉ STATE UNIVERSITY

May 2012

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ABSTRACT

FERAL CAT MANAGEMENT:
PERCEPTIONS AND PREFERENCES (A CASE STUDY)

by Rachel L. M. Wilken

Feral cat management is a highly debated topic. Trap, Neuter, and Return (TNR) programs have become increasingly popular as an alternative to eradication. Public preference about how to manage feral cats has been explored by previous authors, but no consensus has been reached. Public policy and best management practices depend in part upon public opinion on this topic. Wording of a feral cat management preference in surveys can play a role in respondent opinion. For this thesis, the researcher examined public opinion about feral cat control by surveying 298 Stanford University faculty and staff members using two different communication approaches. Half the surveys included scientific language, “feral” and “euthanasia,” and half included colloquial terminology, “free-roaming” and “removal.” Results suggested education and pet ownership affect preference for TNR. The humane treatment of feral cats was of great importance, and respondents were split as to whether feral cats are part of the natural spectrum of wildlife. Public education about feral cat issues and management were of little importance to the respondents. TNR was the preferred method of control in private neighborhoods and overall. Some difference was found between men and women when it came to feeding neighborhood feral cats or perceptions of feral cat nuisance. The age of

respondents did not significantly affect respondent preference for TNR. Results indicated the word “removal” rather than “euthanasia” weakened support for TNR. Recommendations include the use of precise language to avoid confusion in written materials. Also recommended is targeted education about feral cat environmental impacts and management implications.

TABLE OF CONTENTS

Page

List of Tables viii

List of Figures ix

Chapter

INTRODUCTION 1

LITERATURE REVIEW 5

Vertebrate Control Theory 5

Public Perception of Vertebrates and Vertebrate Control 9

Vertebrate Pests and Control 10

Feral Cats 13

Feral Cat Disease 17

Feral Cat Control Options 19

Trap, Neuter and Return (TNR) 21

Previous Public Preference for TNR Surveys 24

The Use of Scientific Terminology Versus Colloquialisms 29

Problem Statement 30

Research Objectives 33

Hypotheses 33

METHODS 35

Study Site 35

Study Design 36

Data Collection 36
DATA ANALYSIS 41
Analytical Methods 41
Results 42
DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS 68
Humane Management 68
Wildlife 68
Area 69
Gender 70
Age 70
Education 71
Pet Ownership 71
Terminology 72
Conclusions 73
Applications/Recommendations 74
References 76
Appendix A. The Stanford Cat Network Agreement 84
Appendix B. Survey 89

List of Tables

Page

1. Study Design 36

2. ANOVA Results for H_6 52

3. ANOVA Results for H_8 54

4. Age as a Factor in “Free-roaming”/“Feral” Cat Control 55

5. Pet Ownership in Respondent Preference for “Free-roaming”/“Feral” Cat Control 57

6. ANOVA Results for H_{12} 64

7. ANOVA Results Location Answers for H_{12} 67

List of Figures

Page

1. Male to female ratio 38

2. Respondent age ranges 39

3. Respondent pet ownership 40

4. Mean response for humane treatment of “free-roaming”/“feral” cats 42

5. Free-roaming/feral cats as a part of the natural spectrum of wildlife 43

6. The importance of public education 44

7. TNR preference in urban neighborhoods vs. open space 45

8. TNR preference in suburban neighborhoods vs. open space 46

9. TNR preference in urban neighborhoods vs. wilderness preserves 47

10. TNR preference for suburban neighborhoods vs. wilderness preserves 48

11. TNR preference for urban neighborhoods vs. National forests 49

12. TNR preference in suburban neighborhoods vs. National forests 50

13. TNR preference for campus and city and office parks 51

14. Likelihood of females vs. males to feed free-roaming/feral cats 53

15. Responses by age to Free-roaming cats should be controlled via TNR 56

16. TNR programs will increase the number of “free-roaming”/“feral cats,” by pet ownership 58

17. TNR can reduce the overall “free-roaming”/“feral cat” population by pet ownership 59

18. TNR is a humane option for “free-roaming”/“feral cats” by pet ownership 60

19. Removal is the only humane option for “free-roaming”/“feral cats" by pet ownership 61

20. Analysis of pet ownership on TNR perception 62

21. Free-roaming/Feral cats should be controlled via TNR by pet ownership 63

22. Only “Removal”/“Euthanasia” is adequate control 65

23. Removal/Euthanasia is the only humane option for “free-roaming”/“feral” cats 66

Introduction

Domesticated cats (*Felis catus*) are very popular human companions. Domesticated cat abandonment, however, is an unfortunate correlate to pet cat popularity (Hatley 2003). Cats are very highly adaptable and easily conform to a wide range of living conditions (Stoskopf & Nutter 2004). Abandonment creates a population of domesticated cats that are not socialized as pets and live in a wild, predominantly unadoptable state (Hughes & Slater 2002). These cats are considered "feral," “semi-feral,” or “pseudo-wild” cats (Bradshaw et al. 1999). For the purposes of this study, unowned, unsocialized, domestic cats will be referred to as “feral.” Feral cats can be seen as a problem for both other wildlife and sanitation if left unmanaged (Jessup 2004). Some researchers believe feral cats decimate wildlife populations; however, most studies do not differentiate between the effects of excessive urbanization, owned-outdoor cats, and feral cats. Feral cats do prey on small animals, no data reliably quantifies to what degree this occurs (Kays & DeWan 2004; Stoskopf & Nutter 2004; Winter 2004).

The traditional method of controlling feral cats has been to catch and euthanize them (Ash & Adams 2003). A second strategy is known as Trap-Neuter-Return (TNR). As the name suggests, administrators of TNR programs trap, sterilize, and return cats to their former territories (Levy & Crawford 2004). This management method is considered by some researchers to be the more humane alternative (Hughes & Slater 2002).

The topic of feral cat control is highly debated and emotionally charged (Slater 2001). Jessup (2004) refers to TNR as “trap, neuter, and re-abandon.” He states that euthanasia is the humane method of control, and abandoning cats is illegal and immoral. Another claims well managed feral cat colonies that follow legal codes can be a successful and humane means of managing feral cats (Hughes et al. 2002).

Some TNR programs require testing for existing diseases, euthanizing diseased cats, treating for parasites, vaccinating against potential diseases, and monitoring and regularly feeding feral cat colonies (Hughes & Slater 2002; Ash & Adams 2004). Properly managed TNR can successfully reduce feral populations over time where new cats are not introduced into colonies (Stoskopf & Nutter 2004). TNR may also serve to stem a flood of secondary pest resurgence when feral cats are removed from their territory (Tompkins & Veltman 2006). Surges in secondary predator populations can also occur when targeting the removal of one primary predator from an environment (Crooks & Soulé 1999).

Baker et al. (2005) note that cats do not differentiate between pest prey and valued wildlife. Domesticated, owned cats continue to prey, even when well fed by their owners (Baker et al. 2005). Diseases carried by outdoor cats can have a negative impact on wildlife health (Jessup 2004; Conrad et al. 2005). In the United States, diseases vectored by cats to humans are heavily debated and such transmission of diseases is generally found to be rare (Shaw et al. 2001; Levy & Crawford 2004). Fleas and ticks often associated with outdoor cats can

range from a nuisance to a rare disease issue (Chomel et al. 1996; Stoskopf & Nutter 2004).

TNR programs reduce feral cat populations where they are tightly managed and in appropriate areas (Castillo & Clarke 2003; Levy et al. 2003; Levy & Crawford 2004; Stoskopf & Nutter 2004; Foley et al. 2005). Organizations in Italy are working towards standardizing TNR best management practices (Natoli et al. 2006). Currently, however, few systematic methods are in place in the United States for monitoring people responsible for feral cats (Levy & Crawford 2004).

The end goal of this study is to increase information on feral cat management. Providing an evenly balanced educational supplement and a discussion of terminology differences will help to determine how bias in feral cat management surveys can affect variations in respondent choices in a balanced study of TNR program perceptions. In addition, the results of this research will help to provide additional information for researchers, wildlife managers, and policymakers as to how the public perceives TNR as an alternative management program.

The controversy about TNR focuses on the true impacts, such as environmental and human health issues, of TNR programs on wildlife, the environment, disease issues, and animal welfare. Data to support scientific conclusions are weak or lacking (Levy & Crawford 2004). Human values and interests are also part of the feral cat controversy. Peoples' perceptions of cats

can differ as to the status of cats as pets or pests (Slater 2004). Conflicting perspectives can become highly emotionally charged where subjective personal ethics are involved and debate becomes closed to reason (Lauber et al. 2007).

Some researchers note a decrease in approval for lethal control of feral cats and an increase in favor of TNR management (Lord 2008; Slater et al. 2008). Others find weak support for TNR as a management program (Ash & Adams 2003; Loyd & Miller 2010). Other researchers find little support for lethal control but more support for TNR or impoundment (Dabritz et al. 2006). The decrease in the favoring of lethal control was also noted in sampled opinion towards wildlife (Zinn & Andelt 1999; Bremner & Park 2007). According to Lauber et al. (2007), there is a blur between whether feral cats are domesticated invasive pests or wildlife. In the US, domestic cats are the most popular household pets, yet feral cats are viewed as non-pets and someone else's concern. This contradiction creates confusion around feral cats and their place in humans' lives (Slater 2004).

Personal opinion often becomes volatile in discussions of the feral cat control issues (Stoskopf & Nutter 2004). Barrows (2004) claims scientific data contradict TNR success and researchers make personal attacks about the ignorance and education background of many TNR advocates (Barrows 2004). Researchers (Stoskopf & Nutter 2004) attribute the attacks to a lack of reliable data from both pro-TNR and anti-TNR people and the need for more studies in order to bring clarity to the debate.

Literature Review

Vertebrate Control Theory

Eradication. Non-native predators are considered one of the biggest threats to wildlife diversity. Some researchers believe that eradication of such threats is the only means of controlling them (Winter 2006; Bremner & Park 2007).

Eradication is an inherently unstable means of control (Bomford & O'Brien 1995). According to Bomford and O'Brien (1995), stringent qualifications of parameters and factors listed below make eradication possible, and without these factors the effort is destined to fail. In summary, the success of eradication is based on six criteria:

1) Trapping and removal numbers must be higher than the influx rate of stray and abandoned pests.
2) Movement of target animals from outside the initial area of intended eradication must not occur.
3) Any unfixed animal needs to be trappable.
4) As population densities decrease, any remaining predators must be visible lest they escape accountability.
5) The costs and benefit for each method of population control need to be determined.

6) There must be social and political support for eradication, relocation, or euthanasia over alternative means of invasive pest population control (Bomford & O'Brien 1995).

Rainbolt and Coblentz (1997) refute the opinion of Bomford and O'Brien (1995), noting a number of eradication programs are successful. They go on to cite a list of islands where exotic species have been eradicated. Island ecosystems are the closest possible environs to a closed system (Rainbolt & Coblentz 1997). Some strategies in a closed system may be unfeasible on larger islands or on a continental level (Nogales et al. 2004).

Tompkins and Veltman (2005) found prey populations, such as rats, can increase following the reduction of targeted pests, such as feral cats. The authors conclude that indirect pest resurgence may undermine the target pest control efficacy; hence, attempted control may become more problematic than the reduction of the target pest species (Tompkins & Veltman 2005).

Exclusion. Exclusion may be a feasible option in wildlife areas where invasive predators such as fox (*Vulpus* spp.) repopulation is made difficult via fencing (Robley et al. 2007). Foxes in nature have few predators of their own. Fox-proof fences may be used to surround the perimeters of wildlife areas where undesired predators have been excluded, or else they will repopulate (Robley et al. 2007). Outside of small island situations, wildlife managers rarely consider exclusion, though it remains a viable option (Robley et al. 2007). In an article by Moseby and Read (2005), fox and rabbit (*Oryctolagus* spp.) exclusion fencing is

described as a means by which a safety habitat for prey species is created. Though the authors recognize undesired predators may eventually find ways around fences, the point of entry can be an ideal bottleneck where invaders can be targeted for trapping (Moseby & Read 2005).

Exclusion fencing can be a means by which to create safe environs for sensitive species for the maintenance of biodiversity (Srinivasu & Gayatri 2005). Study findings reveal that a reserve for prey species can increase populations within the safety of excluded areas. Srinivasu and Gayatri (2005) also conclude that low levels of predator populations may coexist provided ample reserve prey populations. The same research also projects low populations of excluded predators may eventually die out (Srinivasu & Gayatri 2005).

Creating safe environs for the sake of preserving biodiversity can be problematic as well, according to Hayward and Kerley (2009). Overuse of resources within the excluded area can lead to population crashes. Creating exclusion areas can also serve to further fragment populations by disrupting wildlife corridors. Genetic diversity may be compromised where flow into the gene pool is disallowed (Hayward & Kerley 2009). Lastly, theoretically, a protected population may fail to evolve traits for survival outside the safety of the fenced environs (Hayward & Kerley 2009).

Sterilization. Chemical fertility control is being examined in mammalian and avian species (Dell'Omo & Palmery 2002). Authors Dell'Omo and Palmery (2002) note that increases in public preference for non-lethal measures warrant a

closer look into fertility control. According to Dell'Omo and Palmery (2002), effective use of chemical fertility control requires attention to species reproductive and social behavior. At high density, fertility control may not be as effective as lethal population reduction (Dell'Omo & Palmery 2002). In an overview by Barlow (2000), virus-vectored or bait contraception delivery is noted as being largely new to sterilization technology. Barlow (2000) concludes the majority of research is theoretical.

One study in particular was performed on coyotes for the purpose of population reduction. In this study by Conner et al. (2008), coyotes were either removed and euthanized or surgically sterilized. The results of this study found that short-term efficacy belonged to large-scale eradication. The sterilization methods used were surgical vasectomy and tubal ligation. Sterilization was found to be the most effective control strategy when the results of population control are examined over the longer-term of five years.

Relocation/Translocation. Relocating animals to solve human-animal problems is often an unsuccessful strategy. According to Fischer and Lindenmayer (2000), carnivore relocation is not a successful control method for a number of translocated animals possessing homing instincts (Linnell et al. 1997; Fischer & Lindenmayer 2000). Linnell et al. (1997) note that displaced large wild cats such as leopards (*Panthera pardus*) and jaguars (*Panthera onca*) reveal the animals begin preying in the relocated area. In their review of carnivore relocation, they further provide evidence that wild cats (Family: Felidae) die,

disperse, return toward their capture site, and resuming undesired predatory behavior in other areas. Relocation success for conservation purposes is poorly documented and defined (Fischer & Lindenmayer 2000).

Public Perception of Vertebrates and Vertebrate Control

Nature groups use aesthetically appealing animal images to garner support for conservation efforts (Knight 2008). Research findings by Knight (2008) predict human perception of aesthetics and fear drive public opinion for support or lack thereof. Animals ranking high on the "cuteness" (Knight 2008) scale are much more likely to be positively supported. Animals creating a "negativistic attitude" of potential danger are likely to be negatively perceived (Knight 2008). Findings reveal attractive, safe animals are more likely to hold public support for protection based on appealing aesthetics. Less attractive animals and unsafe animals are perceived as unappealing. Based on findings (Knight 2008), support for endangered vertebrate species protection is largely based on irrational and emotional perceptions.

The general public's perception of eradication can be one of dismay, and killing animals, specifically mammals, is often considered a last resort (Bremner & Park 2007). In one study, animals considered pest species, such as rats, met with higher approval for eradication than did birds (Bremner & Park 2007), though half the respondents disagree with the use of poisons used to kill rats. Findings of a questionnaire surveying control methods reveal 87% of respondents agreed that controlling both native and non-native flora and fauna is

important for environmental preservation (Bremner & Park 2007). Findings reveal a number of predicting factors associated with preference options. Gender is a strong predictor revealing men are more likely to select eradication. Women are more likely to choose contraception as a means of control.

A survey in Michigan (Koval & Mertig 2004) reveals the surveyed respondents found lethal measures are warranted to control wildlife disease, damage, public safety, and environmental preservation. The majority (89%) of respondents agreed it is sometimes necessary to kill an animal (Koval & Mertig 2004). Control of wildlife disease meets with the highest approval by respondents for lethal measures. According to Koval and Mertig (2004), support for wildlife disease control is followed closely by 76% of respondents supporting lethal control for species survival and public safety. Most respondents (72%) support ecological health for pro-lethal control, and the least amount of respondents (56%) supported it for means of food gathering (Koval & Mertig 2004).

Vertebrate Pests and Control

Native prairie dogs (*Cynonys* spp.) in Fort Collins, Colorado are a controversial pest management topic. Based on a public survey of local residents by Zinn and Andelt (1999), nuisance perceptions are high while preference for any control is low. Individuals living near the prairie dog colonies are likely to report negative reactions to the prairie dogs. Respondents living further from colonies are less likely to respond negatively to the prairie dogs.

The population sampled does not perceive poison as an acceptable control method (Zinn & Andelt 1999).

Predators and control. Bruskotter et al. (2007) findings reveal a positive attitude toward wolves in Utah. Wolf populations in Utah are noted as being very low, according to researchers' findings (Bruskotter et al. 2007). Among the respondents in the survey, urban dwellers hold higher societal perceptions than do hunters and those in rural settings. The positive perceptions, however, may in fact be a result of fewer interactions with wolves (Bruskotter et al. 2007). Similar findings by researchers Karlsson and Sjöström (2007) reveal respondent populations with further distance from wolf populations have higher positive attitudes toward wolves. Respondents living closer to wolf populations show a more negative perception in their attitudes toward the carnivores (Karlsson & Sjöström 2007). Direct or indirect interaction (via peer conversations or negative media) with wolves may lower the positive perception of survey participants. Researchers (Bruskotter 2007; Karlsson & Sjöström 2007) predict increased direct interaction with wolves as the wolves establish in close proximity to the communities will result in a lowered, more negative response level.

Wolves and coyotes are among the least liked mammalian predators, according to researcher Kellert (1974). Wild predators in general are found unfavorable while domesticated predators hold the highest scores for public acceptance (Kellert 1974). Species attractiveness also is a high indicator for public appreciation. Wolves and coyotes are not considered attractive but are

more associated with human and property damage (Kellert 1974). Research findings across the United States and Alaska reveal Alaskans have the highest regard for wolves in spite of high populations and closeness. Such research is contrary to the research by Karlsson and Sjöström (2007) and Bruskotter (2007) whose findings reveal those living in closest proximity to wolves hold them in the lowest regard. Public survey findings by Kellert (1975) are divided into interest groups based on the primary driving forces behind their interests in animals. The highest ratings for appreciation of wolves and coyotes are from those who have a positive attitude toward wildlife, in general. The lowest ratings belong to those who have a disinterest in wolves and coyotes and those who fear animals (Kellert 1975). Findings indicate the general public is in favor of trapping or shooting only those coyotes known to cause damage to livestock production. Kellert concludes that while the public appreciation of wolves and coyotes is low on a specific species basis, there is a strong positive movement toward wildlife appreciation (Kellert 1975).

Public preference for lethal coyote control (trapping, shooting, and poisoning) is the focus of a study by Martínez-Espiñeira (2006). According to the author, coyotes in Eastern Canada have low predator competition. Hence, coyotes have become a controversial topic as they move from rural to urban and suburban areas (Martínez-Espiñeira 2006). Research findings (Martínez-Espiñeira 2006) indicate respondent preferences can be grouped into demographic components. Those in agreement with lethal coyote control include

older residents, while agreement increases with each year in age, though the initial age of agreement is unstated. Cat (*Felis catus*) ownership increases respondent approval for lethal control, while dog (*Canis lupis*) ownership decreases approval. Residents having experienced coyote damage are more likely to agree with lethal control methods (Martínez-Espiñeira 2006). Recent coyote sightings decrease respondent approval for killing coyotes. The differentiation between trapping, shooting, and poisoning in the study by Martínez-Espiñeira (2006) reveals poisoning is the most controversial method of control by the members of the general public sampled.

Feral Cats

Populations. Dabritz et al. (2006) report 7-25% of people admit feeding feral or stray cats. Levy et al. (2003) reports the estimated feral population is 44% of the population of approximately 44,500 cats in a southern United States college community county. Feral cats can be the result of offspring from existing ferals, lost fertile or abandoned cats adapted to feral living without human socialization (Robertson 2008). Unaltered cats may also be released for pest control, states Robertson (2008). The population of feral cats is hard to estimate. Robertson (2008) notes the US pet overpopulation has led to a number of animals being regarded as expendable, and animal desertion has only added to the feral cat population. The number of homeless cats in the US is estimated to be as high as 90 million, according to the American Bird Conservancy (ABC) (Winter 2006), or to be simply unknown based on the owned cat calculations

made by Levy and Crawford in their 2004 report. Population numbers vary with habitat and data source (Jessup 2004; Levy & Crawford 2004; Dabritz et al. 2006; Winter 2006), as do definitions of stray, feral, semi-feral, free-roaming, and owned outdoor cats (Bradshaw et al. 1999; Levy 2004). According to Bradshaw et al. (1999), the use of differing terms and characteristics by which various cats are categorized further confuses data for specific populations of cats.

Predation. Researchers' (Bonnaud et al. 2007) findings of their research in feral cat scat dissections over a four-year period reveal the remains of small mammals, birds, reptiles, insects, plant material, and human refuse. The island study was located on Port-Cros Island, a small Mediterranean national park. The majority of species are mammalian. Bonnaud et al. (2007) note the second most popular prey for feral cats is birds. On Nativiidad Island, Mexico, feral cat eradication significantly increases the survival of burrow nesting birds (Keitt & Tershy 2003). Research by Keitt et al. (2002) and Keitt and Tershy (2003) find burrow nesting bird mortality lowers by 90% following feral cat eradication.

Kirkpatrick and Rauzon (1986) examined feral cat stomach content on two small coral atolls in the Central Pacific Ocean. Both islands are seabird sanctuaries and uninhabited by humans (Kirkpatrick & Rauzon 1986). Again, burrow nesting birds are noted to be the majority of the population of prey on the atolls (Kirkpatrick & Rauzon 1986).

Feral cat scat samples (Pontier et al. 2002) reveal rabbits are the primary prey species in five sites on the Kerguelen archipelago on Grande Terre. The

research focus (Pontier et al. 2002) was on mammal scat contents and bird remains. In conclusion, Pontier et al. (2002) note in places where a specific prey species population is present or large, the specific predation findings are present and large as well.

Continental studies of surveyed owners of free-roaming pets offer a rigorous analysis of cat-related wildlife kills (Woods et al. 2003; Kays & DeWan 2004; Baker et al. 2005). Reported wildlife kills are not due solely to ferals but also to owned free-ranging cats that roam unmanaged (Baker et al. 2005). Cat kill numbers collected from pet owners are used to quantify feral cat kills through extrapolation (Baker et al. 2005). According to Winter (2004), the exact number of birds killed by owned and non-owned cats is unknown.

Some researchers claim free-roaming cats are wildlife marauders (Woods et al. 2003; Jessup 2004; Winter 2004). According to other researchers, older, well-fed cats return home with fewer birds, reptiles, and amphibians (Baker et al. 2005). In a study of urban predation by domestic cats (Baker et al. 2005), lower prey kills than anticipated by the researchers are revealed. In the same report, cats are referred to as hyper-predators, and survey respondents report only 21 prey kills per cat per year. This is significantly lower than the five and a half kills per 28 days reported by Woods et al. (2003). Kays and DeWan (2004) report even lower cat kills at 0.35 to 1.8 prey occurrences per summer month.

Mesopredator impacts and control. In a review of feral cat impacts (Medina & Nogales 2009) in the Canary Islands, researchers recognize the high

potential for sensitive species predation. The researchers also recognize the role feral cats play in pest prey suppression and warn of secondary predator outbreaks when the target species is eradicated or reduced significantly.

Feral cats have few natural predators in fragmented urban, suburban, and edge settings (Crooks & Soulé 1999). As coyote populations decline, there is a lack of a predator species for feral cats. According to Crooks and Soulé (1999), the coyote represents the apex predator that preys on mesopredators (secondary, mid-sized predators). Without the apex predator, mesopredators flourish and prey species suffer. Crooks and Soulé's (1999) findings reveal scrub bird diversity is higher in areas where coyotes are present. Scrub bird density, however, remains subject to mesopredator predation. While Crooks and Soulé (1999) did find that coyotes prey on cats in some areas, cats avoid areas where coyotes are active. Coyote-cat interactions do indicate that coyotes prey on cats, but the authors Crooks & Soulé (1999) suggest that indirect impacts of coyote presence have the most significant effect. They note that in the presence of coyotes, 46% of cat owners curtail outdoor pet activities. The authors conclude that both the lack of an apex predator such as coyotes and the presence of fragmented systems created by human development may drive scrub bird populations to extinction (Crooks & Soulé 1999).

Predation versus urbanization. In their report on domestic cats preying on birds, Van Heezik et al. (2010) conclude that human activities such as habitat encroachment and urbanization along with suburban sprawl are causes of the

majority of wildlife loss. Urbanization has been referred to as the greatest conservation risk with indoor/outdoor cats showing no significant impact on wildlife populations (Kays & DeWan 2004). Low predation rates and the negative impacts of urbanization on wildlife are also discussed in the article by Baker et al. (2005) illustrating that owned pet increases due to urbanization are responsible for the decreases in wildlife.

Feral Cat Disease

Toxoplasmosis gondii. *Toxoplasmosis gondii* (*T. gondii*) is a parasite that can infect animals and humans via bodily fluid transmission (Afonso et al. 2006). In humans, transmission can cause abortions, clinical neonatal problems, and grave illnesses in individuals with compromised immune systems (Dubey & Beattie 1988). Less severe infections can cause no symptoms at all or flu-like symptoms (Tenter et al. 2000; Conrad et al. 2005). All cats are the primary hosts for this parasite and are the only animals that excrete environmentally persistent stages of *T. gondii* (Dubey 1996). Cats may infect other animals, which in turn can result in infected meat for human consumption (Afonso et al. 2006). Human infection from environmental persistence of *T. gondii* may occur through contact with soil, water, fruits, and vegetables. In their study of domestic cats in urban environs, Afonso et al. (2006) note the prevalence of *T. gondii* is low but may vary according to setting. Dubey (1996) admits data for this parasite and infection among cats are rare and thereby largely inaccessible.

T. Gondii is also indicated to be causing some decline in sea otters (Enhydra lutris) along the California coast (Dabritz et al. 2006). According to Dabritz et al. (2006), parasitic loading from cat feces near fresh water outflows to the sea may to be the cause of a number of sea otter deaths, especially near fresh water outlets. Other wildlife is also affected by *T. gondii* from cat feces (Jessup 2004). According to Conrad et al. (2005), alternate hosts may be contributing to the shedding of *T. gondii* oocysts.

Rabies. Rabies (*Rabies* spp.) is a disease that is of primary importance to public health (Slater 2004). Human rabies infections are fatal once symptoms appear (Haupt 1999). Transmission of rabies (Haupt 1999) is through bites, scratches, entry into existing wounds, and through mucous membranes from infected species. Wildlife and canines are the major carriers in the United States, according to Slater (2004). Though there are reported cases of human rabies infections, the infections were isolated as bat (Order: Chiroptera) and canine (Family: Canidae) variants. According to Slater (2004), cat variant infections have not been found in recent decades among the human population in the United States. Levy (2004) reports that human rabies exposure is predominantly due to infectious interactions with wildlife.

Bartonella henslea. A study of *Bartonella henslea* (*B. henslea*) by Shaw et al. (2001) reveals that this bacterial disease is vectored by the cat flea (*Ctenocephalaides felis*). All cats, including wild cats, are bacterial carriers (Shaw et al. 2001). Rare human infection of *B. henslea* may result in cat scratch

disease spread by cat scratches and bites in patients with compromised immune systems or may be asymptomatic in healthy human populations (Chomel et al. 1996). Serious human infections are much less common and may result in fatalities (Chomel et al. 1996). The frequency of *B. henslea* among cats is highly irregular (between 9% to 90%) but presumed to be on the high end of the spectrum (Shaw et al. 2001). According to Shaw et al. (2001) and Chromel et al. (1996), human infection by the flea is strongly implicated but has yet to be proven. Further research into the subject of human transmission needs to be explored (Chomel et al. 1996).

Other disease. According to Slater (2004), zoonotic disease problems associated solely with free-roaming cats are largely unknown. It is important to note that cat-borne disease is inherent to cats and carried by both feral and owned animals (Robertson 2008). Domestic cat disease spreading to wild felid species is under examination, but data are sparse (Slater 2001). Jessup (2004) discusses wildlife secondary deaths as a result of septic infections from the oral transmission via cat bites. According to Jessup (2004), where high populations of feral cats exist, so do the potentials for wildlife and wildlife disease transmission.

Feral Cat Control Options

Slater (2001) mentions four approaches to feral cat population control. The most historically prevalent method, by default, is the “do nothing” approach. The second method of control is to trap, remove, and euthanize. The third

approach is to trap, remove, and relocate; and the fourth is to trap, neuter, and return (TNR) the cats to their former habitat. Robertson (2008) discusses some of the same along with other approaches to feral cat control.

Do nothing. The problem with leaving cats without control is that the populations do not take care of themselves (Robertson 2008). Unaltered cats continue to reproduce (Lord 2008). Predation and disease issues increase with feral cat population density (Jessup 2004).

Kill on-site. Poisoning and disease introductions can lead to suffering and painful deaths (Robertson 2008). Theoretical models using cat disease to eradicate all cat populations on islands exist and show that control may be possible where natural immunity to the introduced disease is low (Courchamp & Sugihara 1999). On Marion Island, a combination of hunting with guns and dogs, trapping, poisoning, and disease release is used by Nogales et al. (2004). The approach of eradication of all feral cats on this island is not ethically humane or viable on larger scales, according to Robertson (2008).

Trap and euthanize. This is a viable humane approach to some (Barrows 2004; Jessup 2004) as long as the traps are frequently checked (Robertson 2008). The methods of euthanasia must be humane as well. The most humane method of euthanasia involved heavily sedating the cat and administering barbiturate overdoses (Robertson 2008). Other methods of euthanasia (such as non-sedating injections and gassing) are less than humane, according to Robertson (2008).

Trap, remove, and relocate. Trapping, removing, and relocating is another control option. Very young feral kittens can be placed in homes to be socialized, but homes are scarce and hard to find (Robertson 2008). When relocating feral cats, according to Hughes et al. (2002), once they are removed from one neighborhood, they are simply put into another neighborhood. The social structure of the colony destabilizes and becomes unmanageable as they disband. The disbanding places the animals in unsafe territory where they are often injured, killed, or starve (Hughes et al. 2002). Additionally, caregivers feeding the original colony are likely to continue to care for those missed or left behind, and the issue of a growing colony is only a litter or two away (Hughes et al. 2002). Hughes et al. (2002) report eradication via relocation only works if people stop feeding the animals and shelters are removed; otherwise, feral animals from surrounding areas migrate in to fill the void.

Non-surgical sterilization. Non-surgical contraception is being researched but as of yet no successful method for cats has been found (Robertson 2008). Theoretical models of virus-vectored immuno-contraception on island populations are being written, but no working vaccines are currently available (Courchamp & Cornell 2000).

Trap, Neuter and Return (TNR)

Stabilization and reduction of feral cats numbers are the primary objectives of TNR management plans (Robertson 2008). Robertson (2008) states, TNR should contain the elements of humane trapping, surgical alteration

rendering the cat sterile, cutting off the tip of one ear for identification purposes, vaccination for rabies, and returning the animal to its former territory. TNR programs have many different potential components (Stoskopf & Nutter 2004). One such complex version of the TNR method is to trap, test for disease, vaccinate, alter via surgical sterilization, return the cats to their colonies, and monitor (TTVAR-M) (Slater 2001; Hughes & Slater 2002). This and other well-managed programs include euthanasia of diseased cats (Slater 2001; Stoskopf & Nutter 2004). These methods, with all their components, are referred to as TNR for simplicity's sake throughout this review. Many groups concerned with animal rights and the humane treatment of feral cats have developed Trap-Neuter-Return (TNR) programs (Hatley 2003). The programs allegedly have a high acceptance rate among a concerned public (Wallace & Levy 2006).

TNR has the capability of successfully lowering feral cat population toward eradication in an environment where additional cats are not introduced into colony (Hughes & Slater 2002; Levy & Crawford 2004; Stoskopf & Nutter 2004; Natoli et al. 2006). This resulting decrease at a slow, steady, and progressive level keeps secondary pests such as house mice (*Mus musculus*) and rats from surging in populations as a result of the pressure decrease in predation (Tompkins & Veltman 2006). The most successfully controlled feral cat colonies occur in urban areas where appropriate management is in place (Stoskopf & Nutter 2004).

TNR example. A well managed TNR program at Texas A&M (Hughes & Slater 2002) most accurately describes what actions all variations on the program should include to be successful. The acronym for the Texas A&M program is TTVARM and stands for trap-test-vaccinate-alter-return-monitor. Each cat is marked as neutered or spayed ("fixed") by a tip cut off one of the ears (Hughes & Slater 2002). The cats are fed and monitored by volunteers, including the veterinary staff and faculty and campus pest control operators (Hughes & Slater 2002).

TNR programs are deemed successful in a number of areas (Hughes & Slater 2002; Levy & Crawford 2004; Stoskopf & Nutter 2004). At Texas A&M, the college of veterinary medicine implemented a TNR program to counter an out-of-control feral cat population on campus (Hughes & Slater 2002). The veterinary faculty and campus pest control operations claim the highly publicized program to be highly successful (Hughes & Slater 2002). Findings report less cat abandonment by students; fewer noise, odor, and scat complaints; as well as a marked decrease in cats and kittens caught on campus the second year. While Hughes and Slater (2002) claim high satisfaction, a public perception survey by Ash and Adams (2003) on the same feral cat population reveals a lack of awareness and high degree of apathy toward the TNR program in place. Under survey, the faculty and staff at this same university show a mixed response when asked if TNR is the preferred method of control (Ash & Adams 2003).

Previous Public Preference for TNR Surveys

Loyd and Miller (2010). Loyd and Miller (2010) mailed survey packets (including an educational supplement) to homeowners in rural and urban areas of Illinois that addressed a small number of feral cat management perceptions based on questions predominantly regarding wildlife issues. Loyd and Miller (2010) reveal the respondents' preferences are predominantly in favor of capture and confinement to shelters or euthanasia rather than TNR.

Rural respondents are only 16% in favor of TNR while 36% of urban homeowners selected TNR as the preferred method of feral cat control (Loyd & Miller 2010). Females are more likely to choose TNR while males are more likely to choose other methods of cat control, according to responses categorized by gender. The respondents who identify with wildlife values are less supportive of TNR. Those who value wildlife but preferred TNR are described as viewing feral cats as part of the natural wildlife spectrum and view feral cats as pets, according to Loyd and Miller (2010). Age is found to be a predictor for TNR preference with younger residents preferring wildlife over feral cats. Overall results for preference in regard to age are split for the mean data age but specific age ranges are not provided in the findings (Loyd & Miller 2010). In conclusion, Loyd and Miller (2010) believe policy upholding TNR is an appeasement to feral cat advocates and that educating the public on the negative impacts of TNR will aid in furthering the cause against TNR programs.

Lord 2008. Telephone survey findings (Lord 2008) reveal urban respondents, regardless of pet ownership, agreed or strongly agreed (approximately 82%) that TNR is a good way to manage free-roaming cats. Suburban residents with or without pets agreed or strongly agreed at around 81% that TNR was a viable way to manage free-roaming cats, while total rural residents agreed with the use of TNR for free-roaming cat management at 70% (Lord 2008).

In the survey (Lord 2008), while findings reveal a high preference for TNR amongst Ohio residents, there is no differentiation between owned and non-owned free-roaming cats of such programs. Of those respondents who report feeding free-roaming cats, about 23% report seeing new litters in their area, suggesting low fertility intervention for free-roaming cats (Lord 2008).

The variations in all responses defy generalization across urban, suburban, and rural locations (Lord 2008). Thirty-two percent of all respondents report neutral perceptions of free-roaming cats. Almost 30% strongly agree or agree that free-roaming cats are problematic in their neighborhoods while 45% strongly agree or agree that they are an issue across the state of Ohio.

Slater et al. 2008. Survey research by Slater et al. (2008) examines not only the public perceptions of the problems associated with the free-roaming animal populations but public opinion about potential solutions as well. The location of the study is the province of Teramo, Italy (Slater et al. 2008). It should be noted that Italy is a popular study site in use predominantly due to its National

anti-euthanasia laws, excepted for serious and/or incurable illness (Law No. *63* 1974; Law No. *281* 1991; Law No. *34* 1997), and its protection and assistance for feral cats (Natoli et al. 2006). The national policy in Italy, since approximately 1991, is one of TNR for free-roaming domestic dogs and cats (Natoli et al. 2006).

Animal welfare for both cats and dogs is found in the forefront of public concern with environmental pollution of little importance (Slater et al. 2008). Slater et al. uncovers a system of feral animal capture and placement in shelters. The program borders on no management at all, without low-cost sterilization programs in place (Slater et al. 2008). This is a government attempt to serve the feral pet problems in a humane and efficient manner but simply has not provided the infrastructure, funding, or leadership necessary to sustain a long-term solution to the free roaming dog and cat population issue (Slater et al. 2008). Shelters are overcrowded with un-socialized animals, animal abandonment continues unabated, and 90% of the randomly selected sampled public perceives the free-roaming animal issue to be problematic (Slater et al. 2008). The respondent opinion overwhelmingly believes the problem is one belonging to the government and not private organizations, with 98% weighing in against euthanasia (Slater et al. 2008).

Dabritz et al. 2006. Research by Dabritz et al. (2006) on both cat owners and non-owners contains public opinion telephone survey findings. The purpose of the study was to determine the owned and feral cat population size, management practices present, and public perceptions of stray pet management

with the main focus being on the outdoor cat fecal load in regard to its ill-effects on wildlife populations and water quality (Dabritz et al. 2006). Public perception findings by Dabritz et al. reveal the majority of respondents are in favor of TNR for stray cats and dogs with 82% of those in agreement being cat owners and 72% being "all other," or non-cat owners. The same survey finds 62% of cat owners and 82% of non-cat owners in favor of trapping and impounding stray dogs and cats. An overwhelming majority of respondents do not believe in leaving stray cats and dogs alone to fend for themselves. When asked whether water pollution in their respective community is a concern, 61% of cat owners and 69% of non-cat owners express some degree of concern. Sixty-eight percent of cat owners and non-cat owners express concern about the local threatened species while 21% of cat owners remain neutral on the subject and 25% of non-cat owners express a lack of concern over the welfare of the local threatened species (Dabritz et al. 2006).

Ash and Adams 2003. Ash and Adams (2003) examine public preference of faculty and staff at Texas A&M University where a self-proclaimed (Ash & Adams 2003) highly publicized TNR program has been in place on campus since 1998. The purpose of the study by Ash and Adams (2003) was to determine the preferences of the faculty and staff in regard to the feral cat population and its management. The article notes a tone of apathy pervades the respondents (Ash & Adams 2003). One-third of survey takers respond with "no-opinion" to many of the questions. Respondents are queried by Ash and Adams

(2003) as to their preference for feral cat management using the words “free-roaming” versus “feral” and “removal” when referring to feral cat control options other than TNR. “Removal” of cats from their respective locations means euthanasia with 75% of adoptable cats in shelters euthanized due to lack of adopting homes (Levy et al. 2003).

Summarizing the results of the Ash and Adams (2003) survey, respondents are split in half over the preference of removal versus TNR. TNR supporters are predominantly women who identified fewer nuisance behaviors associated with the feral cats than did men. Women are also more apt to believe in the potential efficacy of TNR in reducing the overall feral cat population than men (Ash & Adams 2003). Among respondents of both genders, a surprising three-way split between no control, removal, and TNR preference occurred when asked what method of control should be employed in wilderness areas, wildlife areas, and National forests. The majority of respondents prefer removal of feral cat populations in suburban areas (Ash & Adams 2003). While 44% of respondents believe feral cats are a major environmental issue, they do not believe the predatory impact of cats on wildlife should be management criteria. Only 14% of the respondents are members of conservation or animal welfare organizations and only 13% are aware the feral cat population on campus was being managed by the TNR method (Ash & Adams 2003).

The Use of Scientific Terminology Versus Colloquialisms

In a theoretical paper, Gesler (1999) discusses the social aspects of language in medical situations; the conditions and methods of communication are explored. Gesler (1999) notes words can have negative connotations even if the meaning itself is in fact not negative. Words are important because the pretext of their meaning channels interpretation to the receiver. Language is a cultural construct and words can evoke positive or negative emotional responses even when unintended (Gesler 1999; Barker et al. 2009).

A survey by Ogden et al. (2002) is an examination of the impact of scientific, medical, and lay language on patients' perceptions of their diagnoses. Survey findings by Ogden et al. (2002) reveal using scientific medical terms can lead a patient to negative feelings of self-blame for their condition, whereas lay terms make the patient feel positive and comfortably validated (Ogden et al. 2002). These findings by Ogden et al. (2002) are similar to survey result findings by Barker et al. (2009) indicating that using scientific medical terms can have negative impacts on the patients while lay terms have positive impacts (Ogden et al. 2002; Barker et al. 2009). Scientific medical terms are found to have negative connotations that make participants feel anxious while lay terms suggest the patient can take care of their own medical conditions, the problem will not persist, and it is not their own fault (Ogden et al. 2002). Barker et al. (2009) also find that scientific terms have negative connotations that make participants feel helpless, weak, anxious, and alarmed while lay terms may lead to miscommunication.

Problem Statement

The literature relating to feral cat (*Felis catus*) management programs focuses on eradication versus Trap-Neuter-Return (TNR) colony management. Researchers of both the pro-TNR and anti-TNR opinions require public acceptance of their respective feral cat management program to garner support for any wildlife management policy that would be implemented in a given area. Based on the literature, no researcher has experienced across-the-board success or acceptance for TNR programs or eradication via lethal means (Ash & Adams 2003; Dabritz et al. 2006; Slater et al. 2008; Loyd & Miller 2010).

Public perception has yet to be adequately measured and it varies regionally. In Rome, Italy, a population survey done by Natoli et al. (2006) indicates the number of feral cats decreased by 16 - 30% following a national TNR program, but this number is considered low due to a 21% increase in cat abandonment and immigration. The public perception in this case, while not the primary focus of this study, indicates the national TNR program has not succeeded as well as expected based, not on the success of the TNR program, but rather on the rate at which strays were released into the feral cat population (Natoli et al. 2006). In Texas, university TNR program coordinators claim their program has been met with high satisfaction by faculty and students (Hughes & Slater 2002). However, a survey of the same university program (Ash & Adams 2003) finds a mixed response from the faculty and staff.

Researchers in favor of TNR programs claim TNR has the capability of successfully moving feral populations toward eradication if additional cats do not move into the colony (Levy & Crawford 2004). The slow decrease in feral cat populations may help keep secondary pests from surging in populations (Tompkins & Veltman 2006). Urbanization is blamed for the losses in wildlife due to the loss of habitat and fragmentation (Kays & DeWan 2004; Van Heezik et al. 2010). Baker et al. (2005) notes that urbanization and subsequent owned cat increases are responsible for decreases in wildlife.

Opponents of TNR management programs claim cat predation of small mammals and birds can have negative impacts on wildlife species (Keitt 2002; Keitt & Tershy 2003; Bonnaurd et al. 2007). Many cat-related wildlife kill data are largely based on surveyed owners of free-roaming pets and results vary widely (Woods et al. 2003; Kays & DeWan 2004; Baker et al. 2005). Studies examining only feral cats are predominantly performed on island populations or in isolated areas. These studies reveal predation on small mammals and birds in the absence of control measures (Pontier et al. 2002; Keitt & Tershy 2003; Nogales et al. 2006; Bonnaud 2007; Medina 2009). Feral cat studies performed in urban and suburban areas are difficult due to the presence of free-roaming owned cats (Lord 2010).

Some researchers (Jessup 2004, Winter 2004) cite disease issues and significant predation of wildlife species and birds by feral cats as reasons to prefer TNR be illegalized. Diseases such as *Toxoplasmosis gondii*, *Rabies* sp.,

Bartonella, Ricksettia, and *Coxiella* may be carried by all domestic cats *(Felis catus)* and can be human and wildlife health issues (Chromal et al. 1996; Dubey 1996; Shaw et al. 1996; Haupt 1999). Slater (2004) states that zoonotic disease problems associated solely with feral cats are largely unknown.

Public perception and acceptance are important factors in feral cat and wildlife management, according to Loyd and Miller (2010). In public opinion, there is general movement away from lethal animal control (Kellert 1975; Reiter et al. 1999; Zinn & Andelt 1999; Hatley 2003) while wildlife support and appreciation from the general public is high (Reiter et al. 1999; Zinn & Andelt 1999; Kaczinsky et al. 2004; Koval & Mertig 2004; Bremner & Park 2007).

Public policy and public education depend heavily on responsibly garnered information regarding public opinion on the preferences for best management practices for feral cat populations (Stoskopf & Nutter 2004; Loyd & Miller 2010). Providing unbiased educational information and asking undirected questions about how the public feels about the realities of the topic is the only way to determine what the public perception of the problem may be and where the solutions lie.

Research Objectives

The purpose of this research was to determine public attitude toward feral cat management in a California university and to assess how terminology may alter public perception of TNR programs. The study further examined preferences toward different management methods in differing environmental

landscapes, whether education, demographics, or philosophical differences affected support for TNR versus lethal control.

Also under investigation were respondent preferences to particular questions found in other survey research as follows: Do age range, education level, or pet ownership affect preference? Are feral cats considered a part of the natural spectrum of wildlife? Is the humane treatment of feral cats considered important? What methods of control do respondents prefer in office parks, campus property, and city parks?

Hypotheses

H_1: The humane treatment of "free-roaming"/"feral" cats is of great importance to the respondents.

H_2: Respondents will view "free-roaming"/"feral" cats as a part of the natural spectrum of wildlife.

H_3: Public education about "free-roaming"/"feral" cats will be of no importance to the respondents.

H_4: Respondents, given all methods of feral cat management, will prefer eradication in private neighborhoods versus public lands.

H_5: Respondents will prefer TNR over "removal"/"euthanasia" in office parks, campus property, and city parks.

H_6: Females will prefer TNR; males will not.

H_7: Female respondents will tend to feed more "feral"/"free-roaming" cats than will male respondents.

H_8: Female respondents will perceive fewer nuisance factors than will males.

H_9: Respondents with higher education will prefer TNR over "removal"/"euthanasia."

H_{10}: Older respondents versus younger respondents will prefer "removal"/"euthanasia" over TNR.

H_{11}: Pet owners versus non-pet owners will prefer TNR over "removal"/"euthanasia."

H_{12}: Surveys using the colloquial, neutral terminology "removal" and "free-roaming" will create a more positive response from the respondents regarding TNR management programs than will those surveys using the scientific, negative terminology "euthanasia" and "feral."

Methods

Study Site

A large variation in response was anticipated due to the wide demographics of the greater San Francisco Bay Area. The sample size was large enough to accommodate high variation among the potential respondents and a potentially low response rate, as is typically anticipated for self-administered mailed surveys (Rea & Parker 2005).

The Stanford University campus was chosen for sampling due to its existing successful TNR program. The free-roaming cats on the private Stanford University property are managed by a volunteer TNR organization called The Stanford Cat Network (http://catnet.stanford.edu/). This organization was written about in the local and university press, and familiarity with the program should have been similar to that found at Texas A&M as described in Ash and Adams (2003). The agreement between the University and the Stanford Cat Network is included in Appendix A.

The ecology of Stanford University is dry Mediterranean with grassy hills and oak woodlands. Much of the campus resides in the foothills with the majority of the eastern portion of the campus facing a valley in the peninsula of the greater San Francisco Bay Area. To the west, a flat-topped ridge within the San Fransquito Watershed flanks the campus. Streams, wetlands, and a eutrophic lake are present due to watershed drains from both northeast and southwest

corridors along the ridge (Jasper Ridge Biological Preserve). Stanford University sits on 8,180 acres of land (Stanford University, 2011).

Study Design

Each of the surveys supplied supplemental educational material explaining TNR and the perspectives of both proponents and opponents. Of the total surveys sent, one half used the phrasing “removal” and free-roaming” and one half used the phrase “euthanasia” and “feral” when referring to cats and management via eradication. The model was as follows:

Table 1

Study Design

Alternate Wording A: “Removal”, B:“Free-Roaming”	Alternate Wording A: “Euthanasia”, B: “Feral”	
800 Surveys	800 Surveys	Sent
148 Surveys	146 Surveys	Completed

Hypotheses 1, 2, 6, 8, 9, 10, 11, and 12 are evaluated based on a 5-point Likert-type scale of 1) strongly agree, 2) agree, 3) no opinion, 4) disagree, and 5) strongly disagree. Results for hypotheses 9, 10, and 11 also included demographic data. Statements for Hypotheses 3 and 7 required “yes” or “no” responses. Statements for testing Hypotheses 4 and 5 were formulated to contrast whether “removal”/”euthanasia,” “TNR,” or “no control” was preferred.

Data Collection

An email questionnaire was sent out to 1600 of the University faculty and staff listed at Stanford. The target was a10% sampling of faculty and support

staff. There are approximately 16,128 entries in the faculty and staff listings; hence, 1600 surveys accounts for approximately 10% of the faculty and staff at Stanford University. For Stanford University, the faculty and staff listings section from the 2009 Stanford Directory published by Stanford Student Enterprises was on pages 136 through 280.

Page numbers were randomly generated from the 64 pages containing faculty and staff, and email addresses were randomly selected. All numbers were generated using an online random number generator available free from random.org. The email addresses were entered into a spreadsheet and later imported into surveymonkey.com. The email survey was administered using surveymonkey.com.

The first survey was emailed June 22, 2010, and a second survey was sent out one week after the first survey was emailed. A third survey was emailed to non-respondents after another week. An 18% return rate was achieved for each survey design for a total of 296 surveys completed.

To validate the surveys, pilot surveys were sent to select faculty and instrument graduate students in the Environmental Studies department at San José State University as well as in departments of certain interested subjects. Ten pilot recipients received one of two randomized survey designs and were asked to time their survey participation as well as to provide constructive feedback for a total of 40 surveys emailed. Pilot recipients were informed of the variations in the survey design to avoid unnecessary feedback. The researcher's

personal email was made available for the pilot respondents. Survey details, including the pilot survey, are available in Appendix B.

The resulting respondent breakdown follows. The gender breakdown was 50:50 male to female (see Figure 1). The ratio of females to males was evenly split.

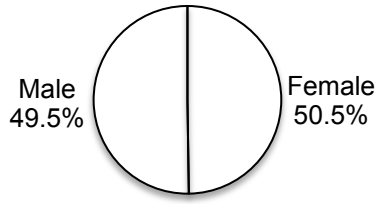

Figure 1. Male to female ratio.

Ages were grouped into several categories. The age ranges were 31% at 41-50 years old, 24% at 51-60 years old, 21% at 31-40 years old, 14% at 20-30 years old, and 9% at 61-70 years old (see Figure 2).

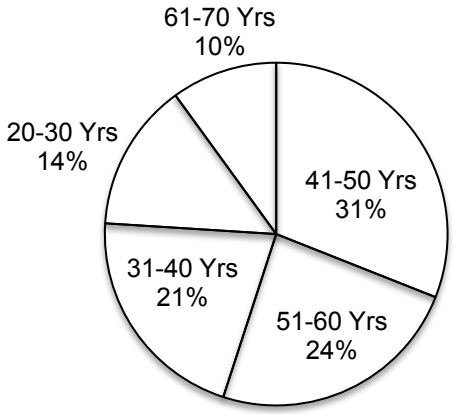

Figure 2. Respondent age ranges.

Thirty-six of the respondents owned no pets, 28% owned cats only, 20% owned only dogs, and 16% owned both cats and dogs (see Figure 3).

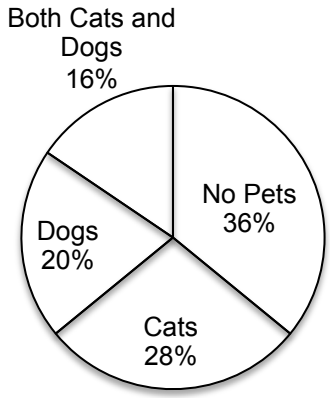

Figure 3. Respondent pet ownership.

Data Analysis

Analytical Methods

Preferences for H_1 through H_4 (influences by education and age) were examined using descriptive statistics. Preferences based on pet ownership for H_{11} was examined via ANOVA with a post-hoc Scheffe test. For H_4 and H_5 (the area questions), Chi-square tests were performed on the area preferences to compare the distributions between the groups. H_7 (gender feeding hypothesis) was analyzed using Chi-square with gender for the independent variable and select statements as the dependent variables. The independent variable was pet ownership and the dependent variable was the respondent rating on the Likert-type scale statements. H_9 was analyzed using Chi-square methodology. H_{10} was examined using ANOVA. Data for H_{12} (the language hypothesis) and H_5 (gender response to nuisance factors) were assessed using Analysis of Variance (ANOVA). For H_{12} select Likert-type statements and location answers were examined as the dependent variable with the scientific and colloquial language surveys serving as the independent variable. Charted values were determined using crosstab calculations. To assess the participants' mean preference for feral cat control in their responses to the Likert-type scale questions, the average (mean) in the overall preferences were first calculated and then compared with the neutral value (=3) on the Likert-type scale. T-test and ANOVA was used to assess the statistical significances in the differences between 3 and the mean value of the respondents' preferences.

Results

When asked if the humane treatment of free-roaming cats was of great importance per H_1, descriptive statistics reflected that 75% of respondents agreed and somewhat agreed (see Figure 4). Descriptive assessment revealed the majority of respondents agreed that the humane treatment of free-roaming/feral cats is of great importance.

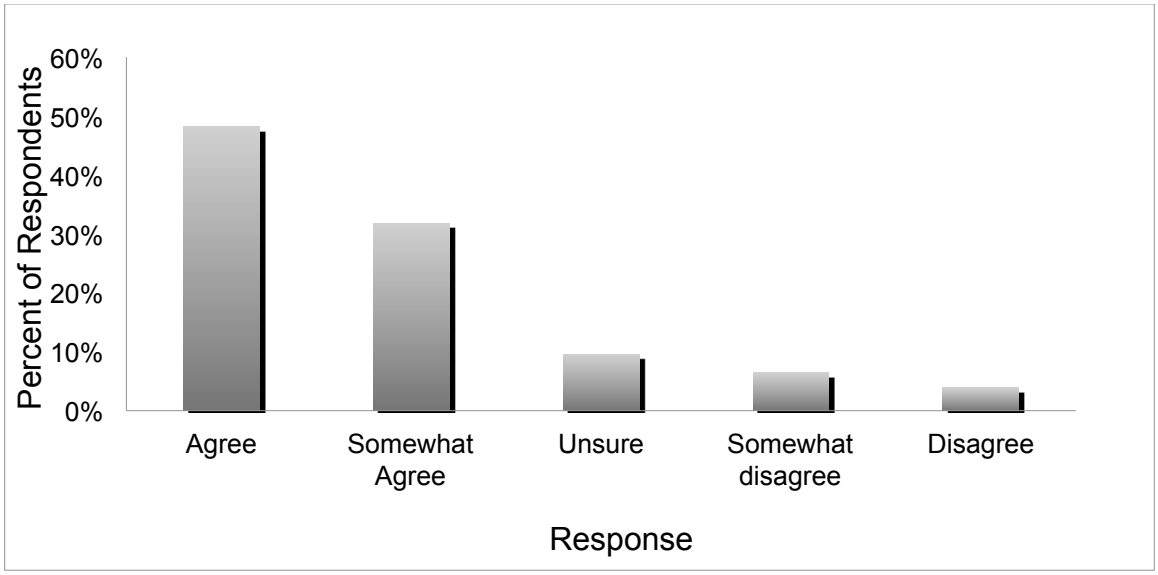

Figure 4. Mean response for humane treatment of “free-roaming”/“feral” cats. (n=280)

As for H_2, respondents were divided with 40% of the respondents somewhat agreeing or agreeing that free-roaming cats were part of the natural spectrum of wildlife and 40% disagreeing or somewhat disagreeing. Nearly 20% were unsure (see Figure 5). Descriptive statistics were used.

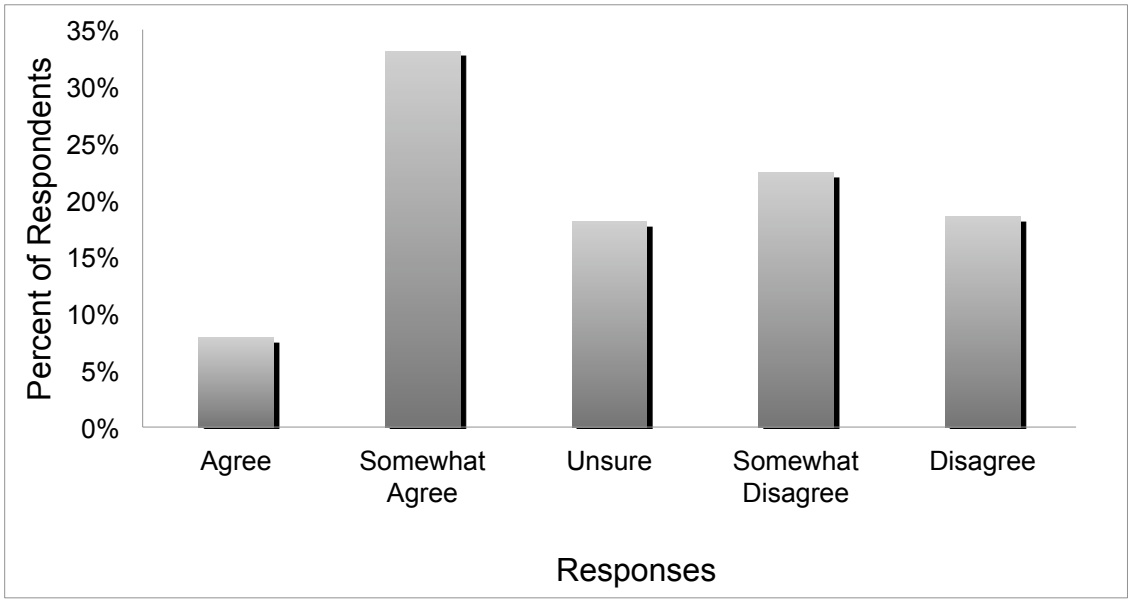

Figure 5. Free-roaming/feral cats as a part of the natural spectrum of wildlife (n-254).

When asked if the public needed to be educated on “free-roaming”/”feral” cat issues (H_3), respondents were split; 36% said “yes” and 41% said “no” (see Figure 6). Descriptive assessment revealed respondents were split as to whether public education of feral cats was of great importance. Forty percent disagreed that it was of great importance while 35% agreed that it was; 10% were unsure.

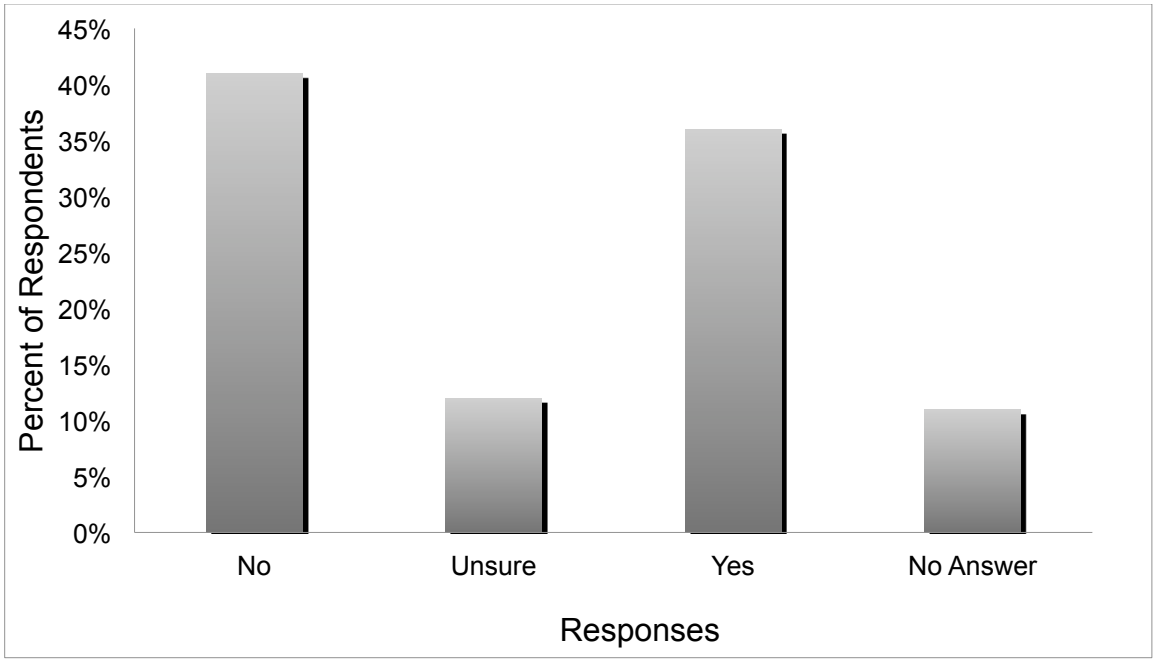

Figure 6. The importance of public education (n=278).

H_4 predicted respondents would prefer removal/eradication in private neighborhoods as opposed to public undeveloped lands. Results for H_4 revealed significant differences in preferences for methods of control in neighborhoods (urban and suburban) as compared to public lands (open space, wilderness preserves, and National forests) in general (see Figure 7).

Using Chi-square assessment to compare urban neighborhoods with open space, it was revealed that respondents preferred TNR in open space by 63% and TNR in urban neighborhoods was preferred by 49%, p=0.000 (see Figure 7). No control was preferred by 26.5% in open space and only 3% in urban neighborhoods. Chi-square assessment revealed that in urban neighborhoods 60% of respondents agreed with TNR while only 5% agreed with removal/euthanasia (p=0.000). In comparison to open space, 50% agreed with TNR while over 35% agreed with removal/euthanasia. Between 25% and 35% agreed with removal/eradication.

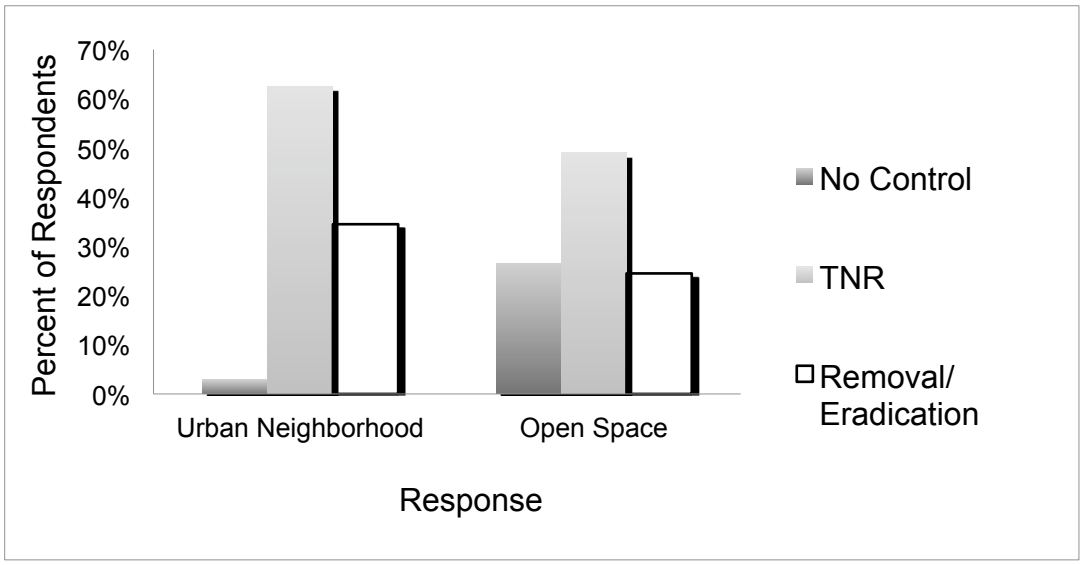

Figure 7. TNR preference in urban neighborhoods vs. open space (p=0.000, n=200).

In suburban neighborhoods, 67% of respondents preferred TNR when compared to 50% preferring it in open space. No control in open space was preferred by 25.6% with 3% preferring no control in suburban neighborhoods (see Figure 8; Chi-square; p=0.000).

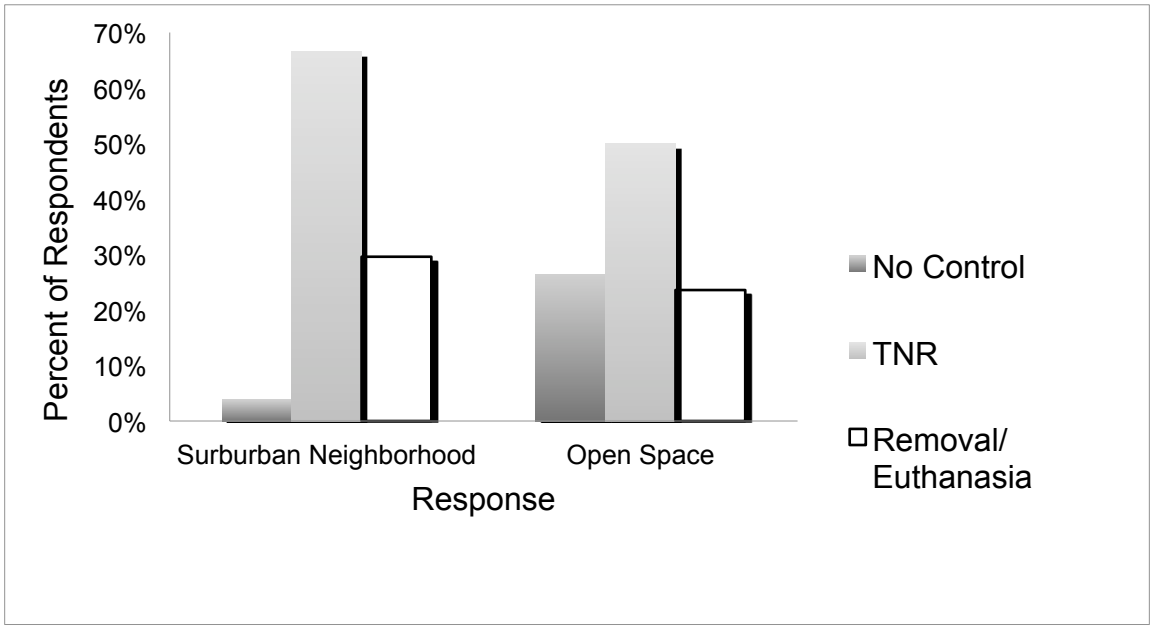

Figure 8. TNR preference in suburban neighborhoods vs. open space (p=0.000, n=199).

TNR was preferred in both places, with over 60% in suburban neighborhoods and 50% in open space. Removal/euthanasia scored closely at approximately 30% while no control was preferred at 30% in open space but less than 5% in suburban neighborhoods. Results were determined using Chi-square assessment p=0.000.

In regard to urban neighborhoods versus wilderness preserves, respondents preferred TNR by 62% and 40%, respectively (see Figure 9; p=0.000). No control was preferred by 25.5% in wilderness preserves and only 3.5% in urban neighborhoods. Chi-square assessment revealed TNR was preferred by 60% in urban neighborhoods while only by 40% in wilderness preserves (p=0.000). Removal/eradication was evenly dispersed at just under 40%. No control was only preferred by under 5% in urban neighborhoods but by 25% in wilderness preserves.

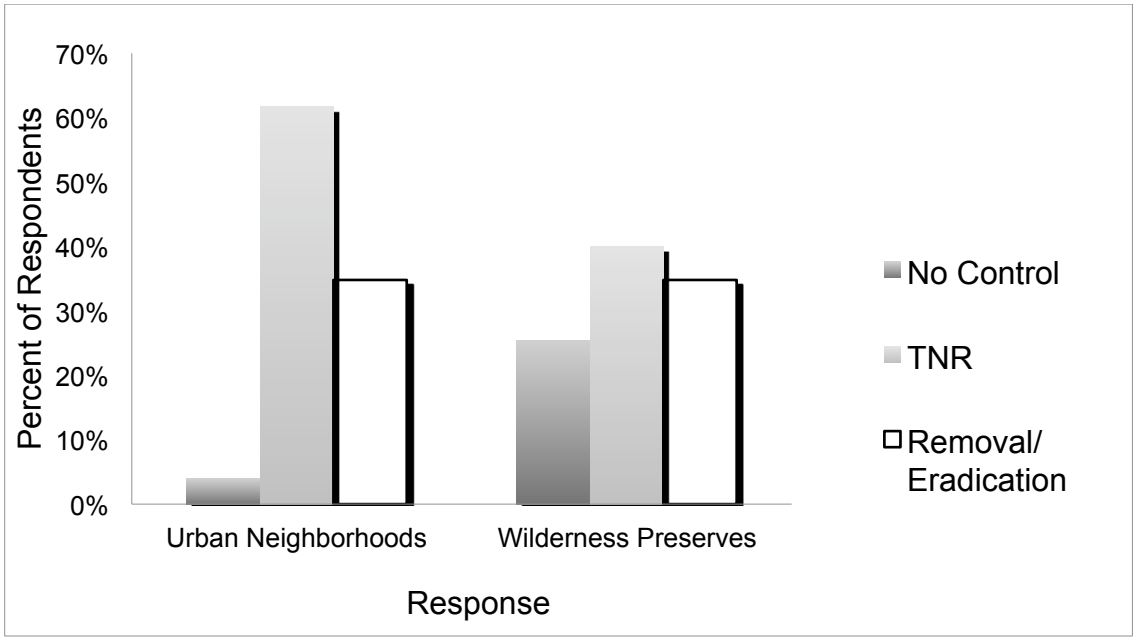

Figure 9. TNR preference in urban neighborhoods vs. wilderness preserves (p=0.000, n=198).

In suburban neighborhoods compared to wilderness preserves, respondents preferred TNR by 66% and 40%, respectively. No control was preferred at 24.7 % in wilderness preserves with 4% preferring no control in suburban neighborhoods (see Figure 10). Chi-square assessment revealed TNR was preferred by 70% in suburban neighborhoods and by 40% in wilderness preserves (p=0.000). Removal/euthanasia was preferred at between 30% and 35% in both areas. No control was preferred by over 25% in wilderness preserves while less than 5% in suburban neighborhoods preferred it.

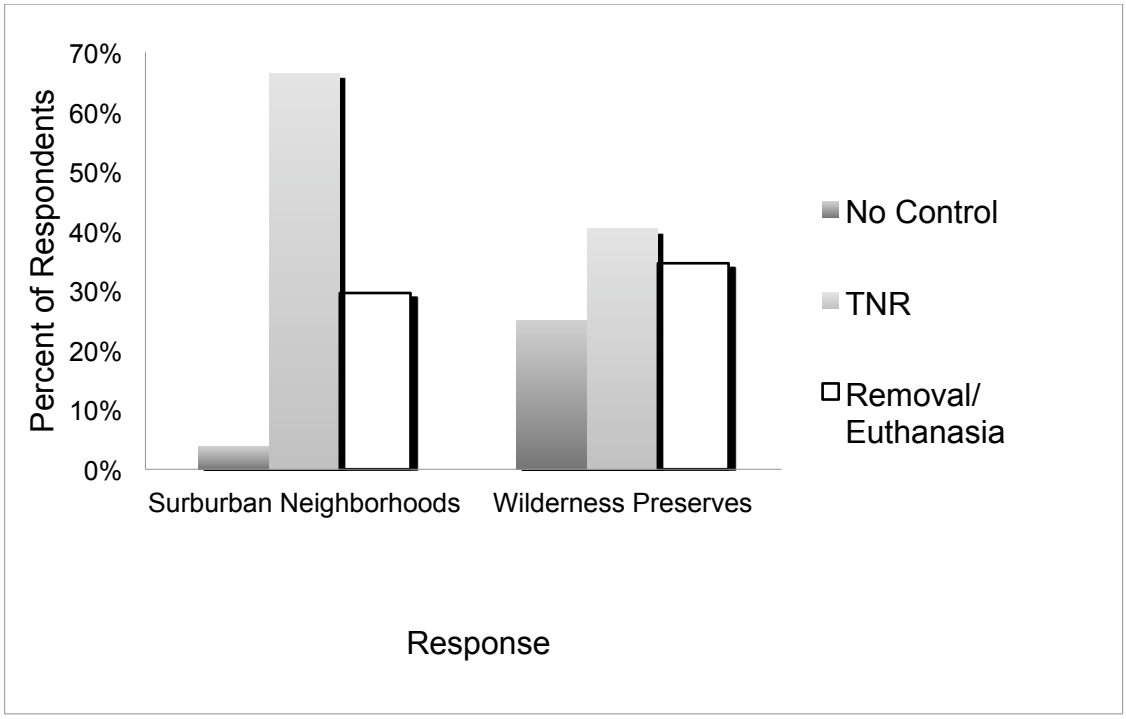

Figure 10. TNR preference for suburban neighborhoods vs. wilderness preserves (p=0.000, n=198).

According to Chi-square assessment, 62% of respondents preferred TNR in urban neighborhoods, 42% in National forests, and 61% in urban neighborhoods (p=0.000). No control was preferred by 30% in National forests and only 3.4% in urban neighborhoods (see Figure 11). Chi-square assessment indicated a preference for TNR in urban neighborhoods was 60% while only 45% in National forests (p=0.000). Removal/eradication was preferred in both areas 30-35%. No control was preferred by 30% in National forests and by less than 5% in urban neighborhoods.

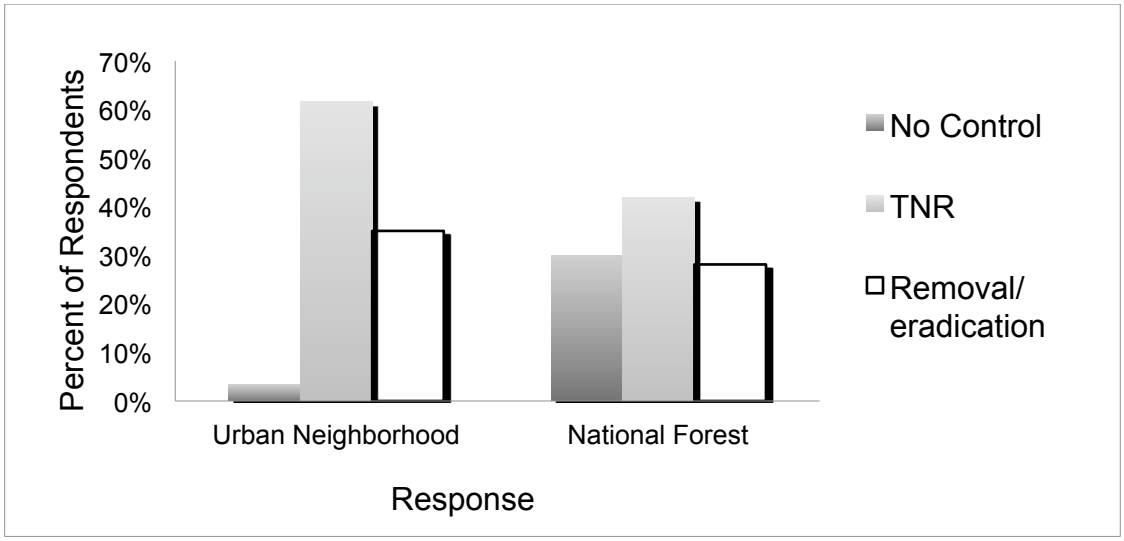

Figure 11. TNR preference for urban neighborhoods vs. National forests (p=0.000, n=203).

According to Chi-square statistics, p=0.000, 66% of respondents preferred TNR in suburban neighborhoods compared to 43% preferring it in National forests. No control in National forests was preferred by 29.4% with 4% preferring no control in suburban neighborhoods (see Figure12). Per Chi-square assessment, TNR was popular in suburban neighborhoods at almost 70% (p=0.000). Removal/Eradication hovered around 30%, while no control in National forests was preferred by 30% and by less than 10% in suburban neighborhoods.

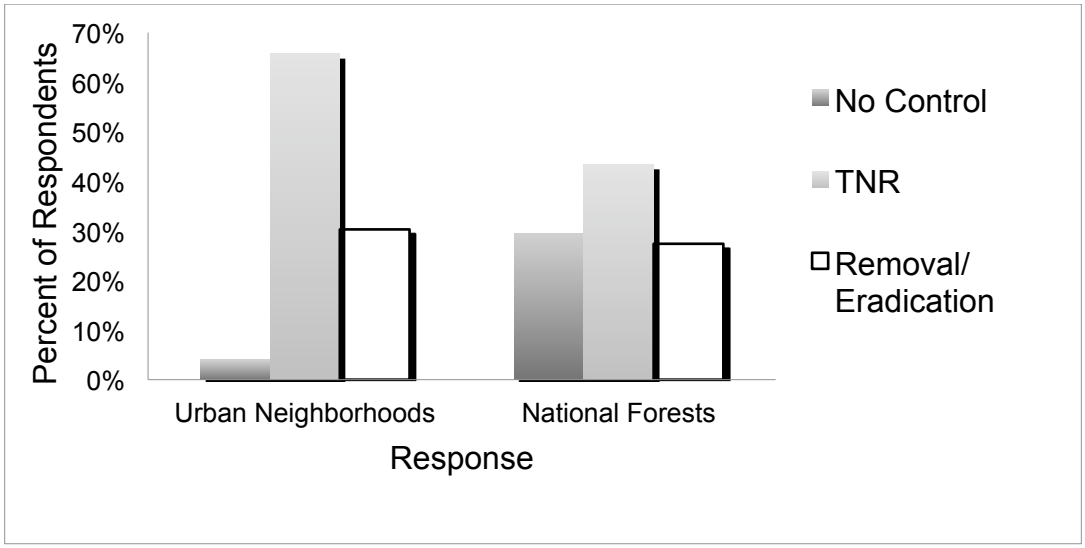

Figure 12. TNR preference in suburban neighborhoods vs. National forests (p=0.000, n=198).

H_5 examined the relationship between attitudes toward TNR in different types of urban lands. For H_5, respondents were expected to prefer TNR over removal/euthanasia in private areas, such as office parks, campus property, and city parks. Chi-square results indicated greater than 60% of respondents supported TNR in all the land types, p=0.000 (see Figure 13). According to Chi-square assessment, p=0.00, TNR preference for campus property and city and office parks was over 60% in all commercial, urban areas.

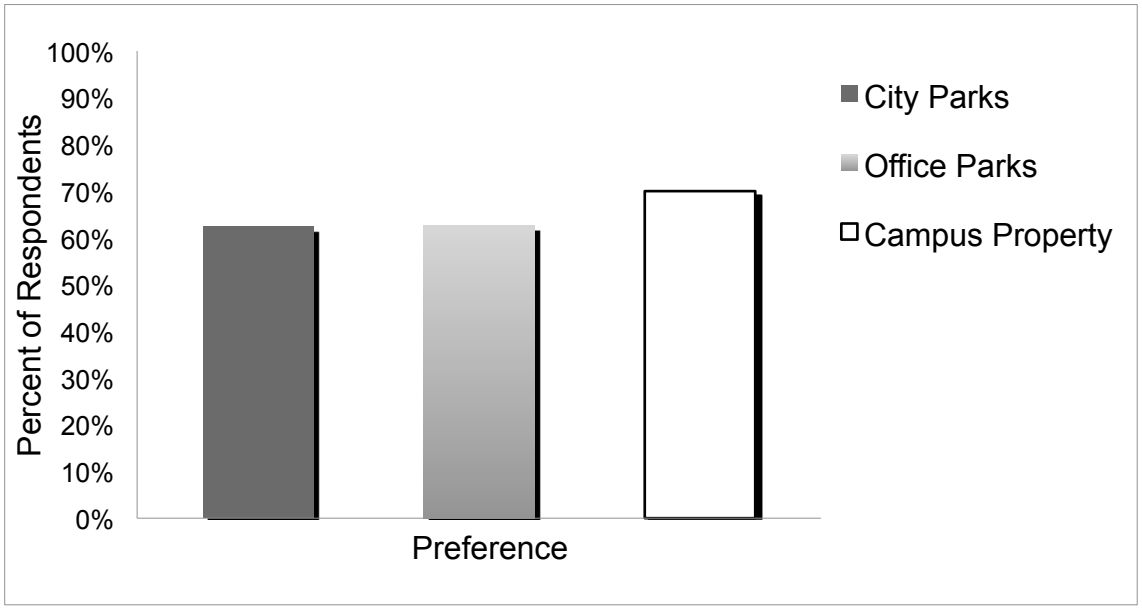

Figure 13. TNR preference for campus and city and office parks (p=0.000, n=205).

H_6 hypothesized that females would show more support for TNR than males. No significant differences were detected using a one-way ANOVA (see Table 2; p> 0.129 for all responses).

Table 2

ANOVA Results for H_6

Likert-type Scale Statements	Df Btwn grps W/in grps	F	Sig.
Only “removal”/“euthanasia” is adequate long-term control.	1 210	1.657	.199
TNR programs will increase the number of “free-roaming”/“feral” cats.	1 208	.367	.545
TNR is a humane option for “free-roaming”/“feral” cats.	1 209	2.324	.129
TNR and feeding “free-roaming”/“feral” cats is equal to animal abandonment.	1 175	.768	.382
TNR can reduce overall “free-roaming”/“feral” cat populations.	1 209	1.906	.169
“Removal”/“Euthanasia” is the only humane option for “free-roaming”/“feral” cats.	1 208	1.435	.232
“Free-roaming”/“Feral” cats should be controlled via TNR	1 209	1.534	.217

Females and males were examined for H_7 via a Chi-square test (p=0.015) as to whether they fed “free-roaming”/“feral” cats. Results indicate females were twice as likely to feed cats, 22% compared to 10% of males (see Figure 14; p=0.015).

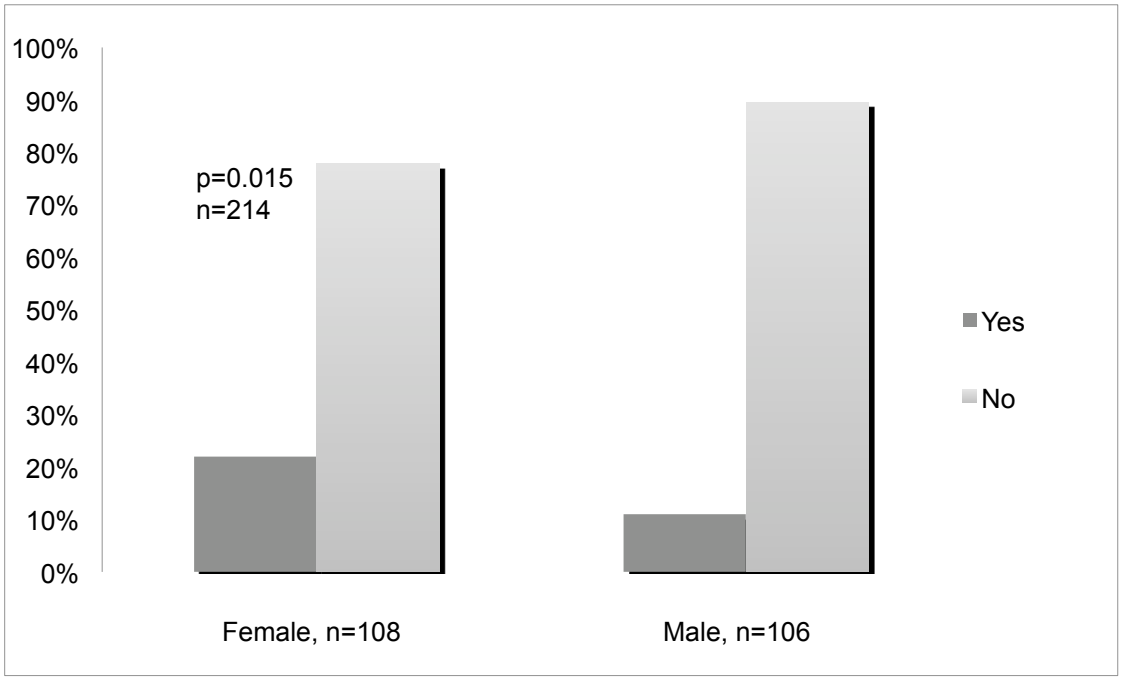

Figure 14. Likelihood of females vs. males to feed free-roaming/feral cats (p=0.015, n=214).

For H_8, females were predicted to be less likely to perceive nuisance factors than males, however, there was no statistically significant difference between the nuisance perceptions in ANOVA results (Table 3, p> 0.217 for all statements).

Table 3

ANOVA Results for H_8

Likert-type Scale Statements	Df Btwn grps W/in grps	F	Sig.
"Free-roaming"/"Feral" cats are physically dangerous to people.	1 208	1.327	.251
"Free roaming"/"feral" cats are unkempt, unhealthy and ungroomed animals.	1 205	.060	.807
"Free-roaming"/"Feral" cats are unsanitary, spray buildings and cause odor issues.	1 208	.864	.354
"Free-roaming"/"Feral" cats carry diseases threatening to humans.	1 208	1.532	.217
"Free-roaming"/"Feral" cats create garbage problems when they scavenge.	1 207	.503	.479

H_{10} predicted respondent age would play a role in feral cat management; however, age did not appear to play a strong role in respondent preferences for "free-roaming"/"feral" cat control (see Table 4).

Table 4

Age as a Factor in "Free-roaming"/"Feral" Cat Control

Likert-type Scale Statements	Df Btwn grps W/in grps	F	Sig.
Only "removal"/"euthanasia" is adequate long-term control.	4 87	.291	.883
TNR programs will increase the number of F cats.	4 86	1.033	.395
TNR is a humane option for "free-roaming"/"feral" cats.	4 85	.611	.656
TNR and feeding "free-roaming"/"feral" cats is equal to animal abandonment.	4 76	1.572	.190
TNR can reduce overall "free-roaming"/"feral" cat populations.	4 87	1.212	.311
"Removal"/"Euthanasia" is the only humane option for "free-roaming"/"feral" cats.	4 87	.203	.936
"Free-roaming"/"feral" cats should be controlled via TNR	4 86	2.237	**.072**

For the statement “Free-roaming/Feral cats should be controlled via TNR,” the researcher observed a trend in the ANOVA results (p=0.072). Respondents in the age group of 51-60 years old were the most supportive of TNR, though all groups were generally supportive. The oldest age group was the least supportive while the respondents in the 20 to 40 years old age groups were the most uncertain compared to a control measure (.072) (see Figure 15).

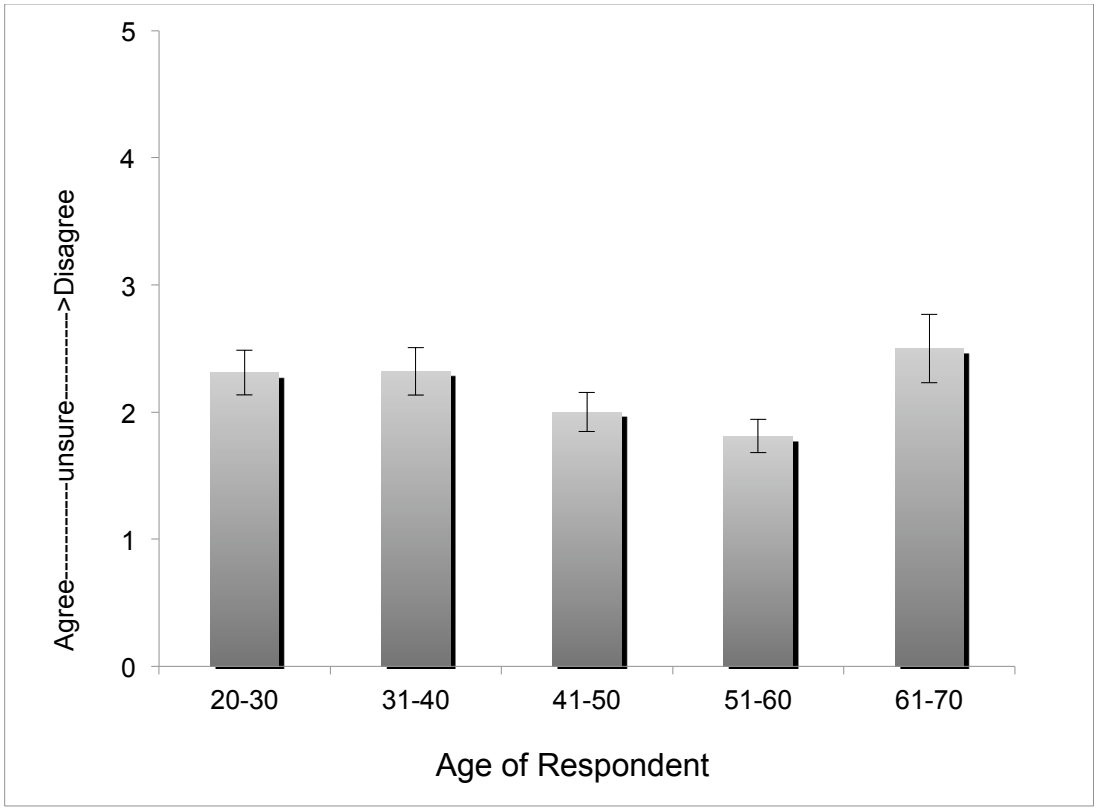

Figure 15. Responses by age to Free-roaming cats should be controlled via TNR (p=0.072, n=91).

Pet ownership for H_{11} was examined via ANOVA to determine if it played a role in determining respondent preference for “free-roaming”/“feral” cat control. The results revealed six out of seven statistically significant differences among group ownership – cat, dog, or both pets (see Table 5 and Figures 16-21).

Table 5

Pet Ownership in Respondent Preference for “Free-roaming”/“Feral” Cat Control

Likert-type Scale Statements	Df Btwn grps W/in grps	F	Sig.
Only “removal”/“euthanasia” is adequate long-term control.	4 193	1.818	.127
TNR programs will increase the number of “free-roaming”/“feral” cats.	4 192	3.690	**.006**
TNR is a humane option for “free-roaming”/“feral” cats.	4 193	3.860	**.005**
TNR and feeding “free-roaming”/“feral” cats is equal to animal abandonment.	4 163	4.316	**.002**
TNR can reduce overall “free-roaming”/“feral” cat populations.	4 193	2.560	**.040**
“Removal”/“Euthanasia” is the only humane option for “free-roaming”/“feral” cats.	4 192	2.877	**.024**
“Free-roaming”/“feral” cats should be controlled via TNR	4 194	2.211	**.069**

According to ANOVA results (p=0.006) and descriptive analysis for the statement “TNR programs will increase the number of free-roaming/feral cats,” respondents with both cats and dogs were strongly divided between agreement and disagreement. Cat owners agreed with the statement. Non-pet owners were less certain than cat owners but generally agreed. Dog owners were the most uncertain or believed it might increase the number of free-roaming/feral

cats (see Figure 16). A few more than one-quarter (26%) of non-pet owners were uncertain and 65% tended to strongly agree or somewhat agree. Cat owners strongly agreed or somewhat agreed at a 71% rate. One-third (33%) of dog owners were most uncertain while 57% tended to agree. More than half (57%) of owners of both either strongly or somewhat agreed, and 37% strongly to somewhat disagreed (ANOVA p=0.006).

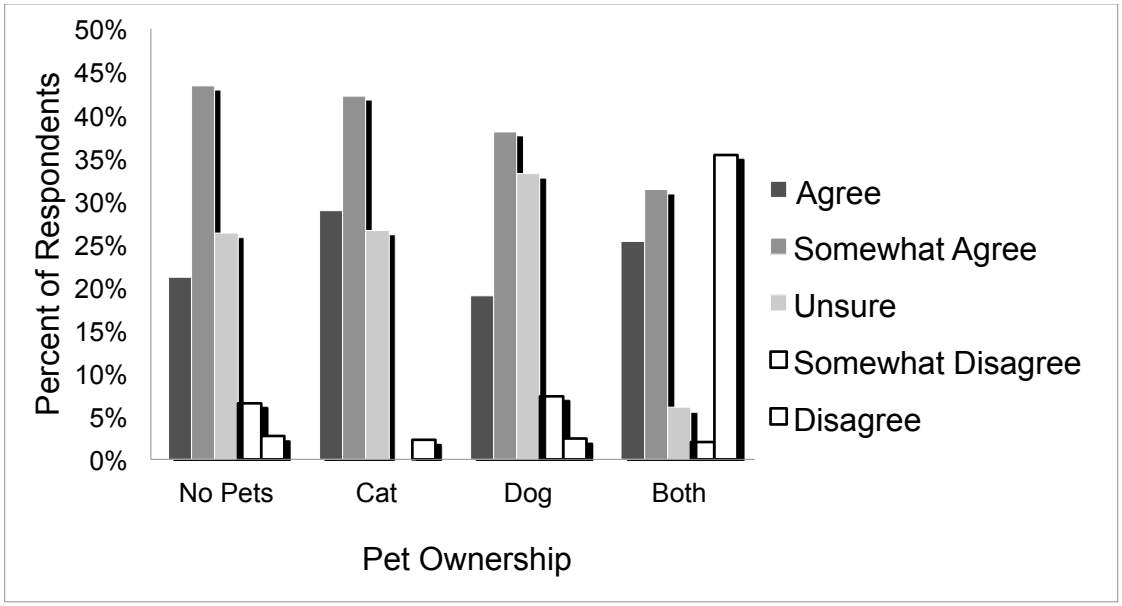

Figure 16. TNR programs will increase the number of "free-roaming"/"feral cats," by pet ownership (p=0.006, n=205).

When provided the statement that TNR can reduce the overall "free-roaming"/"feral cat" populations, non-pet owners in general agreed but were unsure. Cat owners weakly agreed but were generally unsure as well. Dog owners were more unsure than cat owners but were agreeable. Owners of both cats and dogs agreed strongly (more than cat owners) but agreed with it less than with the statement that TNR is the humane option for "free-roaming"/"feral"

cats (ANOVA p=0.040; see Figure 17). ANOVA results (p=0.040) and descriptive analysis indicate 65% of non-pet owners generally agreed but 26% were unsure. More than half (71%) of owners agreed but 26% were unsure as well. One-third (33%) of dog owners were unsure but 57% agreed. Most (88%) owners of both dogs and cats strongly to somewhat agreed.

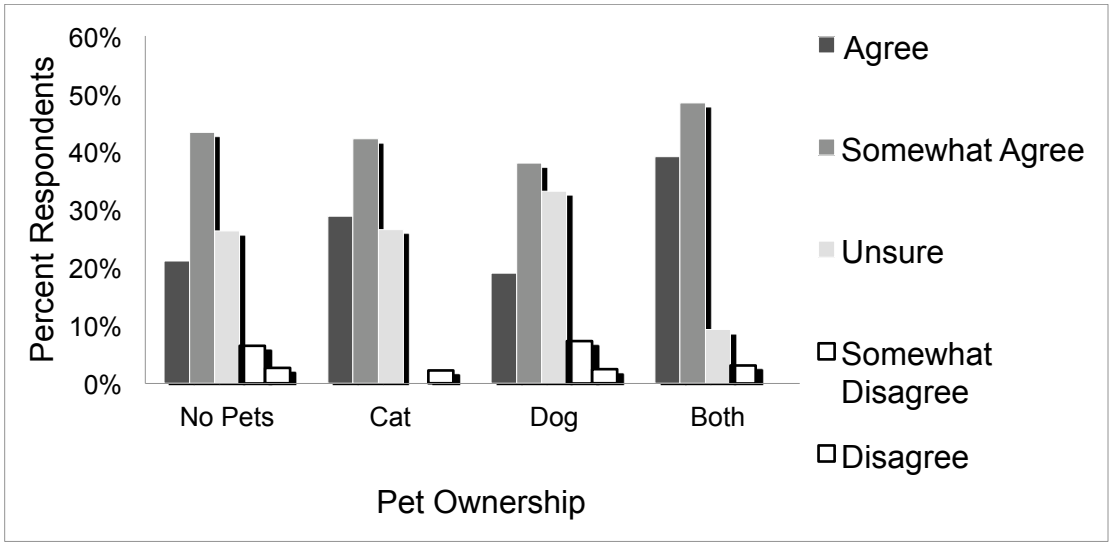

Figure 17. TNR can reduce the overall "free-roaming"/"feral cat" population by pet ownership, (p=0.040, n=206).

When provided with the statement that TNR is a humane option for free-roaming/feral cats, all groups agreed. ANOVA results (p=0.005) and descriptive analysis indicate cat owners and owners of both cats and dogs strongly to somewhat agreed. Non-pet owners generally agreed and dog owners agreed but were less sure than cat owners (see Figure 18). Three quarters (75%) non-pet owners strongly to somewhat agreed. Almost the same amount (77%) of cat

owners agreed as was true for dog owners (75%). Almost all (97%) owners of both pets agreed (ANOVA p=0.005).

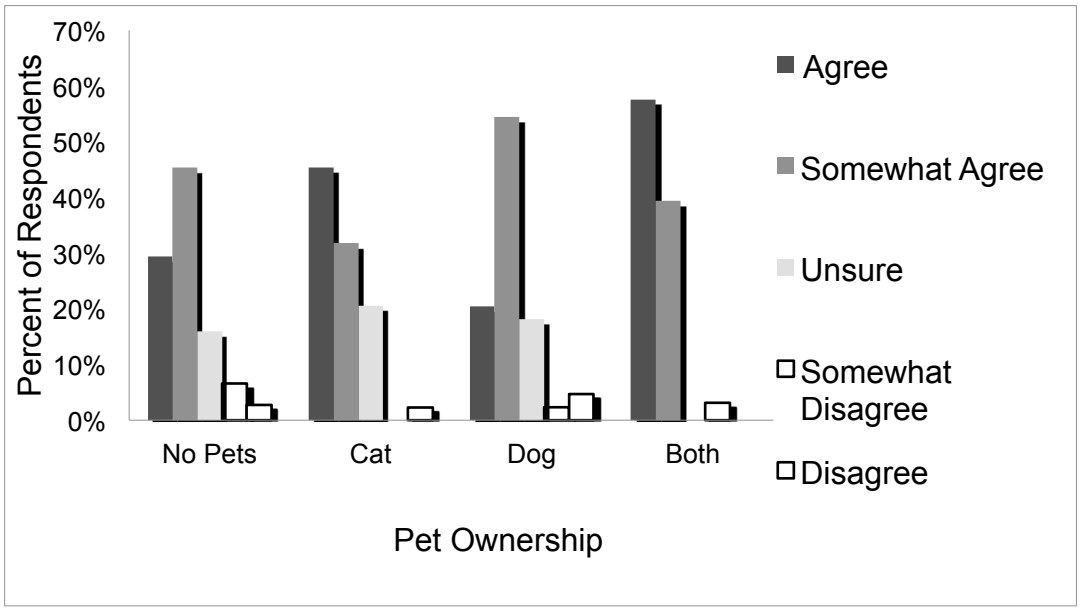

Figure 18. TNR is a humane option for "free-roaming"/"feral cats" by pet ownership (p=0.005, n=206).

Both cat and dog owners, as well as cat-only owners, strongly to somewhat disagreed that removal/euthanasia is the only humane option for free-roaming/feral cats according to ANOVA results (p=0.024) and descriptive analysis. Dog owners were more unsure than others while non-pet owners were the most unsure of all. All ownership groups generally disagreed (see Figure 21). ANOVA results (p=0.024) along with descriptive statistics indicate 55% of non-pet owners disagreed but 22% were unsure. A majority (69%) of cat owners disagreed and 20% were unsure. More than half (58%) of dog owners disagreed but 35% were unsure. Almost three-fourths (73%) of owners with both cats and dogs disagreed and 24% were unsure.

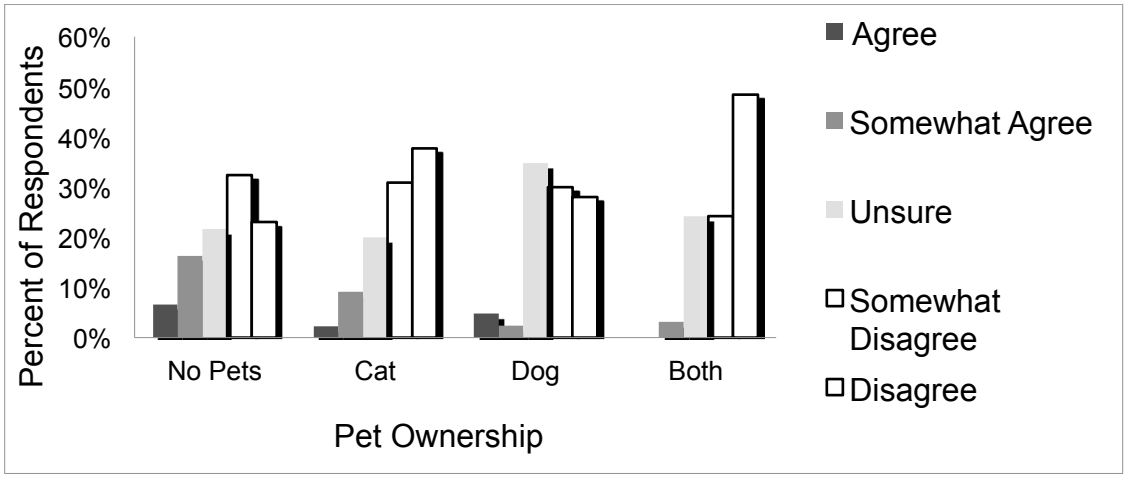

Figure 19. Removal is the only humane option for “free-roaming”/“feral cats" by pet ownership (p=0.024, n=205).

When provided the statement that TNR was equal to animal abandonment, owners of both cats and dogs strongly to somewhat disagreed as did cat-only owners. Dog owners were less sure but generally disagreed. Non-pet owners were the least sure but generally disagreed (ANOVA p=0.002; see Figure 20). ANOVA results (p=0.002) and descriptive analysis indicate 27% of non-pet owners were unsure and 51% disagreed. Most (85%) cat owners strongly to somewhat disagreed. Dog owners (21%) were less sure but 61% disagreed. Most (75%) of owners of both dogs and cats strongly to somewhat disagreed.

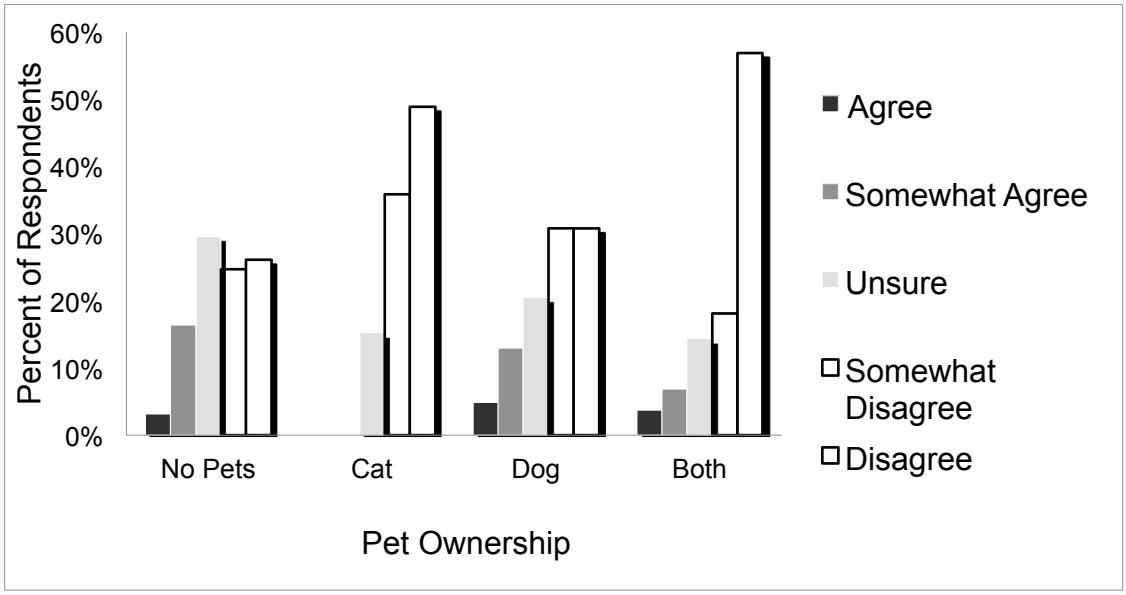

Figure 22. Analysis of pet ownership on TNR perception (p=0.002, n=175).

When provided the statement "Free-roaming/Feral cats should be controlled via TNR," owners of both cats and dogs agreed, according to ANOVA (p=0.069). Cat owners were less sure than owners of both but generally agreed. Dog owners were very unsure. Non-pet owners generally agreed but were more uncertain than dog owners and less uncertain than cat owners (see Figure 21). ANOVA results (p=0.069) along with descriptive statistics indicate 60% of non-pet owners agreed but 31% were uncertain. Two-thirds (66%) of cat owners were in agreement but 27% were uncertain. More than half (52%) of dog owners agreed and 41% were uncertain. Most (82%) of owners of both cats and dogs were in agreement and only 12% were uncertain.

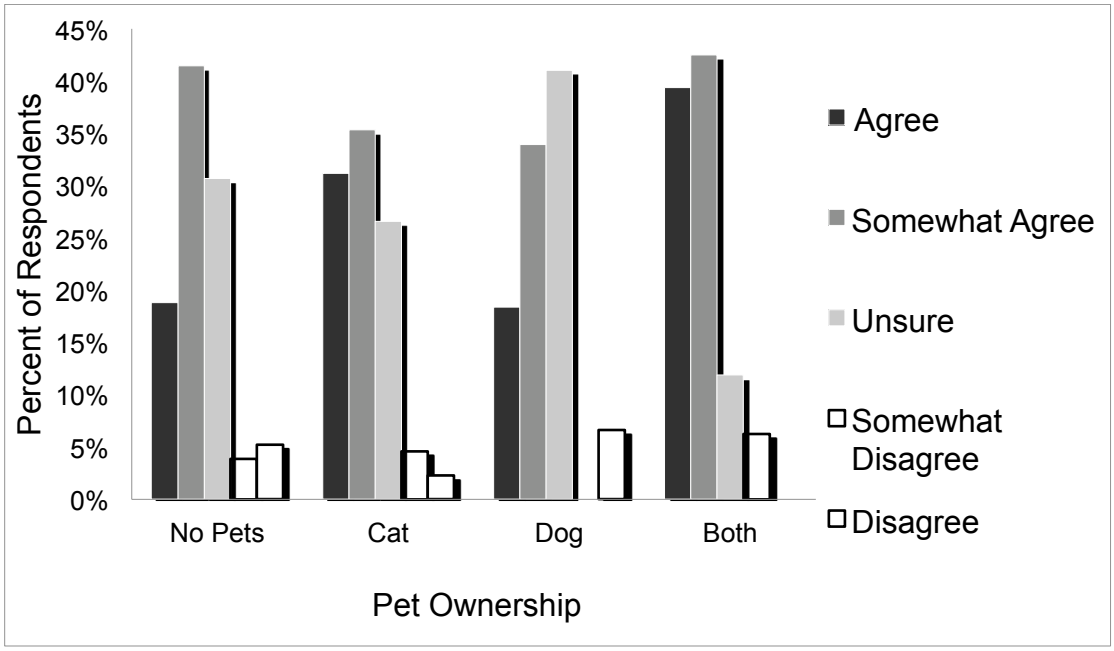

Figure 21. Free-roaming/Feral cats should be controlled via TNR by pet ownership (p=0.069, n=207).

For the experimental component of the study, some effects of survey language were detectable. H_{12} hypothesized that the differences in language choices for the surveys would affect the responses to the survey questions. ANOVA results show the word “removal” elicited significantly more uncertain responses than the term “euthanasia,” while the word “euthanasia” and the word “feral” yielded more certain and positive support for TNR (see Figures 22 and 23). This pattern was the opposite of what was expected.

Table 6

ANOVA Results for H_{12}

Likert-type Scale Statements	df Between groups Within groups	F	Sig.
Only “removal”/“euthanasia” is adequate long-term control.	1 276	6.109	**.014**
TNR programs will increase the number of “free-roaming”/“feral” cats.	1 264	.138	.710
TNR is a humane option for “free-roaming”/“feral” cats.	1 256	.081	.776
TNR and feeding “free-roaming”/“feral” cats is equal to animal abandonment.	1 206	.578	.448
TNR can reduce overall “free-roaming”/“feral” cat populations.	1 247	1.197	.275
“Removal”/“Euthanasia” is the only humane option for “free-roaming”/“feral” cats.	1 246	.4.516	**.035**
“Free-roaming”/“feral” cats should be controlled via TNR	1 244	0.33	.856

Both statements contrasted the term “removal” with the term “euthanasia” and elicited significantly different levels of agreement from respondents. Few respondents believed either “removal” or “euthanasia” were adequate long-term control (ANOVA p=0.014; see Figure 22). Forty percent of respondents were unsure if removal was adequate long-term control, according to ANOVA results (p=0.014) along with descriptive analysis. Twenty-five percent were unsure if “euthanasia” was a long-term control. Approximately 40% somewhat disagreed and disagreed that “removal” was adequate long-term control compared to 55% who believed “euthanasia” was. Only 17% agreed “removal” was adequate long-term control while only 20% believed in “euthanasia” as a long-term solution.

Significantly more respondents disagreed with the term “euthanasia” than with the term “removal.”

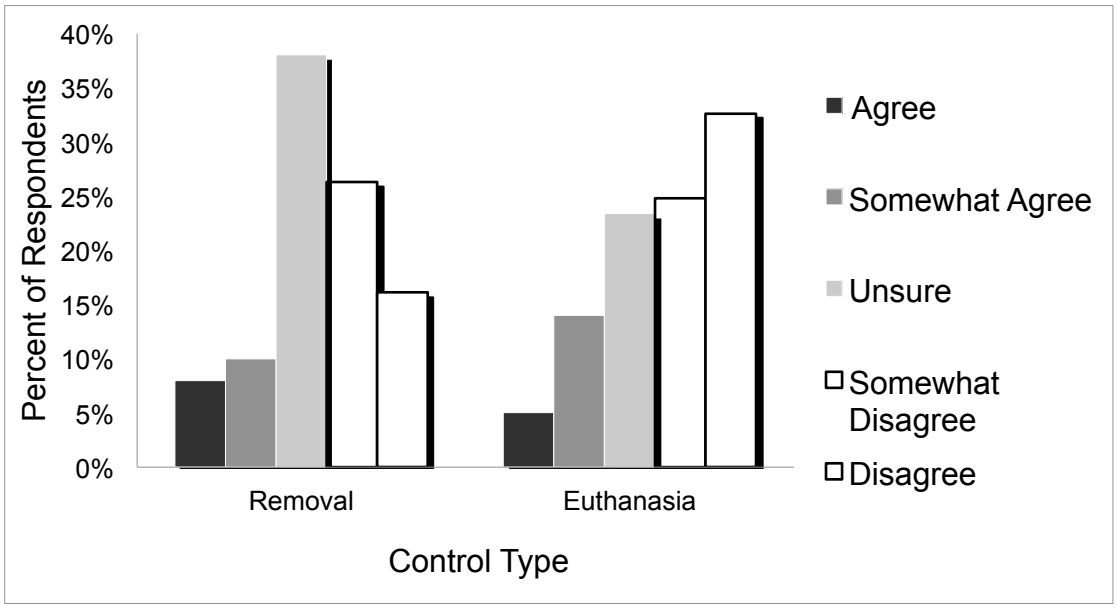

Figure 22. Only “Removal”/“Euthanasia” is adequate control (p=0.014, n=278).

Both “removal” and “euthanasia” were viewed as only one means of humane options for “free-roaming”/“feral” cat management (ANOVA p=0.035; see Figure 23). Sixty-five percent disagreed that “euthanasia” was the only humane option while 55% disagreed that “removal” was the only humane option and 20-25% were unsure. Approximately 20% believed “removal” was the only humane option and 12% agreed that “euthanasia” was the only humane option. ANOVA (p=0.035) and descriptive statistics were used.

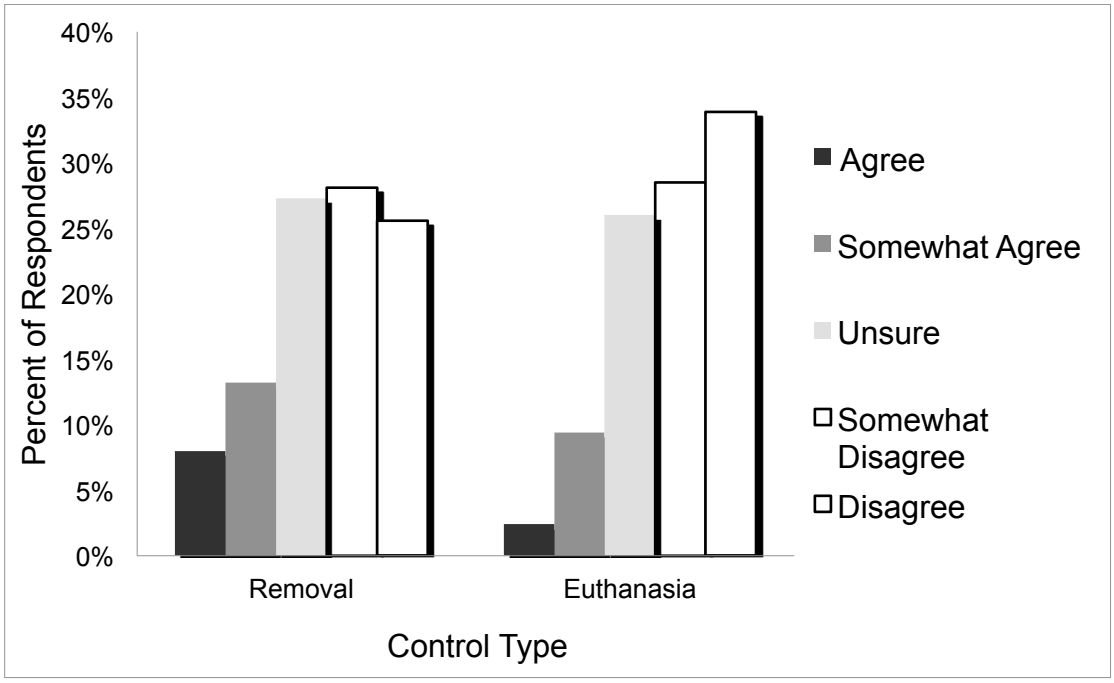

Figure 23. Removal/Euthanasia is the only humane option for free-roaming/feral cats (p=0.035, n=248).

Questions regarding location were also examined via ANOVA to determine if there was a difference between the colloquial and scientific terminology “removal” and “euthanasia.” No significant differences were found.

Table 7

ANOVA Results Location Answers for H_{12}

Location Answers	df Between groups Within groups	F	Sig.
Open Space	1 206	1.936	.166
Office Parks	1 209	2.811	.095
Wilderness Preserves	1 206	.404	.526
Urban Neighborhoods	1 206	1.365	.244
National Forests	1 206	.567	.453
Suburban Neighborhoods	1 204	.016	.900
Campus Property	1 204	.664	.416
City Parks	1 208	1.417	.235

Descriptive analysis was run on the Likert-type scale statements listed in Tables 1-8 to determine overall preference. The mean value for the respondents' preferences was 2.25, which corresponds with somewhat agree with TNR. A T-test (2-tailed) was run to determine how close to the score of 3 (unsure) the mean value fell. The T-test reveals the mean value of 2.25 was significantly different from the 3 value (t=-12.45, p=.000). Thus, language did not play a significant role in feral cat management preference and the preference was for TNR.

Discussion, Conclusions, and Recommendations

Humane Management

In Italy, Slater et al. (2008) found that public opinion about control of free-roaming animals was driven more by a concern for animal welfare than by environmental concerns. The majority of Stanford respondents preferred TNR as the humane treatment for feral cats. The results of this study were consistent with Slater et al.'s findings in Italy. TNR was likely to be perceived as the more humane alternative over no control or euthanasia/removal. It appears the Stanford community was empathetic toward feral cats and their humane management and less concerned with the impacts feral cats have on wildlife.

Wildlife

Based on their study of Illinois residents, Lloyd and Miller (2010) conjectured that those in favor of TNR but concerned about wildlife viewed feral cats as part of the natural spectrum of wildlife. The Stanford cohort appeared to be more sophisticated than Lloyd and Miller who suggested their respondents were of the understanding feral cats are not functional members of the natural ecosystem, and others follow the Illinois perception that feral cats may function as a part of the new natural spectrum of wildlife.

Stanford respondents are split in this study in their opinions over whether or not feral cats are part of the natural spectrum of wildlife. Some believed feral cats were part of the natural spectrum of wildlife while others understood they were not.

Area

Zinn and Andelt (1999) discovered that those living in close proximity to prairie dog populations had more concerns than those living further away. Bruskotter (2007) suggests those living further from wolf populations have a higher regard for wolves than those in close proximity. This suggests the distance factor plays a part in people's acceptance of wild animals in the ecosystem.

Although no previous studies have looked at feral domestic cats, similar patterns might have been expected. In fact, this study found that Stanford community members exhibited differing degrees of TNR's preference over no control or removal/eradication. Interestingly, respondents tolerated neutered cats in close proximity to human dwellings, preferring TNR over removal/euthanasia in urban and suburban areas. Regarding public and wild lands, respondents were less opposed to removal/euthanasia than its use in urban and suburban areas, contrasting the findings of other authors, such as Zinn and Andelt (1999) and Bruskotter (2007).

For unneutered cats, however, Stanford results paralleled results from these studies of wild predators and vertebrate pests. Some Stanford respondents did not oppose having feral cats left uncontrolled in public areas versus urban and suburban areas. It may be that neutered cats are viewed as attractive pests and are not seen as a threat or a nuisance in close proximity. Unneutered cats may have been viewed as pests in natural areas. It also may

be the case that neutered feral cats were viewed as pets and not as wild animals. Stanford respondents viewed TNR in urban open space such as city parks, office parks, and campus property more like neighborhoods, where they more strongly favored TNR.

Gender

Lloyd and Miller (2010) also found that females were more likely to support TNR than males, who supported other methods of control. In the Stanford population, females were twice as likely to feed feral cats than males, possibly reflecting that females in the Stanford community are more empathetic towards feral cats, perhaps helping explain Lloyd and Miller's results.

Similarly, Ash and Adams (2003) found females to be less likely to perceive cat nuisance factors than males. Although the present survey found no differences between the genders in the assessment of nuisance factors, at Stanford, nuisance factors may not be a big issue for either gender or the perception of nuisance factors may be equal between the genders. There is a strong possibility that the Stanford Cat Network was responsible for keeping nuisance factors to a minimum by keeping feral cat feeding areas orderly and clean.

Age

Martinez-Espiñiera (2006) found older respondents in Canada were more in favor of the lethal control of coyotes. Lloyd and Miller (2010) suggested that younger respondents preferred wildlife to feral cats. The fact that in the Stanford

study the oldest respondents tended to not support TNR as much as younger respondents suggests similar cultural attitudes and correlations by education level.

Education

Stanford respondents with bachelor's and master's degrees scored high in uncertainty regarding support for TNR while, ironically, those with doctorates were actually likely to disagree that cats should be controlled via TNR. It may be the doctorate group of respondents was more conservative than the less educated groups. It appears that the more educated groups were less concerned with feral cat population preservation than the others. This result implies that general education does not supply enough specific education about feral cats, and support for TNR is not increased with higher educational degrees. Targeted education about feral cats may influence appropriate support for TNR.

Pet Ownership

Martinez-Espiñiera (2006) notes that dog ownership decreases approval for lethal coyote control. Dabritz et al. (2006) found remarkable differences between cat, dog, and non-pet owners and their correlation for TNR management with 82% of pet owners in favor of TNR. The current study took the question one step further by including those who own both cats and dogs.

Pet owners, specifically cat owners with or without owning a dog, showed more approval for TNR than non-pet owners. This revealed higher approval and empathy for feral cats from cat owners. Owners of both cats and dogs had an

even higher empathetic response for all animals and did not seem to differentiate between pets and wildlife.

Terminology

Many disciplines have examined the effect of wording on survey response and on public education. Gessler (1999), Barker et al. (2009), and Ogden et al. (2002) studied the effects of scientific language versus familiar terms. These studies suggest a strong correlation between the listener's response and the emotional context of the word.

H_{12} stated that surveys using the colloquial, neutral terminology "removal" and "free-roaming" will create a more positive respondent response for TNR management programs than will those surveys using the scientific, negative terminology "euthanasia" and "feral." This is important because it may be easy to manipulate an audience of survey takers by use of language. The ambiguity of terms may create uncertainty, whereas the negative terms can create a negative response.

Survey results revealed, contrary to predictions, the scientific, precise language resulted in more appeal for TNR. It appeared likely that use of colloquial language such as "removal" created higher degrees of uncertainty and may have led to a lack of understanding when it came to feral cats and their control. In this instance, the use of colloquial terms may have obscured and reduced the impact of the proposed action because they were euphemistic. The use of the word "removal" may not have translated to "kill" in the survey wording,

thus creating confusion. The precise word “euthanasia” has become familiar in language. In contrast, “free-roaming” versus “feral” had no effect on respondents. Additionally, the Stanford community, being a highly educated group, may be more familiar with scientific language.

Conclusions

The majority of Stanford faculty and staff members who responded to the survey favored TNR over euthanasia of feral cats on both public and private lands. This can be problematic where sensitive or endangered species require protection from predation. TNR may not be the best alternative where predation could threaten an existing fragile ecosystem.

Semantics does not appear to make a significant difference as to whether Stanford respondents prefer TNR or euthanasia. The educational supplement may have the biggest impact on the outcome of the survey. A slanted introduction may skew results when respondents lack knowledge of feral cat issues. Proximity to feral cats does not appear to affect respondents’ preferences. This may be because cats are traditionally viewed as pets and familiarity is common.

There is no statistically significant difference between Stanford males and females when it comes to perceived nuisance factors. This is contrary to other surveys where females were less likely to perceive nuisance factors than males. This may be an indication that gender is not the predictor it was thought to be.

Age, education, and homeownership did not affect Stanford respondent preference. Again these factors may not be reliable predictors for feral cat management preference.

Pet ownership does play a role in management preference with cat and cat and dog ownership, revealing more empathy toward TNR than toward removal or euthanasia. The humane treatment of feral cats is of great importance to Stanford respondents. The humane treatment of feral cats can range from TNR to humane trapping and euthanasia. There is indication in the data that TNR is more humane than euthanasia.

The Stanford respondents were unsure as to whether or not feral cats are part of the natural spectrum of wildlife. This confusion leads to a difficult conundrum as to whether feral cats should be controlled or left alone. If they are perceived as part of the natural spectrum of wildlife, less control may be preferred.

Education about feral cat issues was of little importance to the study respondents. Education of feral cat issues is of importance if the ecological balance is of importance. The education of feral cat impacts on wildlife is key in feral cat management programs.

Applications/Recommendations

When it came to sensitive environmental areas, the Stanford population was not in support of wildlife preservation. Wildlife specialists should make the decision to choose eradication or removal to protect threatened wildlife. When it

came to urban and suburban areas, the residents would prefer to weigh in with their opinions. Survey data show that this population was in general support of TNR and public hearings could be held to take into account the population's preferences. Additional survey research of localized population preferences should be conducted to create a pattern potential for feral cat management preferences. Precise language should be used when conducting surveys to avoid misunderstandings created by euphemistic terms. "Euthanasia" should be used instead of "removal" and "feral" should be used instead of free-roaming to avoid confusion. Education about free-roaming/feral cats should be provided to people of all education levels regardless of traditional education levels.

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APPENDIX A: The Stanford Cat Network Agreement

This Agreement was adopted in January, 1989 [1] , and is bilaterally revised as appropriate [2]. It permits *homeless* [3] cats to live on the Stanford University campus [4], subject to population management and continuing care. The Stanford Cat Network is authorized to and responsible for providing this, in coordination with the cognizant University Facilities office [5]. The conditions of this working agreement are as follows:

1. Population control [6] **and continuing care**. The Stanford Cat Network is responsible for making every effort to assure that every homeless Stanford cat is:

a) Sterilized (spayed or neutered)

b) Vaccinated against distemper (4-in-1) and rabies

c) Identified by

1) Registration in the Stanford Cat Registry with a caregiver of record.

2) Ear notch (effective Fall, 1993, for any cat requiring anesthesia) [7].

d) Fed by a caregiver of record who monitors the health and safety of the cat and seeks veterinary care as needed [8].

2. Trapping. Trapping of cats is done by the Stanford Cat Network.

a) Any cat trapped by the University or its outside contractors will be surrendered to the Stanford Cat Network, which assumes responsibility for its identification and disposition [9].

b) The only exception is a cat exposed to hazardous or infectious materials, about whom the University will notify the Stanford Cat Network but will assure its humane euthanization in lieu of surrender

c) The University or its outside contractors will notify of and/or surrender to the Stanford Cat Network any injured, sick or dead cat found.

3. Mediation. Problems involving homeless Stanford cats are reported to the cognizant University Facilities office, which will promptly notify the Stanford Cat Network. They will cooperate to mediate with the parties involved to reach a mutually-agreeable solution [10, 11].

4. Humane education [12]. The Stanford Cat Network will undertake efforts to educate students and other members of the Stanford community in the humane treatment of animals and responsible pet ownership, with the cooperation of University administration. Faculty and staff residing on Campus will be encouraged to spay or neuter, vaccinate and identify their pets.

END NOTES:

1. The Agreement was negotiated in response to the announced intent by the University Administrative Council to trap and euthanize the feral cat population living on the Stanford campus. Primary concern was for the health of the cats, many of whom were diseased and starving in areas where no one was caring for them. This concern was addressed by the conditions of the Agreement, which extended to the entire feral cat population, not only those cats for whom care already was provided. Of secondary concern was the perception that feral cats were decimating the indigenous bird population; however, the impact of loss of habitat to buildings and paved areas also was noted, as well as the abundance of birds and wildlife observed in open areas. Later community concern for the potential health risk to humans was addressed in a memo of November 24, 1992,

from G. Morrow of EH&S to B. Witscher of Facilities (available on request).

2. Initial agreement was approved by the Administrative Council, as negotiated between the University and the Stanford Cat Network. The University was represented by Peter Sidebottom of the Office of Public Affairs, and Herb Fong and Ron Parker of the Grounds Division of Operations and Maintenance, in consultation with Crane Pest Control. The Stanford Cat Network was represented by Dolores Arnold, Patricia Elsen, Carole Hyde, Carole Miller, Christina Peck and Hildegard Taleghani. Revisions have been made by agreement between Herb Fong, Ron Parker and Stanford Cat Network representatives named above.

3. *Homeless* describes all cats whose ownership is not claimed by anyone independently of the volunteer caregiver under the auspices of the Stanford Cat Network. Wild and semi-wild cats are released on Campus to the care of a caregiver of record; however, every effort is made to find the owners of tame stray cats. Unclaimed stray cats and any kittens are boarded or fostered until they can be placed permanently in carefully-screened adoptive homes. No cats are euthanized unless medically warranted by a consulting veterinarian.

4. The original area referenced in the Agreement encompasses the main campus, student housing and the Medical Center--including Hoover Pavilion, the Childrens Hospital at Stanford (CHAS) and the main Hospital/Medical School complex. Ongoing efforts extend to SLAC, faculty/staff housing, the golf course, stables and Stanford Barn, Welch Road and beyond.

5. Coordination and cooperation with the University has been through the Grounds Division of Facilities which is responsible for implementation of the Agreement by the University.

6. The homeless cat population was stabilized at about 250 healthy animals and is decreasing slowly through natural attrition. In recognition that this is a dynamic

situation, the Stanford Cat Network diligently monitors the cat population for newcomers, who are trapped before they are assimilated into the Campus cat population and begin reproducing. See Note 4 above.

7. Initially, cats were required to be collared and tagged. However, cats repeatedly lose collars, and collars are unsafely worn by wild and semi-wild cats. The veterinary staff of the Palo Alto Low-Cost Spay/Neuter Clinic, with whom the Stanford Cat Network cooperates in the spay/neuter program, will not collar any cat if it must be done under restraint or anesthesia. As of February 2001, microchip identification is being utilized for cats trapped and re-released.

8. See document Feeding Guidelines, June, 1993.

9. Because many cats behave wildly when trapped and many cats lose their collars and tags, it cannot be readily determined whether a trapped cat is wild/tame, homeless/owned pet. See Note 4 above.

10. Problems are most effectively resolved on site, by changing feeding times or relocating feeding stations within the same area (See document Feeding Guidelines, June, 1993). Relocating cats away from their established territories often results in: a) uprooted animals wandering away from relocation sites and caregivers losing track of them, which undermines the program of continuing care; b) other cats moving in to the vacated territory without oversight of a caregiver; and c) the cat population being concentrated in limited areas, which potentially increases its environmental impact on humans, wildlife and itself in those areas (The natural distribution of the homeless cat population minimizes such impact across Campus).

11. The only exception to on-site resolution of problems involving homeless Stanford cats is the Cat Exclusion Zone encompassing the Facilities/Athletics area in the vicinity of the Child Care Center on Pampas Lane (memo of

November 18, 1993, from Herb Fong to Carole Miller available on request). Many cats have been relocated from the Cat Exclusion Zone to the designated CHAS Relocation Site. Cognizant Facilities staff are responsible for monitoring the remaining cats in the Cat Exclusion Zone for any population increase or health problems, notifying the Stanford Cat Network and cooperating in further relocation as necessary.

12. Experience indicates that Stanford students are the source of most tame stray cats on Campus. Every year most hungry, tame strays show up at Campus feeding stations coincident with the beginning of the schoolyear, quarter breaks and after school is out in June. The Stanford Cat Network supports University Housing Policy which prohibits student residents from having pets in or around Campus housing. It endeavors to discourage students from adopting cats and then abandoning them and offers assistance as appropriate. The Stanford Cat Network also is instrumental in helping faculty and staff residents of Campus find lost pets.

APPENDIX B: Survey

Pilot Survey

Pilot Introduction Email

Subject: A SJSU Student needs your feedback!

Hello. My name is Rachel Wilken, I am a graduate studies masters student at San José State University, I am doing my thesis on cat management on the Stanford campus. I selected you from a small list of people whom I hope can give me some constructive criticism and timing feedback for a pilot survey, The survey should take 15 minutes or less depending on your decision to answer optional open-ended questions.

There will be a page at the end of the survey for your comments or you can email them directly to me at rae.sjsu@gmail.com. I will also provide this address in the survey for your convenience.

Your help is invaluable to me as I know your time is to you, I cannot thank you enough for your assistance.

Very Sincerely, Rachel Wilken

Pilot Survey First Page

Pilot Survey Notes:

Thank you for coming to my survey! Here I will provide you with a few short details to help explain what you are about to see.

There are four survey designs, You will receive only one.

The four designs are written to test survey response as well as public opinion, Two surveys include educational supplements, To further complicate my thesis I am also using different language for referring to cats and management, Half of the surveys will use formal, unsympathetic language and half will use familiar, sympathetic language. This is only of consequence to you for the purposes of your feedback.

Again thank you for your help.

You can note the time you started in the box below. There will be a page at the end of the survey for your end time and any estimated interruptions. Text box

Pilot Survey Last Page
Pilot Survey Comments

You may answer directly here or to my email address at rae.sjsu@gmail.com.

Please note your end time here and any estimated interruptions that may have extended your total survey response time. If you time yourself, please note the total time here.

Please also include any feedback that you feel may help to improve my project.

THANK YOU! Text Box

Pilot Survey results indicate that surveys without educational supplements are

subject to respondents unfamiliar with feral/free-roaming cat management not understanding the questions, This degree of uncertainty skews the results, as it cannot be determined why they are answering with uncertainty. The Pilot survey has led to the omission of surveys without educational supplements,

Additionally, a number of design changes were made within the survey to increase readability, A large section of open-ended questions were deleted due to the length of the survey and their lack of pertinence to the hypotheses.

Survey

First email sent 06/22/2010

INTRO EMAIL # 1:

SUBJECT: IMPORTANT! Your feedback is appreciated

Hello. You have been randomly selected from a small group for a quick survey about cats on the Stanford campus. The subject of the research is environmental policy regarding cat management preferences, and results will be used to support a graduate thesis in the field of Environmental Studies. The survey should take only a few minutes depending whether you choose to answer optional open-ended questions.

Your participation is voluntary, anonymous and confidential. You have the right not to answer any of the specific questions. You can withdraw at anytime with no negative effect on your relationship with any participating university. Surveys will be codified and password protected in a locked computer available only to the researcher. Results will be discarded no later than three years from collection.

Second email sent 06/29/2010

INTRO EMAIL # 2:

SUBJECT: A student needs your feedback!

Hello again. I am writing to ask once again for your participation in my online survey. You have been randomly selected from a small group for a quick survey about cats on the Stanford campus. The subject of the research is environmental policy regarding cat management preferences, and results will be used to support a graduate thesis in the field of Environmental Studies. The survey should take only a few minutes depending whether you choose to answer optional open-ended questions.
Again, your participation is voluntary, anonymous and confidential. You have the right not to answer any of the specific questions. You can withdraw at anytime with no negative effect on your relationship with any participating university. Surveys will be codified and password protected in a locked computer available only to the researcher. Results will be discarded no later than three years from collection.

Third email sent 07 05 2010

INTRO EMAIL # 3

SUBJECT: PLEASE HELP! A student needs your feedback!

Hello again. I am writing to ask once again for your participation in my online survey. Your feedback is very important to my study. You have been randomly selected from a small group for a quick survey about cats on the Stanford campus. The subject of the research is environmental policy regarding cat management preferences, and results will be used to support a graduate thesis in the field of Environmental Studies. The survey should take only a few minutes depending whether you choose to answer optional open-ended questions.
As before, your participation is voluntary, anonymous and confidential. You have the right not to answer any of the specific questions. You can withdraw at

anytime with no negative effect on your relationship with any participating university. Surveys will be codified and password protected in a locked computer available only to the researcher. Results will be discarded no later than three years from collection.

No 4th email was sent as the 10% response rate was met with the 3rd email.

Educational Supplement

Thank you for coming to my survey!

[references available for your optional viewing at the end of the survey].

Cats have been very popular pets for many years. Domesticated cat abandonment however, has been strongly associated with pet cat popularity. Abandonment has created a population of domesticated cats that are not socialized as pets and have reverted to a wild predominantly unadoptable state. These cats are considered "feral cats." Feral cats easily adapt to a wide range of living conditions. They can be seen as a problem for both sanitation and the local ecology if left unmanaged.

Some researchers believe feral cats decimate wildlife populations, however most scientific studies do not differentiate between excessive urbanization, owned-outdoor cats and feral cats. Feral cats do predate small animals, yet available data do not reliably quantify to what degree this occurs.

The traditional method of controlling feral cats has been to catch and euthanize these animals. A second strategy has been to trap, sterilize and return the cats to their former territories, known as Trap-Neuter-Return (TNR). This management method is considered by some researchers to be the more humane alternative.

Some TNR programs also include vaccinating against diseases, monitoring and responsibly feeding feral cat colonies. Properly managed, TNR can reduce feral populations over time. TNR also serves to stem a flood of secondary pest resurgence.

Researchers note that cats do not differentiate between pests and valued wildlife. Domesticated owned cats continue to predate though they are well fed by their owners. Diseases carried by outdoor cats can have a negative impact on human and wildlife health. Fleas and ticks often associated with outdoor cats can range from a nuisance to a disease issue. Unkempt feral colony feeding stations can be unsanitary and attract other pests and wildlife.

Researchers from both sides of the issue confer TNR programs can be successful where highly managed and in appropriate areas. Organizations are working towards standardizing TNR best management practices. Currently, however, there are few systematic methods in place for monitoring people who are responsible for feral cats.

Survey Questions

Yes or No questions

Have you previously heard about Trap-Neuter-Return (TNR) Programs? Yes or No

Are you aware of any feral/free-roaming cats in your neighborhood or location around your workplace? Yes or No

Do you feed or have you ever fed feral/free-roaming cats? Yes or No

Do you make any regular contributions to any conservation groups? Yes or No

Do you make any regular contributions to animal welfare groups other than wildlife groups? Yes or No

Likert Scale Questions

Strongly Agree, 2) Somewhat Agree, 3) Unsure, 4) Somewhat Disagree and 5) Strongly Disagree.

Each question has a text box following the answers for additional comments from the respondents.

Trap-Neuter-Return (TNR) is the only humane option for feral/free-roaming cat control.
The public needs to be educated on feral/free-roaming cat issues.
Only euthanasia/removal is adequate long-term control.
Feral/Free-roaming cat populations need to be controlled.
The humane treatment of feral/free-roaming cats is of great importance.
TNR programs will increase the number of feral/free-roaming cats.
Feral/Free-roaming cats are physically dangerous to people.
Feral/Free-roaming cats need to be euthanized because they are the cause of the decrease in songbirds.
Feeding feral/free-roaming cats reduces wildlife predation.
Feral/Free-roaming cats are unkempt, unhealthy and ungroomed animals.
TNR is a humane option for feral/free-roaming cats.
Feral/Free-roaming cats are part of the natural spectrum of wildlife.
Feral/Free-roaming cats carry disease threatening to humans.
Feral/Free-roaming cats create garbage problems when they scavenge.
Feral/Free-roaming cats kill more pests than they do wildlife.
TNR and feeding feral/free-roaming cats is equal to animal abandonment.
TNR programs can reduce overall feral/free-roaming populations.
Euthanasia/Removal is the humane option for feral/free-roaming cats.
Feral/Free-roaming cats kill more small wild animals than they do pests.
Feral/Free-roaming cats are unsanitary, spray buildings and cause odor issues.

Feral/Free-roaming cats have diseases that are dangerous for wildlife.
Feral/Free-roaming cats should be controlled via TNR programs.

Option Questions

Where should different management methods be implemented? Please enter your thoughts on what type of control should be implemented in the following locations:
A) no control, B) TNR, or C) euthanasia/removal

Each question has a text box following the answers for additional comments from the respondents.

Open Space
Office Parks
Wilderness Preserves
National Forests
Suburban Neighborhoods
Campus Property
City Parks

Educational Supplement Question

Do you feel the educational supplement provided at the beginning of the survey helped you form more informed opinions about the subject?
(Absolutely, somewhat, very little, not at all)
Can you briefly explain your answer? Fill in

Open-ended Question:

Do you have any additional comments you would like to make?

Demographic Questions

What is your gender? Male or Female

What is your occupation/title? Fill In

In which department are you employed? Fill in

What is your age? List options

Under 20	51-60
20-30	61-70
31-40	Over 70
41-50	

Do you own any pets and if so what kind and how many? Fill in

What is your highest education level completed? List options

Did not complete High School	Bachelors Degree
High School	Masters Degree
Trade School	Doctorate Degree
Two Year Associates Degree	Additional or multiple degree: Fill in

Are you a homeowner or do you rent/lease? homeowner, rent/lease

References for Educational Supplement:

Literature Cited: Select either “Show me!” and Skip to reference page. Select “No thanks.” and Skip to Disclaimer Exit

References

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Disclaimer Exit

Surveys will be codified and password protected in a locked computer available only to myself. Results will be discarded no later than three years from collection. There are no perceived risks or compensation for your participation. You have the right not to answer any questions with no repercussions from Stanford University or San Jose State University. In submitting the survey you are stating that you are 18 years of age or older and are giving informed consent to participate in this survey.

Questions may be directed to Rachel Wilken at 650.483.2573
Complaints may be directed to the department Chair, Dr. Lynne Trulio at 408.924.5445
Questions about your participation rights may be directed to Dr. Pamela Stacks at 408.924.2427

EXIT NOTE: THANK YOU FOR TAKING MY SURVEY