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## Proceedings of the Vertebrate Pest Conference

**Title**

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**Permalink**

<https://escholarship.org/uc/item/7gs3d9qm>

**Journal**

Proceedings of the Vertebrate Pest Conference, 26(26)

**ISSN**

0507-6773

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**Publication Date**

2014

**DOI**

10.5070/V426110415

# Social and Economic Aspects of Cat Management in Hawai‘i

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**ABSTRACT:** A large component of natural resources management is ultimately about understanding people. Such is the issue with feral cats, a species whose biology is well understood, but management can be contentious. Hawai‘i in particular is an important location in understanding the human dimensions side of feral cat management given the archipelago’s isolation, tropical climate, cultural history, and native biodiversity. Using both human dimensions and economic approaches, we sought to address the following questions: 1) Do stakeholders want to see changes in feral cat abundance? 2) What damages or benefits are correlated with stakeholder’s desired abundance of cats? 3) Which feral cat management techniques would stakeholders prefer to see employed? and, 4) Is it more cost effective to control feral cat abundance with trap-neuter-release (TNR) programs or trap and euthanize (TE) programs? To address our questions, we conducted both a statewide survey of 6 stakeholder groups across the state of Hawai‘i and developed a benefit-cost model coupled with a population model to evaluate TNR vs. TE. We found that across stakeholder groups a large majority of respondents would like to see a reduction in feral cats, and that support for different management options varied somewhat by stakeholder group. Overall, TNR was the least supported management option across stakeholder groups. Similarly, in a benefit-cost analysis, TNR was more expensive than TE across all range of scenarios. Our findings indicate that although there are differences amongst stakeholders in terms of attitudes and management preferences, that there is a strong consensus that the problem needs to be addressed.

**KEY WORDS:** benefit-cost analysis, consensus convergence models, economic modeling, *Felis catus*, feral cat, Hawai‘i, human dimensions, potential for conflict index, survey, trap-neuter-return, wildlife stakeholder acceptance capacity

Proc. 26<sup>th</sup> Vertebr. Pest Conf. (R. M. Timm and J. M. O’Brien, Eds.)  
Published at Univ. of Calif., Davis. 2014. Pp. 217-219.

## INTRODUCTION

The United States has over 90 million pet cats, of which approximately two-thirds are allowed outdoors (Lepczyk et al. 2010). Recent estimates have suggested that another 60-100 million cats exist outdoors as stray or feral cats, yielding somewhere between 120 and 160 million free-roaming outdoor cats in the country. This large number of outdoor cats poses considerable challenges to conservation, natural resource management, and local governance because of cats’ propensity to depredate wildlife, spread disease, and create a public nuisance. Although these challenges exist nearly everywhere that free-roaming outdoor cats occur, they are of particular importance in places of high conservation values, such as insular environments like the Hawaiian Islands.

Cats were likely introduced to the Hawaiian Islands by European sailors in the late 1700s and early 1800s (Kramer 1971). Because of Hawai‘i’s moderate year-round climate, lack of severe winter, and lack of predators, free-roaming cats face few limitations on survival and reproduction. As a result free-roaming cats are common across nearly all of Hawai‘i’s landscapes, with many existing in colonies. Because of the large numbers of free-roaming cats and widespread presence of feral cat colonies, a pressing need exists to develop management actions and policy initiatives. However, differences in stakeholder views (e.g., see Peterson et al. 2012) and existing policies make the development of management and

policy options challenging.

The central issues surrounding free-roaming cat management are found in the social and economic realm. The biology of cats and their ecological impacts are well understood, but management and policy initiatives are limited by human dimensions, such as differences in stakeholder values and beliefs and the cost of different cat management options. Thus, in order to affect management and policy changes, stakeholder views on cat management and economic tradeoffs need to be understood.

To address the social and economic aspects of feral cat management in Hawai‘i in order to improve management and policy, we have conducted several human dimensions-based studies. Here we address 4 main questions from these studies as follows: 1) Do stakeholders want to see changes in feral cat abundance? 2) What damages or benefits are correlated with stakeholder’s desired abundance of cats? 3) Which feral cat management techniques would stakeholders prefer to see employed? and, 4) Is it more cost effective to control feral cat abundance with trap-neuter-release (TNR) programs or trap and euthanize (TE) programs?

## METHODS

### Assessing Stakeholder Attitudes on Outdoor Cats

As part of a larger assessment of various human dimensions associated with non-native animals, we administered a mail and Internet survey between July and

September 2011 following the tailored design method (Dillman et al. 2009). The survey contained questions about 14 species of introduced terrestrial vertebrates, including feral cats. Here we focus only on the 11 questions related to the perceived abundance and impacts of feral cats (for complete methodology, questionnaire, and survey design, see Lohr and Lepczyk 2014). The questions asked respondents if they would like feral cats to persist in the islands, if they would support the removal of feral cats away from areas with threatened or endangered species, what their preferences are for 7 different management techniques, and basic demographic and behavioral information that we used to define stakeholder groups. The survey was disseminated to 5,407 people from 6 stakeholder groups in 2011 across Hawaiian Islands as follows: agriculturalists (n = 373), animal welfare activists (n = 277), conservation professionals (n = 698), hunters (n = 1,650), native Hawaiians (n = 49), and the public (n = 2,360). The survey and procedures were fully evaluated and approved by the University of Hawaii Committee on Human Subjects (CHS# 18144). Upon completion of the survey, we contacted 5% of non-respondents via telephone or email to request participation in a nonresponse survey.

We used 3 approaches in evaluating the survey data. First, to evaluate the disparity in respondents' desired abundance for feral cats, we used the potential for conflict index (PCI; Manfredo et al. 2003), which ranges from 0 (minimal potential for conflict) to 1 (maximum potential for conflict). The maximum potential for conflict occurs when responses are equally divided between the two extreme values on a Likert scale (e.g., 50% highly unacceptable and 50% highly acceptable; Vaske et al. 2010). Second, to identify the beliefs and values commonly held by stakeholders regarding feral cats, we created wildlife stakeholder acceptance capacity (WSAC) models that compared how people's desired change in the abundance of feral cats related to people's beliefs about the impacts of feral cats and attitudes toward the presence of feral cats (West and Parkhurst 2002, Lischka et al. 2008). Specifically, we used WSAC to ask if people enjoy seeing feral cats, if they see feral cats on the landscape, if they damage property or a source of income, if they pose a health or safety risk to people, if they pose a risk to native species, if they contaminate soil/water, if numbers of feral cats have increased in past 2 years, how often they see feral cats, and whether they would like to see an increase or decrease in feral cat numbers in the future. Third, we used consensus convergence models (CCMs) to develop a consensual ranking of the 7 management techniques (live capture and adoption; live capture and lethal injection; live capture and lethal gunshot; TNR; lethal traps; predator-proof fence; and sharpshooter) for each stakeholder group and for all survey respondents collectively, based upon Regan et al. (2006).

### **Economic Analysis of TNR versus TE**

In Hawai'i, cats are typically managed either through trap and euthanasia (TE) performed by wildlife professionals, or through the trap-neuter-return-manage (TNR) program supported by the Hawaii Humane Society on Oahu (Hawaiian Humane Society 2012). We built a

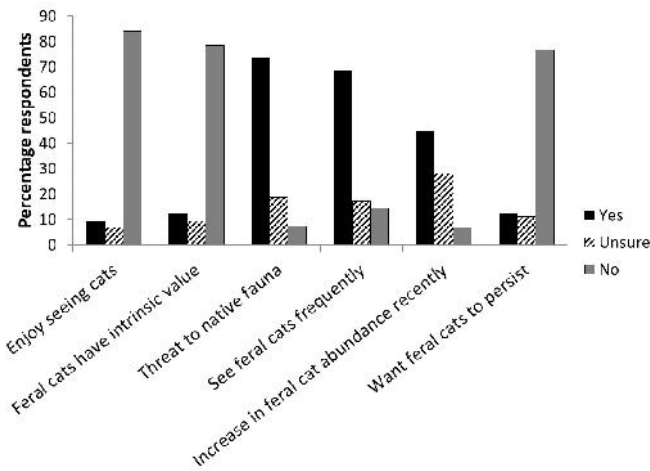
model with STELLA 7.0.3, a systems-modeling program (Gilad et al. 2008, Schmidt et al. 2009) that projected cat abundance in response to each management technique and estimated the costs and benefits over 30 years. Results are averaged outputs from 1,000 iterations of each model simulation to generate abundance, cost, and benefit estimates. To further examine the relative costs of TNR and TE and trap and euthanize programs, we performed a sensitivity analyses on the TNR to TE costs ratio, the TNR benefit-to-cost ratio, and the TE benefit-to-cost ratio. We tested the sensitivity of these parameters against changes in the number of cats, abandonment rate, sterilization rate, trapping intensity, number of birds, predation rate, and the dollar value per bird and against changes in the cost of wages, equipment, identification, food, veterinary care, sterile. For full details on the model construction and parameter estimates, see Lohr et al. (2013).

### **RESULTS**

Overall, 46% of the pre-identified stakeholders and 20% of the public responded to the survey from a total of 1,510 completed surveys. The non-respondent survey revealed that survey respondents and non-respondents had similar interest in wildlife, education level, and average age. The non-respondent survey indicated no notable differences in population characteristics between respondents and non-respondents.

All stakeholder groups, including animal welfare activists and people who feed wildlife frequently, would like to see a moderate decrease in the number of feral cats in Hawai'i. Furthermore, the majority of respondents (78%) supported permanently removing feral cats from the landscape. The PCI analysis found consensus (87%) that outdoor cat abundance should decrease based upon 3 main explanatory variables' weights. Specifically, 84% of respondents did not enjoy seeing feral cats, only 12% assigned an intrinsic value to feral cats, and 73% believe feral cats threaten native fauna. Similarly, the 6 most common explanatory variables in the WSAC models for respondents' desires for the future abundance of feral cats were whether or not they enjoyed seeing feral cats, if feral cats have intrinsic value, whether or not cats pose a threat to native fauna, if they see feral cats frequently, if they have noted an increase in feral cat abundances recently, and whether or not they want feral cats to persist (Figure 1). Finally, CCMs revealed that live capture and lethal injection was the most preferred management technique, whereas TNR was the least preferred management technique (see Lohr and Lepczyk 2014 for complete results of the survey portion of the research).

The benefit-cost analysis demonstrated that TE was the cheapest way to reduce the number of cats, regardless of abandonment rate. This cost effectiveness stems from TE programs being cheaper to run and providing benefits sooner. However, if cat abandonment continues, then costs increase for both TE and TNR, with TE needing to be repeated every 5 years and TNR showing no reduction in the number of cats. In all cases, regardless of the cost assigned to feral cat damage, TE was more cost effective (see Lohr et al. 2013 for complete results of the economics portion of the research).



**Figure 1. The 6 most common explanatory variables for respondents' desires for the future abundance of feral cats.**

## DISCUSSION

In considering the 4 main research questions posed, we found that all stakeholder groups want to see decreases in feral cat abundance; that feral cats are often considered as damaging, leading to a desired reduction in cat numbers; that most stakeholder groups prefer live capture and lethal injection management techniques over TNR; and that TE programs are more cost-effective. Thus, a strong desire exists to reduce and remove feral cats from the landscapes of Hawai'i. Whether such desires can be translated into management actions and policy initiatives ultimately will depend upon the social and political will to bring about change.

Although our findings provide important steps in understanding the social and economic components of feral cat management, work is needed on the front end of the cat management equation by changing policies regarding cat breeding, sterilization, licensing, and allowing cats outdoors. Only through such changes can we increase responsible pet ownership, which will lead to fewer free-roaming cats. Without addressing the owners' responsibility to control cats' breeding and type of roaming, all management options will operate as a form of triage.

## ACKNOWLEDGEMENTS

We appreciate the invitation to present this overview of several of our studies at the Vertebrate Pest Conference. The various projects described were supported by a USDA National Institute of Food and Agriculture, Hatch (HAW00110-H) project, and the Hawaii Department of Land and Natural Resources.

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