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# Deer/elk management actions in suburban environments: what will stakeholders accept?

William F. Siemer, T. Bruce Lauber, Lisa C. Chase, Daniel J. Decker, Rebecca J. McPeake,  
Cynthia A. Jacobson

## Abstract

As stakeholder demands for relief from deer/elk problems in suburban environments mount, so does the importance of understanding public acceptability of potential management responses. We conducted a meta-analysis of 10 studies in suburban areas of New York, Missouri, and Colorado, to correlate 3 variables (i.e. gender, deer population preference, and personal experience with deer or elk problems) with acceptability of deer/elk management actions.

Men were more likely than women to accept lethal management actions. Women were more likely than men to accept nonlethal management actions and a no management approach. People who preferred a deer or elk population reduction were more likely than people who preferred a steady or increasing deer or elk population to accept lethal management actions. The consistency of these findings suggests that they are generalizable across geographic locations.

In general, the analysis showed that people who had experienced deer/elk problems were more likely than those who had not experienced problems to accept lethal management options. However, these findings did not appear for every type of management action or in every location. Findings suggest that the relative importance of problem experiences varies by location. Thus, a situation analysis to characterize the local importance of given experiences may enhance local deliberations about management.

This work identifies useful paths for reanalysis of existing databases, as well as design of new research instruments to explore acceptability of wildlife management actions within a comprehensive theoretical framework on risk perception.

## INTRODUCTION

Wildlife managers and suburban stakeholders increasingly are being confronted with the dilemmas of wildlife abundance in and around suburban development. White-tailed deer (*Odocoileus virginianus*) and elk (*Cervus elaphus*) are 2 species creating such dilemmas. With a few notable exceptions, suburban deer management conflicts are a relatively new challenge facing wildlife agencies and local municipalities. Substantial suburban deer populations are now present in at least

42 states and 195 major metropolitan areas (Conover 1995). Many of these populations are of very recent origin - 41% were not present before 1970 and 21% were not present before 1980 (Conover 1995). A number of suburban elk herds have become established recently, as well. As deer and elk become abundant, public concern about related problems increases, as do actual problems such as damage to ornamental and garden plants, risk of disease

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### Authors' address:

William F. Siemer, T. Bruce Lauber, Lisa C. Chase, and Daniel J. Decker, Human Dimensions Research Unit, Cornell University, Ithaca, NY 14853

Rebecca J. McPeake, University of Arkansas Cooperative Extension, P.O. Box 391, Little Rock, AR 72203

Cynthia A. Jacobson, Alaska Fish and Game, Division of Wildlife Conservation, 333 Raspberry Road, Anchorage, AK 99518

transmission to people and pets, and risks of vehicular accidents. Elevated concerns about deer and elk problems and actual problem incidence often lead to public controversy about these species and their management. In more than half of the recognized metropolitan deer populations, wildlife agencies did not begin receiving public complaints about deer-related problems until the 1980's (Conover 1995).

Wildlife professionals need a thorough understanding of the stakes and stakeholders involved in issues of locally abundant suburban wildlife to make socially acceptable management decisions and develop relevant research agendas. As stakeholder demands for relief from wildlife problems in suburban environments mount, so do the importance and urgency of understanding public acceptability of various methods for managing wildlife.

Most of the research on acceptability of suburban deer/elk management practices is very recent and hypotheses about explanatory variables are still emerging. As the number of independent studies on this topic increases, opportunities arise for research synthesis that can identify patterns and generalizable relationships across studies. Collectively, the authors have obtained data about acceptability of deer/elk management options from over 6,800 people in 10 different metropolitan areas in New York, Missouri, and Colorado (Stout and Knuth 1995, Loker 1996, MDC 1997a, MDC 1997b, Stout et al. 1997, Chase and Decker 1998, Lauber and Knuth 1998, Chase et al. 1999a, Chase et al. 1999b, Loker et al. 1999). Our purpose in this paper is to explore assumptions about a subset of the variables thought to influence acceptance of lethal, nonlethal, and "no action" deer/elk management alternatives in suburban areas.

### **Exploring Assumptions about Acceptability of Management Actions**

**Gender.** Several researchers have explored gender issues related to wildlife management over the past two decades. Among these is a national study completed by Kellert and Berry (1981). Work by Kellert and others has identified gender differences with regard to wildlife-related knowledge, activity involvement, and attitudes. Studies have tended to find that men have greater knowledge of animals than women (Kellert and Berry 1987) and are more likely than women to hunt and trap (USDI 1997). Studies have indicated that men are more likely than women to have a utilitarian orientation toward wildlife (Kellert and Berry 1987). Women are more likely than men to hold a strong humanistic or moralistic orientation toward animals (Kellert and Berry 1987). The stronger humanistic and moralistic orientations among women were consistent with findings that women in the study were more likely than men to

hold strong animal welfare concerns and oppose hunting and trapping (Kellert and Berry 1987). Reflecting on their own research findings, Kellert and Berry (1987:365) remarked that, "We must conclude that gender is among the most important demographic factors in determining attitudes about animals in our society." In this study, we explored the assumption that men are more likely than women to accept lethal deer/elk management actions.

**Deer Population Preference.** Studies of both rural landowners and suburban residents have demonstrated that desires for a smaller deer population are generally related to concern about and actual experience with deer-related problems. Some studies have also found a correlation between preferences for a deer/elk population decline with greater acceptance of lethal management options (Loker 1996).

Lauber and Knuth (1998) found that residents who preferred lethal management techniques were likely to want a moderate decrease in the deer population. Residents who preferred reproductive control of deer tended to want only a slight deer population decrease. Those who preferred other nonlethal techniques tended to want little or no decrease in deer numbers. In this study, we explored the assumption that stakeholders who desire a decrease in deer numbers are more likely than other stakeholders to accept lethal management actions.

**Personal Experiences with Deer/elk Problems.** Several studies have correlated actual experience with deer-related problems with higher acceptance of lethal deer management options. Personal experiences with deer/elk problems vary across individuals. Perceptions also vary about the actual severity of deer/elk problems one has encountered. Suburban residents who believe they incur "large" amounts of damage by deer often feel that the damage they have suffered is unreasonable (Decker and Gavin 1985, Connelly et al. 1987). However, researchers have found that the amount of damage that is defined as "large" and intolerable varies from one stakeholder to another (Siemer and Decker 1991).

As suburban deer management issues developed across the country, wildlife management agencies found little public acceptance of lethal deer management options until residents began to perceive the level of deer-related problems as very severe (McAninch 1995). Indeed, studies have suggested that suburban residents become more likely to accept lethal management options as their perceptions of deer/elk problems become increasingly severe (Loker et al. 1999). In this study, we explored the assumption that people who have personal experience with deer/elk problems are more likely to accept lethal management actions.

Researchers and managers have assumed that stakeholder acceptance is more likely to be influenced

by human health and safety concerns (e.g. Lyme disease, deer-car collisions) than by concerns about aesthetic, nuisance, or economic problems (e.g. damage to ornamental plants, Decker 1991). Several studies have supported the assumption that suburban residents are more likely to accept aesthetic and economic problems than threats to human health and safety (Decker and Gavin 1985, Stout and Knuth 1995, Connelly et al. 1987). In a statewide study of Colorado residents, Wittman et al. (1998) found support for the assumption that acceptance of lethal control actions increases as perceived threat to human health or safety increases. Recent work by Loker et al. (1999) has brought the consistency of this relationship into question. Loker et al. (1999) found that acceptance of lethal methods for deer control was more closely related to concerns about nuisance and economic damage than to concerns about the risks deer pose to human health and safety. In this study, we explored the assumption that personal experience with health and safety threats from deer are more likely than experiences with plant damage to produce acceptance of lethal management actions.

## METHODS

We explored the preceding 4 assumptions through secondary analysis of mail and telephone survey data from 10 separate study sites (Table 1). All of the studies were conducted with metropolitan audiences. The data were collected between 1992 and 1998. Five were completed in Missouri, 4 were completed in New York State, and 1 was completed in Colorado. Detailed information about the instruments, methods, and populations surveyed for each of these studies appears in the literature sources cited in Table 1.

We were interested in understanding more about acceptance of management options in 3 broad categories: lethal options (i.e. method includes death of deer by design), nonlethal options (i.e. death of individual deer may result, but as an unintended outcome), and "no action" options (i.e. methods that involve an active choice not to take deer management actions). We chose to explore acceptability of 8 particular management options that represented a range of approaches to deer management.

We examined 3 options that we placed in the nonlethal category (i.e. using fencing to keep deer away from property; sterilizing or contracepting deer, and trapping deer and moving them to another location). We examined 4 options that we placed in the lethal category (i.e. use sharpshooters to cull deer, allow regulated archery hunting, allow regulated firearms hunting, or trap and euthanize deer). We examined 1 option in the "no action" category" (i.e. let nature take its course with no human interference).

We were interested in examining explanatory variables related to personal characteristics, attitudes, and experiences with deer/elk. We chose to analyze gender, deer population preference, personal experience with a deer/elk car collision, deer/elk damage to landscape plantings, and deer/elk damage to vegetable gardens. We chose these particular variables because they represented a subset of potential explanatory variables that had been measured in  $\geq 8$  studies.

For some items related to acceptability of management options, wording varied slightly across studies. Measures of deer population preference also varied by study. In Missouri, respondents reported whether they believed that the deer population was too small, too big, or about the right size. In all other study locations, respondents were asked if they preferred that the deer population increase, decrease, or remain about the same.

## Analysis

We conducted our analysis in 2 phases. In phase 1, we analyzed each study separately. Depending on the study, respondents were given 4 or 5 response options for expressing their level of acceptance for a particular management option. In every case the scale anchor points were "not at all" acceptable and "very" or "extremely" acceptable. We standardized the data by recoding management option items into a 3-point scale (1 = not at all acceptable; 2 = somewhat acceptable; 3 = very acceptable).

Explanatory variables were treated as dichotomous variables. Gender was coded as male or female. Personal experience with deer/elk problems was coded as present or absent. Respondents in each study had been offered 3 response options to express their deer population preference. We collapsed responses on deer population preference into 2 categories: as preference for a population decrease vs. a preference for no change or a population increase.

We used paired t-tests to identify differences in mean values for acceptability of the 8 management options based on gender, deer population preference, or problem experiences. We then calculated grand means and conducted t-tests to identify differences in acceptability across all studies. Differences are reported at the 0.05 level of significance.

Phase I of the analysis allowed us to recognize significant differences between analysis subgroups at the individual study level. Phase II of the analysis provides some indication of the degree to which differences are generalizable across study sites. This analysis approach assumes that variability does not differ by site. In reality, variability probably does vary by site, but this approach is sufficiently robust to accommodate such an assumption violation.

## RESULTS

### Gender

Men and women differed in their acceptability of all 8 management actions. Acceptance of lethal management actions was consistently higher among men. Acceptance of non-lethal actions and the no management option was consistently higher among women (Table 2). In every study where men and women differed, we observed the same pattern in acceptance of lethal, nonlethal, and no action options. For example, in 9 of 10 studies, men were more likely than women to accept regulated archery hunting as a management option (Figure 1).

### Deer Population Preference

People who preferred a deer population decrease were more likely than other people to accept all 4 lethal management actions. People who preferred that the deer population remain the same or increase were more likely than other people to accept nonlethal actions and a no management approach (Table 2).

People who preferred a deer population decrease were more likely than other people to accept reproductive control as a deer management option. Those who preferred that the deer population remain the same or increase were more likely to accept fencing and a no management approach. There was no difference in acceptance of deer/elk trap and transfer approaches based on deer or elk population preference (Table 2).

The direction of differences was consistent across studies and was particularly strong for some management actions. For example, in 8 of 9 studies, people who preferred a deer/elk population decrease were more likely than other people to accept regulated archery hunting as a management option (Figure 2).

### Experience with Deer/elk-Vehicle Collisions

People who had been personally affected by a deer/elk-related vehicular accident were more likely than people without such experiences to accept regulated archery or firearms hunting as management actions (Table 2). People who had not been personally affected by a deer/elk-related vehicular accident were more likely to accept fencing or no action as management actions (Table 2). Significant differences were not detected in all individual study locations even when meta-analysis revealed significant differences overall for attitudes toward a particular management option.

### Experience with Deer/elk Damage to Gardens and Landscape Plants

People who had been personally affected by deer/elk damage to gardens were more likely than people who had not experienced such damage to accept use

of sharpshooters or archery hunting as management actions. People who had experienced damage to landscape plantings were more likely than people without such experiences to accept use of sharpshooters as a management action. Those who had experienced damage to landscape plants were also more likely to accept 2 nonlethal management actions: sterilizing or contracepting animals and transferring trapped animals to other locations. People who had not been personally affected by damage to gardens or landscape plantings damage were more likely than those with damage experience to accept no action or fencing property as management actions (Table 2). Overall, past experience with plant damage appeared to explain as much variation between subgroups as did past experience with vehicular accidents.

## DISCUSSION AND IMPLICATIONS

### Gender

Our findings support the assumption that men are more likely than women to accept lethal deer/elk management actions. The fact that gender differences appeared consistently in different regions and circumstances suggests that these findings are generalizable across geographic areas.

Lauber et al. (2001) provide a possible explanation for why men and women might hold different attitudes about various management actions.

They concluded that women consider more criteria than men when evaluating management options. Men consider criteria like effectiveness and speed. Women, on the other hand, seem to find management actions more acceptable than men if the action meets criteria in addition to effectiveness and speed, such as humaneness. Arguably, lethal methods are the *least* likely to fulfill these additional criteria — they are very efficient, but have other drawbacks. These drawbacks may not be as important to men, which would explain their higher acceptance of lethal management actions. For many people, perceptions of humaneness are correlated with perceptions of whether a method is lethal or not. That may help explain why the lethal/nonlethal categorization of methods we used for this analysis worked so well with gender as an explanatory variable.

Our findings related to gender have multiple implications for wildlife managers. Managers can anticipate gender differences and can take necessary steps to insure that both men and women are involved in community deliberation about deer management. When surveys are utilized to inform a deer management situation analysis, steps should be taken to involve appropriate proportions and male and female subjects. Data should be weighted by gender if information cannot be obtained from representative

proportions of male and female community residents. Information and education processes should be designed with the knowledge that men and women will often hold different perspectives on lethal and nonlethal management options.

### **Deer Population Preference**

Our findings support the assumption that people who prefer a deer/elk population decrease are more likely than other people to accept lethal deer/elk management actions. These findings have high face validity and may come as little surprise to the careful observer of suburban deer management. They do, however, provide quantitative documentation that should allow wildlife managers to have greater confidence in some of their working assumptions about the relationships between acceptance of various deer/elk management actions and species population preference.

Although our grouping of management actions into lethal and nonlethal categories worked well for an analysis of gender differences, that grouping was not as useful for understanding differences related to deer or elk population preference. For example, we found that people who preferred a population decrease were more willing to accept lethal actions, but also 1 nonlethal approach (i.e. deer sterilization or contraception). One interpretation of the findings on population preference is that people who want a deer or elk population decrease are more likely to accept methods that will have a direct impact on the size of the deer or elk population. Such an interpretation would be consistent with most of our findings and it has high face validity. It is reasonable to expect that people who want a decrease in the deer population would prefer methods that they believe will affect the size of the deer or elk population. For example, Lauber and Knuth (1998) categorized management actions into groups based on their ability to impact the size of a deer population. They found that respondents viewed all "nonreduction methods" similarly.

This leads us to hypothesize that the link between population preference and acceptability of management actions is probably different from the link between gender and acceptability of management actions. It seems reasonable to hypothesize that the primary consideration for those who want a population decrease is not whether a management action is lethal or not but whether it could be expected to lead to a decrease in the deer or elk population. This approach to investigation of population preference and management action acceptance should be more thoroughly explored with further analysis of these data.

### **Personal Experience with Deer/elk Problems**

Our findings support the assumption that acceptance of lethal management actions will increase as people gain direct experience with deer/elk problems. However, variation across study sites suggests that the precise relationship between personal experience and management option acceptance may still vary by locale.

Our findings suggest that experience with plant damage is just as likely as experience with health and safety threats to explain acceptance of wildlife management actions. The relative influence of particular experiences such as deer-car collisions or damage to gardens and landscape plantings does not seem to be generalizable across geographic locations. Our analysis does not provide compelling evidence of a hierarchy in perceived severity of deer-related problems, with risk to human health and safety being perceived as the most severe deer- or elk-related problem. We believe these relationships are context-dependent. In some communities, perceived risks of experiencing a vehicle collision involving deer or elk may be the most important factor influencing management action acceptance. Damage to vegetable or flower gardens may be most important in another community. In still other communities, damage to ornamental shrubs and trees may be the most important experience influencing management attitudes.

Some researchers suggest that experience with deer-related problems influences deer population preferences which, in turn, influence perceived acceptability of different methods. In other words, they suggest that one should expect a less direct relationship between experience with problems and acceptability of methods than between population preference and acceptability of methods. Such an interpretation is consistent with our findings. Future efforts should be made to reanalyze these data such that this hypothesis could be tested.

Our findings on problem experiences and management action acceptability have multiple implications for wildlife managers. Among other things, they provide added justification for communities to conduct some form of situation analysis to quantify the relative importance of particular issues to local residents. These findings also give managers additional evidence that the relationship between experiences, perceptions, and acceptance of management actions can be complex.

### **Explaining Acceptance of Management Actions: Future Research Needs**

Surveys measuring stakeholders' attitudes, beliefs, preferences, and experiences hold promise as tools to characterize stakeholder acceptance of manage-

ment actions where suburban wildlife populations are locally abundant. Our analysis yields additional insight about the types of indicators that may be useful for this purpose. This work contributes to a growing body of survey research that can inform deliberation as wildlife agencies and communities consider their options for addressing local concerns about suburban wildlife problems.

This analysis identified patterns that should be used to frame more focused questions about the ways in which problem experiences, especially experiences with health and safety risks, influence acceptability of management actions. The findings from this analysis should be used to formulate research hypotheses that can be subjected to quantitative analysis within a comprehensive theoretical framework on risk perception. We hope that these findings will give researchers valuable information about useful paths for reanalysis of existing databases, or design of new research instruments to explore acceptability of wildlife management actions in suburban areas. Some of those possible research questions were elaborated in the previous section. However, our analysis focused on just a few of the factors that help explain why people accept particular management actions. The following explanatory factors have been suggested and also need to be explored further through careful human dimensions inquiry.

Some research suggests that perceived characteristics of a management practice influence acceptance of that practice by suburban residents. Suburban residents may evaluate a management technique based on their perception of its effectiveness, speed of results, risks it poses to people and pets, and the degree to which it minimizes animal suffering (Stout and Knuth 1995, Loker 1996, Kilpatrick and Walter 1997, Stout et al. 1997, Lauber and Knuth 1998).

Stout and Knuth (1995) found that perceptions about the health of the deer herd and impact of the deer population on other animals and plants were among the most important considerations suburban residents used to evaluate the acceptability of management techniques. The least important criteria suburban residents used to evaluate the acceptability of management actions were the economic, public use, and recreational benefits that deer provide to people (Stout and Knuth 1995). However, economic, public use, and recreational benefits were important to a subset of suburban residents – those who accepted lethal management actions.

Lauber and Knuth (1998) found evidence that acceptability of management techniques is correlated with experiences with deer (i.e. whether one sees deer around the home; consumptive and nonconsumptive interests in deer) and perceptions about whether an increase in a local deer population is due to political factors (e.g. government inaction), natural factors

(e.g. absence of predators), or social factors (e.g. reduced problem tolerance, human encroachment on deer habitat). They also found that suburban residents who prefer lethal management actions based their preferences on relatively few criteria - protecting human health and safety, effectiveness, and minimizing personal costs of implementation. Residents who preferred deer fertility control as an option placed priority on a broader range of concerns. They tended to place higher emphasis on considerations such as humaneness, protecting other wildlife, minimizing animal death or use of firearms, and choosing techniques that had political support. Those preferring other nonlethal actions also considered a broad range of criteria important when evaluating management actions. Compared to those who preferred lethal techniques, these residents were less likely to consider option effectiveness, speed of results, and providing hunting opportunities to be important considerations.

## ACKNOWLEDGEMENTS

The studies that form the basis for this manuscript were funded by a variety of sponsors. Funding for studies conducted in New York State was provided through the New York Federal Aid in Wildlife Restoration Project WE-173-G and Cornell University Agricultural Experiment Station Project NYC 147403.

The Missouri Department of Conservation funded studies in Missouri. The St. Louis and Kansas City, Missouri studies were conducted by Dr. Rebecca McPeake and Dr. Clark Adams at Texas A & M University. The Springfield study was conducted Dr. Janice Greene at Southwest Missouri State University with assistance by Dr. Rebecca McPeake.

Funding for the Evergreen, Colorado study was provided by the EPA STAR Graduate Fellowship Program, the Morris K. Udall Scholarship and Excellence in National Environmental Policy Foundation, the Cornell University Agricultural Experiment Station, and the Cornell University Graduate Fellowship Office.

We thank Ed Frongillo for statistical consultation. Members of the Human Dimensions Research Unit at Cornell University assisted with many of the studies reported in this manuscript.

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Table 1. Studies and data sets utilized to conduct secondary analysis.

<u>Study Site</u>	<u>Study Date</u>	<u># of Cases</u>	<u>Species</u>	<u>Study reference</u>
1. Rochester, NY	2/92 (mail)	387	Deer	Stout and Knuth 1995
2. Amherst, NY	11/95 (mail)	300	Deer	Loker 1996
3. St. Louis, MO	4/96 (telephone)	1306	Deer	MDC <sup>1</sup> 1997a
4. Queeny Park, MO	4/96 (telephone)	388	Deer	MDC 1997a
5. Burr Oak Woods, MO	4/96 (telephone)	320	Deer	MDC 1997a
6. Kansas City, MO	4/96 (telephone)	1333	Deer	MDC 1997a
7. Springfield, MO	4/97 (telephone)	1,154	Deer	MDC 1997b
8. Irondequoit, NY	1/97 (mail)	910	Deer	Lauber and Knuth 1998
9. Evergreen, CO	4/98 (mail)	342	Elk	Chase and Decker 1998
10. Cayuga Heights, NY	11/98 (mail)	438	Deer	Chase et al. 1999

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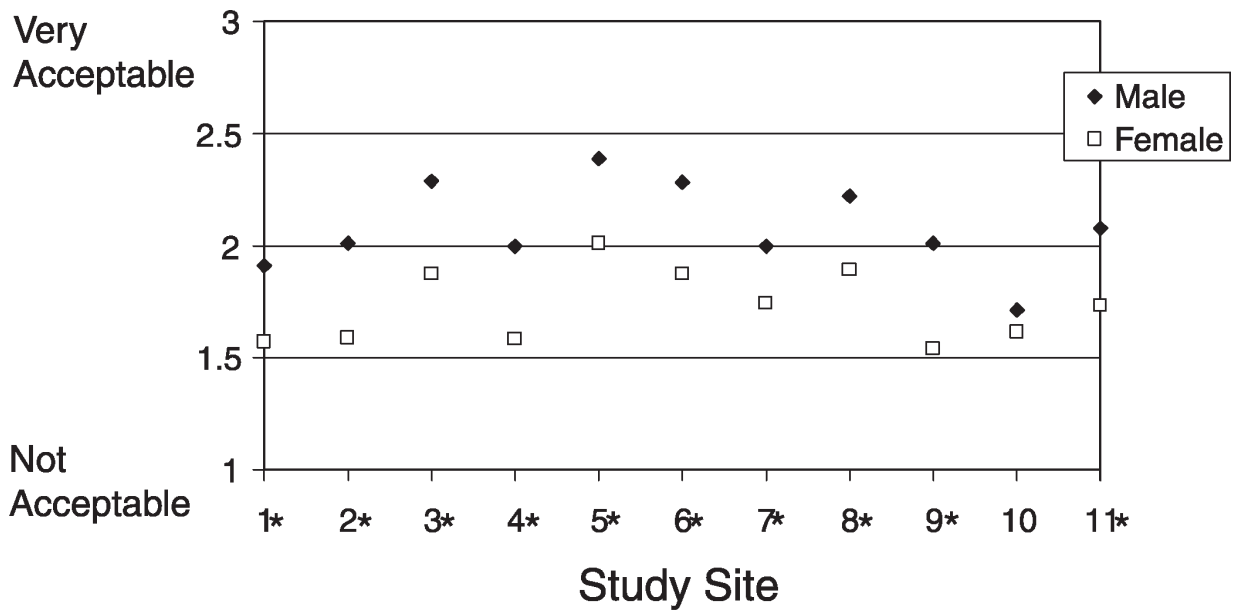
<sup>1</sup> Missouri Department of Conservation.



Table 2. Results of meta-analysis on acceptance of management options by gender, deer population preference, or experience with deer/elk-related vehicular accidents (DRVA's), damage to vegetable gardens, or damage to landscape plantings.

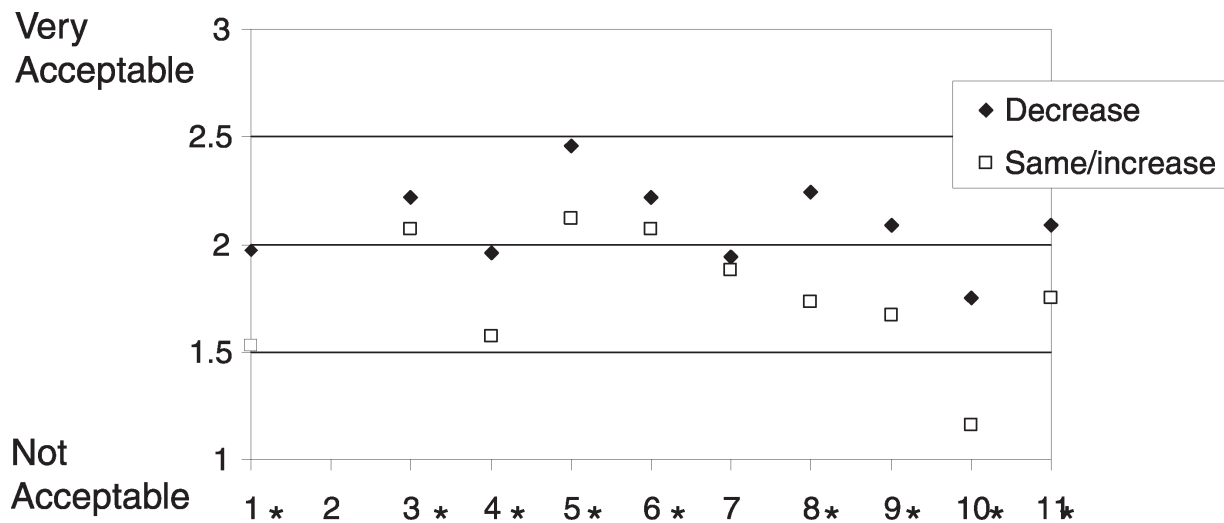
Management Actions	Gender		Deer Population Preference		DRVAs		Garden Damage		Plant Damage	
	Female	Male	Decrease	Same/Increase	No	Yes	No	Yes	No	Yes
Use fences to keep deer away from Property.	2.04 <sup>b</sup>	1.75	1.73	1.98 <sup>a</sup>	1.87 <sup>a</sup>	1.80	1.86 <sup>a</sup>	1.64	1.91 <sup>b</sup>	1.69
Sterilize or contracept deer.	2.00 <sup>b</sup>	1.83	1.96 <sup>a</sup>	1.74	1.93	1.92	1.91	1.92	1.86	1.99
Trap deer and move them to another area.	2.22 <sup>a</sup>	2.10	2.17	2.05	2.13	2.16	2.14	2.07	2.11	2.13
Use firearms sharpshooters to kill deer at bait sites.	1.37	1.58 <sup>a</sup>	1.57 <sup>a</sup>	1.21	1.53	1.59	1.53	1.67 <sup>a</sup>	1.47	1.64 <sup>a</sup>
Allow regulated archery hunting to control the deer population.	1.73	2.08 <sup>a</sup>	2.09 <sup>a</sup>	1.75	1.93	2.02 <sup>a</sup>	1.93	2.12 <sup>a</sup>	1.93	1.99
Allow regulated firearms hunting to control the deer population.	1.59	1.78 <sup>a</sup>	1.81 <sup>a</sup>	1.60	1.66	1.76 <sup>a</sup>	1.68	1.73	1.70	1.74
Drug, capture and euthanize deer.	1.29	1.37 <sup>a</sup>	1.40 <sup>a</sup>	1.22	1.35	1.32	1.39	1.42	1.30	1.42 <sup>a</sup>
Let nature take its course without human interference from now on	1.77 <sup>a</sup>	1.66	1.44	1.99 <sup>a</sup>	1.68 <sup>a</sup>	1.58	1.69 <sup>a</sup>	1.50	1.73 <sup>a</sup>	1.57

<sup>a</sup> Statistically significant difference between groups at P ≤ 0.05 using a paired t-test.



\*Statistically significant difference between groups at  $P \leq 0.05$  using a paired t-test.

Figure 1. Mean acceptability of using regulated archery hunting as a management option, by gender (Site 11 represents results of meta-analysis for all sites).



\*Statistically significant difference between groups at  $P \leq 0.05$  using a paired t-test.

Figure 2. Mean acceptability of regulated archery hunting as a management option, by deer population preference (preference for a decrease vs. preference for stable or increased population (Site 11 represents results of meta-analysis for all sites).