

Running Head: SUBURBAN DEER MANAGEMENT CONFLICT

Acceptability and Conflict Regarding Suburban Deer Management Methods

(Manuscript *b*)

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Abstract

Natural resource agencies and the public often agree on reasons to manage white-tailed deer (*Odocoileus virginianus*) in suburban areas; however, there is frequent disparity in which deer management method is most acceptable. We surveyed 660 residents around 22 conservation areas in a suburban Illinois county to evaluate the acceptance and the potential for conflict of interest regarding 5 deer management methods countywide, in urban and rural areas, and in high (≥ 11 deer/km²) and low (≤ 9 deer/km²) deer density areas. Archery hunting was the most acceptable method followed by gun hunting, sharpshooting, and fertility control; conducting no deer management was unacceptable ($p < .001$). Archery hunting and no deer management had the least conflict among residents; fertility control had the most conflict ($.001 \geq p \leq .01$). We recommend managers conduct surveys that incorporate public conflict regarding deer management methods to gain information that may guide education and resolve management disputes.

Keywords: density, management, *Odocoileus virginianus*, potential for conflict of interest, survey, white-tailed deer

Introduction

White-tailed deer (*Odocoileus virginianus*) have become readily adapted to anthropogenic landscapes and have become overabundant in many locations. High deer densities in developed areas have become increasingly common: Lake County, Illinois, 12-35 deer/km² (Urbanek, Nielsen, Preuss, & Glowacki, 2012); Carbondale, Illinois, 18 deer/km² (Hubbard & Nielsen, 2011); Bloomington, Minnesota, 28.9 deer/km² (Doerr, McAninch, & Wiggers, 2001); Cuyahoga Village, New York, 31 deer/km² (Curtis, Boldgiv, Mattison, & Boulanger, 2009); Bridgeport, Connecticut, 73 deer/km² (Magnarelli, DeNicola, Stafford III, & Anderson, 1995). Currently, 74% of state biologists within white-tailed deer range have affirmed that deer populations are increasing in urban and suburban areas in their state and 97% of these biologists consider management of suburban and urban deer a concern (Urbanek, Allen, & Nielsen, 2011).

Deer management in developed areas is often a reaction to an increase in public complaints about deer-vehicle collisions (DVCs) and damage to personal property (Kilpatrick & Walter, 1997; Stout, Knuth, & Curtis, 1997; Lauber & Knuth, 2004). Thus, most human dimension studies of suburban deer are conducted at small scales and only include 1 or 2 natural areas where the need to cull deer is imminent (Kilpatrick & Walter, 1997; Kilpatrick & LaBonte, 2003; Lauber & Knuth, 2004; Kilpatrick, LaBonte, & Barclay, 2007). Natural resource agencies pursue stakeholder participation in deer management via surveys (Connelly, Decker, & Wear, 1987; Green, Askins, & West, 1997; West & Parkhurst, 2002; Lauber, Anthony, & Knuth, 2001; Kilpatrick et al., 2007), face-to-face interviews (Lauber et al., 2001), town-hall meetings (Kilpatrick & Walter, 1997), and citizen task forces (Stout, Decker, Knuth, Proud, & Nelson, 1996; Stout et al., 1997). All of these methods have proven to be effective in understanding stakeholder perceptions and opinions regarding local deer populations. However, the latter 3

methods are best used on smaller scales (i.e., 1-2 focal communities) unless extensive money and time is available to gain respondents that are representative across the entire region under investigation. Alternatively, managers can access a more geographically-dispersed suite of public participants by deploying surveys via telephone or mail (Siemer, Connelly, Brown, & Decker, 2001). However, few studies have employed these techniques to examine attitudes toward deer or deer management across urban or deer density gradients (Stout et al., 1996; Stout et al., 1997; Kilpatrick et al., 2007; manuscript *a, c*).

In most states, implementation of suburban deer management is limited (Kilpatrick & Walter, 1997; Messmer, Cornicelli, Decker, & Hewitt, 1997; Urbanek et al., 2011) due to safety concerns, conflicting social attitudes and perceptions about deer, hunting and firearm-discharge restrictions, and liability or public relations concerns (DeNicola, VerCauteren, Curtis, & Hygnstrom, 2000). Attitudes and concerns towards deer management in residential areas can vary by a person's gender (Lauber et al., 2001), perceived level of deer-related problems such as DVCs and zoonotic diseases (Connelly et al., 1987; Messmer et al., 1997; Curtis & Lynch, 2001), and feasibility of management options (Messmer et al., 1997). Citizens deem human safety, maintaining a healthy deer herd, and minimizing suffering to deer more important than a method's effectiveness when considering deer management options (Stout et al., 1997). Many communities support a management strategy, but high costs and a long wait until results are observed will decrease support for a management option (Kilpatrick, Spohr, & Chasko, 1997). Thus, deer management in developed areas is often controversial and managers need to assess potential conflict of interest among citizens in order to guide management decisions.

Conflict surrounding the acceptability of different deer management techniques is rarely assessed among public constituents. Most deer studies only report summaries of the percentage

of respondents who think a management option is acceptable (Green et al., 1997; Kilpatrick & Walter, 1997; Stout et al., 1997; Kilpatrick et al., 2007). The potential for conflict of interest (PCI; Manfredo, Vaske, & Teel, 2003; Vaske, Needham, Newman, Manfredo, & Petchenik, 2006; Vaske, Beaman, Barreto, & Shelby, 2010) is one way to provide a thorough examination of conflict. The PCI was developed to statistically assess conflict regarding attitudes, beliefs, or behaviors and to provide a simple graphical representation to facilitate managerial and public understanding of the results (Vaske et al., 2010). The index is on a scale of 0 to 1 where the greatest possibility for conflict occurs when PCI=1, indicating respondents were split on a bipolar issue (e.g., 50% voted highly acceptable and 50% voted highly unacceptable). Alternatively, an index score of 0 would indicate no conflict and would occur when 100% of respondents indicated the same answer (e.g., all voted highly acceptable). Although there have been several studies that have used PCI to examine conflict around management options for other wildlife species (bears [*Ursus* spp.]: Manfredo et al., 2003; grey wolves [*Canis lupus*]: Vaske & Taylor, 2006; desert tortoises [*Gopherus agassizii*]: Vaske & Donnelly, 2007), we are aware of only 2 studies that used PCI in a deer study (Needham, Vaske, & Manfredo, 2004; Vaske et al., 2006). These deer studies, however, only investigated hunter behaviors in response to management actions related to chronic wasting disease. Thus, there has been no study to our knowledge that have used PCI to investigate deer management methods over a large geographic area that encompasses a diverse respondent pool.

Deer biologists must have reliable information concerning human attitudes and conflict toward deer management to efficiently manage deer in developed areas (Storm, Nielsen, Schauber, & Wolf, 2007; Urbanek et al., 2011). This information in the literature is limited to small geographic areas and managers would benefit from a study design that examines a larger

region. Our objective was to assess the acceptability and PCI₂ for 5 deer management methods (archery hunts, gun hunts, sharpshooting, fertility control, and no deer management) across an urban and deer density gradient. Kilpatrick et al. (2007) suggested that managers should strive for community consensus regarding suburban deer management at a landscape level rather than focusing on each town individually. Thus, our goal was to identify a deer management technique that would appease the majority of citizens (i.e., high acceptance rate and low conflict) in a suburban county.

Methods

Study Area

McHenry County, Illinois is located approximately 60 km northwest of Chicago and 70 km southwest of Milwaukee, Wisconsin. It is considered 1 of the 6 counties that make up the Chicago Metropolitan Area and encompasses 1,562 km² of land and had 308,760 residents in 2010 (U.S. Census Bureau, 2010). The McHenry County Conservation District (hereafter, District) consists of >10,036 ha in 17 state nature preserves and 29 other sites throughout McHenry County that provide a combination of natural, recreational, education, and cultural resources for county residents and tourists. District biologists conduct sharpshooting, gun hunting, and archery hunting on 24 of the District areas as a proactive deer management strategy and to reduce the spread of chronic wasting disease which has been confirmed in 10 District areas since 2003. The District biologists' decision-making process regarding which deer management technique to use relates to safety, cost, recreation potential, and site-user conflicts. Similar to many natural resources agencies, District biologists are interested in understanding public opinions regarding deer management.

Site Distribution

We assessed the beliefs and attitudes of McHenry County residents regarding deer management methods using a stratified, random sampling design focused on surveying residents living in closest proximity to District areas. We chose 22 District areas which had a broad range of deer densities (2-36 deer/km²), area (58-1,233 ha), and represented areas along an urban-rural gradient. Sites were chosen so that we had 12 District areas with deer densities ≥ 11 deer/km² (mean density = 18 deer/km²; hereafter, high deer density areas) and 10 District areas with deer densities ≤ 9 deer/km² (mean density = 6 deer/km²; hereafter, low deer density areas). Sites were also selected based on level of surrounding urbanization which was estimated via satellite photos and demarcated as follows: >51% residential = urban ($n = 11$); >51% agriculture = rural ($n = 11$). Sites also included a range of proactive deer management activities including archery hunts ($n = 11$); gun hunts ($n = 3$); combination of archery and gun hunts ($n = 3$); and sharpshooting ($n = 1$); no deer management was conducted on 4 sites.

Survey

We collected 100 names and mailing addresses of residents (2,200 names total) living in closest proximity to and surrounding each District area from public property tax data (McHenry County, Illinois, 2011). We selected residents living in closest proximity to District areas so their attitudes toward management could be associated with the deer density of the nearest District area. Additionally, we believed these residents would be the most affected by management decisions (e.g., sights and sounds of gunfire) and thus we hoped targeting this group would provide a large response rate. Names of residents living directly adjacent to District borders were collected first and then names were systematically chosen at increasing distances from the borders (all <1.5 km) until 100 names were collected. Areas that included residents that were in

close proximity to >1 District preserves were not selected to avoid ambiguity. All names and addresses were verified as valid using the United States Postal Service certified software CASS by the Southern Illinois University Carbondale mail center prior to sampling. A random sample of 30 residents was then chosen from each District area sample pool using sampling without replacement. We then mailed a self-administered, mail-back booklet-format survey to each recipient to examine beliefs and attitudes about deer management methods and deer population trends.

We followed a modified version of Dillman's (1978) total design method, similar to most public surveys of wildlife in the literature (West & Parkhurst, 2002; Sullivan & Messmer, 2003; Lauber & Knuth, 2004; Storm et al., 2007; Davenport, Nielsen, & Mangun, 2010). A pre-test of the survey ($n = 15$) instrument was conducted to determine if the average citizen can competently complete and understand all aspects of the survey; syntax was changed accordingly prior to the actual survey launch. Survey methods and questions were approved by the Human Subjects Committee at Southern Illinois University Carbondale. Each recipient was mailed a cover letter explaining the interests of this study and seeking cooperation, and a questionnaire that took <25 minutes to complete. Surveys were mailed in February 2011 and were followed with 2 additional contacts to non-respondents. A new cover letter and replacement questionnaire was sent to non-respondents 6 weeks after the initial mailing. The new cover letter indicated that we had not received the resident's survey and made another appeal for participation. We telephoned a sample of non-respondents from each District area (13% of all non-respondents; 10-18% of non-respondents from each District area) 11 weeks after the original communication. Phone numbers of non-respondents were found via yellowpages.com and yellowbook.com. Non-respondents were asked select questions ($n = 17$) from the survey.

Surveys consisted of 23 multi-part questions that we analyzed in 3 different papers including this article (manuscript *a, c*). In manuscript *a*, we examined non-response bias and found males were more likely to return the survey while females answered telephone questions. Previous studies have noted that woman tend to pass wildlife management surveys to males in the same household who may be more interested in the topic (Chavez, Gese, & Krannich, 2005). Many women who answered via telephone in our survey informed us that they indeed gave the survey to their husbands but were willing to answer questions to aid the survey and research. We asked non-respondents (i.e., telephone respondents) the same questions in the mail and combined answers from both mail and telephone respondents to incorporate the most robust range of respondent perceptions in the county.

Socio-demographic and behavioral characteristics of respondents were typical of McHenry County (manuscript *a*). All community categories (i.e., urban, rural, high- and low deer density areas) depicted a slight male bias or even sex ratio which is consistent with the county's sex ratio (U. S. Census Bureau, 2010: sex ratio 1:.99). Survey respondents' education attainment (30-33% had a 2-4 yr college degree) was also typical for the county (U.S. Census Bureau, 2010: 29% had a 2-4 yr college degree) as well as length of residence (this survey: 80-83% resided for >10yr; U.S. Census Bureau, 2010: 78% resided for >10 yr). Survey respondents (81-88% were >41 yr old) were older than the median age of 37 yrs (U. S. Census Bureau, 2010).

In this study, we examined 5 two-part questions regarding the acceptability and desirability of 5 deer management methods: archery hunts; gun hunts; sharpshooting; fertility control; and no deer management. Questions were based on a 5-point bipolar adjective scale and grouped according to each deer management method to make the ratings easier for participants to complete. Two questions were used to assess attitudes toward each deer management method.

For example, questions included “In my opinion, no deer management is a (strongly unacceptable-strongly acceptable) method of deer management” and “In my opinion, no deer management is a (strongly undesirable-strong desirable) method of deer management.” At the end of the survey, respondents were also given opportunity to write additional comments.

Data Analyses

Survey responses were first analyzed for non-bias response for questions used in this study. Answers to survey questions received from telephoned non-respondents were compared to mail-respondents using exact G-tests ($\alpha=0.05$ throughout, Sokal & Rohlf, 1995). Responses from the telephoned respondents were then merged with the survey replies received through the mail (Conover, 1997).

We used PCI_2 (Vaske et al., 2010) to determine which deer management method is most acceptable for each District area, countywide, and for urban, rural, high-, and low deer density areas. For this study, the index describes the ratio of people accepting a deer management strategy versus the number of people not accepting a deer management strategy and is centered on the neutral answer in the survey: “neither acceptable nor unacceptable.” Scores were first converted to a -2 (strongly unacceptable) to +2 (strongly acceptable) scale. We then tested respondent reliability by comparing each pair of questions using Pearson correlations (Daigle, Hrubes, & Ajzen, 2002). If the responses were of acceptable magnitude ($\rho > 0.70$), we only used responses regarding acceptability for further analysis.

We calculated PCI_2 values (Vaske et al., 2010) and mean acceptability responses for each community category and District area. We used 2-way ANOVAs (PROC GLM, SAS 9.1, Cary, North Carolina) to compare responses among methods and between rural and urban areas and high-and low deer density areas; Tukey’s *HSD* test was used for pair-wise comparisons (Sokal &

Rohlf, 1995). We used 1-ways ANOVA with Tukey's test to compare methods countywide and for each District area. We then used the observed PCI₂ values from each District area to assess differences in PCI₂ among methods countywide (1-way ANOVA and Tukey's) and between rural versus urban and high- and low deer density areas (2-way ANOVAs and Tukeys). For each individual District area, we followed Vaske et al. (2010) and simulated 400 samples (www.warnercnr.colostate.edu/~jerryv/) to calculate PCI₂ standard deviation for each method and then tested for differences between observed PCI₂ values for each District area (Vaske et al., 2010).

Results

Survey response rate was 34% ($n = 222$; 20-60% per District site). The survey response rate was 42% ($n = 280$; 30-67% per District site) after adding non-respondents contacted via telephone. Survey response rates were 42% for both high- and low deer density areas, and 41% and 43% in urban and rural areas, respectively. Two surveys could not be identified to a District area and were only used in countywide analyses.

We observed no non-response bias regarding questions asked in this paper. Respondents differed slightly on the acceptability of gun hunts ($\chi^2_4=13.44$, $p = .011$); however, >60% of both types of respondents indicated gun hunts were acceptable to some degree. There was no difference between respondent types for the desirability of gun hunts ($\chi^2_4=7.20$, $p = .134$). Both types of respondents had similar responses regarding the unacceptability (mail: 35%; telephone: 40%) of sharpshooting, however telephone (60%) respondents believed sharpshooting was slightly more acceptable ($\chi^2_4=17.09$, $p = .002$) than mail (48%) respondents. We found similar results regarding the desirability of sharpshooting as we did with the acceptability of the technique between mail (undesirable: 35%; desirable 42%) and telephone (undesirable: 37%;

desirable 55%) respondents ($\chi^2_4 = 16.71, p = .003$). We found no differences between respondent types in the acceptability or desirability of archery hunts, fertility control, or no deer management ($\chi^2_4 = 3.27-8.77, .080 \leq p \leq .524$).

Responses regarding the acceptance and desire for each management option were highly correlated ($\rho = 0.87-0.97, p < .001$) indicating respondents provided reliable and consistent opinions. Thus, we used only responses regarding acceptability for the PCI₂ analyses.

Responses regarding the acceptability of the deer management methods differed among methods ($F_{4, 1,389} = 46.24, p < .001$), but did not differ ($F_{1,1374} = 0.39-0.62, p = .429-.534$) between respondents from high- and low deer density areas (Fig. 1A) nor respondents from rural and urban areas (Fig. 1B). Archery hunting (countywide mean response \pm SD = 0.77 ± 1.44) was the most acceptable method followed by gun hunting (0.48 ± 1.46), sharpshooting (0.14 ± 1.51), and fertility control (0.03 ± 1.63); no deer management (-0.82 ± 1.31) was deemed unacceptable (Table 1, Fig. 2). The potential for conflict of interest also differed among methods ($F_{4, 105} = 5.80, p < .001$), but did not differ ($F_{1,100} = 0.19-0.54, p = .465-.660$) between respondents from high- and low deer density areas (Fig. 1A) nor respondents from rural and urban areas (Fig. 1B). Archery hunting (countywide mean PCI₂ \pm SD = 0.43 ± 0.19) and no deer management (0.35 ± 0.12) had the least conflict and respondents were most conflicted regarding fertility control (0.59 ± 0.15 ; Fig. 2). Gun hunting (0.48 ± 0.16) and sharpshooting (0.49 ± 0.21) had similar amounts of conflict (Fig. 2).

We did not detect differences in acceptability responses in most (59%; $n = 13$ of 22) District areas ($F_{4,40-80} = 0.43-2.53, .504 \geq p \leq .7846$). However, 32% ($n = 7$) of District areas had archery hunts and/or gun hunts as the most acceptable method ($F_{4,40-90} = 3.26-10.6, .001 \geq p \leq .018$). Alternatively, 9% ($n = 2$) of District areas deemed fertility control and/or sharpshooting as the most acceptable method ($F_{4,45} = 2.77-4.34, .005 \geq p \leq .0385$). Of the District areas that have

no deer management currently ($n = 4$), archery hunts was the most acceptable method for 2 areas, and acceptability did not differ among methods for the other 2 areas. Potential for conflict of interest values differed among methods for 23% ($n = 5$) of the District areas; archery hunts, gun hunts, and no deer management had the least conflict in 4 areas. However, sharpshooting had a PCI_2 value of 0.00 in 1 District area.

Thirty-nine percent ($n = 87$) of respondents wrote in additional comments on their surveys which covered a diverse amount of ideas and concerns; we generalize major themes pertinent to this study. Twenty-one percent of these comments stated that deer management must be conducted in the county. Thirteen percent of the comments involved the need or want to extend, add, or provide more opportunity for public hunts and 22% of comments were against using sharpshooting or fertility control methods. Although there seemed to be support for public hunting, 14% of the comments were concerns regarding hunters trespassing on personal property, unethical hunters, and the possibility of stray bullets or arrows near homes. Six percent of comments suggested charging fees for hunting, 2% requested lower costs of hunting permits, and 6% stated spending money on deer management was unjustified. Seven percent of respondents requested that if deer were managed via sharpshooting, the meat is used as food for the hunters or sent to food shelters. Fifteen percent of respondents who commented desired no deer management or preferred land management for deer.

Discussion

Suburban deer management is often controversial and attitudes towards management methods can vary among geographic regions (Kellert, 1980, Kilpatrick et al., 2007; Urbanek et al., 2011). This is the first study to our knowledge that has calculated PCI_2 for suburban deer management methods along an urban and deer density gradient. Rural residents typically are hunters that hold

utilitarian values compared to suburban and urban residents that are more educated, are non-hunters, and hold mutualistic values toward wildlife (Kellert, 1980). We found no difference in opinions regarding the acceptability or conflict of any deer management method between rural and urban areas. Although this study examined residents across a larger geographic region than most suburban deer studies (i.e., county vs. 1 community), all McHenry County residents may be considered “suburbanites” if one compares them to residents living outside of the Chicago Metropolitan Area. Most urban and rural respondents were non-deer hunters, educated past high school, and used District areas for education, recreation, or exercise (manuscript *a*). Given similar backgrounds and interests, respondents in this study may hold similar values towards deer regardless of the level of urbanization surrounding their residence. Similarly, we found no difference in opinions regarding the acceptability or conflict of any deer management method between residents of high- and low deer density areas. Public acceptance of lethal management strategies may increase if direct damage (i.e., damage to personal property) to residents causes enough concern (Siemer et al., 2004). However, residents from both high- and low deer density areas perceived comparable amounts of deer damage which tended to be none to minimal (manuscript *a*). Hence, residents had similar experiences with deer regardless of the area they lived and thus may have had similar values.

Dougherty, Fulton, and Anderson (2003) forewarned that surveys focused on management should stratify samples to address gender response or sampling bias because females may hold different perceptions towards management methods than males. Countywide, the male to female respondent sex ratio was 1:.75 (manuscript *a*) which was more evenly distributed than that of Dougherty et al. (1:.38; 2003). Although respondents who returned the survey were slightly male biased, their acceptability scores related to each deer management

method were similar to non-respondents who were slightly female biased. Given this similarity, we did not feel that gender played a contributing role to accepting any of these management techniques. Thus, we chose not to compare male and female respondents in this study because it was not the focus of this study and we believed females were well represented.

Providing no deer management on District areas was deemed unacceptable by respondents and there was very little conflict among citizens on this opinion. The District has been proactively managing deer on most of the areas investigated in this study for about 5 years. Most of the survey respondents have resided in the county for >10 years (manuscript *a*) and thus residents may have directly experienced the benefits of managing deer in their community (e.g., decrease in DVCs and damage to personal property). Similarly, lethal methods were deemed the most acceptable method to manage deer among residents which also may be a reflection of the current management regimes. Many studies of deer have reported that urban and suburban respondents are less favorable of lethal methods (Kilpatrick et al., 1997; Kilpatrick & Walter, 1999; Doerr et al., 2001; DeNicola et al., 2000; Kilpatrick et al., 2007). Conversely, residents in this county may have become accustomed to lethal methods which may explain the higher acceptance rates over non-lethal methods.

Archery and gun hunts had similar levels of public acceptability but there was slightly less conflict surrounding the use of archery hunting. As aforementioned, this may be a reflection of the proactive management that utilizes archery and gun hunts already in the District. The desire for public participation in deer management was evident in the additional comments by the respondents and was also a main reason why respondents accepted archery hunts (manuscript *c*). Although the majority of respondents were not deer hunters, this may have been due to a lack of opportunities within the District to hunt. In fact, several additional comments were explicit in

expressing the desire for the District to extend, add, or provide more opportunity for public hunts. In addition, many respondents expressed negative feelings towards spending money for sharpshooting or fertility control, and a desire for a cheap management method was a driving factor of respondents who accepted public gun hunts (manuscript *c*).

Typically, archery and gun hunts raise safety concerns more than the use of sharpshooters if the general public participates in the hunt (Kilpatrick et al., 1997). Correspondingly, respondents expressed concerns for stray bullets or arrows near the homes which may have contributed to the conflict surrounding public hunts. The District sends notices to homeowners living in close proximity to District areas prior to public hunts and makes regular use of media to spread information. Safety concerns may be further mitigated by strict application rules, education, and safety tests prior to hunts (Kilpatrick et al., 1997; Kilpatrick & Walter, 1999). For example, several respondents were concerned about unethical hunters and trespassing on their property; these concerns may be alleviated if hunters are required to ensure ethical hunting practices and become knowledgeable of District property lines prior to hunts (Kilpatrick & Walters, 1998).

Sharpshooting received the least support of the lethal methods which was similar to findings in Kilpatrick et al. (2007) and Stout et al. (1997). This may be reflective of the lack of familiarity with the method (Kilpatrick et al., 2007) considering only 1 District area currently uses sharpshooting as the prime deer management tool. Nevertheless, there was much conflict among residents regarding the acceptability of this method indicating that some residents strongly accepted this method while others felt it was strongly unacceptable. Respondents who deemed this method acceptable may have preferred professional biologists using guns on conservation areas because they perceived it a safer and more humane option than allowing the

general public to hunt (DeNicola et al., 1997, manuscript *c*). Respondents that perceived this method as acceptable may have also wanted the meat to be donated to food shelters (as mentioned in additional comments). Alternatively, these respondents may have been aware that sharpshooting had been used previously in McHenry County to combat the spread of chronic wasting disease and is used in neighboring Lake County (LCFPD, 2012) and thus were more familiar with the technique.

Mean acceptability responses were neutral for fertility control and the high PCI₂ value indicated elevated conflict among citizens. Fertility control methods tend to achieve high levels of public acceptance (Green et al., 1997; Stout et al., 1997; Kilpatrick et al., 2007) but support usually declines once citizens are educated regarding the cost and effectiveness of such techniques (Kilpatrick & Walter, 1997; Shanahan, Siemer, & Pleasant, 2001). Similar to sharpshooting, many respondents wrote additional comments declaring they were against paying money for fertility control when hunters are a free source. Alternatively, many respondents perceived lethal methods of deer management as inhumane (manuscript *c*) which may have led them to support fertility control as a deer management method.

Management Implications

For the District, it is clear that employing archery hunts to manage deer throughout the county would appease most citizens and raise little conflict. However, it is important to take into account and mitigate safety concerns of residents living adjacent to District borders. It is also vital to examine responses on a site by site basis to identify outliers to this solution. For example, sharpshooting held the least conflict and was the most acceptable management method at 1 District area. Hence, archery hunting may not be the best technique to manage deer at that site. The variation in responses that can exist among sites may warrant individual surveys with

larger sample sizes than we used in this study. However, the price of increasing sample sizes in order to obtain a more rigorous survey for each District site may not be feasible for most natural resource agencies. Thus, stratified random sampling across a county as done in this study may be the most practical way to gain a general consensus of what people desire and determine in which deer management method the most conflict lies.

Investigating conflict among citizens regarding the acceptance of different management techniques can aid managers in making decisions that could appease the public majority. However, managers should take additional steps to truly understand why respondents are conflicted. In this study, we discussed conflict mostly in terms of what has already been stated in the literature or was corroborated by the additional comments written by respondents. Simply knowing whether a method is acceptable or if conflict exists among public opinions does not often provide answers as to why citizens have those opinions or conflicts (Urbanek et al., 2011; manuscript *c*). Gathering information as to why a technique is acceptable may help resolve disparities and be an invaluable aid in future management decisions. We recommend managers take the next step and survey their constituents about their perceived outcomes and desires for management options (manuscript *c*). This type of information then can be used to assess and potentially resolve the differences that drive conflict between respondents who accept a method and those who believe a method is unacceptable (manuscript *c*).

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Figure Legends

Figure 1. Mean response for the acceptability and the potential for conflict of interest (PCI₂) for white-tailed deer management methods by residents in high- (High; ≥ 11 deer/km²) and low deer density areas (Low; ≤ 9 deer/km²) (Fig. A), and urban and rural areas (Fig. B) in McHenry County, Illinois, 2011. Community categories are presented along the x-axis and bubbles are centered on the mean acceptability response. The size of the bubble and the score within the

bubble is the PCI₂ value; fertility control PCI₂ values are below the respective bubbles.

Response scores and PCI₂ values did not differ between high- and low density areas or rural and urban areas ($F_{1,100-1374} = 0.19-0.62, p = .429-.660$). Responses scores (capital letters) and PCI₂ values (lowercase letters) differed among methods ($F_{4,105-1,389} = 44.58-46.24, p < .001$); differences are indicated by different letters.

Figure 2. Mean response for the acceptability and the potential for conflict of interest (PCI₂) for white-tailed deer management methods by residents countywide in McHenry County, Illinois, 2011. The size of the bubble and the score below the label is the PCI₂ value. Response scores (capital letters) and PCI₂ values (lowercase letters) differed among methods ($F_{4,105-1,389} = 5.80-46.24, p < .001$); differences are indicated by different letters.

Table 1. Percent response regarding the acceptability of 5 deer management methods for white-tailed deer management methods by residents in their community countywide (C), high- (H; ≥ 11 deer/km²) and low (L; ≤ 9 deer/km²) deer density areas, and urban (U) and rural (R) areas in McHenry County, Illinois, 2011.

| Management method | Percent response | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------|-----------------------|----|----|----|----|-----------------------|----|----|----|----|---------|----|----|----|----|---------------------|----|----|----|----|---------------------|----|----|----|----|
| | Strongly unacceptable | | | | | Somewhat unacceptable | | | | | Neutral | | | | | Somewhat acceptable | | | | | Strongly acceptable | | | | |
| | C | H | L | U | R | C | H | L | U | R | C | H | L | U | R | C | H | L | U | R | C | H | L | U | R |
| Archery hunts | 14 | 16 | 13 | 15 | 15 | 9 | 7 | 11 | 10 | 8 | 5 | 5 | 7 | 7 | 5 | 29 | 33 | 25 | 30 | 28 | 43 | 40 | 44 | 39 | 44 |
| Gun hunts | 18 | 18 | 17 | 18 | 17 | 11 | 12 | 10 | 13 | 9 | 5 | 3 | 8 | 7 | 4 | 37 | 36 | 39 | 34 | 41 | 29 | 30 | 26 | 28 | 29 |
| Sharpshooting | 24 | 26 | 22 | 21 | 28 | 11 | 9 | 13 | 8 | 14 | 14 | 13 | 15 | 12 | 16 | 28 | 28 | 27 | 34 | 21 | 23 | 25 | 22 | 26 | 21 |
| Fertility control | 30 | 34 | 25 | 26 | 35 | 13 | 11 | 14 | 15 | 11 | 9 | 7 | 12 | 9 | 10 | 20 | 23 | 17 | 26 | 14 | 28 | 24 | 32 | 24 | 30 |
| No management | 43 | 46 | 40 | 44 | 42 | 24 | 23 | 24 | 24 | 23 | 12 | 10 | 14 | 11 | 13 | 14 | 13 | 16 | 13 | 16 | 7 | 7 | 6 | 8 | 6 |

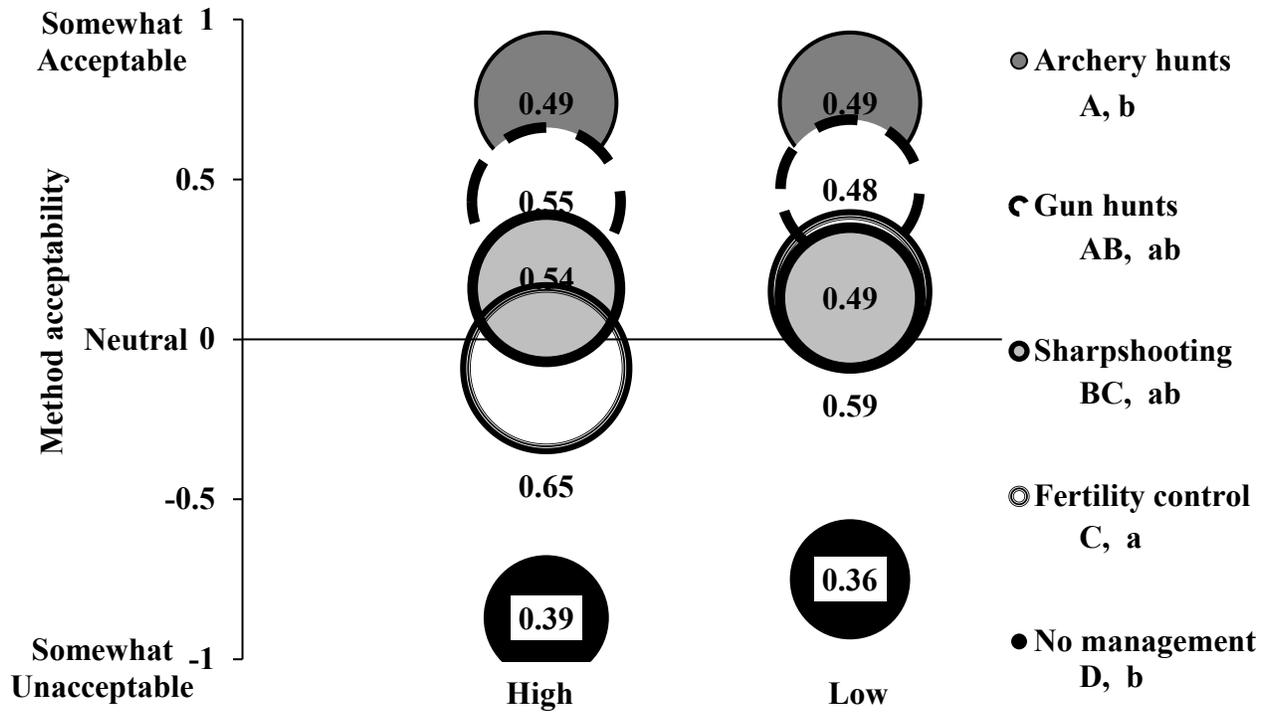


Figure 1A

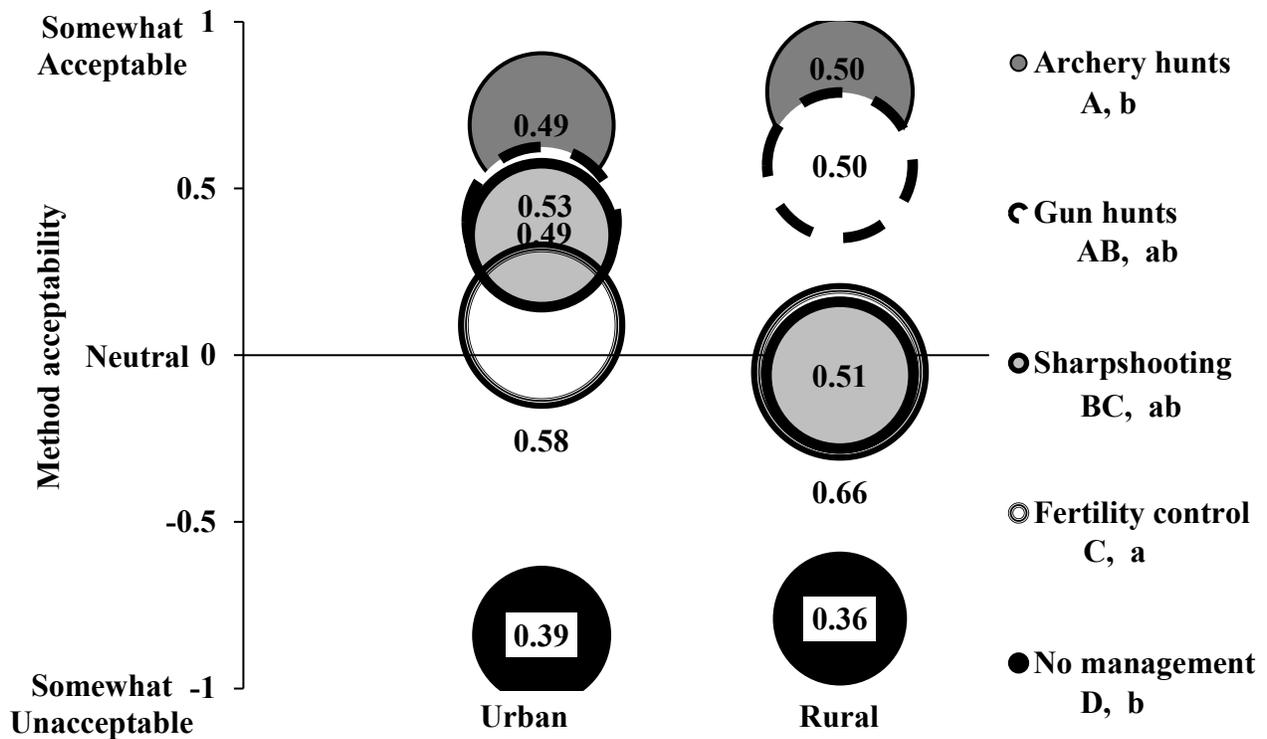


Figure 1B

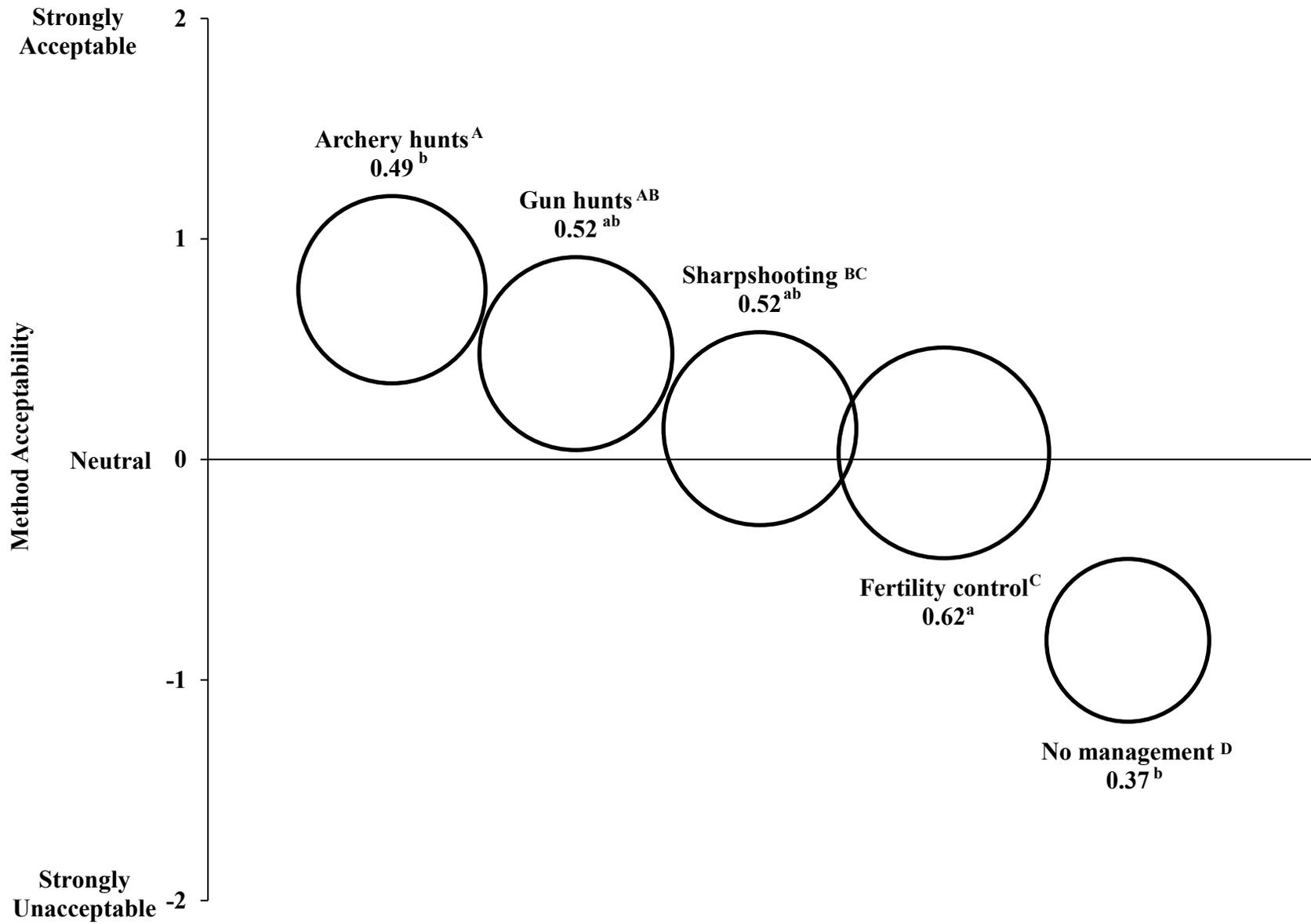


Figure 2