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Determinants of Public Preferences for Changes in Suburban Deer Density (Manuscript *a*)

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Abstract

Suburban deer management often aims to decrease deer densities as an imminent response to public complaints. We surveyed residents in a suburban Illinois county where deer have been proactively managed since 2001 to determine socio-demographic and behavioral characteristics that contribute to public preferences for management-induced changes in deer density. Almost half of the respondents perceived the number of deer as "perfect." Respondents who preferred a decrease in deer density experienced heavy damage to their personal property and enjoyed deer but were concerned about the number of deer in their area. Respondents who enjoyed deer (and were not concerned with local deer numbers) were less likely to prefer a decrease. Respondents who preferred an increase in deer density perceived the number of deer in their area as decreasing. This study exemplifies the complexity of deer acceptance capacity and aids managers in understanding public concerns for suburban deer management.

Keywords: density, management, *Odocoileus virginianus*, preference, survey, white-tailed deer

Introduction

Contemporary white-tailed deer (*Odocoileus virginianu*) management now requires training and experience integrated with stakeholder participation for decision making (Siemer, Connelly, Brown, & Decker, 2000; Riley et al., 2002; Raik, Decker, & Siemer, 2006). Many studies have examined reasons to manage deer and common motives are the public's desire to decrease deer-vehicle collisions (DVCs), damage to personal property from deer, and zoonotic diseases (Connelly, Decker, & Wear, 1987; Decker & Gavin, 1987; Kilpatrick &Walter, 1997; Stout, Stedman, Decker, & Knuth, 1993; Storm, Nielsen, Schauber, & Wolf, 2007). Similarly, many studies have found public attitudes towards suburban and urban deer management (e.g., public hunts, sharpshooting) can vary by a person's gender (Lauber, Anthony, & Knuth, 2001), perceived level of deer-related problems, (Connelly et al., 1987; Messmer, Cornicelli, Decker, & Hewitt, 1997; Curtis & Lynch, 2001), and feasibility of management options (Messmer et al., 1997). These studies often identify general concerns of citizens; however, most do not identify predictors of respondent preferences for changes in deer density (i.e., deer acceptance capacity).

Few studies have investigated the driving factors associated with deer acceptance capacity (Decker & Gavin, 1985; Stout et al., 1993; West & Parkhurst, 2002; Lischka, Riley, & Rudolph, 2008). Decker and Gavin (1985) inferred from their survey design that respondents who had experienced recent damage to personal property desired a decrease in deer density whereas respondents with positive attitudes about deer desired to maintain or increase deer density. West and Parkhurst (2002) found heavy damage to personal property was correlated to a respondent's desire for deer population reduction. These authors also suggested that agricultural producers that lived in areas with high buck harvest/km^2 were more likely to desire a population reduction than homeowners that lived in similar areas. Stout et al. (1993) modeled

social values and perceptions of deer held by respondents to determine variables that contribute to a preference in deer density. They found the degree to which a respondent perceived few social benefits from deer, the degree of problem-intolerance toward deer, the perceived probability of a DVC occurrence, and personal involvement with DVCs all influenced a respondent's preference for a decrease in deer density. Lischka et al. (2008) modeled socio-demographics and personal interactions with deer to examine determinants of deer acceptance capacity in rural southern Michigan. They found total effect of deer interactions, feeding deer, and holding either a high-school diploma or an associate degree positively related to deer acceptance capacity. Lischka et al. (2008) also reported that the respondent's age and whether they grew up on a farm or in a small town negatively affected acceptance capacity. These studies provide insight to deer acceptance capacity; however, only Decker and Gavin (1985) and Stout et al. (1993) were conducted in urban or suburban areas where socio-demographics, public beliefs, and perceptions regarding deer may be different from rural residents (Kellert, 1980).

Suburban deer management studies have become increasingly common (Connelly et al., 1987; Decker & Gavin 1987; Kilpatrick &Walter 1997; Stout et al., 1993; Storm et al., 2007) as deer densities continue to rise in developed areas (Urbanek, Allen, & Nielsen, 2011). Most human dimension studies regarding suburban deer are small scale and only include 1 or 2 communities where the need to manage deer is imminent (Kilpatrick & Walter, 1997; Kilpatrick & LaBonte, 2003; Lauber & Knuth, 2004; Kilpatrick, LaBonte, & Barclay, 2007). Human attitudes towards deer vary greatly and can be influenced by an individual's education, income, gender, age, and place of residence in an urban or rural area (Kellert, 1980). Few studies have examined public preferences for deer density across urbanization or deer density gradients (Stout, Decker, Knuth, Proud, & Nelson, 1996; Stout, Knuth, & Curtis, 1997). Stout et al. (1996)

and Stout et al. (1997) surveyed residents living in multiple towns with different deer densities based on deer-management units. Stout et al. (1996) did not determine factors that predicted a preference in deer density, but reported different deer-population objectives (buck take/mi^2) for each study area as determined by public input. Stout et al. (1997) suggested that respondents who resided near locally abundant deer population preferred a greater reduction in the deer herd than residents living with moderate or low deer densities. Alternatively, Kilpatrick and Walter (1997) investigated whether proximity to a conservation area altered respondent perceptions of deer. They found respondents shared the same perceptions regarding deer density except residents living closer to the area experienced more plant damage. Thus, deer acceptance capacity for suburban deer can be complex and vary greatly between sites and individuals (Decker & Purdy, 1988; Lischka et al., 2008). Managers require information of how public perceptions may differ across larger geographic areas in order to make better management decisions (Kilpatrick et al., 2007).

Current human dimensions literature regarding suburban deer is focused in communities where the majority of respondents desire a decrease in deer (Kilpatrick & Walter, 1997, Stout et al., 1997; West & Parkhurst, 2002; Kilpatrick et al., 2007), which is unsurprising since urban and suburban deer populations are increasing in most states (Urbanek et al., 2011). As deer management activities increase in developed areas throughout the nation, managers will require information as to which socio-demographic, behavioral characteristics, and perceptions of deer populations drive a respondent's preference for a change in deer density when the matter is not pressing. However, no study to our knowledge has examined the public's preference for deer density in areas where deer management occurs regularly.

Our objective was to identify determinants that contribute to the public's desire for a change in deer density in conservation areas where deer have been actively managed. Unlike most human dimension surveys of urban and suburban deer (Connelly et al., 1987; Decker & Gavin, 1987; Kilpatrick & Walter, 1997), we explored predictors for a respondent's preference to decrease deer density and preference to increase deer density. Variables in our models included a gradient of deer densities and urbanization, socio-demographic variables, human involvement with deer, and the respondent's perceptions of local deer. Our goal was to identify core concerns of citizens that affect their preferences for deer density so that managers may monitor and improve the decision-making process for suburban deer management.

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 km^2 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 which factors are involved in the public's preference for a change in deer density.

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/km^2), 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/km^2 (mean density = 18 deer/km^2; hereafter, high deer density areas) and 10 District areas with deer densities ≤9 deer/km^2 (mean density = 6 deer/km^2; 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: >75% residential = highly urban (n = 7); 51-75% residential = moderately urban (n = 4); 51-75% agriculture = moderately rural (n = 4); >75% agriculture = highly rural (n = 7). Sites 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 of District border) 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 U. S. 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 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 (manuscripts *b*, *c*). In this paper, we addressed 12 questions that asked the respondents about their socio-demographic and behavioral characteristics, and perceptions and attitudes toward deer in their community. Questions included demographic variables (e.g., gender, age, education, length of residence in McHenry County) and whether the respondent ever hunted deer, participated in a public hunt on District property, and used District property for any purpose (i.e., recreation, exercise). Other questions centered on the respondent's involvement with deer such as their or a family member's involvement in a DVC and deer damage to their personal property. The remaining questions asked the respondent's perceptions about the number of deer in their area (e.g., too few deer, too many deer, perfect amount), whether the local deer population has been increasing or decreasing, and the respondent's general attitude toward deer (e.g., enjoy them, indifferent). Respondents also were given opportunity to write additional comments. Non-respondents were asked all questions addressed in this paper.

Data Analyses

Survey responses were first analyzed for non-bias response and sampling bias. We compared demographic data to county demographics (U.S. Census Bureau, 2010) to assess sampling bias. Answers to survey questions received from telephoned non-respondents were then compared to mail-respondent answers using Fischer's exact chi-square test for questions that could be answered "yes/no" or "male/female" and exact G-tests for questions that had >2 categories to choose from (α=0.05 throughout, Sokal & Rohlf, 1995). Responses from the telephoned non-

respondents were then merged with the survey replies received through the mail (Conover, 1997).

We summarized survey responses to characterize the respondent pool and generalize perceptions within the following community categories: countywide; high- and low deer density areas; and urban and rural areas. We then used 2 logistic regression analysis (PROC LOGISTIC; SAS 9.1, Cary, North Carolina) with AIC_c model selection (Burnham &Anderson, 2002) and forward step-wise regression (Stout et al., 1993; Riley & Decker, 2000) to regress preference for deer population changes (i.e., preference for a decrease and preference for an increase) on the socio-demographic, deer perceptions, and beliefs variables (Table 1), level of urbanization, and deer density of each site. All variables, including level of urbanization and deer density, have been suggested to affect preference for deer density in prior research (Stout et al., 1993; Lauber et al., 2001; West & Parkhurst, 2002; Storm et al., 2007; Lischka et al., 2008). Thus, creating a set of a priori models (Burnham & Anderson, 2002) would have been ineffective since each variable could reasonably be combined with any other variable. Hence, forward step-wise regression allowed us to determine the variable(s) that had the highest predictive power from a suite of potentially influential variables.

We randomly selected 75% of the received surveys (i.e., answers from both mail and telephone respondents) to develop the model and retained 25% for model testing for each analysis (Geisser, 1975). For the first analysis, respondents who perceived that there were too many deer in their area were coded as 1 (indicating a preference for a decrease in the population) and respondents who did not know how to rate the number of deer in their area, perceived there were too few deer, or that there were a perfect amount of deer were coded as 0 (Stout et al.,

1993). For the second analysis, respondents who perceived that there were too few deer were coded as 1 (indicating a preference for an increase in the population) and all other answers as 0.

Variables selected for the model were tested using the forward stepwise procedure based on Wald χ^2 values (Sokal & Rohlf, 1995; Stout et al., 1993), AIC_c values (Burnham & Anderson, 2002; Lischka et al., 2008), and Hosmer and Lemeshow goodness-of-fit tests (Sokal & Rohlf, 1995). Individual variables were tested first and variables with an AIC_c value less than the null model and which had a significant χ^2 *p*-value were retained. The variable with the lowest AIC_c value was used to start building the more complex model. Additional variables were added individually to the model using these methods until AIC_c was minimized and the remaining variables did not contribute to the prediction (i.e., >0.05 χ^2 *p*-value). The final model was then tested using the withheld 25% of data where a predicted probability >0.50 was considered a "1" and a predicted probability ≤0.50 was considered a "0."

Results

Survey response rate was 34% (*n* = 222; 20-60% per District area). The survey response rate was 42% (*n* = 280; 30-67% per District area) after adding the 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 District area so were only included in the countywide summary.

Socio-demographic and behavioral characteristics of our respondents were typical of McHenry County. All community categories (i.e., urban, rural, high- and low deer density areas) indicated 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 male:.99 female). Education attainment of survey respondents (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 county's median age of 37 yrs (U. S. Census Bureau, 2010).

We observed few differences between respondents and non-respondents indicating minor non-response bias. Gender (χ^2_1 =132.00, p = .007) was male-biased for mail respondents (male 61%; female 39%) compared to telephone respondents (male 41%; female 59%) which was female-biased. Mail respondents (74%) experienced more damage to personal property from deer (G_4 =14.40, p = .007) than telephone respondents (50%). More telephone respondents (62%) perceived the number of deer in their area as perfect (G_4 =12.46, p = .007) compared to mail respondents (37%). There was no difference in the number of deer hunters vs. non-hunters; number of people who participated in public hunts on District areas; use of District areas for recreation, exercise, or education; and involvement in a DVC (χ^2_1 =2-178, $p \leq$ .175-.887). There was also no differences in opinion on whether deer numbers are changing; general feelings towards deer in the area; years lived in McHenry County; respondent age; and education between mail and telephone respondents ($G_{3\text{-}6}$ =1.81-10.44, $p \leq$ .128-.625).

Responses were similar across all community categories for demographic questions. Overall, male to female sex ratios of respondents were slightly male-biased for countywide, high deer density, and urban areas (1:.75, 1.57, 1:.61, respectively); sex ratios in low deer density areas and rural areas were approximately equal (1:1.07, 1:.93, respectively). Most (58-67%) respondents across all community categories were >51 yr old, followed by 41-50 yr old (20-23%), 31-40 yr old (6-12%), and 18-30 yr old (2-3%). The highest level of education most respondents have earned across all categories was a 2-4 yr college degree (30-33%), followed by

post-graduate education (22-26%), some college (20-25%), high school diploma or GED equivalent (14-18%), and some high school (1-3%). Most respondents (80-83%) across all categories lived in McHenry County for >10 yrs, followed by 6-10 yr (8-10%), 3-5 yr (4-7%), and 1-2 yr (2-4%).

Responses were also similar across all community categories for behavioral characteristics and perceptions and beliefs regarding deer in their community. Most (72-78%) respondents were not deer hunters and thus never participated in a public deer hunt on a District area (96-100%). However, most (77-86%) respondents used District areas for recreation, exercise and/or education. Slightly more than half of the respondents (53-61%) had been involved in a DVC or have had a family member involved in a DVC. Most (56-75%) respondents characterized deer damage to personal property (e.g., gardens, shrubs, or trees) as none or minimal, followed by moderate, and heavy damage (Fig. 1A). Respondents from urban and high deer density areas perceived more heavy or moderate damage than respondents from rural or low deer density areas (Fig. 1A). Most (63-67%) respondents enjoy having deer in their neighborhood, while some (17-24%) respondents enjoyed having deer in their neighborhood but were concerned about the amount of deer. Three percent of respondents from all community categories did not enjoy deer in their neighborhood and a small percentage (9-13%) of respondents was indifferent toward deer.

Many (40-43%) respondents believed the number of deer in their community was perfect. Slightly more respondents in urban and high density areas (23-24%) believed there were too many deer compared to rural and low density areas (16-17%). Subsequently, slightly fewer respondents in urban and high density areas (15-17%) believed there were too few deer compared to respondents in rural and low deer density areas (18-21%). Most (33-39%)

respondents perceived the number of deer in their area to be remaining the same over years; however, many rural respondents (35%) perceived deer in their community to be decreasing (Fig. 1B). Several (23-26%) of respondents from urban and high deer density areas perceived deer numbers in their community to be increasing, while fewer (17-21%) respondents from rural and low deer density areas perceived this increase (Fig. 1B).

We obtained predictive models for respondents who preferred a decrease in deer density and for respondents who preferred an increase in deer density (Fig. 2). Twenty-four of the surveys were incomplete and could not be used in the models resulting in 256 surveys available for modeling. Each model was validated using withheld data (n =56 for each analysis) and both exhibited high levels of predictive power (decrease: 94% correct predictions; increase: 75% correct predictions). Respondents who preferred a decrease in deer density (n = 38; other preference: n = 155) experienced heavy damage to personal property ($\chi^2_1 = 13.55$, $p < .001$) and enjoyed deer but were concerned about the number of deer in their area ($\chi^2_1 = 6.13$, $p = .013$). Alternatively, respondents who enjoyed deer (and were not concerned about deer numbers) were less likely to prefer a decrease in deer density ($\chi^2_1 = 14.47$, $p < .001$). More respondents who preferred an increase in deer density (n = 35; other preference: n = 148) perceived the number of deer in their area as decreasing compared to respondents who did not prefer an increase in deer density ($\chi^2_1 = 35.81$, $p < .001$).

Thirty-nine percent (n = 87) of respondents wrote in additional comments on their surveys which covered a diverse amount of ideas and concerns; we generalized major themes pertinent to this study. Twenty-one percent of the additional comments stated that deer management must be conducted in the District while 9% of these respondents said deer are too

few in the county. Personal accounts regarding damaging to personal property (8%), DVCs (8%) and concern for zoonotic disease (7%) were also frequent comments.

Discussion

We determined which socio-demographic and behavioral characteristics contribute to the public preferring a change in their local deer density. Compared to other studies that have examined preferences for changes in deer density (Decker & Gavin, 1985; West & Parkhurst, 2002; Stout et al., 1993; Lischka et al., 2008), our study is novel in that deer were proactively managed on most of our sites. Thus, respondents were accustomed to deer management in the county and were not necessarily responding reactively to the normal catalysts (e.g., recent increase in DVCs or increased deer damage to personal property) that often drive suburban deer management. Hence, responses regarding preferences in deer densities in this study may reflect determinants of suburban deer acceptance capacity better than previous studies where acceptance capacity typically has been exceeded for most residents and most people desire an imminent decrease in deer (Kilpatrick & Walter, 1997; Kilpatrick & LaBonte, 2003; Lauber & Knuth, 2004; Kilpatrick et al., 2007).

Respondents to our survey were representative of the county (i.e., no sampling bias); however we recognize that our survey may have potential response bias. It was not surprising that respondents who returned the survey had experienced more damage to plants than respondents who answered via telephone. Damage to personal property by deer is often a high concern and cause for deer management action among citizens in developed areas (Decker & Gavin, 1985; Kilpatrick & Walter, 1997; Storm et al., 2007). Similarly, more respondents who did not return the survey (i.e., telephone respondents) perceived the deer numbers in their area as "perfect." These respondents may not have been concerned with a deer management survey

because they felt it was unnecessary. The only demographic difference between respondent types included a male response bias. Previous studies have noted that women 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 were able to combine answers from both mail and telephone respondents to incorporate the most robust range of respondent perceptions in the county.

Suburban deer management often focuses on decreasing deer densities (i.e., via sharpshooting or hunting) as an imminent response to public complaints (Kilpatrick & Walter, 1997; Stout et al., 1997; Lauber & Knuth, 2004). Deer have been managed on most of our sites for about 5 years and almost half of our respondents perceived the number of deer in their area as "perfect." Given the broad range of deer densities (2-36/km^2) our respondents experienced, it is surprising that so many people were happy with their local deer density and exemplifies how deer acceptance capacity can change per individual and situation (Decker & Purdy, 1988; Lischka et al., 2008).

Nearly one-quarter of respondents from urban and high deer density areas perceived deer densities as too high, indicating a preference for a decrease in deer density. Additional comments from respondents focused on damage to personal property, DVCs, and concern for zoonotic diseases (i.e., Lyme disease) which are well-reported catalysts that drive preferences for a decrease in deer density (Connelly et al., 1987; Decker & Gavin, 1987; Kilpatrick &Walter, 1997; Stout et al., 1993; Storm et al., 2007; Urbanek et al., 2011). Our results indicated that

respondents who preferred a decrease in deer density experienced heavy damage to their personal property and enjoyed deer but were concerned about the number of deer in their area. Although risk of Lyme disease has been increasing over years in northeast Illinois, this disease is not highly prevalent in McHenry County (Rydzewski, Warner, & Mateus-Pinilla, 2010) and may be the reason why this was not a contributing variable to the model. More than half of the respondents had experienced or had a family member experience a DVC in this study and it was surprising that this variable did not contribute to our model. From 2003-2006, McHenry County was 1 of the top 10 Illinois counties for DVCs which may explain the large percentage of respondents who have experienced a DVC (Illinois Department of Transportation, 2003; 2004; 2005; 2006). After 2006, DVCs decreased in the county due to road-side habitat management and McHenry County has not been on this top 10 list since (Illinois Department of Transportation, 2007; 2008; 2009; 2010). McHenry County citizens may have become tolerant to the possibility of DVCs and may not perceive them as a serious concern since their decrease in the county. Likewise, Stout et al. (1993) also found that as a respondent's perceived probability of involvement in a DVCs increased, preference for a decrease in deer density increased.

Respondents from rural, urban, high- or low deer density areas were included in our model for predicting a decrease in deer density. Respondents from urban and high deer density areas had experienced more damage to their personal property than respondents from other areas (Fig. 1A). However, most respondents from all areas experienced minimal or no damage thus minimizing any effect from level of urbanization. Likewise, more respondents from urban and high deer density areas perceived an increase in deer density compared to other areas, but these respondents were few in comparison to respondents who perceived the deer density as remaining the same or decreasing (Fig. 1B).

Several respondents perceived there were too few deer, indicating a preference for an increase in deer density. This preference was driven by a respondent's perception that deer populations have been decreasing in their area (Fig. 1B). Deer hunters often desire an increase in deer density (Diefenbach, Palmer, & Shope, 1997; Lischka et al., 2008), however most of our survey respondents were non-deer hunters and status of deer hunter versus non-deer hunter did not affect the model. Although respondents from all community categories perceived a decrease in deer, respondents from rural areas perceived this decrease more often than respondents from other areas (Fig. 1B). However, similar to the model for predicting a decrease in deer density, level of urbanization was not a contributing variable to this model. Respondents from all areas may have perceived this decrease in deer density as a result of the sharpshooting the District has been conducting on several areas since 2003 to halt the spread of chronic wasting disease. Among other sites, this disease has been confirmed on a wide representation of rural (n = 4), urban (n = 2), high (n = 2) and low (n = 4) deer density areas in this study. Alternatively, many respondents used District areas for a multitude of purposes and citizens may have perceived a decline in deer based on the number they see when using District properties. However, the variable for District area use by the respondents did not contribute to the model which may mean all respondents regardless of District area use held this perception.

Management Implications

Regardless of deer density or level of urbanization, most people in our survey perceived deer in their community as "perfect" which exemplifies respondent plasticity in deer acceptance capacity. This variability in deer density preference makes it difficult for managers to maintain countywide deer management goals. Hence, a single deer density goal for a large geographic area (e.g., county) will not fulfill most public desires. Thus, managers need to investigate deer

acceptance capacity at site level (Purdy & Decker, 1989; Stout et. al, 1997) which is inevitably a financial burden if many sites exist in a given area of concern.

Given that level of urbanization and deer densities did not contribute to the public's preference for desiring a change in deer density, managers may be able to monitor public desires using the same methods throughout a county. Specifically, managers can assess public preferences for changes in deer density by asking citizens 3 simple questions regarding damage to personal property, perception of changes in the local number of deer, and general feelings towards deer. By limiting survey questions to information that may fit on a postcard, managers can easily obtain valuable information to use in predicting preferences at numerous sites and at low costs. In addition, management goals can be adapted more frequently if citizens are asked these pivotal questions each year rather than after long sessions between more extensive surveys. Finally, if managers indeed ask these questions on a yearly basis, citizens should become more salient to deer damage and deer numbers which may unify public attitudes toward deer density (Fishbein & Ajzen, 1975).

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Figure Legends

Figure 1. Perceived amount of white-tailed deer damage to gardens, shrubs, or trees (Fig. A) and perceived change of the amount of white-tailed deer (Fig. B) by residents countywide (All), high deer density areas (>11 deer/km^2), low deer density areas (<9 deer/km^2), urban areas, and rural areas in McHenry County, Illinois, 2011.

Figure 2. Logit p models ([β(SE)]) and percent response for variables contributing to a respondent's preference for a decrease (Fig. A) and increase (B) in deer density in their neighborhood in McHenry County, Illinois, 2011. Preference for deer density was coded as 1 for respondents who preferred a decrease in deer density (n = 38) and 0 as other (n = 154) for Fig A. Preference for deer density was coded as 1 for respondents who preferred an increase in deer density (n = 35) and 0 as other (n = 147) for Fig. B.

Table 1. Variables used for logistic regression model selection analyses to predict a respondents' preference for a decrease and increase in deer density in their local community in McHenry County, Illinois, 2011.

Variable	Survey information	Responses	# of parameters
Socio-demographic and behavioral characteristics			
Hunter	Deer hunting experience	Yes or No	1
District	Use of District areas	Yes or No	1
DVC	Involvement in DVC	Yes or No	1
Gender	Gender	Male or Female	1
Age	Age group	18-30 yr; 31-40 yr 41-50 yr; >50 yr	3
Education	Highest level of education	Some high school; High school diploma/GED; Some college; 2-4 yr degree; Post-graduate	4
Perceptions and beliefs regarding deer			
Damage	Deer damage to personal property	None; Minimal; Moderate; Heavy; N/A	4
Pchange	Perceived change in deer numbers	Decreasing; Same; Increasing; Don't know	3
Feelings	General feelings toward deer in the area	Enjoy; Concerned; Indifferent; Dislike	3

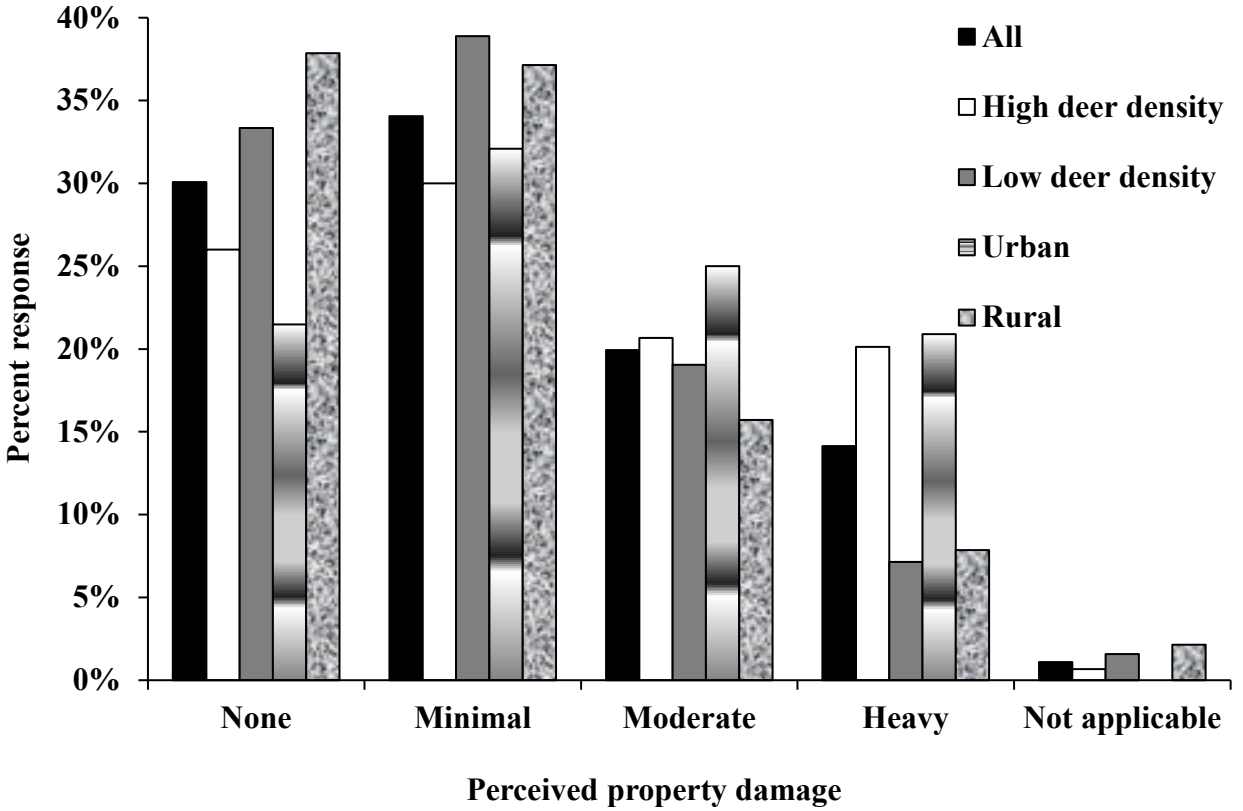

Figure 1A

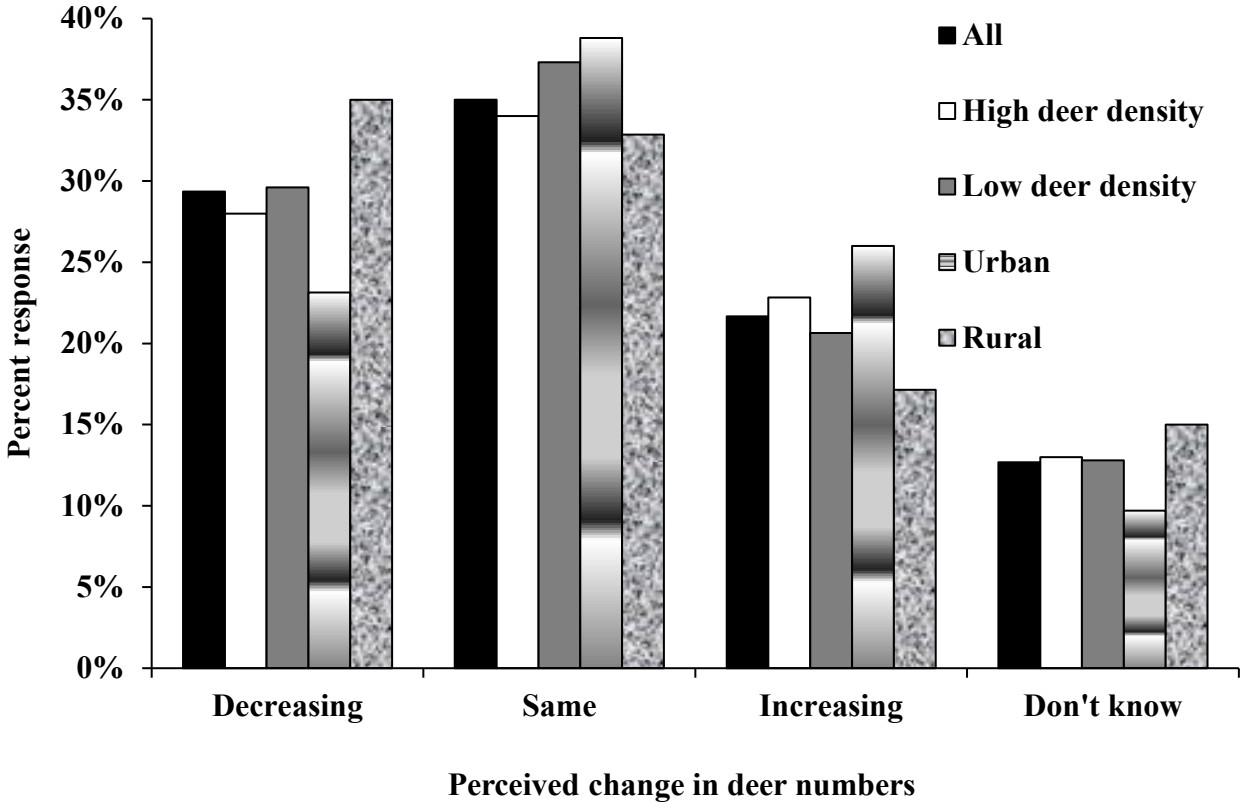

Figure 1B

Preference for a decrease in deer density = -.86(.40) + 1.22*Feelings_Concerned(.49) + 1.77*Damage_Heavy(.48) – 1.99*Feelings_Enjoyed(.52)

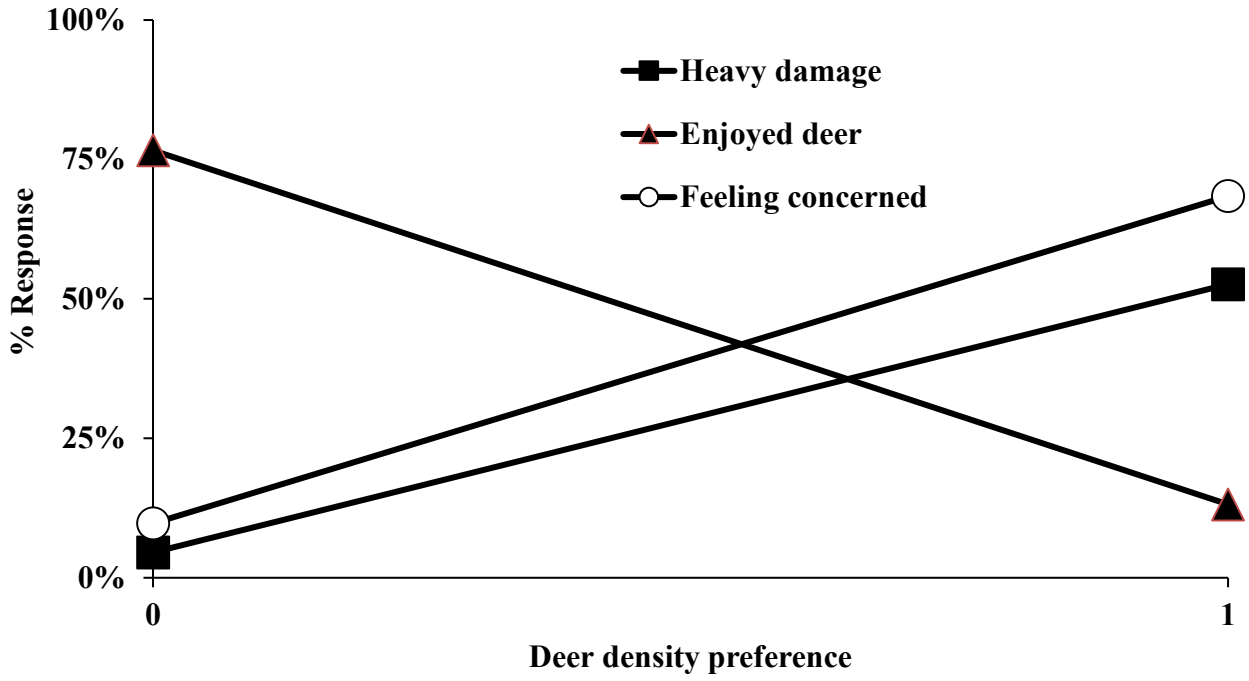

Figure 1A

Preference for an increase in deer density = -2.29(.35) + 2.40*Pchange_Decreasing(.40)

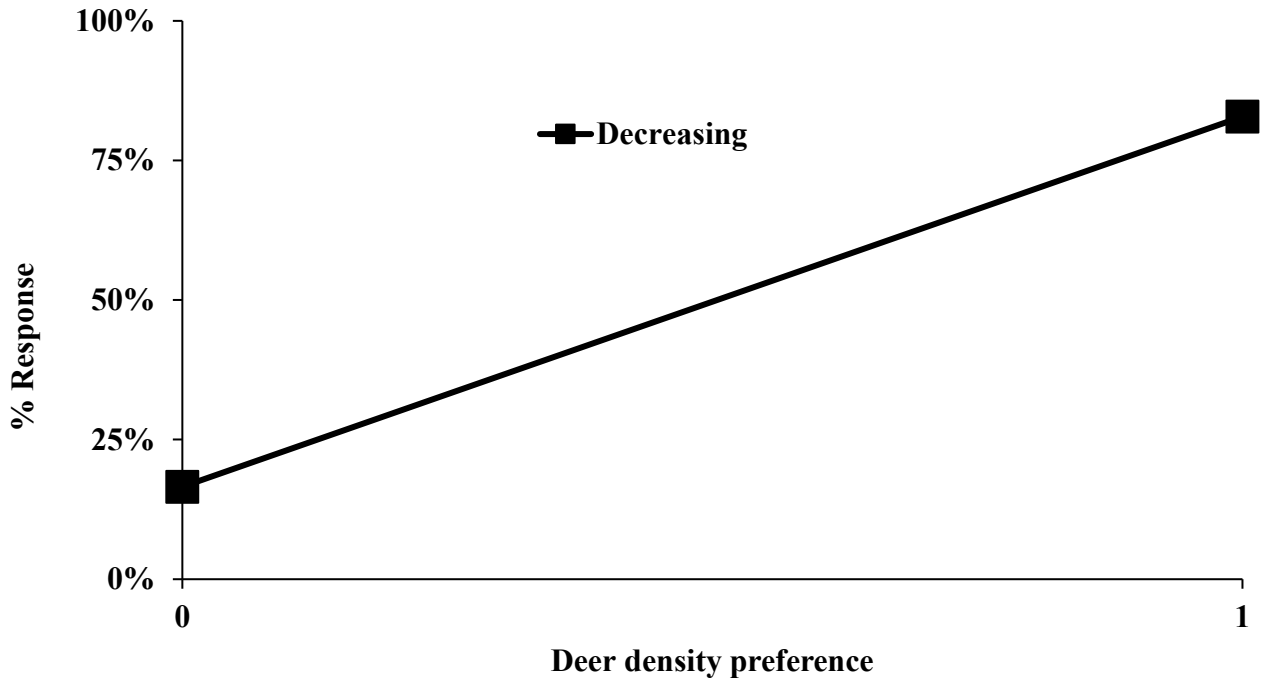

Figure 1B