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Assessing Residents' Knowledge, Attitudes, and Values Towards the Duluth
Urban Deer Herd.

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Abstract

The purpose of this exploratory quantitative mail survey was to discover Duluth residents' knowledge, attitudes, and values towards the urban deer herd. An area based purposive sample was drawn and the households selected were mailed a four-part questionnaire. The sample was comprised of households in 5 of Duluth's 34 Deer Hunt Areas (DHAs) which had been created by the Arrowhead Bowhunters Alliance (ABA). With a 32% return rate (150 surveys returned of 469 viable sent), surveys found: scores of; 64% correct on factual deer knowledge; personal experiences, family, and friends were the most common sources of knowledge; personal perceived knowledge was higher than the perceived knowledge of others; overall attitudes and values were positive towards deer; and communication benefits were the most important attitude and values topic. From these results, it was found that factual knowledge was low, self-initiated sources of knowledge were most common, residents' perceived knowledge was higher than factual knowledge, and naturalistic attitudes were the highest while deer tolerance and educational values were the lowest. From these results, the following recommendations were made: schools could create more lessons revolving around deer in all subject matters to increase knowledge; nature centers and ELC's could create more programs concentrating on deer to increase positive attitudes and values towards them; government agencies could use their position for outreach campaigns revolving around deer to reach a large amount of people; and the City of Duluth and the ABA could use the results of this survey to help create a management plan for the urban deer herd.

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Chapter 1: Introduction

“Although other species perished, whitetails took advantage of us. Currently they exploit the urban savannah we created and the agricultural lands that sustain us. The whitetail just adjusts, fits in, and thrives. Like humans, whitetails are not habitat-specific but are “adjusters” that do well wherever there is food and a place to hide. Humans and whitetails are a species without an ecological niche. The whitetail’s current strength is its ability to thrive along with man on man-made landscapes.”
–Valerius Geist, Professor Emeritus of Environmental Science, University of Calgary

Background

There are roughly 1.5 million deer-vehicle collisions in the US every year according to the National Highway Traffic Safety Administration. “As deer numbers increase, so do car-deer collisions.” Also, “when deer populations increase, so does the incidence of Lyme disease,” (Cambrone, 2013, p. 194). A majority of these occur in urban and suburban areas, where deer and humans are interacting more and more every year. Deer become habituated to the “city life” and learn to live in people’s yard, avoiding dogs, and eating flowers and shrubs to survive. The overabundance of white-tailed deer in Duluth is frustrating for many people who deal with property damage caused by the resident deer. People’s knowledge, attitudes, and values on the subject are wide ranging, but almost all agree that it is an issue that needs to be discussed. According to Raik, it is difficult for the residents to voice their opinion on deer management techniques to wildlife agencies (2005). A study done by Stout, Knuth, and Curtis designed and implemented a communication plan for the residents of Rochester, New York to be heard by the management agencies about their views on urban deer management techniques (1997). A high percentage of residents show interest in being a part of management decisions being made solely by wildlife management agencies, like the DNR, but cannot make sufficient contact with them (Chase, 1999).

The city of Duluth recently completed its 10th annual city bow hunt (2014), its method of managing the urban deer population. According to Arrowhead Bowhunters Alliance president, Phillip Lockett, the deer numbers have decreased over the years and less deer are being seen. But others disagree, stating that deer are just getting smarter and hiding in places where hunters aren’t allowed to hunt, like Hartley Nature Area, for a majority of the season. In Duluth, where hunting in the region is a common

outdoor recreational activity, it would seem residents would have even more of an interest in the importance and techniques used in managing the urban deer population than residents in other parts of the country with less interest (Chase, 1999). A naturalistic attitude is a key focus in this study, based on affection for wildlife and the outdoors being in line with the issue of Duluth's urban deer herd and how residents feel about them (Kellert, 1980). A majority of studies surrounding this issue have been conducted quantitatively with mail surveys being sent out investigating opinions on white-tailed deer management techniques. What remains to be explored, however, is assessing the knowledge, attitudes, and values of residents towards the Duluth urban deer herd.

Therefore, the purpose of this study was to collect quantitative information from the Duluth community, focusing on their knowledge, attitudes, and values surrounding Duluth deer herd. The significance of these ideas and beliefs being discovered is that there will be a better idea of a direction to work towards concerning the management plan for the urban deer in the future based on attitudes and values towards urban deer. More importantly, it will provide educators with an idea of residents' knowledge of deer, where they gain their knowledge from, and how they feel about them. Using this, they can create programs and outreach sources in order to educate residents on one of Minnesota's most illustrious animals. Residents' property damage could decrease as well as deer-vehicle collisions, complaints to and about management agencies would decrease and deer would be seen in a better light, and residents would feel more knowledgeable, and therefore have complete attitudes towards the deer they encounter in their backyard. These are just a few positive outcomes gained from learning about people's attitudes, values, and knowledge on the subject.

Research Questions

1. What knowledge do residents hold regarding deer and where did they gain this information?
2. What attitudes does the Duluth community hold towards the urban deer population?
3. What values does the Duluth community hold regarding the urban deer population?

Definition of Terms

The following section defines key terms and how they will be used in this study. The terms are defined using the process for specification of concepts outlined in Babbie (2011) and Creswell (2009).

1. Arrowhead Bowhunters Alliance (ABA)

An organization of residents that govern the Duluth urban bow hunt every fall. Working alongside the City of Duluth and the Minnesota Department of Natural Resources, they design the rules and guidelines of the hunt, as well as create the designated Deer Hunt Areas (see below).

2. Attitudes

A person's feelings and beliefs towards the urban deer herd's presence, their nostalgic beauty, and the damage they cause. Both positive and negative outcomes can arise from these feelings, based on what they are. "An orientation toward certain objects or situations that is emotionally toned and relatively persistent" (Theodorson, 1969).

Attitudes represent a person's level of like or dislike for a person, place, thing, action, or idea. Attitudes can and do shift based on experience. In general, attitudes are judgments. Examples of attitudes a person might express include: amusement parks are a waste of time; the government is too big; exercise isn't worth the effort. They represent a combination of a belief about the subject, a positive or negative evaluation of that subject, and a tendency to act accordingly (Ardoin, 2013).

Attitudes will be discovered by the WAVs scale created by Purdy and Decker (1989) administered in the questionnaire.

3. Deer Hunt Areas (DHAs)

Designated areas within city limits in which bow hunters that are selected for the urban bow hunt can be assigned to hunt in. These 34 DHAs have a large amount of green space,

and therefore have the capacity to hold higher populations of deer compared to other areas. They range from the extreme west end of the city to the extreme east end.

For this study, five of the DHAs with the largest deer harvests over the 10 years of the hunt will be used as the sample population.

4. Deer Management Techniques

A combination of lethal and non-lethal methods of deterring or removing deer from an unwanted location based on availability of funding, interests, and local laws. Urban management techniques are often limited to archery hunts, deer hazing/deterrents, or habitat modification (DeNicola, 2000).

In this study, the focus will be mainly on the archery hunt available in Duluth, MN for managing the widespread urban deer herd.

5. Green Space

On account of urban sprawl, cities are becoming more spread out with more “green space”. Parks and nature areas, like Hartley Nature Area, between houses and businesses are areas where urban deer thrive; eating, sleeping, and producing (Cambronne, 2013).

Green space is mainly found in DHAs within Duluth

6. Habituation

Habituation is a form of learning in which an animal, after a period of exposure to a stimulus, stops responding. Sensory systems may stop, after a while, sending signals to the brain in response to a continuously present or often-repeated stimulus (Cohen, 1997).

In this study, urban White-Tailed Deer become habituated to stimuli such as dogs, vehicles, and human presence, and no longer feel as threatened by them.

7. Knowledge

The familiarity of deer, especially the urban population, based on facts and experiences. Knowledge is proven facts, not thoughts or beliefs. Knowledge can often be combined with attitudes and values. Knowledge is important to having accurate attitudes and values towards an object.

In this study, knowledge will be tested by the knowledge quiz designed by Whitetail Unlimited and adapted by Egan (2011).

8. Overabundance

Overabundance occurs when white-tailed deer exceed the carrying capacity of an ecosystem; destroying plant growth, spreading disease, utilizing the same resources as other animals, and by altering the structural heterogeneity of the habitat (Rooney & Waller, 2003). Urban overabundance causes car accidents, passing of diseases (such as Lyme's disease), and destruction of yards and gardens (Creacy, 2006).

9. Urban Deer Population/Urban Deer Herd

The number of deer living in or near a developed area, among houses and businesses. They are termed as a herd although deer do not technically live in herds as other ungulates like cows and bison do.

In this study the urban deer population will be defined as the deer living within Duluth city limits.

10. Values

An enduring concept of the preferable which influences choices and actions (Brown, 1984). The good in relation to Duluth's urban deer herd. Examples include; aesthetical,

recreational, educational, ethical, or moral values brought on by the sight or thought of these deer (Manning, 1998).

Values are related to moral convictions and are deeply held, core constructs about what is good or bad, right or wrong. Values develop slowly throughout the course of one's lifetime and, once set, are difficult to change. Some examples of values include: family, faith, independence, honesty, and justice (Ardoin, 2013).

“The underlying standards and ideals used to guide preference, behavior, and evaluation,” (Kellert & Applegate, 1984).

In this study values will be discovered by the WAVs scale developed by Purdy and Decker (1989).

11. Wildlife Agency

Wildlife agencies duties include; working with citizens to conserve and manage the state's natural resources, to provide outdoor recreation opportunities, and to provide for commercial uses of natural resources in a way that creates a sustainable quality of life (MN DNR, 2013).

In this study, the DNR works in part with the Arrowhead Bowhunters Alliance to regulate the Duluth City Bow Hunt in order to manage the urban deer population (ABA, 2012).

Limitations of the Study

1. Exploratory study, more research will be needed.
2. The decision to contact participants in certain parts of the city based on deer interactions on their property. Focusing only on five of the ABA's DHA zones.
3. Sample size of roughly 500 households (1.4% of total households in Duluth, but 48.5% of population of the DHAs that were sampled) instead of the whole city based on time and cost constraints.
4. Attitudes and Values will be viewed as the same concept. Using the WAVs Scale, there is no differentiation between the two.
5. Quantitative survey only, no qualitative information used.

Delimitations of the Study

1. This study was done to gather information on knowledge, attitudes, and values of urban deer, not to make conclusions about deer management practices.
2. The decision to focus on DHAs because those residents encounter the most deer and interact with them on a day to day basis. This allow for higher knowledge, possibly, as well as more set attitudes and values towards deer.

Assumptions

1. People view wildlife differently in urban settings compared to rural areas.
2. Attitudes, values, and beliefs are different for everyone. But, an overall pattern can be developed.
3. Attitudes and values will be viewed as one in the same.
4. Duluth has a high population of deer living within its boundaries, with even higher populations in the DHAs.
5. Duluth's residents' environmental knowledge is higher than most parts of the country because of its proximity to "wilderness" and overall attitude towards outdoor recreation.

Chapter 2: Literature Review

Introduction

The purpose of this study was to discover residents' knowledge, attitudes, and values towards the Duluth deer herd. This chapter is comprised of a literature review surrounding definitions and studies used to strengthen this project. The differences between knowledge, attitude, and values is discussed. It also discusses people's attitudes and values towards wildlife, their knowledge of wildlife and deer, and where they gained it. Lastly, the survey methods used in this study are discussed. These points were examined in order to provide the strongest pillar of an urban deer study possible.

Difference Between Knowledge, Attitudes, and Values

Humans have a variety of emotions that make them unique. They can love or hate, be curious or bored, angry or happy, and anything in between. They often strive to learn, to understand, and to gain knowledge. They can organize this knowledge, along with opinions, and rearrange inputs to develop their attitudes. Furthermore, their values are developed over long periods of time of gathering knowledge, opinions, and other inputs. Understanding each of these variables separately is important to understand how they are connected to one another.

Knowledge is defined as, "facts, information, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject," (Oxford Dictionary, 2014). Building upon this, the operational definition of deer knowledge used in this study was; the familiarity of deer, especially the urban population, based on facts and experiences. Knowledge, experiences, and information are gained through a variety of sources (Pew Review Center, Fig. 3, p. 8). It is a fundamental key to base one's attitudes and values on, as stated by Kellert through his fourth variable, knowledge and understanding about a species, in Value of Life (Kellert, 2006).

Knowledge is a necessary precursor to attitudes. If a person doesn't have any information about an issue nor has any experiences with it, they can't have a defensible stance on an attitude about said

issue or subject. Therefore, knowledge of a topic is critical to hold an attitude towards it. According to Espinosa, “higher knowledge was positively associated with positive attitudes. (And,) a misunderstanding or ignorance can exacerbate negative attitudes,” (Espinosa & Jacobson, 2012, p. 63).

Attitudes, in general, “are judgments”, a like or dislike for something based off of knowledge and experiences (Ardoin, 2013, p. 22). Manning’s definition states, “An orientation toward certain objects or situations (like urban deer) that is emotionally toned and relatively persistent. An attitude is learned and may be regarded as a more specific expression of a value or belief,” (Manning, 1999). Based on these conditions, attitude fits between knowledge and values in the framework of human feelings.

Values are a deeper grasp of core feelings and beliefs and are often more grounded than attitudes. They are not simply “like or dislike”, but the belief of “right or wrong”. They take time to develop and are very difficult to change (Ardoin, 2013, p. 22). They are often rooted in one’s environment and are built through experiences throughout their life. Values can be influenced by family, culture, environment, and faith; and may be skewed by outside sources as well.

Knowledge, attitudes, values are often linked and discussed together. “Attitudes and values, in addition to knowledge, are key factors in influencing environmental behavior,” (Ardoin, 2013, p. 25). Attitudes and values may lead to action if there is strong enough feeling about them. But, one must have enough knowledge about a subject to know what action is needed to cause the desired change. All three variables are needed to make decisions regarding how people feel towards an issue.

The differentiation of attitudes and values is difficult to conceptualize. There are very minor and minute differences, which are unimportant for this study. Therefore, attitudes and values will be viewed as one in the same for the remainder of the study.

People’s Attitudes and Values towards Wildlife

Attitudes and values differ towards wildlife depending on people’s activities revolving around them, especially between viewing and hunting. For example, both groups rated high on wildlife enjoyment

according to Daigle, but hunters scored significantly lower when it came to animals having rights (Daigle, 2002 p. 19). A major point in Daigle's article was that "observing and learning about wildlife was important to both groups" (Daigle, 2002, p. 22). He went one step further and concluded that hunters valued "achievement and power" over animals, while wildlife views simply wanted "enjoyment," (Daigle, 2002, p. 23). This is a discrepancy between the two groups that is often found, and is a sticking point when it comes to wildlife management discussions.

In the village of Oyacachi, Ecuador, it was clear that the attitudes and values towards the Andean Bear were very different from one person to another. "Individuals valued bears and believed bears were personally important and should be protected," (Espinosa, 2012, p. 22). Yet, before an educational program was implemented into the community 16% of villagers said they would shoot a bear cub (although only 7% after education). Although they believed bears were personally important, they were willing to shoot bear cubs and destroy their habitat for farming. These actions are examples of several of Kellert's nine attitude types described in his five-part report to the United States Fish and Wildlife Service delivered between 1977 and 1983. In phase III, he first described the nine attitudes (1980);

Naturalistic is the primary interest and affection for wildlife and the outdoors.

Ecologicistic is the primary concern for the environment as a system, for interrelationships between wildlife species and natural habitat.

Humanistic is the primary concern and strong affection for individual animals, principally pets.

Moralistic is the primary concern for the right and wrong treatment of animals, with strong opposition to exploitation or cruelty towards animals.

Scientistic is the primary interest in the physical attributes and biological functioning of animals.

Aesthetic is the primary concern in the artistic and symbolic characteristics of animals.

Utilitarian is the primary concern for the practical and material value of animals of the animal's habitat.

Dominionistic is the primary interest in the mastery and control of animals typically in sporting situations.

Negativistic is the primary orientation for an active avoidance of animals due to indifference, dislike or fear.

These attitudes are driven by two primary motivational considerations; affection towards animals and economic and pragmatic considerations (Kellert, 1980, phase III). According to Kellert, “these attitudes reflect patterned feelings, ideas and beliefs and, in most cases, considerably influence individual action and activities,” (Kellert, Phase III, 1980, p. 41).

According to Kellert the four most felt attitudes in American society are; humanistic (35%), naturalistic (35%), moralistic (20%), and utilitarian (20%), which align nicely with this paper’s goals (Kellert, Phase III, p. 44). Kellert also found that the demographic groups of women, children, and residents of cities between 50,000 and 100,000 (Duluth has a population of 86,000) averaged higher humanistic, moralistic, and dominionistic attitudes than men and rural residents, who had higher utilitarian scores (Kellert, Phase III, p. 83). Naturalistic scores were found to be highest in those who had higher education levels and a household income between \$35,000 and \$50,000 (Kellert, Phase I, p. 92). People who read and watched educational shows on wildlife (like National Geographic) had higher naturalistic, ecologicistic, and scientific attitudes compared to those who didn’t, who held utilitarian attitudes (Kellert, 1980, phase III). Serpell designed a model of two motivational considerations towards attitudes of animals based off of Kellert’s work. They were; “Affect-representing people’s affective and/or emotional responses to animals, and Utility-representing people’s perceptions of animals instrumental value,” (Serpell, 2004, p.146).

Wildlife values were divided into classifications long ago. They included; recreational, aesthetic, educational, biological, social, and commercial (King, 1947). Purdy and Decker (1989) used these groups along with Kellert’s work to create the Wildlife Attitudes and Values Scale, or WAVS as a tool to determine the importance of wildlife to different groups of people. Attitudes and values are grouped together, with no differentiation in this scale. They did group the questions into four “Ways of thinking

about wildlife” topics, which described the four most popular issues surrounding wildlife. These topics were: social benefits, communication benefits, traditional conservation, and problem tolerance (Butler et al., 2001). Whether it’s an attitude towards wildlife or a value of said wildlife, knowledge is needed to comprehend both of these variables (Kellert, 2006).

People’s Knowledge of Animals, and Where did they get it?

People of today obtain their information differently than decades ago and they get it much faster, usually right at their fingertips. Local information can come from a range of sources, but news channels are responsible for 74% of the source of local news according to the Pew Research Center. This is followed by word of mouth (55%), radio (51%), and newspapers (50%) (PRC, Fig. 5, p. 13). There is also a pattern as to where to look when looking for certain information. According to Pew Research Center, the local newspaper was the source that covered the most topics and was most often used as an overall news source. Also, when people wanted specific news on community events, like a city deer hunt, 25% of the population relied on the newspaper. Word-of-mouth (13%) and internet (12%) were the next most relied on sources (PRC, Fig. 6, p.15).

A large nation-wide survey discovering the knowledge of animals was collected by a five-phase report conducted by Stephen Kellert. Phase III of Kellert’s Report on American’s attitudes, knowledge, and behavior pertaining to wildlife and natural habitats focused specifically on the knowledge and attitudes toward animals. Using a true/false or multiple choice questionnaire of 33 questions (chosen from 500 wide-ranging subject levels) to test factual animal knowledge, Kellert found these results: the national average of correct answers was 53%, with biological knowledge scoring a high of 55%, and knowledge of endangered species scoring a low of 27%. The public’s knowledge of domestic animals and predators was fairly high compared to the other animal groups tested, at 53% and 47% correct respectively (Kellert, Phase III, p.15).

Demographically speaking, outdoor enthusiasts scored higher in knowledge than the non-activity population in every group. Birdwatchers scored the highest, 68%, followed by hunters, 59%, and zoo-

goers, 55%. Anti-hunters scored 54%. This was the lowest of any activity group, but still 1% above the general population (Kellert, Phase II, p. 20). Members of nature organizations also scored quite high, with wildlife preservation organizations scoring 66%, and sportsman organizations and general conservation organizations both scoring 63% (Kellert, Phase II, p. 145). This was compared to the general population score of 53%. Generally speaking, the more education a person received, the higher their animal knowledge scores were. This also was true of income levels; with higher grossing households having higher levels of knowledge. Often, education and income levels positively correlate with one another.

“Involvement in any kind of animal related activity is associated with higher knowledge scores, especially if they are recreational,” (Kellert, 1980). This means that spending time in nature increases animal knowledge. Kellert found that the less knowledgeable a person was the more negative or indifferent they were towards animals. If the spending time in nature increases knowledge, it will also allow a person to make more educated judgments towards animals. These educated judgments can be claimed as attitudes, as they are synonymous. If there are stronger attitudes, it often means personal values towards wildlife will be more solidified (Kellert, 2006).

People’s Knowledge, Attitudes, and Values towards Urban Deer

According to a study of the Village of Cayuga Heights, New York, which assessed attitudes towards urban deer, 54% of residents enjoyed the presence of deer but worried about deer-related problems (car accidents, passage of disease, and plant damage) and another 34% didn’t enjoy the presence of deer at all. This is a total of 88% of people concerned about deer present in the community (Chase, 1999, p. 4). Over 50% had voiced their opinion about deer population control. A majority of these, 96%, discussed issues with neighbors or friends, and 19% had contacted state agencies about deer problems (Chase, 1999, p. 7). Eighty-one percent wanted a decrease in the deer population and only 11% were happy with the amount of deer. Urban deer populations are a major issue for many communities on the east coast. Beginning in the ‘80s and increasing in the ‘90s, communities began implementing management programs to cull the urban deer herds. This tactic began to sweep west around the turn of the century, and in the early 2000s

Duluth, MN implemented an urban bow hunt to manage the herd that had begun to overtake the city of 86,000.

“At first it was fun to see deer. But then...citizens of Duluth began to complain,” (Cambronne, 2013, p. 200). This has been a common theme among Duluth residents. They are excited to see deer, often thought of as a sign of “wilderness” and can instill attitudes of awe and excitement. But these feelings often change when they wake up to their gardens mowed to the ground or their dog waking the neighborhood in the middle of the night by barking at the vegetable thieves. These are a few of the reasons Duluth implemented a city bow hunt, and its reception was quite positive from the start. “Rather than ‘not in my backyard’, its ‘*please* hunt in my backyard!’”(Cambronne, 2013, p. 201). “Almost four-hundred hunters sign up for the program each year, and together they remove between four to six-hundred deer from within the city limits (yearly),” said ABA President Phil Locket. This provides a numerical figure about the overabundance of deer, and more importantly an overarching attitude towards deer in Duluth. Brian Borkholder, the ABA secretary and statistics specialist, says Duluth urban hunting “has strong support from the community,” (p. 207). Cambronne asked one Duluth couple how their neighbors felt about allowing the ABA to hunt in their yard. They replied, “They were delighted. All of them. They’d been losing their gardens and flowerbeds, and having all kinds of trouble with deer,” (p. 201). They went on to say that they don’t like seeing deer killed, but it is much better to be shot with a bow and used as food for families than to be hit by a car causing human injury and property damage. The attitude of killing deer to protect human’s rings clear in the Duluth community.

But, there are still residents that see deer as their pets, and think it is their responsibility to take care of them. Although it is illegal to feed deer in Duluth, there are still known ‘feeders’ in the community. In an interview, Borkholder states, “Those deer aren’t their property. But they don’t get that. One man the ABA frequently has issues with calls them ‘our pet deer’. Tells you a lot about how some people view wildlife,” (p. 207-8). Serpell states, “over abundant whitetail deer...are economically damaging and pose significant health and traffic hazards, yet public affection for these animals sometimes protects them from

lethal control measures,” (Serpell, 2004). Deer are wildlife; and therefore nobody can claim them for themselves.

“I know the deer were here first, and civilization is making its way into their territory. But there are plenty of woods around us, they don’t all have to be here in the city,” said a Duluth resident (Cambronne, p. 212). Phil Mannon, another ABA board member, stated that urban deer are smart and habituate quickly. “These deer are fully habituated to traffic and human activity. They know there’s nothing to fear from a homeowner raking leaves, mowing the lawn, or walking the dog. (But) they’ve learned to associate my truck with danger. They know what’s normal and what’s not,” (p. 204). On account of this recognition, Phil has to start parking behind a garage, hiding his truck from view from the deer, not the residents of Duluth. This shows that knowledge is a two way street, and both the hunter and the hunted must understand their surroundings and adapt. Both must learn from each other’s actions. The Life-Dinner Principal states; the prey (deer) must adapt to survive, yet the predator (hunter) is only concerned with dinner (or in this case reducing the population to save gardens and reduce car accidents) (Dawkins, 1979).

Although overall, resident’s knowledge of urban deer is low, they believe they should have an influence on what management techniques are used to control deer populations (Chase, 1999, p. 18). Only 1% thinks no public input should be used, while 79% think town meetings should be open to everyone. On the other hand, 73% of the public are only willing to devote 1 hour a month or less to help make decisions on urban deer management decisions, (Chase, 1999, p.19). These confounding stats suggest that although the public is interested in being a part of decisions, they are not willing to actually put in the time or effort necessary to help. This is a typical trend found in studies covering resident’s knowledge, attitudes, or values of urban deer management by Chase, Siemer, and Decker (1999).

Survey Methods

Mail questionnaires are common for surveying a large population to get an overall assessment of a population's knowledge, attitudes, and values of a situation. They are often used in social research because of cost and ease of implementation (Dillman, 1991. p.225). Dillman is careful to discuss the four major errors using mail questionnaires, which are; sampling, noncoverage, nonresponse, and measurement. Sampling error can often be corrected by selecting a larger sample size in order to cover a larger range of the population. In this study, households in only certain DHAs were sampled. Therefore, although the sample size may seem smaller, it was only intended to sample a smaller population of Duluth in the first place. Noncoverage error can be avoided by giving the whole population an opportunity to reply to the survey, meaning certain parts of the city cannot be left out. This is different in the case that only certain parts of Duluth were aimed to be reached in this survey because residents need to be interacting with deer on a semi regular basis in order to hold attitudes and values towards them. Nonresponse error can arise on account of low interest levels or difficulty of the survey questions administered. This was addressed by analyzing the difference in results between early returns and later returns of the survey. Usually, early returns means more interest in the subject, correlating into stronger attitudes and values. Survey implementation has been vastly improved over the last few decades, and the acceptable response rate is 60% for a mail questionnaire to a general population according to Dillman (Dillman, 2007, p.208). This holds true if four rounds of mailings are conducted, which is discussed later. This also implies that an incentive is used, usually monetary. Measurement error is dependent on the removal of underlying variables, and "can occur because of poor questionnaire wording and construction", such as question order or bias towards the situation by the interviewer (Salant & Dillman, 1994).

Type of Sampling. Purposive random sampling entails dividing the population into groups or sections, and then randomly selecting a sample from each of these groups to use. Using the ABA's 34 Deer Hunting Areas are spread out across Duluth to evenly distribute city bow hunters based on deer

densities and land size. In this study, five of the DHAs with the highest harvest numbers over the past few seasons were chosen to ensure the greatest human-deer interaction. This did not include the whole population of Duluth, because some areas are not huntable and have very few deer. This excluded downtown, portions of west Duluth, and Park Point residents. This ruled out sampling error for those whose knowledge, attitude, and values of deer may skew the results based on their unfamiliarity of, or not having to deal with deer on their property. This study was interested in the population that deal with deer issues, and have attitudes, values, and knowledge based on personal interaction with them. An example would be as follows; “If 99% of the population agrees with a certain issues, for example, it is extremely unlikely that a probability sample will greatly misrepresent the extent of agreement. If the population is split (50% agree, 50% disagree), however, sampling error will be much greater. Rather than selecting a sample from a total population at large, it would be more informative to select appropriate samples from a more homogeneous subgroup of the population,” (Dillman, 2007, p.187).

Survey Implementation. Mail surveys have less incentive to be completed than other forms of surveys. Therefore it is important that they are well written, use personalized correspondence, and use repeated mailings to help get a satisfactory response rate. It is also important to have the sampling list in an electronic format; it will make repeat mailings simpler and organization easier, saving time and money in the end (Dillman, 2007, p. 193).

Dillman’s “Tailored Design Method” has been widely used as the best source of how to conduct mail surveys in order to receive the highest response rate. Multiple contacts are the most effective way to do so, with four separate mailings being sent to the sample as the suggested amount. They include;

1. Prenotification letter- sent to entire sample stating the purpose of the study, a questionnaire will be arriving soon, and that participation would be appreciated. The letter should be concise and written on University Letterhead, and have signatures and contact information of

- the investigator. It should be mailed first class, and have the specific respondent's name on the envelope.
2. First questionnaire packet- sent to entire sample a week after prenotification letter. It should include the envelope containing a personalized and signed cover letter, the questionnaire, and a return envelope that is addressed and has postage already on it. Personalize the cover letter as much as possible to make it personable to the residents, assure them the study will be confidential, and thank them for their participation in the study. The questionnaire should be organized and neat, with individual identification numbers in order to discern who has completed and returned it and who needs to be sent a replacement questionnaire. The return envelope should be addressed to the researchers address and provide first class postage. This should increase the likelihood of completion and return because monetary value has been given to the questionnaire and conveys importance
 3. Thank you/Reminder postcard- "expresses gratitude to those who responded and mailed back completed questionnaires, and reminds those who have not response that it would be appreciated," (p. 198). The postcard should say when the questionnaire was sent, why it was sent, and include a signature of the investigator. It should be sent a week after the questionnaire was mailed using first class mail.
 4. Replacement Questionnaire- A packet containing a reminder letter, another questionnaire, and an addressed postage paid envelope to return the questionnaire should be sent two weeks after the thank you/reminder postcard. The letter should be more urgent, making the respondent feel as if their participation is important to the study. The questionnaire should be the same as the first, as will the return envelope.

After these four steps have been taken, a response rate at or above 60% should be expected. Although mail questionnaires are not the most personable ways to obtain information, it is a great way to reach a wide range and large amount of people. Since roughly 500 random households had to be reached, a mail questionnaire was the most efficient way to do so.

Although four rounds of mailings are suggested by Dillman (2007), funding and time constraints altered these methods. In order to receive the greatest amount of questionnaires returned within these constraints, the following protocol was suggested by retired Professor of Sociology and Anthropology William Fleischman;

1. Prenotification Postcard containing an introduction of the principal investigator and of the study, the reasoning behind the study, contact information, and notification of a questionnaire arriving soon.
2. Questionnaire packet containing an introduction and consent letter, the questionnaire, and a pre-paid and addressed return envelope.
3. Reminder/Thank You Postcard reminding those who haven't completed the questionnaire to please do so and return it, thanking those who have completed and mailed the questionnaire, and contact information to replace a lost questionnaire.

Summary

Knowledge, attitudes, and values are key components when assessing a group's feeling toward something like the urban deer herd in Duluth. By assessing these traits, a management decision on how to deal with this wildlife could be able to be put into motion. Knowledge is the keystone on which attitudes and values can be built upon. As shown, there is not a great amount of knowledge about animals, and this is especially true in more urban areas. According to Kellert (1980) people view animals with a humanist or naturalist attitude a majority of the time. This means either treating them as pets or the enjoyment of viewing them in nature. Whether it's feeding them like pets, or simply seeing them populate green spaces across the city, Duluth has them both. A majority of residents are okay with the city bowhunt, and it seems as if they are begging for deer to be removed from their yards. Although they don't like seeing deer killed, they would rather see it happen through hunting and using the meat to feed their families than the front of a car ruining both property and the meat. Assessing knowledge, attitudes, and values of the

Duluth urban deer herd will indicate if there is a need for educating the public to increase deer knowledge and provide stakeholders the information needed to make management decisions about herd management.

Chapter 3: Methodology

Introduction

The purpose of this study was to discover resident's knowledge, attitudes, and values towards the Duluth deer herd. This included finding what they know about deer and how they gained the information, as well as how they feel towards and about deer and the management practices used to control them. To discover the residents' feelings towards the deer, the study was comprised of an exploratory questionnaire that used a Likert type scale, as well as a true or false knowledge-based quiz.

Design

A survey design with a mailed questionnaire was used for this study. The reasoning behind the questionnaire is based on the fact that a wide variety of residents that were contacted. The large number, and the variety of the questions being asked, would have make other surveys difficult and time consuming to conduct. Personal interviews would have likely take far too long to conduct, and email addresses or personal cell phone numbers would have been difficult to obtain for specific residents. This is why a cross-sectional purposeful random sampling questionnaire delivered by mail was used. The knowledge, attitudes, and values at the present time are what interest the study.

Duluth is a large city with a variety of environments. Some are ideal for deer habitat, while others are not. The Duluth Arrowhead Bowhunter's Alliance has been in charge of a public city bow hunt every fall for the past 10 years, and has divided habitats that deer have been found to reside in around the city into 34 zones used to hunt. The study used five of the 34 zones to specify areas for the random sampling. The five zones were chosen by harvest numbers though the ten years of the city hunt, with higher harvests correlating with larger deer densities. A mail-delivered questionnaire was the only feasible way to conduct a random sample, as there was no way to collect email addresses for specific residents, especially at random. House phones are a thing of the past for most, and therefore would not have provided a useful sample. Addresses were obtained through a public database called St. Louis County Land Explorer, as only households within the five selected DHAs are of interest for the study.

Population and Sample

As stated, the study only covered the residents of Duluth that live in known deer habitat, instead of including areas with little green space like downtown. This was because the study was interested in those who have the most contact, and therefore familiarity, with the Duluth deer herd. This study was not meant to discover the attitudes of the city as a whole, but rather knowledge, attitudes, and values towards deer of those who interact with them on a more regular basis.

Duluth has an estimated population of 86,000 people and roughly 35,500 households (U.S Census Data). Majorities of the population lives in the downtown areas of Duluth with little green space, and therefore were omitted from the project. Within the 34 DHAs, the investigator selected the five zones with the highest harvest numbers over the last few years. These zones are; 1 (near Fond Du Lac), 12B (between HWY 53, Arrowhead Rd, and Arlington Ave), 13 (Between Arrowhead Rd, Rice Lake Rd, Norton Rd, and Howard Gnesen Rd), 16B (Between Woodland Ave, Martin Rd, and Jean Duluth Rd), and 17D (below Hawk Ridge). These five zones are evenly distributed across Duluth, with 1 being in the extreme west end, 12B and 13 in the central area, and 16B and 17D on the east side. Each DHA zone was mailed the same questionnaire, but a different color was used for each in order to differentiate between the DHAs for analysis purposes (Fig 1).

A probability proportionate to size (PPS) method was used for sampling. This meant that a certain amount of each DHA chosen was sampled. In this study, 48.5% of households in each of the DHAs chosen were sent questionnaires. The addresses were be cross checked using the program St. Louis County Land Explorer and the DHA overlay maps developed for Google Earth to make sure they fell within the selected DHAs.

The principle investigator organized files gained from St. Louis County Land Explorer into following columns; First Name, Last Name, Company Name, Address, City, ZIP, Owner Address, and many other land record information. Duplicates and business addresses were deleted so that only residences were remaining. The excel files holding the address information was organized alphabetically

by last names. Each DHA had a separate excel file, to keep them separated. The remaining amounts of residences left in each DHA were: 1- 116, 12B-409, 13-217, 16B-205, and 17D-83, with a total of 1030 residences across the five zones. With a goal of surveying 500 residences, 48.5% of the residences were sent a questionnaire. This equaled; DHA 1-55, 12B-200, 13- 105, 16B-100, and 17D-40, for a total of 500. This information is displayed in Table 1. A funding summary of mailing the surveys is located in Appendix D.

Table 1.
Deer Hunt Area specifications

DHA Number	Questionnaire Color	Section of Duluth	Total Residences	Questionnaires Sent
1	Purple	West	116	55
12B	Green	Central	409	200
13	Yellow	Central	217	105
16B	Blue	East	205	100
17D	Pink	East	83	40
Total			1030	500

Once the excel files were organized and the amount of residences' needed for each DHA, randomized selection was needed. The principle investigator used a random number generator called random.org. Random numbers were generated in the amount needed dependent on the DHA being generated. Using the amount of numbers needed, the principle investigator selected the corresponding addresses from the excel file. An example of this is as follows; For DHA one, a random integer generator generated 55 random numbers between 1 to 116. The 55 numbers generated were matched with the alphabetically ordered last name. The first number generated was 88, it was matched with the 88th last name in the alphabetized list. A total completed list was then transferred into one excel file containing all 500 randomly selected addresses in which to mail postcards and a questionnaire to.

The questionnaire was a multi-stage mailing loosely following Dillman's "Tailored Design Method" discussed in detail in Chapter 2. Briefly, these stages included; a prenotification postcard, a questionnaire

packed including a personal cover and consent letter and postage paid return envelope, and a thank you/reminder postcard. This will be more specifically covered later in the chapter.

Instrumentation

The instrument used in this study was a combination of a modified instrument used by Purdy and Decker (1989) called WAVS (Wildlife Attitudes and Values Scale), as well as an intact instrument developed by writers of the popular magazine *Whitetails Unlimited* and adapted by D'Arcy Egan (2011) to test white tail deer knowledge. There was also a source of deer knowledge section, and a demographics portion created by the principle investigator. The complete instrument can be found in Appendix C.

The WAVS scale was developed in 1989 to discover a wide range of attitudes and values towards wildlife across a wide range of demographics of every kind (Purdy, 1989). Demographics of the Purdy study included; race, social class, gender, profession, and more. The first section of the study used 18 questions that measure one's attitudes and values of wildlife in general and was adjusted to focus on only white tailed deer. It was adjusted by changing the word "wildlife" to "deer" in every question. Also, one question was reformed from "People trap wildlife for sale of fur or pelts" to "People hunt deer for sale of fur or antlers", to adjust for a more rational and realistic choice. Answers to the questionnaire were then evaluated using a 5 point Likert-type scale ranging from strongly agree to strongly disagree. The participant marked the corresponding box with their response. 5=strongly agree, 4=agree, 3=indifferent, 2=disagree, 1=strongly disagree.

Kellert's (1980) study of nine attitude types found in a general population was a large influence for this study as well as Purdy and Decker used answers from this study to write theirs. In Kellert's study, a large amount of questions were pilot-tested, adjusted, and removed for various reasons until the instrument was ready to be used for his study. This report was a large study of 3107 adults across that nation that took 6 years to complete. Kellert's surveys had a 61% response rate and were conducted primarily by phone interviews.

Using the WAVS scale along with Kellert's study of his nine attitude types, patterns were

established. Evaluation of these answers will help discover the overall attitudes and values towards the deer herd in the specific DHAs. Statistical analysis will also be used to compare groups against one another, like the demographic differences of hunters versus non-hunters, as well as across DHAs.

The second instrument incorporated into the questionnaire was a true or false quiz developed by Whitetails Unlimited and adapted by D'Arcy Egan, and outdoor writer for The Plain Dealer. He published this quiz in The Plain Dealer in 2011, and it is comprised of 15 true or false questions. All the questions are based on facts that can be found in a variety of sources, and the language is clear, concise, and straightforward. This was tested through the pilot test. With a baseline of 50% as a score, as each answer is either right or wrong; the scores were compared to that. Answers were also compared across demographics and between DHAs as well.

A self-designed portion of the instrument investigated resident's source(s) of knowledge of deer. These sources included the main sources of knowledge; local news, social media, personal communication, and education. Each of these sources will be split into finer detail to hone in on the exact source. News included newspapers, TV, radio, and internet. Social Media encompassed Facebook, Twitter, and magazines. Personal communication was split into family, friends, and neighbors. Lastly, education included formal, non-formal, and self-education. Each respondent was then asked to indicate their main source of knowledge, as well as all of the sources they have gained deer knowledge from. Also, they were asked to rank their perceived deer knowledge levels on a scale of 5=great amount of knowledge to 1=very little amount of knowledge. Lastly, they were asked to score the perceived knowledge of other Duluth residents, Minnesota residents, and the rest of the United States residents to develop perceived knowledge scores.

The last part of the instrument was general demographic questions created by the principle investigator. Questions included; gender, age, years lived in Duluth, amount of deer seen on their property in the last 30 days, whether or not they receive property damage from deer, and whether they participate in hunting or not. The demographic information was needed in order to compare groups to discover trends among different populations. These demographics helped give a more statistical comparison between

groups, and really showed what groups know and how they felt towards the deer herd. It was thought that maybe these answers could have helped answer the question of why they feel the way they do as well.

Validity for these instruments were provided by construct validity, as a panel of experts in the study were given the instrument first to detect mistakes or needed changes. The WAVS scale has been rigorously tested and used a variety of times by a range of scientists, and has proven itself. Changing the word “wildlife” to “deer” may have affected validity slightly, and therefore was examined by a panel. The deer knowledge quiz has been used but was found untested, and therefore was looked at closer and more carefully by the committee and graduate students. The demographic section was reviewed by the panel for the same reasons. Reliability has been established for the WAVS scale via testing a wide range of participants over many different studies. The nature of how the questionnaire was written and delivered will ensure reliability as well.

The questionnaire was handed out to members Environmental Education class, and therefore will not be randomly assigned or conducted without confidentiality. The reason behind the panel test was to strictly check for ease of use and understanding of the questionnaire. It was not to ensure return rates or as a comparison to the real test. If there was difficulty or misunderstanding of questions in the questionnaire it would have been revised and ran through the panel and field test again, but no changes were found to be needed. After panel testing the instrument, the Internal Review Board assessed the instrument for validity and confidentiality, with no changes needed.

Non-response bias was examined by comparing surveys returned very early versus those returned later in the study. This is because early returns often have more pronounced passionate attitudes and values, and later returns show a more neutral view (Sheikh, 1981). Non –response bias was also covered by returned questionnaires that were not completed but had written comments on them stating their disinterest in the study.

Data Collection Procedures

Survey administration was discussed in chapter 2 as part of a discussion of Dillman’s “Tailored Design Methods”. Special attention to order and thoroughness was needed during administration to

ensure desired results. The steps for the survey administration should be as followed:

1. Prenotification postcard (Appendix B) - sent to entire sample stating the purpose of the study, a questionnaire would be arriving soon, and that participation would be appreciated. The postcard was concise, written on University Letterhead, and have signatures and contact information of the investigator. It was mailed first class, with a deer head symbol in order to grab attention.

2. First questionnaire packet- sent to the entire sample a week after the prenotification postcard was sent. It included a size 10 Education Department envelope containing a personalized and signed cover letter (Appendix A) explaining the study and a consent statement, the questionnaire (Appendix C) in the specified color pertaining the to DHA the household is located in, and a size 9 business reply return envelope that was addressed and free of charge to return to the Education Department office.

Personalizing the cover letter as much as possible made it personable to the residents. Assuring the population that the study was voluntary and all information will be confidential to only the principle investigator, and thanking them for their participation in the study also made it personable. The questionnaire was organized and neat and included a boarder to make it stand out more. The return envelope was addressed to the Education Department office and samples were provided business return reply postage. This was to increase the likelihood of completion and return because monetary value was given to the questionnaire and this conveyed truth and realistic importance.

3. Thank you/Reminder postcard (Appendix B)- to “expresses gratitude to those who responded and mailed back completed questionnaires, and reminds those who have not response that it would be appreciated,” (Dillman, 2007, p. 198). The postcard stated when the questionnaire was sent, why it was sent, a deadline of a questionnaire return date, and a signature of the investigator in order to make it more personable. It also included contact information for the investigator and instructions on how to receive a replacement questionnaire if one was needed. It was sent a week after the questionnaire was mailed using first class mail.

The first and final postcard were designed and mailed out by VistaPrint.com. VistaPrint allows the upload of address files and cross checks them for accuracy. They also use bulk mailing rates to reduce the

price, and allow for a range of delivery dates specified by the customer.

Once all the surveys were administered and given ample time for return (25 days after the questionnaire was mailed), the author collected the data and entered the results into a spread sheet for data analysis. A spread sheet was also needed in order to separate questions and demographics into groups in order to fully comprehend the results from all angles. The subjects were instructed not to include their return addresses on the return envelope or completed questionnaire in order to ensure anonymity for the study, although many included it. No names were collected and added to any data. The data was stored in a hidden file on a personal computer with a password. Questionnaires were returned to the Education Department office in the Education Building on the University of Minnesota-Duluth Campus. They were stored in an office that is locked by staff. The only information the principle investigator will have is the DHA the questionnaire was returned from based on the color of the questionnaire. A contract of confidentiality was also addressed in the prenotification letter and questionnaire to ensure no information was shared.

The prenotification mailing was sent November 10th, 2014, followed by the questionnaire two weeks later, and the reminder postcard a week after that. At this time deer were just be coming off their peak of activity during the rut, making themselves very visible and therefore on residents' minds. Winter was also starting and deer were frequenting bird feeders in residents' yards. The visibility of deer at this time was a positive point as it got the residents' thinking about deer and therefore hopefully more willing to take a survey about the topic. Data was collected throughout most of the month of December, and analysis was done throughout January.

Permission to conduct research was attained by a letter explaining the reasoning behind the questionnaire and what the results will be used for. Completing the questionnaire and returning it to the researcher garnered consent to use the information provided by the subject in the questionnaire. See Appendix A for the cover letter.

Data Analysis

Data analysis used in this study was used to answer what knowledge, attitudes, and values Duluth

residents have towards the urban deer. Knowledge was tested using Egan's (2011) quiz on the instrument. It compared against a 50% correct answer rate which is the statistical average for random guessing. The researcher's hypothesis was that the resident's knowledge is much higher than the national average, based on abundance of deer and outdoor loving nature of the community.

Attitudes and values of the residents were analyzed by Purdy and Decker's (1989) portion of the instrument. This was analyzed by overall attitude and value scores, e.g. what questions scored highest on the survey, which can be traced back to Kellert's nine attitude types discussed in Chapter 2. It could then be further broken down by demographics, to reveal what demographics aligned with what attitude types more strongly and visa-versa. The results from this survey were also compared to Kellert's results when he used the same questions in his surveys in the early 1980s. The analysis of the results will be discussed in greater detail in Chapter 4.

The researcher used an excel spreadsheet and a software called SPSS to conduct statistical analysis of the results of the questionnaire. Using SPSS, the researcher obtained information and statistical differences between all demographics important to this study.

Summary

A mail-type questionnaire was sent to 500 Duluth residents living within the five of the ABA's 34 DHA's. Purposive random sampling was used because of the higher chance of obtaining desired results pertaining to residents' knowledge, attitudes, and values of the urban deer herd. A computer program used by the GIS Specialist for the City of Duluth randomize addresses to send the three rounds of mailings to chosen residents during the month of November for peak interest in the deer. The mail questionnaire contained four parts; a modified WAVS scale, an in-tact deer knowledge test, a self-designed source of knowledge information, and demographic information. The questionnaire results were inserted into SPSS to analyze the data recovered from the questionnaire.

Chapter 4: Results

Introduction

The purpose of this study was to discover Duluth residents' knowledge, attitudes, and values towards the Duluth urban deer herd using a mail-type questionnaire purposefully distributed across different areas of Duluth. Three research questions were asked, as followed;

1. What knowledge do residents hold regarding deer, and where did they gain this information?
2. What attitudes do the Duluth community members hold towards the urban deer population?
3. What values do the Duluth community members hold regarding urban deer population?

The questionnaire was designed in four sections, covering; attitudes and values, actual knowledge, knowledge source and perceived knowledge, and demographics. Demographics are the first results presented, followed then by each research question. An all-encompassing overview of each of the main research questions began each section, with related sub-questions divided by demographics following afterwards. Research question 1 was split into two sections, "What knowledge do resident's hold regarding deer?" and "Where did they gain this information?" This was then followed by "perceived knowledge" and the demographic sub-sections. Following this was a combination of research question two, "What attitudes do the Duluth community members hold towards the urban deer population?", and question three, "What values do the Duluth community members hold towards the urban deer population?". From here on, attitudes and values were grouped together because there is no differentiation between the two on Purdy and Decker's Wildlife Attitudes and Values Scale (WAVs). The demographic sub-sections paired with these questions were then analyzed. Lastly, Purdy and Decker's WAVs questionnaire was split into four different ways to think about wildlife, which will conclude this chapter.

The data collected by the questionnaire were organized into an Excel file by date returned, the Deer Hunt Area (DHA), and corresponding question on the survey. Table 2 displays when each phase of the survey process was carried out. Figure 1 depicts when surveys were returned. A large influx of surveys

were returned around December 5th, 8 business days after surveys were mailed out. Smaller influxes of returns were documented on the 9th, 14th, and 18th of December 2014.

Table 2
Dates of Mailings and Returns

Description	Date (2014)
Prenotification Letters Sent	November 10 th
Prenotification Letters Received	November 17 th
Questionnaires Sent	November 25 th
First Questionnaire Returned	December 3 rd
Thank You/Reminder Postcard Sent	December 3 rd
Thank You/Reminder Postcard Received	December 10 th
Final Questionnaire Returned	December 19 th

Note. Dates depict mailing and return dates for the survey.

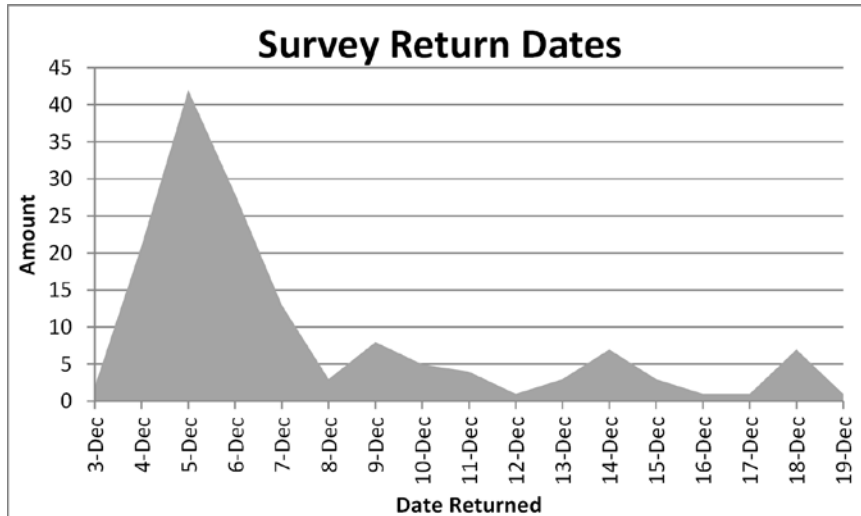


Figure 1. Graph depicting the return dates of the surveys from participants.

Demographics

A total of 500 surveys were mailed out to five different DHA’s across Duluth (Table 3). This included two western locations, one central, and two eastern (Figure 3). Of these 500, 31 were returned to the sender because of a no address or incorrect address, leaving 469 viable surveys. In the 3 weeks allowed for questionnaire returns, 150 usable questionnaires were returned, resulting in a 32% return rate overall. In addition, 20 more questionnaires were returned after the 3 week acceptance period was complete. Return rates varied for each DHA, ranging from 20% to 45% (Figure 2).

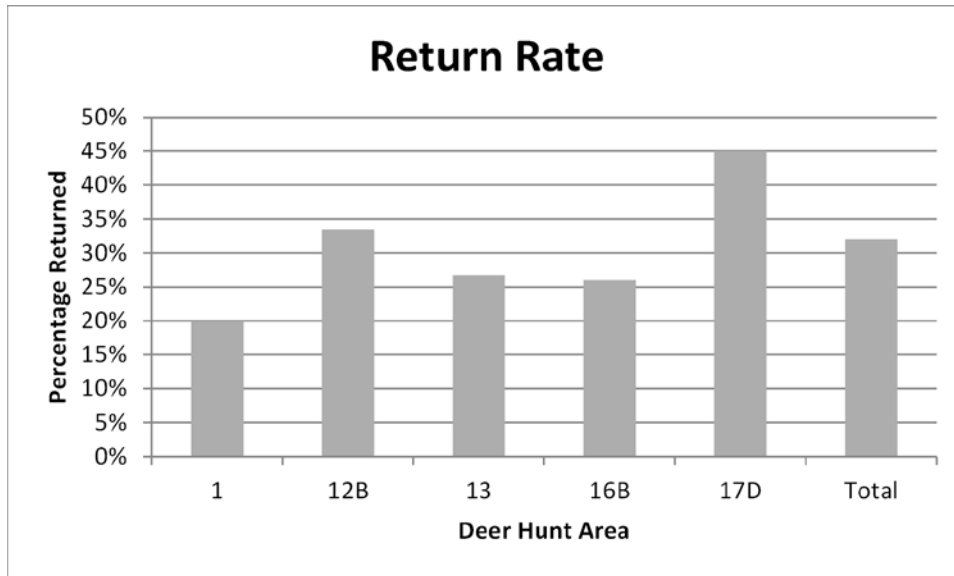


Figure 2. Bar Chart illustrating the return rate of each Deer Hunt Area surveys were mailed to, as well as the total return rate for the project.

Table 3

Surveys sent and return rates.

DHA	Survey Sent	Survey Returned	Percent returned
1	55	11	20%
12B	200	67	33.5%
13	105	28	26.7%
16B	100	26	26%
17D	40	18	45%
Total	500	150	31.98%

Note. DHA indicated the Deer Hunt Area.

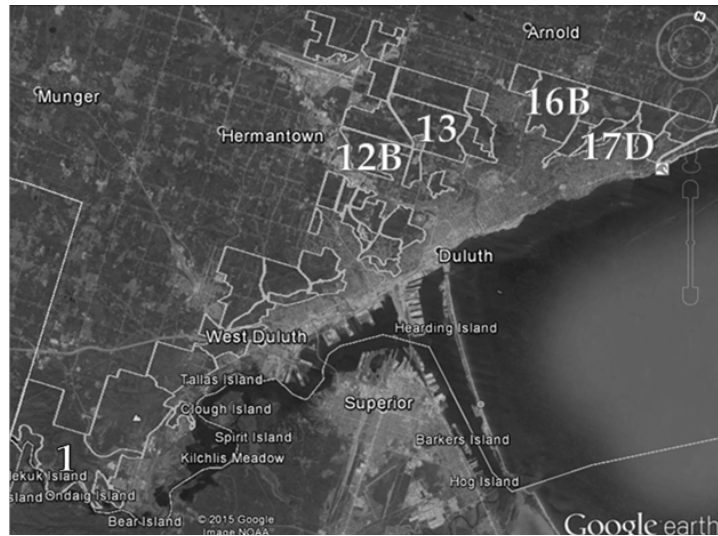


Figure 3. A map of Duluth and the Deer Hunt Areas designed by the Arrowhead Bowhunters Alliance (green). Zones 1, 12B, 13, 16B, and 17D were selected for questionnaire mailings.

Table 4 depicts the demographics of the returned surveys. As shown, a majority of respondents were above 56 years of age (43%). The most common answer for hunting status was non-hunters (65%). For this survey, there were more responses from men than women (69%). Those who have lived in Duluth for more than two decades had more responses (67%) than those who hadn't. Respondents who frequently saw deer on their properties were in the majority (46%). This left the demographic groups of females (31%), under the age of 40 (9%), those who had lived in Duluth less than 5 years (5%), those who are hunters (35%), those who have zero deer sightings on their property (5%), and those with "great" deer damage (13%) as the least common answers for each demographic portion of the survey. There was, however, a wide demographic range of correspondents, covering a range of biases against the study. It is important to remember that surveys were sent to households in selected areas, not specific residents of these households.

Table 4
Participant Demographic Information

Variable	n	(%)	Variable	n	(%)
Gender			Hunter		
Male	103	(68.7)	Yes	52	(34.7)
Female	47	(31.3)	No	98	(65.3)
Age			Deer sighting in the last 30 days		
18-24	1	(0.7)	0	7	(4.7)
25-40	13	(8.7)	1-3	31	(20.7)
41-55	42	(28.0)	4-6	23	(15.3)
56-70	65	(43.3)	7-9	20	(13.3)
71+	29	(19.3)	10+	69	(46.0)
Years lived in Duluth			Deer damage in the last year		
Less than 2	4	(2.7)	No	31	(20.7)
2-5	4	(2.7)	Slightly	67	(44.7)
6-10	17	(11.3)	Moderately	33	(22.0)
11-15	14	(9.3)	Greatly	19	(12.7)
16-20	10	(6.7)			
21+	101	(67.3)			

Note. n = 150

Respondents' Knowledge about Deer

Research question one investigated the knowledge participants had about deer. Fifteen true or false questions spanning the horizon of deer topics comprised this section of the survey. Table 5 shows the questions that were on the quiz and the overall percent correct for each question. The overall score for the quiz was 64% correct. Of the 15 questions, the top three statements with the highest percent correct were; #13: "The reason fawns are born with a pattern of white spots is so the mother can recognize her offspring." (False, 89% correct), #14: "Deer have extraordinary senses, including sight, hearing and smell." (True, 88% correct), and #15: "Newborn deer have no scent, and the mother will place the fawn by itself in a secluded spot for protection against predators." (True, 79% correct). The three statements that showed the lowest percentage correct were, #12: "Deer are native to every state in the U.S." (False, 41% correct), #10: "Like cows, deer have four chambered stomachs." (True, 43% correct), and #6: "Just like humans, deer have a set of "baby teeth" that fall out and are replaced by permanent teeth." (True, 45% correct). Table 5 not only presents the overall percent correct for the respondents, but also compares the knowledge of hunters versus non-hunters.

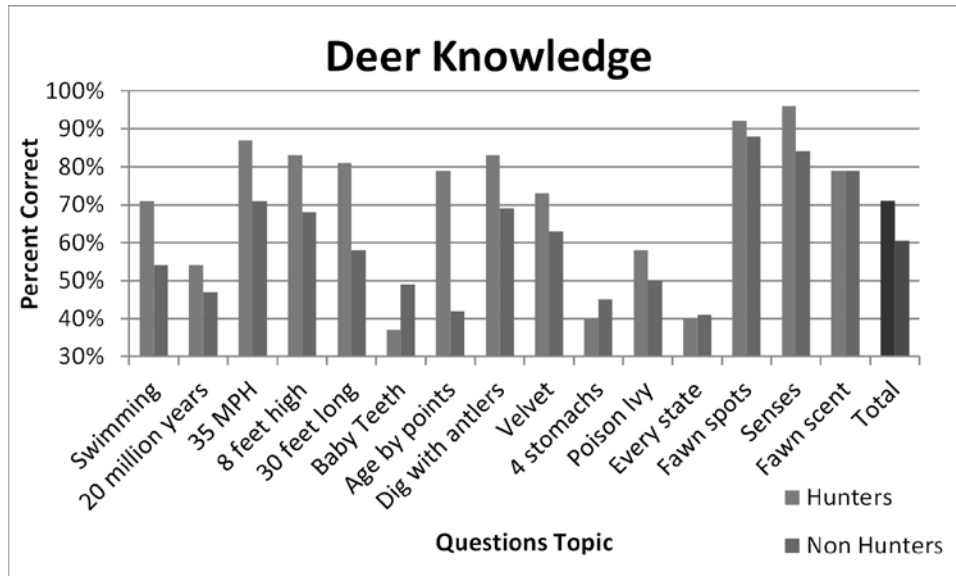


Figure 4. Comparison of deer knowledge answers between Hunters and Non-Hunters.

Deer Knowledge: Hunters versus Non-Hunters. According to Kellert and Berry (1980), “Involvement in any kind of animal related activity is associated with higher knowledge scores, especially if these activities are recreational (birdwatching, hunting, fishing).” This led to my hypothesis, “hunters have higher deer knowledge than non-hunters.” Comparing the hunter to non-hunter groups showed that hunters scored higher on 12 of the 15 questions, including a total knowledge score of 71% correct, compared to 60% correct for non-hunters. Of those, five questions were statistically significant (Table 5). They were; #1: “Deer are strong swimmers, in part because they have a layer of hair that is hollow, providing buoyancy in the water.” (True, 71% vs. 54% correct), #3: “Deer can run in excess of 35 miles per hour.” (True, 87% vs. 71% correct), #5: “Deer can cover 30 feet in a horizontal leap.” (True, 81% vs. 58% correct), #7: “You can tell how old a male deer is by how many points there are on his antlers.” (False, 79% vs. 42% correct), and #14: “Deer have extraordinary senses, including sight, hearing and smell.” (True, 96% vs. 84% correct). Meanwhile, non-hunters scored higher on three questions, none of which had a p-value below 0.05, the baseline for statistical significance (Table 5). The results also revealed that the hunter had more overall knowledge than the non-hunters ($M=10.52$ vs. $M=9.08$; $t(148)=3.89$, $p=0.00$).

Table 5

Deer Knowledge: Percent Correct for Overall Group and Comparison of Hunter and Non Hunter

Statement	Overall	Hunter		Non-Hunter		Chi-square	p
	(n=150) %	(n=52) n (%)	(n=98) n (%)	(n=98) n (%)			
1 Deer are strong swimmers, in part because they have a layer of hair that is hollow, providing buoyancy in the water.	60.0	37 (71.2)	53 (54.1)		4.12	0.04*	
2 Deer have existed for 20 million years, and have had the same basic form for the last one million years.	49.3	28 (53.8)	46 (46.9)		0.65	0.42	
3 Deer can run in excess of 35 miles per hour.	76.7	45 (86.5)	70 (71.4)		4.34	0.04*	
4 Deer can leap over fences eight feet tall.	73.3	43 (82.7)	67 (68.4)		0.57	0.06	
5 Deer can cover 30 feet in a horizontal leap.	66.0	42 (80.8)	57 (58.2)		7.74	0.00**	
6 Just like humans, deer have a set of "baby teeth" that fall out and are replaced by permanent teeth.	44.7	19 (36.5)	48 (49.0)		2.13	0.15	
7 ^a You can tell how old a male deer is by how many points there are on his antlers.	54.7	41 (78.8)	41 (41.8)		18.8	0.00**	
8 ^a Deer use their antlers during the winter to dig for food under the snow.	74.0	43 (82.7)	68 (69.4)		3.13	0.08	
9 When antlers grow, they are covered with "velvet," a soft, fuzzy tissue. This velvet is the only regenerating skin found in mammals.	66.7	38 (73.1)	62 (63.3)		1.47	0.23	
10 Like cows, deer have four chambered stomachs.	43.3	21 (40.4)	44 (44.9)		0.34	0.56	
11 Deer can eat poison ivy without ill effect.	52.7	30 (57.7)	49 (50.0)		0.81	0.37	
12 ^a Deer are native to every state in the U.S.	40.7	21 (40.4)	40 (40.8)		0.00	0.96	
13 ^a The reason fawns are born with a pattern of white spots is so the mother can recognize her offspring.	89.3	48 (92.3)	86 (87.8)		0.74	0.39	
14 Deer have extraordinary senses, including sight, hearing and smell.	88.0	50 (96.2)	82 (83.7)		5.01	0.03*	
15 Newborn deer have no scent, and the mother will place the fawn by itself in a secluded spot for protection against predators.	78.7	41 (78.8)	77 (78.6)		0.00	0.97	

Note . Percent correct was used as descriptive and inferential statistics for the statement with True or False response option; ^a In these 4 statements, False was correct.

Demographic Comparisons of Deer Knowledge. Comparison of the demographics for actual knowledge is shown in Table 6, and discussed throughout the next sections. The table describes the demographic groups first, including; hunting status, gender, age, and years lived in Duluth. The mean score of the test was out of 15.

According to a study done by Dahlgren (1977), there is “greater knowledge of wildlife among males”, which led to a hypothesis for this study that males have higher deer knowledge than females. This was presented in Table 6, in which males’ average score was almost a point higher (M=9.87 vs. M=8.94). Males also scored almost a point higher than females on the overall quiz score (M=9.87 vs. M=8.94), with a $p < .05$.

Kellert and Berry (1980) also suggested “that less knowledgeable groups tended to be young or elderly,” leading to the hypothesis that middle aged (<56) residents would be more knowledgeable than the elderly residents (56+). Older and younger residents had a difference of the means of 0.13 (M=9.63 vs. 9.50). No significant difference between the two groups was found in this study.

There was no study of Duluth residents and deer knowledge before this study, so there was no article to use as a resource for a hypothesis. However, I hypothesized that residents who have lived in Duluth for over 21 years had higher deer knowledge based on their familiarity with deer and interacting with deer often for a long period of time. This was depicted in table 6. Those who lived in Duluth over 21 years had more knowledge than those who lived 20 or less years, and scored well over a point higher on the quiz overall (9.97 vs. 8.78; $t(148)=3.13, p=0.00,$).

Table 6
Deer Knowledge: Group Comparisons on the Total Quiz Score

Group	n	Mean	SD	<i>t</i> (148)	<i>p</i>
Hunting Status				3.89	0.00**
Hunter	52	10.52	2.14		
Non-Hunter	98	9.08	2.17		
Gender				2.40	0.02*
Male	103	9.87	2.19		
Female	47	8.94	2.29		
Age					
18-24	1	12.00	n/a		
25-40	13	9.46	2.696		
41-55	42	9.45	2.121		
56-70	65	9.75	2.236		
71+	29	9.34	2.365		
Age_2 Groups				0.33	0.74
56+	94	9.63	2.27		
55 or less	56	9.50	2.25		
Years lived in Duluth					
Less than 2	4	9.00	0.82		
2-5	4	9.75	1.26		
6-10	17	8.53	2.50		
11-15	14	8.71	1.86		
16-20	10	8.80	1.81		
21+	101	9.97	2.29		
Years lived in Duluth_2 Groups				3.13	0.00**
21+	101	9.97	2.29		
20 or less	49	8.78	1.97		

Note. The range of possible total quiz scores is 0-15. * $p<.05$ ** $p<.01$

Source of Knowledge

Table 7 presents the analysis of the data from the second part of research question one, which asked “Where did residents gain their knowledge?” The first column displays the sources of information available. It was then divided into two sections: first, a “single source” in which residents were asked to pick the most important source that they gained the most amount of knowledge from, and second, “multiple sources” in which residents could indicate all the sources which they have used to gained knowledge.

In the single source section, self-education was the source that was overwhelmingly picked most, with 31% of the respondents selecting it. Family was next, at 18%, and friends represented 12.7% of the population. Word of mouth and magazines were the main sources of information for 6.7% of people. Social media, including both Twitter and Facebook were not cited by anyone as a main source of knowledge. Also, formal education and non-formal education were only represented by 1.3% of the population.

The multiple sources of information section of Table 7 was organized the same way, except residents could pick multiple sources. On average, each resident selected 5.8 different sources, which showed their sources of knowledge were wide ranging. The top five choices were as follows: friends were a source of knowledge for 66.7% of the population, family and self-education were cited 62.7% of the time for each, the newspaper was the fourth most cited source at 49.3%, and neighbors, fifth, were cited by 47.3%. The least common sources of knowledge stated for the multiple sources section included: Twitter (0.7%), Facebook (1.3%), and social media (5.3%). Less than 1/3 of participants selected non-formal education (29.3%), radio (24%), internet (20%), and formal education (18%).

Table 7
Source of Deer Knowledge: Single Source and Multiple Sources Option

Source	Single Source			Multiple Sources		
	n	%	Top 5	n	%	Top 5
Self-Education (research or experience)	47	31.3	1	94	62.7	2
Family	27	18.0	2	94	62.7	2
Friends	19	12.7	3	100	66.7	1
Word of Mouth	10	6.7	4	92	61.3	4
Magazines	10	6.7	4	69	46.0	
Newspaper	8	5.3		74	49.3	5
TV	7	4.7		70	46.7	
No response	6	4.0				
Local News	5	3.3		59	39.3	
Neighbors	3	2.0		71	47.3	
Internet	3	2.0		30	20.0	
Non-Formal Education (Field trips/camp)	2	1.3		44	29.3	
Formal Education (School books/project)	2	1.3		27	18.0	
Radio	1	0.7		36	24.0	
Social Media	0	0.0		8	5.3	
Facebook	0	0.0		2	1.3	
Twitter	0	0.0		1	0.7	
Total	150	100		871 (5.8 per person)		

Note . Scores are ranked from highest to lowest based on the most important single source.

Perceived Knowledge

When surveying all of the participants, personal knowledge was the highest score while general US knowledge was the lowest across a majority of the demographic groups. A common trend was a funnel down effect from personal perceived knowledge being the highest, down to the perception of the general US's knowledge (Figure 5).

Perceived knowledge was compared between demographic groups to discover how each group compared themselves to; other Duluthians, Minnesotans, and the rest of the United States (Table 8). Overall, the perceived deer knowledge was fairly high. On a scale of 1 through 5, variables ranged from very little knowledge (1) to great amount of knowledge (5). Table 8 revealed that participants perceived that the amount of knowledge, Personal (3.27), Duluthians (2.97), and Minnesotans (2.91) are perceived to have near average knowledge, while general US population (2.1) have less than average amounts of knowledge.

Table 8 also includes sections comparing different demographic groups of participants and their perceptions of others' knowledge. Each group comparison includes mean, standard deviation, t-values, and p-values.

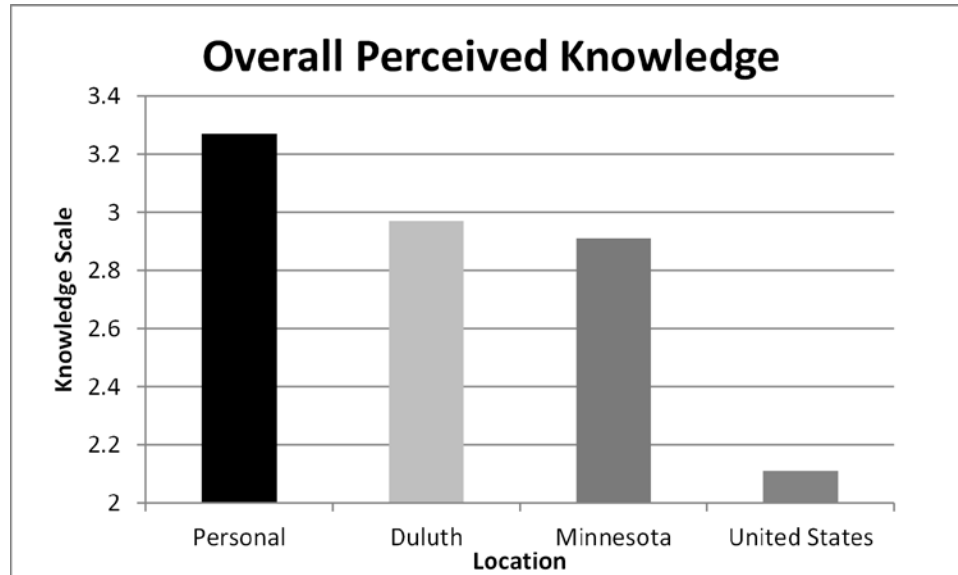


Figure 5. Bar graph comparing perceived knowledge personally, for residents of Duluth, the population of Minnesota, and the population of the United States.

Demographic Comparisons of Perceived Knowledge of Deer. Using Kellert and Berry (1980), I hypothesized that hunters would have higher perceived knowledge than non-hunters. When comparing demographics, hunters perception on their knowledge ($M=3.81$) was significantly higher than non-hunters perception of their knowledge ($M=2.98$; $t(148)=6.92$, $p=0.00$). Hunters perceived that the knowledge of Duluthians, Minnesotans, and the US's was lower than the non-hunters perception of knowledge for the same groups.

Using Dahlgren (1977) to again compare genders, I hypothesized that males' perceived knowledge would be higher than females'. This was shown when males perception of their knowledge was over a half point higher than females' perceived knowledge ($M=3.46$ vs. $M=2.85$) and statistically significant. It was also found that males perceived knowledge scores were lower for every other location than the same groups' perceived knowledge by females. This followed the same pattern that hunter vs. non-hunters did.

By following the pattern of actual knowledge found in Table 5, I hypothesized that there would be no significant difference between the two groups. This was the case, as age made almost no difference at all for perceived knowledge (56+ M=3.28; <56 M=3.25).

Again using the results of actual knowledge as a guideline, I hypothesized that those living in Duluth 21 years or longer would have higher perceived knowledge than those living in Duluth for less than 21 years. It was found that this was true, as those living 21+years lived in Duluth had higher perceived knowledge than those living in Duluth <21 years (21+ M=3.35, <21 M=3.10) albeit not a significant difference.

Table 8

Perceived Knowledge of Deer: Overall and Group Comparison

Statement:	Group 1		Group 2		<i>t</i> (148)	<i>p</i>
	Mean	SD	Mean	SD		
Overall (n=150)						
1 you have?	3.27	0.80				
2 the residents of Duluth have?	2.97	0.71				
3 the general population of Minnesota have?	2.91	0.75				
4 the general population of the US have?	2.11	0.63				
By Hunting Status						
	Hunter (n=52)		Non-Hunter (n=98)			
1 you have?	3.81	0.69	2.98	0.70	6.92	0.00**
2 the residents of Duluth have?	2.83	0.76	3.04	0.67	-1.77	0.08
3 the general population of Minnesota have?	2.77	0.78	2.98	0.72	-1.66	0.10
4 the general population of the US have?	2.04	0.69	2.15	0.60	-1.06	0.29
By Gender						
	Male (n=103)		Female (n=47)			
1 you have?	3.46	0.78	2.85	0.69	4.58	0.00**
2 the residents of Duluth have?	2.92	0.72	3.06	0.67	-1.14	0.26
3 the general population of Minnesota have?	2.83	0.73	3.09	0.75	-2.00	0.05
4 the general population of the US have?	2.06	0.65	2.23	0.56	-1.59	0.11
By Age						
	56+ (n=94)		55 or less (n=56)			
1 you have?	3.28	0.782	3.25	0.84	0.20	0.85
2 the residents of Duluth have?	2.96	0.671	2.98	0.77	-0.21	0.84
3 the general population of Minnesota have?	2.83	0.682	3.04	0.83	-1.65	0.10
4 the general population of the US have?	2.05	0.662	2.21	0.56	-1.52	0.13
By Years lived in Duluth						
	21+ (n=101)		20 or less (n=49)			
1 you have?	3.35	0.77	3.10	0.85	1.77	0.08
2 the residents of Duluth have?	2.96	0.69	2.98	0.75	-0.16	0.88
3 the general population of Minnesota have?	2.90	0.66	2.92	0.91	-0.13	0.89
4 the general population of the US have?	2.11	0.62	2.12	0.67	-0.12	0.90

Note. Scores on a 5-point rating scale; Little to none=1, Less than average=2, Average=3, More than average=4, and Great amount=5. ** $p < .01$

Attitudes and Values

Research questions two; “What attitudes do Duluth residents hold towards the Duluth deer herd”, and question three; “What values do Duluth residents hold towards the Duluth deer herd,” were answered using the WAVs scale designed by Purdy and Decker (1989). The WAVs scale is 18 Likert-type questions designed to discover the feelings towards wildlife, and in this case urban deer in Duluth. The scale ranged from strongly agree (5) to strongly disagree (1). In total, the overall mean score of all 18

questions was skewed far more towards agreement with the statements than disagreement (M=3.73) (Table 9).

Table 9 illustrates the attitudes and values towards the urban deer herd. The question number is in parenthesis behind the statement. Overall, the three statements that were most agreed upon were “#2: People know that deer exist in nature, (M=4.73)”, “#8: People see deer in books, movies, paintings, and photographs, (M=4.37)”, and “#14: Local economies benefit from equipment, supplies, and services related to deer, (M=4.35),” The most disagreed statements included, “#10: People hunt deer for sale of fur or antlers, (M=2.32)”, “#4: People understand about the behavior of deer, (M=3.02)”, and “#16: People tolerate most levels of property damage by deer, (M=3.03)”. Overall, there were seven answers above 4 (agree), 10 answers between 3 and 4, and only one answer where the average was closer to disagree (2) than agree.

As described by Daigle (2010), hunters and non-hunters have been shown to have different attitudes and values towards wildlife. Therefore, Table 9 has also included a comparison of these two demographic groups for each item on the WAVs scale. Overall, hunters had higher scores for 9 questions, the same score for one, and lower scores for the remaining five questions. The two largest differences between these two groups were significant (question 4 and question 10).

Table 9

Attitudes and Values toward the Urban Deer Herd: Overall and Group Comparison of Hunters vs. Non Hunters

Statement	Overall	Hunter		Non-Hunter		<i>t</i> (148)	<i>p</i>
	(<i>n</i> =150)	(<i>n</i> =52)		(<i>n</i> =98)			
	Mean	M	SD	M	SD		
People know that deer exist in nature (2).	4.73	4.69	(0.47)	4.76	(0.56)	-0.69	0.49
People see deer in books, movies, paintings, and photographs (8).	4.37	4.33	(0.55)	4.40	(0.59)	-0.72	0.47
Local economies benefit from the sale of equipment, supplies, or services related to deer (14).	4.35	4.44	(0.73)	4.30	(0.65)	1.27	0.21
People observe and photograph deer (7).	4.34	4.35	(0.62)	4.34	(0.75)	0.08	0.94
People hunt deer for food (12).	4.32	4.35	(0.68)	4.31	(0.65)	0.35	0.72
People talk about deer with family and friends (6).	4.23	4.23	(0.61)	4.22	(0.73)	0.05	0.96
People hunt deer for recreation (11).	4.17	4.17	(0.99)	4.17	(0.90)	0.00	1.00
Deer are managed for annual harvest for human use without harming the future of the deer population (13).	3.99	4.06	(0.83)	3.96	(0.92)	0.65	0.52
People consider the presence of deer as a sign of the quality of the natural environment (1).	3.85	3.94	(0.80)	3.81	(0.93)	0.90	0.37
People appreciate the role that deer play in the natural environment (3).	3.67	3.63	(0.89)	3.69	(0.83)	-0.41	0.69
People express opinions about deer and their management to public officials or to officers of private conservation organizations (9).	3.50	3.58	(1.04)	3.46	(0.93)	0.71	0.48
People tolerate most deer nuisance problems (15).	3.37	3.50	(1.04)	3.31	(1.08)	1.06	0.29
People tolerate ordinary personal safety hazards associated with deer (18).	3.35	3.27	(1.07)	3.40	(1.00)	-0.73	0.47
Deer are included in educational material as the subject of learning more about nature (5).	3.29	3.15	(0.89)	3.36	(0.85)	-1.37	0.17
People tolerate the ordinary risk of deer transmitting diseases to humans or domestic animals (17).	3.20	3.16	(0.95)	3.22	(0.98)	-0.41	0.69
People tolerate most levels of property damage by deer (16).	3.03	3.21	(1.13)	2.93	(1.14)	1.45	0.15
People understand about the behavior of deer (4).	3.02	2.69	(1.06)	3.19	(0.93)	-3.00	0.00**
People hunt deer for sale of fur or antlers (10).	2.32	1.83	(0.96)	2.58	(1.03)	-4.38	0.00**

Note. Scores on a 5-point rating scale, where 1 being Strongly disagree, 2 Disagree, 3 No opinion, 4 Agree, and 5 Strongly agree. ***p*<.01

Demographic Comparisons of Attitudes and Values towards Deer. As shown in Table 10, there were no significant differences in attitude and values in terms of the average score of the combined 18 statements by any of the major demographic variables, including; hunting status, gender, age, and years lived in Duluth.

According to Daigle (2010), hunters had more favorable attitudes and wildlife-related values in general. Based on this, I hypothesized that hunters would have more positive attitudes and values than non-hunters. This was not supported in the group comparison on the attitude and values toward the deer herd. The hunters responded with statistically significant lower agreement than the non-hunters in two

statements, which were “4: People understand about the behavior of deer.”(2.69 vs. 3.19; $t(148)=-3.00$, $p<.01$), and “10: People hunt deer for sale of fur or antlers” (1.83 vs. 2.58; $t(148)=-4.38$, $p<.01$).

Meanwhile, non-hunters didn't respond significantly lower to any of the statements. Hunters were more in agreement for nine questions, tied for one, and less in agreement for five statements overall.

Also, non-hunters scored slightly higher than hunters ($M=3.75$ vs. $M=3.69$) on an overall scale. It was also found that hunters and non-hunters had no significant differences when they were compared in the section Ways of Thinking about Deer. Therefore, hunters and non-hunters scored very similar overall, but when split into individual questions, there was some statistically significant differences.

Kellert and Berry (1980) showed that attitude and values varied greatly between males and females, and it was dependent on the wildlife or activity regarding wildlife. This was not supported in my study (Table 10), in which there were no significant differences between the two. However, based off of Kellert, we hypothesized that females would have more positive attitudes and values towards urban deer. This was supported by Table 10, in which females scored slightly higher than males ($M=3.77$ vs $M=3.71$

Kellert and Berry (1980) found no significant difference of attitudes between older and younger participants. Therefore, my hypothesis was that there would be no difference between our age groups. I found that the younger the participants, the higher they scored, ranging from 4.2 down to 3.68. On account of different sample sizes in each category, they were grouped into two groups. When grouped, <56 scored only slightly higher than 56+ ($M=3.77$ vs $M=3.70$). This did not represent a significant difference.

Again, since there has been no test done regarding how length of time residents live in Duluth affect attitudes and values, there was no data to base a hypothesis on. As before, I hypothesized that those living in Duluth 21+ years will have more positive attitudes towards the urban deer because they are used to interacting with them. By grouping the years lived in Duluth into two groups, it resulted in a slightly higher score for those living 21+ years there than <21 years ($M=3.74$ vs. $M=3.69$). Again, it resulted in no statistically significant difference.

Table 10

Attitudes and Values toward the Urban Deer Herd: Group Comparison on Average of 18 Statements

Group	n	Mean	SD	<i>t</i> (148)	<i>p</i>
Hunting Status				-0.78	0.44
Hunter	52	3.69	0.37		
Non-Hunter	98	3.75	0.41		
Gender				-0.96	0.34
Male	103	3.71	0.41		
Female	47	3.77	0.35		
Age					
18-24	1	4.20	n/a		
25-40	13	3.89	0.34		
41-55	42	3.72	0.42		
56-70	65	3.71	0.39		
71+	29	3.68	0.40		
Age_2 Groups				-1.08	0.28
56+	56	3.70	0.39		
55 or less	94	3.77	0.40		
Years lived in Duluth					
Less than 2	4	4.13	0.36		
2-5	4	3.28	0.55		
6-10	17	3.79	0.41		
11-15	14	3.70	0.34		
16-20	10	3.51	0.41		
21+	101	3.74	0.37		
Years lived in Duluth_2 Groups				0.71	0.45
21+	101	3.74	0.37		
20 or less	49	3.69	0.43		

Note. Scores on a 5-point rating scale, where 1 being Strongly disagree, 2 Disagree, 3 No opinion, 4 Agree, and 5 Strongly agree

Ways of Thinking about Deer. Butler, Shanahan, and Decker (2001) divided Purdy and Decker's 18 question WAVs questionnaire into four different ways people think about wildlife based on analysis of the question type. These "Ways of thinking about wildlife" were; Social Benefits, Communication Benefits, Traditional Conservation, and Problem Tolerance (Figure 6). Communication Benefits was viewed as the most positive attitude group overall (M=4.08). Problem Tolerance was the lowest viewed attitude, but was still above the "no opinion" score of 3 (M=3.12). It was also found that males and females had no significant differences when they were grouped into ways of thinking about

deer. When the results between age groups were analyzed, they showed differences between them; 56+ year olds had less positive views in both Traditional Conservation (M=3.63 vs. M=3.83) and Problem Tolerance (M=3.14 vs. M=3.40) than those younger than 56 years of age. Although not all of these graphs are shown, they all had a similar pattern to the graph below (Figure 6).

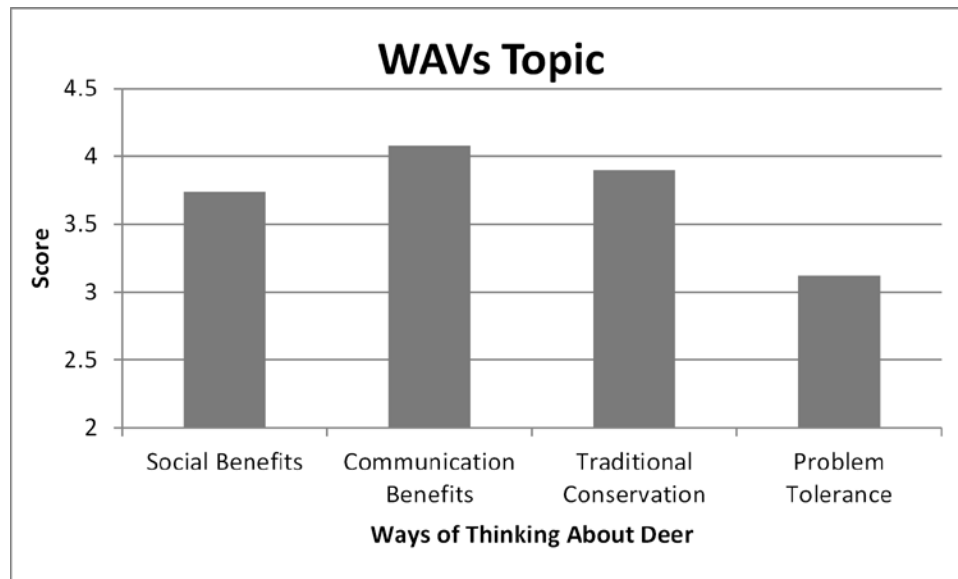


Figure 6. Four topics derived by the WAVs scale, which describes the overall attitudes and values towards the Duluth urban deer herd.

Chapter 5: Discussion

Introduction

A survey was sent out to 500 households in selected areas across the City of Duluth to gain understanding of their knowledge, attitudes, and values towards the Duluth Urban deer herd. Three main research questions were used to frame the instrumentation.

1. What knowledge do residents hold regarding deer, and where did they gain this information?
2. What attitudes does the Duluth community hold towards the urban deer population?
3. What values does the Duluth community hold regarding the urban deer population?

Using an array of applicable surveys designed by others, as well as self-designed questions; an instrument was created and mailed in late 2014. 32% of surveys were returned, and results were gathered and analyzed using SPSS.

Results showed that there was low deer knowledge overall. The sources of formal knowledge were mostly self-reliant or personal communication, with few people reporting use of educational sources. Duluth residents' personal perceived knowledge was higher than the perceived knowledge of other groups, especially the rest of the United States. Overall, residents' attitudes and values towards Duluth's urban deer were positive and contingent across the demographic spectrum. There were some demographic discrepancies and outliers among the results, which will be discussed in this chapter.

Participants

Survey participants were selected from across five of Duluth's Deer Hunt Areas defined by the Arrowhead Bowhunters Alliance. Demographically speaking, the surveys returned were very comparable to similar types of surveys (Kellert, 1980). According to the Minnesota Department of Natural Resources, roughly 15% of Minnesota adult's deer hunt, with the percentage likely higher in Northern Minnesota. Therefore, the fact that 65% of returned surveys were from non-hunters is not out of the ordinary. In fact, only 15% of Minnesota adults deer hunt. Therefore, 35% of respondents being hunters may indicate that hunters were actually more likely to respond to the questionnaire.

With males replying 69% of the time, it might be that more men are concerned with deer and outdoor activities. Forty-three percent of respondents were 56 years of age or older. According to the U.S. 2010 Census, 25.5% of Duluth residents fall under this age category. Therefore, it was most likely that this age category would reply to the survey. This is plausible because of the high percent of residents fall in this age category, but also because some of these residents are retired and have more time to spend replying to surveys. Over 2/3 of survey respondents, 67%, indicated that they have lived in Duluth for more than 21 years. With a large portion of respondents being older, this is plausible. But beyond that, it may suggest that once people move to Duluth they rarely leave. This may be because Duluth was voted the “Best Outdoor Town” by Outside Magazine in 2014, and has a wide range of outdoor activities and sightseeing opportunities. Forty-six percent of respondents stated that they had at least 10 occasions per 30 days that they saw deer in their yard. Almost half the survey population saw deer in their yard a few times a week. But, the most common response to deer damage was “slight”, at 45%. This suggests that even though there are a large number of deer in areas of Duluth, the damage they are doing to property is not overwhelming or not being considered as so. This means that residents may be doing a good job of deterring deer from eating their gardens and shrubs, agencies may be doing a good job of maintaining deer populations to a manageable level that the ecosystem can handle, or both of these.

Respondents’ Knowledge about Deer

Using 15 true or false questions covering a range of deer related facts (Egan, 2011), it was found that respondent’s deer knowledge was low; an average of 64% correct. The percent correct ranged quite widely, from 41% to 89%, which suggests that certain topics about deer are either taught using correct facts or discussed more than other. It is unlikely though, because the questions with higher percentages correct do not fall into specific topics. There seems to be no rhyme or reason behind residents’ deer knowledge, other than that it is lower than what it is expected for such a familiar keystone species. Are students not being taught about deer in school? Whether it is science class, or a different subject like history or economics, deer factor into them all. Or, is it that people are using unreliable sources of

information when learning about deer? These points will be discussed later in the Source of Knowledge section.

Deer Knowledge: Hunters versus Non-Hunters. There was evidence of a difference between hunters and non-hunters when it came to deer knowledge. Hunters scored over 10% higher than non-hunters (71.1% vs. 60.5%) overall on the deer knowledge quiz, and scored higher on a majority of the individual questions as well. Hunters excelled in topics surrounding the physical capabilities of deer, as well as topics about antlers. This suggests that it may be that hunters' use their experience and learn by observing deer while hunting them. Experiencing their speed and leaping abilities, as well as observing their antlers and how they use them gives them an edge over non-hunters. We must take into consideration that there are some non-hunters that may observe and study deer as well. But, as an overarching pattern, hunters are more familiar with deer than non-hunters and therefore have more knowledge than non-hunters.

Demographic Comparisons of Deer Knowledge. Demographically, males scored almost a point higher on the knowledge test than females out of a total score of 15. According to National Geographic, 11% of hunters are women, meaning a majority of hunters are men. It is likely the case that a majority of hunters were also males. Since men are often viewed as more "outdoorsy" and it has been established that more men hunt than women, following the trend above, it is no surprise men have higher deer knowledge than women.

Age groups were shown to have no bearing on deer knowledge. This is interesting, and suggests that formal education focusing on deer has not changed over the last few generations. It may also suggest that people are not continuing to learn about deer throughout their lives, and their deer knowledge is the same as a young adult as an elderly person. What is interesting, however, is that people who have lived in Duluth for 21 or more years scored over a point higher than those who have lived there for less than 20 years. Perhaps Duluthians learn about deer while they live in the city through first-hand experience. Through observation of deer in their yards, as well as discussion with neighbors and family, long-term residents of Duluth might gain higher deer knowledge than those who don't live there.

Sources of Knowledge

Sources of knowledge were gained using two checklists of sources, one for single most important source and one for all sources used to gain deer knowledge. The top four answers were the same for both questions, albeit not in the same order. The top four answers were; self-education, family, friends, and word of mouth. This is interesting for the fact that schools or news sources did not appear.

When grouped, Personal Communication (friends, word of mouth, family, and neighbors) comprised 39.4% of the most important source of information. Education (non-formal, formal and self- education) was 33.9% of the most important source. Entertainment (TV, internet, and magazines) made up 13.4%. Local Media (newspaper, radio, and local news) only made up 9.3%. And, Social Media (Twitter, Facebook, and social media) made up exactly 0%.

The fact that personal communication made up the largest portion of the most important source of knowledge suggests that deer are an important subject to discuss. Perhaps this discussion between family, friends, and neighbors is occurring at hunting camp or while spending time in nature. Although education made up 1/3 of the most important source, it was almost completely self-education (31%). Again, it is possible that deer are not being discussed in schools or while visiting nature centers or parks. With deer being a keystone species, they are easy to integrate into a multitude of lessons. The clear choice is science classes, such as biology and ecology. But, they can also be discussed in history classes because of their importance to Native Americans and pioneers. In economics classes deer can be integrated because they were responsible for \$234 million in direct retail sales, and directly responsible for nearly 4000 jobs in 2013 alone (MN DNR, 2014).

Local media was the single most important source for less than 1 out of 10 respondents to the survey. This was a surprise for the fact that the urban bow hunt is a very important issue in the City of Duluth. If they are not gaining knowledge from local media outlets, where is the information regarding the hunt coming from? This is an issue for agencies such as the MN DNR and Arrowhead Bowhunters Alliance, as factual knowledge cannot always be obtained from less credible sources, such as word-of-mouth “through the grape vine”.

When considering multiple sources of deer knowledge, personal communication represented the largest source of knowledge. Local media and entertainment were the next sources. Education was lower, and social media was cited the least amount.

Compared to the single most important source, personal communication and local media had a larger percentage of respondents in the multiple sources section. This suggests that residents do still use local media as a source of information, but they are secondary sources. On the contrary, education decreased, strengthening the argument that education is not a strong source of knowledge. Surprising in today's world, social media was almost non-existent for respondents. With Facebook groups and Twitter feeds for every subject imaginable, it is surprising that more people don't use them as a source of deer knowledge. It may be that these sources are too new or not thought of as educational tools. Either way, are these sources, however, perceived as reliable sources of knowledge?

Perceived Knowledge

When asked to judge their perceived knowledge, as well as the perceived knowledge of others, the overwhelming pattern was a step pattern from high to low. Data showed that residents felt that they had higher deer knowledge than non-residents, especially than those in other states [Personal (3.27), Duluthian's (2.97), Minnesotan's (2.91), United States' (2.11)]. This may be because Minnesota is thought of as a nature-filled state, in which other parts of the United States are not. However, it is a common trend across perceived knowledge surveys, in which people believe they know more than they actually do, no matter the subject (Barnes, 2013).

Demographic Comparisons of Perceived Knowledge of Deer. When broken down into demographics, it was found that hunters and males had much higher personal perceived knowledge scores than non-hunters and females, respectively. Using actual knowledge scores, hunters and males did score much higher than their counterparts, suggesting that their higher perceived knowledge scores are appropriate. Although it may be suggestive that males', especially those who hunt, high perceived knowledge scores are aided by testosterone, they do in-fact score higher on factual knowledge quizzes.

Attitudes and Values

Overall, the residents' responses were skewed towards agreement to the attitudes and values statements rather than disagreement. This suggests that people view deer in a positive light, rather than negative. When explored further, it was evident that respondents value deer as a part of the natural world and beauty, as well as the importance of hunting them. When discussing nature and beauty, deer were viewed through both pictures and in first hand experiences. The WAVs Scale was scored on a Likert-type scale, ranging from 5=strongly agree to 1=strongly disagree. The highest score on the Wildlife Attitudes and Values scale (WAVs) was to the statement, "People know that deer exist in nature (M=4.73)". Other high scoring statements included "People consider the presence of deer as a sign of the quality of the natural environment (M=3.85)," and "People appreciate the role deer play in the natural environment (M=3.67)," suggesting that deer are viewed as an integral part of the ecosystem and therefore are important for "nature to exist". The values deer bring to the hunting community are different, however. Although deer are often thought of as trophy game for hunters to pursue and make a fortune from, the WAVs scale showed quite different results. The highest results pertaining to deer hunting and the culture surrounding it include "People hunt deer for food (M=4.32)" and "People hunt deer for recreation (M=4.17)". The lowest scoring overall statement on the whole test was "People hunt deer for sale of fur and antlers (M=2.32)", which was also the only question scoring below "no opinion". According to the results, many people rely on deer for a source of food, as well as a source of recreation in which to spend time with their families and friends. This does not mean food and recreation are the only reasons people use deer, but it is a major reason. Deer hunting is an important pastime for many Americans, serving as a tradition and providing local economic stimulus. This is a far cry from the trophy hunters seen on TV hiring guides and "bagging monster bucks" to mount and sell and advertise their products.

Although still agreed upon, there was weaker agreement upon the attitudes and values towards deer tolerance issues. A variety of deer tolerance statements including nuisance, disease transmission, and property damage, all fell within the range of M=3.37 and M=3.03. While still above the "No Opinion" line, they were among the least agreed upon statements on the survey. This suggests the possibility that

residents do have an issue with deer on their property. This contradicts with the demographics, which state that the majority of respondents had “slight” deer damage, and a very small proportion had a “great amount”. If disgusted by deer damage to their property, one would think that respondents would answer less conservatively to the demographic question. It may be, however, that residents have developed a method to reduce deer damage to their yard, such as growing non-appetizing plants to deer or putting up fencing around their gardens. They may perhaps even allow bow hunting on their property in conjunction with the Arrowhead Bowhunters Alliance (ABA).

Demographic Comparisons of Attitudes and Values towards Deer. When comparing the attitudes and values of hunters versus non-hunters, they were surprisingly similar, except for two statements. These statements, “People understand about the behavior of deer (hunter M=2.69 vs. non-hunter M=3.19),” and “People hunt deer for sale of fur and antlers (hunter M=1.83 vs. non-hunter M=2.58)” suggest that there are different attitudes and values when it comes to specific deer topics. With hunters disagreeing that people understand deer behavior, and non-hunters stating that people do in-fact understand deer behavior, it correlates with the idea that the hunters were correct in feeling that the overall perceived knowledge is higher than it actually is when tested. This is shown by the finding that hunters had higher factual knowledge as well as lower perceived knowledge scores for the other groups when compared to non-hunters. It is interesting that hunters spend more time and efforts trying to understand deer and their behaviors, but non-hunters believe that people understand deer better than what hunters do. With hunters disagreeing to strongly disagreeing about the sale of deer parts, while non-hunters only slightly disagreeing, it proposes a cultural divide and misunderstanding of the reasoning behind deer hunting, as suggested above. One thing seems clear and that is that whatever respondents’ attitudes and values are towards the Duluth urban deer herd, deer are always on their minds, as is discussed below.

Ways of Thinking about Wildlife. “Previous analysis of the (WAVs) scale in several studies revealed that these (18) items tend to coalesce into four ways of thinking about wildlife, (Butler et al., 2001).” These Ways of Thinking were separated by important wildlife issues, in which this case is

focused on the Duluth deer herd. Communication Benefit encompasses the importance of discussion and observation of deer with family, friends, neighbors, and agencies. Social Benefit includes appreciation and understanding of deer in nature and educational materials. Traditional Conservation contains the act of deer hunting and the economics and politics surrounding it. Problem Tolerance is comprised of the understanding of risks involving deer and the tolerance of damage caused by them. Communication Benefits (M=4.08), Traditional Conservation (M=3.90), Social Benefit (M=3.74), and Problem Tolerance (M=3.12) all score on the average and above average side of the scale. With communication scoring such a high score, it suggests that deer are in fact an important topic of conversation in the community. Traditional conservation and social benefit issues are also of high importance to the residents, showing that hunting and the culture around it is important to the Duluth community. On the other hand, problem tolerance was the least agreed upon subject, further strengthening the argument that residents are fed up with dealing with deer problems on their property.

When comparing across demographics, the patterns were similar to the overall graph shown in Figure 6. Appendix E displays the following data using graphs. There were slight differences when ages groups were compared as well as well years lived in Duluth groups were compared. The 56+ years old group scored significantly lower in the subjects of traditional conservation as well as problem tolerance. Since most 56+ year olds are retirement age, they often have more free time, which in turn equates to spending more time focusing on hobbies such as gardening and lawn care. On account of this, problem tolerance scores lower because they recognized more deer damage to their property and spend more time and effort trying to stop it. Traditional conservation may have scored lower because of this as well, with traditional conservation measures not being enough to stop the deer damage. Contradictory to this statement is that residents who have lived in Duluth for 21+ years scored higher on the problem tolerance scale than those who have lived here less than 21 years. One possible explanation is that “born and raised Duluthians” have either become habituated to dealing with deer problems or have devised ways to reduce deer related problems. So, unless there is a large influx of retirement aged people moving into Duluth, these results conflict with each other.

Hunters and non-hunters, as well as males and females, had almost no differences between their results (Appendix E). This is interesting because hunters were found to have different attitudes and values towards hunting topics on the WAVs scale, yet there was no difference in traditional conservation or problem tolerance result. On the same note, males are found to be hunters much more often than females, and therefore their attitudes and values follow a similar pattern as hunters. The similar overall pattern that all the demographics follow suggests that deer are being recognized as a topic of conservation, which is shown by the fact that it is the most important topic for the ways residents of Duluth think about deer.

Significance

This study focuses on Duluth residents' knowledge, attitudes, and values towards the Duluth urban deer herd. This is important since deer are a keystone species that the ecosystem and local economy relies on. So, having knowledge about them is important to understand how ecosystems and economies function. It is also important to see how people feel towards urban deer because it will influence their decisions about them as well as their actions and the actions of others towards them.

Since it was found that knowledge about deer is low in Duluth, it is important to ask what can be done to increase it. One method would be to install more deer education materials in schools. Another idea is a city-wide education effort. Increasing educational efforts could result in increased knowledge of deer and their influence on the ecosystem. With increased knowledge comes stronger and better understood attitudes and values.

Since it was found that some of the most important sources of deer knowledge were family, friends, and word of mouth, it is important to create discussion opportunities for the public to engage in. The information being passed on must be accurate, as perceived knowledge levels were often higher than actual knowledge.

With a majority of the overall WAVs scores being on the agreed upon end of the spectrum, urban deer in Duluth are seen in a positive light. The discrepancy between a few of the statements dealt with understanding deer behavior and the goals of deer hunters. This is important because groups are not seeing eye-to-eye on the goals of deer related activities. Since there is disagreement, how can education

not only increase the knowledge about deer, but also about the deer related activities of different user groups?

Recommendations

Based on the results of the questionnaire, four recommendations have been suggested for the schools, nature centers, and other agencies to increase residents' knowledge, and improve the attitudes and values related to the urban deer herd.

First and foremost, schools could increase their education efforts. For this to happen, schools or other professionals should design and implement lesson plans about deer, as well as urban wildlife, which meet Minnesota Academic Standards. These lessons should not only be for science classes, but interdisciplinary. An example of this may be a history lesson discussing the importance of deer to the Native Americans and pilgrims. Or, an economic lesson revolving around the economy of deer related sales and jobs. There is also a great amount of literature about deer, including Al Cambronne's "Deerland". A well designed lesson should cover a wide range of subjects, both for efficiency as well as fostering a systems-based learning style, while revolving around the keystone species of deer.

Nature Centers and Environmental Learning Centers could create and implement community education programs and outreach to reach a large amount of community members. The idea of "Living with Deer" could be a focus, because deer were here first and they here to stay. On account of this, residents should learn how to live with them instead of trying to remove them. Instead of battling against them, have programs teach how to coexist in urban areas. Deer have habituated to live within city parks and backyards. So, what can nature centers do to make this cohabitation smoother? Ideas for these centers include botany classes to discuss deer-resistant plants in yards and on properties, or creating outreach materials and signage with deer facts and figures. Outreach to the community is important, as schools will only reach children, but nature centers can reach children and adults alike.

As major hubs of activity and sources of information, government and other local agencies and groups can be a large part of spreading deer knowledge and fostering positive attitudes and values

towards them. With large campaigns or press releases, deer knowledge could be spread broadly and quickly. Knowledge creates the building blocks for residents to create their attitudes and values.

City of Duluth and Arrowhead Bowhunter's Alliance (ABA) ought to determine the need to adjust management practices based off of attitudes and values discovered through this survey. As the law and policy makers, governments and agencies, both locally and statewide, have a large say in the deer control methods and actions taken towards the deer herds in Duluth. Overall, residents' attitudes and values are positive, but they are still concerned about the property damage done by deer. With the ABA sponsored City bow hunt in its 10th year, and harvesting over 4000 deer during that time, deer management is in action. But, is it enough? The City of Duluth, working with the Minnesota DNR and the ABA, should implement a deer population survey across the city in order to get a comprehensive understanding of the residents' knowledge, attitudes, and values. Based on the population density, wildlife managers can suggest an increase or decrease in population as well as population control methods. Without this information, it is difficult to suggest a management plan. The overall goal would be to maintain an urban deer population that would not cause significant property damage without removing deer completely.

Ideas for Future Research

Throughout the survey process, it was found that a qualitative portion would be helpful. Many interested residents stated their concerns and ideas either on the survey or through emails and phone calls. Overall, the information sought after was collected, and the survey was a success. But, a deeper understanding of specific attitudes and values could be gained if qualitative data were also collected. This would take either a much larger cohort of researchers to administer interviews on a longer timeline, or a smaller sample population. Now that the ground work is laid, this is a possibility for future research.

From a deer management perspective, a survey could be implemented discussing the possibilities of deer population management techniques. There are a wide range of techniques that could be used, with a wide range of outcomes and range of lethality of deer and deer herds. Since the attitudes and values of

the Duluth residents in some DHAs towards the deer herd have now been discovered, the idea of a survey of preferred management practices could be implemented.

Conclusion

In conclusion, it was found that overall deer knowledge is low, suggesting that efforts need to be made through educational processes to increase the knowledge level across the board. An increase in knowledge will, in-turn, solidify attitudes and values towards deer and increase the ability to make educated management decisions towards the keystone species. Secondly, it was found that the source of deer knowledge was mostly self-initiated or through discussion with family or neighbors. This fact again suggests that measures need to be taken to implement deer education into formal and non-formal settings. Perceived knowledge was slightly above average, which contradicts the low actual knowledge levels. Lastly, it was found that a majority of attitudes and values were positive or neutral towards the urban deer herd. A positive viewpoint towards the urban deer is important in fostering a good learning environment for the community. If the issue of problem tolerance can be addressed by educational measures, it will likely create a more positive viewpoint towards an important keystone species for our environment and culture.

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Appendix A

Assessing Residents' Knowledge, Attitudes, and Values towards the Duluth Urban Deer Herd

Mail Questionnaire Introduction and Consent Form

Dear Duluth Resident,

You are invited to participate in a research study involving a survey of knowledge, attitudes, and values towards the deer we have in Duluth. This residence was randomly selected from addresses within five Deer Hunt Areas designed by the Arrowhead Bowhunter's Alliance and the City of Duluth. I am asking that one adult in your residences to complete the attached questionnaire. A postage-paid return envelope is included so that you may return the questionnaire at no cost to you. Your participation would be greatly appreciated. Your response will improve education about urban deer and will inform management decisions to improve humans and deer relationships.

In this questionnaire, you will be asked questions about your knowledge, attitudes, and values towards deer. Your answers will be anonymous. The survey will take less than 15 minutes to complete. Participation in this project is voluntary and you have the right to stop at any time. Your decision whether to participate will not affect your relationship with the University of Minnesota-Duluth. There are no direct benefits to you as a result of participation in this research.

This survey is part of an Environmental Education master's thesis research project that is being directed by Ryan Timmerman, a graduate student at UMD. You may contact Ryan at 507-381-7002 or (timme075@d.umn.edu) with any questions you have about this project. You may also contact Ryan's adviser, Bruce Munson (bmunson@d.umn.edu) with any questions you have. If you have any questions or concerns regarding this study and would like to talk to someone other than the researcher, you are encouraged to contact the University of Minnesota Research Subjects' Advocate Line, D528 Mayo, 420 Delaware St. Southeast, Minneapolis, Minnesota 55455; (612) 625-1650.

None of your answers will be released and no names will used, only addresses on envelopes. Return addresses are not needed, to further insure that you remain anonymous. Participating in this study will help the researchers and agencies better understand the relationship between humans and urban deer in Duluth.

Sincerely,

Ryan Timmerman
Masters of Environmental Education Candidate

Appendix B

Prenotification Postcard

Assessing Residents' Knowledge, Attitudes, and Values Towards the Duluth Urban Deer Herd.

Dear Duluth Resident,

As you may know there are a large number of deer living within the city. My name is Ryan Timmerman, an Environmental Education graduate student at the University of Minnesota Duluth, and I will be investigating residents' knowledge, attitudes, and values towards the Duluth urban deer herd.

In about one week you will receive a mailed survey on these topics that will take about 10 minutes to complete. Your answers to the survey can help improve management and education about human-deer interactions in Duluth. All survey participants will be kept anonymous.

Please contact me if you have questions or concerns.

Ryan Timmerman

Reminder Postcard

Assessing Residents' Knowledge, Attitudes, and Values Towards the Duluth Urban Deer Herd

Recently you received a survey regarding deer in Duluth. If it is already completed, I thank you for your participation.

If you have not yet completed the survey, I encourage you to do so as soon as possible. It will assist with management and educational decisions with deer in Duluth.

If you have misplaced your survey and would like a replacement, please contact me. I appreciate your willingness to help in the study.



Ryan Timmerman



Appendix C Instrument

Assessing Residents' Knowledge, Attitudes, and Values Towards the Duluth Urban Deer Herd.

Please answer the four sections of this questionnaire to the best of your ability without any assistance. This will ensure honest results to analyze. Answering this questionnaire will assist with understanding the interaction between humans and deer, and will help make management decisions for educating communities.

Part 1 Wildlife Attitudes and Values Scale (Purdy and Decker, 1989) modified to fit the study.

Please indicate how you feel about the following statement by marking the answer that fits best.

	Statement	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
1	People consider the presence of deer as a sign of the quality of the natural environment.					
2	People know that deer exist in nature.					
3	People appreciate the role that deer play in the natural environment.					
4	People understand about the behavior of deer.					
5	Deer are included in educational material as the subject of learning more about nature.					
6	People talk about deer with family and friends.					
7	People observe and photograph deer.					
8	People see deer in books, movies, paintings, and photographs.					
9	People express opinions about deer and their management to public officials or to officers of private conservation organizations.					
10	People hunt deer for sale of fur or antlers					
11	People hunt deer for recreation.					
12	People hunt deer for food.					
13	Deer are managed for annual harvest for human use without harming the future of the deer population.					
14	Local economies benefit from the sale of equipment, supplies, or services related to deer.					
15	People tolerate most deer nuisance problems.					
16	People tolerate most levels of property damage by deer.					
17	People tolerate the ordinary risk of deer transmitting diseases to humans or domestic animals.					
18	People tolerate ordinary personal safety hazards associated with deer.					

Part 2 Deer Knowledge Quiz (adapted from Whitetails Unlimited, Egan, 2011). Mark the correct answer without the use of any aide.

	Statement	True	False
19	Deer are strong swimmers, in part because they have a layer of hair that is hollow, providing buoyancy in the water.		
20	Deer have existed for 20 million years, and have had the same basic form for the last one million years.		
21	Deer can run in excess of 35 miles per hour.		
22	Deer can leap over fences eight feet tall.		
23	Deer can cover 30 feet in a horizontal leap.		
24	Just like humans, deer have a set of "baby teeth" that fall out and are replaced by permanent teeth.		
25	You can tell how old a male deer is by how many points there are on his antlers.		
26	Deer use their antlers during the winter to dig for food under the snow.		

27	When antlers grow, they are covered with "velvet," a soft, fuzzy tissue. This velvet is the only regenerating skin found in mammals.		
28	Like cows, deer have four chambered stomachs.		
29	Deer can eat poison ivy without ill effect.		
30	Deer are native to every state in the U.S.		
31	The reason fawns are born with a pattern of white spots is so the mother can recognize her offspring.		
32	Deer have extraordinary senses, including sight, hearing and smell.		
33	Newborn deer have no scent, and the mother will place the fawn by itself in a secluded spot for protection against predators.		

Part 3 Knowledge Source

For question 34: Please indicate the source(s) of your deer knowledge. Marking MORE THAN ONE source is acceptable.

For questions 35: Please indicate the source you gained the most knowledge from. Mark ONLY one answer.

34. Where does your knowledge of deer come from?

(Check all that apply)

Newspaper	TV	
Radio	Internet	
Local News	Facebook	
Twitter	Magazines	
Social Media	Family	
Friends	Neighbors	
Word of Mouth	Formal Education (School books/project)	
Non-Formal Education (Field trips or camp)	Self-Education (research or experience)	

35. From what single source have you gained the most deer knowledge?

Newspaper	TV	
Radio	Internet	
Local News	Facebook	
Twitter	Magazines	
Social Media	Family	
Friends	Neighbors	
Word of Mouth	Formal Education (School books/project)	
Non-Formal Education (Field trips or camp)	Self-Education (research or experience)	

For questions 36 through 39, mark the answer that fits best.

	Statement	Great amount	More than average	Average	Less than average	Little to none
36	How much knowledge of deer do you feel you have?					
37	How much knowledge do you feel the residents of Duluth have about deer?					
38	How much knowledge do you feel the general population of Minnesota have about deer?					
39	How much knowledge do you feel the general population of the US have about deer?					

Part 4 Demographic information

Demographic information is important to compare groups in statistical analysis. Please circle which category you fall under for each question. Remaining anonymous is ensured.

40. **Gender:** Male Female

41. **Age:** 18-24 25-40 41-55 56-70 71+

42. **Years lived in Duluth:** Less than 2 2-5 6-10 11-15 16-20 21+

43. **Are you a deer hunter:** Yes No

44. **Number of times deer have been seen on your property in the last 30 days:** 0 1-3 4-6 6-9 10+
45. **Has your property been damaged by deer in the last year:** No Slightly Moderately Greatly

Thank you for taking the time to complete the questionnaire, it is greatly appreciated. The results will be used for research into improving educational programming towards urban deer, as well as assisting agencies in making management decisions.


*Please place the completed questionnaire in the **PRE-ADDRESSED** and **POSTAGE-PAID** envelope and return to the researcher by no later than **December 5th**. You will be receiving a thank-you or reminder postcard soon.*

Sincerely,
Ryan Timmerman
Masters of Environmental Education Candidate
University of Minnesota Duluth

Appendix D Funding Summary

Thesis Funding	Cost	Funded By	Amount Covered	I paid
First Postcards (500)(VistaPrint)	226.54	Izaak Walton League	200	26.54
Size 10 Envelopes (500)	50	Education Dept.	50	0
Size 9 Business Reply Envelopes (500)	50	Education Dept.	50	0
Consent forms (500)	20	Dad	20	0
Questionnaires (500)	20	Dad	20	0
Address Labels (600)	19.40	Me		19.40
Questionnaire Mailing (500)	124.76	Me		124.76
Business Reply of questionnaires		Education Dept.		0
Final Postcards (500)	243.96	Me		243.96
	754.66			414.66

Prenotification Postcard Receipt

<p>Assessing Residents' Knowledge, Attitudes, and Values Towards the Duluth Urban Deer Herd.</p> <p>Dear Duluth Resident,</p> <p>As you may know there are a large number of deer living within the city. My name is Ryan Thompson, an Environmental Education specialist under the University of Minnesota Duluth, and I will be investigating residents' knowledge, attitudes and values towards the Duluth urban deer herd.</p> <p>In about one week you will receive a mailed survey on these topics that will take about 10 minutes to complete. Your response to the survey can help improve management and education about human-deer interactions in Duluth. All survey participants will be kept anonymous.</p> <p>Please contact me if you have questions or concerns.</p> <p>Ryan Thompson rthompson@umn.edu</p> 	<p>Postcards Assessing Residents' Knowledge, Attitudes, and Values Towards t</p> <p>484</p> <p>\$60.00 \$38.99 You Saved 35%</p>			
	<p>Black & White Back Side</p> <p>Glossy Stock</p> <p>INCLUDED</p> <p>INCLUDED</p> <p>\$38.99*</p>			
	<p>Uploaded List Number of Records: 484 File Name: Vistaprint_MailingList.xls</p> <p>484</p>			
	<p>Postcard Mailing Fee Includes:</p> <ul style="list-style-type: none"> • Address validation • Duplicate checking • Address printing and sorting <p>484</p> <p>\$29.99</p>			
<p>Current Resident Requested Option</p> <p>Postage: First Class Postage</p> <p>Printing Speed: Standard Printing</p> <p>INCLUDED</p> <p>\$154.88</p> <p>INCLUDED</p> <p>\$184.87</p>				
<p>Promo Code Promotion: 35% off sitewide. Plus, 50% off Holiday Cards and Calendars</p>		<p>Original Price</p> <p>You Pay</p>		
	<p>Product Total:</p>	<p>\$244.87</p>	<p>\$223.86</p>	
	<p>Sales Tax:</p>		<p>\$2.68</p>	
	<p>Total:</p>	<p>\$247.55</p>	<p>\$226.54</p>	

Reminder Postcard Receipt



Postcard	484	\$60.00
Item #: 084-001		
Share		

Options

Postcard Mailing Fee Item #: 360-001	-	\$29.99
Standard Printing Item #: 362-001	-	FREE
First Class Postage Item #: 364-001	-	\$154.88
Current Resident Requested Option Item #: 368-001	-	FREE
Postcard Mailing Service Item #: 369-001	-	FREE
Website Coupon Item #: 950-001	-	(\$15.00)
Glossy Stock Item #: 956-001	-	FREE
Black & White Back Side Item #: AMB-001	-	\$10.00

Merchandise:	\$254.87	
Coupons:	(\$15.00)	
Shipping Charges:	FREE	
Tax:	\$4.09	
Total:	\$243.96	

Appendix E

Ways of Thinking about Deer: Demographic Comparison

