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Characterizing Minneopa State Park Visitor's Prairie Attitudes, Views of Conservation and Knowledge Through the Development and Implementation of the Prairie Attitude and Knowledge Survey (PAKS)

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Characterizing Minneopa State Park Visitor's Prairie Attitudes, Views of Conservation and Knowledge through the Development and Implementation of the Prairie Attitude and Knowledge Survey (PAKS)

By

Addeline R Theis

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This thesis has been examined and approved by the following members of the thesis committee:

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Acknowledgement

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Abstract

CHARACTERIZING MINNEOPA STATE PARK VISITOR'S PRAIRIE ATTITUDES, VIEWS OF CONSERVATION AND KNOWLEDGE THROUGH THE DEVELOPMENT AND IMPLEMENTATION OF THE PRAIRIE ATTITUDE AND KNOWLEDGE SURVEY (PAKS)

Theis, Addeline R., M.S. Biology Education, Minnesota State University, Mankato, July 2020

For successful conservation and the continuation of restoration projects, public understanding, acceptance and support are essential. While research into public views related to restoration exist but large gaps remain. Studies examining attitudes related to conservation are limited and even fewer studies investigate these constructs in relation to demographic, societal or cultural factors; even fewer of these studies focus on prairies. Tall-grass prairies were once a dominate biome in Minnesota but now are an endangered ecosystem. While conservation is occurring throughout Minnesota to restore and create new prairies, there is lack of information examining the relationship of prairie restoration and the public's views. New restoration programs include the use of bison as flagship species which can serve to promote engagement and education. Minneopa State Park recently introduced a herd of bison and provides an ideal study site to investigate. The purpose of this research was to investigate knowledge and values of visitors at a state park with a prairie ecosystem. A new research instrument PAKS, (the Prairie Attitude and Knowledge Survey), was created for this study that was designed specifically to measure three constructs: people's attitudes, behaviors and knowledge. The instrument included statements that elicit individual's knowledge, attitudes and behaviors related to conservation and prairies. Data collection of park visitors occurred in the summer of 2018 and comparison group in spring of 2019. The participants responses on the PAKS show consistently positive environmental views for both state park visitors and non-visitors. Almost all visitors valued a community with natural attractions and enjoyed spending time in nature however they also indicated a worry regarding environmental issues. Individuals who indicated positive attitudes toward conservation are likely to indicate positive behaviors. However, these individuals demonstrated a novice-level of knowledge. Although, 90% of responses indicated that participants are worried about environmental issues of concern in southern Minnesotans. This study not only adds to research investigating Minnesotan's views of environmental conservation but specifically of prairies. The information gained from this study could be used in educational research and have implication in future conservation.

Chapter 1: Introduction

Introduction

Concern over environmental issues are becoming more widespread. To effectively

engage with these issues, individuals need to understand and appreciate the natural world.

Environmental issues often are multifaceted and complex to understand. A contributing

factor to this complexity is that humans are dependent on the environment, yet our

activities often have negative environmental byproducts. For example, the burning of

fossil fuels, deforestation, introduction of non-native species, and habitat fragmentation

(Ramkissoon et al., 2012; Isbell et al., 2015) are some of the large environmental

problems facing our planet today which are directly affected by human activities. These

issues all involve a trade-off related to food consumption, transportation or energy needs

to meet human demands. The complexity of these issues is further complicated as they

contribute to climate change, rising sea-levels, and species endangerment (Steg, 2008).

One of the most prolific environmental concerns is habitat loss which can have a

cascading environmental impact.

Habitat loss, which is defined as degradation or change of an ecosystem, is one of

the main threats facing loss species diversity (Monastersky, 2014) and is of particular

importance for threatened and endangered species (Martínez-Estévez et al., 2013; Barak

et al., 2017). Ecosystem functioning and services often directly depend on biodiversity

(Isbell et al., 2015, Hausmann et al., 2016). Conflicts between biodiversity conservation

and human development needs, which are driving habitat transformation and biodiversity

loss, are difficult to resolve (Home et al., 2009; Hausmann et al., 2016). By bridging the

gap and understanding this difficult relationship we may help inform real-world decision making on the local front (Hausmann et al., 2016).

Background of the Problem

Environmental Concerns Related to Prairie Ecosystems

Within the United States as a result of the Homestead Act of 1862, 2.7 billion acres of federal land was distributed for private ownership (From 1862 to 1932) (Samson et al., 2014), which led to a substantial reduction in prairie ecosystems as the land was converted to agricultural use (Knowles et al., 2002). Over 53.8 million acres compose Minnesota, consisting of four distinct biomes: coniferous forest, deciduous forest, tallgrass aspen parkland and prairie grassland (Figure 1). In Minnesota prior to European settlement, the landscape looked very different than today. Almost 18 million acres of prairie covered the southern and southwest parts of the state (Figure 2). The prairie grassland (also known as tallgrass prairies) is one of the most threatened ecosystems in the world, with less than 1% of the original range remaining (Martínez-Estévez et al., 2013). Prairies are a unique ecosystem characterized by the dominance of a grass species, usually occurring in a level or rolling landscape, and have high diversity in flora species despite high intensity and frequent disturbances (Heisler et al., 2003; Keeley and Rundel 2005; Allred et al., 2011; McMillan et al., 2011) ranging from drought, extreme temperatures, fire and herbivory (Anderson, 2006).

Figure 1. Map of Minnesota representing the four major biomes found in Minnesota. (MN DNR 2020).

Due to habitat fragmentation and the small remaining range, tallgrass prairie conservation is a top priority as many researchers have advocated for conservation of this landscape due to their important ecosystem services that benefit humans (Samson & Knopf 1994; Leach & Givnish 1996; Knapp et al., 1999; Heisler et al., 2003; Dodds et al., 2004; Edwards & Reading 2010). However, the rate of grasslands destruction is largely exceeding their protection despite most grassland ecosystems being listed as critically threatened (Martínez-Estévez et al., 2013).
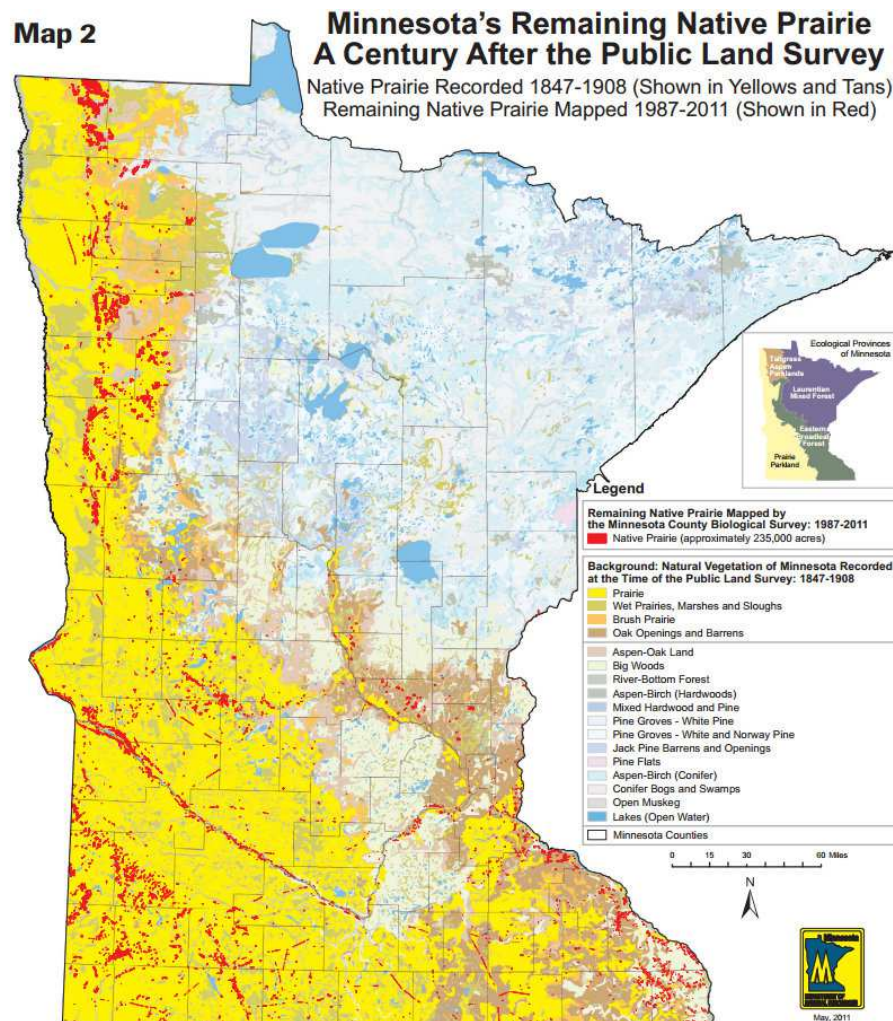
Figure 2. Map of Minnesota representing the original extent of the prairie and today's native prairie (approximately 235,000 acres). Reprinted from Minnesota Department of Natural Resources (2017).

Degradation and reduction of prairie ecosystems can have numerous consequences based on the services prairies provide (Polley et al., 2005; McMillan et al., 2011; Hausmann et al., 2016). Prairies provide multiple beneficial services including; water filtration, mitigation of floods and droughts (Nippert et al., 2012), soil quality (Bach et al., 2012), prevention of erosion (Shantz, 2013), habitat native for flora and fauna (Diamond, 2002; Symstad & Jonas 2011). In addition, as the global community

faces consequences of climate change, prairies may provide some stability by functioning as a carbon sink, providing a method for capturing excess CO_2 and storing it in the plant roots (Sage, 2004) and buried soil organic material. There is a direct value to the protection and conservation of tallgrass prairies.

Not only are these essential ecosystem services something individuals' value, these wild lands draw humans from around the world to visit which supports such claims. This intrinsic value can be measured across different types of spaces, but numerous popular activities have spiked up in these public lands (e.g., birding, geocaching, and hiking).

However, even if the benefits and potential consequences relate to habitat loss of prairies, this ecosystem is sometimes overlooked in research or conservation efforts. Limited research and information are available about the issue surrounding the loss of prairie ecosystems. Understanding the individuals of the community views of prairie ecosystems is of importance in Minnesota due to the current land use and the degradation that has occurred. Much of this original prairie land is what made this area known as the breadbasket as it is still in crop production. A potential conflict of interest exists between agriculture, which is a facet of many Minnesotans lives, and conservation efforts. Therefore, conservation of tallgrass prairie not only is an ecological issue but also has social and economic concern as well.

Environmental Literacy

Conservation of biodiversity, or the variety of life in the world or in a particular habitat or ecosystem, is a complex issue (Wilson & Tisdell, 2004), many factors can play

a positive role in conservation. Successful biodiversity conservation efforts depend upon effective awareness of citizens support and fundraising campaigns (Verissimo et al., 2011). One factor that can impact species conservation is the public's awareness and knowledge of that species (Wilson & Tisdell, 2004) and threats it faces. Knowledge about environmental issues is thought to be a precondition for meaningful pro-environmental behavior and its transmission is considered a key component for successful implementation of environmental education programs (Geiger et al., 2019).

Education is a prerequisite for effective natural resource management (Engels & Jacobson, 2007). The main goal of environmental education is to change an individual's behavior, or to establish environmentally literate citizens with the prospect of acquiring pro-environmental behavior (Hsu & Roth ,1998). Pro-environmental behaviors are those that consciously seeks to minimize the negative impacts of one's actions on nature (Kollmuss & Agyeman, 2002) while environmental literacy is the ability to comprehend environmental issues and how human activities affect the environment (Roth, 1990; Hsu & Roth, 1998).

Environmental literacy is the idea of understanding the relationship between humans and their natural environment (Roth, 1990). As Cheng & Monroe (2012) states, "understanding young people's environmental attitudes is important because in time they will face environmental problems and will need to have the skills and disposition to work on resolutions for these problems." The importance of environmental literacy is communicating the issues of environmental degradation to the public and having education drive change in attitudes as well as behaviors (Rowe, 2002). If we want

individuals to engage in pro-environmental behaviors, we first need to understand what is facilitates these behaviors.

Characterizing environmental views

Most research focusing on the formation of behaviors conflict on what determines how a behavior is created. An early model developed by Hungerford & Volk (1990), investigated the development of behavior creation (Figure 3). Their initial hypothesis explained that increased environmental knowledge invoked an attitude, which could lead to change in behavior. However, research into environmental behavior does not support these linear models for changing behavior, because behavior can be influenced in many ways (e.g., family values, previous experiences, personal beliefs). This is even highlighted by the National Park Service which contends that "through interpretation, understand; through understanding, appreciation; through appreciation, protection" (U.S. Department of the Interior, 2004).
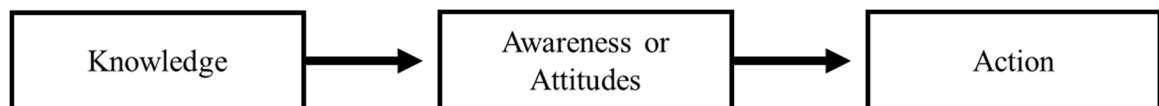
Figure 3. An early cognition model on the factors that contribute to the creation of a behavior. (Hungerford & Volk 1990)

The creation of a behavior is complex and not fully understood which makes examining environmental behaviors challenging. When it comes to understanding the development of pro-environmental behaviors, Hungerford & Volk (1990) have presented a model to represent the creation of an environmental behavior with a variety of variables (Figure 4). Their model represents that intention to act is controlled by several variables

acting in combination (e.g., cognitive knowledge, cognitive skills, and personality factors). Before an individual can intentionally act on an environmental problem that individual must understand the issue. Thus, knowledge of the issue appears to be a prerequisite to action, but not the only one. Developing a better understanding of these variables could help contribute to the development of more successful programs that will promote environmental behaviors (Cheng & Monroe, 2012).
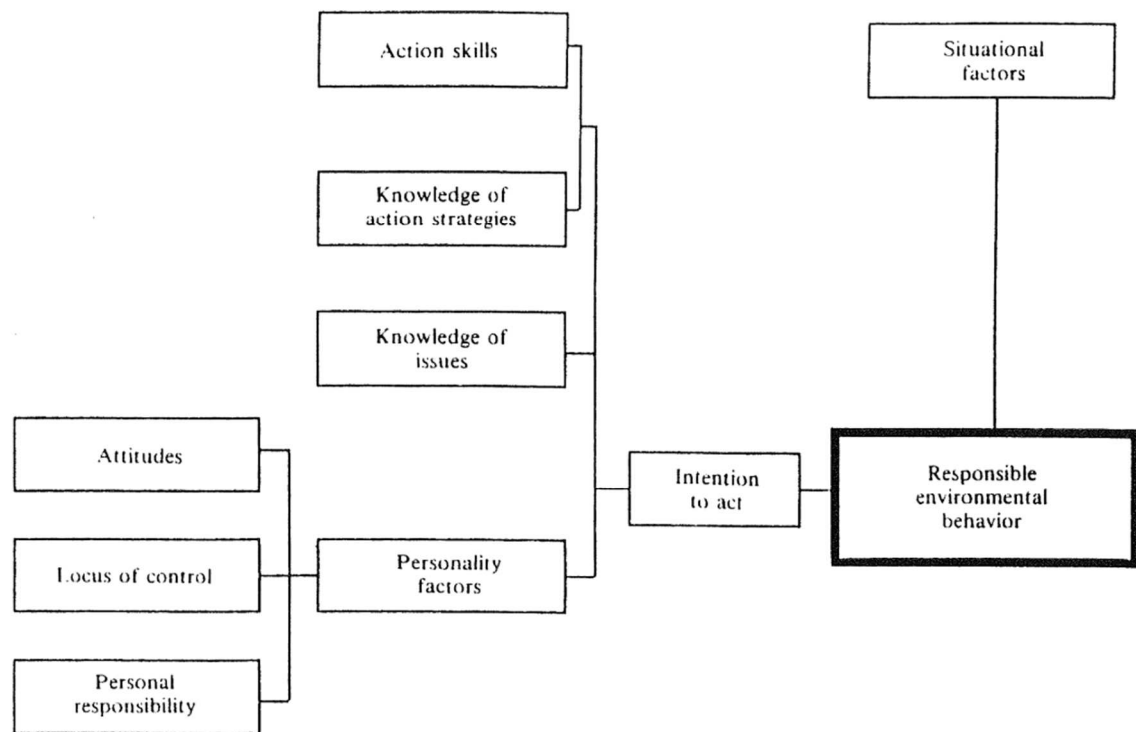
Figure 4. Multi-factor model of the creation of a pro-environmental behavior (Hungerford & Volk 1990)

Attitudes are multi-faceted and include attributes, such as emotional affinity, empathy and sympathy which can predict pro-environmental behaviors (Kals et al., 1999; Kollmuss & Agyeman, 2002; Chochola, 2009; Cheng & Monroe, 2012). Values are commonly defined as desirable individual end states, modes of conduct, or qualities of

life that are individually or collectively hold dear, such as freedom, equality and honesty (Vaske, 2011; I.M. de Groot & Steg, 2008). Values reflect our most basic desires and goals and define what is important to us. Value shifts occur between generations, but not within generations. Since values are often formed early in life, are culturally constructed, and are tied with one's identity, they are extremely resistant to change (Vaske et al., 2011). Value shifts occur between generations, but not within generations, because values are formed early in life and remain largely unchanged throughout a person's lifetime. In addition to the attitudinal factors that contribute to environmental behaviors, the 'actively caring' hypothesis proposed by Geller (Allen & Ferrand, 1999) states that in order to act pro-environmentally, individuals must focus beyond themselves and be concerned with the greater community (Kals et al., 1999; Cheng & Monroe, 2012). The actively caring hypothesis therefore is similar to the altruism theory (Allen & Ferrand, 1999) which states that the model of altruistic behavior allows an individual to become aware of all possible consequences that may arise when they adopt a particular behavior.

Knowledge also plays a role in the creation or formation of an intention to act in an environmentally responsible manner. But how much of a role does knowledge play on creating a pro-environmental behavior compared to other factors is unclear. Research remains mixed as studies that have tried to investigate the knowledge often have had methodological issues therefore it is impossible to derive sound conclusions about the influence of actual environmental knowledge on pro-environmental behavior (Geiger et al., 2019).

Certain demographic factors (e.g., sex, age, ethnicity, education level) can also influence pro-environmental behavior (Vaske et al., 2011; Chase, 2014; Hartel et al., 2015; Gamborg & Jensen, 2016). Vaske et al., (2011) found in the Netherlands, older individuals were more likely to hold non pro-environmental views or dominant/utilitarian views while females were more likely to hold 'pro-environmental' or mutualist oriented views. Kals et al., (1999) found that women usually have a less extensive environmental knowledge than men but they are more emotionally engaged, show more concern about environmental destruction, believe less in technological solutions, and are more willing to change. The longer the education, the most extensive is the knowledge about environmental issues. Yet more education does not necessarily mean increased pro-environmental behavior.

The use of flagship species

Some environmental agencies have found a unique way to spark interest within the public. To promote conservation in a time where the experience of nature is neglected, providing an entity people can relate to, value and sympathize with, which is what the flagship species is as a tool (Cheng and Monroe, 2012). Flagship species are popular, charismatic species that function as a symbol and rallying point to stimulate conservation awareness and action (Caro et al., 2004). Flagship species are being used as supporting tool to conservation management because they are able to incorporate emotion and value characters as well as knowledge-based information (Simberloff, 1998).

Many organizations and agencies have adopted flagship species as their symbol to help promote conservation to the public, donors, and political attributes. They most

recognizable and successful examples of flagship species are the giant panda (*Aluropoda melanoleuca*), the tiger (*Panthera tigric*) and the African Elephant (*Loxodonta africana*) (Bowen-Jones and Entwistle, 2002). Studies have suggested that charismatic species attract more people to support conservation initiatives than does the general concept of saving ecosystems (Engels and Jacobson, 2007). These flagship species are used to be awareness to environmental issues including deforestation and habitat loss in specific ecosystems.

The classic model of a flagship species is the Florida panther (*Puma concolor coryi*), where the species has been used as a poster-animal in both public and private campaigns for broader conservation objectives (Simberloff, 1998). With only 40 individuals remaining of the species, many factors contribute to the decline of the Florida panther, such as rapid development, habitat destruction leading to fragmented habitats and the extreme decline of their favorite prey animal, the white-tailed deer (*Odocoileus virginianuns*) (Simberloff, 1998). Conservation of panther habitat could serve a double-duty purpose because there are 51 other mammal, bird, reptile, and amphibian species that are also threatened in Florida (Simberloff, 1998). Although it may be too late for the Florida panther, even with the intense conservation practices this example provides a guide that other organizations can follow to increase awareness and education of habitat conservation and restoration efforts.

The use of flagship species is not isolated to global or national conservation campaigns. Minneopa State Park is one of two state parks within Minnesota that introduced American bison (*Bos bison athabascae)* as a flagship species. The goals of

this introduction was done not only increase the number of bison in the state, sustain

genetic diversity and help promote prairie restoration (MN DNR, 2014) but to increase

visitation and to allow for educational opportunities. The addition of the bison herd to the

park has allowed new educational programs to be developed and implemented.

Statement of Problem

Given that in Minnesota, prairies are currently reduced to < 1% of their original

range. The benefits of ecosystem services to humans is crucial for Minnesotan's clean

water and soil health in western/southern Minnesota. Research has not been conducted

focusing on environmental literacy of prairie and values or attitudes of prairies by the

public.

The process of how environmental behaviors are created is still unknown because

of there are a multiple of factors that contribute to the creation of one. It is not known

what factors are the most important in facilitating pro-environmental factors especially

when considering prairie ecosystems. Understanding the variables that influence pro-

environmental behaviors may help program developers promote pro-environmental

actions (Cheng & Monroe, 2012).

Research Questions and Hypotheses

This study aims to characterize the public's knowledge, attitudes and value of

prairies and conservation which can have implications for educational outreach. This

study focuses on views of visitors to Minneopa State Park which located within a prairie

ecosystem and has introduced a flagship species. The objectives of this study was to develop an instrument to effectively measure values, attitudes and knowledge related to prairie and prairie conservation and to assess park visitors and non-visitor's values, attitudes and knowledge about prairies and prairie conservation in Southern Minnesota. The research questions for this study include:

1. What are the values, attitudes and knowledge of Minneopa State Park visitors in relation to prairie and prairie conservation?

2. What are the relationships between values, attitudes and knowledge related to prairies and prairie conservation of Minneopa State Park visitors?

3. What aspects of visiting state parks and engaging in conservation efforts are encouraging and discouraging to Minneopa State Park visitors?

4. What are the relationships between Minneopa State Park visitors' demographics values, attitudes and knowledge about prairies and prairie conservation?

5. What are the relationships between Minneopa State Park visitors and non-park visitors values, attitudes and knowledge of prairies?

Knowledge is an important component in influencing a person's behavior, value and/or attitude, therefore, I hypothesize based on the model developed by Hines et al., (1986) (Figure 4), that individuals that are more knowledgeable about prairies will also have views that are more aligned with valuing prairies. In addition, based on previous studies (Morgan & Hodgkinson, 1999; Borrie et al., 2002; Ceurvorst & Lamborn, 2018) would be expected that a relationship between participants values and attitudes related to conservation will

exist. Due to Minneopa State Park visitors are already engaging in behaviors that align with an interest in prairies, this population will have a place a higher value on and will hold more environmentally friendly conservation views of prairies compared to non-visitors or people that have never visited the Minneopa State Park before. Therefore, I hypothesize that there will be significant differences in the values, attitudes and knowledge with Minneopa State Park visitors being more likely to hold pro-environmental values and be more knowledge than non-visitors.

Chapter 2: Review of Related Literature

Introduction

Current research in the field of environmental education or environmental literacy is quite broad because each population and location of these studies vary greatly. A major theme of this research area focuses on aspects of learning, views of management techniques, general natural resources perceptions and views of public lands. The scope and scale of research in this area exemplifies the challenge in trying to characterize individuals' views or understanding of complicated environmental issues. Even though, environmental research into prairies is extremely limited, understanding broader environmental education and literacy issues can be informative in developing studies in this area.

Knowledge, views and attitudes

Studies investigating the public's perception can be challenging and the results showcase the complexity of environmental issues. A study by Vining & Merrick (2008) examined forest-management perceptions of fire-mitigation techniques of residents at vary proximities to national forests in Northern Minnesota. The project focused on perceptions of a management technique as well as the motivations behind these preferences. Their results show that whether participants lived close or far from the public lands, they preferred many methods of forest fire management rather than one technique alone. The results from this study indicate a high level of complexity in

participants decision making since they had a strong preference for a multipronged approach (Vining & Merrick, 2008). Similarly, in a study by Meijaard et al. (2013) who examined villagers in Borneo's understanding and perception of forest use found villagers had high awareness of negative environmental impacts of deforestation, with high levels of concern over higher temperatures, air pollution and loss of clean water sources.

A study investigating park visitors at Miquelon Lake Provincial Park in Canada examined visitors' perceived impacts of knowledge, attitudes, and behaviors (Hvenegaard, 2017). For visitors, the most common motivational factor for visiting was time with family and friends, recreation, escape, scenery and time in nature. Even though visitors lacked interest in educational programs they still perceived these programs to be valuable regardless of participation.

Clay et al.'s (2007) main objective was to examine links between perceptions and perceived factors of water quality degradation. In this study, a direct mail survey was developed to assess public attitudes about water resource issues, awareness of water quality issues and where knowledge related to water resource information was obtained. The results indicate a lack of understanding of how soils, water, and landscapes interact to influence water quality or the link between water quality and watershed management In addition, the data showed many respondents held conflicting views and a disconnection between knowledge and behavior.

Not only does knowledge and attitude influence someone's view of conservation and environmental issues but barriers can also have an impact. Kollmuss & Agyeman

(2002) provided insight into why people act environmentally and the barriers to pro-environmental behavior which included individuality, responsibility and practicality. An example of a barrier can be lack of previous experience in nature. Experience provides a context and a connection to nature therefore, if an individual has minimal experience in nature it can disconnect the person from being an advocate for it. These barriers are especially influential in people that do not have a strong environmental concern.

Flagship Species

Lamb & Cline (2003) conducted research on public knowledge and perceptions of Black-Tailed Prairie which is a mammal that inhabits short-grass prairie ecosystems. They found respondents were more familiar with terms used in everyday conservation and reported lower levels of knowledge on specific scientific and technical terms. All of this suggests that the public has a basic knowledge about general ecology but lacks detailed-specific knowledge related to prairie dogs. Overall, the public held negative perceptions of black-tailed prairie dog management. Two-thirds identified low to minimal benefits of conservation. Those who were in the best position to make a direct connection to quality of life felt that protection of the rodents was less beneficial to society. In researchers contend that, "the most successful symbols of environmental concern are those directly relevant to an individual's quality of life or that evoke a fear of eminent ecological disaster" (Lamb & Cline 2003). This study is one of the few that examines a facet of prairie ecosystems. Based on this study, Prairie dogs may not hold all the characteristics required of a quality flagship species and more positive views of

conservation of a species would be predicted if a more reverent species was used as part of the study.

Hacker & Miller (2016) conducted a study to assess perceived elephant behavior and its effects on conservation-related attitudes and behavioral intent at the San Diego Zoo Safari Park in Southern California. The study serves to highlight any connections, relationships, and shortcomings t to maximize visitor experience, thereby encouraging guest contributions to elephant conservation. The findings show that up-close encounters with an elephant had the greatest effect on guests' attitudes about wild elephants and on guests' reported conservation intent. Visitors who scored highly on conservation intent were those with positive attitudes toward elephants in the wild and negative attitudes regarding the modification of nature. Guests who reported seeing elephants engage in active behaviors and a high diversity of behaviors reported greater conservation intent. Although this study provides useful information in understanding the role of flagship species it is limited in scope since the survey focuses only on the animal and the behavior of the animal.

Environmental Attitude Instruments

Systematic measuring an individual's environmental views is challenging as there are multiple components that could influence their development and those views may vary in certain contexts. Despite these challenges, numerous environmental surveys have been developed to measure different constructs relation to environmental issues (e.g. attitudes, behavior, values and beliefs). In most cases these instruments are intended for

characterizing a generalized view or targeted to a specific issue which does not necessarily translate into effective implications in other contexts.

A metanalysis by Milfont & Duckitt (2010) looked environmental attitude inventory. Environmental attitudes are defined as crucial constructs in environmental psychology and are a psychological tendency expressed by evaluating the natural environment with some degree of favor or disfavor (Milfont & Duckitt, 2010). There are numerous of environmental attitude instruments available based on different conceptual and theoretical frameworks, and most researchers prefer to generate new measures rather than organize those already available. The goal is to create an instrument that is valid and reliable in measuring the structure of environmental attitudes as well as create an inventory of attitudes related to the environment have been created for a variety of population.

The Environmental Attitudes Inventory (EAI) (Milfont & Duckitt, 2010) highlights why development of instruments for specific studies is valued. The EAI is an extensive instrument that has value in characterizing numerous facets of environmental attitudes but in order to accomplish this, it includes 10 scales and 120 items. Due to the scope of this instrument many scales would not fit within the context of this study (e.g. 'attitudes towards democracy', 'social desirability' and 'right-wing authoritarianism') and therefore it would not be an appropriate instrument to use. In addition, because of the length of this instrument it would not be feasible to use in a field setting.

Survey Development

The main method in which information is gathered from the public or visitors of a natural attraction is through the use of a survey instrument. To effectively use a survey instrument, the validity of that instrument must be established and is the most important idea to consider when preparing or selecting an instrument for use. Validating a survey instrument refers to the process of assessing the survey questions for their dependability because there are multiple, tough-to-control factors that can influence the dependability of a question (Trochim & Donnelly 2008). The development and validation of an instrument is important to ensure the instrument is unbiased and contains clear questions (Fraenkel & Wallen 1996). Validity is the degree to which evidence supports any inferences a researcher makes based on the data he or she collects using a particular instrument (Fraenkel & Wallen 1996). It is the inferences about the specific uses of an instrument that are validated, not the instrument itself. Validity, therefore, depends on the amount and type of evidence there is to support the interpretations researchers wish to make concerning the data they have collected (Fraenkel & Wallen 1996). During validation the crucial question is: Do the results of the assessment provide useful information about the topic or variable being measured?

Likert scale is applied as one of the most fundamental and frequently used psychometric tools in educational and social sciences research (Joshi et al., 2015). The original Likert scale is a set of statements offered for a real or hypothetical situation under study. Participants are asked to show their level of agreement (from strongly disagree to strongly agree) with the given statement on a metric scale. Here all the statements in combination reveal the specific dimension of the attitude towards the issue,

hence, necessarily inter-linked with each other. The Likert scale was devised in order to measure 'attitude' in a scientifically accepted and validated manner. (Joshi et al., 2015). An attitude can be defined as preferential ways of behaving/reacting in a specific circumstance rooted in relatively enduring organization of belief and ideas (around an object, a subject or a concept) acquired through social interactions (Joshi et al., 2015). A study by Lo, Chow et al. (2012) observed the relationship between the likelihood of participating wildlife conservation programs and social influences related to Asian turtles. The results showed that the community had little motivation to protect the species from commercial exploitation. However, the results indicated that social expectation was the strongest predictor, followed by attitudes toward turtle protection and perceived behavioral control. The results also suggested that awareness of consequences could activate personal norms. The study also found that turtle conservation education campaigns may fail to motivate people if they are framed in economic terms. It may be beneficial to focus on an emotional connection instead. Kals et al. (1999) examined the relationship between emotional affinity and pro-environmental activities. The results showed that emotional affinity toward nature proved to be as important for the prediction of nature-protective willingness and behavioral decisions as interest in nature (e.g. using public transportation systems instead of one's own car and exploiting and polluting natural resources).

Conclusions

These studies focused on developing methods to measure and characteristics views related to environmental issues showcase complex and nuanced views that individuals hold. Although, research in this field overall is extensive, most the research has not focused on prairies ecosystems. Examining environmental literacy or views related to prairie ecosystems research is novel. Little information is available that assesses public knowledge about prairies as well if the public supports prairies conservation in this area. The importance of environmental literacy related to prairie conservation is for the success of prairie conservation to occur throughout the state if we can understand what Minnesotans knowledge and if they value prairie systems.

Chapter 3: Survey Development and Validation

Introduction

A new research instrument was created for this study because there is no instrument that has previously been developed and validated that aligned with the scope and goal of this study. A new research instrument, Prairie Attitude and Knowledge Survey (PAKS), was created for this study and was designed specifically to measure people's views, attitudes and knowledge related to conservation and prairie ecosystems. This method of data collection is ideal as it allows for the gathering of data about abstract ideas or concepts that are otherwise difficult to quantify, such as opinions, attitudes, and beliefs. Surveys are also useful for collecting information about behaviors that are not directly observable.

In order to effectively measure attitudes a survey instrument that allows for the distinction between factors related conservation is necessary. A literature review was conducted when initially developing the PAKS instrument. This included consulting existing research on survey development and implementation related to individuals' views of conservation, environmental behaviors and attitudes about conservation. Experts in the field were consulted to help ensure inclusion of important topics and response options. Think-aloud sessions were conducted with students to help identify ambiguous wording, verify reading of item meaning, inclusion of response options.

The PAKS is composed of two parts. The first section in the survey that is composed of 16 statements on the Likert scale. These statements were designed to elicit

responses concerning attitudes about prairie conservation, attitudes about personal

conservation and prairie knowledge questions. The second section consist of eight

multiple-choice questions which were designed to measure encouraging and discouraging

factors that encourage or discourage participants from engaging in pro-environmental

behaviors (e.g. visiting a state park and participating in conservation efforts). This second

section also asked questions concerning responsibility of environmental issues. Lastly,

participants completed a demographic survey which included questions about sex, age,

education level, ethnicity, frequency to the park, distanced traveled to the park, etc.

(Appendix H).

Instrument Development and Validation

The statements on the first version of the PAKS were included because each had

already been established in research related to environmental views or were adapted from

previously conducted research or were developed specifically for this study (Table 1).

During the initial phase of development all statements were iteratively and

collaboratively written, reviewed and revised. The PAKS underwent a thorough

development and validation process before being implemented for final data collection.

The first version of PAKS consisted originally of 28 Likert scale questions (Table 3). The

first version was implemented to undergraduate students enrolled in BIOL 106: General

Biology II at MSU at Minnesota State University (MSU) during Spring 2018 (N=30)

(IRB# 1196240). The population used for this preliminary implementation, allowed

access to a population who would be familiar with biological content, conservation and

who was expected to have an interest in nature.

Table 1. Hypothesized Inventory of instrument items of PART A supported from previous conducted work. Construct are labeled and color coded. Attitudes about conservation are dark grey, personal conservation is light grey and prairie knowledge is the lightest shade.

Question	Construct Addressed	Source
1. Turning unused land into agriculture or commercial development should be supported even if it means losing natural resources	Attitudes about conservation	T.L. Milfont Altering nature scale
2.In my life I try to find ways to conserve resources (e.g. shorter showers, turning off lights)	Personal conservation	T.L. Milfont Personal conservation behavior scale
3. Prairies function in water filtration	Prairie knowledge	Lo, A.Y., et al., 2011
4. I value living in a community with nature attractions	Attitudes about conservation	T.L. Milfont Enjoyment of nature scale Kals, E. et al., 1999
5. I enjoy spending time in nature	Attitudes about conservation	T.L. Milfont Enjoyment of nature scale Kals, E. et al., 1999
6. Conservation is important even if it lowers people's standard of living	Personal conservation	T.L. Milfont Conservation motivated by anthropocentric concern scale
7. Prairies provide vital habitat for animals	Prairie knowledge	Lo, A.Y., et al., 2011
8. Wildlife and nature should only be conserved for hunting and fishing purposes	Attitudes about conservation	T.L. Milfont Human utilization of nature scale
9. Prairies help maintain soil quality	Prairie knowledge	Lo, A.Y., et al., 2011
10. I am worried about environmental issues	Attitudes about conservation	T.L. Milfont Enviornmental threat scale
11. When I make lifestyle choices, I consider the impact it has on the environment	Personal conservation	T.L. Milfont Personal conservation behavior
12. Prairies support diverse animal wildlife	Prairie knowledge	Lo, A.Y., et al., 2011
13. Prairie ecosystems should be conserved	Prairie knowledge	Lo, A.Y., et al., 2011

14. Nature exists primarily for human use	Attitudes about conservation	T.L. Milfont Human utilization of nature scale
15. I am more likely to visit state parks that are not in prairie ecosystems	No construct association but required to ask to answer research questions	
16. The ability to view wildlife (e.g. bison) impacts my decision to visit a state park.	No construct association but required to ask to answer research questions	

Once data was collected with the first draft of the PAKS survey, Principal Axis Factoring (PAF) was the extraction method used for this study as it focuses on the common variance that exists between items (Henson & Roberts, 2006) allowing for the reduction of items in targeting the variables this study aimed to measure. PAF is a form of exploratory factor analysis which allowed for the exploration of the structure of items to determine if statistically associate within the constructs that this study was aiming to measure (Table 2). Exploratory Factor analysis is appropriate for this study because this form of analysis identifies and measures variables that latent variable's or those that cannot be directly measured.

PAF analysis is more commonly used in behavioral and social sciences and its aim is to understand a shared variance in a series of measurements through set of hidden variables (Warner, 2013). PAF gives the best results when working with non-normal data (Costello and Osborne, 2005). Varimax rotation was used as differences in correlations between factors for other rotation methods was minimal. Established guidelines were followed when considering the removal and retaining of items (Costello and Osborne, 2005) while also considering conceptual and theoretical from work in which this research

is being conducted based on the analysis and interpretation of the results (Appendix A), four statements were removed because of low-loading (i.e. items 2, 12, 27, 28). Their removal also did not negatively impact the integrity of the data.

Table 2. Hypothesized construct definitions for PAKS instrument.

Scale Label	Construct Definition
Attitudes about conservation	A settled way of thinking or feeling about someone or something; typically, one that is reflecting in a person's behavior
Personal Conservation	Taking care to conserve resources and protect the environment in personal everyday behavior
Prairie Knowledge	Facts, information, and skills acquired by a person through experience or education

Multivariate analysis was conducted to determine if any items were correlated with each other and was used to determine if items could be removed to reduce the overall number of statements of the instrument. Item 8 and item 10 were found to be highly correlated (0.7625) and item 8 was removed as it had a lower loading in the PAF than item 10. After the removal of these items, PAF was ran again and items 11 and 15 were removed. The final analysis showed three factors which explained 51.462% of the variation. However, the loadings for some items were cross loaded among different constructs. For these items (i.e. 4, 6, 9, and 24) revisions were made to increase alignment with the construct this study aimed to measure. It is important to note, that correlation between items is also expected in studies examining aspects of behavior (Costello & Osborne, 2005). Items 5 and 28 were reworded before inclusion in the next version of the instrument.

Lastly, statements 21, 23, and 26 were not included in analysis as they are not designed to measure the constructs of interest in this study, but behavior or views related to visiting a state park. These three questions were also kept for the final draft because they help us answer other questions that helped collect data as well for the staff at Minneopa State Park.

Based on the analysis, an updated version of the PAKS was developed (Table 3). The second version was implemented in an upper-level biology course at MSU during Spring 2018 (n=28) (IRB# 1196240). This population provided similar qualities to the population who completed the first version (e.g. interest in nature, familiarity with biology etc.) but since this was an upper-level course the population was expected to have a more developed understanding and be more knowledgeable about the topic. It was also important to use a different population than those who complete the first version since those individuals would already be familiar with the instrument.

Similar analysis was performed on the second version as on the first. However, one difference in how analysis was conducted was that the knowledge questions were removed prior to PAF analysis. Based on previous analysis and the literature review, the decision was made to remove the knowledge statements from PAF analysis since these statements are not designed to measure latent variables (i.e. psychological constructs) which is a tenant of PAF. The knowledge statements did not lend themselves well to be analyzed with the other constructs in this study.

The knowledge questions were instead evaluated using Spearman's Rho, which is a non-parametric test that measures the strength of association between variables. The

analysis indicated the removal of items 3, 4 and 11 they had the weakest association

(Appendix D). Again, Items 21, 22, and 23 were also not included in the PAF analysis as

these statements were not designed to measure the psychological constructs on interest

but behaviors and view related to state parks.

Table 3. Development of PART A questions. Green (Lightest grey) represent questions that did not change and continued on to next draft. Blue (Darkest grey) are questions that kept by reworded. Red (Middle Grey color) are questions that were eliminated. Number is parenthesis are the original question number.

Draft 1	Draft 2	Final
1. Turning unused land into agriculture or commercial development should be supported even if it means losing natural resources	1. (1) Turning unused land into agriculture or commercial development should be supported even if it means losing natural resources	1. (1) Turning unused land into agriculture or commercial development should be supported even if it means losing natural resources
2. Prairies respond to environmental changes (e.g. drought, fire)	2. (3) All ecosystems can change due to environmental factors	2. (5) In my life I try to find ways to conserve resources (e.g. shorter showers, turning off lights)
3. All ecosystems are equally important to conserve	3. (2) Prairie ecosystems can change due to environmental factors	3. (11) Prairies function in water filtration
4. Prairies are stable, never changing ecosystems	4. (5) Prairies do not have plant diversity	4. (8) I value living in a community with nature attractions
5. Prairie have little plant diversity	5. (6) In my life I try to find ways to conserve resources (e.g. shorter showers, turning off lights)	5. (10) I enjoy spending time in nature
6. In my daily life I try to find ways to conserve resources (e.g. shorter showers, turning off lights)	6. (7) Prairies support diverse animal wildlife	6. (12) Conservation is important even if it lowers people's standard of living
7. Prairies support diverse animal wildlife	7. (9) Prairies help maintain soil quality	7. (9) Prairies provide vital habitat for animals
8. I have a strong emotional bond with nature	8. (10) I value living in a community with nature attractions	8. (14) Wildlife and nature should only be conserved for hunting and fishing purposes

9. Prairies contribute to soil quality	9. (12) Prairie provide vital habitat for animals	9. (7) Prairies help maintain soil quality
10. I value living in a community with nature attractions	10. (13) I enjoy spending time in nature	10. (15) I am worried about environmental issues
11. Conservation is an important environmental issue	11. (14) Prairies function in water filtration	11. (16) When I make lifestyle choices, I consider the impact it has on the environment
12. Prairies provide a habitat for pollinators	12. (15) Conservation is important even if its lowers people's standard of living	12. (6) Prairies support diverse animal wildlife
13. I enjoy spending time in nature	13. (16) Prairie only provide a habitat for nuisance animals	13. (17) Prairie ecosystems should be conserved
14. Prairies function in water filtration	14. (17) Wildlife and nature should only be conserved for hunting and fishing purposes	14. (18) Nature exists primarily for human use
15. Conservation is important even if it lowers people's standard of living	15. (18) I am worried about environmental issues	15. (21) I am more likely to visit state parks that are not in prairie ecosystems
16. Prairies only provide a habitat for nuisance animals	16. (19) When I make lifestyle choices, I consider the impact it has on the environment	16. (22) The ability to view wildlife (e.g. bison) impacts my decisions to visit a state park
17. Wildlife and nature should only be conserved for hunting and fishing purposes	17. (20) Prairie ecosystems should be conserved	
18. I am worried about environmental issues	18. (22) Nature exists primarily for human use	
19. When I make lifestyle choices, I consider the impact it has on the environment	19. (24) Human needs are more important than the needs of other animals and plants	
20. Prairie ecosystems should be conserved	20. (28) Plant and animal conservation are equally important	
21. I am more likely to visit a state park if it is not located in a prairie ecosystem	21. (21) I am more likely to visit a state park if it is not located in a prairie ecosystem	
22.Nature exists primarily for human use	22. (23) The ability to view wildlife (e.g. bison) impacts my decision to visit a state park located in a prairie ecosystem	
23. The ability to view wildlife (e.g. bison) impacts my decision to visit a state	23. (26) I would likely visit a prairie regardless of whether it is located in a state park	

park located in a prairie ecosystem		
24. Human needs should take priority over nature and wildlife		
25. It is acceptable to use animals in research even if some may be harmed or killed		
26. I would likely visit a prairie regardless of whether it is located in a state park		
27. Humans are as much a part of an ecosystem as other animals		
28. Animals conservation is more important than plant conservation		

Once the knowledge questions were removed, the PAF was then conducted on the remaining statements. Due to low loading of a couple of problematic statements, items 2, 3,19 and 20 were removed. The best fit of the data resulted in four distinct factors that emerging, in addition to the separate knowledge factor (Table 4).

This instrument development of PAKS, allowed for the investigation of the dimensionality of responses to items on the survey. Although, there are differences between the factor structure that emerged and the *a priori* conceptions the items did associated by clear constructs that are meaningful and beneficial to this study. The factor identified as having the greatest explanatory power was views of conservation (Items 1, 4, 5, 8, 10). The final version of the instrument had an overall reduction in items and some constructs had fewer items retained than others. The output indicates high loadings for factors that have only two items retained. Spearman's Rho indicated that these items

were strongly associated before proceeding (Appendix D). Based on this analysis the third and final version of the instrument was implemented for data collection.

For the development PAKS part 2 it was decided to allow for timely and efficient survey completion that the questions should be multiple-choice. To develop response options, as part of the development component, fellow biology graduate students were asked to answer the questions as open response. The importance of this was gathering general response to these questions and then were clumped into related response. After the second draft of the instrument was created, we listed to 10-15 responses for each multiple choice. I also conducted think-a-louds sessional with participants and used their feedback to develop response options make modifications the existing wording, reduce ambiguity and clarify questions. The reduction in response allows for more effective time in delivering the survey and to reduce participant survey fatigue. The final part of the survey consisted of demographic questionnaire. This information allows for the analysis of any relationships between a participant's response and their demographic background (Appendix H).

Table 4. Associated Factors after analysis of final data collection. Final version numbers.

Factor 1- Personal Conservation	Factor 2- Intent for nature	Factor 3- Value of Nature	Factor 4 –Land Use Value	Factor 5- Knowledge of Prairies
2. In my life I try to find ways to conserve resources (e.g. shorter showers, turning off lights)	8. Wildlife and nature should only be conserved for hunting and fishing purposes	4. I value living in a community with nature attractions	1. Turning unused land into agriculture or commercial development should be supported even if it means losing natural resources	11. Prairies function in water filtration
6. Conservation is important even if it lowers people's standard of living	14. Nature exists primarily for human use	5. I enjoy spending time in nature	13. Prairie ecosystems should be conserved	7. Prairies provide vital habitat for animals
10. I am worried about environmental issues				9. Prairies help maintain soil quality
11. When I make lifestyle choices, I consider the impact it has on the environment				12. Prairies support diverse animal wildlife

Conclusions

The aim with the development of the PAKS instrument was to effectively measure participant's views, attitudes and knowledge related to prairies and prairie conservation. The PAKS instrument underwent an extensive development and validation process to help ensure the validity and reliability of the instrument prior to data collection. The PAKS instrument overcomes limitations that exists with other

conservation or environmental inventories while aligning with the research goals of this

study.

Chapter 4: Data Collection

Study Locations

Minneopa State Park (44°09'23.7"N 94°05'2708"W), located 10 minutes south of Mankato, Minnesota serves as an ideal site for this study. The park draws visitors through several attractions (e.g. waterfalls, hiking, camping). In 2015, a herd of bison (*Bos bison* athabascae) was established, and the park has seen a significant increase in visitor numbers (Figure 5). Bison were once found throughout the state, but the last wild bison was seen in 1880. Bison are classified as a "near-threatened" species because of the small number of bison that are managed for the preservation of the species.
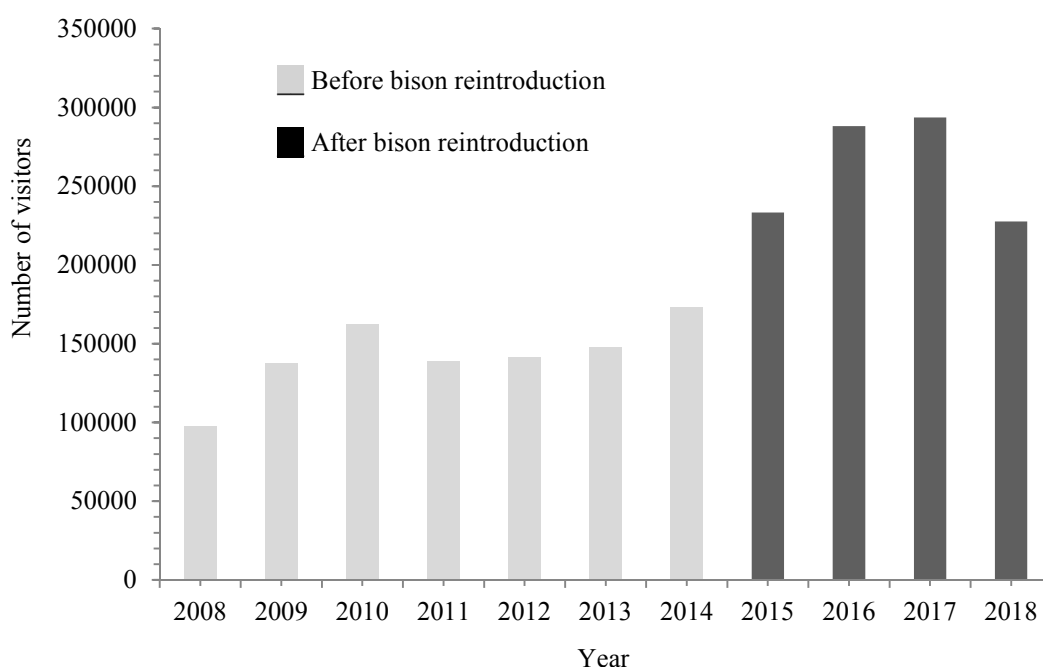
Figure 5: The number of visitors at Minneopa Park from the year 2008 to 2018. The bison herd was introduced to the park in 2015. (Minneopa State Park Data, 2020)

Minnesota now has an initiative for the protection of bison through the Minnesota Bison Conservation herd. Minneopa State Park is the second bison herd site in the state. The first was Blue Mounds State Park located just north of Luverne, Minnesota. Minneopa State Park was selected as a site for the expansion of the Minnesota Bison Conservation Herd program for a variety of reasons. The location includes an established prairie remnant in need of herbivores for prairie restoration and is less than 100 miles from a metropolitan area that can provide high visitor traffic.

In order to make comparisons between Minneopa State Park visitors and the general public, a second site was utilized. Participants were recruited from the 2019 Regional Middle/High School Science Fair hosted by MSU. To recruit participants a display table was setup with incorporated visual photos and diagrams of the bison herd and bison anatomy as well as hands on items like hides and bones of bison. This table was used as a recruitment to by helping to increase interactions and interest.

Data Collection

Data was collected from the Minneopa State Park group from June 2018 to August 2018. IRB # 1256206, the Minnesota Department of Natural Resources (MN DNR), and Minneopa State Park approved this project. Participants were recruited from park visitors by myself or by Bison Ambassadors who were volunteers and underwent training for recruitment and survey administration. Ninety-nine face-to-face surveys were completed at Minneopa State Park with an 89% response rate.

For the general public group or the comparison group, survey data was collected on February 16th, 2019 (IRB# 1380237). Approval was obtained from the supervisor of the regional science fair and MSU. Participants were recruited from visitors of the regional science fair. The population were individuals that were either teachers or parents of students in the science fair and probably a science mind set compared to the average public. Twenty-two face-to-face surveys were completed with a 92% response rate. (n=21) This sample size is small and was not helped by the fact that 3 surveys were turned in but the back was not completed. Those data points were not included in the results of the survey.

Data Processing and Analysis

It can be difficult to evaluate the difference in scale between strongly agree and agree is the same between agree and neutral. Collapsing response categories can help alleviate this concern in the data (Grimbeek et al., 2005). By creating three categories (i.e. agree, neutral and disagree) and analyzing data dichotomously (e.g. agree vs disagree) this allows for a more accurate distinction between views and allow for better interpretation (Harpe, 2015). The first part of the PAKS was comprised of Likert scale statements. For analysis, strongly agree and agreed collapsed and strongly disagree and disagree collapsed resulting in three categories. A recent literature reviews of similar data have established that the use of parametric test is appropriate due to the robustness of the statistical methods used (Norman, 2010). This idea that parametric statistics cannot be used with ordinal data is an oversimplification (Harpe, 2015). For our analysis, the

overall PAKS factors were analyzed, therefore items were not examined at an individual Likert scale item level but in aggregate and be treated as a continuous data set (Harpe, 2015). The development of this instrument also has established its validity and reliability and contributes to the appropriateness of this approach.

To determine the relationships between factors measured by the PAKS and other variables (e.g. demographics, knowledge etc.) one-way ANOVAs were conducted. To describe relationships between variables bivariate regressions were completed for PAKS factors. Participants responded to items on a Likert scale which was converted into ordinal data for analysis. The associated construct scores were averaged to get an individual score for each factor for each participant. For analysis of ordinal data descriptive statistics were conducted.

Chapter 5: Results

Visitors' PAKS

Participant responses on the PAKS Part 1 show consistently positive environmental views (Table 5). For example, the majority of visitors (82%) disagree with turning unused land into agriculture or commercial development. Eighty four point two percent of visitors believe wildlife and nature should only be conserved for hunting and fishing purposes with 80.5% of visitors believed that nature exists primarily for human use. Similarly, 84% of visitors try to find ways to conserve resources (e.g. shorter showers, turning off lights) in their life and 80.2% of visitors consider the environmental impact when making lifestyle choices. Although, 90% of responses indicated that participants are worried about environmental issues, fewer agreed (77.4%) that conservation is important even if it lowers people's standard of living. Almost all participants (98.9%) value living in a community with nature attractions and enjoy spending time nature.

When considering the relationship between participants views related to conservation and the state park in which this data was collected, almost all participants agreed (96.9%) that prairie ecosystem should be preserved. However, when asked about how viewing a flagship species, such as bison, impacts their decision to visit the state park less than two-thirds agreed that it does. When considering the relationship between participant views related to conservation and views of state parks, only half of non-

visitors are likely to visit state parks that are in a prairie ecosystem and this agreement

only increases by 9.4% when considering the ability to view bison.

Table 5: Minneopa State Park Visitors Responses on PAKS (% of people who responded).

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Turning unused land into agriculture or commercial development should be supported even if it means losing natural resources	0	5%	12%	38%	44%
In my life I try to find ways to conserve resources (e.g. shorter showers, turning off lights)	41.2%	50.3%	4.04%	4.04%	0
Prairies function in water filtration	48.5%	35.6%	15%	0%	0%
I value living in a community with nature attractions	83.8%	15.4%	1.01%	0%	0%
I enjoy spending time in nature	82%	16.1%	1.01%	0%	0%
Conservation is important even if it lowers people's standard of living	33.3%	44.1%	21.4%	1.01%	0%
Prairies provide vital habitat for animals	83.6%	12.1%	1.01%	1.01%	0%
Wildlife and nature should only be conserved for hunting and fishing purposes	41.2%	43.1%	8.06%	5%	2.02%
Prairies help maintain soil quality	61.2%	30%	8.8%	0%	0%
I am worried about environmental issues	57.3%	33.3%	6.25%	2.88%	0%
When I make lifestyle choices, I consider the impact it has on the environment	23.2%	57.6%	16.1%	3.03%	0%
Prairies support diverse animal wildlife	68.7%	27.2%	4.04%	0%	0%
Prairie ecosystems should be conserved	73.7%	23.2%	2.02%	0%	1.01%
Nature exists primarily for human use	42.2%	38.3%	13.1%	5.04%	1.01%
I am more likely to visit state parks that are not in prairie ecosystems	2.02%	8.08%	44.2%	36.2%	9.09%
The ability to view wildlife (e.g. bison) impacts my decision to visit a state park	23.3%	38.4%	29.2%	9.02%	0%

A significant relationship exists between participant knowledge and their personal conservation (factor 1) ($F_{1,98} = 26.345$, p <=0.001). Intent for nature (factor 2) ($F_{1,98}$= 12.360, p < 0.001), value of Nature (factor 3) ($F_{1,98} = 16.717$, p = 0.001) and land use value (factor 4) score was significant ($F_{1,98} = 34.420$, p < 0.001). For personal conservation, value of nature and land use value the data indicates an increase in participants value or attitude towards each of these factors increases with their knowledge however the opposite was observed for intent for nature.
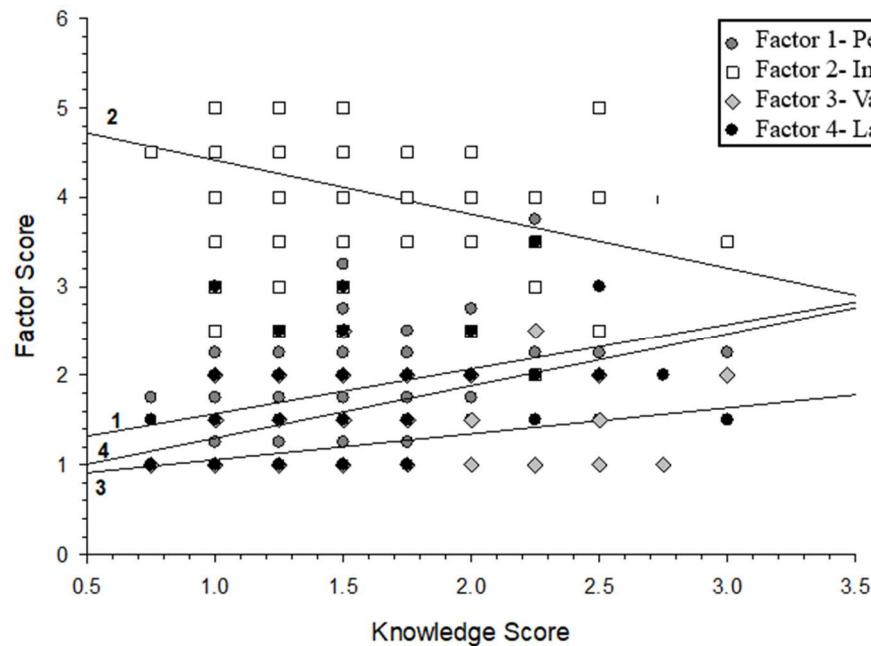
Figure 6. Multiple Scatter Plot Regression representing the 4 factors; 1) Personal Conservation 2) Intent of Nature 3) Value of nature 4) Land Use Value over participants knowledge score.

The intent of nature (factor 2) differed from all other significant relationships between factors from the PAKS in that it consistently exhibited inverse relationships with personal conservation ($F_{1,97}$ = 20.0168, p(0.0001, R^2=0.1711) value of nature ($F_{1,97}$ = 5.2882, p=0.0236, R^2=0.0517) land use value ($F_{1,97}$ = 15.4100, p=0.0002, R_2 = 0.1371) and knowledge ($F_{1,97}$ = 13.3604, p <0.0001, R^2 =0.1518) In each case, overall, participants who were more often agreeing with statements within the intent of nature construct were less likely to agree with the statements in the other constructs.

Visitor views of visiting a state park and engaging in conservation

The results described below include the most pertinent to the aim and scope of this study. The focus of the results in on participants views of state parks and prairie ecosystems. All results from the PAKS are found in Appendix B.
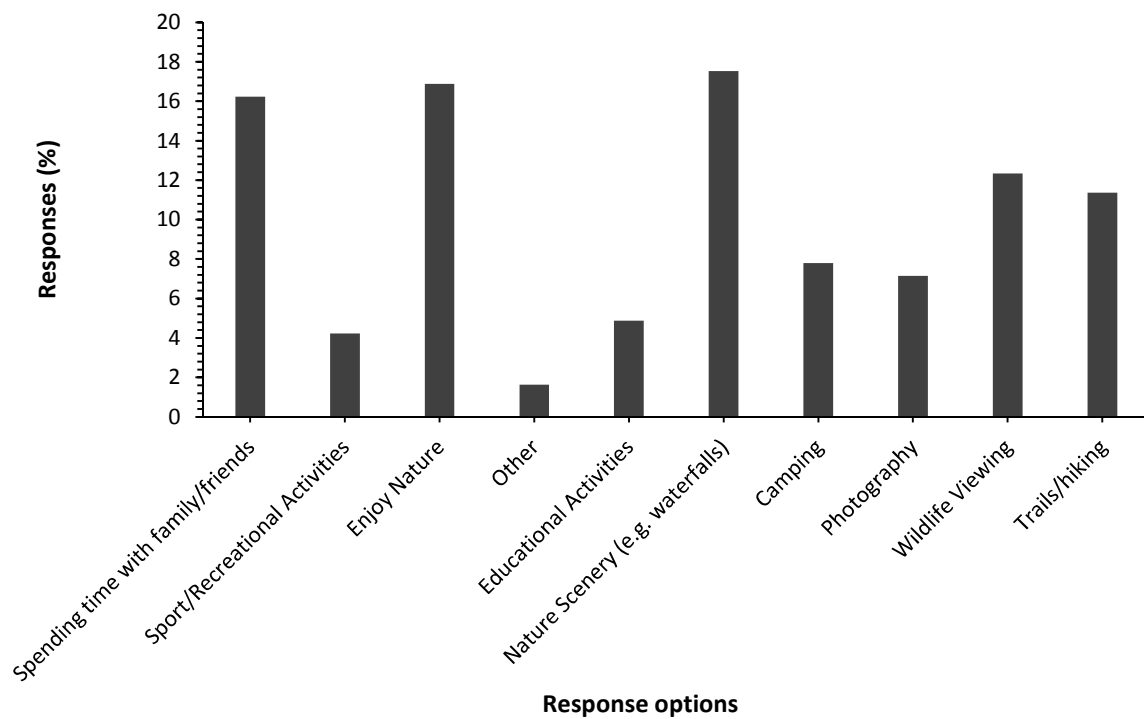
Figure 7: Responses from question 2 part 2: What encourages you to visit a state park located in a prairie ecosystem?
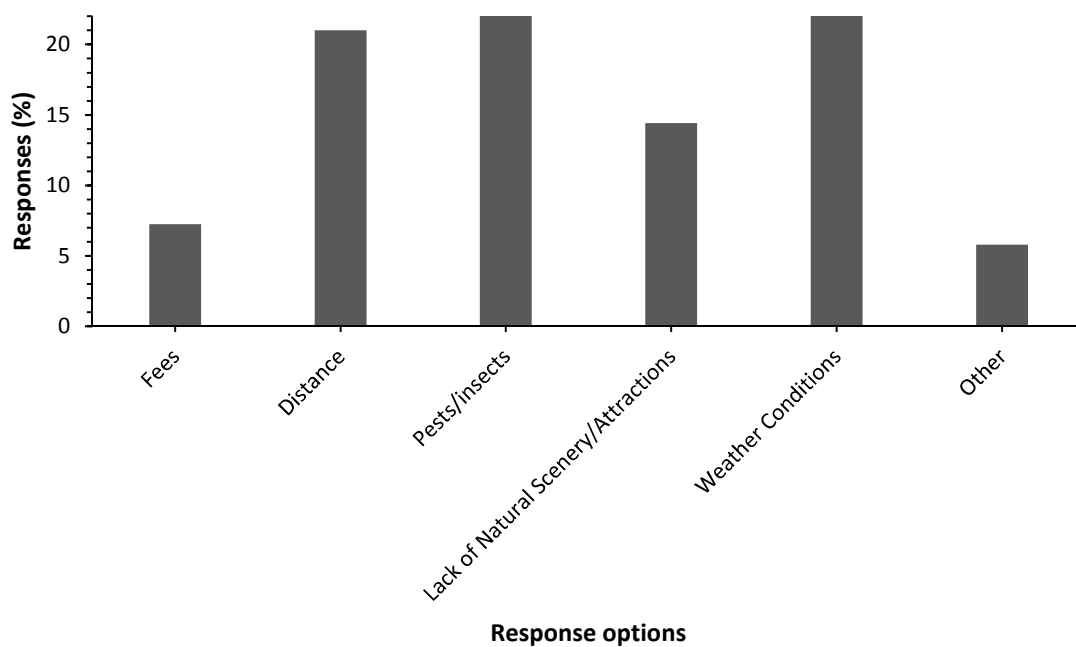
Figure 8: Responses from question 3 part 2: What discourages you from visiting a state park located in a prairie ecosystem?

Figure 9: Responses from question 4 part 2: What would encourage you to be more likely to visit a state park located in a prairie?
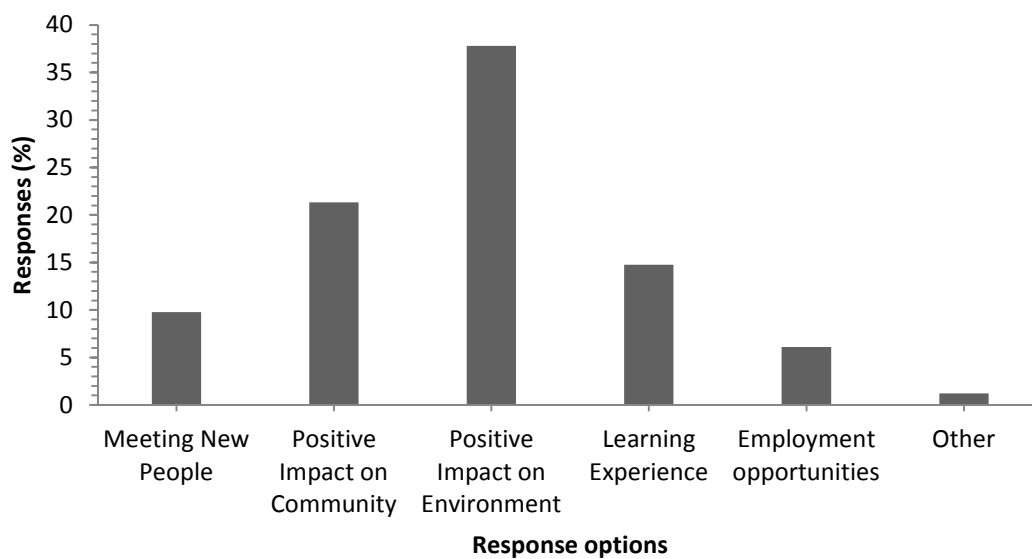
Figure 10: Responses from question 5 part 2: What would encourage you to participate in prairie conservation/ restoration?
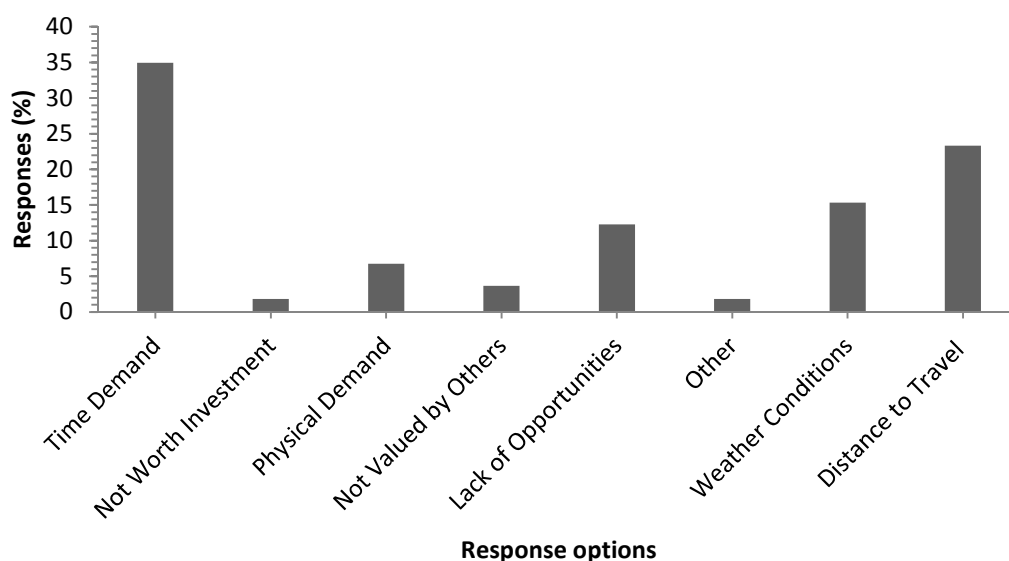
Figure 11: Responses from question 6 part 2: What would discourage you to participate in prairie conservation/restoration?

The factors with the highest responses that participants found encouraging when considering visiting a state park located in a prairie ecosystem were spending time with family/friends (17%), nature scenery (e.g. waterfalls) (18%), wildlife viewing (12%) and trails/hiking (11%) (Figure 7). Conversely, visitors responded that the distance (19%), pests (20%), and weather conditions (22%) were the main factors that contributed to not visiting a state park in a prairie ecosystem (Figure 8). In addition, to these factors participants often indicated lack of natural areas (11%) and fees (7%) are as discouraging.

The majority of visitors responded experience (e.g. learning experience) (57%) would encourage them to be more likely to visit a state park located in a prairie. Knowing the importance (27%) would also contribute to visiting a state park located in a prairie

(Figure 9). Visitors responded that a positive impact on environmental (39%) and positive impact on community (22%) would encourage them to participate in prairie conservation/restoration. While meeting new people was only 10% response as a factor (figure 10). Factors that discourage visitors to participate in prairie conservation/restoration were time demand (35%), distance to travel (26%) and weather conditions (17%). While not worth investment got a response of less than 5%. Some visitors (14%) responded with lack of opportunities (Figure 11).

Demographics and visitors' PAKS

There is a significant relationship between age and personal conservation ($F_{3,93}$ = 3.705, p = 0.015). Tukey HSD post hoc test indicated that 20-30 years old were significantly different from age 31-45 years old (p = 0.023) with 20-30 years-olds holding more mutualistic views. Similarly, a significant relationship was found between age and the land use factor, ($F_{3,93}$ = 4.511, p = 0.005) with results from the Tukey HSD post hoc test indicating that 20-30 years old were significantly different from 31-45 years old (p = 0.026) from 46-64 years old and from the 65+ age group (p = 0.044). However, age was not related to the intent for nature or the value or nature factors.

Ethnicity was significantly related to intent for nature ($F_{4,89}$ = 3.532, p = 0.010) and value of nature ($F_{4,89}$) = 3.063, p = 0.021). For the value of nature factor, participants who identified as Asian/Pacific Islander agreed with statements that aligned with place a higher value on nature than the other groups for the state park visitor group. Within this study the majority of (>75%) participants identified as white/Caucasian which limits the

degree in which extrapolations related to ethnicity can be made. However, more research is needed to understand the relationship between ethnicity and individuals views of nature. However, there was not a significant relationship between ethnicity and personal conservation or land use value.

Value of nature was the only factor that showed a significant relationship with distance participants traveled in order to visit the state park ($F_{6,94} = 2.666$, $p = 0.020$) with participants who valued nature higher on the PAKS being more likely to travel larger distances of either 61-75 miles ($p = 0.001$) and 100+ miles ($p = 0.001$).

The number of times people visited the park after the bison re-introduction was also not significantly related to any of the factors measured as part of the PAKS. There was no significant relationship on the total number of times people visited the park and any of the factors measured as part of the PAKS instrument. In addition, there was not a significant relationship with any of the factors related to sex.

Visitor and non-visitor PAKS comparison

The responses for the non-visitors on PAKS Part 1 show more diversity than the visitor participants (Table 6). For four statements, (i.e. I'm worried about environmental issues', 'I value living in a community with nature attractions', 'I enjoy sending time in nature', 'Prairie ecosystems should be conserved') there was unanimous agreement. In comparison, fewer participants (83.3%) agreed that they find ways to conserve resources in their life and consider environmental impacts when making lifestyle choices. Although the majority (83.3%) of non-visitors disagree that nature exists primarily for human use

only slightly more than half (58.3%) agreed that conservation is important even if it lowers people's standard of living. Lastly, only a fourth of participants agreed that unused land should be turned into agriculture or commercial development even if it means losing natural resources and that wildlife and nature should only be conserved for hunting and fishing purposes.

Table 6: Non-visitors of Minneopa State Park Responses on PAKS (% of people who responded).

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Turning unused land into agriculture or commercial development should be supported even if it means losing natural resources	0%	0%	25%	41.7%	33.3%
In my life I try to find ways to conserve resources (e.g. shorter showers, turning off lights)	50%	33.3%	16.7%	0%	0%
Prairies function in water filtration	66.6%	33.3%	0%	0%	0%
I value living in a community with nature attractions	83.3%	16.7%	0%	0%	0%
I enjoy spending time in nature	91.6%	8.3%	0%	0%	0%
Conservation is important even if it lowers people's standard of living	33.3%	25%	33.3%	8.3%	0%
Prairies provide vital habitat for animals	91.6%	8.3%	0%	0%	0%
Wildlife and nature should only be conserved for hunting and fishing purposes	16.7%	0%	8.3%	41.7%	33.3%
Prairies help maintain soil quality	58.3%	41.7%	0%	0%	0%
I am worried about environmental issues	33.3%	66.6%	0%	0%	0%
When I make lifestyle choices, I consider the impact it has on the environment	33.3%	50%	16.6%	0%	0%
Prairies support diverse animal wildlife	75%	25%	0%	0%	0%
Prairie ecosystems should be conserved	66.7%	33.3%	0%	0%	0%
Nature exists primarily for human use	0%	8.3%	33.3%	25%	33.3%
I am more likely to visit state parks that are not in prairie ecosystems	0%	25%	25%	50%	0%
The ability to view wildlife (e.g. bison) impacts my decision to visit a state park	16.7%	41.7%	25%	8.3%	8.3%
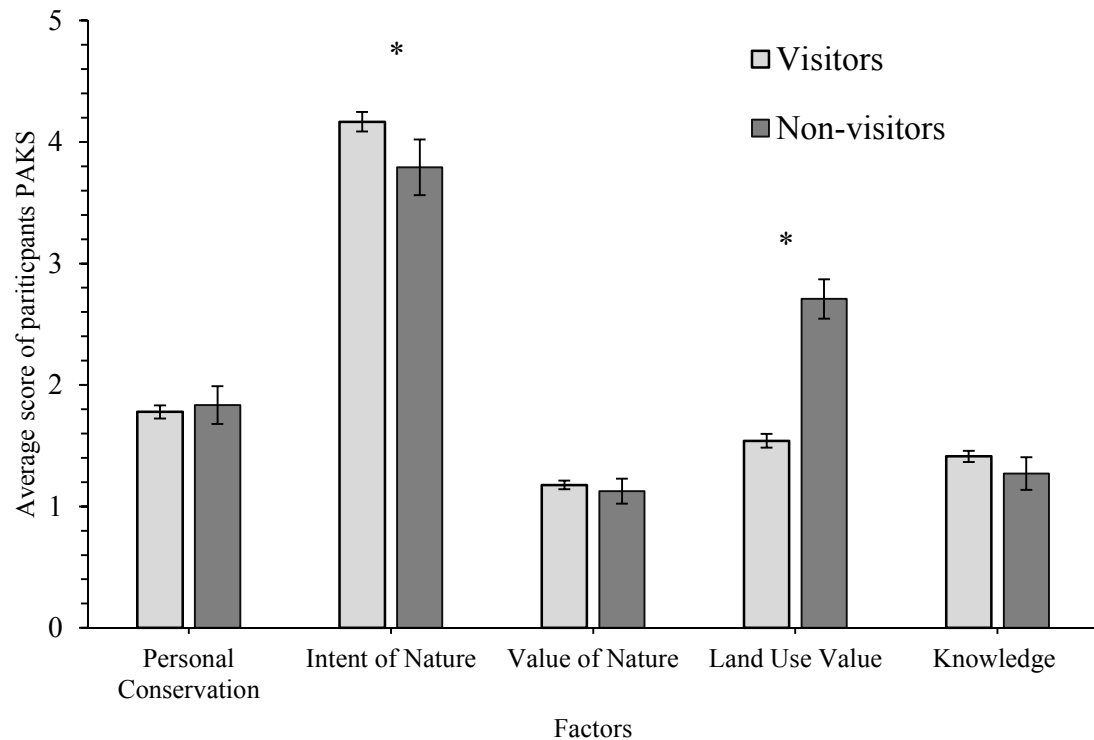
Figure 12. Comparison of mean response scores between the different factors measured by PAKS for Minneopa State Park Visitors and Non-Visitors. Error bars ± SE

There are also significant differences between visitors and non-visitors based on factors the PAKS examined (Figure 12). Non-visitors had a significantly higher score than visitors with the land use value ($F_{1,109}$) = 2.70833, p = 0.1626) while visitors were significantly higher on the intent of nature($F_{1,109}$) = 2.386, p = 0.021). For knowledge, personal conservation and value of nature however, there were no significant difference between visitors and non-visitors of Minneopa State Park.

Chapter 6: Discussion

Visitor's PAKS

Although, it was originally hypothesized that two factors related to conservation (Table 2) would emerge, the data from the PAKS Part 1 showed four factors: Personal Conservation, Intent for Nature, Value of Nature and Land Use Value that were pertinent in understanding the public's view of nature. This may suggest that views of conservation are more unique and distinctive than previously hypothesized. Another study by Sotomayor (2011), identified 15 motivational items when analyzing viewing of state/national parks compared to farms or private lands. The Sotomayor (2011) study was larger and covered the entire state of Missouri and its scope was broader as it focused not only on state/national parks but also farms and private lands. These differences could explain why Sotomayor (2011) had more diversity in the motivational factors compared to this study.

Individuals views or values related to nature and conservation can be characterized on a value orientation dichotomy system. Vaske et al. (2011), explains two main views including the domination value orientation where individuals believe wildlife should be managed for human benefit and prioritize human well-being over wildlife in their attitudes and behaviors while a mutualism wildlife value orientation reflects an egalitarian ideology that fostered social inclusion and equality which extends to human-animal relationships. Individuals with a mutualism orientation view wildlife as part of an extended family, deserving of rights and care. The PAKS instrument includes statements

that align with features of these orientations. Based on the data collected in this study, responses seem to align with mostly a mutualism-based ideology for the visitor group.

Based on the data collected in this study, not all participants fall into one the two value orientation categories. Instead of value orientation related to nature and/or conservation existing as a dichotomy it could exist as a spectrum. Some research has suggested that value orientation toward wildlife and the environment are changing (Vaske et al., 2011) which confirms that more research needs to be done to better measure and identify nature values of the public.

Knowledge

Overall, participants in this study answered the knowledge questions correctly. Although, these results are encouraging it should be noted that just because participants could identify specific facts, such as that prairie ecosystems provide water filtration, this does not necessarily mean that participants understand the specific function of the process or why the process is important in a prairie ecosystem. In a study by Lamb & Cline (2003) that focused on knowledge and perceptions of prairie dogs found that people may have general knowledge related to ecology of the prairie dogs, but when it comes to specifics about prairie dogs their knowledge cannot be characterized as extensive. In another study by Adelman et al., (2000) conducted at the National Aquarium in Baltimore examined visitors conservation attitudes, behavior an knowledge and found that visitors were more knowledgeable than the public about conservation related issues, but visitors only had a marginal understanding of environmental issues related to the

local ecosystem. The results from the study by Lamb & Cline (2003) and Adelman et al. (2000) are consistent with the results found when examining the PAKS.

Based on previous research, the knowledge results of this study are not surprising since the study's questions were designed to measure participant's general-ecology knowledge. It would be expected that if the PAKS included detailed specific or more advanced knowledge questions, participants would not perform as well. However, the goal of this study was to measure the public's general understanding of the prairies so asking more specific questions would have not been appropriate. Knowledge is of particular importance because as identified by Lamb & Cline (2003), knowledge has implications for public involvement in decisions concerning management. The ability of the public to be involved in policy discussions depends on their relative level of their knowledge compared to other policymakers and experts.

Having a clearer understanding about the public's views and values regarding wildlife may be useful when adjudicating wildlife-related conflicts or preventing them from occurring in the first place (Gamborg & Jenson, 2016). It is not clear to what level of knowledge is necessary for citizens to feel compliant to engage in positive environmental behaviors. Although, further research should be conducted examine the relationship between the level of knowledge held by the public and their views and/or behaviors related to conservation is these citizens that can have a positive impact on conservation issues.

The results from this study show a significant relationship between knowledge and all factors measured by the PAKS. For all relationships, visitors who tended to be

more environmentally focused also tended to be more knowledgeable about prairies. These results also support my hypothesis about the relationship between knowledge and value of nature related to prairie ecosystems and highlight the connections with knowledge and conservation as well as environmental issues.

Encouraging and discouraging factors of visitors

The data suggested that the main factors that encourage someone to visit a state park located in a prairie ecosystem was spending time with family and friends, enjoying nature, wildlife viewing. These results are supported by previous studies. Hvenegard (2017) found that the most common motivation to visit a provincial park in Canada was related to time with family and friends, recreation, escape, scenery and time in nature. Similar results were also found for visitors to Great Smoky Mountains National Park, who rated scenery, time with friends and family, escape and immersion in nature as the most common motivations (Hvenegaard, 2017). Similarly, Sotomayor (2011) study found overall the three most important motivations for visiting a natural setting (farm, state/national park, private forest) are, doing something with their family, viewing the scenic beauty, and enjoying the smells and sounds of nature.

It is important to understand what may encourage and discourage visitors from participating in conservation or visiting natural areas such as state parks because engagement has become almost the lifeblood of the environmental movement and has the potential to preserve, build, and restore significant environmental and civic capacity of local community (Bramston et al., 2011). Engagement in volunteering or visiting state

parks also can indicate a behavioral change as well as the potential for a value orientation shift.

Research suggests that nature-based tourism or leisure travel to natural areas has had large amount of growth over the last two decades (Ardoin et al., 2015). Natural areas such as state parks provide a connection between nature-based tourism and conservation/restoration efforts. Although, concern of the environment was almost universal in this study for both visitors and non-visitors and is consistent with results from Bramston et al., (2011) which found that the concern about the environment was considerable in an Australian population, which is consistent with the results presented in this study as almost all participants (visitors and non-visitors) indicated their concern with environmental issues. However, the concern over the environment does not translate into actionable behavior (e.g. invest of time or effort) to address these issues. Based on the results from this study, having a positive impact on community and engagement in learning experiences were top encouraging factors for participating in conservation/restoration efforts. Increasing opportunities or visibly of these experiences could translate into increased environmentally positive behavior. There may also be a trade-off that exists as well, in that although participate value nature and environmental issues, this needs to be balanced with other factors. For example, a participant may value visiting the state park and the importance of nature but also not value pests or specific weather conditions which would impact their behavior. Or a participant may value conservation efforts but not behave in their day to day life in a way that aligns with the conservation value.

This study did not investigate the specific issues that people were or were not concerned about. It is possible that views, attitudes and/or behavior related to nature and conservation are context dependent. It could be that participants are concerned about environmental issues however the specific issues were not addressed as part of the PAKS instrument. Further research could characterize whether views and attitudes are context-dependent on what influences these views as well as how they develop or how they could be change.

Relationship of visitor's demographics and views of prairies and conservation

Responses for Intent for nature (factor 2) and Land Use Value (factor 4) differed significantly based on ethnicity. What this suggest is that cultural background is significant in the creation of a pro-environmental view. Studies conducted in the national parks from 2009 to 2011 found than only 22% of visitors were people of color, despite the fact that minorities account for 37% of the country's entire population (Weber & Sultana, 2012) Similarly, studies based on the Forest Service's National Visitor Use Monitoring (2016) data show a wide disparity in racial and ethnic use of national forests with Black or African Americans only accounting for about 1% of national forest visits in 2010 and Hispanics or Latinos accounting for less than 7%. Although little information exists about it is clear to see that part of the problem in attracting diverse populations to parks. Contributing factors to the lack of visitorship diversity may include cost, familiarity, ease of access, distance and cultural values (NPS, 2009) as well as lack of diversity within parks. For example, less than a quarter of the National Parks and

Monuments recognize diverse people and culture (Blaszark, 2006) with over 80% of the workforce being white (NPS, 2011)

The Vinning & Merrick (2008) study highlights that proximity variables (location to public lands) may not be as significant as previously thought. The PAKS instrument created measures the visitors distance traveled to a state park that had a prairie ecosystem in it and the results showed that there was a relationship with distance and visiting a state park. This suggest that even if far away, visitors will travel to prairie ecosystem in a state park. They value the ecosystem to visit even of upwards of 100+ miles. But this does not mean they will travel for volunteer work.

Education level is not related to knowledge score which suggest that being knowledgeable about prairies and prairie conservation is not the result of formal education. Although, it was not the goal of this study to determine where knowledge was developing from it is possible then that this knowledge develops from other sources. Conservation knowledge can develop through a combination of long-term ecological understanding and learning from crises and mistakes (Berkes & Turner, 2006).

Park visitors and non-park visitors

Even though the non-park visitors are not a true comparison group, reviewing the data may at least provide a trend. Keep in mind the sample size differences between the populations. The responses for the non-visitors on PAKS show more diversity than the visitor groups. Non-visitor responses indicate a more dominating view towards land use compared to those who visited the park. In addition, non-visitors held more dominating

views in regard to their intent of nature compared to visitors. Although sample size was too low to analyze based on demographics other studies have found significant relationships between sociodemographic variables of age, level of education, employment status and life stage and level of national park visitation (Griffin & Archer, 2006). Other research has shown that non-visitors have negative perceptions of national parks as being a dangerous and expensive place to visit (Griffin, Wearing & Archer, 2004). A general lack of knowledge and awareness of national parks and their key attractive factors also showed significant in the decision to visit a national park (Griffin, Wearing & Archer, 2004). The observed difference between visitors and non-visitors could be due that people who tend to visit forest, state parks or other protected areas have experienced documented changes including to their values, attitudes and behaviors (Brooks et al., 2004). The non-visitors still valued prairie ecosystems even though their previous experience in nature and more specifically a prairie was different for each individual. This might relate to many Minnesotans that might have not visited a prairie in a state park before but they still value these landscapes in our state as well as understand their importance for continued conservation. This reiterates the importance of increasing visitation and engagement with parks.

Implications

Even though, visitors to Minneopa State Park have increased since the introduction of bison, it was surprising that only 61.4% of visitors responded that the ability to view wildlife (e.g. bison) positively impacted their decision to visit the state

park. This response rate could be because when you visit a state park or other natural attractions, visitors are never be guaranteed to see wildlife unlike if they visited a zoo. Therefore, it could presume that the main reason for visiting the state park is for the natural attractions and then seeing wildlife is an added benefit instead of a direct draw. This also could explain some of the discouraging responses as visitors may invest (e.g. time and money) visiting the park with the goal in viewing bison but not get that pay off. In some cases, visitors may have to visit Minneopa State Park numerous times before being able to view the bison and not all visitors would be this committed or motivated to continually return. The bison may be a flagship species to prairies but for Minneopa State Park it does not seem to be the only focus for visitors and an approach to encourage visitors may best be served with a multifaceted approach. Based on the results from this study, the other main draws hat encouraged people to visit included the park's natural attractions (e.g. waterfalls) and spending time with friends and family which the park also has accommodations for (e.g. picnic grounds, pavilions, bathrooms and potable water). Scott Kudelka, Minneopa Naturalist, explained a lot of time visitors come to Minneopa State Park for the first time to see the bison, but then find other attractions that the park offers and that brings them back again (Kudelka, *personal communication* September 24th, 2017).

The results from this study have a variety of implications for both the understanding of individual's values, attitudes and knowledge related to prairie ecosystems and in regard to Minneopa State Park. Understanding what types of people are coming to the park will allow the staff to accommodate all people to the parks located

in Minnesota. As the Minnesota population changes as new cultures and families immigrate here, our public lands should be welcoming to all people. Based on the data a potential avenue to increase advocacy is to utilize social media platforms to promote others to these events or even sharing information about how to help local prairies.

After identifying the attitudes and values and as well knowledge level of visitors and non-visitors of a state park with a prairie ecosystem in it, the results show that not one single factor leads to proenvironmental behaviors. Instead, numerous factors play a role in in engaging in environmental behaivors (Figure 13). A flagship species can be another factor approach to connect the public to nature which hopeuflly will form an attitude that will relate to a pro-environmental beahvior. Thus, in order forenviornmental education to be successful it needs to target multiple factors. In addition, not all inviduals views or value nature or conservation for the same reasons therefore, diversity in an approach could also be beneficial. Current enviornmental eduators should use concepts like flagship speceis, to help public make that connection to nature. While it might not be the only thing that connects that person to nature, it may form an attitude with them that might contribute still to proenviornmental behaviors.
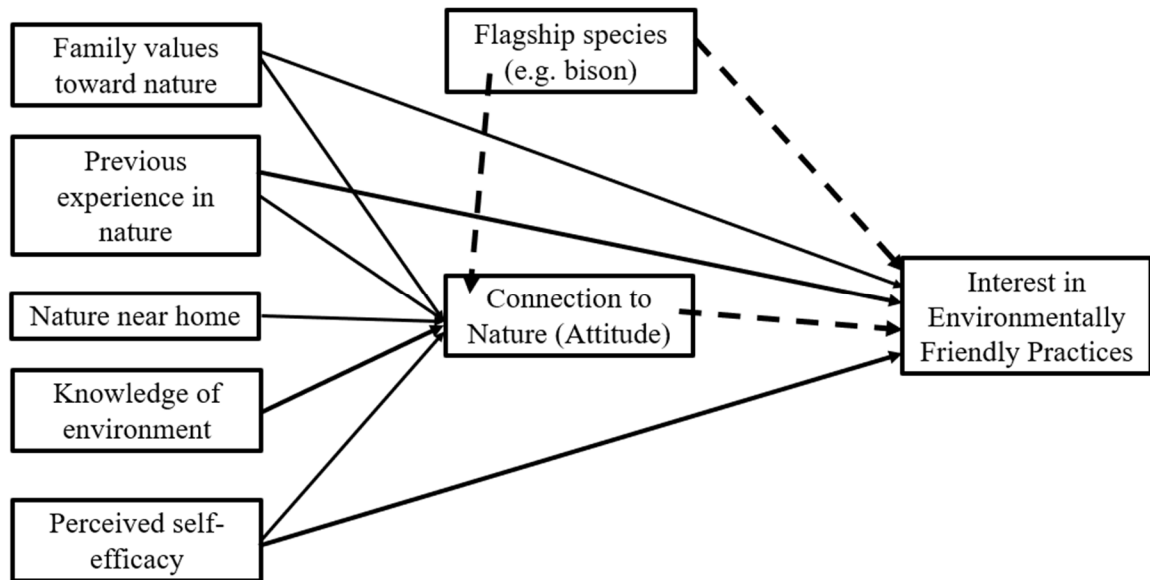
Figure 13. Diagram representing the factors that contribute to the connection to nature and then to contribute to interest in environmentally friendly practices (pro-environmental behavior). The dotted arrow represents a new method of engaging the public to connect in nature.

Limitations

Overall, this research project was limited in a few ways. The first limitation is low sample size specifically for the non-visitor group. This was also exacerbated by some participants turning in the survey without completing the back page. Those data points were not included in the results of the survey. Due to low sample size it was not appropriate to examine relationships based on demographics in this study, this is why similar analysis cannot be done like with the visitor group.

Vaske et al., (2011) found in the Netherlands, older individuals were more likely to hold non pro-environmental views or dominant/utilitarian views. Although, the views of males and females were not investigated as part of this study Vaske et al., (2011) also

found that females were more likely to hold 'pro-environmental' or mutualist oriented views. While visitors from Minneopa were mostly mutualist, there was no significant difference between male versus female. Although, Vaske et al (2011). Based on this result, sex could also be another important demographic characteristic that is related to view of nature that should be investigated in future studies.

An appropriate comparison group was challenging to obtain. Data collection was refused at multiple locations including the River Hills Mall, Southern Minnesota's Children's Museum, Blue Earth County Library and North Mankato Library. This also limited the potential for a larger sample size because it reduced my access to a larger and more diverse population.

The comparison group, or non-visitors of Minneopa State Park were scientifically orientated people. They were either parents or teachers of students participating at the science fair, not random. This sample might not represent the true values or non-visitors of Minneopa State Park. Lastly, anytime one works with self-reported data there can be a concern over whether the individual is provided accurate. There also is a concern over social desirability bias which occurs when individuals give responses they believe are more socially acceptable light instead of their actual views (King & Bruner 2000). Although measures were implemented to help reduce the likelihood of this bias it was also assumed that participants were providing honest and accurate responses based on their views and perceptions of themselves. This study did not examine whether participants actually behaved in ways that would align with these views. Therefore, it is not known whether a participant who said he/she altered their daily activities to promote

conservation did so and to what extent. To help reduce the potential for social desirability bias, the PAKS instrument was designed to include statements that were not within the scope of the study (e.g. responsibility for conversation), statements were randomized, included statements that were construct independent (e.g. item 15 and 16) or not all opinion-based (e.g. knowledge statements), and the survey was completed anonymously. The topic investigated in this study is also not personally or socially sensitives which can also reduce the likelihood of bias to occur (King & Bruner 2000).

Recommendations

This study examined views related to prairie conservation and ecosystems as well as prairie knowledge however, this study did not measure behavior. Future research can examine the relationship between views and whether that is associated with behavior or how to influence behavior. Measuring direct behaviors could give us more insight into what pro-environmental decisions they make. More research on measuring people's environmental attitudes and values has been published since the creation of PAKS, so updating PAKS to measure more directly. More research could be conducted to measure the values and attitudes of visitors of forest dominated state parks versus visitors of prairie dominated state parks to see if there are differences in visitor's. Future research could also examine how programs or interventions impact views. For example, in regard to the scope of this study ideally, a study could examine visitors views and knowledge before and after Minneopa State Park reintroduction of bison. Further data should be collected about the factors that contribute to influence or create pro-environmental behaviors, looking at factors across a wide diversity of a population.

As the use of bison as a flagship species referring to the specific reintroduction of bison to Minneopa State Park was successful. The park goal was not only to reach out to the public and introduction a new and exciting new feature but as well as to teach the public about native mammals. The reach of the information increased as the park had a spike in visitors after the introduction of bison (Figure 5). Now after the initial excitement period, the bison are still serving a purpose as tools for prairie restoration.

In the field of environmental education, more research could be done to establish effective ways of communicating environmental problems. Every person is different, every person learns differently, every person establishes a behavior differently too. So, one strategy will not be able to communicate the message of the importance of environmental advocacy. Future research in environmental education should investigate multiple strategies to reach out to the diverse public.

Conclusions

The goal of this research was to create a survey instrument to measure values, attitudes and knowledge about prairie ecosystems and prairie conservation (PAKS). This survey was then implemented to populations then to collect data about Southern Minnesotan's views of environmental conservation but specifically of prairies. Through measuring a population of the public that has visited a prairie in a state park verses public that has not visited a prairie in a state park, we have collecting introductory information related to this topic. The results show the public has a good understanding of the basic functions of the prairie, as well as have concern about environmental problems. More

investigation is needed to pinpoint exactly which concerns are worrisome to the public. More research focusing on previous experience in nature and the importance it relates to forming an attitude could be conducted focused specifically about prairies. There are no previously conducted studies that have measured the attitudes and knowledge of people about prairie ecosystems and conservation. Even though much effort has been put into this study, it only scratches the surface of information surrounding the topic that has not been studied yet. Hopefully this novel research will serve as a starting point for the continued research of values, attitudes and knowledge about prairie ecosystem to then hopefully continue the conservation and restoration process.

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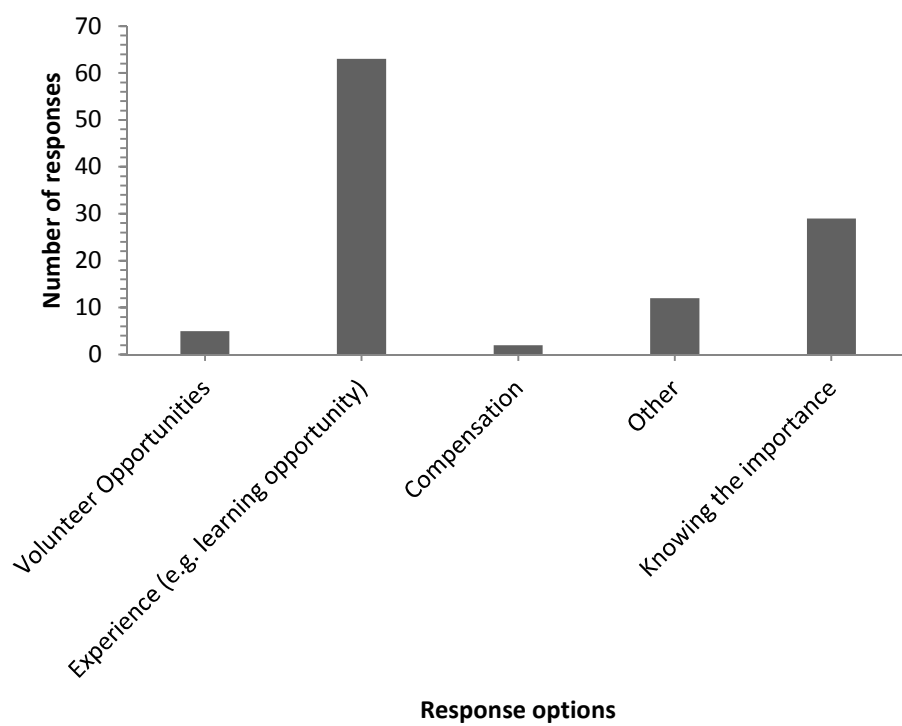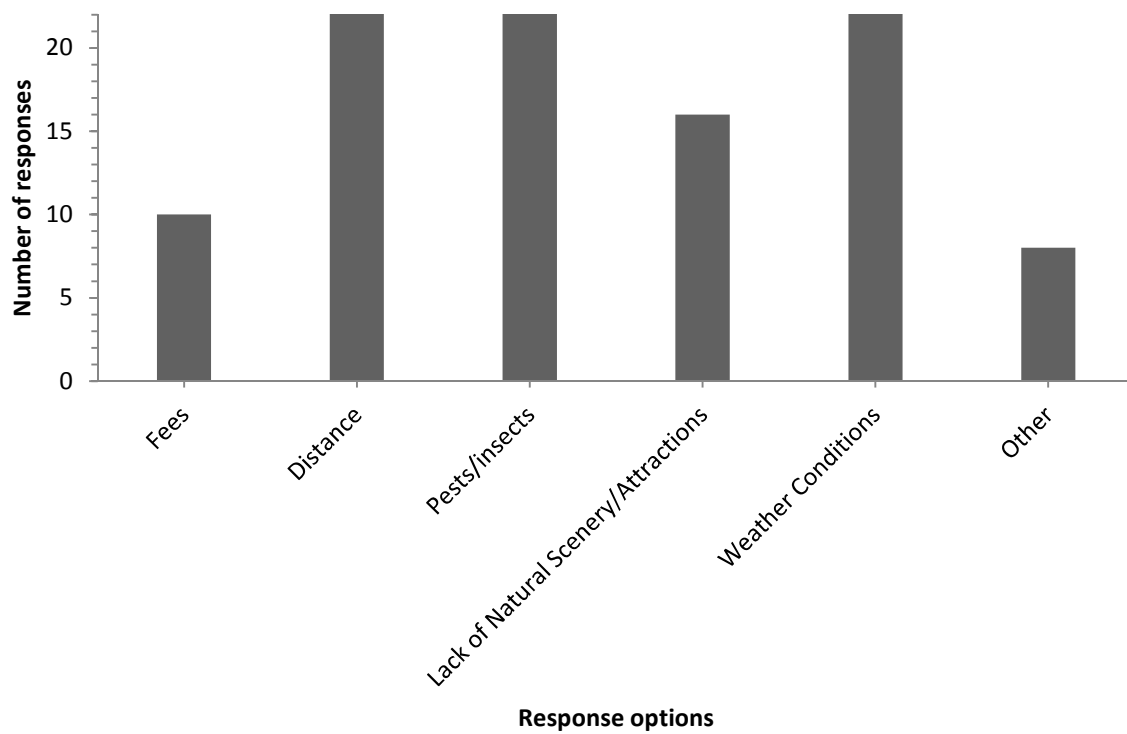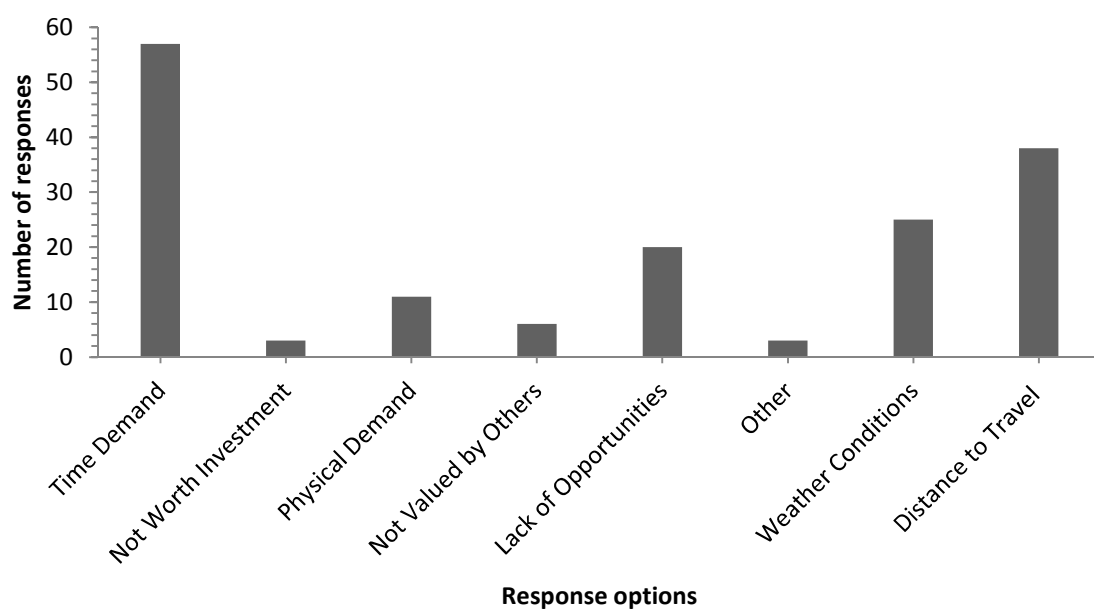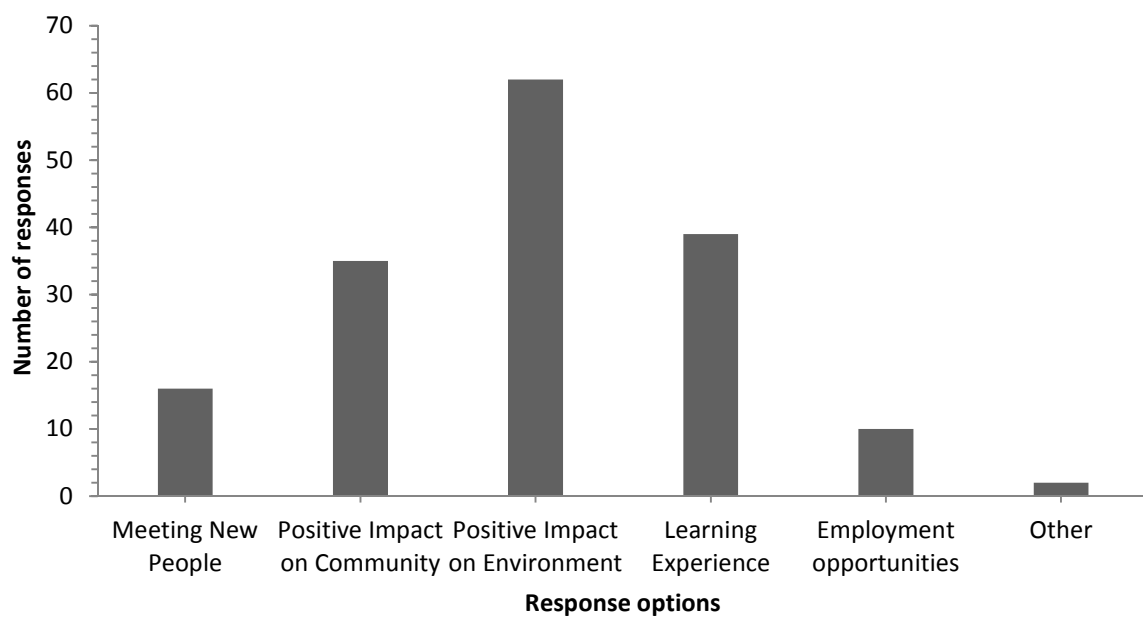
APPENDICES

Appendix A. The loading outputs for the first round of PAF (rotated factor loading)

	Factor 1	Factor 2	Factor 3	Factor 4
Q3	0.7730878083			
Q19	0.7521203387			
Q22	0.727706643			
Q15	0.6416216791			
Q24	0.5709443481	0.3836303512		0.2818447049
Q6	0.5233702342		0.4301943349	0.422866512
Q4			-0.633592018	-0.507840958
Q10		0.8379256802		
Q18		0.7797016249		
Q13		0.7500648128		
Q7			0.8438080881	
Q14			0.7384056963	
Q9		0.4470036179	0.6311809957	
Q20			0.5085006775	
Q17				0.8704363608
Q16				0.8064780862
Q1				0.5668805688

Appendix B. Response results from part 2 of PAKS Statements 2-8.
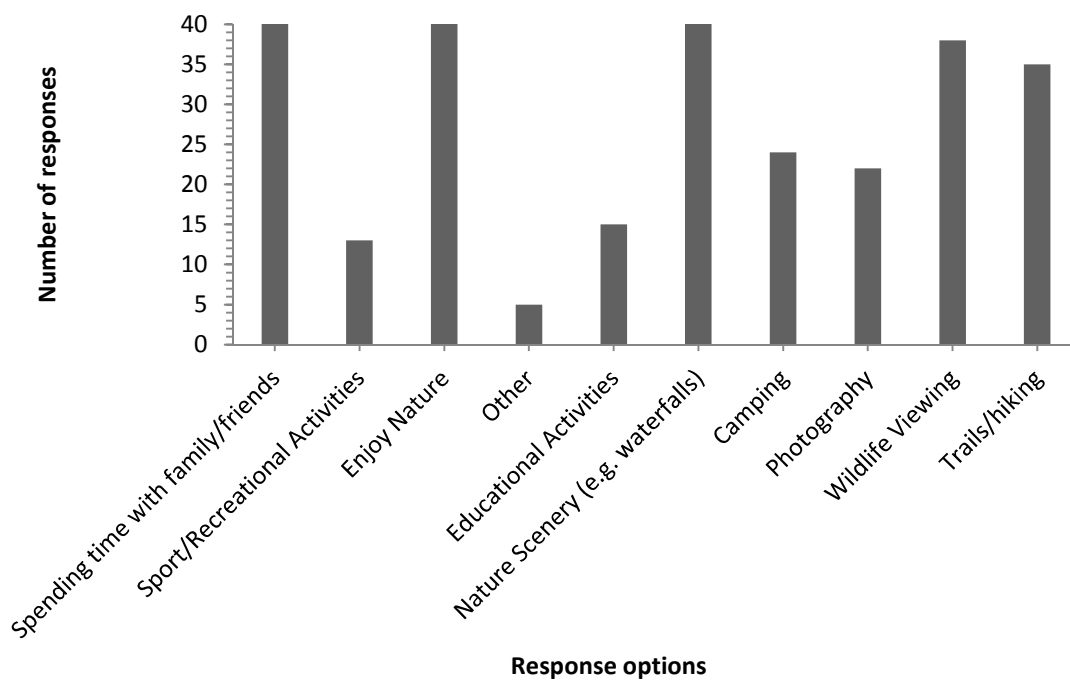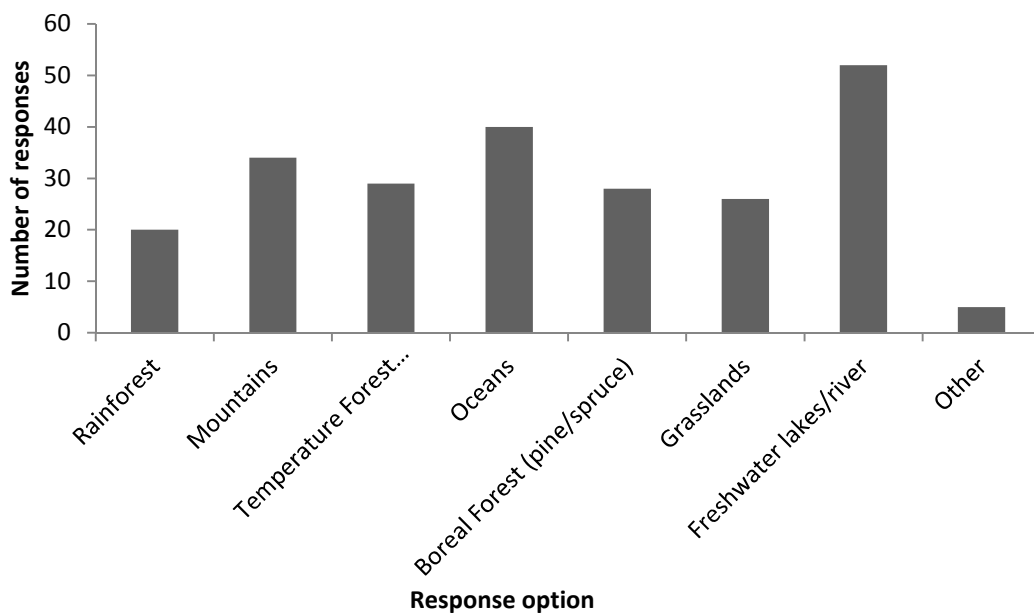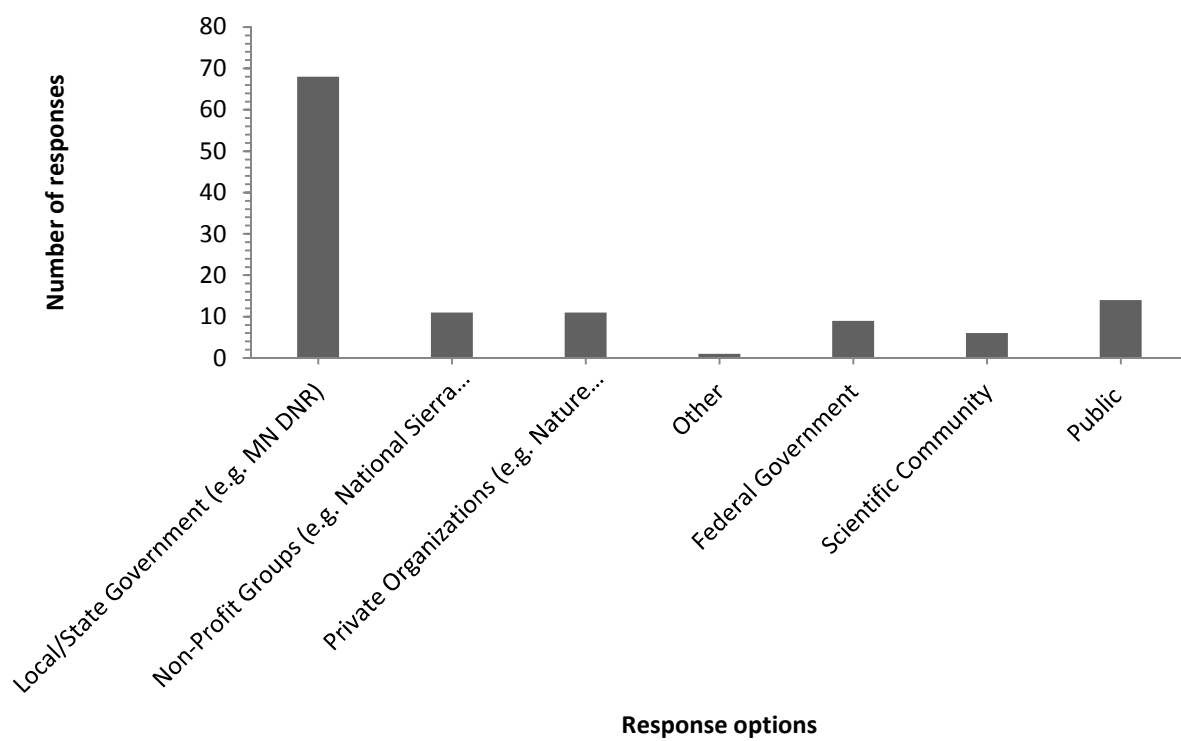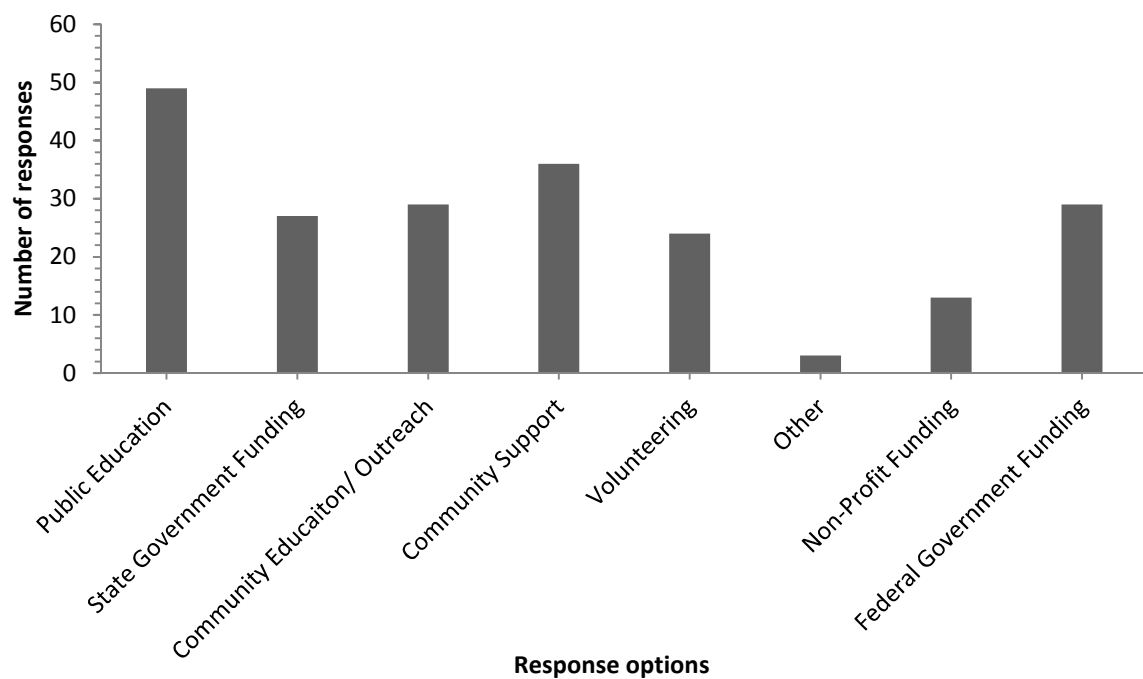
Appendix C

Output of variance explained by each PAKS factor for first round of analysis

Factor	Variance	Percent	Cum Percent
Factor 1	2.9803	17.531	17.531
Factor 2	2.8286	16.639	34.170
Factor 3	2.7218	16.010	50.180
Factor 4	2.6667	15.686	65.867

Appendix D

The loading outputs for the second round of PAF (rotated factor loading)

	Factor 1	Factor 2	Factor 3	Factor 4
Q16	0.8000872768			
Q15	0.7764084235			
Q12	0.6682023632			
Q5	0.6190742801			
Q14		0.8713135313		
Q18		0.8228820167		
Q10			0.888388496	
Q8			0.8441762635	
Q1				0.8555834699
Q17				0.662135841

Appendix E

Variance Explained by each factor, second round.

Factor	Variance	Percent	Cum Percent
Factor 1	2.4605	24.605	24.605
Factor 2	1.8924	18.924	43.529
Factor 3	1.6850	16.850	60.379
Factor 4	1.5548	15.548	75.927

Appendix F

Results of demographic data represented as percentage.

	Visitor (%)	Non-Visitor (%)
Sex	N=94	N=19
Male	47.9	68.4
Female	52.1	31.6
Age	N=94	N=18
19-30 years old	36.2	0
31-45 years old	36.2	44.4
46-64 years old	17	55.5
65+ years old	10.6	0
Education	N=92	N=19
High School/GED	18.5	10.5
Associates	41.1	15.8
Bachelors	39.1	31.6
Master's	20.7	26.3
Doctorate	7.6	15.8
Ethnicity	N=90	N=17
Hispanic	2.2	11.8
Multiracial	1.1	5.9
Native American	3.3	0
Asian	8.8	5.9
White	84.4	76.5
Visited the park before bison	N=94	N=19
0 times	66	52.6
1 to 2 times	16	21.1
3 to 4 times	6.4	5.3
5 to 6 times	5.3	15.8
7+ times	6.4	5.3
Visited the park After bison	N=95	N=19
0 times	24.2	57.9
1 to 2 times	57.9	31.6
3 to 4 times	6.3	10.5
5 to 6 times	7.4	0
7+ times	4.2	0
Distance Traveled	N=95	N=19
5 to 15 miles	23.2	10.5
16 to 30 miles	6.3	5.3
31 to 45 miles	9.4	5.3

46 to 60 miles	7.4	10.5
61 to 75 miles	13.7	42.1
76 to 100 miles	20	21.1
101+ miles	20	5.3