Urban and Rural Acceptance of Management of a Newly Established Wood Bison

(*Bison bison athabascae*) Population in Alaska, USA

by

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Abstract

This human dimensions study on wood bison restoration in Alaska aims to understand and analyze public values, attitudes, fear, and support for management in the state. Self-administered questionnaires (n=515) were distributed in urban centers. Interviewer-administered questionnaires (n=31) were applied in rural villages. Findings showed that overall tolerance of wood bison is very high among Alaskans, but that urban and rural residents differ greatly on their preferred management of the animals. Results indicated that stable attitudes have not yet been formed by the urban public, although support for lethal management is very low indicating more positive attitudes toward the species or at least their conservation. Wildlife managers will need to use this information in order to inform future management strategies to minimize any potential social conflicts surrounding the resource.

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I would like to first and foremost express thanks to my supervisor Dr. Alistair Bath. It is inspiring to be mentored by someone that not only believes in you enough to spend time on you, but also a great deal of funding. Throughout this degree Alistair has kept me honest and has always treated me with the utmost respect and dignity.

My gratitude also goes out to my committee members Dr. Jerry Vaske (Colorado State) and Dr. Arn Keeling (Memorial University) for the all the insight and overview throughout this research.

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Overview

This thesis is organized into four chapters. Chapter 1, *Introduction*, presents a brief introduction of the subfield of Human Dimensions of Wildlife, the history of interaction between humans and bison in North America, as well as the story of wood bison restoration in Alaska. This chapter also highlights the research objectives and relevance of this research, the conceptual framework used to frame the study, and study area and methodologies employed. The following two chapters are comprised of scientific papers: Chapter 2, *Predicting Acceptance of Lethal Management of Wood Bison in Alaska, U.S.A.* and Chapter 3, *Understanding Conflict and Consensus Regarding Wood Bison Management in Alaska, U.S.A.* Chapter 2 was submitted to Restoration Ecology, an international journal focused on highlighting social and biological factors concerning ecological and conservation sciences. Chapter 3 was submitted to Wildlife Research, an internationally recognized journal based out of Australia that highlights very interesting, outside-of-the-box research on wildlife management and conservation issues. Chapter 4, Summary, explains the key findings of this research and its contributions to the discipline of human dimensions of wildlife and wood bison restoration and conservation in Alaska. This chapter also provides insight into the knowledge gaps this research has helped fill, but it also identifies what knowledge gaps future research should aim to fill. Lastly, this chapter provides final recommendations for wildlife managers in Alaska to more effectively manage wood bison populations. The research instrument is in the *Appendix*.

Chapter 1: Introduction

Human Dimensions of Wildlife

Geographers have long been interested in exploring human-environment relationships (Pattison, 1964). In fact, resource geographers have focused on understanding environmental perceptions, beliefs, and values, decision making in resource management, land use and development, social-environmental trade-offs, and perceptions of natural hazards and the risk and human resilience associated with them (White, 1945; Krueger, 1978; O'Riordan, 1979; Saarinen et al., 1984; Tuan, 1990). More recently, resource geographers paid attention to the various dimensions of resource management and the socio-political challenges surrounding environmental management (Krueger & Mitchell, 1977; Dearden & Mitchell, 2012; Bennett et al., 2017). The dimensions of resource management encompass Grumbine's (1994) ecosystem management concept that involves integrating the human society into the ecosystem model of ecological integrity.

Building on this, a growing number of academics within geography are exploring how attitudes and values differ over space with regard to natural resource/wildlife management issues (Bath, 1998; Bath et al., 2008; Decker et al., 2010; Jacobs et al. 2014). The field of human dimensions emerged in the 1970s to study the integration of public involvement and social dimensions of wildlife and resource management.

Human Dimensions of Wildlife (HDW) is a subfield of human and resource social science that emerged in order to address the need of public engagement and knowledge within wildlife decision making processes. The term human dimensions was introduced to

the field of wildlife management in 1973 by Hendee and Shoenfeld at a North American Wildlife and Natural Resources Conference as a way to place more emphasis on social concerns in fish and wildlife management (Manfredo et al. 1998; Decker et al. 2001). Decker et al. (2001) define HDW as the study of human values and attitudes toward wildlife management and how people affect, or are affected by wildlife and wildlife management decisions.

Wildlife reintroductions can cause problems for human and biological entities; predominantly in regions where public and wildlife are not familiar with the reintroduced species (Hermann et al., 2014). Reintroductions occur for a wide variety of reasons (i.e. economic, social, ecological, political), however they usually attempt to avoid previous management failure leading to the initial disappearance of the species. Similar to reintroduction of wolves (*Canis lupus*) in Yellowstone or European Bison (*Bison bonasus*) in Germany, the success of wood bison restoration in Alaska strongly depends on public acceptance. A restoration based on potential positive ecological or economic impacts for example, may have negative social impacts that must be understood through social science research.

Effective fish and wildlife management restoration and holistic wildlife decision-making practices has significantly improved because of the establishment of theory in practice developed through HDW research (Decker & Chase, 1997; Decker, Riley, & Siemer, 2012). The broad scope of the subfield of HDW is truly interdisciplinary in nature and draws upon a diversity of fields and practices including: geography, economics, social psychology, public engagement, education, tourism, biology, and many others (Vaske & Donnelly 1999; Vaske et al. 2006; Manfredo et al. 2008; Moscardo

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2008; Tanner 2010; Johansson et al. 2012). This allows the field to be multidimensional in gaining information related to public knowledge, values, norms, attitudes, behavioral intentions, and behaviors surrounding wildlife management and natural resources (Heberlein & Ericsson 2005; Majic & Bath 2010).

HDW is both a theoretical and applied field. Theoretical research in HDW helps decipher the relationships between values, attitudes, and behaviors. This then becomes practical research used to inform wildlife management decisions (Decker et al. 2001). Bath (1998) noted that the public should not dictate wildlife management decisions, nor should they be a "popularity contest"; rather public involvement in wildlife management needs to act as a process that can help managers understand and assess situations using representative input from their constituents (Decker & Chase, 1997).

During the 1970's, HDW research focused primarily on hunting, fishing, recreation, and urban wildlife (Bath, 1998). In the 80's, there was a switch of focus onto economic values associated with wildlife (Bath, 1998). However, the biggest turn in the field came in the late 90's and early 2000's, when HDW research began to make its way into wildlife management decision making, a realm previously dominated by biological and technical oversight (Manfredo et al. 2009). Currently, the field is broad, and covers a diversity of issues that have emerged in the 2000's and 2010's such as illegal trade (Eliason, 2004; Kahler & Gore, 2012; Nijman et al., 2017), indigenous rights (Parlee et al., 2014; Brinkman et al., 2016; Hazzah et al., 2017), governance (Gibson et al., 2000; Jacobson & Decker, 2008), and many others that broaden the scope of HDW even further (Manfredo et al. 2009).

Over the past decade there has been a shift in research focus from large herbivores to large carnivores (Decker et al. 2010). HD research on large herbivore species has not disappeared, it has however been greatly underrepresented in the recent literature when compared to large carnivore species (Gore et al., 2006; Bruskotter et al., 2007; Heberlein & Ericsson, 2008; Agee & Miller, 2009; Treves et al., 2013). Large herbivore research in HDW has and continues to be focused on hunting, disease, or motor-vehicle collisions (Decker & Connelly, 1989; Miller & Graefe 2001; Sullivan & Messmer, 2003; Heberlein, 2004; Dorn & Mertig, 2005; Vaske et al., 2009). Ungulate HD research has often focused on species such as deer, moose and elk in prominent geographic locations, however little research exists on the human dimensions of wood bison in the North and the successful conservation initiatives centered around them.

Background of Wood Bison in North America

Humans and bison have a long history of interaction (Stephenson et al., 2001; Sandlos, 2011; Will, 2015). Historically, bison acted as an important pillar of Indigenous livelihoods in the North American Great Plains for thousands of years (Epp & Dyck, 2002). Bison were depended on as a necessary source of protein, clothing, jewelry, and held cultural and spiritual importance for the Indigenous people of North America (Burton, 2000; Mitchell & Gates, 2002). While many may be familiar with plains bison history, the history of wood bison and their demise may be lesser known. Wood Bison (*Bison bison athabascae*) are a subspecies of Bison that differ from the more widely known plains bison (*Bison bison*). Wood bison are adapted for northern boreal regions with an elevated ability to digest a wide variety of meadow vegetation (Reynolds &

Hawley, 1987). Wood bison differ from plains bison most prominently in that they are roughly 15% larger, darker in color, smaller more pointed, and they have a much taller and squarer hump (Stephenson et al., 2001). In snow covered habitat, bison forage by sweeping snow with their heads to expose vegetation, which ultimately led to a more pronounced hump in the more northern Wood bison subspecies (Guthrie, 2013; Stephenson et al., 2001).

Plains Bison
- Bulls average 730 kg. (Cows, 410 kg.)
- Shorter neck
- More rounded hump
- Smaller and stockier
- Chaps of long hair on forelegs
- Cape is usually lighter in color
- In summer, cape forms distinct boundary with the rest of body
- Frizzy hair on head
- Larger more rounded beard

Wood Bison
- Largest native land mammal in North America
- Bulls average 840 kg – 10 to 15% heavier than plains bison (Cows, 475 kg)
- Taller and squarer hump
- Darker in color
- Generally taller and larger
- Little or no chap hair on forelegs
- Cape usually does not form distinct boundary with rest of body
- Long, straight hair, sloping down on forehead
- Smaller, more pointed beard

Figure 1. Difference between wood bison (B. b. athabascae) and plains bison (B. bison). Courtesy of Alaska Wildlife Conservation Center.

Soper (1941) estimated a total wood bison population of 168,000 in Alaska and northwestern Canada in 1800. However, by the the end of the 19th century, nearly the entire North American population of wood bison had been decimated due to unregulated

hunting with the westward expansion of the fur trade, European settlement, and changing habitat conditions (Homes & Bacon, 1982; West, 1981; Gates et al. 1992). Alaska's wood bison population had been extirpated, while some small herds still survived in Canada (Stephenson et al., 2001). By the 1950's wood bison were thought to be globally extinct. In 1957, however, a small herd of 200 bison were discovered in Alberta (Figure 3). This population provided a chance of restoration and conservation of the species to their native ranges. Populations in Alberta, have since increased in Wood Buffalo National Park and Elk Island National Park to 5000 and 450 animals respectively (Wood Bison Restoration Project, 2009; Will, 2015), and with limited space, opportunities to relocate bison to historic ranges occurred (Wood Bison Restoration Project, 2009).
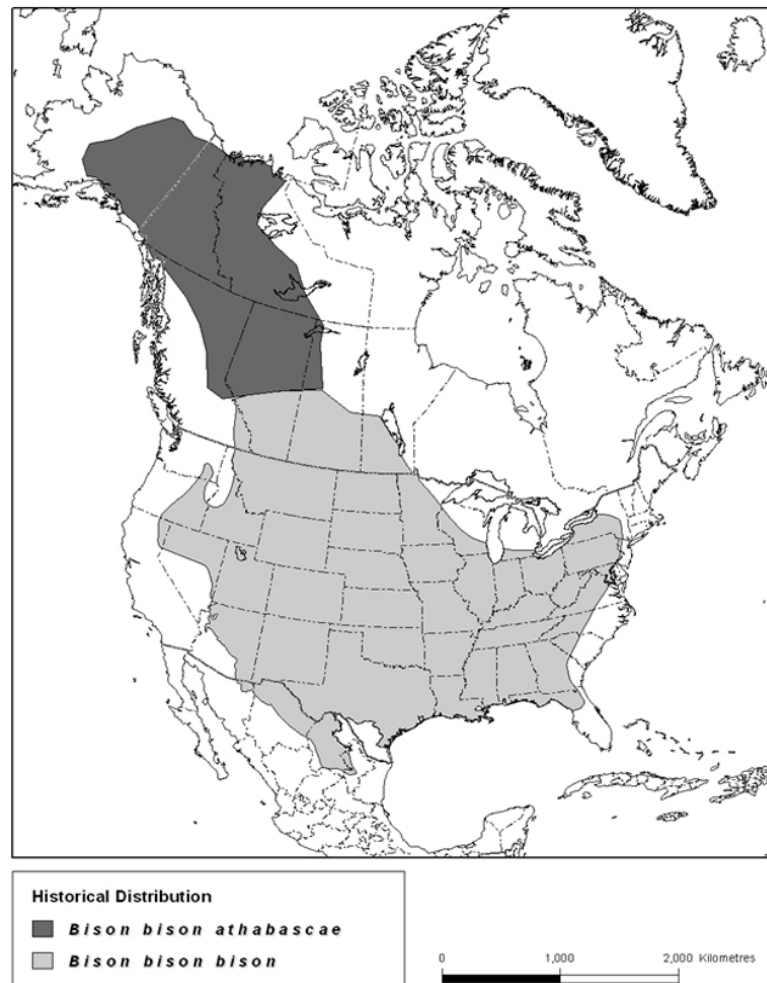
Figure 2. Historic range map of wood bison and plains bison in North America (COSEWIC, 2013).

Due to successful recovery in many parts of Canada, wood bison now roam free in the wild of Alberta, Manitoba, British Columbia, Northwest Territories, and Yukon (see Figure 2). Some herds have grown, even exceeded stable habitat-suitable numbers, such as the Elk Island herd, which provided potential surplus translocation animals to restore wood bison to the last of its native North American Range, Alaska (Wood Bison Restoration Project, 2009).

Alaska Wood Bison Restoration Efforts

In 1991, the Alaska Department of Fish and Game (ADFG) proposed a reintroduction of wood bison to the Yukon Flats region of Alaska's interior. This proposal sparked excitement, however not without generating concern over future land use conflicts. Since 1973, wood bison have been listed as "endangered" under the Endangered Species Act (ESA) until recent re-designation as "threatened" in 2012 (Final EA, 2013). Any species categorized under either "endangered" and "threatened" status would result in any habitat being deemed "critical" and therefore preventing future oil and mineral exploration in any reintroduction areas (Final EA, 2013).

These developing concerns were met with a plan for a stringent public involvement process in addition to a more in depth habitat assessment (Final EA, 2013). Berger et al. (1995) carried out a wood bison habitat inventory in Yukon Flats with two further assessments in Minto Flats and the Innoko/Yukon River regions (Stephenson et al., 2001; Final EA, 2013) (See Figure 3). All three areas assessed for wood bison habitat were suitable to support various wood bison populations sizes (Final EA, 2013). Concerns regarding land use were then managed through the successful proposal by ADFG to designate the reintroduced wood bison as a "nonessential experimental population" (NEP) under section 10(j) of the Endangered Species Act (ESA) granted by the U.S. Fish and Wildlife Service (Final EA, 2013). The geographic boundaries for the NEP designation are shown in Figure 2 and denotes the habitat that the reintroduced wood bison could be killed under potential situations of social conflict (UFWS, 2013). This designation minimized perceived impacts related to industry and exploration restrictions that would

come with placing threatened wildlife on the landscape. This being said, there remained

considerable concern from oil and gas interests for the areas of Yukon Flats and Minto

Flats. Thus, lower Innoko/Yukon River became the most ideal site (Wood Bison News,

2010).
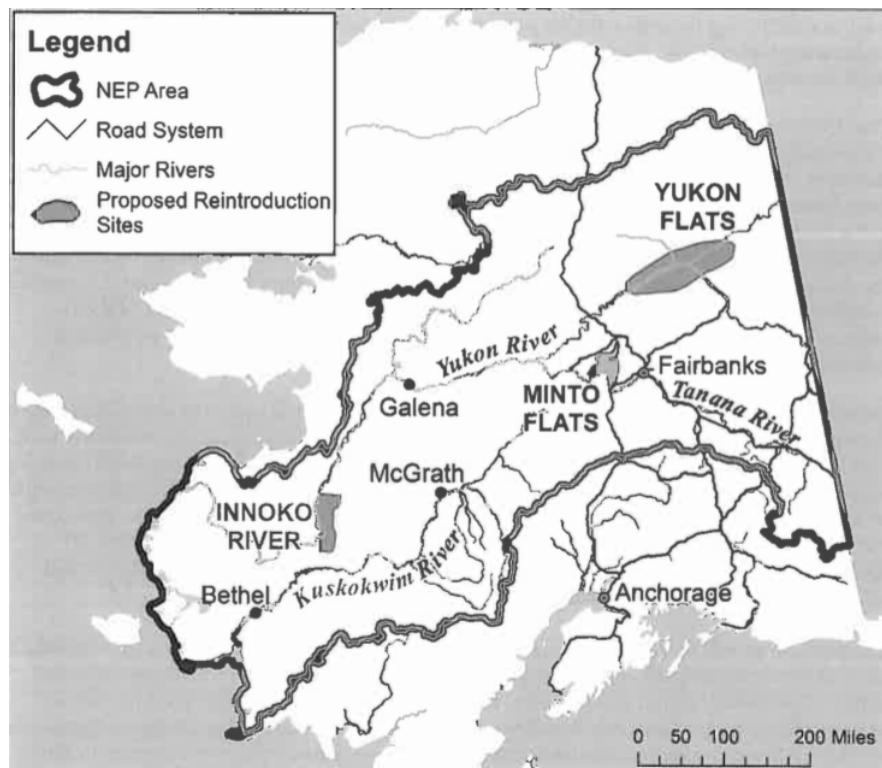
Figure 3. Map illustrating all 3 assessed habitat locales and NEP designated land for

wood bison reintroduction (Department of the Interior, 2014).

This site was chosen based on strong public support from local communities, a lack

of identified industrial economic exploration or development projects, as well as the site

being the furthest away from the closest plains bison herd to avoid hybridization

(Stephenson et al., 2001; Final EA, 2013, ADFG, 2015). Final plans and future

management decisions, needed to begin the restoration processes, were outlined in a

series of workshops with the Alaska Wood Bison Management Planning Team (group of over 30 interest groups). Together, the team reached consensus using an applied human dimensions facilitated workshop approach, on a "*Wood Bison Management Plan for Lower Innoko/Yukon River in Westcentral Alaska, 2015-2020*" (Bath, 2009; ADFG, 2015). This plan states eight goals, corresponding objectives and actions, to guide management decisions from 2015 to 2020, when it will be re-opened for adaptations to any identified issues and concerns. Figure 4 highlights the key events in this wood bison restoration story.
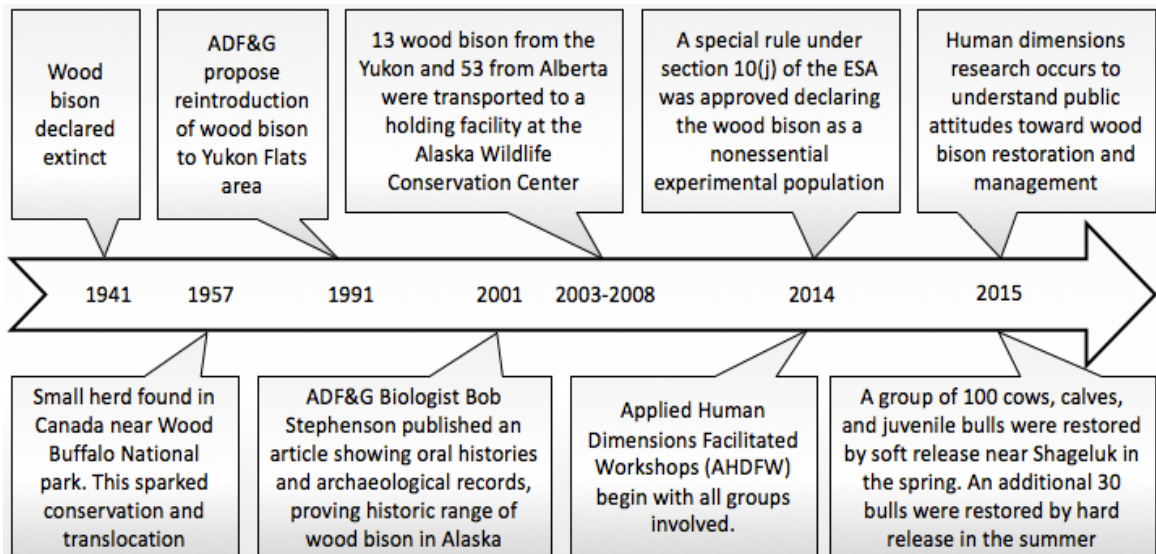
Figure 4. Timeline of key events concerning wood bison restoration in Alaska.

Wood Bison Restoration Context

Between the months of April to June, 2015, 130 wood bison were released to the Alaskan wilderness close to the village of Shageluk on the lower Innoko River (ADFG, 2015). The restoration was achieved by overcoming more than 23 years of legal, social,

and political challenges and through a strong public involvement process. While many hurdles were overcome in order to get these animals on the ground, the future of wood bison in Alaska depends highly on the continued public involvement process to ensure effective conservation of the animals.

The management plan was designed to guide planning of wood bison management for the next 5 years. However, HDW research is needed in order to test the effectiveness of aspects of the management plan to better understand the broader public concern and management preferences. The success of this collaboration between many groups within the state has generated positive outcomes on the managerial side of the project, however the attitudes and support of the public is still widely unknown.
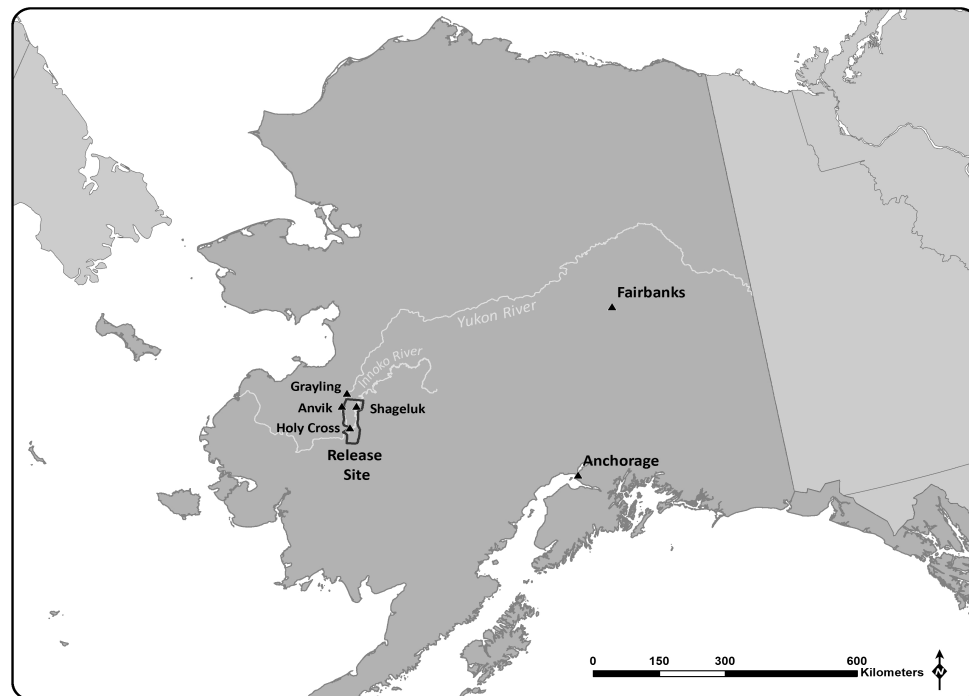
Figure 5. Map identifying all 6 study areas for the research and the release site of the wood bison.

Alaska is both culturally and biologically a diverse place. Attitudes and acceptance for wood bison and wood bison management may also be quite diverse and crucial to understand so wildlife managers can make informed decisions in managing this restoration. Researchers have explored attitudes by segmenting groups by beliefs (Vaske & Needham, 2007; Glikman et al., 2010), interest group (Bath & Buchanan, 1989; Bright et al., 2000; Farnworth et al., 2014), native v. non-native (Beach & Clark, 2015; Will, 2015; Clark et al., 2016), but few studies have focused on rural/urban comparisons (Loyd and Miller, 2010; Ambarlı, 2016). The HDW research detailed in this thesis was carried out in six different study areas in the state of Alaska (see Figure 5): Anchorage, Fairbanks, Grayling, Anvik, Shageluk, and Holy Cross. Anchorage and Fairbanks were deemed important as they are the two urban centers closest to the release site. It is also imperative to understand attitudes of residents living closest to the resource along the lower Innoko/Yukon River region. Research was conducted in the small Native[1] villages of Grayling, Anvik, Shageluk, and Holy Cross in order to gauge support by local communities. For the purpose of this research, "urban" areas are defined as having > 10,000 residents, and "rural" areas are outlined by having < 10,000 residents. Some decision-making entities (i.e. Board of Game, Federal Subsistence Board) are working independently and have greater influence by rural interest groups on wildlife management. Given that the ADF&G offices are located in urban areas, surrounded by the largest concentration of hunters, wildlife enthusiasts, and politicians, we felt that

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[1] Native is the culturally appropriate terminology in Alaska.

Anchorage and Fairbanks population will be important for understand future management on wood bison in Alaska. Together, understanding the urban population of Anchorage and Fairbanks and the local residents, who are responsible for the ongoing conservation and tolerance of the animals, will help wildlife managers manage wood bison effectively for years to come.

Research Objectives

The overarching goal of this study is to better understand how residents of Fairbanks, Anchorage, and the GASH (Grayling, Anvik, Shageluk, Holy Cross) communities feel about wood bison and wood bison management in Alaska. The specific objectives of this study are:

1) To understand the factors that drive public acceptability toward lethal management of wood bison under potential human-bison conflict situations.

2) To compare urban and rural preferences for management (direct or indirect) of wood bison under certain scenarios.

These objectives are explored in two manuscripts that follow in this thesis. Both objectives aim to provide a baseline of practical and theoretical understanding of public acceptance to wood bison management in Alaska. The data collected are already aiding ADFG managers in their management decisions in the situation of human-bison interactions. Without recent, accurate data, managers are forced to listen to loud lobby groups and individuals. HD data provides wildlife managers a understanding of the

broader public views which then allows for the ability to balance disagreeing and angry opinions (Bath, 1998).

Outline of Papers

The manuscripts corresponding to Chapters 2 and 3 are not mutually exclusive, rather they work together to accomplish the overarching goal of the study, which is to better understand public perceptions toward wood bison management in Alaska. The concepts explored in each paper are independent; one focuses on the theoretical and the other takes a more practical approach. The first objective is to better understand how cognitions and emotions influence the urban publics' acceptance of lethal management of wood bison in Alaska. The second objective is to assess urban and rural Alaskans' preferences for situational management interventions and to explore the differences and similarities between each public. Abstracts for Chapters 2 and 3 are provided below:

Chapter 2 consists of a paper submitted to *Restoration Ecology*, titled: "Predicting Acceptance of Lethal Management of Wood Bison in Alaska, U.S.A.".

Wood bison were reintroduced into Alaska after a 170-year absence in the state. Wildlife reintroductions can cause problems when the restored animals damage property, spread disease, increase fear levels, and injure or kill people. We examined the influence of urban Alaskan's wildlife value orientations (WVO) (domination and mutualism), fear and attitudes toward wood bison on their behavioral intention to support lethal management under specific situations. We hypothesized that: (a) domination, mutualism and fear would influence public attitudes toward wood bison, and (b) attitudes would predict an individual's behavioral intention to support lethal management of the newly restored

bison population. Data were obtained from a self-administered questionnaire randomly distributed to residents in Anchorage ($n = 243$) and Fairbanks ($n = 272$). Regression analyses indicated that both mutualism and domination were positively related to attitudes, and fear was negatively related to attitudes. Attitudes did not predict behavioral intention to support lethal management practices. Both WVO and fear predicted behavioral intentions. The model helps understand how cognitive and emotional components can influence tolerance of a newly restored herbivore species. Findings also suggested that for situations where an attitude may not exist, people may use more basic value orientations and emotions when thinking about how they would react in specific situations.

Chapter 3 consists of a paper submitted to *Wildlife Research*, titled: "Understanding Areas of Conflict and Consensus Regarding Wood Bison Management in Alaska, U.S.A.".

Wood bison have been absent from Alaska for over 170 years. In the spring and summer of 2015, however, 130 animals were reintroduced to the state. These wood bison were restored through a consensus-based human dimensions process, but it remains unknown how the animals will be managed. We surveyed urban and rural Alaska residents to understand the effect of proximity to the resource on resident's preference for management of wood bison in different scenarios. Data were collected in urban areas using a mail-back questionnaire ($n = 515$, 39% response rate) and by on-site interviews with rural residents ($n = 31$, 100% response rate) between June and September of 2015. Respondents were asked to state their preferred wood bison management strategies under specific situations of potential human-bison conflict. Residents from urban and rural

study areas differed in their preference of bison management particularly in more severe situations. Urban and rural residents were reluctant to use lethal management of wood bison even under situations that threaten human property. Rural residents are in favor of lethal management when human injury occurs; in contrast, urban residents are still not supportive of lethal management, thus wildlife management will need to decide whether to manage wood bison based on the wants of urban or rural residents.

Relevance of Research

This research project has practical and conceptual importance for the successful restoration and conservation of wood bison in Alaska, as well as restoration initiatives more broadly. Firstly, this research addresses the Alaska Department of Fish and Game's need for:

- A baseline study on the social acceptance of wood bison and wood bison management.

- Understanding the parameters of the term "nuisance" used in the management plan and what the local and urban public perceive to be a "nuisance" wood bison.

- Information regarding management options under human-wood bison interactions in order to inform management.

- Establishing a basis for human dimensions research in a form of public involvement around the reintroduction site to ensure conservation occurs.

In addition, this research has responded to literature recommendations to explore and assess fear of wildlife in the context of reintroductions (Decker et al., 2010) and to

further test and use psychological and cognitive models to better nuance how they help to understand and predict public acceptance to wildlife and wildlife management (Bruskotter & Fulton, 2012). Finally, this research contributes to a growing body of literature focused on using the Potential for Conflict Index (Vaske et al., 2010) to present findings to readers and wildlife managers in an accessible way. The Potential for Conflict Index is a relatively new tool in HD research and has been under utilized with respect to wildlife reintroductions. This tool has been applied in the current research on wood bison reintroduction to understand conflict and consensus in a situation of new resource management acceptability.

Conceptual Framework

The conceptual basis for this research is embedded in the HDW literature (e.g. Decker & Chase, 2001; Manfredo, 2008; Decker, Riley & Seimer, 2012; Vaske & Manfredo 2012; Bennett et al., 2017), and is guided by the psychological, cognitive, and emotional approach to human behavior (Fulton et al., 1996; Vaske & Donnelly, 1999; Fishbein & Azjen, 2011; Jacobs et al. 2012). More specifically, this research explores the relationships between WVO, attitudes, emotion (i.e. fear), and acceptability of management options (behavioral intention). The relationships tested are based on the cognitive hierarchy (Fulton et al. 1996). This conceptual framework is explained in more detail in the following chapters.

Data Collection

Data were collected between the months of May and August 2015 through a mail out questionnaire. The questionnaire contained close-ended questions, all of which were

pre-tested to ensure reliability of attitudinal concepts and to be sure that all concepts were

logical and unequivocal as Grimm (2010) suggests. The questionnaire contained several

sections (see Appendix), however, for the purpose of exploring the two research

objectives for this thesis, only the following were analyzed:

- Wildlife value orientations

- Attitudes towards wood bison

- Emotional disposition (fear)

- Acceptability of management options under specific scenarios (behavioral
  intention)

Questionnaires were distributed by mail to a random selection of potential

respondents in the urban centers of Anchorage and Fairbanks. Potential respondents were

recruited by telephone directory in each city and telephone contact was made with each

respondent to obtain consent and verify addresses prior to sending. In the villages of

Grayling, Anvik, Shageluk, and Holy Cross, questionnaires were administered by the

primary researcher and done by census method. More detailed explanations of specific

data collection and analysis techniques are outlined in Chapters 2 and 3.

Co-Authorship Statement

The author of this thesis has been the primary researcher of this study. This included all review of literature, preparation and design of research proposal and objectives, preparation of technical, applied documents, data collection and analysis, and manuscript preparation. All co-authors and committee members have provided valuable contributions to this research project by critically analyzing, providing feedback, and aiding with data analysis techniques throughout all stages of the project.

The author has been the primary and corresponding author for both manuscripts included within this thesis. The co-authors have provided significant contributions to each article by critiquing theory, methods, and analysis, interpreting data and results, and reviewing the manuscripts multiple times. The below paragraphs detail the journal that each manuscript has been submitted to and the order of the co-authors proceeding the primary author.

The first manuscript "*Predicting Acceptance of Lethal Management of Wood Bison in Alaska, U.S.A.",* was collaboratively prepared with Dr. Jerry Vaske (CSU), Dr. Alistair Bath (MUN), Mrs. Monica Engel (MUN), and Ms. Bethany Downer (ISU). This paper was submitted to *Restoration Ecology*.

The second manuscript "*Understanding Areas of Conflict and Consensus Regarding Wood Bison Management in Alaska, U.S.A.",* was collaboratively prepared with Dr. Alistair Bath (MUN), Dr. Jerry Vaske (CSU), and Mr. C. Tom Seaton (ADFG). This paper was submitted to *Wildlife Research*.

Chapter 2: Predicting Acceptance of Lethal Management of Wood Bison in Alaska, U.S.A.

Introduction

Failure to adequately involve the public in wildlife decisions has resulted in ineffective management (Bath 1998; Riley et al. 2002; Manfredo 2008; Bennett et al. 2017) and decreased public support for a variety of initiatives (Decker & Chase 1997; Stern et al. 2017). Public support for wildlife reintroductions, for example, is often key to success (Bath 1998; Hermann et al. 2012). This was especially true for wood bison (*Bison bison athabascae*) in Alaska, where a group of diverse interests supported the idea of reintroduction (Alaska Wood Bison Planning Management Team 2015), but little was known about the specific approaches to management on the landscape.

After approximately 170 years of statewide absence, 130 wood bison were restored to the rural Alaska wilderness in the spring and summer of 2015. Wood bison are listed as threatened under the U.S Endangered Species Act (ESA) (U.S. Fish and Wildlife Service 2013), highlighting the importance of this restoration from a species conservation standpoint (Stephenson et al. 2001; Seaton 2016). A federal rule in the ESA, however, designates these reintroduced animals as a "nonessential experimental population," meaning bison can be killed in situations of social, economic, or political conflict. The management plan states that a "nuisance" wood bison can be destroyed (Alaska Wood Bison Planning Management Team 2015), but fails to define what "nuisance" means. The public may perceive a wood bison entering their community, damaging their property, or

attacking a person as a "nuisance" animal, but these specifics were not defined in the management plan.

Lethal control is a cost-effective, yet controversial method of managing conflicts between humans and wildlife (Sanborn & Schmidt 1995; Sponarski et al. 2015b). While lethal management is frequently employed in Alaska (e.g. urban moose, bears, wolves), we expect that due to the 'experimental' designation of the wood bison population this type of management would still be highly contested. A lot of state resources were used to establish this population on an ecological and social basis, therefore it is expected that the public will anticipate more careful management of these animals (i.e. less intensive conflict management). Wood bison were restored as an additional food source and new hunting opportunity. If lethal management is used in situations deemed unacceptable to the public, this could greatly diminish trust for ADFG and may affect public support for future restoration initiatives.

Understanding public acceptability of lethal management requires knowledge of the cognitive and emotional considerations underlying the issues (Decker et al. 2006; Bruskotter et al. 2009; Loyd & Miller, 2010; Vaske et al. 2013; Jacobs et al. 2014). The objectives of this research was to: (a) understand the level of support or opposition for lethal management of wood bison in specific contexts, and (b) identify predictors of lethal management to inform educational outreach and communication strategies.

Conceptual Framework

Cognitions are mental processes that individuals use to understand situations (Vaske & Manfredo 2012). The "cognitive hierarchy" arranges these cognitions ranging from general to specific (Vaske & Donnelly 1999). The hierarchy seeks to outline the

relationships between values, value orientations, and attitudes to better discern how cognitions influence behaviors and behavioral intentions of individuals and decision makers. An increasing amount of empirical research has applied this conceptual approach to wildlife and wildlife management (Manfredo 2008).

The cognitive hierarchy separates values from value orientations. *Values* are often understood as qualities of life that are held true individually or collectively, such as honesty or fairness (Rokeach 1973). Values are general constructs that do not evaluate specific situations. For example, people who value "honesty" will be honest when interacting with their family / friends and in business deals. Values are not expected to explain a great deal of the variability in specific behaviors, due to the fact values are widely shared by all members of a culture. *Basic beliefs*, on the other hand, represent general classes of objects (e.g., all wildlife) that give meaning to cognitions represented in values. *Value orientations* are arrangements of basic beliefs that provide context for fundamental values in regard to a particular realm such as wildlife (Fulton et al. 1996; Manfredo et al. 2009; Teel & Manfredo 2010).

Human dimensions research has assessed wildlife value orientations (WVO) through individuals' identification or perceived association with *domination oriented* beliefs and *mutualism oriented* beliefs (Teel et al. 2007; Jacobs et al. 2014b). Domination and mutualism value orientations are not mutually exclusive, rather they are arranged along a continuum. Individuals towards the domination end of the continuum hold more utilitarian views and believe wildlife should be managed mainly for the benefit of humans, and therefore are more likely to prioritize human well–being over wildlife in their attitudes and behaviors (Gamborg & Jensen 2016). These individuals are also more

likely to support management actions that result in death or harm to wildlife. Mutualists hold a more symbiotic view of human and non-human entities as equal. This leads to more positive human–animal relationships, viewing wildlife as part of an 'extended family' (Wildavsky 1991; Gamborg & Jensen 2016). Mutualists will also be less supportive of behaviors that harm wildlife, more likely to take actions that benefit wildlife, and more likely to see wildlife as similar to humans. WVO have proved effective in predicting attitudes toward wildlife species (Hartel et al. 2015) as well as behavioral intention to support wildlife management decisions (e.g., Bright et al. 2000; Dougherty et al. 2003; Hermann et al. 2012; Sijtsma et al. 2012).

*Attitude*s are defined as the evaluation, either favorable or unfavorable, of a person, object, or action (Manfredo & Dayer 2004) and are important because they precede and direct behavior. Attitudes can focus on either a general or a specific object. For example, if "wood bison" are the object, the evaluation reflects a general attitude. If "wood bison reintroduction in Alaska during 2015" is the object, the evaluation reflects a more specific evaluation. We focused on general attitudes toward wood bison.

Attitudes have both a cognitive and an evaluative (or affective) dimension. The cognitive aspect refers to the beliefs associated with the attitude object. Beliefs are what we think to be true, but are not always objective facts. The evaluative component refers to whether the individual views the attitude object as positive or negative. To predict behavior, both the cognitive and the evaluative characteristics of an attitude must be understood. For example, one person may have a cognitive belief that wood bison are dangerous to humans and evaluate bison negatively because of fear. Another person may also believe wood bison are dangerous, but feel positively toward them because s/he is

excited by the potential danger or perhaps has WVO that are consistent with this positive

attitude. Both individuals share the belief that wood bison are dangerous, but their

evaluations of this belief are different and may vary depending on context.

In attitude research, the concept *affect* represents *feelings* experienced by humans;

emotions are in this category (Manfredo 2008). Although the relationships among value

orientations, attitudes, and behavioral intention have received considerable amount of

attention in the human dimensions literature (Vaske & Manfredo 2012), less attention has

focused on the role of emotions in wildlife decision making (Engel et al. 2016; Jacobs et

al. 2012a; 2012b; Manfredo 2008).

People do not exhibit emotional reactions randomly, but rather in response to

specific objects, events, or situations. The evaluation of a situation leads to an emotional

appraisal which in turn affects the emotional response (Scherer 1999). The criteria that

influence the appraisal are emotional dispositions. Emotional states mirror *how* you are,

while emotional traits (i.e. emotional dispositions) reflect *who* you are as an individual

(Hamaker et al. 2007). Differing from states, traits are always present, even if they are not

active. As traits, emotional dispositions are relatively stable compared to states. Being

scared by a wood bison is a temporary state that can switch on and off and differ in

intensity based on the situation; a disposition to fear wood bison is usually stable. The

fact that many phobias are persistent illustrates the stability of emotional dispositions.

General fear is the most commonly studied emotion in human dimensions

literature and is rooted in the study of perceived risks associated with potential hazards

and the level of uncertainty associated with those hazards (Sjoberg 2000; Johansson &

Karlsson 2011). Studies of fear of large carnivores have become increasingly common

(e.g. Røskaft et al. 2003; Johansson et al. 2012a; Jacobs et al. 2014; Sponarski et al. 2015a; Engel et al. 2016). Fear in general, can include a range of emotional components such as anxiety, worry, and outrage (Sjoberg 2000; Gore et al. 2006). We focused on fear as an emotional disposition. Large herbivores may elicit fear if they are seen near roads and runways, attack and injure people, damage property, transmit disease, and/or cause vehicle collisions (Sudharsan et al. 2009; Decker et al. 2010; Vaske & Lyon 2011).

Fear has been shown to influence attitudes toward wildlife and support for management actions (Johansson et al. 2012b; Marchini & Macdonald 2012; Slagle et al. 2012, Engel et al. 2017). Lethal management of wildlife is one of the most controversial management strategies used and can be a source of conflict and public distrust of wildlife management agencies (Agee & Miller 2009; Loyd & Miller 2010). Conflicts typically arise as a result of competing views between interest groups surrounding a resource (Triezenberg et al. 2011; Pomeranz et al. 2013). In the case of wildlife reintroductions, human-wildlife conflicts are known to be more prevalent when large species are reintroduced to a region they have been absent for over a full generation (Hermann et al. 2012). As the threat level increases for a situation such as injuring a person or pet/livestock, lethal management can be more acceptable than for a less severe situation such as simply being present in the community or near a runway (Sponarski et al. 2015b).

Hypotheses

Based on previous research (e.g., Fulton et al. 1996; Vaske & Donnelly 1999; Whittaker et al. 2006; Manfredo 2008; Vaske & Manfredo 2012; Engel et al. 2016), we hypothesized that mutualism, domination, and fear would influence attitudes and behavioral intention (Figure 1). Based on the cognitive hierarchy, we predicted that our

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attitude measure would mediate the relationships between the general WVO / fear

disposition and the specific support for lethal management. The following hypotheses

were advanced:

H_1 Domination will be negatively related to attitudes toward wood bison.

H_2 Domination will be positively related to behavioral intention to support lethal

management of wood bison.

H_3 Mutualism will be positively related to attitudes toward wood bison.

H_4 Mutualism will be negatively related to behavioral intention to support lethal

management of wood bison.

H_5 Fear will be negatively related to attitudes toward wood bison.

H_6 Fear will be positively related to behavioral intention to support lethal

management.

H_7 Attitudes will be negatively related to behavioral intention to support lethal

management.
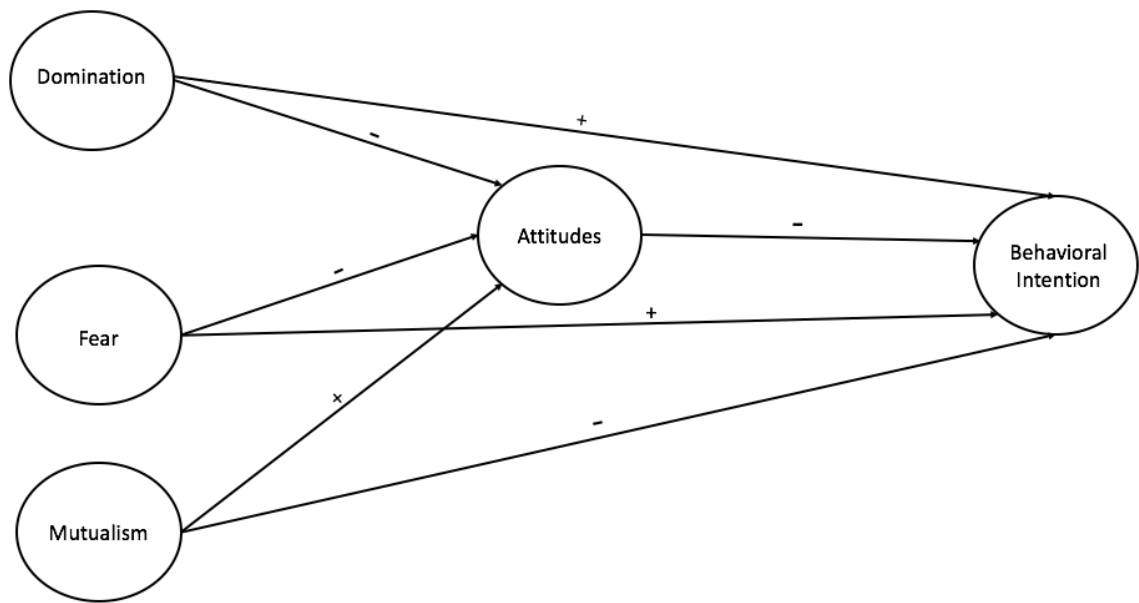
Figure 6. Hypothesized model of relationships between value orientations, fear, attitudes, and behavioural intention. (+) indicates a positive hypothesized relationship between constructs and (-) indicates a negative hypothesized relationship between constructs.

Methods

Study Area and Population

The study was conducted in Anchorage (population size: 300, 950) and Fairbanks (population size: 32, 324), Alaska, U.S.A; the two urban centers closest to the wood bison restoration location (Figure 2). In Alaska, urban centers form the largest public constituencies in the state, thus making them drivers of decision making. Regardless of direct interaction with the animal, understanding how urban residents view wood bison management is important for gauging future conflicts related to management of these animals. Failing to do this could affect levels of public trust and public support for future wildlife restoration initiatives. Only adult (> 18 years) residents of Anchorage and Fairbanks participated in the study. The sampling frame was generated from the most

recent telephone directories (Alaska Communications 2014a; 2014b) for each city. A random sample of phone numbers and a random selection of an individual within the household was used to obtain the potential respondent base. Potential respondents were then called to request permission to send a questionnaire to their address.
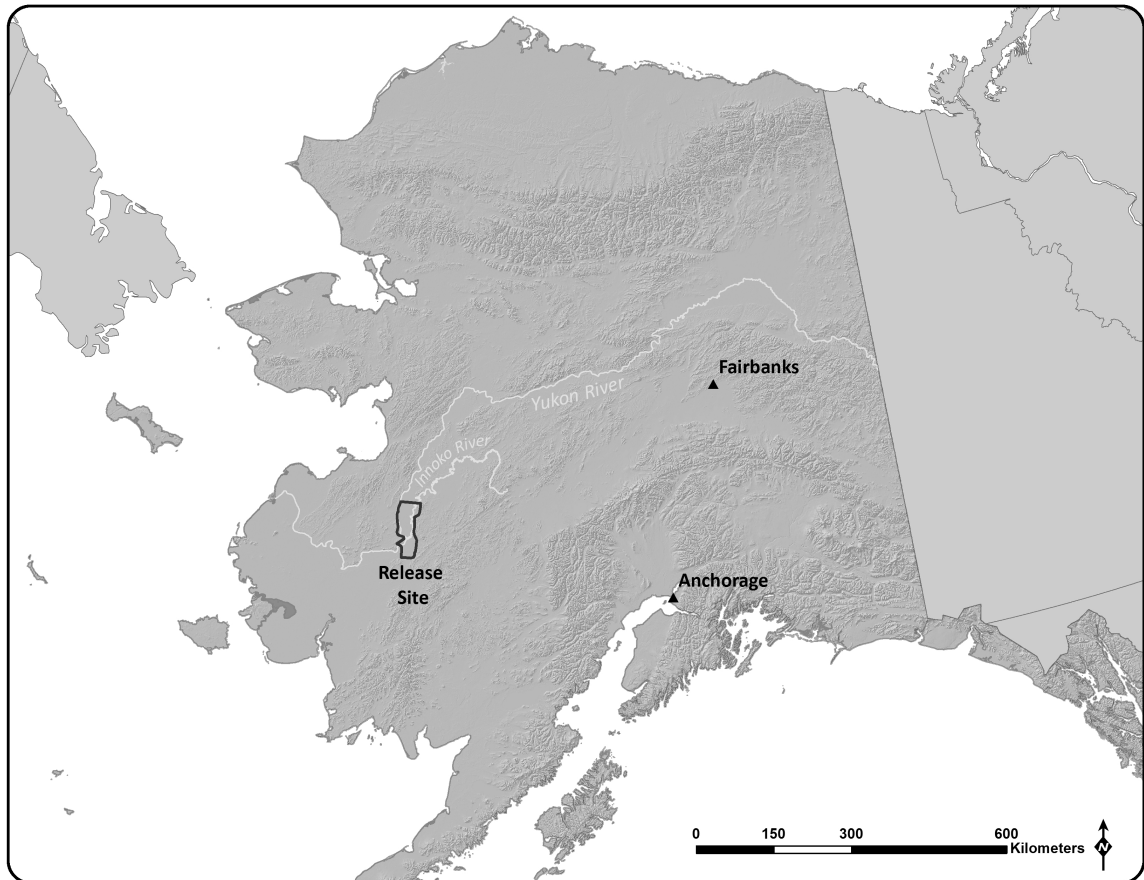
Figure 7. Relief map of Alaska showing the urban study area and the reintroduction site of the wood bison (Courtesy of Nathan Pamperin, Alaska Department of Fish and Game).

Data Collection

Data were obtained between the months of June and August of 2015. Each potential respondent was sent the questionnaire, a cover letter outlining the research and its importance, and a pre-stamped return envelope. A total of 750 questionnaires were mailed to Anchorage residents and 700 to Fairbanks residents. There were 68 questionnaires undeliverable to Anchorage residents and 53 were undeliverable to Fairbanks residents. The response rate for Anchorage residents was 36% ($n = 243$) and for Fairbanks 42% ($n = 272$), yielding an overall response rate of 39%. Budget restraints did not allow for a non-response bias check. In general, distribution of responses in terms of self-identified gender and race were similar to that of the population of Alaska, with the exception of a skew in age with an older respondent base (Alaska Census 2010). Responses were not weighted to account for skewed age distribution. In addition, standardized procedures of questionnaire design, methods of data collection, and analysis were employed to address all survey research error (Dillman 2000; Vaske, 2008).

Variables in the Model

The questionnaire contained 18 variables, organized into four latent constructs: WVO (7 items; 3 mutualism, 4 domination), fear of wood bison (5 items), attitudes toward wood bison (3 items), and the behavioral intention to support or oppose lethal management under specific situations (3 items). All items used were coded on a 5-point scale from -2 to 2 from strongly disagree to strongly agree (WVO, fear, attitudes) or extremely acceptable to extremely unacceptable (behavioral intention).

The three general mutualism variables were: (1) animals should have rights similar to the rights of humans, (2) I feel a strong emotional bond with animals, and (3)

we should strive for a world where humans and wildlife can live side by side without fear. The four domination items were: (1) humans should manage wildlife populations so that humans benefit, (2) we should strive for a world where there is abundance of wildlife for hunting and fishing, (3) wildlife are on earth primarily for people to use, and (4) people who want to hunt should have the opportunity to do so (Fulton et al. 1996; Jacobs et al. 2014b). The general fear disposition of wood bison was measured with five variables: (1) fear for own personal safety, (2) fear for own children's safety, (3) fear for own pet's safety, (4) fear for the spread of disease, and (5) fear for damage to own personal property.

Attitudes were measured by asking respondents to evaluate whether they thought wood bison in Alaska to be: bad or good, harmful or beneficial, and negative or positive (Manfredo et al. 1992; Manfredo et al. 2004). Behavioral intention to support or oppose lethal management was measured for three scenarios: (1) if a wood bison is seen near the runway, (2) if a wood bison damages your property, and (3) if a wood bison attacks and injures you or someone in your community (Table 1).

Data Analysis

Independent sample *t*-tests were used to verify that responses from residents of Anchorage and Fairbanks were not statistically different to justify combining the two samples. Cronbach's alpha was used to measure internal consistency within each construct (Vaske 2008; Bland & Altman 1997). Ordinary least squares regression models were used to determine whether specific attitudes mediated the relationship between WVO (domination and mutualism) / general fear and behavioral intention (support or opposition for lethal management).

Results

Descriptive Statistics

There were no significant differences ($p > 0.5$) in responses from Anchorage and Fairbanks residents for the variables used in the analysis; responses from the two cities were combined. The mean age of respondents was 61 years; 58% of the respondents were male, 42% were female.

Table 1. Means and standard deviations for behavioural intention scenario items.

Behavioral Intention Scenarios:	Mean	Standard Deviation
If a wood bison is seen near the runway how acceptable or unacceptable would it be for Fish & Game to kill the wood bison?	-.86	1.29
If a wood bison damages property how acceptable or unacceptable would it be for Fish & Game to kill the wood bison?	-.94	1.24
If a wood bison attacks and injures you or someone in your community how acceptable or unacceptable would it be for Fish & Game to kill the wood bison?	-.06	1.54

Cronbach alpha scores for the five constructs ranged from .66 to .91 (Table 2). Deleting any of the items from its associated concept did not improve the overall Cronbach's alpha. The corrected item total correlations were always larger than the recommended .4 (Vaske 2008). For all of these reasons, items were grouped with their respective latent concepts and composite indices were computed.

Table 2. Means, standard deviations, and reliability analyses for WVO, fear, and attitude constructs used in the regression model.

Concept Variable	Item Total Correlation	Alpha If Item Deleted	Cronbach Alpha	Mean	Standard Deviation
WVO: Domination			.77		
Humans should manage wildlife populations so that humans benefit	.66	.67		.54	1.25
We should strive for a world where there is an abundance of wildlife for hunting and fishing	.54	.74		1.05	1.08
Wildlife are on earth primarily for people to use	.55	.74		-.45	1.40
People who want to hunt should have the opportunity to do so	.59	.72		1.20	.96
WVO: Mutualism			.66		
Animals should have rights similar to the rights of humans	.50	.51		-.44	1.31
I feel a strong emotional bond with animals	.45	.59		.58	1.14
We should strive for a world where humans and wildlife can live side by side without fear	.46	.57		.12	1.33

Fear			.91		
I fear for my own personal health and safety	.88	.87		-1.75	.60
I fear for my children's health and safety	.87	.87		-1.73	.64
I fear for my pet's health and safety	.86	.87		-1.71	.66
I fear for the spread of disease by wood bison	.59	.95		-1.40	.92
I fear for my own property	.79	.89		-1.72	.67
Attitudes			.91		
Do you think of wood bison as bad or good?	.81	.87		1.44	.83
Do you think of wood bison as harmful or beneficial?	.81	.87		1.32	.88
Do you think of wood bison as negative or positive?	.82	.86		1.44	.85

Regression Model

The first regression predicted attitudes toward wood bison using mutualism, domination, and fear as the independent variables (Figure 3). Consistent with H3, mutualism was positively related to attitudes ($\beta = .18$, $p < .001$). Individuals with a mutualism orientation were more likely to hold positive attitudes toward wood bison. As predicted by H5, fear was negatively related to attitudes ($\beta = -.38$, $p < .001$). People who were fearful of wood bison were more likely to hold negative attitudes. Although domination statistically influenced attitudes toward bison ($\beta = .19$, $p < .001$), the

coefficient was positive (i.e., not in the predicted negative relationship). This finding does not support H1. Taken together, the three predictors explained 12.5% of the overall variance in attitudes toward wood bison.
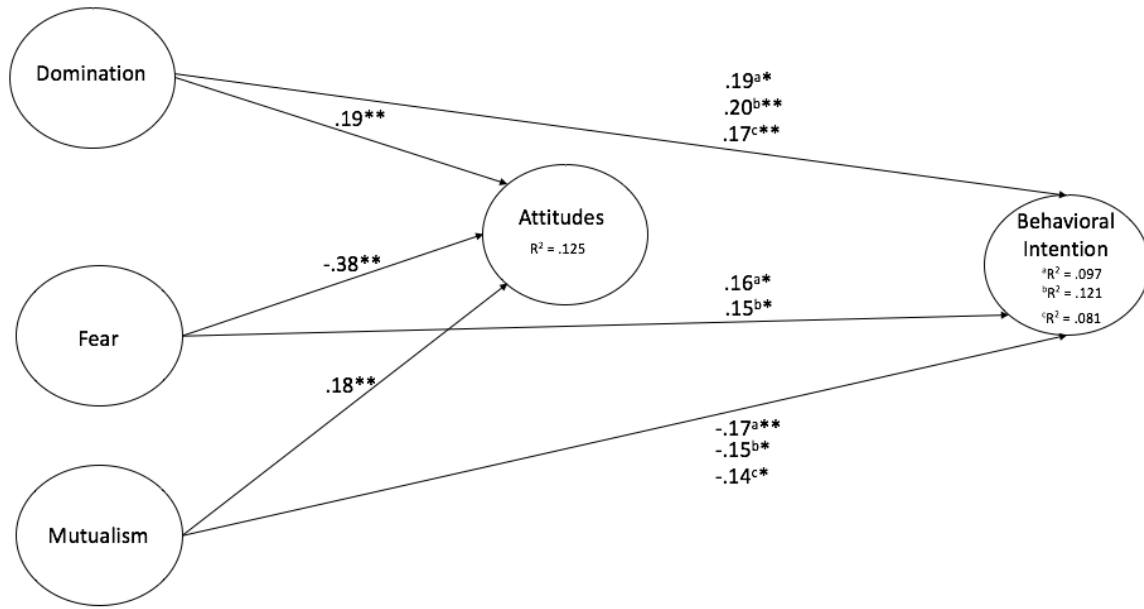
Figure 8. Regression model illustrating regression coefficients for significant relationships within the model. The superscripts represent the specific situation the regression is testing the behavioural intention for. [a]: Support for lethal management if a wood bison is seen near the runway, [b]: Support for lethal management if a wood bison damages your property, and [c]: Support for lethal management if a wood bison attacks and injures you or someone in your community. ** Denotes a p value <0.001 and * denotes a p value <0.005.

The second regression looked at the scenario where a wood bison is seen near a community's airport runway. The model examined relationships between WVO, fear, attitudes, and behavioral intention (Figure 3). The results showed that domination (H2), mutualism (H4), and fear (H6) all significantly influenced behavioral intention to support lethal management. As predicted, domination ($\beta = .19, p = .003$) and fear ($\beta = .16, p <$ .001) positively related to behavioral intention, whereas the mutualism negatively related

to the behavioral intention to support lethal management (ß = -.17, $p < .001$). Attitudes toward bison did not significantly influence behavioral intention (rejecting H7). This regression explained 9.7% of the overall variance.

The third regression looked at the scenario where a wood bison damages property. The model examined relationships between WVO, fear, attitudes, and behavioral intention (Figure 3). The results again showed that domination (H2), mutualism (H4), and fear (H6) all significantly influenced behavioral intention to support lethal management. As hypothesized, domination (ß = .20, $p < .001$) and fear (ß = .15, $p = .001$) positively related to behavioral intention, whereas mutualism negatively related to the behavioral intention to support lethal management (ß = -.15, $p = .001$). Attitudes toward bison did not significantly influence behavioral intention (rejecting H7). This regression explained 12.1% of the overall variance.

The fourth regression looked at the scenario where a wood bison attacked and injured someone. The model included the same variables as regressions two and three (Figure 3). The results showed that domination (H2) and mutualism (H4) significantly influenced behavioral intention to support lethal management of wood bison. For this scenario, however, fear as well as attitudes did not significantly influence behavioral intention (rejecting H6, H7). The domination value orientation (ß = .17, $p < .001$) positively related to behavioral intention, whereas the mutualism value orientation negatively related to the behavioral intention to support lethal management (ß = -.14, $p = .003$). This regression explained 8.1% of the overall variance.

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Discussion

Results supported previous findings regarding the influence of WVO on behavioral intention (Loyd & Miller 2010; Hermann et al. 2012; Sijtsma et al. 2012). Consistent with theory, individuals with a mutualism value orientation were less likely to support lethal wildlife management (Teel & Manfredo 2010). Similarly, those with a domination value orientation were more likely to support lethal control (Schwartz 2006; Manfredo et al. 2009; Teel & Manfredo 2010). This finding might reflect the high density of hunters in Alaska. In 2015, around 190,000 Alaska residents possessed hunting and fishing licenses; this represents approximately 27% of the total Alaska population (State Licensing Database 2015). This might suggest a utilitarian population that is dependent and appreciative of wildlife; thus, the positive relationship.

Previous research has repeatedly found that attitudes are a direct predictor of behavioral intention (e.g. Vaske & Donnelly 1999; Vaske & Manfredo 2012; Engel et al. 2016) and mediate the relationship between value orientations and behavior. In our data, attitude did not influence behavior in any of the three scenarios, thus contradicting previous research. Given that this study was conducted in 2015, the same year as the reintroduction, attitudes toward wood bison might not have been strong and present on people's mind when the data collection occurred. Furthermore, although attitudes can be created, it takes a concentrated effort (Enck & Brown 2002). Prior to the discovery of chronic wasting disease (CWD) in Wisconsin, for example, few people knew about this disease; yet, they demonstrated strong attitudes toward deer and deer hunting (Heberlein & Stedman, 2009). Because deer are important in Wisconsin, major newspapers published CWD stories at a rate of more than one a day for 10 months during 2002.

Within weeks, new attitudes were created along with behavioral intentions and documented changes in behavior. This level of publicity and communication did not happen in Alaska with respect to the reintroduction to wood bison. Such evidence suggests that people interviewed might lack the knowledge and information about wood bison reintroduction initiative, thus influencing their attitudes and behavioral intentions (Decker et al 2010). Previous research has found that knowledge both indirectly and directly influence behavioral intention (Vaske & Donnelly 2007; Espinosa & Jacobson 2012; Slagle et al. 2012). In the case of desert tortoise management in California, high knowledge levels were linked to more well developed attitudes and therefore effectively influenced behavioral intention (Vaske & Donnelly 2007). A model including knowledge levels could be effective in helping grasp cognitive understandings of the complex and anomalous Alaskan context as well as offer a baseline assessment of residents' knowledge levels surrounding wood bison conservation in the state.

Lack of experience and exposure to lethal management of a reintroduced species might also have influenced the fact that attitudes did not predict behavioral intentions (Fazio et al. 1982). As experiences increases, whether positive or negative, attitudes will become more developed and will likely predict behavioral intentions (Bath & Enck 2003). Despite the evidence that attitudes predict behavioral intentions, when attitudes and behavioral intention are not in the same level of specificity (i.e. attitudes toward wood bison reintroduction), attitudes may not predict the support/opposition to reintroduction (Ajzen and Fishbein, 1977). The lack of specificity between attitudes and behavioral intention in this analysis could be another factor affecting the lack of correlation between these two variables.

Fear was the strongest predictor of attitudes, and influenced behavioral intention in two of three scenarios. The model provided a clear example of the predictive power of the emotional disposition of fear on attitudes toward wildlife and support for lethal management (Vaske & Manfredo 2012). Results indicated that individuals who have higher levels of fear toward wildlife are likely to have more negative attitudes toward them and, in turn, this influenced their intention to support lethal management decisions (Decker et al. 2010; Johansson et al. 2012b). These findings, however, contradict research by Jacobs et al. (2014) where fear was not a strong predictor for acceptance of lethal management of wolves among Dutch and Canadians. This difference could be attributable to the species in question (i.e. wolves and wood bison). Nonetheless, our findings depict the predictive potential of fear as an emotional disposition in the cognitive hierarchy framework. Fear did not predict behavioral intention in the scenario that a wood bison attacked and injured someone.

Future Considerations

This article provided a baseline for understanding WVO, fear, attitudes, and support / opposition for lethal management of wood bison in Alaska. Future research regarding lethal management, wildlife restoration, and cognitive and emotional research may consider the following: first, we only examined fear; we did not examine other emotional dispositions. More emotion-based research is necessary to understand perceptions of wildlife restorations and lethal management in different contexts. Including multiple emotions would build theory and identify better situational understandings (e.g. Jacobs et al. 2012b; Vaske et al. 2013; Jacobs et al. 2014).

Second, research is necessary to examine knowledge in a cognitive model. The lack of attitudinal mediation between value orientation and behavioral intention could be explained by an overall lack of knowledge of the wood bison project.

Third, we examined two urban regions closest to the resource itself. Future research might focus on rural areas near the restoration site. Research suggests that proximity to a resource influences the attitudes and behavior toward the resource (Boholm & Lofstedt 2004; Jurowski & Gursoy 2004; Karlsson & Sjostrom 2007). This suggests that attitudes and behaviors of urban Alaskans may be different than residents in close proximity to the wood bison restoration site. Anchorage and Fairbanks residents make up nearly half of the state's population (Alaska Census 2010). Thus, understanding this urban population assists wildlife managers in implementing successful and preferred wildlife management plans in the future. With that said, understanding the rural residents is equally important as they are closest to the resource.

The "social climate" (Bright & Manfredo 1996) of the wood bison restoration project is in its infancy and therefore we anticipate it changing over time as bison numbers grow, interactions increase, and hunting opportunities begin. Therefore, it is crucial to understand and monitor these changes so to best inform future management decisions. This must not be a "one shot" study; human dimensions of wildlife research is a holistic and continuous process, especially with the uniqueness and changing nature of this restoration project. The strength of this research is in providing a baseline in the beginning of this restoration project. The benefits of having this baseline will be fully realized in conducting longitudinal research in conjunction will the biological monitoring.

Our model contributes to a theoretical and practical understanding of large herbivore restoration. This research aids wildlife managers and decision makers in identifying key areas of concern associated with public attitudes and sentiments toward wood bison and wood bison management in the state. We have articulated the level of tolerance and support for wood bison in Alaska by the urban public of Anchorage and Fairbanks. Residents expressed low levels of fear, positive attitudes, and low support for lethal management. While the outlook appears bright for public support, we are able to deduce based on previous research and the lack of attitudinal predictability on behavioral intention that attitudes about wood bison are not yet well developed in Alaska and lack of behavioral experience (i.e. due to the recency of their reintroduction) (Fazio et al. 1982; Enck & Brown 2002; Vaske & Donnelly 2007) and therefore must be monitored closely during the initial stages of this project. Despite limitations, our results allow managers to better understand the implications of taking certain actions with a newly reintroduced species.

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Chapter 3: Understanding Conflict and Consensus Regarding Wood Bison Management in Alaska, U.S.A.

Introduction

Wildlife management is controversial and contested due to the diverse and dynamic nature of humans, wildlife, and the ways in which they interact (Bath and Enck 2003). Wildlife cause problems for people in a variety of ways: attacks causing injury or death (White and Gehrt 2009; Bhattacharjee and Parthasarathy 2013); crop raiding and livestock depredation (Suryawanshi 2013; Hill 2015); destruction of property (Messmer 2000); vehicle collisions (Marcoux and Riley 2010); disease transmission (Heberlein 2004; Vaske *et al*. 2009); and even risk perceptions and fear associated with coexisting with wildlife (Riley and Decker 2000; Johansson and Karlsson 2011; Sponarski *et al*. 2016). Not all human-wildlife interactions, however, are negative (Bath and Enck 2003); wildlife viewing (Navrud and Mungatana 1994; Skibins *et al*. 2012), hunting and fishing (Decker and Connelly 1989; Beardmore *et al*. 2014), and economic valuation (Sinha *et al*. 2012; Van Wijk *et al*. 2015; Groulx *et al*. 2016), for example, are often positive. The conflicting and harmonious understandings of wildlife-human coexistence differs among individuals, groups, and urban versus rural populations (Treves *et al.* 2006; Kretser *et al*. 2009; Rentfrow 2010; Teel and Manfredo 2010). The line between wildlife space and human space is becoming less clear, requiring increased human tolerance of wildlife within human space (Frank 2016). Human dimensions of wildlife (HDW) research strives

to identify and understand these differences to better inform wildlife management and conservation practices (Manfredo 2008).

Wildlife managers and decision-makers have actively attempted to listen to and involve their key constituents to best develop wildlife policy. Social, political, and financial barriers, however, often prevent or hinder the success of public involvement (Messmer 2000; Bennett *et al*. 2017). HDW research bridges the gap between wildlife managers and the broader public to more inclusively inform wildlife policy. In the case of wood bison restoration in Alaska, an applied human dimension facilitated workshop approach was used to bring together representatives from different groups to reach a consensus on a management plan for wood bison restoration (Bath 2009). While the representatives reached consensus on the reintroduction plan, the views of the Alaskan public remain largely unknown.

Wood bison restoration processes have been underway in Alaska for more than 23 years. After a 170 year statewide absence, 130 animals were reintroduced to Alaska during the spring and summer of 2015 (AWCC 2017). Wood bison are listed as threatened under the Endangered Species Act (ESA) (USFWS 2014). A federal 10(j) rule was developed under the ESA to designate these reintroduced animals as a "nonessential experimental population", meaning they can be killed in situations of social, economic, or political conflict. The management plan states that a "nuisance" wood bison can be removed (Alaska Wood Bison Planning Management Team 2015), however, the plan fails to define what "nuisance" means to the public in the case of future human-wood bison conflict.

Understanding support for management strategies under specific scenarios of potential human-wildlife conflict will help managers define the publics' interpretation a "nuisance" animal. Understanding the difference between urban and rural support for wood bison management strategies will highlight the effect of proximity to the resource (Martínez-Espiñeira 2006; Don Carlos *et al.* 2009; Sponarski *et al.* 2013). While a small body of research has examined urban and rural differences toward natural resource management, few studies have addressed similarities and differences between urban and rural populations regarding wildlife management (Bandara and Tisdell 2003; Ambarlı 2016).

Research has segmented populations based on stakeholder groups (Glikman *et al.* 2010; Sponarski *et al.* 2015a; 2015b), demographic characteristics (Agee and Miller 2009), and cognitive indicators (Vaske and Needham 2007). Geographical differences likely exist between urban and rural Alaskans on their preferences for wood bison management. This article sought to understand where areas of conflict and consensus within the urban and rural populations exist regarding "nuisance" bison using the Potential for Conflict (Consensus) Index (PCI$_2$).

PCI$_2$

PCI$_2$ graphically displays potential for conflict / consensus in between groups (e.g., urban vs. rural residents). Rather than present a table of measures of dispersion, PCI$_2$ offers this visual interpretation to bridge 'understanding gaps' between researchers and wildlife managers (Manfredo *et al.* 2003). Index values range from 0 to 1 (Vaske *et al.* 2010). The greatest potential for conflict exists (PCI$_2$ = 1) when responses are equally divided between the two extreme values of a response scale (e.g., 50% strongly agree,

50% strongly disagree, 0% neutral) (Vaske *et al*. 2010). When all responses lie on one side of the neutral value on a response scale (PCI = 0) consensus and no potential for conflict within a population can be assumed (Vaske *et al*. 2010; Sponarski *et al*. 2014).

PCI$_2$ analysis are illustrated graphically using bubbles. The center of the bubble along the vertical axis represents the central tendency on the variable (Vaske *et al*. 2010). The size of the bubble portrays the magnitude of the PCI$_2$ and illustrates the degree of dispersion within the sample, or potential for conflict regarding a specific management issue. Large bubbles represent little consensus and high potential for conflict, whereas small bubbles indicate high levels of consensus and minimal potential for conflict (Vaske *et al*. 2010).

Hypotheses

Based on previous conflict and consensus research on wildlife management issues (e.g. Bandara and Tisdell 2003; Koichi *et al*. 2013; Sponarski *et al*. 2014), the following hypotheses were advanced:

H$_1$: Differences regarding wood bison management preferences will exist between urban and rural populations.

H$_2$: The potential for conflict will vary based on the severity of interaction scenarios.

H$_3$: The urban population will have less consensus on situational management preference than the rural population.

Materials and Methods

Study Area and Population

Data were obtained from the urban centers of Anchorage (301,010 inhabitants) and Fairbanks (32,469 inhabitants) and the rural villages of Grayling (194 inhabitants), Anvik (85 inhabitants), Shageluk (83 inhabitants), and Holy Cross (178 inhabitants) Alaska (Alaska Census, 2010; U.S. Census Bureau 2015). Only adults (> 18 years) participated in the study. The Anchorage and Fairbanks samples were randomly selected from the most recent telephone directories from each city (Alaska Communications 2014a; 2014b) and representative of a combined urban sample of the two cities based on Vaske (2010) recommendations. In the rural villages, every member of the villages was asked to participate (i.e. a census).
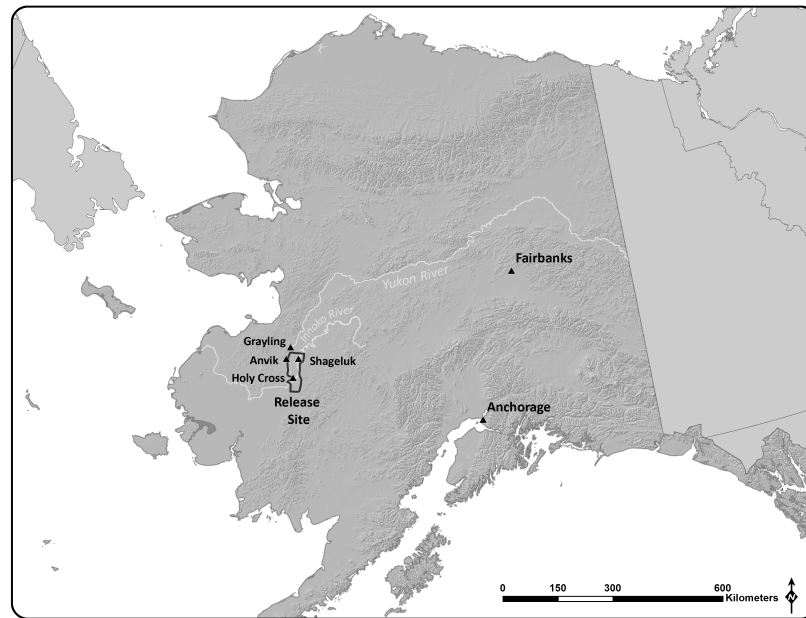
Figure 9. Relief map of Alaska showing urban study areas (Anchorage, Fairbanks), rural study areas (Grayling, Anvik, Holy Cross, Shageluk), and the wood bison release site (Courtesy of Nathan Pamperin, Alaska Department of Fish and Game).

Data Collection

For the urban samples, one mailing was conducted between June and August, 2015. The mailing packet included the questionnaire, a cover letter outlining the research and its importance, and a pre-stamped return enveloped. The questionnaire was pre-tested before distribution. Potential respondents were telephoned prior to the mailing. A total of 750 questionnaires were sent to Anchorage residents and 700 to Fairbanks residents. The response rate for Anchorage and Fairbanks residents was 36% ($n = 243$) and 42% ($n = 272$) respectively, with an overall urban response rate of 39% and 515 usable surveys returned. In the villages, data were obtained through on-site interviews administered to all

respondents who agreed to participate in the survey. A total of 31 interviews were done in

Grayling (n = 12), Anvik (n = 3), Holy Cross (n = 6), and Shageluk (n = 10).

Variables Used

Respondents evaluated four wood-bison interaction scenarios: 1) wood bison is

seen in the community, 2) wood bison is seen near the runway, 3) wood bison damages

property, and 4) wood bison attacks and injures someone. For each scenario, respondents

rated how acceptable or unacceptable it would be for wildlife managers to: 1) do nothing,

2) monitor the situation, 3) haze the wood bison, or 4) kill the wood bison. Management

options were coded as: extremely unacceptable (-2), unacceptable (-1), neither acceptable

nor unacceptable (0), acceptable (1), and extremely acceptable (2); or beneficial, and

negative or positive. The human-bison interaction scenarios and specific management

strategies were based on previous research by Sponarski *et al*. (2014). The 'wood bison

near the runway' scenario was included because the rural villages near the release site are

only accessible by air and air safety is an important concern. The 'do nothing' and

'monitor the situation' scenarios were indirect management options and the 'haze the

wood bison away' and 'kill the wood bison' were direct management options (Treves *et

al*. 2009).

Data Analysis

Independent sample *t*-tests examined differences in the means reported by

respondents in the different samples. PCI_2 was used to understand the amount of conflict /

consensus. Programs for calculating, graphing, and comparing PCI_2 values can be found

at http://warnercnr.colostate.edu/~jerryv/PCI2/index.htm.

Results

Descriptive Statistics

There was no significant difference ($p = .05$) in responses from the two urban areas (Anchorage and Fairbanks) or the four rural villages (Grayling, Anvik, Holy Cross, Shageluk). The samples were thus grouped together into 'urban' and 'rural' populations. The mean age of respondents from urban areas was 61 years, and the mean age for rural respondents was 47; 59% of respondents identified as male, while 38% identified as female. One hundred percent of rural respondents identified as Alaska Native, while overall, Alaska Natives comprised 8% of the total sample; 89% of the urban and rural samples identified as non-Native. The independent samples t-test revealed that 10 of the 16 management situations were statistically significant ($p < .05$).

Table 3. Independent Samples T-Test between urban and rural populations showing means, t-values, and significance of each scenario.

Concept Variable		Mean	t-value	Sig.	eta
Scenario 1: If a wood bison is seen in your community…					
How acceptable or unacceptable would it be for ADFG to do nothing?	Urban	0.01	0.30	.761	.15
	Rural	-0.06			
How acceptable or unacceptable would it be for ADFG to monitor the situation?	Urban	1.48	3.03	.003*	.20
	Rural	1.00			
How acceptable or unacceptable would it be for ADFG to frighten/haze the wood bison away?	Urban	0.03	-10.43	<.001*	.39
	Rural	1.58			
How acceptable or unacceptable would it be for ADFG to kill the wood bison?	Urban	-1.21	2.68	.011	.13
	Rural	-1.67			

Scenario 2: If a wood bison is see near
the runway…

How acceptable or unacceptable would it be for ADFG to do nothing?	Urban	-0.91	-2.81	.005*	.17
	Rural	-0.26			
How acceptable or unacceptable would it be for ADFG to monitor the situation?	Urban	1.29	-0.55	.581	.12
	Rural	1.40			
How acceptable or unacceptable would it be for ADFG to frighten/haze the wood bison away?	Urban	1.14	-7.26	<.001*	.15
	Rural	1.79			
How acceptable or unacceptable would it be for ADFG to kill the wood bison?	Urban	-0.86	2.83	.005*	.15
	Rural	-1.53			

Scenario 3: If a wood bison damages
property…

How acceptable or unacceptable would it be for ADFG to do nothing?	Urban	-0.40	4.93	<.001*	.16
	Rural	-1.23			
How acceptable or unacceptable would it be for ADFG to monitor the situation?	Urban	1.16	-1.26	.210	.09
	Rural	1.40			
How acceptable or unacceptable would it be for ADFG to frighten/haze the wood bison away?	Urban	0.98	-1.84	.066	.13
	Rural	1.37			
How acceptable or unacceptable would it be for ADFG to kill the wood bison?	Urban	-0.94	-2.35	.019	.11
	Rural	-0.40			

Scenario 4: If a wood bison attacks and injures someone…

How acceptable or unacceptable would it be for ADFG to do nothing?	Urban	-1.20	5.81	<.001*	.16
	Rural	-1.86			
How acceptable or unacceptable would it be for ADFG to monitor the situation?	Urban	1.01	-7.80	<.001*	.14
	Rural	1.76			

How acceptable or unacceptable would it be for ADFG to frighten/haze the wood bison away?	Urban	1.12	8.40	<.001*	.36
	Rural	-0.72			
How acceptable or unacceptable would it be for ADFG to kill the wood bison?	Urban	-0.06	-12.53	<.001*	.30
	Rural	1.62			

PCI$_2$

Scenario 1: *wood bison seen in the community.* – In general, urban and rural

residents agreed that the most appropriate management option when a *wood bison is seen*

in the community was to 'monitor the situation' (urban: $\bar{x}$ = 1.48; rural $\bar{x}$ = 1.00). Rural

residents also supported a 'haze away' option in this scenario ($\bar{x}$ = 1.58), while urban

residents were neutral towards this type of management ($\bar{x}$ = 0.03). Mean responses

differed between urban and rural residents on two of four management options: 'monitor

the situation' and 'haze away' (p < .05; Table 1). Both urban and rural residents were

opposed to a 'lethal control' management option for this scenario (urban: $\bar{x}$ = -1.21; rural

$\bar{x}$ = -1.67). There was consensus for three of four management options: 'monitor the

situation', 'haze away', and 'lethal control, with PCI$_2$ values ranging from 0.07-0.39

(Figure 2). Both urban and rural residents had little consensus and hovered over the

neutral line relating to the 'do nothing' management option with PCI$_2$ values of 0.39

(rural) and 0.44 (urban) (Figure 2).

A Wood Bison is Seen in your Community
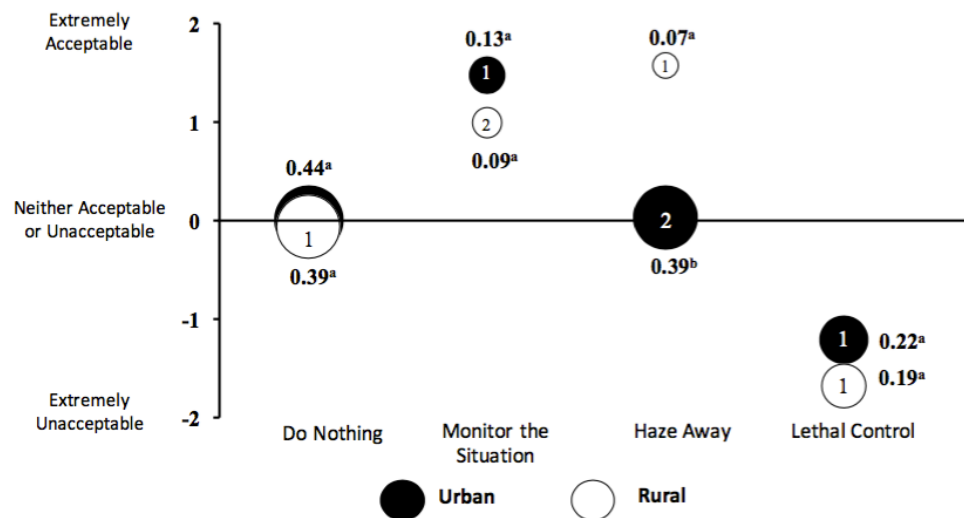
Figure 10. Potential for Conflict Index (PCI2) values for urban and rural acceptability for: 1) doing nothing, 2) monitoring the situation, 3) hazing away, and 4) lethal management in the scenario that a wood bison is seen in the community.

Scenario 2 – wood bison seen near runway. –For this scenario, both urban and rural residents felt that the most acceptable management strategies were 1) 'monitor the situation' (urban: $\bar{x}$ = 1.29; rural $\bar{x}$ = 1.40) and 2) 'haze away' (urban: $\bar{x}$ = -1.21; rural $\bar{x}$ = -1.67). In contrast, both groups felt that it was unacceptable to 1) 'do nothing' (urban: $\bar{x}$ = -0.91; rural $\bar{x}$ = -0.26) and 2) and to use 'lethal control' (urban: $\bar{x}$ = -0.86; rural $\bar{x}$ = -1.53). Mean responses differed between the urban and rural samples on three of the four management options (do nothing, haze away, lethal control) ($p < .05$; Table 1). The PCI$_2$ values for this scenario ranged from $< .01$ - .36 (Figure 3).
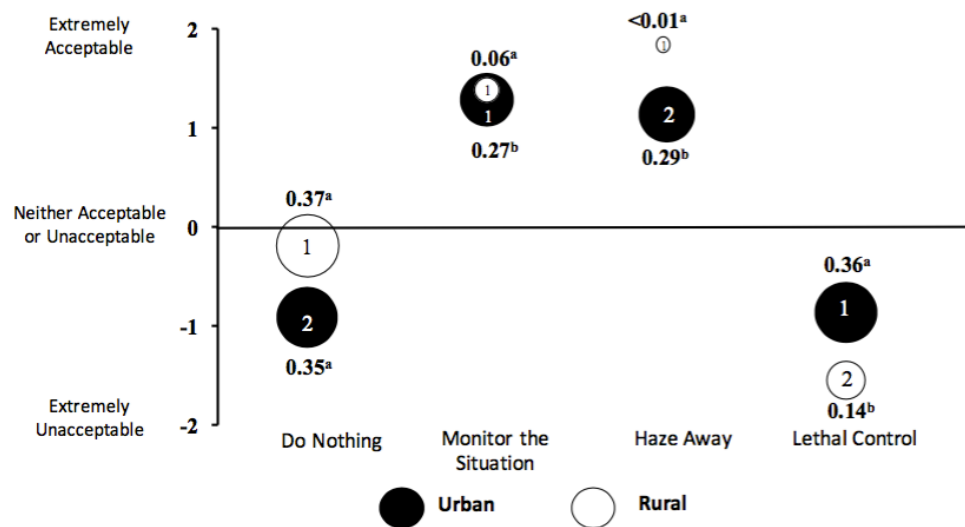
Figure 11. Potential for Conflict Index (PCI2) values for urban and rural acceptability for: 1) doing nothing, 2) monitoring the situation, 3) hazing away, and 4) lethal management in the scenario that a wood bison is seen near the runway.

Scenario 3 – wood bison damages property. –Similar to scenario 2, urban and rural residents agreed that 'monitoring the situation' (urban: $\bar{x}$ = 1.16; rural $\bar{x}$ = 1.40) and 'hazing away' (urban: $\bar{x}$ = 0.98; rural $\bar{x}$ = 1.37) were the best management options in this case. While 'doing nothing' (urban: $\bar{x}$ = -0.40; rural $\bar{x}$ = -1.23) and 'lethal control' (urban: $\bar{x}$ = -0.94; rural $\bar{x}$ = -0.40) were still unacceptable to both urban and rural residents. Mean responses only differed for the 'do nothing' option ($p < .05$; Table 1). The degree of consensus (PCI$_2$ values) within groups for each option ranged from .09 - .41. There was, however, less consensus among both urban and rural respondents regarding direct management options (i.e. hazing and killing) with PCI$_2$ values ranging from .26 - .41.
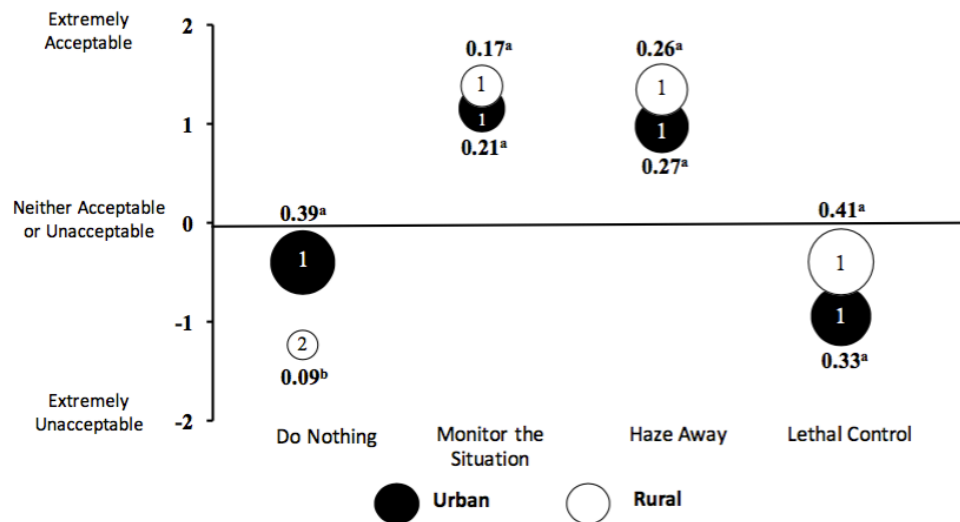
Figure 12. Potential for Conflict Index (PCI2) values for urban and rural acceptability for: 1) doing nothing, 2) monitoring the situation, 3) hazing away, and 4) lethal management in the scenario that a wood bison damages property.

Scenario 4 – wood bison attacks and injures someone. –Urban and rural residents both supported 'monitoring the situation' in this scenario (urban: $\bar{x} = 1.01$; rural $\bar{x} = 1.76$). 'Doing nothing' was also an unacceptable (urban: $\bar{x} = -1.20$; rural $\bar{x} = -1.86$). Mean responses differed between urban and rural residents on all four management options ($p < .05$; Table 1). The differences, however, were greater for the two direct management options; urban people favored 'hazing' ($\bar{x} = 1.12$) and were neutral-slightly opposed to 'lethal control' ($\bar{x} = -0.06$). In contrast, rural residents opposed 'hazing' ($\bar{x} = -0.72$) and strongly supported 'lethal control' ($\bar{x} = 1.62$). Consensus ranged from high to low, with PCI$_2$ values spanning from $< .01 - .53$. The least consensus existed in the urban population with respect to 'lethal control' (PCI$_2 = .53$).
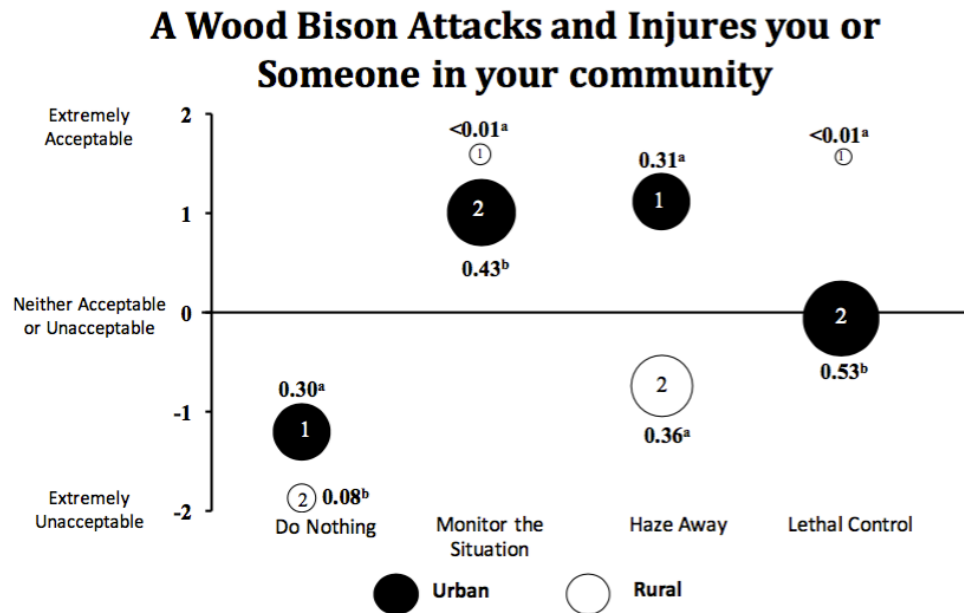
Figure 13. Potential for Conflict Index (PCI2) values for urban and rural acceptability for: 1) doing nothing, 2) monitoring the situation, 3) hazing away, and 4) lethal management in the scenario that a wood bison attacks and injures someone.

Overall, the analyses supported all three hypotheses. Urban and rural residents differed in the preferences across 10 of the 16 potential human-bison conflicts (H1). Potential for conflict varied across the scenarios; when situations became more severe less consensus was documented among groups (H2). In 14 of 16 cases, urban residents had less consensus than rural residents on their preferences for management options (H3).

Discussion

Certainly the impacts of the wood bison reintroduction will be felt within the rural villages the most, urban respondents are not likely to be impacted directly. Given the lack of support for lethal management, urban and rural Alaskans were tolerant of wood bison, even when property has been damaged or when a wood bison attacks and injures

someone. Our results present areas of conflict and consensus on wood bison management strategies under scenarios of potential human-wood bison conflict. Support for management strategies (direct or indirect) will depend highly on the animal and the context (Sponarski *et al*. 2015a), however our findings on newly reintroduced wood bison are closely related to numerous other studies looking at management acceptability of a variety of wildlife species (Kaltenborn *et al*. 2006; Sponarski *et al*. 2015a; Liordos *et al*. 2017).

A high degree of similarity exists between urban and rural resident views toward indirect management options. Both groups believe it is generally unacceptable for wildlife managers to 'do nothing' in the case of human-bison conflict, while it is viewed as acceptable for them to 'monitor the situation'. Wildlife managers in Alaska will need to communicate clearly their 'monitoring' efforts so that locals and urban residents believe the situation is in fact being 'monitored' and not that wildlife managers are perceived as 'doing nothing'. For both indirect management options (doing nothing and monitoring the situation), there were varying levels of consensus. This is important because it makes indirect management an easy and preferred option for wildlife managers in the future.

Potential for conflict was highest when assessing direct management in the scenario that a *wood bison attacks and injures someone*. Urban and rural residents are on opposite sides of the spectrum on 'hazing away' a bison that has injured someone, with relatively low levels of consensus within each group. This illustrates a high potential for conflict between urban and rural residents, but also within the two groups. Most concerning for wildlife managers is the potential for conflict that exists if a method of 'lethal control' was used if a *wood bison attacked and injured someone*. This is no

surprise, as often times lethal control as a management action is a highly contentious issue faced by wildlife managers even under severe situations (Sanborn and Schmidt 1995; Sponarski *et al*. 2015a). While rural residents are strongly in favor of this management option, urban residents are neutral to slightly opposed to the option, but with very little consensus within the group. This suggests high potential for conflict within the urban population if this type of management action is to be used in the future. In addition, wildlife managers will see the biggest divide between urban and rural residents when implementing a decision on lethal management under this scenario. This is similar to findings related to predator management in rural Africa when wildlife threatens human life (Kaltenborn *et al*. 2006). Loyd and Miller (2010) also found that rural residents were more supportive of lethal control of feral cats in the United States, while urban residents preferred non-lethal options. The public will prefer non-lethal types of management as opposed to lethal if the context does not affect human health, regardless of predator/non-predator status (Wittman *et al*. 1998; Kaltenborn *et al*. 2006; Sponarski *et al*. 2015a; Liordos *et al*. 2016).

These findings could be based on the rural residents in the United States being more utilitarian (Schwartz 2006; Manfredo *et al*. 2009; Teel and Manfredo 2010). Support for lethal management will be most acceptable when it is seen as necessary in preserving or bettering the natural environment (Dandy *et al*. 2012). In this case, lethal management is not a controversial issue to the population closest to the resource, rather for the urban population further away. While the urban population is a larger constituency for the Alaska Department of Fish and Game than the rural village residents, wildlife managers may wish to support lethal management to maintain the high degree of

tolerance and support from the local communities but understanding that such a decision will be met with opposition from the urban residents. The issues of lethal management are very much linked to how a nuisance animal is defined. This research has show that a wood bison that is seen in the community or near the runway or damages property is not viewed as a nuisance animal.

It is likely urban residents are less likely to support lethal management for a few reasons: (1) they are far away from the resource; (2) there are is a lower percentage of hunters and utilitarian individuals; and (3) there were a higher percentage of female respondents in the urban sample, who are less likely to support management that causes harm the animal (Koval and Mertig 2004; Loyd and Miller 2010). Rarely has human dimensions data provided such clear direction for wildlife managers in lethal management context of a newly reintroduced species for conservation purposes. Despite any differences in rural and urban management preferences and potential for conflict under contextual situations; there is an overwhelming positive acceptance and tolerance to coexist with wood bison by both urban and rural Alaskans.

We were surprised with the limited information regarding urban and rural views toward management options in addressing human-wildlife conflicts (Loyd and Miller 2010; Ambarlı 2016), particularly in new restoration programs. Given that species are reintroduced in rural areas but, consumed also by urban residents through state hunting allocation, understanding preferences from both groups is essential. In our study, the high levels of acceptance of human-bison interactions are indeed positive. Such local support has led to protection of the resource and to date no poaching of any animals by local

residents that have been directly involved in the management planning process has occurred. Unfortunately, a wood bison that had travelled outside of the immediate release area was recently illegally harvested by a resident not involved in the planning process. We are fortunate in this situation that the local residents from the release area have chosen to be supportive of protecting bison. The involvement of local communities early in the process and having them as an integral part of creating the management plan has certainly contributed to this public support and overall success of the wood bison restoration project to date. This positive outlook has occurred through active listening; maintaining this support will require managers to continue to act on these rural views rather than the urban majority farther away. This is a challenge, as usually the local views are more negative toward a species and as wildlife managers we argue that the majority often farther away from the resource should have a say. Indeed, urban residents will be the primary consumers of the resource and balancing the views heard from these two constituencies will be a management challenge.

Implications for Future Wildlife Management

The findings of this study provide preliminary understanding of how rural residents in the immediate wood bison release area feel about bison management in order to address current management needs (Alaska Wood Bison Management Plan 2015). This allows wildlife managers to understand and plan according to the local priorities, with an influence of urban preference.

With that said, we lack information on the broader rural Alaska population. Now that public involvement and management research has taken place in the immediate bison

release area, of particular future importance will be the rural regions with relatively close proximity to the release site. This means that wildlife managers will have to broaden the diameter of involvement efforts to more distant rural villages in the state in order to stay proactive with potential bison range expansion. The recent poaching of 'Bison 124' (Demer 2017) accentuates this need to integrate human dimensions even more so in the continued conservation and management of the herd. This research is not stagnant and plays an active and ongoing role in minimizing resource conflicts. As wood bison expand their range, more communities will become adjacent to the wildlife resource and managers will need to continue their effective public involvement strategy in order to maintain high public tolerance to wood bison.

Future concerns could arise due to potential interbreeding between the restored wood bison on the Innoko River and the Farewell Plains Bison herd roughly 300 km to the east. This could have harvest, ecological, and social implications. Biologists will need to discuss the biological/ecological implication, but social scientists will need to address the social implications concerning support and acceptability of this potential situation. The herd will not expand effectively without broadening public support. Expanding rural assessment as wood bison expand their range will generate new social partners that will enter into decision-making and will also help gauge the support for future wood bison restoration initiatives in rural Alaska. With that said, this must not come at the expense of urban resident views, as the urban population of Alaska comprise the majority of the state population (Alaska Census 2010) and therefore drive the political decision-making process.

We have documented that differences between urban and rural residents exist with regard to wood bison management. This provides managers with adequate insight into managing these animals in the immediate future. What we lack, however, is an understanding *why* these differences exist. Differences between urban and rural people may exist for a variety of reasons, human dimensions seeks to understand knowledge gaps related to how and why people think differently regarding resource management issues (Decker *et al.* 2012). Minimal research has looked to address specific differences in populations based on cultural, social, or demographic factors. This could greatly improve the capacity of human dimensions research to better understand why populations differ in their preference for wildlife management decisions. Differences may occur due to the predominant Alaska Native population in the rural area and the non native population in the urban areas. Indigenous people may demonstrate culturally distinct ways of interacting with and understanding wildlife (Sandlos, 2011; Will, 2015). It is important for wildlife managers to acknowledge the differences and similarities in urban and rural views represented in this paper, but also to plan to better understand the underlying reasons influencing these views as these variables could affect the success of other aspects of the management plan or even future restoration initiatives.

This research has addressed specifically one (e.g. defining nuisance animal) of many aspects of the wood bison management plan. A continued effort will be required to test other aspects of the management plan with a broader audience. Managers now have an informed idea of what should be done in the case of wood bison-human conflict situations. Most notably, in the coming years, managers will need to understand public support for resource allocation particularly involving wood bison hunting. This will be a

pressing issue considering the large majority of users will be from other parts of the state, presumably urban areas (Alaska Wood Bison Management Planning Team 2015). The management plan does discuss non-consumptive wildlife viewing opportunities of bison for all Alaskans. Traditionally, human dimensions researchers have focused on hunting issues (Bath 1998; Manfredo 2008; Decker *et al*. 2012), but there is a need to explore potential conflicts between consumptive and non-consumptive activities (National Research Council 1997). Wildlife viewing, particularly of large game, is important in Alaska, clearly illustrated by the popularity of the McNeil River (Aumiller and Matt 1994) and Brooks River (Higham *et al*. 2008) bears (Whittaker 1997) and Denali National Park (Skibins *et al*. 2012) to name a few. Wood bison offer an additional wildlife viewing opportunity for visitors and Alaska residents alike.

Methodologically, we have demonstrated the strength of using PCI_2, a relatively new tool in human dimensions research (Vaske *et al*. 2010; Engel *et al*. 2017). While PCI_2 has been used in several areas once animals are on the ground and conflicts begin to occur (Frank *et al*. 2015; Sponarski *et al*. 2015b), we see incredible opportunities to use PCI_2 as a strategic planning tool for wildlife managers in the context of reintroductions. In this role, PCI_2 can be a proactive way to: (a) investigate similarities and differences across different publics, (b) explore attitudes and acceptability of management options, and (c) understand overall support for restoration initiatives before animals are on the landscape.

Conclusion

With almost two years of no illegal poaching, officials have called the killing of Wood Bison 124 a rare "restoration setback" (Khachatoorian 2017). While this poaching is unlikely to have any effect on the rest of the population, it is deemed detrimental as this bison had been regarded as a pioneer and leader in the group travelling hundreds of miles from the Alaska Yukon to the Kuskokwim Delta, exploring the southern range of habitat with the potential for starting a satellite herd (Demer 2017). This echoes a past rhetoric of conservation tragedies based on a lack of human dimensions grounding.

A public with no involvement in the process of restoring a species may take actions against the recently restored species (e.g. timber wolf translocation in Michigan (Weise et al. 1975) or bear restoration in Austria (Zedrosser *et al*. 1999) and other parts of eastern Europe (Kaczensky *et al*. 2011)). Wildlife management is about managing people. While wildlife managers in Alaska have been successfully involving the public throughout restoration efforts, the poaching incident represents a need for expanding these efforts to more regions potentially affected by wood bison in the future. We have shown high tolerance toward wood bison from rural and urban Alaskans and we have also shown where conflict may arise in the case of wood bison-human interaction. There is a need for continued and expansive human dimensions work on wood bison management in Alaska. Human dimensions is not a single one-shot study, rather baseline research allows monitoring of attitudes, catching shifts in views that demand immediate action. Such longitudinal studies are limited and similar to biological research that may not monitor wildlife populations each year, HDW research could be integrated to work in a similar

capacity. In successfully involving the public in wildlife decision making and carefully incorporating resident views into wildlife policy, managers will effectively ensure informed management, built trust, and pave the way for future restoration and conservation initiatives.

Acknowledgements

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Chapter 4: Summary

The purpose of this thesis is to develop a baseline understanding of local attitudes in Alaska towards wood bison restoration and management in order to provide useful, informed recommendations to better manage and conserve bison in the state for future generations. The following section consists of a highlight of key findings from the quantitative research, and an analysis of how the research findings fit, or do not fit into the existing literature. This chapter also provides recommendations for future research needs both for the field of HDW and for wood bison management in Alaska. Lastly, I offer recommendations to wildlife managers and decision makers on best practices for wood bison management in the state based on the research findings provided in Chapters 2 and 3 of this thesis.

The quantitative questionnaires used for this study helped achieve my goal of documenting and understand and understanding of Alaskan attitudes toward wood bison and wood bison management in the context of their reintroduction. While the data collected is not generalizable to the entire state of Alaska, we are able to generalize our findings to the cities of Anchorage and Fairbanks, which together comprise the largest urban constituency in the state. Rural data helped understand how residents living with, and around the resource feel about wood bison and their ongoing management.

Discussion

For wildlife reintroductions to be successful, public support for the species and their reintroduction is crucial (Decker et al. 2010). Wildlife agencies have traditionally focused on the biological, ecological, financial, and political grounds for wildlife

restoration, however understanding public attitudes and support has often been overlooked. Human dimensions of wildlife management proactively assesses and forecasts the social climate surrounding wildlife management issues (Bright & Manfredo, 1996; Decker, Riley & Siemer, 2012). The Alaska Department of Fish and Game funded this research understanding the magnitude of the restoration project and the importance of being proactive on managing the animals. This study was able to quantify levels of support for lethal management by understanding the cognitive and emotional predictors of behavioral intention. This research also highlighted areas of conflict and consensus between urban and rural samples with regard to wood bison management.

Consistent with the relevant literature, we found in Chapter 2 that mutualism predicted positive attitudes (Hermann et al., 2012; Hartel et al., 2015) and opposition to lethal management (Teel & Manfredo, 2010; Hermann et al., 2012; Sijtsma et al., 2012); fear predicted negative attitudes (Decker & Bath, 2010; Zajac et al., 2012; Engel et al., 2017) and support for lethal management (Marchini & Macdonald, 2012); and domination predicted support toward lethal management (Sijtsma et al., 2012). Much of this literature has explored cognition and emotion surrounding large carnivores; it is interesting that these concepts also show similar trends with respect to wood bison, a large herbivore.

We also found our results from Chapter 3 to be consistent with the literature on wildlife management and PCI_2. Our research found that differences existed between urban and rural preference for management strategies (Bandara & Tisdell, 2003; Ambarlı, 2016). Results showed that the potential for conflict varied greatly based on the severity of the scenario (Sponarski et al., 2015; Engel et al., 2017). Lethal management of wood

bison was, on average, unacceptable. Very few studies have attempted to understand conflict and consensus relating herbivore management, and no research has studied this segmenting urban and rural populations. The PCI$_2$ analysis used in Chapter 3 tells us that public preference for management of large herbivore species does not deviate much from that of large carnivore studies. Overall, results have shown a tolerance among the urban public and rural residents to coexistence with wood bison.

In contrast to the literature, in Chapter 2 we found that domination WVO predicted positive attitudes toward wood bison (Hermann et al. 2013), rather than negative. Past research has shown that individuals with a more utilitarian mindset would have negative attitudes toward the species in question. As previously discussed in Chapter 2, the positive attitudes toward wood bison could be attributed to the nature of the Alaska population. Alaska has the highest density of hunters and the most utilitarian (domination) population in the western US, therefore positive attitudes towards wood bison may arise based on the harvest potential of the animal (Manfredo et al., 2009). Additionally, attitudes toward wood bison showed no significant influence on behavioral intention to support lethal management practices. The significant relationship between attitudes and behaviour is one the most nuanced understandings in the cognitive hierarchy (Vaske & Donnelly, 1999). Some of these inconsistencies may be due to attitudes still being formed and the potentially limited public knowledge surrounding the wood bison restoration. In this case, individuals will tend to fall back on broader values, as opposed to the inconsistent (unformed) attitudes; this would be consistent with our findings. As mentioned in Chapter 2, as interactions, media, and education related to wood bison in

Alaska increase, public attitudes will begin to form into a reliable cognitive predictor of human behaviour.

In conclusion, this thesis has relevance to the field of human dimensions of wildlife as it: (a) explored and identified how cognitions and emotions affect lethal management of wood bison, and (b) identified areas of conflict and consensus among urban and rural residents regarding the management of a newly restored large herbivore species. This research contributes to a diminishing body of literature focused on understanding human emotions and cognitions regarding large herbivore management. In addition, this research has explored the very unique context of wood bison restoration, providing a very important baseline for establishing management policies for newly restored wildlife species. Results from this research, therefore, should help management implement management strategies salient with public preference. In summary, it was observed that the public has a high tolerance to coexist with wood bison in Alaska, however future research and management strategies are needed to preserve the long term sustainability of the wood bison population in Alaska.

Given the single field season (due to financial and time constraints), and the geographic isolation of Alaska (rural study areas only accessible by air), sampling constraints limited the range of participants in the study. The urban sample in this research consisted of Anchorage and Fairbanks as the two urban centers closest to the resource, however a full urban study might include Juneau in this sample. The rural study area consisted on four very small villages and time constraints limited the amount of interviews that were able to be conducted. Therefore, I suggest expanding the data collection in urban areas to include all three major urban centers in Alaska (or a full

Alaska sample), and to extend time in rural villages to maximize the amount of interviews for more comprehensive data.

Considering some of the limitations of this study, in the following section of this chapter, I outline some recommendations for future research as well and recommendations for wildlife managers and decision makers on wood bison management.

Recommendations for Future Research

I. Expand the investigation on the effect of emotional dispositions (beyond fear as a single disposition) on acceptability of lethal management strategies under potential wood bison-human conflict (see Jacobs et al., 2014 for details on expanding research on emotional dispositions);

II. Further explore the role of cognitive variables capable of influencing behaviour intention to support of oppose management strategies. More directly, I suggest that knowledge be incorporated into a similar model in the case of a reintroduction context to better understand whether a lack of knowledge results in a public with undeveloped attitudes (see Enck & Brown, 2002; Vaske & Donnelly, 2007; and Decker et al., 2010) for more information on the effect of knowledge on attitudes);

III. Examine a broader range of rural study areas to account for wood bison range expansion. This should include research on attitudes towards the extralimital movement of the wood bison and their potential mixing with the Farewell plains bison herd (see Jung, 2017 for more information on extralimital movement and the potential effects of bison mixing);

IV. Continue human dimensions research on wood bison management and public attitudes. For years, researchers have pleaded for the longitudinal collection of social science data for wildlife management (see Majic and Bath, 2010), and as wood bison populations increase, questions of lethal management will become more relevant over time;

V. Examine factors of future wood bison harvests in Alaska. Before harvest is planned, to limit potential conflict, research should address bison harvest allocation issues (urban/rural/non-resident), method of harvest, local village needs, etc. Allocation of harvest drives management conflict in Alaska and should be proactively understood.

VI. Similar to any field of academic discipline, which is built on its own language, human dimensions is revisiting the jargon of the trade. This thesis has been based on the traditional use of concepts such as beliefs (Hendee & Potter, 1971), attitudes (Rokeach, 1973), values (Purdy & Decker, 1989), and perceptions and behaviours (Vaske & Donnelly, 1999). These terms are being revisited (see Bennett et al., 2017), leading the field in a broader direction. Future research must address both traditional and changing terms within the field to ensure consistency with the literature.

Recommendations for Managers and Decision Makers

I. Work to maintain and improve relationships with rural villages, providing an environment where the different interest groups from the Wood Bison Planning

Team can openly discuss their issues and concerns wood bison management together, through continued applied human dimensions facilitated workshops (see Bath, 2009);

II.   Continue biological monitoring of wood bison movement to better understand when more social science research is needed in other rural regions of Alaska.

III.   Formulate a comprehensive strategy for the first year of hunting wood bison in Alaska. This should involve the education program for local communities to take in outside hunters as well as a full list of rules and regulations for hunting allocation and harvesting.

IV.   Develop communication campaigns and education programs designed to increase knowledge, improve attitudes, decrease fear, and limit support for lethal management strategies regarding wood bison;

V.   Need to invest in wildlife-based tourism as a way to improve the local economy, provide more tourist attractions to both urban and rural Alaskan, and ultimately garner more positive attitudes toward wood bison in rural regions. Such topics are currently being explored in another masters thesis (Franchini Silveira, *in progress*).

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Appendix

Fear Factor:
The Influence of Fear on Bison Management
Alaska, U.S.A.

Dear Resident,

Thank you for agreeing to participate in this research project. Memorial University of Newfoundland in cooperation with the Alaska Department of Fish and Game are interested in learning more about Alaskan attitudes and toward the newly reintroduced wood bison and specific management issues for the animals in years to come. We are sending this questionnaire to a select number of residents so your participation is very important.

All responses, whether opposed to, in favour, or neutral, are valuable to our study and I encourage you to answer all questions. You have the right to withdraw from the study at any time between the point of contact and the time of collection at your own discretion. Your answers will be grouped with those of other respondents and your individual answers will be kept anonymous and strictly confidential.

Thank you for your time and for expressing your views on this topic. If you have any questions about the project please feel free to contact me by phone at 709-725-7219, or by email, at alaskawoodbison@gmail.com.

Sincerely,

Ethan Doney
Project Coordinator
Memorial University M.Sc Candidate
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A Study Conducted Cooperatively by:

SECTION 1: In the following section you will be asked two similar sets of questions. The first set of questions is about *wildlife* in *general* and the second set of questions is about *wood bison* in *general*.

1. To what extent do you disagree or agree with *each* of the following? *(For **each statement**, circle the number that best represents your response.)*

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Humans should manage wildlife populations so that humans benefit.	1	2	3	4	5
Animals should have rights similar to the rights of humans.	1	2	3	4	5
We should strive for a world where there's an abundance of wildlife for hunting and fishing.	1	2	3	4	5
I feel a strong emotional bond with animals.	1	2	3	4	5
Wildlife are on earth primarily for people to use.	1	2	3	4	5
We should strive for a world where humans and wildlife can live side by side without fear.	1	2	3	4	5
People who want to hunt should have the opportunity to do so.	1	2	3	4	5

2. To what extent do you ***disagree or agree*** with *each* of the following? *(For **each statement**, circle the number that best represents your response.)*

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Humans should manage wood bison populations so that humans benefit.	1	2	3	4	5
Wood bison should have rights similar to the rights of humans.	1	2	3	4	5
We should strive for a world where there's an abundance of wood bison for hunting.	1	2	3	4	5
I feel a strong emotional bond with wood bison.	1	2	3	4	5
Wood bison are on earth primarily for people to use.	1	2	3	4	5
We should strive for a world where humans and wood bison can live side by side without fear.	1	2	3	4	5

People who want to hunt wood bison should have the opportunity to do so.	1	2	3	4	5

SECTION 2: These questions ask you for your opinion on *wood bison*, *moose, grizzly bear, and wolves.*

1. In general, do you *think* of **Wood Bison** in Alaska as: *(For each statement, circle the number that best represents your response.)*

	Extremely	Slightly	Neither	Slightly	Extremely	
Bad	1	2	3	4	5	Good
Harmful	1	2	3	4	5	Beneficial
Negative	1	2	3	4	5	Positive

2. In general, do you *think* of **Moose** in Alaska as: *(For each statement, circle the number that best represents your response.)*

	Extremely	Slightly	Neither	Slightly	Extremely	
Bad	1	2	3	4	5	Good
Harmful	1	2	3	4	5	Beneficial
Negative	1	2	3	4	5	Positive

3. In general, do you *think* of **Grizzly Bear** in Alaska as: *(For each statement, circle the number that best represents your response.)*

	Extremely	Slightly	Neither	Slightly	Extremely	
Bad	1	2	3	4	5	Good
Harmful	1	2	3	4	5	Beneficial
Negative	1	2	3	4	5	Positive

4. In general, do you *think* of **Wolves** in Alaska as: *(For each statement, circle the number that best represents your response.)*

	Extremely	Slightly	Neither	Slightly	Extremely	
Bad	1	2	3	4	5	Good
Harmful	1	2	3	4	5	Beneficial
Negative	1	2	3	4	5	Positive

5. To what extent do you *disagree or agree* with *each* of the following? *(For **each statement**, circle the number that best represents your response.)*

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
Wood bison are nuisance animals in the state of Alaska	1	2	3	4	5
Wood bison have a right to exist in the state of Alaska.	1	2	3	4	5
The presence of wood bison is a sign of a healthy environment.	1	2	3	4	5
I may never see a wood bison but it is important to me to know they exist in the state.	1	2	3	4	5
Overall, wood bison population should be completely protected in the state of Alaska.	1	2	3	4	5
Wood bison pose a threat to people in the state.	1	2	3	4	5
If a wood bison attacks a human in the state, the Alaska Department of Fish and Game should be allowed to selectively kill the animal.	1	2	3	4	5

6. Given that **Wood Bison** are now present in the State of Alaska, how do you *feel* about *each* of the following? *(For **each statement**, circle the number that best represents your response.)*

I fear for …	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	
... my own personal health or safety.	1	2	3	4	5	
... my children's health or safety.	1	2	3	4	5	n/a
... my pet's health or safety.	1	2	3	4	5	n/a
... the spread of diseases by bison.	1	2	3	4	5	
… my own property.	1	2	3	4	5	

7. Given that **Moose** are common in the State of Alaska, how do you *feel* about *each* of the following? *(For **each statement**, circle the number that best represents your response.)*

I fear for …	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	
... my own personal health or safety.	1	2	3	4	5	
... my children's health or safety.	1	2	3	4	5	n/a
... my pet's health or safety.	1	2	3	4	5	n/a
... the spread of diseases by moose.	1	2	3	4	5	
… my own property.	1	2	3	4	5	

8. Given that **Grizzly Bear** are common in the State of Alaska, how do you *feel* about *each* of the following? *(For **each statement**, circle the number that best represents your response.)*

I fear for …	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	
... my own personal health or safety.	1	2	3	4	5	
... my children's health or safety.	1	2	3	4	5	n/a
... my pet's health or safety.	1	2	3	4	5	n/a
... the spread of diseases by grizzly bear.	1	2	3	4	5	
… my own property.	1	2	3	4	5	

9. Given that **Wolves** are common in the State of Alaska, how do you *feel* about *each* of the following? *(For **each statement**, circle the number that best represents your response.)*

I fear for …	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree	
... my own personal health or safety.	1	2	3	4	5	
... my children's health or safety.	1	2	3	4	5	n/a
... my pet's health or safety.	1	2	3	4	5	n/a
... the spread of diseases by wolves.	1	2	3	4	5	
… my own property.	1	2	3	4	5	

10. Imagine you are out in the wild:

a. What is the **likelihood** of the following events occurring to you while in the state? *(For **each statement**, circle the number that best represents your response.)*

b. *Wood Bison*

	Extremely Unlikely	Somewhat Unlikely	Neither	Somewhat Likely	Extremely Likely
Seeing a wood bison.	1	2	3	4	5
Being approached by a wood bison.	1	2	3	4	5
Being charged at by a wood bison.	1	2	3	4	5
Having property damaged by a wood bison	1	2	3	4	5

c. Moose

	Extremely Unlikely	Somewhat Unlikely	Neither	Somewhat Likely	Extremely Likely
Seeing a moose.	1	2	3	4	5
Being approached by a moose.	1	2	3	4	5
Being charged at by a moose.	1	2	3	4	5
Having property damaged by a moose.	1	2	3	4	5

c. Grizzly Bear

	Extremely Unlikely	Somewhat Unlikely	Neither	Somewhat Likely	Extremely Likely
Seeing a grizzly bear.	1	2	3	4	5
Being approached by a grizzly bear.	1	2	3	4	5
Being chased by a grizzly bear.	1	2	3	4	5
Having property damaged by a grizzly bear.	1	2	3	4	5

d. Wolf

	Extremely Unlikely	Somewhat Unlikely	Neither	Somewhat Likely	Extremely Likely
Seeing a wolf.	1	2	3	4	5
Being approached by a wolf.	1	2	3	4	5
Being approached by a wolf, snarling.	1	2	3	4	5
Having property damaged by a wolf.	1	2	3	4	5

11. How much *control* do you feel you have at preventing the following from occurring to you while you are out in the wild? *(For **each statement**, circle the number that best represents your response.)*

a. Wood Bison

	No Control	Nearly No Control	Neither	Some Control	Complete Control
Seeing a wood bison.	1	2	3	4	5
Being approached by a wood bison.	1	2	3	4	5
Being charged at by a wood bison.	1	2	3	4	5
Having property damaged by a wood bison	1	2	3	4	5

b. Moose

	No Control	Nearly No Control	Neither	Some Control	Complete Control
Seeing a moose.	1	2	3	4	5
Being approached by a moose.	1	2	3	4	5
Being charged at by a moose.	1	2	3	4	5
Having property damaged by a moose.	1	2	3	4	5

c. Grizzly Bear

	No Control	Nearly No Control	Neither	Some Control	Complete Control
Seeing a grizzly bear.	1	2	3	4	5
Being approached by a grizzly bear.	1	2	3	4	5
Being chased by a grizzly bear.	1	2	3	4	5
Having property damaged by a grizzly bear.	1	2	3	4	5

d. Wolf

	No Control	Nearly No Control	Neither	Some Control	Complete Control
Seeing a wolf.	1	2	3	4	5
Being approached by a wolf.	1	2	3	4	5
Being approached by a wolf, snarling.	1	2	3	4	5
Having property damaged by a wolf.	1	2	3	4	5

SECTION 4. Situations Involving: I will describe 3 different situations involving wood bison. Think about what each situation would be like for you. Then respond to the questions about the situation.

SCENARIO #1: Imagine that **a bison is seen in your community.** *(For each item, circle the answer closest to your own response.)*

1. Would you say that your experience in knowing that a bison is seen in your community would be a negative, neutral, or positive experience? *(Circle the response that best represents your opinion.)*

    ❏ Extremely Negative ❏ Negative ❏ Neutral ❏ Positive ❏ Extremely Positive

2. Given Scenario 1: how *unacceptable or acceptable* would it be for Alaska Department of Fish and Game to take *each* of the following actions? *(For **each statement**, circle the number that best represents your response.)*

Management Action	Unacceptable Extremely	Somewhat	Neither	Somewhat	Acceptable Extremely
.. do nothing	1	2	3	4	5
.. monitor the situation	1	2	3	4	5
.. educate the public	1	2	3	4	5
.. frighten the wood bison away	1	2	3	4	5
.. capture then relocate the wood bison	1	2	3	4	5
.. kill the wood bison	1	2	3	4	5

1. Would you say that having a wood bison near the runway would be a negative, neutral, or positive experience? *(Circle the response that best represents your opinion.)*

❏ Extremely Negative ❏ Negative ❏ Neutral ❏ Positive ❏ Extremely Positive

2. Given Scenario 2, how ***unacceptable or acceptable*** would it be for Alaska Department of Fish and Game to take ***each*** of the following actions? *(For **each statement**, circle the number that best represents your response.)*

Management Action	Unacceptable Extremely	Somewhat	Neither	Somewhat	Acceptable Extremely
.. do nothing	1	2	3	4	5
.. monitor the situation	1	2	3	4	5
.. educate the public	1	2	3	4	5
.. frighten the wood bison away	1	2	3	4	5
.. capture then relocate the wood bison	1	2	3	4	5
.. kill the wood bison	1	2	3	4	5

1. Would you say that a wood bison damaging your property would be a negative, neutral, or positive experience? *(Circle the response that best represents your opinion.)*

    ❏ Extremely Negative   ❏ Negative   ❏ Neutral   ❏ Positive   ❏ Extremely Positive

2. Given Scenario 3, how *unacceptable or acceptable* would it be for Alaska Department of Fish and Game to take *each* of the following actions? *(For **each statement**, circle the number that best represents your response.)*

Management Action	Unacceptable				Acceptable
	Extremely	Somewhat	Neither	Somewhat	Extremely
.. do nothing	1	2	3	4	5
.. monitor the situation	1	2	3	4	5
.. educate the public	1	2	3	4	5
.. frighten the wood bison away	1	2	3	4	5
.. capture then relocate the wood bison	1	2	3	4	5
.. kill the wood bison	1	2	3	4	5

SCENARIO #4: Imagine that **a wood bison attacked and injured you, or someone in your community**. *(For each item, circle the answer closest to your own response.)*	

3. Would you say that a wood bison injuring you, or someone in your community would be a negative, neutral, or positive experience? *(Circle the response that best represents your opinion.)*

❏ Extremely Negative   ❏ Negative   ❏ Neutral   ❏ Positive   ❏ Extremely Positive

4. Given Scenario 3, how ***unacceptable or acceptable*** would it be for Alaska Department of Fish and Game to take ***each*** of the following actions? *(For **each statement**, circle the number that best represents your response.)*

Management Action	Unacceptable Extremely	Somewhat	Neither	Somewhat	Acceptable Extremely
.. do nothing	1	2	3	4	5
.. monitor the situation	1	2	3	4	5
.. educate the public	1	2	3	4	5
.. frighten the wood bison away	1	2	3	4	5
.. capture then relocate the wood bison	1	2	3	4	5
.. kill the wood bison	1	2	3	4	5

SECTION 5: Please provide the following information about yourself. Thank you.

1. Do you identify as:

❏ Female ❏ Male ❏ Other

2. Do you identify as Alaska Native?

❏ Yes ❏ No

4. What is your age?

❏ 18-24 years ❏ 25-34 years ❏ 35-54 years
❏ 45-54 years ❏ 55-64 years ❏ Over 65 years

5. Are there any other comments you wish to make?

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On behalf of Memorial University and Alaska Department of Fish and Game, thank you again for your participation.