URBAN AND RURAL PERCEPTIONS TOWARD THE REINTRODUCTION OF WOOD BISON IN ALASKA, USA

by

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"One of the key determinants of success in biodiversity conservation is how well conservation planning decisions account for the social system in which actions are to be implemented" (Guerrero & Wilson, 2016).

Note: Thesis partially completed during the Covid-19 Pandemic.

ABSTRACT

This study investigates public perceptions surrounding wood bison restoration in Alaska, differentiating responses by urban and rural settings and hunting participation. It establishes and compares baseline levels of social acceptability norms, trust in the wildlife agency, and perceived impacts (both risks and benefits) of the reintroduction. The study encompasses two major urban centers and four rural villages near the release site. Data collected through mail surveys and structured interviews are analyzed using t-tests and ANOVA, with reported effect sizes. Overall, the public holds positive views regarding bison and its management. Notably, rural participants display higher levels of trust, management support, and expectations of impacts. Conversely, urban hunters exhibit the lowest endorsement of proposed management actions. These findings underline the importance of tailored communication and education efforts to address variations in perceptions among distinct groups and ensure effective conservation strategies. The study also highlights potential opportunities and recommendations tied to the wood bison reintroduction initiative.

Keywords: Human Dimensions; Wood bison; *B. b. athabascae*; Alaska; Reintroduction; Impacts; Risks; Benefits; Trust; Norms; Rural; Urban; Hunter; Management; Acceptance.

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Finally, I thank my family and friends for dealing with and supporting me during this project, especially my fiancé, who listened and helped me in many ways and occasions I couldn't describe, and my mom, whose continuous support truly made all this possible.

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LIST OF ABBREVIATIONS

ADFG = Alaska Department of Fish & Game

AK = Alaska

EINP = Elk Island National Park

ESA = Endangered Species Act

HD = Human Dimensions

HDW(M) = Human Dimensions of Wildlife (Management)

NA = North America

NP = National Park

NH = non-Hunters

UR = Urban hunters

RH = Rural Hunters

US/A = the United States of America

USFWS = US Fish and Wildlife Service

WM = Wildlife Management

TRA/TPB = Theory of Reasoned Action/Theory of Planned Behavior

HAM = Hazard Acceptance Model

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PREFACE ON THE INDIGENOUS CONTEXT OF MY THESIS

This study investigates the perceptions of urban and rural Alaska residents related to the wood bison reintroduction to the state. Due to Alaska's unique history, the composition of these groups can also be described as primarily Native (i.e., rural) and non-Native (i.e., urban) populations. Being trained initially as a biologist before entering the master's program in geography, in conducting this research, I have kept mindful of my limitations and the importance of approaching the study with cultural sensitivity. With deep respect for the knowledge systems of the Indigenous communities involved while engaging with the communities in this research, my thesis did not directly engage Indigenous knowledge of bison. The results obtained in this study have been presented to and shared with all the communities and interest groups. Additionally, this thesis will be made available to them, and peer-reviewed research articles deriving from it will be prepared to further disseminate the results.

It's important to note that this study's data collection predates the adoption of the "*Research Impacting Indigenous Groups*" (RIIG, 2020) policy by Memorial University of Newfoundland, which aims to "ensure Researchers carry out and continue to carry out appropriate engagement with Indigenous collectives in Indigenous research, starting at the research design stage" (policy available at: *www.mun.ca/policy/browse-or-search*). This study nevertheless maintained full ethical clearance throughout the thesis timeline (ICEHR #20160097-AR). Also worth noting is that the Alaska Department of Fish and Game was the sponsor of this study, and there was a considerable amount of work done previous to this study (and also continued thereafter) to involve the local Native communities through a rigorous public involvement process of workshops, with the commitment of providing them

with an active voice, involvement throughout the whole process, and clear benefits from it (e.g., hiring of locals for local work demands related to the restoration and management of wood bison in the area). All four local communities present in the area had expressed interest in wood bison, with continued support and involvement through the years, leading to a very positive welcome when I arrived to conduct this research. During my first visit to the area, I already shared the privilege of being invited to speak about the research project during the "*Denakkanaaga, Elders and Youth Conference and Annual Meeting*". This major local cultural event unites people from all the surrounding communities to exchange knowledge as "Native Elders speak out on social and cultural issues, passing on their traditions, language, skills, stories and values" (more info at: *www.denakkanaaga.org*). These interactions profoundly affected me when I learned about their culture and way of life and participated in ice cream making and other traditional activities. It was an opportunity for trust development and carried great personal value for me.

North American Indigenous Peoples have diverse self-identification preferences, which can vary even within the same community. Standard general terms include *Native American*, *Indigenous, American Indian*, *Native*, and *Indian.* When discussing Native groups or individuals, it is appropriate to employ the terminology used by the community members to describe themselves. In different regions of the Western Hemisphere, various terms are utilized. In the Arctic, the *Inuit, Yup'ik*, and *Aleut* Peoples perceive themselves as culturally distinct from the *Indians*. In Canada, individuals may identify themselves as *First Nations*, *First Peoples*, or *Aboriginal* (see: *americanindian.si.edu*). In Alaska, the term *Alaska Native* is widely used.

Officially, the U. S. Census Bureau statistics reported in this study follow the 1997 Office of Management and Budget standards (OMB, 1997), requiring five minimum race categories: *White*, *Black or African American*, *American Indian or Alaska Native*, *Asian*, and *Native*

Hawaiian or *Other Pacific Islander*. Respondents self-identify and report one or more races for themselves and their household members, including a sixth category, “Some Other Race” (U.S. Census Bureau, 2019). The "*American Indian or Alaska Native*" category serves as the foundation for population estimates, capturing data on both groups. According to the OMB standard, an *American Indian or Alaska Native* is an individual whose roots trace back to the original peoples of North, Central, and South America and who maintains tribal affiliation or community connection. Those identifying as *American Indian* or *Alaska Native* can specify their enrolled or principal tribe, allowing for the reporting of multiple tribes. Data for this category include those who: identify their race as *American Indian* or *Alaska Native*; specify a particular American Indian tribe (e.g., Navajo, Blackfoot), or Alaska Native tribe (e.g., Inupiat, Yupik); or identify with other groups such as Canadian Indian, French American Indian, or Spanish American Indian (U.S. Census Bureau, 2019).

Presently, the majority of Alaska Natives reside in small villages and remote regional centers, despite the growing urban Native population. Alaska's Indigenous peoples comprise the *Inupiat* from the northern and northwest regions, *Yupik* from the southwest coastal and delta areas, *Aleut/Unangan* along the Aleutian chain, *Alutiiq/Sugpiaq* and *Eyak* from the southcentral coast, *Athabascans* from the interior, and the *Tlingit* and *Haida* of Southeast. Numerous distinct cultures exist within these larger groups (Hunsinger & Sandberg, 2013). The term "*Indian*," still in common use for many Indigenous peoples of the Americas, is not applicable to the *Inuit*, *Yupik,* and *Aleut* populations of Arctic North America. The rural participants in this study, residents of interior Alaska, on the other hand, self-identify as *Athabascan Indians*. The *Athabascan Indians* of interior Alaska and Canada are close relatives of the *Navajos* and *Apaches*. Due to their location, these groups faced harsher living conditions than the groups living by the coast, confronting more frequent famines. They excelled in hunting, tracking, fishing, and foraging. Their valued fringed garments and furs

were often traded with neighboring *Tlingit*, *Yupik*, and *Inupiaq* communities. The *Athabascans* were organized into various tribes with distinct dialects (State of Alaska, 2023).

It is also essential to discuss the larger context of this research, the controversial and complicated story of the demise of the American bison (i.e., plains bison and wood bison). The ecological relationships among bison, humans, and the land in the North American Great Plains are intricate, and the story of "what happened to bison and the people who hunted them over the past twelve thousand years was neither simple nor straightforward" (Cunfer & Waiser, 2016; p. xiii). Since the 1990s, historiography has been challenging the simplicity of the narratives that prevailed in the preceding century. Scholars like Dan Flores (1990; 1991; 2003; 2016a, b, c) and James Sherow (1992) proposed a more intricate narrative in which Indigenous peoples were also implicated in the decline of bison. After all, as emphasized by Anthropologist David C. Posthumus, the history of bison can't be detached from Indigenous history (Posthumus, 2016). Over the last three decades, many authors contributed to the revealing of a more nuanced human and ecological history behind the collapse of the North American bison, such as Geoff Cunfer (2016), George Colpitts (2010; 2012; 2014; 2016), Pekka Hämäläinen (2001; 2003), William Dobak (1995; 1996), Elliott West (1998), Andrew Isenberg (2000), Ted Binnema (2004), among others. The bison inhabited a complex ecosystem shaped by geology, human migrations during the Ice Age, the establishment of Native American nations, and the disruptive changes European colonizers and industrialization brought about. This more nuanced and evolving narrative considers the long-term fluctuations in the balance among humans, animals, vegetation, and climate. It challenges some myths about the settlement of the North American West while emphasizing the central role of the market economy that emerged as part of the colonization, with the commodification of bison (i.e., the robe trade and the meat trade). The story of the bison's demise is complex, shaped by unsustainable practices, encompassing Indigenous horse

culture and Euro-American impact, alongside the interplay of human, animal, vegetation, and climate factors. It questions the idealized views of Native peoples living in perfect harmony with nature, emphasizing the dynamic relationship between people and their environment without oversimplified notions of heroes, villains, or victims (Cunfer, 2016; Flores, 2016a). As well put by Dan Flores, “Hornaday was right all along, at least in part. Bison died from a perfect storm of effects" (Flores, 2016b; p. 43).

Similar were the dynamics that unfolded in the central and northern plains, though historians of the northern plains have yet to conduct a thorough analysis of bison populations comparable to the work done for the southern plains (e.g., Flores, 1991; 2016a, b, c; Brown, 1986). However, the combination of high market demands for bison products and unsustainable hunting practices likely contributed to the decline in the northern bison populations from the late eighteenth century onward (Cunfer, 2016). The nuances of this story will be discussed in the following chapter.

On a final note, considering that this thesis’ study areas were specifically chosen based on their location or urban status, it would be important that future work focus primarily on the views and perceptions of Native versus non-Native peoples to clarify these relationships and differentiate them from their respective locations. This thesis does provide a brief historical review of the Native peoples residing in Alaska; however, later work should have a more direct focus on the Indigenous component of the many rural villages in Alaska, diving further into this theme.

1. Introduction

1.1. Overview

This research thesis is a result of a cooperative effort between Memorial University of Newfoundland (MUN) and the Alaska Department of Fish & Game (ADF&G), as part of a greater project investigating the biological and social aspects involving wood bison restoration to Alaska. It is inserted within the human dimensions of wildlife management scientific field, which explores social-psychological aspects involving wildlife conservation and management. It was approved by the 'Memorial University Interdisciplinary Committee on Ethics in Human Research' (ICEHR #20160097-AR).

This research thesis is written in traditional thesis structure and investigates the following question: How does the public perceive wood bison restoration in Alaska? It is organized into seven chapters and four appendices. Chapter one, *Introduction*, presents the project framework, an introduction about animal recovery, the study context, objectives, and relevance. The next chapter, *Literature Review*, provides information about the field of Wildlife Management, the subfield Human Dimensions of Wildlife Management, the approach, and the history, research, and relationship between humans and bison, as well as the history of wood bison in Alaska. Chapters three and four describe the study area and the methodology used, respectively. The subsequent chapters report the study results, and the discussion of findings. Chapter seven summarizes the study findings, outlines its contributions to the broader HD literature, illustrates how it helped fill several knowledge gaps, and provides clear recommendations for further research and wood bison management practice in Alaska. The next sections contain the *References* and *Appendices*. The appendices contain the research instrument; a summary of the 2015-2020 Alaska wood bison

management plan's goals and objectives; a written transcript of participants' opinions and concerns, voiced during the study, and the reproduction of a map illustrating the extermination of the American bison.

1.2. Project Framework

Wildlife conservation depends largely on the willingness of people to coexist and share a limited amount of space and resources with the wildlife. Therefore, conservation success depends not only on the capacity of wildlife to adapt to a changing environment, but also on people's *acceptance of* (here used interchangeably with *tolerance for*) wildlife and its management by the local agency. Success of wildlife management decisions depends on people's behavior towards wildlife, which is largely determined by human psychology (i.e., the science that studies thoughts and emotions). So, to better understand how people in Alaska view the wood bison reintroduced to the state and its management by the Alaska Department of Fish and Game, this section of the thesis outlines the framework and terms used in this study.

This research is inserted within the field of Human Dimensions of Wildlife (HD), which is a science that draws and builds upon theory and concepts from the social sciences, especially social psychology. Social psychology is concerned with understanding the way in which people's thoughts, feelings and behaviors are influenced by their environment – including cultural factors (Decker et al., 2012). Such expertise can be used to assist wildlife management and conservation in many different issues and topics (e.g., decision-making, management, philosophies, governance, theory, law and policy, politics, planning processes, behavior, values, perceptions, etc.), at various scales (i.e., global/regional; national/sub-national; local/individual), by many types of organizations (e.g., international bodies, politicians, policymakers, scientists, civil society, etc.; Bennett et al. 2017). This research

project investigates trust, perceived impacts and norms, important topics to consider for wildlife management decision-making related to reintroduced wood bison in Alaska, USA. This study is inserted at the local scale, to inform and assist communication and decision-making among the different actors (local governments, management boards, residents of urban areas and local communities, and other relevant stakeholder and user groups inside the state of Alaska).

Typically, humans respond to wildlife-related challenges based on a complex combination of emotions and cognitions (Manfredo, 2008). Human Dimensions research extensively makes use of two theoretical approaches from social psychology: the cognitive and motivation approaches. The cognitive approach examines concepts such as values, value orientations, attitudes, and norms, as well as its relationships, in the processes leading from thought to action, therefore, it can be used to predict behavior (Decker et al. 2001). Its methods involve the self-reporting of people's thoughts, to understand the learning process and the way people form evaluations about their world (Manfredo, 2008). The motivational approach explores why people do what they do. This study will follow the **cognitive approach**. This approach emphasizes attitude and value theories (Vaske, 2008). These theories propose that human thought is arranged in a *hierarchy of cognitions* (Vaske & Donnelly, 1999), suggesting that values determine people's attitudes, which in turn affect behavior (Decker et al. 2001). Before discussing the relevant theories, it's important to outline some important psychological jargon.

Attitudes are perhaps the most studied construct in social psychology (Manfredo et al. 2004). They refer to individual evaluations (favorable or unfavorable) of an entity or object (e.g., like-dislike, positive-negative, good-bad; Eagly & Chaiken, 1993). Differently, **beliefs** are individual assessments of the certainty that a proposition is true, and *can* carry evaluative meaning, but not necessarily need to be tied to an evaluation (Wyer & Albarracín, 2005). For

example, one might believe that a species went extinct, and may or may not attach a positive or negative evaluation to it. Attitudes organize multiple beliefs around specific objects or situations. Attitudes are important because they can influence behavior. Behavior can be divided into **behavioral *intention*** and ***actual*** **behavior**, the first subject to the context, not necessarily always leading to action. Actual behavior may be *automatic* (i.e., involuntary, or unconscious), or under volitional (i.e., conscious) control, which will often involve effortful thinking and processing of relevant information (Slagle & Bruskotter, 2019). It's worth nothing though the not infrequent presence of unstated conscious intentions.

Values are more abstract constructs, formed early in life, and shaped by family and other significant people. They are organized in an enduring system of beliefs about desirable end-states of existence (e.g., freedom, a comfortable life), or appropriate modes of conduct (e.g., honesty, fairness; Rokeach, 1973; Vaske, 2008). They are basic evaluative beliefs that guide life decisions and direct attitudes, norms, and behaviors. Values are considered central to a person's identity, being present across situations and events as standards for determining good/bad, right/wrong, therefore, they are stable and difficult to change (Manfredo, 2008; Vaske, 2008).

Values are frequently shared within groups; therefore, they are not very useful to account for variability in people's attitudes, norms, or behaviors. On the other hand, more targeted basic beliefs, expressed by thoughts about specific objects, can give meaning to the broad values in the form of ***value orientations***, or the patterns of direction and intensity of these beliefs toward specific targets (Vaske, 2008). They reflect the unity, ethos, or social ideology of a group, both at the individual and social level (Kluckholn, 1951). A component of personality, ideology, sometimes called 'worldview', incorporates groups of attitudes and values, including political orientation, religiosity, value systems, morality, assumptions about human nature, etc. The investigation of value orientations sheds light into a group's ideology or

worldview, associating things, people, actions, or activities with the best possible living, according to the observed perspective (Manfredo, 2008; Kluckholn, 1951). Value orientations direct and can predict attitudes, which in turn influence behavior.

Social psychology theories like the ***Theory of Reasoned Action/Theory of Planned Behavior*** (TRA/TPB; Ajzen and Fishbein 1980; Fishbein & Ajzen 2010; see Fig. 1) have been largely used to explain a broad set of human behaviors, continuing today as the dominant theoretical approaches guiding research in behavioral psychology (although not short of critique and modification, e.g., Sniehotta et al., 2014). The TRA/TPB proposes that volitional human behavior is a function of the *intention* to perform a behavior and perceived behavioral control (PBC). PBC refers to the "*generalized belief that one's outcomes are under the control of one's own behavior as opposed to being under the control of such external factors as powerful others or chance*" (Ajzen, 2005; pg. 91). The theory hypothesized that intention is influenced by attitudes toward the behavior, subjective norms and PBC. The degree of actual control over the behavior is hypothesized to influence the degree to which PBC influences behavior directly and indirectly through intention. The strength and evaluation of accessible behavioral controls and normative beliefs are thought to determine attitudes, PBC, and subjective norms (Ajzen and Fishbein 1980; Fishbein & Ajzen 2010; Sniehotta et al., 2014). Many studies have successfully tested this theoretical approach, and, overall, they found intention and PBC to be consistent psychological predictors of behavior, and that successful changes in intention are likely to lead to behavior change (Webb & Sheeran, 2006; McEachan et al., 2011).

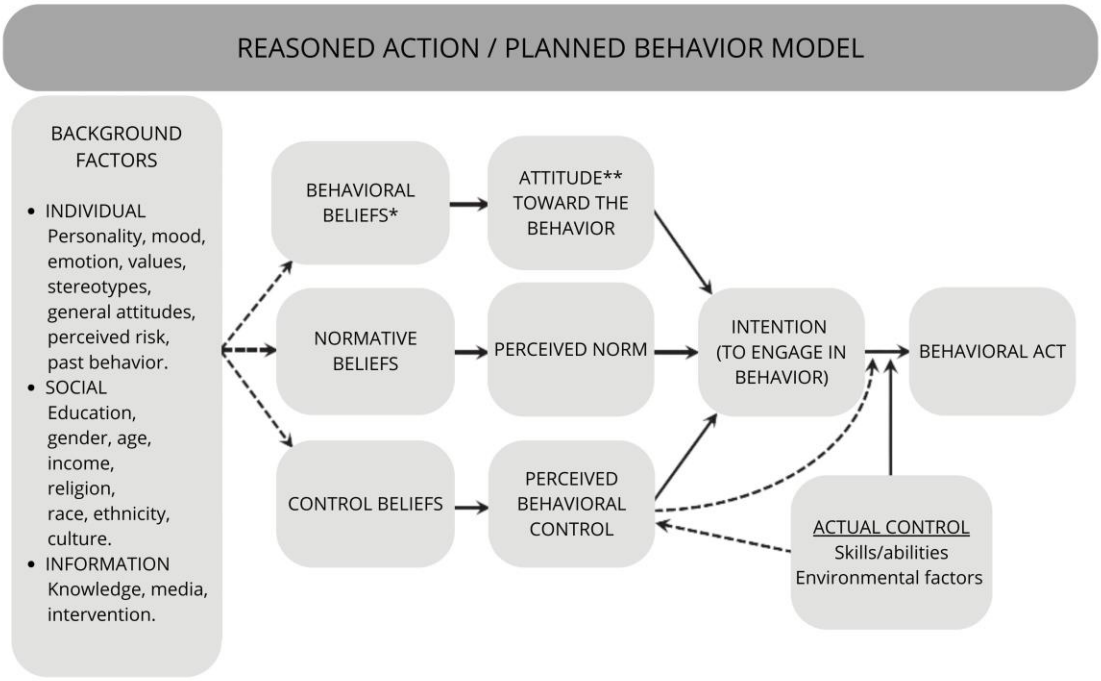

Figure 1. Theory of Reasoned Action/Planned Behavior Model (adapted from Slagle & Bruskotter, 2019). **Behavioral beliefs* refer to "the advantages (benefits, anticipated positive outcomes)" and "disadvantages (costs, anticipated negative outcomes)" associated with particular behavioral act (see: Fishbein & Ajzen 2010, p. 19). **Attitudes refer specifically to the behavior act, as opposed to a particular object (Slagle & Bruskotter, 2019).

Building on social psychology theories like the TRA/TPB (Ajzen and Fishbein 1980; Fishbein & Ajzen 2010), Manfredo and colleagues have developed a model for studying human thought and behavior towards wildlife, called the ***Cognitive Hierarchy*** (Fulton et al. 1996; Manfredo, 2008; Teel & Manfredo, 2010; Whittaker, et al, 2006). This framework, often illustrated as an inverse pyramid, classifies human values inside a hierarchy of cognitions, which build one upon another to form the basis of human behavior. It includes the most broad and abstract values at the base, moving forward in specificity through value orientations, attitudes, norms, behavioral intentions, and behaviors at the apex (Jacobs et al., 2012). By this interpretation, human thought builds up, from the broader values to more specific attitudes, while experiencing strong influence from one's social group or personal standards for behavior (beliefs about things one should or shouldn't do), through the concept of norms (Manfredo, 2008).

Norms are often recognized as a driver of conservation behavior, and among the strongest motivators for compliance or cooperation with decision makers (Tyler, 2000; Niemiec et al. 2020). A norm consists of a group of personal (or shared) beliefs about a certain situation or condition, action (i.e., behavior), or attitude, considered as appropriate or inappropriate, by the individual himself/herself (or his group; Jackson, 1965; Shelby et al. 1996). In other words, norms are "*standards* that individuals use for evaluating activities or environments as good or bad, better or worse" (Vaske et al. 1986; Vaske & Whittaker, 2004). Within the literature, social and personal norms are discussed (Niemiec et al. 2020). *Personal norms* represent an individual's own standards for behavior, arising from personal values and judgements about consequences, while *social norms* are shared by members of a social group. *Social norms* may refer to a description of the factual behavior within a group (i.e., what most people are doing; a descriptive norm), or to what people *should* or *ought* to do in a specific situation (i.e., injunctive/subjective norm; Cialdini et al. 1991), that is, a judgment about whether other important and respected people in the community think a behavior should be performed. The concept of norms is usually intimately connected to that of *sanctions*: rewards for those who comply with the norms, or punishment for those who break them (Vaske & Whittaker, 2004). Norms are defined, measured, and studied in different ways within the social sciences, with researchers applying the most appropriate norm type and conceptual tradition, depending on the objectives of the study (see Vaske & Whittaker, 2004, for a review). The TRA/TPB (Fishbein & Ajzen 2010) and the Cognitive Hierarchy hypothesize that ***subjective norms*** exert social pressure to influence behavior, thus, following with this tradition, when referring to "norms" in this study, we are referring to *subjective social norms*. Similar to attitudes (good/bad/positive/negative evaluations of a behavior), this paradigm posits that subjective norms (beliefs about how others would want you to behave) direct behavioral intentions and actual behavior (Vaske & Whittaker, 2004). This has been

the most widely applied norm paradigm in the human dimensions field (Niemiec et al. 2020). The TRA is primarily focused on social norms, not directly addressing the concept of personal norms, which are considered subsumed within a person's attitudes (Vaske, 2008).

People's view of wildlife can vary greatly, within the same or among different socio-cultural groups, or still, inside an individual, varying with time and experience. Studies investigating ***acceptance*** of wildlife have traditionally looked at the extent to which individuals or groups are willing to accept/tolerate local wildlife populations (Decker & Purdy 1988; Riley & Decker 2000; Lischka et al. 2008). Similarly, studies on ***tolerance*** for wildlife have examined people's attitudes toward animal populations and preferences for policy and management (Bruskotter et al., 2015). The term *wildlife acceptance capacity* was conceptualized to refer to the maximum acceptable wildlife population level in an area (Decker & Purdy, 1988). When wildlife numbers grow exceeding the threshold held by the people, it becomes "unacceptable"; this can trigger human behavior to reduce size and distribution of the population.

Many studies have explored the concept of *tolerance for* or *acceptance of* a species, population, or its management (Bruskotter et al., 2015). Although much of the previous research on the subject was considered to lack theoretical guidance to allow for comparisons, they were all interested in the same underlying question, searching for the point at which people *cease inaction* and take up action to impact wildlife populations (Bruskotter and Fulton (2012). Therefore, Bruskotter and Fulton (2012) argued that *tolerance for* or *acceptance of* can be considered the same construct, proposing a general model for operationalizing it using multiple behavioral criteria (Bruskotter et al., 2015), based on important characteristics that both terms share: inaction, or passive restraint on the part of the affected individuals as the "normal state"; and the existence of a point at which inaction ceases and individuals become motivated to act. Acceptance/Tolerance can be illustrated as a

passive concept, in the middle of a behavior continuum, where inactivity or no relevant behavior occurs. In opposing poles of this continuum (Fig. 2) are the areas of *Intolerance*, and *Stewardship*, in which behaviors are respectively taken to negatively, or positively, impact a given species population [or different target].

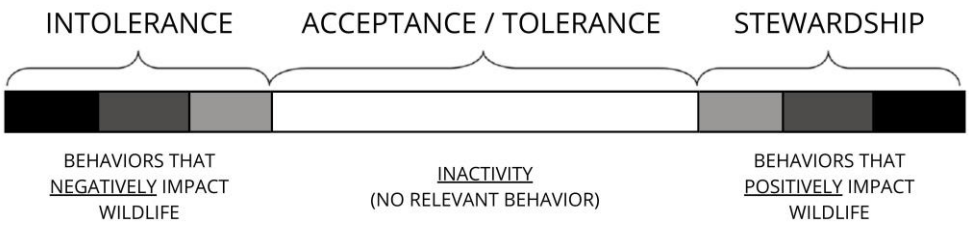

Figure 2. A conceptual model of wildlife conservation behavior (Adapted from Bruskotter and Fulton; 2012).

Though Bruskotter and Fulton (2012)'s model conceptualizes acceptance/tolerance as a behavior, the authors stress that these concepts may also be operationalized in other ways, for example, as attitude, behavioral intention, or **norm** measures (e.g., Bruskotter et al., 2015; Zinn et al., 1998). In many natural resource management studies, acceptability has been measured using norms as an evaluative standard related to individual behaviors or conditions in a given context (Donnelly et al., 2000; Shelby et al., 1996; Shelby & Vaske, 1991). Each choice of how to operationalize measuring acceptance carries its own limitations. It's been argued that using multiple measures of acceptance can help make more reliable predictions (see Slagle & Bruskotter, 2019, for a discussion). This study measures acceptance in the form of *social acceptability norms*, which are directly tied to management strategies, especially the ones related to land access fees and hunting allocation, areas most prone to disagreements.

It's important to note that, although attitudes do influence behavior, they may not always be reliable predictors of behavior, since behavior is also influenced by other factors such as opportunity and skill, which may prevent an intended behavior from taking place at a specific

time. Other factors may also enter to influence decision making, like the effect of emotions and intuition. People have two types of information processing systems affecting decision making, one systematic and another intuitive. In some instances, wildlife acceptance-related behaviors will arise from deliberate reasoning (i.e., systematic system, cold, slow cognition), while in others, it will result from automatic, intuitive reasoning (i.e., hot, fast cognition); it will largely depend on the context (Bruskotter & Wilson 2014). When wildlife provokes an affective stimulus (hot cognition), it can influence the individual's evaluation. Time pressure is one of the factors that strengthens the effect of affect on choices, biasing judgements, and decisions. If affective reactions towards potential hazards are positive, people tend to believe the hazard as less risky and more beneficial (Slagle & Bruskotter, 2019).

In conservation research, promoting coexistence between people and wildlife involves avoiding conflicts and dealing for example with potential risks (Slagle & Bruskotter, 2019). Only recently applied to wildlife (Bruskotter & Wilson 2014), the *Hazard Acceptance Model* (HAM; Fig. 3), is useful when wildlife is seen as potentially hazardous. Acceptance can be understood as the propensity to accept a species, its population, or its management (i.e., attitudinal, or normative measures), or as the (behavior) intention to take actions to minimize risks or increase benefits associated with that species or population.

While the TRA/TPB is most useful when describing specific and single behavioral acts that are time-bound, the Hazard Acceptance Model deals with multiple behavioral acts specifically related to tolerance or intolerance for a species or population. In the same way as hazards, wildlife issues are permeated with uncertainties, especially regarding the outcomes, or impacts of conservation actions (Slagle & Bruskotter, 2019). Risks and benefits related to a hazard are important predictors of acceptance of the hazard (Bruskotter & Wilson 2014). The perceived likelihood of a risk-event and severity associated with it are judgements people incorporate when assessing risks. Discussions about wood bison reintroduction in Alaska

could elicit a variety of these views within the public that could affect or be affected by bison on the landscape.

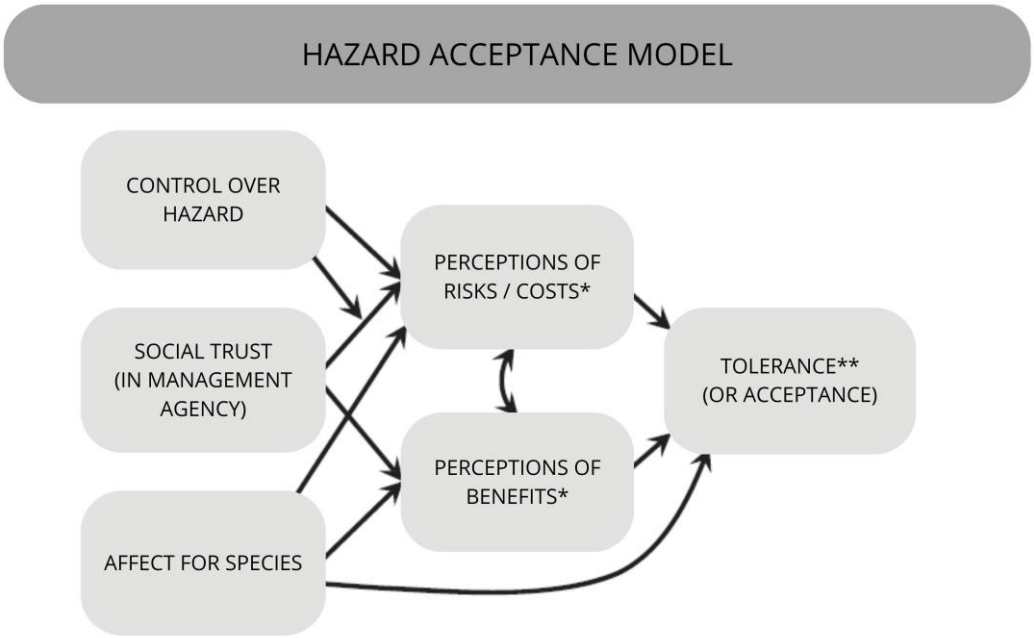

Figure 3. Hazard Acceptance Model (adapted from Slagle & Bruskotter, 2019).
*Perceptions of risk and benefit refer generally to those risks and benefits associated with a particular hazard – in this case a species or population of wildlife. **Tolerance can be addressed as both an individual's propensity to accept a species or population (attitudinal measure), or as his or her intention to take actions designed to minimize risks or increase benefits associated with that species or population (Slagle & Bruskotter, 2019).

Both the TRA/TPB and the HAM are important to consider for this research, and, as demonstrated by Slagle and Bruskotter (2019), differences and parallels can be drawn between them. Of most importance, however, is the subject of interest. While the TRA/TPB is concerned with a behavior of interest, the HAM is concerned with a species or population target. Both models bring an implicit weighting and balancing of outcomes, where in the TRA/TPB it is in the form of a combination of beliefs about the likelihood of a behavior leading to certain outcomes (wildlife conservation), and in the HAM it is in the form of risks and benefits as impacts of conservation. The attitudes construct in TRA/TPB is also substituted in the HAM for measures of affect (emotion), and perceived control over the behavior is replaced by control of the hazard itself in HAM. Because of the specific nature of

the HAM, the management of wildlife by unknown others (the wildlife agency) requires an adaptation in the socially focused variable, in which, norms are substituted by measures of trust. While in the TRA/TPB norms connect an individual to social influences (how others think a person should behave), in the HAM the trust variable measures perceptions of how an individual thinks another entity should or will behave (Slagle & Bruskotter, 2019).

Wildlife management requires citizens to trust those who govern them to be effective. It is imperative to establish cooperation and trust to improve chances of animal restoration and conservation success (Cvetkovich & Winter, 2003; Metcalf et al., 2015). **Trust** is defined by Rousseau et al. (1998) as: "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" (p. 395). Therefore, trust requires a certain degree of dependence, and accompanies a particular set of expectations (Davenport et al, 2007). The public frequently pictures management agencies based on past interactions, which are summed up in a background *image* people use to evaluate it in the future. It is influenced by three main elements: perception of agency personnel; perception of agency function; and perception of communication behavior (Decker et al., 2012). A judgment of value similarity between the public and the agency being judged for its trustworthiness affects the image being drawn (see Siegrist, 2000 for more information).

In environmental risk management situations, two types of trust are important: *calculative* trust, where individuals place confidence in others for the management of risk due to necessity and lack of possibility of controlling risks themselves; and *relational* trust, where individuals place confidence in those in whom they perceive to share values with (Earle & Cvetkovich, 1995; Siegrist 2000). Because it doesn't involve shared values, calculative trust is less resilient and more easily lost due to the perception of mistakes (Slagle and Bruskotter, 2019). This is the type of trust measured in this study.

Because trust requires accepting vulnerabilities, it is important to recognize that wildlife may frequently pose different impacts to distinct human populations, being singularly experienced by each of the groups involved, and influenced by the future management program's spatial and temporal scales (Gray et al. 2012; Metcalf et al., 2015). Highly vulnerable and resource-dependent members are likely to have different needs and expectations from management programs than less vulnerable people (Davenport et al. 2007). Rural communities, which are immersed and often more dependent on the natural resources, are always weighing the costs and benefits of agencies' programs and policies (Davenport et al, 2007). At the same time, urban settlements, often more powerful than smaller areas, are frequently influencing decision making, based on their own perceptions of risks and benefits. Trust in a wildlife management agency has been shown to influence how people perceive negative or positive impacts that may be put to them by management actions. Such impacts, experienced in the form of risks and benefits, influence public acceptance of such actions (i.e., *opposition or support*; Siegrist, 2000; Zajac et al., 2012; Sharp et al. 2013; Metcalf et al., 2015). Research has found that individuals with greater trust in the agency have been more accepting of management actions (Cvetkovich &Winter 2003).

The essence of wildlife management may thus be described with a focus on positive and negative impacts of wildlife, with respect to people and human values. Hence, impacts can be defined as effects (i.e., detrimental, or beneficial) resulting from the interaction among humans and wildlife, wildlife managers, and other interest groups (Riley et al., 2002). There is a difference between the actual measurement of risks, and how people *perceive* risks, emphasizing the subjective and evaluative nature of this concept. Risk perception is an intuitive judgement, made by citizens, of the threat an object or activity may pose to them (Slovic 1987, McDaniels et al. 1996). It reflects the degree by which people believe they may be vulnerable to a hazard (Zajac et al., 2012). There are features that affect how and why

people develop risk perceptions, including spatial proximity and prevalence of the potential hazard; visibility, severity, possible effects; and who it affects and how (Decker et al., 2010). It largely influences how diverse interest groups interpret the world around, influencing decisions and behaviors of the public, policy makers, agency staff, and other stakeholder groups (Gore et al., 2009; Decker et al., 2012).

Different studies have shown that acceptance of potentially dangerous wildlife is determined, in part, by perceptions of risk (Riley & Decker, 2000; Gore et al., 2006; 2007). Wildlife may cause a variety of negative impacts, or risks, to humans, which can be represented by social, economic, psychological, cultural, or health and safety threats (Dickman, 2010; Decker et al., 2012). When people perceive one or more of these threats as an impact (real or potential) on their livelihoods and safety, it may become the source of a conflict (WWF, 2005). Therefore, conflicts often arise from opposition towards wildlife or management decisions. However, wildlife can also be a source of benefits to people, in the form of recreation, harvest, aesthetic enjoyment, wildlife-related tourism, or through its effect towards healthy environments, among others. Researchers have argued the importance of measuring perceived benefits alongside perceived risks associated with a species (e.g., Bright and Manfredo 1996, Bruskotter et al. 2009; Zajac et al., 2012). There is no single and unmistakable measure to address human-wildlife conflicts or to produce peaceful coexistence, therefore, it is crucial to identify potential *key impacts* related to managed wildlife on a site and context-specific basis (Shelby et al., 1996).

In the United States, where wildlife is publicly owned and the public must accept management actions and policies, norms are particularly important measures when studying the acceptability of management actions (Zinn et al. 1998). Norms may be operationalized with measurements at the individual level, which then can be broadened to explain social regularities, helping to understand people's behavior (Vaske & Whittaker, 2004). Individual's

normative beliefs about what is or not acceptable in management is influenced by: personal values; perceived risks and benefits; prior experience with the issue being managed; knowledge about the issue; trust in the management agency's capacity; and other situational specifics (Zinn et al., 1998; Kneeshaw et al., 2004).

Normative theory research has increased our understanding about wildlife values, and why people evaluate management actions as acceptable or not (Decker et al., 2006). Because of the importance norms play in people's cognitions, Vaske et al. (2007) proposed segmenting the public according to norm-based fractions, what should help managers predict which groups and in what proportions are more likely to support, oppose, or be indifferent toward management actions, and improve the targeting of education efforts. Most research on norms have been done to understand recreation management issues (Shelby et al., 1996), however, it could be more frequently applied to study other management scenarios as well, like animal restoration, where a better understanding of people's normative beliefs will help decision makers improve communication and resolve potential conflicts more effectively (Zinn et al 1998).

Studies and theories examining acceptance of/tolerance for wildlife and its management measuring impact perception, norms, and trust can be seen as complementary, each investigating a few constructs that can help managers better connect the observed facts and understand the reasoning behind stakeholder views and evaluations toward wildlife management. No other study has been found which assessed social acceptability normative beliefs associated with management of a reintroduced large ungulate, such as the wood bison. Additionally, not many previous studies have investigated Human Dimensions' aspects overall related to a bison reintroduction (exceptions are Decker et al., 2010; Hermann et al., 2013; Balčiauskas & Kazlauskas, 2014; Clark et al. 2016; Doney et al., 2018; 2020), existing ones mainly focusing on attitudes, values, and emotions. This study also contributes to gaps

in the literature by investigating at the same time multiple Human Dimensions constructs related to a restored ungulate population.

1.3. Animal Recovery and Study Context

Reintroduction of animal species into that species' historically Indigenous areas, from which they were extirpated, has long been practiced and is increasingly used for conservation purposes, particularly for ecologically significant species like apex predators and large herbivores (Jørgensen, 2013; Reading & Miller, 2001; Arts et al., 2016). However, as the number of reintroductions grows and practitioners gain more experience, it becomes evident that these efforts are complex, risky, and multifaceted (Reading et al., 2001). Reintroductions for species that recently became extinct in that area tend to be smoother, but controversies are more likely to arise when attempting to restore long-extirpated species, especially large mammals with the potential to cause damage (Arts et al., 2012; 2016; Jørgensen, 2013).

Human-wildlife conflicts frequently arise when people and wildlife interact over shared resources (Decker et al., 2010). This opposition to wildlife management is often driven by conflicts arising from various factors, such as nuisances, property damage, attacks on pets, and potential disease transmission (Decker et al 2006; Kansky et al., 2014). The perception of reintroduced animals as invaders further complicates the situation for landowners and special interest groups (Jørgensen, 2013). Cooperation among different interest groups is crucial for the conservation of species (Keane et al., 2008; Smith et al., 2009; Decker et al., 2014). The increasing diversity of stakeholders involved in wildlife management necessitates their active inclusion in decision-making processes. Policy interventions, including ballot initiatives, are becoming more common, leading to conflict-prone situations that require informed management (Teel & Manfredo, 2010; Marchini, 2014).

Public debates can emerge when conservation approaches are seen as limiting human actions, resources, or income, particularly involving local farmers and landowners (Schmitz, 2015). Opposition to animal restoration and illegal behavior can result from a lack of consultation with public opinion and disregard for local values and views. Responses to management actions are influenced by various factors, such as the specific context, species involved, encounter experiences, policies, and severity of the situation (Wittmann et al., 1998; Zinn et al., 1998; Shindler et al., 2004; Decker et al., 2006; Kaltenborn et al., 2006; Fix et al., 2010). Supporting restoration efforts typically requires presenting ethical and economic arguments, along with fostering societal interest in the reintroduced animals (Hermann & Menzel, 2013; Arts et al., 2016). The field of *Human Dimensions of Wildlife Management* (HDW) studies human-wildlife relationships using social science theories, providing valuable insights to managers dealing with conflicts and enhancing wildlife conservation effectiveness for over 40 years (Manfredo, 2008).

Public resistance to wildlife management frequently results from failure in attracting public support for goals and strategies due to insufficient understanding of the public's attitudes and preferences (Kaltenborn et al., 2006). The reintroduction of wolves to Michigan, for example, failed after large rates of human-induced mortality, supported by deeply ingrained anti-predator and anti-government attitudes, not previously accounted for by decision makers at the time (Hook & Robinson, 1982; Kellert et al., 1996). This example symbolizes the importance to initiate, manage and evaluate stakeholder involvement through a context-specific and adaptive format, incorporating changes in attitudes and beliefs in the process, to enhance the capability of improved decision-making (Decker & Chase, 1997; Enck & Decker, 2008). Within the Human Dimensions science, the cognitive approach proposes that values determine people's attitudes and norms, which in turn affect behavior. Conflicts typically involve competing values, and acceptance of wildlife will depend on individual

differences associated with personal, societal, and cultural experiences (Tarrant & Cordell, 1997), but also on perceptions of impacts related to wildlife and trust in the agency managing this wildlife.

Values are abstractions, central single beliefs that transcend objects and situations, and from which attitudes and behaviors are built. The value systems organize individual values and provide standards that can guide conflict resolution and decision making (Rohan, 2000). So, investigating and assigning priorities guided by values can help resolutions (Manfredo 2008). Values cannot be directly observed, but we can look for evidence of it. Basic beliefs are what give values a meaning, and the patterns of direction and intensity among these beliefs consist of *value orientations* (Fulton et al. 1996). According to the original concept, they capture the personality of a cultural group, and measure its relation and orientation towards nature (i.e., mastery, subjugation, and harmony; Kluckholn, 1951), affecting how people perceive wildlife. There are two key value orientations that affect relationships with wildlife in North America: *domination* (i.e., utilitarian) and *mutualism*. Utilitarians are individuals who believe that wildlife should be used and managed for human benefit. The mutualists represent a less traditional view of wildlife, in which they believe humans and wildlife are meant to co-exist in harmony (Teel et al., 2005).

Wildlife value orientations (WVO) are strong predictors of attitudes toward fish and wildlife issues, where people with a strong domination orientation for example, are much more accepting than mutualists of management techniques that result in direct harm to wildlife. Across the American West, between 25-50% of the public were classified as utilitarian, with the highest percentages found in Alaska (50.4%), where the distribution of mutualists was among the lowest in the region (15.3%; Teel et al., 2005). Other WVO described for Alaska were individuals who exhibited a mix of conflicting value orientations, with high levels of both mutualist and domination orientations, described as *pluralists* (27.4%). Furthermore, the

distanced, were people who held neither, being considered distanced from the issue of wildlife in general (6.9%; Teel et al., 2005).

The composition of values within a state has been strongly associated with modernization variables (e.g., increased education, economic well-being, urbanization, hunting participation). Demographic shifts in the American society have led increasing numbers of the public to live in urban instead of rural areas (i.e., place of permanent residence), gathering people from diverse backgrounds, who value wildlife in many ways (Decker et al., 2001). In western US, increased modernization is leading to a shift from domination to mutualistic values, reflecting changes in people's daily lives and causing intergenerational value shifts (Manfredo 2008). Predominantly, traditional (utilitarian) based values give place to broader, multicultural values. Modern lifestyles distance people from utilitarian views of wildlife, since it is no longer seen as a necessity for survival, but more as potential companions. Learning about it is becomes increasingly more theoretical, coming from indirect rather than direct sources (e.g., hunting, tracking, practical learning in rural areas). Consequently, urban residents are increasingly becoming more disconnected from natural resources, contributing to growing lack of knowledge and interest about it.

Values and wildlife value orientations in general tend to correspond to a social group's needs, which shape thought and direct behavior (Manfredo 2008). Within the rural landscape, farmers and ranchers are groups where utilitarian viewpoints and the valorization of animals for practical and material reasons prevail (Decker et al., 2010). They tend to view wildlife in economic terms, which is to be expected, given the potential economic and livelihood impacts farmers can experience. Management of wildlife that can potentially damage human property remains a controversial subject continually under scrutiny (Lauber et al. 2001; Decker et al., 2006). It affects decisions on land use and allocation of wildlife, which increasingly depend on land development interests (Organ et al., 2012). Stakeholder

preferences in management and policy varies widely, and rural/urban residency has been associated with many general tendencies, working as a marker for societal groups' preferences (e.g., Kellert, 1984; 1985; McFarlane et al., 2007). Alaska is comprised of a mix of a few larger urban centers and numerous small rural villages. Interestingly, even in the urban areas, residents are believed to hold views more traditionally associated with rural areas in other parts of the USA. However, the impact of residency on views toward wood bison restoration in Alaska remains largely unknown.

Dealing with recovery efforts can be very complex because they usually take place in rural areas, many times privately owned, and where hunters and residents have the most potential to impact species survival and persistence (Tucker & Pletscher, 1989). These groups have been described as the most negative towards the reintroduction of wolves for example, and likely to have become more negative during the process of restoration (Ericsson & Heberlein, 2003). Research has traditionally suggested that people with the least experience are the most positive regarding animal restoration (Williams et al. 2002), thus, it's likely that the people most likely to start negative, may consolidate negative attitudes following negative experience. Progress in education, income, and urbanization may however help slow down, or revert, such trends (Williams et al. 2002).

Even though wildlife is considered a public resource in the USA, private landowners control a very large portion of the land (Decker et al., 2001b), leaving species survival to depend on private habitat bases and practices. Compared with urban residents, rural residents are more likely to fish and hunt and tend to have closer personal ties with farming, ranching, fishing, forestry, and mining. Landowners and hunters have received a lot of attention by HD researchers, with studies concerning issues in rural landscapes going back to the first publications in the field (Decker et al., 2001b). With the growing urban population and the

modernization of the American society, it is becoming even more pressing to characterize and contrast viewpoints from urban and rural populations.

Even when general population surveys may indicate high support towards the return of a species, it could be misleading if the diverse groups of people, especially the local ones sharing the habitat with the animals, are not properly assessed (Ericsson & Heberlein, 2003). Private landowners who are closely linked to property (i.e., rural) and depend on the natural environment for their livelihoods and income, are particularly sensitive to the costs associated with wildlife (Ericsson et al. 2004). They tend to be less tolerant towards damage (Daley et al., 2004; West & Parkhurst, 2002), although the tolerance threshold is highly variable, making some people remarkably more tolerant than others (Decker et al., 2010). Attitudes and tolerance to damage differ according to landowner's values, experiences, perceived amount of damage, behavior toward damage prevention, and ability to withstand the economic consequences. The degree of utilitarian attitudes exhibited seems to be proportional to the degree of economic dependency on land, and concerns tend to be proportional to the degree of familiarity (novelty, such as a reintroduced species) and to the perceived control over economic threats (Decker et al., 2001).

Interactions between humans and wildlife that are perceived as negative (especially when it threatens livelihoods) can motivate retaliatory or preventative killing of wildlife. People may have multiple motivations for engaging in illegal behaviors (e.g., unemployment, unawareness of rules, economic necessity, social defiance, symbolic protest, etc.); and motivations to comply are not necessarily equivalent to noncompliance motives (Kahler & Gore, 2012). Decisions to comply with wildlife rules are very complex because of the highly diverse geographic, economic, social, and psychological environments where it occurs (Kahler & Gore, 2012).

To promote the sustainable recovery of a species in an area, it is important to study and contrast views of people that will be most directly affected (Ericsson & Heberlein, 2003). For example, extensive literature investigates stakeholder views about wolf reintroduction, mostly concerning attitudes towards the species and their restoration (e.g., Bath, 1989; Biggs, 1988; Tucker & Pletscher, 1989; Pate et al., 1996; Schoenecker & Shaw, 1997; Williams et al. 2002; Ericsson & Heberlein, 2003). Aspects usually associated with rural areas, such as lower income and lower education, were associated with more negative responses towards wolf reintroduction (e.g., Biggs, 1988; Williams et al. 2002). Age has also been associated with more negative attitudes, although some researchers debate the possibility it could be a cohort effect of opinions formed earlier in life (Williams et al. 2002).

Participation in hunting activities is influenced by many factors and is reportedly decreasing with the increasing degree of urbanization and aging of the population. It also differs among ethnic and racial groups, tending to be lower among minorities, and higher among Anglos in the USA. In Alaska, motivations to hunt vary based on their skill level, though motivations like the enjoyment of the outdoors, the challenge, socializing, and hunting for meat/subsistence are important across all levels of hunting skills (Aastrup et al., 2021). Hunters usually think differently from the overall population. For example, in Alaska, hunters are more likely to agree to killing animals that cause negative impacts to humans than non-hunters (Miller & McCollum, 1994). Hunters also tend to be more associated with emotions favoring human over animal rights (Lute et al., 2016), and less positive about the existence and spreading of a potentially dangerous species (Tucker & Pletscher, 1989; Ericsson & Heberlein, 2003).

Animal reintroduction occurs inside suitable habitats, and even though managers strive for the best possible legal scenario, animals not necessarily respect human boundaries. Thus, restoration success depends on the support and cooperation from the public, First Nations,

industrial and agricultural communities, etc. (Harper 2002). For many Native Americans, wildlife continues to play important subsistence and cultural roles, a relationship extensively studied by ethnography, anthropology, ethnobotany, history, and Native studies literatures. Although Native Americans frequently share habitat with wildlife in rural areas, the HD literature has devoted much less attention to Native American attitudes, values, and behaviors toward wildlife in comparison with non-Native peoples. It can lead to misunderstandings and mistrust when dealing with issues involving Native groups and subsistence resources, ultimately leading to conflict with management agencies (McDonald & McAvoy, 1997; Decker et al., 2001). Since managers can only address a certain number of populational concerns, these must be first known, and then evaluated, to be effectively prioritized and addressed in decision-making (Carpenter et al., 2000; Riley et al., 2002). As the population shifts in numbers of hunters, non-hunters, urban and rural residents, it's increasingly important to understand what characteristics help define each group, to compare how Alaska fits inside the American scenario, and how these views may impact wildlife management in the future.

This research describes psychological characteristics related to the acceptance of wood bison restoration and management in Alaska (i.e., normative beliefs, trust, perceived impacts), by examining views according to urban/rural locality and hunting participation and discusses potential conflicts among stakeholder groups.

1.4. Problem and Purpose of Research

This study aims to contribute toward filling gaps in HD and bison research, while arguing for the importance of appropriately representing diverse views across interest groups. The reintroduction of wood bison to Alaska presents a unique opportunity to examine how local and non-local peoples, hunters and non-hunters perceive the reintroduction of the largest terrestrial mammal in North America. It is not the purpose of this paper to use psychological characteristics (i.e., normative beliefs, trust, or perceived impacts) to *predict* future behavior, but to *reveal and determine* relevant information about the studied variables associated with each group's view and indicate areas of potential conflict for management attention. Results present the views and perspectives of the Alaskan urban and rural sampled strata of the population.

Following the growth of urbanization, income, and education, wildlife-related values are believed to be shifting inside the U.S. (including Alaska), with more people showing mutualistic and less utilitarian values (Manfredo et al., 2003; 2016; Manfredo, 2008). That could be an argument against exploring hunting participation as a factor in this analysis. However, hunting remains an integral part of the Alaskan way-of-life. Alaska not only makes up for over half of all designated wilderness areas in the country (Norris, 2007), but hunting participation in Alaska has also traditionally been higher than any other state in the U.S., with 25% of all Alaskans participating in hunting between 2003 and 2007 (Woodford, 2009). Along the years, Alaska continued to be one of the states with the highest percent of residents holding paid hunting licenses – 12.3% in 2020, according to 2020 data from the U.S. Fish and Wildlife Service and 2018 Census population data. This could be associated to the state's highly utilitarian population, isolation, and high dependence on wildlife resources for consumptive and leisure purposes (Teel & Manfredo, 2010).

Most previous studies in wildlife management have either compared hunter *versus* non-hunter's views locally (e.g., Tucker & Pletscher, 1989; Stafford et al. 2007), or urban *vs* rural general views across localities (e.g., Heberlein et al. 2002), usually involving the study of carnivores. Few studies have addressed both locality and hunting participation (e.g., Miller et al., 1994; Ericsson & Heberlein, 2003), especially going beyond measures of attitudes. This study examines multiple HD concepts, while addressing both hunting participation and locality. Understanding how perceptions vary across groups of residents is an essential step towards designing effective and targeted communication and education programs, improving the chances of success of a restoration effort.

This study's urban/rural comparison is somewhat unique because it also illustrates a contrast between a mostly non-Native population (i.e., urban hunters and non-hunters), and another population which consists of mostly Native Americans who largely participate in hunting activities (i.e., rural). We, however, cannot claim to capture the opinions of all individuals inside each locality, much less to try to represent all urbans or rural Alaskans, Native or non-Native. The intent of the research is to contribute to the understanding of different perspectives regarding the wood bison restoration and management in Alaska, by interpreting views according to the determined group divisions.

Although previous natural resource studies have individually examined impacts, norms, and trust associated with wildlife and management actions (e.g., Zinn et al., 1998; Riley and Decker 2000; Cvetkovich & Winter 2003), no previous research was found studying all three concepts together in the context of a large mammal restoration and its management. Therefore, this study aims to answer:

How does the public perceive wood bison restoration in Alaska?

The public is defined here as the urban and rural Alaska residents that are closest to the resource. The public was divided into hunters and non-hunters, representing key potential

users of bison as a resource. Therefore, to answer that question, the objectives of this study are:

1. Identify baseline levels of social acceptability norms (support or opposition) towards proposed wood bison management strategies, especially ones related to land access fees and hunting allocation; calculative trust in the management agency; and perceived impacts (i.e., risks and benefits) potentially resulting from the reintroduction.
2. Compare and contrast perceptions of norms, trust, and impacts between the urban and rural public.
3. Compare and contrast perceptions of norms, trust, and impacts according to both locality (urban or rural) and hunting participation (hunter or non-hunter) together.

Understanding how perceptions vary across groups of residents is an essential step towards designing effective communication and education programs for the population, affected or not, by the bison reintroduction. It helps to set a baseline for future comparison and discusses issues most prone to conflict among the people involved. Based on previous literature, we expected that:

1. The public will be generally positive towards bison and the management plan strategies, which were collaboratively developed (AWBMPT, 2015).
2. Rural residents will be more supportive of the management strategies, show higher levels of trust, and perceive more potential impacts from the restoration, due to the proximity to bison and closer contact with agency personnel.
3. Hunters will be more supportive of the management strategies, show lower levels of trust, and perceive more potential impacts from the restoration, as compared to non-hunters.

Because some aspects are, in essence, more controversial than others, the management of wood bison must continue to be adaptive.

2. Literature Review

2.1. Management of Wildlife

The importance of human values and behaviors for managing wildlife has been recognized since the formalization of the profession in the early 20th century (Decker et al., 2001). According to Giles (1978), wildlife management is "the science and art of making decisions and taking actions to manipulate the structure, dynamics, and relations of populations, habitats, and people, to achieve specific human objectives by means of the wildlife resource". Therefore, it may be said that wildlife management is 10% about managing wildlife and 90% about managing people (Fazio & Gilbert, 1986) and that it only exists because wildlife is viewed as a resource for people and is based on human values.

Individuals organize their ideas into a value system consisting of parts. It involves arranging beliefs into a cohesive framework including cognitive (true or false evaluation aspects), affective (emotional elements and like/dislike evaluations), and behavioral components (linked to some actions; Manfredo 2008). According to Rokeach, a value is: "an enduring belief that a specific mode of conduct or end state of existence is personally or socially preferable to an opposite or converse mode of conduct or end state of existence" (Rokeach, 1973, p. 5).

Between the 17th and the 19th centuries, prevalent utilitarian values (where wildlife is viewed as an unlimited resource to human ends), led to dramatic declines of American wildlife populations, with the history of the American bison as a clear example of how wildlife was viewed at the time (Colpitts, 2010). Animals were seen either as beneficial or harmful, and thus, were often exploited or exterminated by the growing population. Overexploitation however, led to growing public concerns, and in the late 19th century a conservation

movement emerged, largely influenced by diverse wildlife-related values, and symbolized by two of its main articulators, Gifford Pinchot and John Muir (Decker et al., 2001).

The conservation movement has been fractured since birth. From the early 1900s, what constitutes wildlife conservation and management was already being debated, exemplified by disagreements between Pinchot and Muir concerning the use of public lands. Pinchot defended a sustainable-use philosophy, a "conservationist" position, while Muir was a "preservationist", advocating a position against any commercialization of nature, committed to completely protecting portions of land for limited or no human intervention (Meyer, 1997).

In 1933, during the wildlife management scientific revolution, Aldo Leopold, a student of Pinchot, published *Game Management*, a landmark book which became the foundation of the art and science of wildlife management (Decker et al., 2001). Aldo Leopold was one of the first people to recognize the need to integrate biological and sociological knowledge into wildlife management (Riley et al. 2002). Research in the area was then mainly focused on game species, and largely funded by hunters' tax and fee payments, evolving thus to serve their interests. The utilitarian bias affected the public perception of the wildlife manager profession and created barriers to the support of wildlife agencies.

Philosophical differences contributed to the fracturing of the conservation movement. Scholarly analysis indicates the emergence of two major fields of research worried about the conservation of natural resources, wildlife management professionals and conservation biologists, which have traditionally differed from one another (Jensen & Krausman, 1993). Despite the differences, the broad recognition of a biological crisis in the 1970/1980s led to a resurgence of environmental concern and to the creation of the *Conservation Biology* journal (Meffe & Viederman, 1995), and other journals like *The Journal of Wildlife Management* and the *Wildlife Society Bulletin* (Jensen & Krausman, 1993).

Pinchot's concept of *conservation* and the utilitarian viewing of wildlife prevailed as the main paradigm in wildlife conservation and management, exemplified by the North American Model of wildlife conservation (NAM), which focuses more on maintaining a harvestable level of game species' populations than on maintaining biodiversity and ecosystems preserved and functional. Not until very recently has this model of wildlife conservation been challenged with authors characterizing it as a narrow construct (Peterson & Nelson, 2017; Serfass et al. 2018). Not denying the important and ongoing contributions made by hunters, concern is based upon the selective overemphasizing of their historical contributions. The continuing promotion of a consumer-focused view as the model to conserve species has been failing to adequately portray the large contributions made by other stakeholders with differing interests in wildlife. Not inclusive enough to represent past and present diversity of contributions, the narrative has been undeniably biased toward harvesting and the species involved in it, even though hunting has little similarity with most conservation and management efforts in the 21st century (Peterson & Nelson, 2017). According to critics, the NAM has served to empower hunters, marginalizing the non-hunting parcel of the population, not evolving thus, to fully represent the complex and broader conservation efforts of the past and into the future (Serfass et al. 2018).

Calls for the broadening of interests in wildlife conservation practice, to represent a more inclusive range of values and stakeholders, have been made for at least three decades, although they are still many times ignored (Jensen & Krausman, 1993). Wildlife conservation and management practices occur within an evolving structure of governance, and should, thus, be shaped by worldwide trends in democratization (Decker et al., 2012; Peterson & Nelson, 2017). Democratic decision-making asks for modern and inclusive approaches. By paying a closer attention to the social and economic diversities within a population – without losing the practical basis – conservationists should be able to attract higher support for

proposed management actions. Many researchers advocate for new approaches under a *public trust* narrative, which would engage more representative parcels of the population than traditionally. This could help gain the public's trust, who will view assessments as more honest, potentially building broader-based coalitions for support (Peterson & Nelson, 2017; Serfass et al. 2018).

2.1.1. Human Dimensions of Wildlife Management

There is no doubt that people are interested in and care about wildlife, and have for many years, however, the emergence of the scientific field of *Human Dimensions of Wildlife Management* (HD) is relatively recent. Over the past 50 years, this field has emerged, evolved, and taken root (Brown, 2009). Traditionally, management has been advised by purely technical and biological expertise. Still, managers have been increasingly faced with 'people problems', with greater public involvement in wildlife management, advocating for higher participation in decision-making. In the 1950s, Douglas Gilbert was one of the first people to notice that technical knowledge does not matter when the public does not understand or accept management actions, thereafter, working towards managing the agency's interaction with the public (Decker et al., 2001).

The inability of traditional measures of wildlife management to address complex issues and the 'people problems' led to the emergence of interest in the 'human dimensions' of wildlife management. Born within the wildlife management practice, HD publications have also had some allegiances to hunter's interests and landowners'. However, wildlife recreation and other types of resource uses have also largely been depicted in the literature (e.g., Vaske et al., 2006). In the 1930s, wildlife state agencies collected biological information from hunters (e.g., mortality, age and sex of harvested animals, harvest/unit effort); such data typically doesn't require HD expertise (USDOI et al., 2016). But after the 1950s, more and more

people were driven to interact with wildlife in parks, forests, and wildlife refuges, making Human Dimensions issues more prominent. Recognizing the changes in the uses of the American landscapes, regulations and laws were created, and programs were approved, which helped control the use and management of wild lands (ORRRC 1958; Brown, 2009). By 1955, the U.S. Fish and Wildlife Service started conducting national surveys every five years, estimating national and regional hunting participation and expenditures. Later, in 1980 it started state estimates, and non-consumptive activities were included (e.g., wildlife observation, photography) (e.g., USFWS, 1987). Stakeholder conflicts have also been documented for over half a century. With excellent wildlife habitat on private lands, landowners were concerned with increasing numbers of hunters and the damage they did to the lands. The first studies about the matter are from the 1950s, concerning farmers, policies to hunt and hunters' difficulty finding places to hunt (e.g., Morrow, 1950; Whitesell, 1952). Human dimension studies mainly became available after the mid-1960's, with the number of papers on people-wildlife topics growing, and now involving entire conference sessions about appreciative and consumptive wildlife uses, attitudes and communication about wildlife, program evaluation, and the estimation of economic values related to wildlife (Manfredo, 1989; Decker et al., 2001).

Human Dimensions was first recognized as a growing scientific field of research by a review in 1971 by Hendee and Shoenfeld, who reported that research in HD topics was scarce and identified several topics for future research. By 1973, these authors coined the term 'human dimensions of wildlife' at a session of the *North American Wildlife and Natural Resources Conference*, to emphasize aspects of fish and wildlife management involving human attitudes, behaviors, and incorporate social sciences' information into decision-making (Manfredo et al., 1998; Manfredo, 2008). The scientific journal *Wildlife Society Bulletin*, established in 1973, started publishing (and still does) the results from HD studies.

Stimulus for the research came primarily from federal, state, and local government agencies, looking for assistance with growing human-wildlife problems (Manfredo, 2008). An agency's concerns about their public could be summarized as the need to: identify increasingly diverse stakeholders, understand the forces driving participation in wildlife activities, involve and obtain stakeholder input, and resolve how to incorporate diverse preferences into decision-making (Decker & Enck, 1996). Such needs have driven stimulus for incorporating HDW research, providing wildlife managers with new toolsets and viewpoints to help address wildlife challenges, while serving a growing body of interest groups (Decker et al., 1987).

By the mid-1970s, the HD scientific field further expanded. Several classical studies were published, involving hunters' willingness to pay, and behavior of waterfowl hunters (Brown, 2009). Other important efforts spent on HD topics explored communication aspects in wildlife and natural resources (Gilbert, 1971); psychological dimensions in big game hunting (Hautaluoma and Brown, 1978); and reasons behind people's opposition to hunting (Shaw, 1977; Brown, 2009). Many conceptual advances were made, involving value orientation toward wildlife, wildlife attitudes and value scales, multiple-satisfaction approach to hunting, and the development of scales describing the American public orientation toward wildlife (Kellert, 1976), and the wildlife attitudes and value scale (Purdy and Decker 1989), changing how agencies looked at and managed hunting and wildlife.

As the world started facing increasingly complex environmental and social threats, the wildlife profession also faced changes (Manfredo, 2008). To accommodate new challenges and serve broader stakeholder groups, Giles (1978) encouraged a systemic approach, where wildlife populations, habitat, and people, are illustrated as a triad, in which each element is vital and interactive. Giles suggested the adoption of a more comprehensive paradigm, acknowledging the lack of training of wildlife managers in the past to deal with human dimensions of wildlife management. To be done well, this science should include the three

elements in balance (Giles, 1978; Decker et al., 1987). In 1980, Kellert conducted the first national survey about Americans' attitudes toward animals and wildlife, a landmark in the field. From this moment onwards, dissemination of research in the field increased, with more meetings, symposiums and journals devoted to HD topics. The first conference entirely devoted to social sciences in natural resources was hosted in Oregon in 1986 and continues today (Brown, 2009).

Created in 1981, the *Human Dimensions in Wildlife Study Group* gathered members, organized meetings, and published newsletters, later evolving as a professional organization. In 1996, it gave rise to the *International Association for Society and Resource Management*, its journal *Society and Natural Resources*, and later the *Human Dimensions of Wildlife* Journal, all contributing to developing a common language in the field (Brown, 2009).

The increasing demand for HD advice, the growing complexity of issues, and the long-term consequences of decisions further stimulated the development of the science, leading to more case studies being conducted, further advances in theory and methods, and more collaborative models. All these advances recognized that species and habitats cannot be conserved unless people agree, find common ground, and sometimes be willing to make sacrifices (Brown, 2009).

Even though the initial focus of the HD science had been on hunters and anglers, it became evident that recreational interests were tied to broader natural-resource topics (Manfredo, 2008), and the growing public involvement stimulated the incorporation of more than game species. After the 1990s, the discipline became more comprehensive with more complicated issues on hand. Themes like species restoration; people-wildlife interaction in urban and suburban environments; wildlife agency-public communication; wildlife depredation; crop damage; stakeholder needs and preferences; impacts suffered by specific stakeholder groups;

and other traditional problems involving recreationists and landowners were added to the spectrum of HD research (Decker et al., 2001).

In response to evolving public values, the field of human dimensions (HD) now encompasses a broader range of concepts and practices, including economic and social values, individual and societal behaviors, public engagement in decision-making, and effective communication (Decker et al., 2001; Manfredo, 2008). The recognition that HD information is essential for delineating wildlife resources, setting objectives, conducting inventories, resource management, and understanding public involvement in decision-making has gained widespread support (Brown, 2009). Despite significant advancements since the field's inception, challenges have emerged over time due to the inability to consistently demonstrate social information's relevance and applicability. This has led to difficulties as managers often lacked the knowledge to utilize this expertise to guide assessments and plans, which traditionally focused primarily on biological aspects (Brown, 2009). To maintain its relevance in decision-making, human dimensions science requires ongoing evaluation and an expanded or adapted understanding (Manfredo, 2008). More efforts to showcase the significance of HD's social information and aid managers and administrators in comprehending its application and integration into wildlife decisions are still necessary. Arguments led by Bath in 1998 are still relevant today when he emphasized that, to be successful, wildlife management, research, and public involvement programs *"should be proactive (not crisis-driven), longitudinal in design (rather than one-shot studies), representative of the entire constituency (not just the vocal lobby groups), and truly integrated into the daily decisions of wildlife managers"* (Bath, 1998; p. 353).

2.1.2. The Future of Human Dimensions of Wildlife Management

The future approach of HD will need to be more inclusive, to represent evolving societies. With increased urbanization and modernization, mixing of cultural and ethnic backgrounds, many regions are registering shifts from previously dominant use-oriented value orientations (e.g., decreased hunting) and showing an increase in mutualistic views of nature, with more valorization and care for the natural environment (Manfredo et al. 2016). Urban populations do not generally share a connection to the land as usually found in rural areas. Tendencies toward the decreasing engagement in hunting and fishing activities, the increasing recognition of the complexity of ecological systems, and human dependency on healthy natural environments have all been observed in urban environments (Brown, 2009). As urban settlements progressively encroach into the remaining wildlife habitat, interactions, and potential for conflicts among stakeholders and wildlife will continue to increase, asking for the development of new policies and management responses to address these new issues, advised by HD expertise (Brown, 2009).

Historically, more numerous research papers in HD have used descriptive and applied approaches rather than conceptual and decentralized approaches, focusing mostly on north America and the global south (Manfredo, 2008), leaving many areas completely uncovered. Research in HD is slowly migrating to other countries (e.g., Jones et al., 1998; Marchini & Macdonald, 2012) and adapting to their contexts. With so many poorly known wildlife species, plenty still being discovered, and too many already endangered, there are huge knowledge gaps to be filled by future scientists, especially in areas outside North America. In the future, more HD research should investigate less popular locations and species, and at different scales. Although many issues are only comprehensively understood if studied at the local and regional scales, conceptual studies should be more frequently conducted to allow researchers to look for patterns and test hypothesis about wildlife-human interactions.

To evolve, HD science will need to become more comprehensive and to diversify approaches, since much of the variability found in human behavior is still not explained by traditional theories. Research topics should diversify beyond pure descriptions and popular themes like attitudes, hunting and angling, game species, carnivores, recreation, etc. New conceptual studies should go beyond description, investigating the reasons for existing conditions. For example, it has been argued that little attention has been paid to investigating wildlife values, how they are formed and change. However, researchers have traditionally studied existing values and advocated for changes without a comprehensive understanding of the reasons that lead to it, or how to move away from it when necessary (Manfredo et al. 2017).

It is likely to be more effective and lasting if solutions to wildlife issues study not only the existing, but also the evolution of attitudes, norms, and behaviors, in the specific contexts in which they occur (Manfredo et al. 2017). Perhaps the most important construct, at the root of every wildlife-related decision, are values which remain difficult to study directly. But, because they direct beliefs, attitudes, and behaviors, which are more easily studied, these constructs help infer underlying values. Even though value change is largely advocated for, it is very difficult to achieve. It tends to slowly respond to other social-ecological factors, such as behavior change. Arguing that "shifts in values occur gradually in response to changes in social–ecological surroundings", Manfredo et al. (2017), suggested pursuing a *systems framework*, with a multilevel and dynamic view, to better understand value formation and change. If these changes are substantial, they will produce new adaptive values, behaviors, attitudes, and social affiliations (Manfredo et al. 2017; pg. 778).

Along with values, attitudes should also be studied more comprehensively, and will likely continue to be one of the most frequent topics in HD research, given its centrality. Typically framed in terms of *like/dislike*, *good/bad,* attitudes are described as positive or negative

evaluations about a person, object, concept, or action. They are a product of people's values (and beliefs) and have a direct influence on (and can be used to predict) people's behavior (intention or actual). Therefore, desired behavior changes won't usually become permanent unless underlying attitudes and beliefs also change.

Human Dimensions research has also traditionally focused on cognitive rather than emotional aspects of human decision-making, failing to explain large parts of behavior variability. Norms and attitudes (considered parallel constructs) both influence behavior, and have affective (i.e., emotional) and cognitive (i.e., associated beliefs) components. And norms still have an extra dimension, obligation, attaching beliefs about internal or external sanctions for breaking the norms (Vaske & Whittaker, 2004). Measures of attitude consider positive and negative evaluations, while measures of norm consider evaluations of *acceptability*, it is, what a person, group, or institution believe they *should do* in a specific situation (Vaske, 2008). Because people act in different manners under different circumstances, and not necessarily always follow the same or predominantly the cognitive path to engage in certain behaviors (e.g., actions driven by hormones), HD research would benefit from more alternative explanations and studies exploring emotional behavior (Jacobs et al. 2012).

Another aspect in HD research that should be addressed in the future is consensus over the most widely used terms. Even commonly used concepts are sometimes misinterpreted (e.g., impact, acceptance; Zajac, 2012), which can lead, unintendedly, to the publication of erroneous data, false interpretations, and faulty comparisons. Because many articles fail to show the actual questions used in their questionnaires, it makes it much more difficult to detect terminology issues, and to confirm proper testing of the intended concepts (i.e., concept validity), which may lead to erroneous conclusions being perpetuated and built upon (Zajac, 2012). The analysis of the field literature, and development of standards in HD

science practices, terminology, and methodologies, by a task force of HD professionals from multiple backgrounds could help mitigate these issues in the future.

2.2. Approach Based on Impacts

The field of Human Dimensions was born from the Human and Resource Geography as a response to the necessity to accommodate increasingly more complex environmental and social threats (Manfredo, 2008). As the human population increasingly grows into wildlife habitat (Dirzo et al., 2014; Pimm et al., 2014), more interactions occur, more species become threatened (Schipper et al. 2008; De Vos et al., 2014), and more complex situations arise for management attention. More diverse groups of stakeholders are becoming involved in wildlife management issues, bringing with them diverse sets of values, which will influence decision making. The use of collaborative models for achieving management decisions can improve the representation of the multiple actors and perceptions involved.

More interactions between people and wildlife mean more people will be and perceive themselves to be impacted by such interactions on a daily basis. *Impacts* can be defined as the effects (i.e., *detrimental,* or *beneficial*) resulting from the interaction between humans and wildlife, wildlife management interventions, and the interaction among diverse interest groups (Riley et al., 2002). Such 'effects' may be of different natures (e.g., ecological, physiological, psychological, cultural, and societal), but may only be called *impacts* if people targeted by these effects *recognize* and *perceive* them as sufficiently important to warrant management attention (Riley et al., 2002). In 2002, Riley et al. proposed to look at wildlife management as the management of wildlife-related impacts. In this interpretation, impacts represent human goals which the science of wildlife management wishes to achieve (i.e., lower detrimental impacts, and increase beneficial impacts). The authors proposed that the essence of wildlife management "*is a focus on the positive and negative impacts of wildlife*

with respect to people (i.e., human values)". To better help managers serve society, the core concept of 'impacts' should be taken into consideration along with two precepts: 'multidisciplinary integration', and 'participatory management' (see Riley et al., 2002, p. 591). Such an approach to wildlife management based on impacts would better connect social and ecological systems, as they interact and produce outcomes (Riley et al., 2003). Therefore, wildlife management can be thought of as influencing decision making to achieve the *impacts* valued by stakeholders (Riley et al., 2002).

The management of wildlife-related impacts is often the topic of HD research (e.g., Simpson & Wall, 1999; Riley et al., 2003; Enck et al., 2006; Decker et al., 2014). Based on people's perceptions, *impacts* may be perceived as positive (i.e., *benefits*) or negative (i.e., *risks*; Decker et al., 2012). In HD research for example, the literature related to impacts has looked into: human-wildlife interactions (e.g., Gore et al., 2006; Hofman-Kamińska & Kowalczyk, 2012); stakeholder interactions (e.g., Vaske et al., 1995; Brashares et al., 2014); yields of economic benefits (e.g., Kim et al., 2006) and/or costs (e.g., Walpole & Goodwin, 2000); threats to human health and safety (e.g., Needham et al., 2004; Sudharsan et al., 2009); ecological services provided by wildlife (e.g., Jones et al., 1994; Fox et al. 2012); physical, mental and social benefits from recreational enjoyment of wildlife (e.g., Manning & Lime, 2000); cultural and social impacts on local populations (e.g., Lindberg et al, 2001; Moyle et al., 2010); among others.

Damage-causing large mammals are of particular interest to such research because these animals are known to provoke mixed opinions and emotions amongst people. Frequently involved in conflicts with humans through perceived damage, species such as carnivores and ungulates are often also considered *key* species in the ecosystem, helping its processes, functioning, and maintenance. Well-studied and admired, many are considered culturally important and iconic, also sometimes representing staple resources (and/or threats) to

subsistence-based communities. Opposing views and interpretations of a species' roles commonly result in disagreements between sectors of the society, each holding different sets of values that influence their judgment toward wildlife management (Marchini, 2014; Sponarski et al., 2015).

Human-wildlife conflicts arise when people perceive any negative social, economic, cultural, or conservational impacts resulting from an interaction between humans and wildlife (WWF, 2005). Conflicts between people and wildlife, and among different stakeholders over wildlife, are expected to increase globally, often occurring when an action by one has an adverse impact on the other (Kansky & Knight, 2014). Despite the long history of such negative interactions, HD knowledge has only recently been incorporated into understanding and mitigating measures involving human-wildlife interactions (Dickman 2010; Decker et al. 2012). It's argued that focusing on human-wildlife *conflict* has limited conservation success, and a more holistic approach that includes positive interactions is needed (Frank, 2016).

Human-wildlife conflict is a complex issue with spatial heterogeneity, and inter- and transdisciplinary approaches and multilevel governance approaches can help to promote human-wildlife coexistence (König et al., 2020). Frequently arising from opposition towards wildlife or management decisions, there is no single and unmistakable measure to address negative wildlife-human interactions and lead to coexistence. Each interaction and socio-cultural aspect in a landscape must be evaluated, studied, and addressed separately (Kansky & Knight, 2014), encompassing different stakeholder interests, and accommodating their changing nature. It is essential, therefore, to initiate, manage and evaluate stakeholder involvement through an adaptive format incorporating changes in attitudes and beliefs, to enhance the capability for improved decision-making (Decker & Chase, 1997; Enck & Decker, 2008).

2.3. Bison in North America

> *"The buffalo were meat, drink, shoes, houses, fire vessels... and their master's whole substance... and yet - there was more, much more, to the relation between Indian and buffalo than all these material considerations." (NBA, 2014)*

2.3.1. Bison Evolution and Taxonomy

Bison originated in Asia and existed in various forms for more than two million years, according to the available fossil record evidence (McDonald, 1981; Shapiro et al., 2004). Bison species represented an important part of the Pleistocene megafauna, however, only two species survived to the present day, the European bison, or wisent (*Bison bonasus*), and the American bison (*Bison bison*). Even though investigations into bison phylogeny have an extensive history, much of it, from the appearance of the first species in the late Pliocene (3.6-2.58 Ma), to the middle-end of the Pleistocene is still uncertain (Zver et al., 2021). Fossils have traditionally been classified based on their morphology, many times making it difficult to distinguish between species. However, the development of molecular and DNA analyses has led to a better understanding of the species' history.

The two surviving bison species have different phylogenetic histories, having had origins in two separate speciation events. The lineage of the American bison (species focus of this thesis) originated from one event, about 1.55 Ma BP, which led to *Bison priscus*, and eventually to the modern *B. bison*. On the other hand, the European bison came from a different event, about 1.3-0.85 Ma BP, which separated *Bison bonasus* from the *Bos* lineages (Zver et al., 2021).

The steppe bison, *B. priscus*, entered North America through the periodically exposed Bering Land Bridge, dispersing into Alaska in two waves. The first occurred during the middle Pleistocene 300-130 ka BP, and the second about 45-21 ka BP (Shapiro et al., 2004). The newly arrived *B. priscus* from the first wave began dispersing south to central North America,

continuing until 75 ka BP, when advancing glacial ice imposed a barrier. The first species to evolve there from *P. priscus* was the long-horned bison, *Bison latifrons*, a giant form (Shapiro et al., 2004). In central North America, the *B. latifrons* lineage demonstrated a gradual reduction in size, giving rise to the smaller *Bison antiquus* no later than 60 ka BP. During the Pleistocene, climate shifts often caused migrations, either due to scarcity of food in colder periods, or because of changed sea levels and new vegetation types, like forests, in the warmer interglacial periods (Zver et al., 2021).

Populations of bison from central North America and the north Beringian area were periodically separated by glacial ice between 75 ka BP and 14 ka BP, when the ice from the Last Glacial maximum started to melt, and some *Bison antiquus* dispersed north towards Canada (Shapiro et al., 2004; Zver et al., 2021). A second wave of *Bison priscus* migrated to North America across the Bering Land Bridge between 45-21 ka BP, where this branch began to evolve into the smaller *Bison occidentalis*, which kept mostly constrained to Beringia by the extensive ice sheets (Guthrie, 1990; Boyd, 2003). About 14 ka BP some of these bison may have moved south through the newly established ice-free corridor toward central North America, until the later formation of spruce forests after 10 ka BP imposed new barriers to the migrations (Zver et al., 2021).

It is generally accepted that the extant American bison, *Bison bison*, evolved from *B. antiquus* about 12 ka BP in central North America, through the smaller intermediary *B. occidentalis* (Shapiro et al., 2004; Wilson, 2008). If it was a product of hybridization between the invading *B. occidentalis* with the *Bison antiquus* already present in the area, or a product of *in situ* evolutionary transition, is still debated (see van Zyll de Jong, 1986; Boyd, 2003; Wilson, 2008; Zver et al., 2021). Because the evolution took place in midcontinent North America, but the holotype of *B. occidentalis* is from Alaska, concerns about the applicability

of this name and identity of midcontinent fossil records have been expressed (Wilson, 2008; Zver et al., 2021).

The reduction in size into more compact forms is well documented in bison evolution, but it is unclear if any behavioral changes accompanied the anatomical changes (Walker, 2016). Most forms of bison didn't survive the Pleistocene extinctions or had their populations extremely reduced and isolated. *B. priscus* became extinct in most parts, by the end of the Pleistocene, although in Beringia the species survived into the Holocene, and even more recently into the middle-Holocene, as testified by the recently discovered mummy of a juvenile animal in Yukon, Canada (Zazula et al., 2017; Zver et al., 2021). *B. latifrons* was never as geographically widespread as the other species, coexisting with *Bison antiquus* until its extinction more than 20 ka BP (McDonald, 1981). *B. antiquus* became extinct in the early Holocene, before 10 ka BP in central North America (Shapiro et al., 2004). And *B. occidentalis*, which was adapted to the northern woodlands, and had a distribution mostly limited to Alaska and the Yukon (due to the long-term ice barriers), became increasingly restricted to the northwestern parts of its range, surviving there until about 1730 BP (van Zyll de Jong, 1986; Shapiro et al., 2004; Wilson, 2008).

The North American bison includes two modern variants (Meagher, 1986; Stephenson et al., 2001). Even though debate still exists and the details are not completely established, it can be said that, following the expansion of grasslands subsequent evolution gave rise to the more derived variant, the southern plains bison (*B. bison bison*), more similar to *B. antiquus*, while the more primitive of the subspecies, the northern wood bison (*B. bison athabascae*) retained more of the ancestral characters of *B. occidentalis* (Guthrie 1990; van Zyll de Jong, 1986; 1993; Stephenson et al., 2001).

The modern bison, *Bison bison* spread out during the Holocene, historically occupying large parts of North America, from Alaska and western Canada to northern Mexico (Meagher,

1986). Both extant bison species experienced several bottlenecks and gradual loss of diversity during the Holocene, but none as extreme as the one caused by humans in the 19th or 20th century, and which led to the low genetic diversity that we observe today (Shapiro et al., 2004; Zver et al., 2021).

The naming of organisms is important to identify, assess, monitor, and conserve our biological diversity. It allows the creation and interpretation of laws, treaties, and conservation programs by creating legal identities, subject to legal action (Geist, 1991; 2007). The American bison has been part of the American society for centuries; however, considerable debate persists regarding bison taxonomy. The most common discussions are about the common names in use, the species genus, and its separation in two subspecies (Boyd, 2003). Historically, bison has been referred to as "buffalo", a misnomer, since the bison is not a buffalo – which is only native to Africa and Asia. However, the word has been used to describe bison since early explorers first discovered it in North America, becoming an accepted colloquialism, which persists entrenched in North American culture and language to these days (Hornaday, 1889; Boyd, 2003).

Member of the Bovidae family, the wood bison is the largest Native terrestrial mammal found in the western hemisphere, with adult bulls weighing up to 2,000 pounds (900Kg). When bison was first classified by Linnaeus, in 1758, for the 10th edition of the *Systema Naturae*, it was assigned to the *Bos* genus (Wilson & Reeder, 2005). Later, it was assigned to its own genus by Knight, in 1849, mainly due to anatomical distinctiveness (Skinner & Kaisen, 1947). Since then, and after the emergence of more molecular genetic and evolutionary evidence, taxonomists have debated the validity of the *Bison* genus, leading many scientists over the last decades to prefer using the name *Bos* instead of *Bison* in their publications (Boyd, 2003; Boyd et al., 2010a). Another important aspect fueling this debate is the potential of *Bison bison* and some members of *Bos* to hybridize and produce fertile

females (Ward, 2000). Although more research is necessary before any change in nomenclature can be seriously discussed, as it will have implications for bison management across the world, complicating measures pertaining to the five subspecies of bison (three European, two American), and disrupting the established history of public policy and scientific identification with the name *Bison* (Boyd et al., 2010a).

Consensus has been reached so far regarding the separation of bison into two different species, the American and the European, which have kept separated for at least 10,000 years (Bork et al., 1991). However, the most controversial aspect of bison taxonomy is perhaps the legitimacy of the two American bison subspecies which have been the subject of heated discussions for many years (Peden & Kraay, 1979; Bork et al., 1991; Geist, 1991; ETWP, 2013). Differences between the 'plains' and 'wood' *varieties* of bison have been debated for generations, dating as far back as Allen's 1876 publication of *The American Bisons* (Allen, 1876). Allen in 1876 and Hornaday in 1889 used "wood buffalo" and "mountain buffalo" to describe animals that were scarcer and larger than the "common bison of the plains", and also showed different pelage characteristics. These bison varieties were differences accounted for and shared among members of each varietal population, and not rare variances like the occurrence of albinism and melanism within the populations, something already described as well (Allen, 1876; Hornaday, 1889).

Although is amply recognized that the two subspecies clearly vary in morphology, some taxonomists argue it isn't enough to substantiate the separation in subspecies, debating over various lines that consider geographical variation, morphological traits, environmental influence, molecular and genetic comparison (Boyd, 2003). Normally, it's argued, to warrant a subspecies classification, there should be demonstrations of multiple conspicuous morphological differences, geographic allopatric population patterns, and genetic divergences at several genes, with hybrids experiencing reduced fitness (Winston 1999).

The wood bison was first recognized as a subspecies (*Bison bison athabascae*) in 1897 by Rhodes, using the descriptions of only one animal (Geist 1991). Although morphologic and geographical variation between northern and southern populations of plains bison existed, a gradation of intermediate forms shown in the fossil record connecting the two makes it impossible to recognize a separation within plains bison (van Zyll de Jong 1993; Boyd, 2003). The wood and plains bison on the other hand, show a phenotypic variation that is discontinuous, indicating that barriers existed, and impeded gene flow, leading to the observed differences in habitat preferences, seasonal movements, and the boreal forests acting as natural barriers (van Zyll de Jong 1993; Boyd, 2003). Fossil record evidence also furthers the differences, putting wood bison as more closely related to *B. occidentalis*, the early Holocene bison that ranged in the north of North America, and the plains bison more closely related to *B. antiquus*, which occupied the south (van Zyll de Jong 1986; Stephenson et al., 2001). Even though phenotypic differences and allopatric distributions between the wood and plains bison are consistent with the concept of subspecies (ETWP, 2013), Geist (1991; 2007) has argued that the two variants should be considered as ecotypes, where differences would reflect the environmental conditions, not heritable traits. This argument is further contested by others who debate this explanation isn't supported by observations of transplanted wood bison (Boyd, 2010; see Gear & Gear, 2012 for a review of the arguments).

In 1957 a group of about 200 wood bison, then believed extinct, was discovered by the Canadian Wildlife Service researchers, near the Nyarling River in Wood Buffalo National Park (WBNP; Banfield & Novakowski 1960). This herd was believed to have remained isolated from other hybrid herds in the park, representing thus the last reservoir of original wood bison (Banfield & Novakowski 1960; van Camp, 1989). To save the subspecies, these bison were used as founders for the Mackenzie Bison Sanctuary in 1963, and Elk Island National Park (EINP) in 1965 (Boyd, 2010). Later, analysis showed that the populations of

wood and plains bison in WBNP did have contact previously to the Nyarling River herd discovery, however, it was minimal enough to maintain predominantly wood bison traits (van Zyll de Jong et al., 1995).

Even though the environments of the Mackenzie, EINP, and WBNP Nyarling River are very different, the wood bison there did not show differences from each other over time, or from other specimens taken from their original habitats (van Zyll de Jong 1986; van Zyll de Jong et al., 1995). Even after many decades, the wood bison in the EINP, living under the same conditions as plains bison there, shows no evidence of morphological convergence towards the plain's bison form (van Zyll de Jong 1986; van Zyll de Jong et al.,1995). Plains bison introduced in 1928 to the Delta Junction in Alaska, from the National Bison Range in Montana, have also kept plains bison traits, further suggesting morphological characteristics that distinguish the subspecies to be genetically controlled (van Zyll de Jong et al.,1995).

New studies using genetic analysis to detect differences between wood and plains bison populations have contributed to the confusion on the matter, with some studies failing to detect differences to support the subspecific designation (Peden & Kraay, 1979; Bork et al., 1991; Strobeck, 1993; Douglas et al., 2011). The divergence between the two American subspecies is estimated to have happened at only about 5,000 years ago (van Zyll de Jong 1993); this might help explain why some genetic studies failed to detect enough genetic differences between them with the currently available techniques. The ability to detect differences in molecular tests is limited to specific sequences in the available genetic material, so the inability to detect significant genetic differences does not necessarily mean there are no differences (Boyd, 2010).

Furthermore, the genetic diversity within the plains and wood bison populations has been described as low, which is to be expected, given the historical bottlenecks which resulted in all American bison that exist today coming from original stocks of 22 wood bison and 30

plains bison (Bork et al., 1991). The diversity found between populations of plains and wood bison in WBNP was significant and compatible with each existing as a unique population, thus corroborating the existence of geographic barriers in their evolutionary divergence.

The matter of subspecies designation is further complicated by human-induced hybridization. The controversial introduction of 6,673 plains bison in 1925-28 from the Wainwright Buffalo Park in Alberta into the only place where wood bison remained, the Wood Buffalo National Park (WBNP), led to some degree of hybridization with the remaining original wood bison later discovered there (in 1957; van Zyll de Jong 1986). Genetic analysis investigating this hybridization indicated however that it would be minimal enough, not resulting in phenotypically homogeneous populations (van Zyll de Jong et al.,1995; Wilson & Strobeck, 1999). Wood bison originating from founders with minimal contact with plains bison were described as more similar to one another than to plains bison (van Zyll de Jong et al., 1995; Wilson and Strobeck, 1999).

The lack of consensus over the bison subspecies has complicated conservation efforts and led to legal challenges. In 2012, a petition was filed in the United States to delist the wood bison under the Endangered Species Act (ESA) based on a challenge to its classification as a distinct subspecies (see: Gear & Gear, 2012). After extensive evaluation, the Fish and Wildlife Service published a finding announcing their decision not to warrant the delisting of the wood bison based on lack of sufficient information available to justify the initiation of a status review, although recognizing the existence of controversy around the subspecific designation (ETWP, 2013). Though these petitioners requested the delisting of the wood bison and the merging of the subspecies, they failed to provide new information refuting the previously identified threats and did not indicate that all or most threats to bison had been ameliorated, a critical requirement for the removal of any species from the Federal Lists (Endangered and Threatened Wildlife and Plants, 2013). This illustrates and summarizes the

complexities of the century-old scientific debate regarding the differentiation of the American bison subspecies and its legal implications (see Legal protection status in section 2.2.5.). Even though the debate over the validity of the current names assigned to bison is likely to continue, it should not preclude the conservation of the two forms as separate entities and evolutionarily significant units (van Zyll de Jong et al., 1995; ETWP, 2013). Many are the indications that the wood bison are functioning as distinct genetic entities (Wilson & Strobeck, 1999) and should continue to be managed independently (Gates et al., 2010). This thesis follows the currently prevailing classification of the two forms in two subspecies.

2.3.2. Ecology

The wood bison is adapted to boreal regions and have a highly efficient digestive system which gives the animal the ability to forage on a variety of common grasses and sedges found in meadows and early successional habitats (Stepherson et al., 2001). Larter & Gates (1991) investigated wood bison feeding behavior and found that they show pronounced seasonal changes in diet and move among open and forested habitats to maximize efficiency through the selection of foraging grounds with the highest availability of crude protein to minimize daily foraging time. The wood bison frequent areas of frozen lakes, ponds, and disturbed sites, which provide winter access to forage, although increases their susceptibility to major mortality rates from drowning (Gates et al., 1991). The wood bison is adapted to the low temperatures and snow conditions typical of northern latitudes and can persist in areas experiencing deep snow cover (Gates & Aune, 2008; Stepherson et al., 2001). Bison excavate snow by sweeping it away using the side motions of their muzzle (Gates & Aune, 2008), which contributes to the aeration of the soil, which is important during the winter. The wood bison does not engage in seasonal migrations as does the plains bison, rather moving accordingly to forage availability. It also doesn't form large herds, but instead forms seasonal

aggregations in the breeding and calving seasons, from May to August (Gates & Aune, 2008). At other times, it is more commonly found in groups formed by cows and their calves, with males normally being solitary, although sometimes found in small male groups (Schuler et al., 2006). The wood bison also exhibits sex-specific differences in seasonal habitat selection (Larter & Gates 1991), contributing to the male-female separation during most of the year.

There is minimal concern regarding competition for foraging resources, as studies have indicated a low level of dietary overlap between wood bison and other coexisting ungulate species (Larter & Gates, 1991; Fischer, 2002). Over hundreds of thousands of years, bison have co-evolved with other biota, functioning as a *key* component of native biodiversity in vast areas on the continent. *Keystone* species such as bison exert a significant impact on the patterns of occurrence, distribution, and density of other species. Their presence influences the structure, composition, and stability of plant and animal communities (Truett et al., 2001). Bison are also recognized as *Ecosystem Engineers*, playing a role in modifying, maintaining, and creating habitats by directly or indirectly influencing the availability of resources to other species through physical alterations of biotic or abiotic materials (Jones et al., 1994).

2.3.3. Historical Distribution

2.3.3.1. Abundance

In 1772, Hearne made the earliest recorded mention of wood bison abundance, describing them as "very plentiful" after observing the animals near the lower Slave River in the Northwest Territories, Canada. (Soper, 1941). It was estimated that, in 1800, the total wood bison population had been about 168,000 animals for the Athabasca River range (Soper, 1941). However, this estimate was based on the number and distribution in Wood Buffalo National Park, which was considered speculative not to consider regional variability in

habitat availability. Stephenson et al., (2001) found evidence of a larger original range, suggesting that wood bison may have been more numerous than previously estimated.

The plains bison were always more numerous than wood bison. In the grasslands, bison thrived in massive herds. The most common estimates range around 60 million, as given by Ernest Thompson Seton in the 1890s, although, more recently this number has been considered of questionable validity (Shaw 1995). Based on estimates for the carrying capacity of the grasslands, under optimum conditions, it was argued that the entire Great Plains could hold up to 28-30 million animals (Flores, 1991). Such optimum numbers would have been continually affected by the environmental conditions. After the 1800s, cycles of drought were already affecting bison numbers all over the Great Plains, and with former drought refuges for bison increasingly filled with people, the animals had diminishing opportunities to escape. Following the conclusion of the American Civil War in 1865, there were likely only about 10-12 million bison left (Bryson, 1982), a more credible number when compared to the 10 million hides brought to market by the subsequent hide hunt (Flores, 1991). In any case, it would have given 19th century observers the impression of limitless herds, as it is reasonably clear that bison did range in the tens of millions before European settlement.

2.3.3.2. Range

Approximately 5,000 years ago, the modern North American bison subspecies diverged, resulting in the wood bison as the more recent northern variant and the plains bison as the more recent southern variant (van Zyll de Jong, 1986; Stepherson et al., 2001). Although the wood bison inhabited a vast region of the boreal forest in northwestern North America, their population was never as abundant as that of plains bison due to limited habitat (Gates et al., 2001b). The historical range of the wood bison encompassed northern Alberta, northeastern

British Columbia, a small portion of northwestern Saskatchewan, the western Northwest Territories, Yukon, and significant parts of Alaska (Fig. 4). Notably, the wood bison was the last bison subspecies to inhabit Alaska and adjacent regions, where they thrived for the majority of the past 100,000 years (Stepherson et al., 2001).

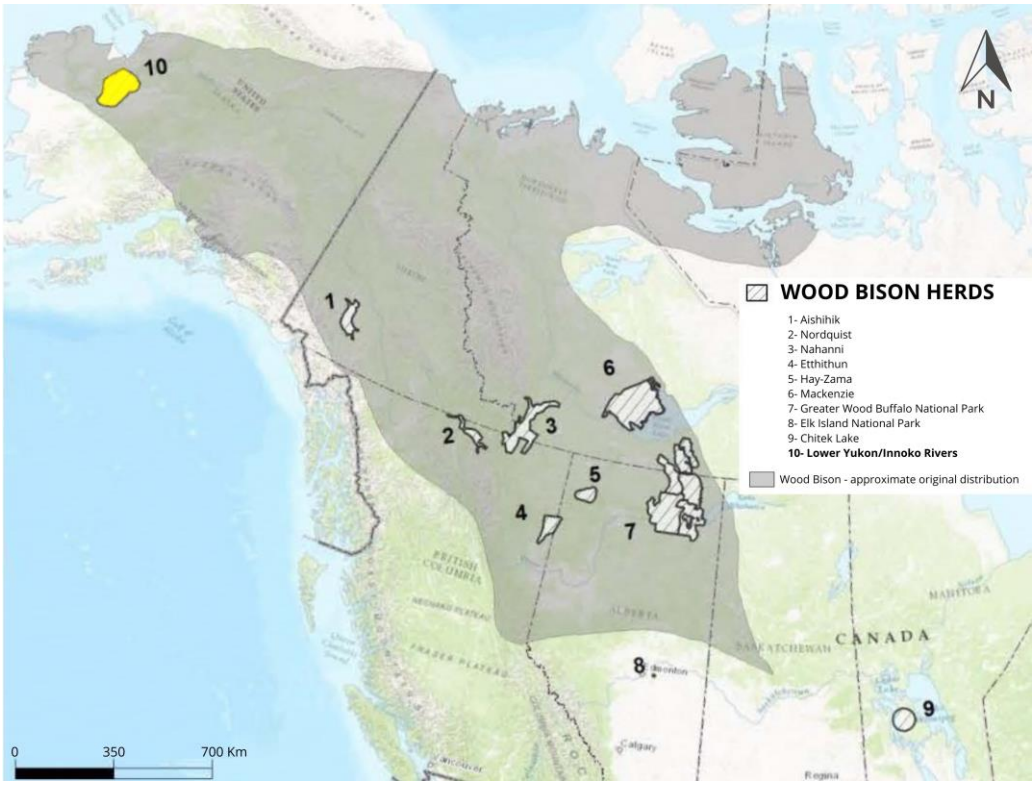

Figure 4. Approximate historical distribution of wood bison (grey shading) and the current distribution of wild wood bison herds (hatched lines). Adapted from CITES (2016).
In yellow, the wood bison herd restored to Alaska. Sources: Data on the current range of wood bison in Canada is from COSEWIC (2013). Data on the current range of wood bison in the United States and the original distribution of wood bison in North America is from Seaton pers. comm. (2016) and Alaska Department of Fish and Game (2016).

Archaeological and paleontological records, combined with oral narratives from Indigenous peoples in Alaska, Yukon, and Northwest Territories, demonstrates that wood bison were present in the Yukon and Alaska within the last two centuries. Findings indicate that the primary region for bison during the Holocene was the upper Yukon and Tanana River basins in east-central Alaska and Yukon (Stepherson et al., 2001; See Fig. 5). Other research suggested that bison became extinct in north-central and northwestern Alaska at the start of the Holocene, preventing human hunting in that region (Rasic & Matheus, 2007). Genetic

studies indicate that the decline of bison in Beringia began around 37,000 BP, before humans became widespread, thus suggesting that human predation was not the main cause (Shapiro et al., 2004). However, considering the significance of bison as a subsistence resource in the area, it is possible that interactions between humans and bison occurred despite the early disappearance of bison in northern Alaska (Rasic & Matheus, 2007; Note, (Eastern) Beringia is used here to refer to unglaciated Alaska, Yukon Territory, and parts of adjacent Northwest Territories).

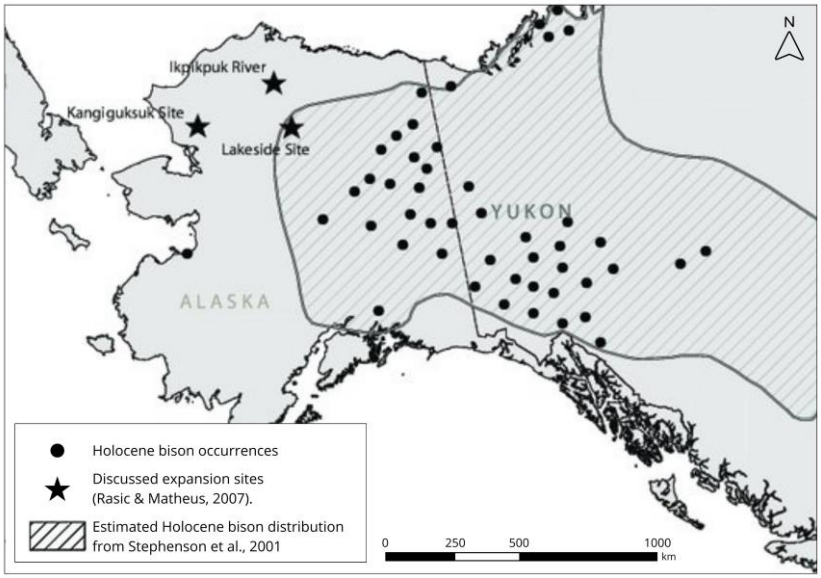

Figure 5. Map of Eastern Beringia (unglaciated Alaska, Yukon Territory, and parts of adjacent Northwest Territories) showing Holocene bison occurrences and the range of Holocene bison (shaded area) as estimated by Stephenson et al., 2001. Adapted from Rasic & Matheus (2007).
*Marked sites refer to sites where excavated remains could have represented an expansion of the Holocene bison range, but this was disproved by Rasic & Matheus (2007).

The persistence of bison until relatively recent times is well-documented in interior Alaska and adjacent regions. However, there is no evidence of late survival of bison in northern and southwestern Alaska. The decline and extinction of bison in northern Alaska during the Pleistocene-Holocene transition – about 10,200 - 10,000 BP – could be attributed to ecological factors (Rasic & Matheus, 2007). Rasic & Matheus (2007) hypothesized that the region provided a less favorable habitat for bison compared to interior Alaska and other parts of Beringia, thus the presence of tundra-like habitats and a shift towards 'paludified'

conditions. *Paludification*, the process by which land becomes a wetland (naturally or through human activities), contributed to the decline of grassland vegetation, which was vital for bison survival. Bison persisted in interior Alaska due to more favorable habitat conditions, while paludification and tundra expansion in northern Alaska hindered their survival (Rasic & Matheus, 2007). Overall, ecological factors, including changes in vegetation and climate, likely played a significant role in the decline and extinction of bison in northern Alaska, while human interactions may have contributed to the overall dynamics between bison and human populations in Beringia.

In its range, wood bison has coexisted with various species including moose (*Alces americanus*), elk (*Cervus elaphus*), caribou (*Rangifer tarandus caribou*), white-tailed deer (*Odocoileus virginianus*), mule deer (*Odocoileus hemionus*), as well as predators such as wolf (*Canis lupus*), cougar (*Felis concolor*), lynx (*Felis lynx*), grizzly bear (*Ursus arctos*), and black bear (*Ursus americanus*; Gates et al., 2010). Predation by wolves, especially targeting calves, injured, or aged bison, can sometimes significantly impact the mortality of wood bison (Larter et al., 1994).

2.3.4. People and Bison in North America

> "The history of human-environment interaction in the Great Plains is an engaging story, not of pure heroes, villains, and victims, but rather of generations upon generations who were all too human in their genius, their desires, their capabilities, their successes, and their failures." […] "The speed of the final extermination is legendary, and for a long time obscured the fact that bison populations were already in decline a century earlier." (Cunfer, 2016, pg. 41-43)

Paleo-Indigenous people colonized North and South America coming from Siberian Asia across Beringia and into Alaska at least 27,000 years ago, continuing during times of low sea level, when this land route was exposed. Continental ice sheets blocked movement inland, and people remained there until a warming climate opened corridors southward through the ice, occupying most of the present Great Plains between 13,500 and 12,000 BP (Cunfer, 2016). These hunters were skilled and targeted large game animals throughout their occupancy, with hundreds of examples from the archaeological record dating about 13,000 and 8,500 years ago (Flores, 2016c; Cunfer, 2016). Within only a few thousand years of human colonization, nearly three dozen genera of large mammals went extinct in North America, with many researchers arguing that overhunting was a fundamental factor for the animal losses, at a time when populations were already imperiled by climate change (Haynes, 2009). In fact, the influence of human activities on the biodiversity of animals is a globally significant environmental change that tends to be overlooked (Dirzo et al., 2014). Sometimes described as an opportunistic (or "weed") species, bison survived the Pleistocene extinctions, taking advantage of empty niches, and quickly occupying, and dominating the plains (Flores, 2003). This gave archaic Indigenous cultures a new opportunity, developing an economy around the bison species evolving there, perfecting hunting techniques, like bison drives, corrals, and atlatl (a hunting and warfare tool used in ancient times as a spear-throwing device; Flores, 2016c).

The Great Plains underwent significant ecological changes between 15,000 and 8,500 years ago. As the climate warmed and glaciers retreated, the landscape shifted from forest to grassland. During this time, various species of bison rose to prominence, and human populations migrated into the Americas. These early inhabitants, known as Paleo-Indigenous people, were skilled hunters who played a role in shaping the environment. They hunted large game animals, including mammoths and bison, which eventually led to the extinction of many of these species (Wedel, 1941; Flores, 1990; Haynes, 2009). The causes of these extinctions are still debated among scientists, with some attributing them to climate change and others to overhunting. Regardless of the exact causes, the impact was significant, and the loss of these game species had a profound effect on Paleo-Indigenous culture and the ecological richness of the region. This historical background questions the concept of the Great Plains as an untouched wilderness and emphasizes the interdependent connection between humans and the environment, where people consistently modified habitats to suit their own needs, particularly through the use of fire (Crosby, 2004; Haynes, 2009).

For the entire time humans have occupied the Great Plains, it has had drier climate than the country areas on either side of it. Because of its inland position, far from the oceans, and the Rocky Mountains intercepting most of the moisture from the Pacific, the climate there has changed frequently, as has its biology (Flores, 2016c). During the archaic period (8,500-1,350 BP), known as the longest-lasting human lifeway in the history of the Great Plains, the climate drove the system. Archaeological records show bison herds followed cycles of expansion and contraction, according to the weather and vegetation fluctuations, being followed by the mobile hunters. Bison abandoned the plains during hot and dry periods in search of refugia, like the “Great Drought” period of about 8,500 to 4,730 years ago, when human occupation sites also went scarce in the region. (Waldo, 1986; Flores, 2016a).

Between 8,500 and 1,350 BP (Before Present), Native Americans in the Great Plains region adapted to the loss of large animals by shifting their economy to a diverse range of food sources. They hunted small game like rabbits, gophers, and waterfowl, and gathered various plant foods including nuts, berries, and seeds (Cunfer, 2016). Bison remained a crucial food source, and their smaller size and faster reproductive rate allowed them to thrive alongside humans (Flores, 2003). The human occupation of the plains fluctuated with climate changes, as people followed bison herds that expanded and contracted based on rainfall (Wedel, 1986; Flores, 2003). Communal bison hunting strategies emerged during this period, involving sophisticated techniques to kill large numbers of animals for sustenance (Brink, 2016). The cultures of the Great Plains during this time were resilient and adapted to the changing environment over hundreds of generations. Despite the limitations of archaeological and oral history records, it is evident that these people had a well-adapted economy that lasted for thousands of years, far longer than Euro-American agricultural settlement in the region (Wedel, 1978).

During historic times and later with the arrival of Europeans, hunting had overwhelmingly been a quest for the fattest animals, which were the cows for most of the year, a selectivity that had profound impacts on the entire bison population (Brink, 2016). Archaic Indigenous people also had sophisticated hunting techniques that could take many dozens of animals at a time, guaranteeing resources for many months (bison “jumps” and “pounds”). Because these hunting practices couldn’t control the number of animals killed, it often led to significant parts of carcasses going to waste (Brink, 2008).

Later, on the Plains and where weather fluctuations permitted, agricultural cultures arose, who cultivated crops, built long-term houses, and traded for animal products with nomadic hunters from drier and colder areas to the west and north (Flores, 2016c). Trade and farming allowed for larger human populations, who had already been increasing their take at bison

jumps at least by AD 200. Increased harvesting of bison on a market scale predated European arrival by at least 1,500 years. (Brink, 2008). However, there is no evidence that the increased harvesting of bison diminished the herds. On the contrary, where Indigenous cultures grew and became more sophisticated, with the aid of wetter conditions after 1450, the use of intentional and controlled fire management helped expand the size of grasslands considerably, thus raising bison carrying capacity, and allowing populations to reach all-time highs, estimated at 29 million by 1700 (Flores, 1991; 2016a; Sauer, 1950).

From 250 BC to AD 1700, farming communities called Horticultural Plains Woodland cultures settled in the Great Plains. They practiced agriculture alongside hunting and gathering, cultivating crops and trading bison products. These settlements were limited to river valleys and relied on human labor (Wedel, 1941; Binnema, 2004). The farming communities had a symbiotic relationship with nomadic hunters, exchanging bison products for agricultural produce (Jennings, 1974; Binnema, 2004). Bison jumps (i.e., specific cliff locations that allowed for mass bison kills) became highly productive sites, and the advent of agriculture led to population growth, transformed trade networks, and further increased bison hunting. Therefore, it is worth noting that market hunting of bison existed for centuries before the arrival of Europeans (Brink & Dawe, 1989; Brink, 2008).

With sophisticated land management practices, the village cultures contributed to the growth of bison populations and the expansion of grasslands on the plains. Through intentional and controlled use of fire, Native Americans transformed the landscape, creating larger grasslands that provided more habitat for bison (Sauer, 1950; Pyne, 2019). The larger populations of both bison and Native Americans during this time allowed for extensive landscape management. By the 1500s, when European explorers arrived, bison and Native American populations were at their highest levels in thousands of years. This cultural and natural legacy

of a productive grassland ecosystem shaped the final phase of Native American occupation before the arrival of Euro-Americans (Sauer, 1950; Flores 1991).

The period between 1630 and 1750 marked the Horse Revolution on the Great Plains, a transformative era that accompanied a technological revolution and reshaped the relationship between Indigenous people and their environment. With the introduction of domesticated horses, combined with the abundance of bison herds, various Indigenous tribes were attracted to the region (West, 1998; Binnema, 2004). This influx of new groups, particularly the Sioux, Cheyenne, and Comanche, led to conflicts over bison access and military dominance, ultimately destabilizing the long-standing relationship between people, grasses, and grazers. The arrival of horses brought about significant changes, as they served as a new hunting tool, allowing for safer, faster, and more efficient bison hunts from horseback. It also granted a crucial military advantage, enabling horse-riding tribes to dominate other Indigenous people who were on foot (West, 1998; Hämäläinen, 2001; Flores, 2003; Brink, 2008). This revolution resulted in cultural reorganization, gender role shifts, population expansion, and the adoption of new strategies for survival. The horse revolution had a profound and rapid impact on the Indigenous peoples from the Plains, shaping their way of life within just a few generations (Hämäläinen, 2003).

2.3.4.1. Decline on the Southern Plains

Bison survived fifty centuries of climate shifts and hunting, remaining as the dominant megafauna of the Great Plains until a little over a hundred years ago. It all started to shift, rapidly and dramatically, after the domesticated horse brought with it a cultural revolution (Flores, 2016a; c). Once extinct in North America, horses were brought back by the Spanish, spreading throughout the southern plains after 1630. During the 18th century, horses became a central part of many Indigenous cultures, allowing for much more efficient bison hunting and

crucial military advantages over other Indigenous people (Flores, 1991; 2016a). Tribes remade their way of life once again, with many becoming fierce mounted warriors that actively incorporated and subjugated other groups, expanding this way their own populations, and claiming the best bison hunting grounds. Such increased exploitation of the immense, but limited bison stocks, dramatically changed the relationship between people and nature in the grasslands (Flores, 1991; West, 1998; Isenberg, 2000; Hämäläinen, 2003; Binnema, 2004). Trade systems in which bison-derived goods were traded by produce of the horticultural villages had existed at least since 1450. But, by 1790, to maintain their own increased populations and feed these trade alliances, Indigenous people began overhunting bison, that is, killing more than reproduction could replace in a year (Brown, 1986; Flores, 1991; Hämäläinen, 2001).

As more Indigenous people were concentrating in bison rich territories, many moving south due to U.S. government removal policies, bison herds were becoming less reliable. Historic plains tribes frequently addressed diminishing resources by engaging in warfare and raids against each other, later forming alliances against others who were seen as trespassing on the territory (Flores, 1991). Peace alliances after 1840 guaranteed access to hunting grounds for many tribes, and the intertwining of most southern Indigenous tribes in the European market system added further critical pressure on already diminishing bison herds (Flores, 1991). Indigenous people's preference for young breeding bison cows, which provided better meat and thinner, more easily processed hides, with pelts making for more luxurious robes, impacted bison reproduction, accelerating the loss (Flores, 1991; Brink, 2016). On top of that, traders along the Santa Fe Trail and New Mexican bison hunters were also taking an estimated 15 to 25 thousand bison a year between 1825 and 1850 from the southern herds (Flores, 1991).

Horses represented a critical factor in the widespread overhunting of bison on the southern plains, particularly by the Comanches, who controlled the region at the time, and their Kiowa allies. Between 1780 and 1870, before any significant contact with Euro-American markets, this overhunting, coupled with other factors, led to a 25% reduction in the southern bison population, equivalent to two million animals. The rate of overhunting escalated from 1840 to 1860, causing an additional decline of two million bison, leaving only three to four million remaining. The year of 1840 was marked by a peace agreement between the Comanches, Kiowas, and their northern enemies, opening hunting in disputed territories that had previously served as sanctuaries with safer grazing environments for bison. As a result, bison hunting intensified for all tribes involved. Around that time, the Euro-American market for bison began penetrating the plains. With the increasing presence of Euro-Americans, Indigenous peoples from the Plains experienced an accelerated collapse (Brown, 1986; Flores 1991; Hämäläinen, 2001; 2003). During the 1840s, there were already shortages of bison reported in Indigenous calendars, and accounts of starving Indigenous people on the plains were already frequent in the 1850s, before the commercial hide hunter's arrival (Flores, 1991; 2016b).

The collapse of bison herds and the disruption of Plains Indigenous culture from 1840 to 1885 were influenced by multiple factors. The dynamics observed include the influence of the Little Ice Age, a climatic cycle characterized by favorable moist and grassy conditions in the Great Plains, a period that coincided with Europeans arriving in North America (Neilson, 1986). Tree ring studies reveal a wet period from the early 17th century to the first half of the 1800s, favoring the growth of grasses that bison thrived on. As a result, the bison population flourished, expanding eastward across the Mississippi and westward across the Rockies (Weakley, 1943; Frits et al., 1964). However, the favorable climate conditions gradually shifted, and the period after 1821 was marked by wet and dry periods, with the plains

experiencing intermittent droughts after 1840. The most severe drought occurred from 1855 to 1866, affecting a vast area and having a devastating impact on grass and animal populations (Lawson, 1974; Coupland, 1958). This prolonged drought, considered more severe than any previous localized droughts due to its extensive scale, significantly reduced the carrying capacity for bison, leading to an estimated decline of 40-60 percent (Bryson, 1981). Archeological records show a strong relationship between the climate cycle and bison populations. After four decades of mostly wet weather, rainfall dropped up to 30% below the median on the southern and central plains from 1846 and for six to nine of the next ten years. (Flores, 1991). During the same period, the emergence of the Euro-American market for bison robes introduced traders who set up outposts in the region. Bringing goods desired by Native Americans – such as guns, horses, liquor, and consumer items – traders acquired bison robes for export to the eastern markets, increasing the demand for bison products (Hämäläinen, 2001; Flores 1991; 2016a).

The tipping point in bison history thus occurred in the 1840-1850s rather than the 1870-1880s. The decade-long drought reduced the plains carrying capacity for large grazers, at the same time as competition for forage increased. The Indigenous peoples from the Plains relied on horses for hunting and pastoralism, requiring large grazing areas. With considerably drier weather, and hundreds of thousands of Indigenous people's horses in direct competition with bison for forage, many animals and Indigenous people alike didn't survive the winters. Refugia along the river valleys became increasingly degraded as more animals and people competed for resources in the winter. (Hämäläinen, 2001; Flores 1991; Sherow, 1992; West, 1998; Brink, 2008). With a dietary overlap of over 80 percent, European-reintroduced horses became formidable competitors to bison, consuming a significant portion of the same grasses and water sources (Flores 1991; Isenberg 2000). By 1800, horse herds in the West numbered around two million and continued to grow throughout the 19th century, further impacting

resources available to bison (Haley, 1949). Added to that, gold-looking Euro-Americans used the same river courses, along with their domestic animals (West, 1998).

The finalization of the transcontinental railroad in 1869 facilitated Euro-American settlements in the Great Plains, which in turn intensified these processes. As the railroad system cut through the plains, it brought a surge of Euro-American settlers seeking land and economic opportunities. Emigrant trails and the influx of settlers and their livestock exacerbated the ecological strain on the region (Sherow, 1992; West, 1998; Brink, 2008). Increasing numbers of homesteaders and entrepreneurs, along with overhunting, grazing competition, habitat degradation, and drier weather, pushed Plains Indigenous societies and the bison herds to the brink of collapse by the late 1860s (Hämäläinen, 2001; 2003; Flores 1991).

Bison populations had already been significantly reduced by the 1850s. Drought, Indigenous market hunting, and cow selectivity were critical elements impacting herds on the southern plains. On top of that, other factors like hunting disruptions by white overlanders, wolf predation, the expansion of horse populations and increasing grazing competition, and the potential impact of exotic bovine diseases added further pressures (Brink, 2016). The degree of the impact of exotic diseases on nineteenth-century bison remains unclear, though Charles Goodnight's account of numerous inexplicably dead bison in 1867 hints at disease causes, which is also supported by other reports (Koucky, 1983). Around the 1800s, Anthrax was introduced from Louisiana, and later, Tuberculosis and Brucellosis were brought by feral and stolen cattle in Texas, diseases which can affect reproduction in bovines. Most of the remaining bison that were saved in the late 19th century were infected with these diseases. Wolf predation on calves also affected bison annual increase (Flores, 1991).

The market played a significant role throughout the bison's history of collapse (Burlingame, 1929; Flores 1991; Isenberg 2000). With more demand east, a powerful market for bison

robes and leather was created, supplied first by Native hunters interested in industrialized products (like guns and ammunition), and later by Euro-American hunters. The white hunters who flooded into the Great Plains after the Civil War are often portrayed negatively, although they were part of a complex economic system. The railroads played a crucial role in transporting bison hides out of the plains, and merchants set up shops and trading posts to support the hunters' needs (Isenberg, 2000).

Driven by the growing industrial leather market in the eastern United States, the white hunt intensified after the Civil War and rapidly depleted the remaining bison herds. The hunters operated in teams and their hides were collected, purchased, and transported by middlemen. The economic infrastructure, including railroads, merchants, and frontier communities, supported the massive enterprise of harvesting and selling of bison hides. A commercial undertaking deeply connected to the American industrial economy, the “white hunt”, severely depleted the remaining bison from 1871 to 1883, reducing it to just a few hundred animals by the late 1880s (Fig. 6; Isenberg, 2000; Hämäläinen, 2003; Hansen, 2016).

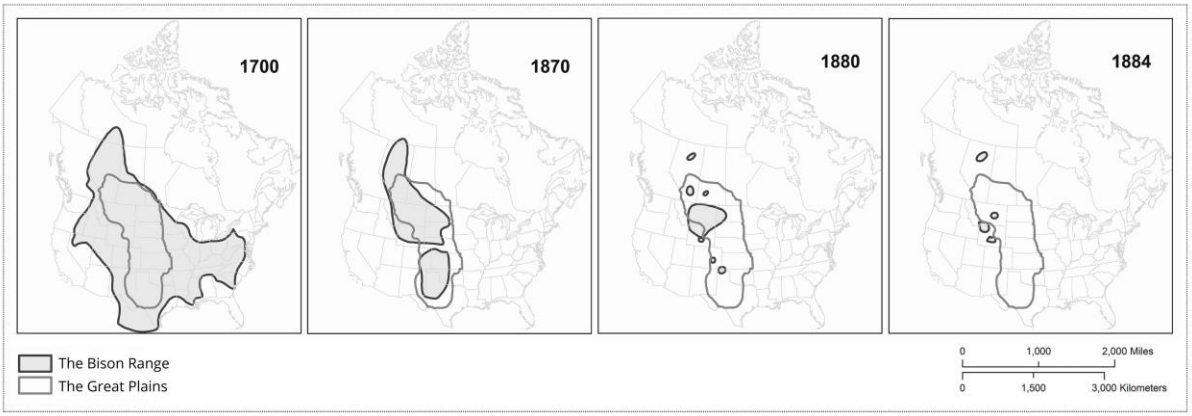

Figure 6. The contraction of the American Bison range, according to Hornaday (1889). Adapted from Cunfer (2016). See the original map by Hornaday on Appendix 4.

For a long time, it has been acknowledged that the American government would have *actively supported* the persecution of bison through the supply of guns and ammunition to hunters, with the first indicative of this idea appearing in the 1907 memoir of former hide

hunter John Cook (Cook, 1938). Although the military was reluctant to intervene with the consequences of a laissez-faire capitalist system that viewed bison as just another available resource, susceptible to uncontrolled exploitation without regulations, their approach was not characterized by intentional destruction. No concrete evidence has emerged to support the claim of army posts providing free ammunition to hide hunters. The available evidence shows instead that the army fulfilled existing treaty obligations by providing military escorts for Columbia Plateau Indigenous people on buffalo hunts, and, on occasion, expressed concern for Indigenous bands struggling to find bison (Dobak, 1995). Even Philip Sheridan – who's frequently misquoted to the present day – upon hearing about the mass slaughter of bison, advocated for its cessation (Sheridan, 1879). These facts indicate that if there was a government conspiracy to destroy the bison, many individuals within the western army, including Sheridan, were unaware of it (Flores 2016a; b).

In 1887, William T. Hornaday was already referring to the extermination of the American bison as a complex combination of factors, pointing to the importance of unregulated market hunting. The role of the American Indigenous people in the over exploitation was also already noted in 1887, with Hornaday, citing the historical practice of "impounding buffaloes", which doesn't control the number of animals affected, often slaughtering a couple hundred at a time, and leaving most of the meat to putrefy, practice which was intensified after the acquisition of horses, and participation in the market trade (Hornaday, 1889).

By the end of the 1880s the estimated number of bison left in the United States and Canada, both in the wild and in captivity, under protection or not, was around a thousand animals, with over half this number being the so called "wood buffalo", and believed to inhabit the more inaccessible areas of the Athabasca Lake in the Northwest Territory, where a few were still killed every year by the Indigenous people (Hornaday, 1889). The remaining wood bison were primarily found in northern Alberta and the Northwest Territories, while plains bison

inhabited scattered groups across the Central Great Plains, including notable populations in what is now Yellowstone National Park (Potter et al., 2010).

In the span of a decade, Euro-American hunters on the southern plains hunted and killed approximately 3.5 million bison, which accounted for around 40 percent of the eight million bison that existed in the region in 1780 (Flores 1991). Although the white hunt is often seen as the primary cause of the bison's decline for the past 150 years, it has been argued that the collapse of the bison herds might still have occurred without direct engagement with the industrial American economy (Cunfer, 2016).

In the post-Civil War United States, the government grappled with the wildlife and market dilemma, with both political parties favoring laissez-faire economics. Despite some efforts to pass protective legislation for animals like the bison, significant progress remained elusive, and unregulated market hunting of American wildlife persisted for another quarter-century. Meanwhile, divergent viewpoints emerged concerning the impact of preserving bison on Indigenous assimilation, ranging from sentimental appreciation to perceiving it as a potential catalyst for acculturation. Nevertheless, the government administrations of the time chose a hands-off approach, allowing the unregulated market to dictate the fate of the buffalo. Tragically, this resulted in the eventual extinction of the bison and the assimilation of Native Americans, a fate that was regarded by only a few as regrettable but ultimately "inevitable" (Flores 2016a).

2.3.4.2. Decline on the Northern Plains

Similar dynamics unfolded on the central and northern plains, where the Indigenous populations heavily depended on bison, experienced population growth, shared similar subsistence requirements, and possessed robust trade networks. On the northern plains, the Native populations also experienced the horse revolution and a growing emphasis on bison

hunting between 1770 and 1881. However, in this region, the Euro-American market for bison products was present from much earlier, leading to increased hunting and a shift in Native hunting practices (Cunfer, 2016). Already in the early 1770s, French Canadian fur traders exchanged manufactured goods for pemmican – a nutrient-dense food made from dried meat, fat, and other ingredients – practice later followed by the British Hudson's Bay Company fur traders by the end of that decade. Increased competition led to the merger of Hudson's Bay Company with its trading competitor in 1821, unifying the market. Natives then experienced a drastic drop on market prices for pemmican, reducing economic incentives for sustainable hunting and further increasing hunting pressures and dependence on European trade goods (Colpitts, 2012; 2014). By 1830, Native hunters had already increased their bison take by 20% in response to the new American robe market (Cunfer, 2016). The Red River Métis, a group with a mixed French and Cree heritage, also participated in bison hunting and transportation of the produce early in the nineteenth century (Dobak, 1996; Colpitts, 2016). By the 1880s, the bison had disappeared from the northern plains, prompting Native communities to seek treaties with the Canadian government for basic subsistence and agricultural education (Dobak, 1996; Waiser, 2005).

Historians of the northern plains have not yet conducted a comprehensive analysis of bison populations like the one done for the southern plains by Dan Flores and William Brown (e.g., Flores, 1991; 2016 a; b; c; Brown, 1986). However, it is likely that the strong market demand for bison products combined with unsustainable hunting practices, contributed to the decline of bison populations as early as the late eighteenth century (Cunfer, 2016). Historical researchers Jim Sherow and William Dobak explored the challenges posed by horses to the Indigenous peoples from the Plains and identified similar patterns in the disappearance of bison from both the American plains and Canada (Sherow, 1992; Dobak, 1996).

The story of the bison's decline across its range is complex and shaped by unsustainable practices of the Indigenous horse culture, the impact of Euro-Americans, and the intricate interplay of human, animal, vegetation, and climate factors. It dispels the myth of Native people living in complete harmony with nature and emphasizes the human ability to both adapt and disrupt. The history of human-environment interaction in the region is a compelling narrative that reveals the dynamic and evolving relationship between people and their environment, devoid of simplistic notions of heroes, villains, or victims (Cunfer, 2016; Flores 2016a).

2.3.5. Narratives

The history of the bison's decline underwent a significant revaluation over the past few decades. Previous accounts portrayed a simplistic narrative of the bison's rapid extermination by the march of civilization, with blame primarily placed on the U.S. government. However, many now recognize a more complex and multifaceted story. Respected historians, geographers, and anthropologists have incorporated and expanded upon the multifaceted arguments initially outlined in 1991's groundbreaking article "*Bison Ecology and Bison Diplomacy*" (Flores, 1991), applying them to the central and northern plains in addition to the southern plains (e.g., West, 1998; Isenberg, 2000; Hämäläinen, 2001; 2003; Zontek, 2007). These new publications presented a revised perspective on the bison's decline, significantly contributing to a new and profound understanding of the complexities within environmental history and shedding light on the demise of the bison. (Flores, 2016b), although, this was also not without scrutiny, with others criticizing the new environmental history explanations (e.g., Shaw, 1995; Robbins, 1999).

Native peoples had long recognized the diminishing bison herds, attributing the decline to various factors, including the intrusion of white settlers. Popular accounts of the

government's deliberate eradication policy emerged in the 20th century but lacked critical scrutiny. The reality was a culmination of individual self-interest, capitalism, ecological factors, and government actions, with the bison population dwindling from tens of millions to only about 1,073 animals by the late 19th century (Hornaday, 1889; Flores 1991; 2016a; b).

The story of the bison's demise is depicted through contrasting perspectives. William T. Hornaday's book attributed the collapse of the bison population to unregulated market hunting driven by profit motives, involving both white hide hunters and Native peoples. He emphasized the destructive role of the market in wildlife decline and the need for regulations to prevent further devastation (Hornaday, 2002). While some of the surviving hide hunters expressed sorrow at their actions, others celebrated their role in what would be the “inevitable march of civilization” (Inman, 1899; Muir, 1901; Burlingame, 1929; Mooar, 2005). Narratives emerged suggesting that the U.S. government had *intentionally orchestrated* the bison's eradication to clear the Great Plains of Native Americans (Cook, 1938). This theory gained popularity, overshadowing Hornaday's market explanation, despite the lack of substantial evidence to support John Cook’s 1907 memoir narrative that he and other hunters patriotically slaughtered bison on behalf of the military, federal government, and civilization (Flores 2016a; b).

The differing viewpoints also extended to the involvement of Native hunters. While some scholars argued that Native peoples operated in an ecological balance and were not complicit in the bison's demise, others debated their participation in the mass killing of bison for profit. These perspectives often intersected with broader societal attitudes about civilization's progress and the displacement of Indigenous populations. The controversy surrounding the causes of the bison's decline demonstrates the complex narratives that emerged, with Hornaday's market explanation clashing with theories of government conspiracy and debates about Native involvement, revealing the socio-political dynamics at play in understanding

and interpreting the history of the bison (Burlingame, 1929; Holder, 1970; Roe, 1955; 1970). The revised understanding of the bison's decline does not question the enduring relationship between Native people and bison. It recognizes the extensive history of bison hunting on the Great Plains, where bison would depart due to human mistakes but return when people rectified their behavior (Flores, 2016b).

One of the first to challenge the prevailing narrative attributing the decline to hide hunters acting on U.S. government policy was Rudolph Koucky, who noted the illogic when comparing numbers of the documented hide hunt – projecting the highest possible figures for shipped bison hides – and raising questions about the fate of the other millions of bison not accounted for (see Koucky, 1983). Although Koucky's proposed bovine disease explanation for the disappearance of bison was considered too speculative at the time, it highlighted the inconsistencies of these dominant explanations. Only later, the emergence of environmental history as a field of scientific investigation provided a more holistic approach to understanding the bison's demise (Flores 2016b).

It's important to highlight the contrasting perspectives between how Native Americans and non-Native Americans viewed bison. Many Plains tribes viewed bison as more than just animals—they were seen as having families, societies, and souls that could regenerate even after death. The Indigenous understanding of bison was rooted in kinship and reciprocity, while Euro-Americans, influenced by Christianity and western science, saw them as soulless creatures existing for human exploitation (e.g., Brightman, 1987; Eliade, 1974; Mooney, 1894). The global market, driven by capitalism, exerted a significant influence on Euro-Americans' perception of animals as mere resources.

Interestingly, in Canada, where neither white hide hunters nor a supposed "secret government conspiracy" were involved in the bison story, the outcome was remarkably similar: the market hunt driven by the fur trade resulted in the complete extermination of bison on the

Canadian plains, and this happened even earlier than Hornaday's final hunt in Montana during 1882-1883 (Flores 2016a).

The profound impact of the bison's disappearance reverberated across North America. Indigenous communities saw the loss of a fundamental aspect of their livelihood and spiritual connection to the land. The end of the bison era marked a significant historical shift, prompting Crow leader Plenty Coups to state, "After this, nothing happened" (Linderman, 1962). The downfall of the bison serves as a powerful symbol of America's environmental history, illustrating the catastrophic effects of uncontrolled exploitation and underscoring the critical necessity for conservation initiatives (Flores 2016b).

2.3.6. Conservation, Recovery & Current Herds

Bison demise in the Great Plains was the result of a perfect storm of factors, including overhunting, ecological changes, competition for resources, habitat degradation, exotic bovine diseases, and the expansion of Euro-American settlements, all contributed to the collapse of the bison, and the disruption of Plains Indigenous culture (Cunfer, 2016; Flores 2016a; b). The bison population suffered due to unregulated capitalism, where white hide hunters pursued them for economic gain, and Native Americans hunted them for their hides, often unaware of the broader impact. The decline of the bison had profound effects on both Indigenous communities and conservationists, prompting initiatives to safeguard the species.

In the late 19th century conservationists were profoundly concerned about the imminent extinction of the American bison. William T. Hornaday, a taxidermist at the National Museum in Washington, embarked on an expedition contracted by the Smithsonian Institute to “find wild buffalo, if any were still living, and in case any were found to collect a number of specimens” for museum preservation (Hornaday, 1889, p. 529). The once abundant and iconic animal had dwindled to a few scattered herds, and Hornaday aimed to capture its

essence before it vanished entirely. Supported by the U.S. Army, Hornaday and his team ventured into west-central Montana in search of the remaining bison. Despite many difficulties, they managed to obtain twenty-two specimens of about 30 estimated to be left in Montana in 1886 (Flores 2016a; See Hornaday, 1889; see Appendix 4).

The limited legislative action for the protection of bison after declining to alarming levels led a few individuals to take matters into their own hands and establish herds from the remaining bison, but in a peculiar way. These elite white saviors saw bison as potential beef animals or historical symbols, rather than creatures to be returned to the wild. Among them were Charles "Buffalo" Jones (Kansas), who had been a hide hunter himself, the Texas ranchers Charles and Mary Goodnight, James McKay and Charles Alloway (Manitoba), and Michel Pablo and Charles Allard (Montana). Alongside, Native Americans like Samuel Walking Coyote (Montana) and Frederick Dupree (South Dakota) also played significant roles in these efforts to save the bison. From the 1880s to the early twentieth century, they fought to preserve the bison, with motivations that varied (Coder 1975; Danz 1997; Potter et al., 2010; Flores 2016a).

During the 20th and 21st centuries, federal, state, provincial agencies, and conservation organizations played important roles in the conservation and recovery of wood bison as wildlife. Private citizens played a significant role in early plains bison conservation efforts (Danz, 1997). The American Bison Society was created in 1905 as a response from private citizens to the failure of the U.S. government in protecting bison. It further advocated for the establishment of public herds in various locations, for saving the bison, although their vision focused more on creating parks and refuges for buffalo viewing rather than restoring the species to its original habitat. This group pressed the congress to establish several public herds, especially of plains bison, and, driven by its commercial value, they were responsible for saving this subspecies in the U.S. (Coder, 1975; Danz, 1997). Although these individual

rescues were successful in saving the bison (especially the plains), it transformed the animal into a symbol of conquest and a ranched beef animal, rather than a truly wild and free species. In recent times however, with bison populations growing and restoration efforts by various tribes, there is potential for a different buffalo future (Flores 2016a).

With the implementation of hunting restrictions in the 1870s, the population of plains bison began to recover, driven initially by nostalgia and later by their commercial value. By 1909, it was considered safe (Coder 1975). By 1970, there were 30,000 plains bison, with half in public herds and half in private herds. Currently, there are over 20,500 plains bison in conservation herds and about 400,000 in commercial propagation (Gates & Ellison, 2010).

The wood bison population faced a similar decline, reaching a low point estimated to be around 250 animals by the end of the 19th century. Then thanks to the implementation of Canadian laws aimed at protecting the species, the population gradually increased to 1,500-2,000 individuals by 1922. By 2008, approximately 10,870 wood bison existed in 11 conservation herds (Soper 1941; Gates et al., 2001b; Gates & Ellison, 2010). Conservation herds are herds managed by the government or NGOs for species conservation (Gates & Ellison, 2010; Fig. 7). Since approximately 1970, the population of bison in commercial propagation (mainly plains bison) has surpassed that of bison in conservation herds (Freese et al., 2007).

More commonly managed as wildlife than the plains bison, the wood bison faces more challenges in habitat fragmentation and disease management, complicating conservation efforts. Bison can carry various pathogens, including livestock diseases that can negatively impact both bison conservation and human health. Measures such as depopulation, restricting dispersal and range expansion, and controlling translocations are implemented to prevent the spread of diseases. Currently, large free-ranging bison populations in the 'Greater Yellowstone Area' (plains bison) and the 'Greater Wood Buffalo Ecosystem' in Alberta and

the Northwest Territories (wood bison) are affected by exotic diseases such as bovine brucellosis and tuberculosis (Gates & Gogan, 2010).

The current wood bison herds in boreal regions inhabit natural environments without hindrances such as fences and land uses, unlike most plains' bison herds. Wood bison is restricted by land use and wildlife management policies in the south and by wildlife disease management policies in the north (Gates & Aune, 2008). In general, north American bison conservation herds currently occupy less than 1% of their original range (Sanderson et al., 2008, Fig. 4). Conservation herds are herds managed in the public interest by governments and environmental organizations. Estimates from 2008 account for approximately 11,000 total wood bison in 11 conservation herds across Canada (Sanderson et al., 2008). Populations that exceed 1000 individuals are considered viable in the long term, although only three wood bison conservation herds exceed 1000 animals each (Gates & Aune, 2008). In contrast, over 500,000 bison are in captive commercial herds on more than 4000 privately owned ranches, most of which is represented by the plains' subspecies. Of the total number of both North American bison subspecies, estimated 15,000 animals are considered wild bison inside its natural range (free ranging, not confined; Sanderson et al., 2008; Gates & Aune, 2008).

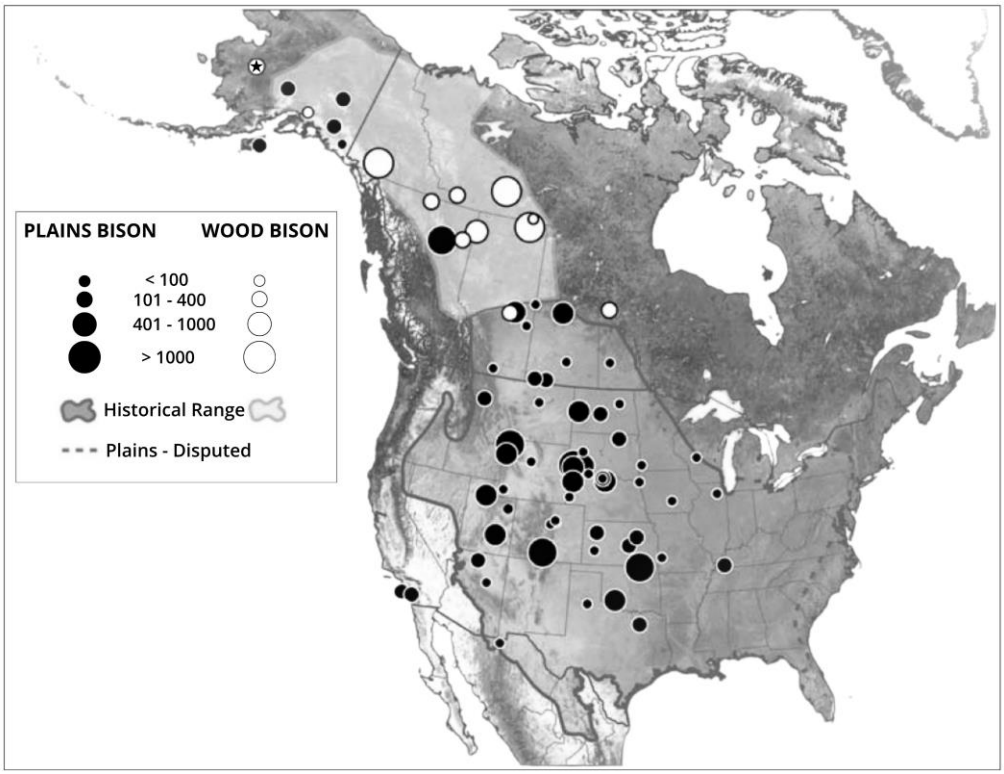

Figure 7. Distribution of bison conservation herds across their historical range (and beyond) in North America. Size classes in units of animals. Adapted from Gates & Ellison (2010). The star marks the dot representing the current size of the reintroduced wood bison herd in Alaska. Historic ranges of wood and plains bison were based on Stephenson et al. (2001) and Sanderson et al. (2008), respectively. The size of the dots represents herd class sizes. Estimates are that bison currently occupy <1% of their 1500 historical range.

Hornaday's foresight in the 1880s is evident in the following quotes, which accurately anticipated significant threats that the American bison would face:

"*There is reason to fear that unless the United States Government takes the matter in hand and makes a special effort to prevent it, the pure blood bison will be lost irretrievably through mixture with domestic breeds and through in-and-in breeding*"; and "*With private owners of captive buffaloes, the temptations to produce cross-breeds will be so great that it is more than likely the breeding of pure-blood buffaloes will be neglected*" (Hornaday, 1889; pg. 527-8). And indeed, it was.

The decline of North American bison in the 19th century led to concerns about genetic diversity. Factors such as hybridization, domestication, and population isolation have potentially affected the bison genome. Genetic diversity is vital for adaptation and fitness, but

reductions can lead to decreased growth and limited adaptability. Bottlenecks, founder effects, genetic drift, and inbreeding have impacted genetic diversity in bison populations. Efforts to recover the species have been successful, but the consequences of the bottleneck on diversity are unclear. Genetic studies using various techniques are necessary for assessing and preserving diversity. Management strategies must consider whether herds should be managed as a large metapopulation or closed herds to maintain overall and localized diversity. Maintaining an inventory of genetic diversity, avoiding biased selection, and understanding population dynamics are essential for preserving North American bison (Meffe & Carroll 1994; Boyd et al., 2010b).

Hybridization involves interbreeding genetically distinct populations, creating novel gene combinations despite reduced fitness. Artificial hybridization however can disrupt genetic integrity, locally adapted genes, and devalue offspring. Plains bison introduction into wood bison range caused much controversy, eroding important genetic distinctiveness. Efforts to salvage the wood bison subspecies were partly successful, but hybridization still occurred. Genetic distances remain small, indicating gene flow is occurring. Maintaining separation between representative herds is crucial to prevent further hybridization in conservation efforts (see Wilson & Strobeck 1999). In the past, attempts to crossbreed bison with domestic cattle have resulted in the introgression of cattle DNA into bison herds, impacting genetic integrity. Hybrid offspring tend to have fertility issues and reduced viability. Genetic studies have found evidence of cattle mitochondrial DNA and nuclear DNA introgression in many bison herds, which raises uncertainties about their fitness and productivity. Management options include selective culling, maintaining hybrid-free herds, and conducting genetic inventories and population studies (see Ward, 2000).

Bison may be unique in terms of species management, as it can be managed either as wildlife or livestock, with the wood bison primarily managed as wildlife, and the plains bison as

livestock. Domestication is also a conservation issue for bison. The bison industry keeps growing as more ranchers recognize the economic advantages of raising bison. Bison possess traits that make them superior to cattle as a range animal, including their ability to digest low-quality forage, defend against predators, and experience fewer calving difficulties. However, domestication can lead to genetic changes and reduced genetic diversity. Commercial bison operations may pose a threat to conservation herds if genetically selected animals are mixed into them, therefore it is crucial to protect existing conservation herds (van Zyll de Jong et al.,1995; Gross et al., 2010). For plains bison conservation herds, genetic management practices vary due to limited genetic testing and a lack of comprehensive data. Augmentation (adding new animals) and bull replacement are common methods to maintain diversity. Selective breeding for diversity is rare, and only a few herds focus on specific genetic characteristics. Culling practices differ, with some herds relying on hunting and others conducting regular culling based on various criteria. Standardized and informed culling decisions are needed to preserve genetic diversity. Further research is necessary to develop appropriate culling practices and understand their impact on conservation herds' genetic composition (Boyd, 2003; Gross et al., 2010)

Diseases such as anthrax, bovine tuberculosis, and bovine brucellosis pose significant challenges to bison conservation. These contagious diseases can cause high mortality rates and reproductive issues in bison populations. Surveillance programs monitor the prevalence of bovine tuberculosis, while bovine brucellosis affects both cattle and bison, leading to abortions and reproductive inflammation. These diseases not only impact bison viability but also pose economic risks to neighboring livestock owners (Aune & Gates, 2010).

Two significant chronic disease issues have been identified in plains bison herds in North America. The herds in Yellowstone National Park and the Jackson herd in Grand Teton National Park/National Elk Refuge, both located in the Greater Yellowstone Area, are

affected by brucellosis. These herds account for 24% of the North American plains bison population. The presence of brucellosis poses a risk to the livestock industry, as bison leaving the park could transmit the disease to domestic cattle. Agencies from various jurisdictions are involved in developing a long-term bison management plan to address this issue (Aune & Gates, 2010). Similarly, wood bison herds in Wood Buffalo National Park, the Slave River Lowlands, and the Caribou Mountains-Lower Peace area are affected by bovine tuberculosis and brucellosis. These diseased herds account for 54% of the total wood bison conservation population, posing a threat to the recovery of wood bison, as they experience increased mortality, reduced fecundity, and increased vulnerability to predation. The diseases also have the potential to be transmitted to healthy herds, hindering the re-establishment of wood bison in their original range. Efforts are being made to eradicate the diseases and reintroduce healthy wood bison to the affected areas (Boyd, 2003). Effective disease management in wild populations requires careful consideration of intervention, aligning strategies with conservation goals and prioritizing research and development of frameworks within a broader context.

Most bison conservation efforts have primarily focused on plains bison, but wood bison in more remote areas of northern Canada have also received attention and rebounded. The Canadian Wood Bison Recovery Team has been working since 1975 to establish viable, disease-free wood bison populations in different regions. However, the presence of diseased bison herds in and around Wood Buffalo National Park and the presence of plains bison in wood bison range limit the recovery opportunities (Gates et al., 2001a). Potential areas for wood bison recovery include the Mackenzie Valley, reclaimed grasslands after development, the Yukon Flats and Innoko River Areas in Alaska. The Hook Lake Wood Bison Recovery Project aims to establish a captive, disease-free herd of wood bison and reintroduce them into the wild (Nishi et al., 2002). The Heart Lake Wood Bison Recovery Project in Alberta

involves establishing a captive commercial herd and a conservation herd for future recovery efforts (Boyd, 2003). In Alaska, after bison reintroduction to the Innoko River Area, efforts have been made to supplement this population, and potentially also reintroduce wood bison to the Yukon Flats area. The Pleistocene Park in Siberia is considering the inclusion of wood bison to recreate the Mammoth Steppe grazing system (Gates et al., 2001a; c). Grasslands ecosystem restoration projects, such as the Living Grasslands Initiative, envision the formation of protected areas that could support bison reintroduction (Teel, 2002). Additionally, there are opportunities for bison restoration in North American aboriginal communities, with efforts by the InterTribal Bison Cooperative to reintroduce bison within tribal lands and restore cultural ties (McDonald 2001; Boyd, 2003). Many other reintroduction efforts also exist for the European bison, in the context of *rewilding* initiatives, such as the Făgăraș Mountains project in Romania, part of the Endangered Landscape Program (ELP; endangeredlandscapes.org), however, we are going to keep the discussion here focused on the American bison, target of this thesis.

The wood bison is the only subspecies naturally occurring in Alaska. Believed extinct at the time, efforts were made in 1928 to introduce plains bison - coming from the National Bison Range in western Montana - to the state's delta junction as a substitute for wood bison. As a result, Alaska now hosts two populations of plains bison, in the delta junction and farewell regions (Fig. 7). Until 1957, wood bison were believed to have been lost to hybridization, when a seemingly isolated herd of 200 animals was discovered near the Nyarling River and Buffalo Lake in Canada (WBNP). These animals were considered morphologically representative of wood bison, being contact with the introduced plains bison in the area considered minimal enough to still exhibit predominately wood bison traits. To salvage the wood bison, this herd was captured and relocated, with 24 animals successfully transferred to Elk Island National Park (EINP) in Alberta in 1965-8. To date, no genetic evidence of

domestic cattle introgression or diseases have been reported in EINP (van Zyll de Jong 1986; van Zyll de Jong et al.,1995; Boyd et al., 2010a).

Reintroduction efforts greatly contribute to enhancing overall survival in the wild. So, in 2008, 53 disease-free wood bison from the 'Elk Island National Park' (EINP) herd in Alberta (Canada) were transferred to the only U.S. state it naturally occurs, Alaska, where they were quarantined for many years prior to their planned reintroduction. They were held in a temporary holding facility at the 'Alaska Wildlife Conservation Centre' (AWCC). These animals added to the small herd already existing at the AWCC, which had been confiscated in 2003 after being imported illegally. The animals taken from the EINP were considered excess, thus not adversely affecting the genetic diversity of the park's herd. Elk Island has a long history as being the epicenter of world bison conservation, providing seed stock for new herds, as well as an emerging bison ranching industry (Parks Canada). In 2015, about 140 wood bison were residing in the AWCC.

2.3.7. Protection

In the United States, despite numerous bills introduced between 1871 and 1876, no laws were enacted to protect bison. Although some state and territorial governments enacted protective legislation, these laws were largely ineffective. Yellowstone National Park was established in 1872 to safeguard natural resources, including bison, but rampant poaching reduced the park's bison population significantly by 1894. The National Park Protective Act (Lacey Act) was signed in 1894, becoming the first federal law to protect bison within Yellowstone National Park (Coder 1975; Danz 1997).

In Canada, bison protection efforts began in 1877 with *An Ordinance for the Protection of Buffalo*, but it faced challenges and was later repealed. Subsequent legislation, including the *Ordinance for the Protection of Game*, also proved ineffective. The *Unorganized Territories*

Game Preservation Act was enacted in 1894, but enforcement was minimal until the Northwest Mounted Police took charge in 1897. Wood Buffalo National Park, established in 1922, played a vital role in enhancing protection and promoting the gradual increase of the wood bison population. Prior to 1907, plains bison in Canada were limited to small herds in Rocky Mountains Park and Winnipeg, but in 1907, the Dominion of Canada purchased the Pablo-Allard plains bison herd, which was used to establish herds in multiple national parks (Soper, 1941; Ogilvie, 1979).

Listing and legal status refer to the classification of vulnerability assigned to a species and the protection provided under wildlife legislation. The international classification of the North American bison subspecies is based on the IUCN Red List Categories, which assess the extinction risk. The IUCN Red List does not subdivide its classification in subspecies, listing the American bison (*Bison bison*) as near threatened, under the justification that it's a species dependent on ongoing conservation programs to persist beyond the next 5 years, and has a limited number of viable populations, with most bison in small, isolated populations (Aune et al., 2017; IUCN, 2017), since wild populations could severely decline if management regimes are changed (IUCN, 2017).

The U.S. Endangered Species Act (ESA) requires a range of protections for listed species and their habitats. In 1969 the U.S. Fish and Wildlife Service (USFWS) listed wood bison (*B. b. athabascae*) as 'endangered' under the ESA (AWBMPL, 2015). After multiple petitions to de- and down-list this subspecies, driven by economic interests, the status was changed to 'threatened' in 2012 (www.fws.gov/species/wood-bison-bison-bison-athabascae).

The wood bison was listed under CITES Appendix II, while the plains bison was not listed. In 2016, a proposal to remove the wood bison from the CITES appendix II was accepted based on the justifications that wood bison does not have a small, restricted, or declining population, and that there are measures in place for the protection of the subspecies, and

management plans to address current threats (CITES, 2016). In the United States, wood bison are listed as threatened under the Endangered Species Act (ESA) (77 FR 26191, May 3, 2012). Attempts to delist it from the Endangered Species list are frequently being made, basing its arguments on discussions about the validity of the subspecies as a taxon (see Gear & Gear, 2012 for an example).

Within Canada, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated wood bison as a threatened species. The Committee re-examined the wood bison in 2013, downlisting it to Special Concern (COSEWIC, 2020). The Canadian Species at Risk Act (SARA) aims to prevent species extinction and may recognize COSEWIC listings. The Canadian Endangered Species Conservation Council (CESCC) oversees species status assessment and recovery efforts.

Perceptions of a species can be affected by management status, conflicts, and legal interferences in recreational and property uses (Kellert, 1996). Support for animal restoration is known to decrease if people think it will cause restrictions on recreational or commercial uses of land (Tucker & Pletscher, 1989), which indeed has caused support for wood bison in Alaska to dwindle in the past over its legal status as a threatened species. To increase support, legal adaptations were made, previously to any animal translocation taking place, allowing it to move forward (see Jahrsdoerfer & Stephenson, 2014 for legal details). The wood bison in Alaska were designated, through a law amendment, as a 'non-essential experimental population', a legal status postulating that the animals can be removed at any time, depending upon the impacts they may be causing to humans. Such information delivered to the population can greatly help ease concerns about having a threatened species locally (e.g., Schoenecker & Shaw, 1997; this study).

2.3.8. Conflicts

Conflict between rural communities and non-local hunters is known as an important, long-term issue in Alaska (Kofinas et al., 2010). Public perception of natural processes or animal species greatly differ between rural and urban communities (e.g., Kellert, 1985). Urban and rural residents differ on how they generally view wilderness (Lutz et al., 1999). This contrast may lead to conflict among stakeholders, as urban people may perceive the bison as inhabiting the wild, thus, accessible to all residents of the state, while the rural population may view the animals inhabiting their backyards, inside their Native corporation areas. The wood bison restoration to Alaska, therefore, should be perceived to impact small communities and large urban centers differently, depending on factors such as the distance to the release site, involvement during the process, interaction with agency staff, cultural and value aspects.

As previously observed in other areas, as soon as a bison population increases in number, it also increases the likelihood of human-bison interactions and, possibly, conflict (i.e., negative interactions) (Hofman-Kamińska 2012; Balčiauskas & Kazlauskas, 2014). Animals often ignore political and human-set boundaries (e.g., limits of private/public lands, village and city borders, sacred areas, private plantations, etc.; Gordon & Festa-Bianchet, 2004), and, during their trips in search of available feeding areas, they may encounter human settlements. In the presence of humans, bison can show different behaviors, such as aggression (Yorks & Capels 1998) or flight, depending on the distance, feeding season, and traveling mode of the observer (Fortin & Andruskiw, 2003; Schmitz, 2015), thus, bison are rarely tolerated near human settlements (Harper 2002). However, it has been reported that mammals capable of causing damage to humans can persist alongside dense human populations, if management policies remain favorable to both sides of that coexistence (Bruskotter & Shelby, 2010).

A single wildlife interaction may have diverse effects for different people, representing negative or positive impacts, depending on attitudes and motivations before, during and after the interaction (Bath & Enck, 2003), and, as time passes, perspective changes could be either positive or negative. Kansky et al. (2014) conducted a meta-analysis of the factors that affected attitudes towards four groups of mammals, and their results indicated that human tolerance to ungulates was inversely proportional to the probability of experiencing damage. Urban residents displayed positive attitudes in cases with low probability of damage, and non-positive attitudes when probability of damage was high. Rural residents live in areas that are less modified by human activity, and depend more directly on the local natural resources, therefore, it is to be expected that an even more intensive relationship between damage-experience and attitudes in rural areas. An applied past example concerns a small population of introduced plains bison (i.e., *B. b. bison*; the other of two American bison sub-species) in the Alaska's Delta Junction region, which have been reported as causing large damages and economic loss to farmers in the region, leading to discussions about its management (Gipson & McKendrick, 1981).

To manage the reintroduced population of wood bison in Alaska, 28 interest groups contributed to the elaboration of the *Wood Bison Management Plan for Lower Innoko/Yukon River in Westcentral Alaska* (AWBMPT, 2015), which states eight goals, corresponding objectives and actions, to guide management decisions from 2015 to 2020. Heated discussions among groups centered around issues such as land-access fees, hunting permit regulations, and provision of benefits to local communities living with on-the-ground impacts from bison. As the population may take over three years to expand, harvesting benefits won't be shared anytime soon. Therefore, an atmosphere of trust between agency and stakeholders is extremely important to achieve compliance with management goals. It was explicitly stated in the wood bison management plan the importance of "capitalizing the trust" gained during

the collaborative process. It shows that the management planning team considered trust an important means for achieving agreement about management strategies.

To clearly identify all sides of opinions is particularly relevant since hunting seasons will be opened as soon as the population reaches safe numbers. Discussions are ongoing with the communities and various groups regarding hunting allocation. In an early draft of the management plan members of the four local Native villages, by the release site, would have the right to at least 20% of the total harvest, while most of the remaining would be distributed by lottery to the rest of the state, likely reaching mainly large urban center's residents. The novelty represented by wood bison in Alaska is an ideal scenario to study initial perspectives of different interest groups towards ungulate reintroduction, and to monitor it, since people tend to become more resistant to changes as their opinions become less neutral (Ericsson et al., 2004), and they gain experience with a situation (Wu and Shaffer 1987). Therefore, it will be easier for persuasive appeals to increase acceptance of bison while the public remains relatively fresh to having wood bison on their home state.

Other risks to humans posed by bison involve possible injury to children playing outside and to adults travelling on the landscape, who may be afraid to encounter the animals on their way to do their normal activities, limiting local resident's lifestyle choices (opportunity costs). Fear has been previously reported as an important concern involving acceptance of European bison (Decker et al., 2010), and child safety as one of the main concerns of the coexisting population (Balčiauskas et al., 2017). Although rare and usually provoked, the issue of bison attacking adult humans has been amply documented in Yellowstone National Park. Despite warnings to avoid approaching bison (<25 feet), up to three tourists have been attacked each year for getting too close for photographs (Freer, 2004). Bison injuries in the park exceed injuries from any other wild animals, resulting in three known deaths (Conrad &

Balison, 1994; Freer, 2004). In the absence of accidents, however, fear of bison seems to lower over time (Balčiauskas et al., 2017).

Transmissible diseases are also frequently associated with bison, impacting its recovery, and presenting health and economic risks to humans, the most important being brucellosis and bovine tuberculosis, although anthrax may also be a periodical concern in some areas (Harper, 2002). Thought to have firstly originated in cattle, brucellosis and bovine tuberculosis are currently present in large proportions of American bison herds, worrying livestock producers about the safety of their herds (see Gates et al., 2010 for a review). These diseases can be transmissible to humans, where anyone handling carcasses or consuming meat (or milk) from infected animals is at risk (CDC, 2016; CFIA, 2017). These risks are considerably lowered if hunters practice biosecurity measures, especially in areas of confirmed herd infection (CDC, 2016; CFIA, 2017). The current Alaska wood bison population was carefully selected from a herd (i.e., Elk Island National Park, Alberta, Canada) free from such diseases, and post-translocation quarantine time certified its status (AWBMPT, 2015). However, other wild ungulates can also serve as hosts for these and other diseases, thus monitoring will be necessary to keep the status of the wild bison as 'healthy', while also keeping the local populations informed about it.

Hunters and local residents have the potential to exert the most direct impacts on a restoration's success (Tucker & Pletscher, 1989). Research on hunters has reported them as less trusting and more concerned about the risk of animal's diseases than non-hunters (Stafford et al., 2007). Although this study did not reveal such distinctions in trust, this should be closely monitored, especially once hunting starts. This study didn't quantify disease perceptions inside the tested risk scale, since this did not come up as a starting pressing issue, given the absence of diseases, at present, in the herd, although it may become one once the herd expands.

Tolerance to damage from ungulates is said to be inversely proportional to the probability of experiencing damage (Kansky et al., 2014). Although rural residents can adapt to living with large, damage-causing wildlife (Kansky et al., 2014), people depending on a single livelihood strategy may be less tolerant to losses (Dickman, 2010), being it from crops or other staple resources. Moose is a year-round staple subsistence food source for the rural population in Alaska (Johnson et al., 2016), leading residents to present concerns about bison competing with moose for food, or injuring calves. However, research on dietary overlap reported it to be very low, concluding there is little concern for competition between reintroduced bison and native populations of moose or caribou (Fischer, 2002) – although populations are a dynamic system, and people need to keep their expectations modest over what research can tell (Jung et al., 2015). Managers have already started educational work on this issue with villagers, leading to a decrease in such concerns.

As people familiarize themselves with wood bison in Alaska, they are more likely to start seeing it less as a threat. This could encourage some riskier behaviors around the animals in the future. Incidents, leading to injury, death, or loss of valuables, especially if receiving media attention, may increase threat perceptions related to bison, negatively influencing the overall view of the animals, and its management in the area. Research on conflicts between humans and wildlife has shown that stakeholder opinions may change with time, and people tend to be less accepting if negative impacts result from an interaction (Decker et al., 2006; Decker et al., 2012).

Across the US, animals that are responsible for human injuries or property damage are amongst the least liked (Kellert, 1985). In areas where no compensation is offered to losses caused by wild bison, low acceptance, poaching and population declines have been documented (Kerley et al., 2012). In fact, the most common cause of death for reintroduced damage-causing mammals is by human means (e.g., shooting, poisoning, automobile driving

accidents; Jule et al., 2008). Wildlife poaching is often associated with poverty, although it may also be addressed more comprehensively, if seen as a challenge related to development as well as cultural identity and lifestyle (Duffy et al., 2016). It's essential to recognize the political-economic context inside which managers will work to prevent or deal with potential illegal behavior (e.g., poaching) related to emerging negative attitudes. Perceptions of benefits related to a hazard tend to contribute to lowering the related risks perceived (Bidwell, 2009), and to improving the animal's general image. Thus, promoting means of additional income to areas coexisting with bison populations may help avoid losing animals. When people benefit from wildlife in the landscape, they tend to be more passionate about protecting it (e.g., Clark et al., 2016).

2.3.9. Cultural Importance

Few species have as rich archaeological, paleontological, story, legend, and oral histories as the American bison. It may be responsible for the greatest cultural and political influences from a single species in North America, which is due to a co-existence of thousands of years, providing sustenance, and shaping social and economic patterns, as well as influencing national history and international political relationships (Stepherson et al., 2001). There is a very extensive literature regarding the American bison, its history, biological aspects, and relationship with human societies. Before the European settlement, the American bison had the largest original distribution of any Indigenous large herbivore in in North America (Stepherson et al., 2001). With their rich history, political weight, and cultural significance, bison have had a profound impact on North American Indigenous cultures. They have been integral to folklore, rituals, dances, and ceremonies, symbolizing a barrier to Euro-American expansion and control over Indigenous populations (Wissler 1927). Additionally, bison have played a crucial role in subsistence economies, providing meat and robes, and continue to do

so in modern times through commercial bison production (Isenberg 2000). Their enduring symbolism is evident in their representation on currency, stamps, and as logos for various institutions (Dary 1974; Geist 1996). Millions of tourists visit publicly owned bison herds, highlighting the universal fascination and connection with these majestic animals. The return of the American Bison to Alaska presents an opportunity for Indigenous communities to revive cultural traditions and for all to engage in recreative activities, subsistence hunting, or contemplative tourism.

The species has maintained a continuous presence in North America for a span of at least 300,000 years, enduring the fluctuations between glacial and interglacial periods from the Pleistocene era to the Holocene and up to the present day. It has maintained a connection with various cultures since human habitation began around 12,000 years ago (Guthrie 1990). The cultural significance of the American bison is deeply intertwined with the history and traditions of Indigenous cultures in North America. Coexisting with humans for thousands of years, bison have influenced social and economic patterns, shaped national history, and even impacted international political relationships (Potter et al., 2010).

Bison importance in subsistence economies, particularly in the Great Plains region, is evident from archaeological evidence, showcasing specialized hunting techniques during the Palaeo-Indian period (Guthrie 1990). As climatic conditions changed, human populations adapted, developing new economic strategies in the Archaic period. From 2,000 years ago, bison continued to be the preferred game for many Native American cultures, providing food, clothing, shelter, and tools, while also serving as central figures in oral traditions and cultural rituals (Hofman & Todd, 2001). In Alaska, there is empirical evidence from numerous archaeological and paleontological complexes from 12,000 to 1,000 years ago documenting hunting and linking bison with cultural traditions (Potter, 2005). Combined with oral

accounts, all indications show that bison were hunted by humans until their disappearance from Alaska (Stepherson et al., 2001).

With the arrival of Europeans, however, human-bison interactions underwent significant shifts, resulting in profound changes to Native American life. The introduction of horses and the emergence of a commercial market for bison products led to the near extinction of the species (Crosby 1986). Presently, Native tribes manage bison on their lands, with diverse perspectives on their cultural and commercial value. The perception of bison in the North American food system is evolving, as they are increasingly recognized as a healthy alternative to industrially raised meat, thanks to higher levels of beneficial fatty acids. The future role of bison in the American food system and ongoing conservation efforts remains a topic of discussion (Potter et al., 2010).

2.3.10. Wood bison restoration and management in Alaska

"Through the collaboration of many, reintroduce and manage a sustainable wood bison herd while ensuring a healthy landscape benefiting all people for future generations" (Vision statement; AWBMPT, 2015).

Native to the state of Alaska, the wood bison disappeared approximately 170 years ago, due to a combination of factors such as long-term climate change, loss of habitat, and excessive hunting. Extensive evidence from various sources, including zooarchaeological, paleontological, oral, and written historical data, confirms that wood bison once inhabited a wide range extending across the Yukon and Tanana River areas. These bison played a crucial role as a subsistence resource for Athabascan villages in central and eastern Alaska, serving as a source of food and materials during the late Pleistocene and early Holocene periods until around 200-300 years ago (Stephenson et al., 2001).

The wood bison restoration effort in Alaska, USA, is led by the Alaska Department of Fish & Game (ADF&G), in collaboration with organizations such as the Council of Athabaskan

Tribal Governments, U.S. Fish and Wildlife Service (USFWS), U.S. National Park Service (NPS), and private partners. The objective of this reintroduction is to establish one to three free-ranging wood bison populations and conduct long-term monitoring and evaluation to assess the possibility of establishing additional populations in the future. Apart from contributing to the recovery of wood bison in North America (NA), this initiative aims to restore a key indigenous grazing species in northern ecosystems, enhance biological and habitat diversity, promote natural processes, improve the overall species survival by increasing disease-free wood bison herds, provide a regulatory framework for sustainable development, including opportunities for local tourism and hunting, and re-establish the historical and cultural connection between bison and Alaskans (Jahrsdoerfer & Stephenson, 2014).

The implementation of the wood bison reintroduction has faced significant delays, primarily due to conflicts among stakeholders. The wood bison was classified as threatened under the Endangered Species Act (ESA), which raised concerns about restrictions on development activities in areas where endangered species were present. To address these concerns, the Alaska Department of Fish & Game collaborated with the USFWS to develop a federal rule (10j) that designated the wood bison in Alaska as a "nonessential experimental population" (NEP area, Fig. 8). This rule, published in 2014, allowed the wood bison population in Alaska to be exempt from certain limitations associated with their status (Jahrsdoerfer & Stephenson, 2014). Still, ongoing concerns regarding management requirements under the NEP classification led the ADFG to select the Lower Innoko/Yukon River area as the most suitable release site for initiating the restoration project. This decision was based on the support of local communities and the absence of large-scale economic development projects in the area (AWBMPT, 2015).

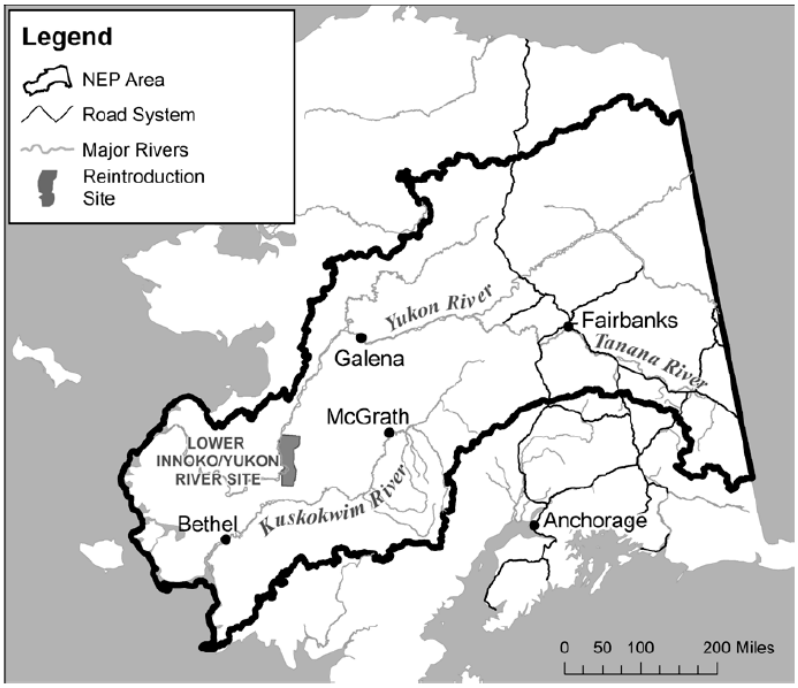

Figure 8. The Alaska wood bison nonessential experimental population (NEP) area and the Lower Innoko/Yukon River release site.
Reproduced from AWBMPT, 2015, with permission (Seaton, T. pers. comm., 2016; 2023).

In the period between March and August of 2015, a total of 130 wood bison were released in the Lower Innoko River area, inhabited by four small and primarily Native villages. Despite authorities perceiving both local and non-local peoples as supportive of bison and bison restoration for an extended period (AWBMPT, 2015), there was a lack of empirical evidence to substantiate these perceptions. Also, it is important to acknowledge that perceptions can change based on real experiences and interactions with the animals (Wu & Shaffer, 1987; Zajac et al., 2012).

To ensure inclusivity, the Alaska Department of Fish & Game (ADFG) extended invitations to all interested groups to send representatives for participation in the planning of wood bison management in Alaska. A total of 28 groups responded, with most of them actively participating in three meetings to address the various aspects of bison management. The groups made a commitment to listen to one another and reach decisions through consensus. Extensive discussions took place on significant matters such as respect for private property,

acknowledging diverse cultural values, and the importance of fairness. The concept of "equitable or balanced opportunity" was agreed upon, as it better reflected the complex reality of landownership, proximity of users to wood bison, and other relevant differences (AWBMPT, 2015). Eight goals with corresponding objectives were formulated to guide wood bison management during the initial five years of the reintroduction. These goals emphasized long-term sustainability, minimizing conflicts between humans and bison, fostering stakeholder cooperation, ensuring equitable benefits for all interested parties, minimizing the impact on other wildlife and the ecosystem, and maintaining ongoing communication among the involved groups (refer to Table 1, Appendix 1, for selected goals relevant to this study).

2.4. Wood Bison Research

The wood bison is the least studied of three surviving groups of bison: the American bison, including the wood (*B. b. athabascae*) and plains bison (*B. b. bison*); and the European bison (*B. bonasus*). After near extirpation of all three groups, bison were successfully reintroduced and conserved in many areas (e.g., Boyd, 2003; Freese et al., 2007; Sipko, 2009; Balčiauskas & Kazlauskas, 2014; Perzanowski et al., 2014; Schmitz, 2015; Clark et al., 2016). In America, plains bison groups were more numerous and found closer to population centers (e.g., open, and southern *vs* wooded and northern areas), thus, conservation efforts started earlier for them. Efforts to conserve and reintroduce wood bison only started later, after a small remnant population was discovered, in 1957, in a remote area in Canada (Banfield & Novakowski, 1960, through Larter et al., 2000). Then, since 1975 the Canadian Wood Bison Recovery Team has proposed projects to reintroduce the woodland bison into four viable, geographically separate, free-ranging, and tuberculosis and brucellosis-free wood bison populations in Canada (Gates et al., 2001). It has then, been restored to many regions across

western Canada (e.g., Larter et al., 2000; Harper, 2002; Clark et al., 2016), from where it has been migrating and expanding (e.g., Markel & Clark, 2012). Although the wood bison will never be as numerous as the other bison groups, given its more limited range, its recovery is also constrained by the presence of diseases in Canadian herds, in and around Wood Buffalo National Park, limiting the availability of founding animals and suitable, disease-risk-free territories (Gates et al., 2001). Thus, much more research has been done regarding aspects related to plains and European bison populations than to wood bison. The Alaska reintroduction is the first time the wood bison is being restored outside Canada and in the United States, inside its historical range.

In view of bison's extensive history, literature found on the species is extensive and comprehensive, with the interest in better understanding the species increasing soon after the conservation efforts of the early 1900s. Recurrent themes in bison research, which can be observed by a quick search in the literature comprise: (1) History, evolution, paleontology, and taxonomical classification (areas addressed by many book accounts); (2) Anatomy, physiology, breeding, development, and habitat adaptation; (3) Genetic variability, hybridization with cattle and/or other bison subspecies, and techniques associated with captive breeding and management; (4) Population dynamics, ecology, individual behavior and social interactions; (4) Diseases and other threats to the survival of the species.

In addition, some examples of bison research themes important for restoration efforts are: (1) Conservation and management of populations, and policy decision making (e.g., Sanderson et al., 2008; Gates et al., 2010; Kerley et al., 2012; Markel & Clark, 2012; Redford et al., 2016); (2) Reproduction and survival (e.g., Komers et al., 1994); (3) Reintroduction accounts (e.g., Larter et al., 2000; Harper, 2002; Safronov et al., 2012; Schmitz, 2015); (4) Population dynamics, distribution and movement across habitat, summer and winter ranges (e.g., Raup, 1933; Gates & Larter, 1990; Bruggeman et al., 2006; Perzanowski et al., 2012; Jung, 2017);

(5) Summer and winter diets (e.g., Komers et al., 1993; Jung et al., 2015); (6) Relationship with the environment and other wildlife (e.g., Fischer, 2002); (7) Threats and the relationship with humans (injury/hunting/persecution and extermination) (e.g., Conrad & Balison, 1994; Gates & Aune, 2008; Sipko et al., 2010; WCPP, 2017); (8) Native, cultural and spiritual relationships (e.g., Howard, 2012; WCS, 2016); and (9) Diseases (e.g., Bidwell, 2009).

Human Dimensions Research is critical to any restoration effort requiring people and animals to coexist. Because of the relative youth of the discipline, HD research on bison is still very limited in comparison with most other aspects of bison research. A search for an overview of papers investigating human dimensions aspects associated with bison resulted in the following: (1) Attitudes toward European bison and their reintroduction (Decker et al., 2010; Bergsten, 2012; Balciauskas & Kazlauskas, 2014; Balčiauskas et al., 2017); (2) Beliefs and levels of support or opposition toward European bison restoration (Decker et al., 2010); (3) Preferred management measures for dealing with problematic European bison (Balčiauskas et al., 2017); (4) Youth attitudes and perception of risks toward restored European bison (Hermann & Menzel, 2012); (5) Human dimensions of European bison management and conservation (Prior, 2006; dissertation not published); (6) Wildlife value orientations predicting support for European bison reintroduction (Hermann et al., 2013); (7) Concerns related to an European bison translocation negative impacts (Balčiauskas et al., 2017); (8) Damages to crops by plains bison in Alaska (Gipson & McKendrick, 1981) and by European bison (Balčiauskas et al., 2017; Hofman-Kamińska & Kowalczyk, 2012); (9) Regional attitudes and values towards migratory plains bison (Garvoille et al., 2014; Metcalf et al., n.d.); (10) Wood bison (Clark et al., 2016) and plains bison (Franklin & Burke, 2003) impacts over human Native populations; (11) Plains bison impacts over park visitation (Loomis, 2004); (12) Risks perceptions about plains bison diseases (Bidwell, 2009); (13) Park visitor behavior related to plains bison (Loomis & Caughlan, 2004; Lalasz, 2013); (14) Poaching

and commercial hunting as causes of European bison declines in Ukraine and the Caucasus (Parnikoza et al., 2009; Sipko et al., 2010).

Other important work related to bison conservation and management include: comprehensive reviews involving the history, conservation, ecological and biological aspects related to the American bison (e.g., Soper, 1941; Stephenson et al., 2001; Boyd, 2003; Gardner & deGange, 2003; Freese et al., 2007; Gates et al., 2010; Kolipinski et al., 2014); academic student's thesis investigating competition between wood bison and caribou in the Yukon (Fischer, 2002); reconnection of first nations' communities with the bison as part of their cultural identity in Canada (Howard, 2012); local residents involvement in the development of a framework for community-based conservation and management of the Plains bison in central Saskatchewan (Kelly, 2007); and analysis of acceptability of lethal management for wood bison in Alaska (Doney et al., 2018; 2020).

3. The People in Alaska and Study area

In contemplating the future, reflections on the past emerge. Western Alaska lacked moose a century ago, as evidenced by accounts from elders and early explorers. However, presently, moose hold immense significance in the lives of the local population, being intricately intertwined with their diet and cultural practices. Thus, pondering the potential assimilation of bison a similar process may unfold. Considering how swiftly moose became integral to their lives, maybe a century from now, bison could assume a comparable role, being an essential element of their diet and culture (Seaton, 2016).

3.1. The state of Alaska

Alaska is a vast state, covering over 400 million acres, which is more than twice the size of Texas (ANCSA, 2020) and four times larger than Newfoundland and Labrador in Canada. It is the largest state in the United States in land and water area, comprising 16% of the total land area and 35% of the total water area in the country. Despite its vast size, Alaska has a low population density of 1.3 people per square mile, making it the third least populous state – representing 0.2% of the nation's population. Most of the population is concentrated in the Anchorage municipality area (Robinson et al., 2016).

With 737,625 people, about 80% of Alaska's population was considered urban in 2015, while 17% lived in areas of less than 2500 people (316 out of 354 places, here defined as rural). The remaining 3% of the population lived in unorganized territories (here also defined as rural), even though, most still live within boroughs near cities or along road systems. In 2015, over 50% of the population lived in areas with more than 10,000 people, including the municipality of Anchorage, the city and borough of Juneau, and the city of Fairbanks (Robinson et al., 2016). The state is home to nearly 200 communities, ranging in population from less than 20 to around 300,000 individuals. These communities are primarily accessible by boat or plane. Alaska Native people make up about 15 percent of the state's population (ANCSA, 2020).

Most people living in Alaska are migrants to the state, where only 41% of the population were born there. The state has the second highest rate of gross migration in the nation – in-migration plus out-migration, representing a 12% population change from 2013 to 2014. The larger boroughs are the areas attracting the most migrants, where only around 30-40% of the people are state born. Additionally, in-state migration is also frequent in Alaska, and the more urbanized areas also receive people from the rural, more isolated ones (see Robinson et al., 2016 for details).

3.1.1. Demography

With steady growth over the years, the state of Alaska's total population has risen in all but three years from statehood in 1959 to 2016. The exceptions were observed following the completion of the Trans-Alaska Pipeline in the late 1970s, and after the crash in oil prices in the late 1980s (Whitney & Brooks, 2017). Alaska experiences significant annual migration flows both inward and outward, with most of the people moving interstate being young adults; this is also true at the national level. Irrespective of economic conditions, these flows remain consistent in Alaska, with 20% being tied to the military. The state's seen both periods of net migration loss and gain since its statehood. While in 23 years there was a greater number of people leaving the state than moving in, in the remaining years, the natural population growth through births exceeding deaths compensated for the migration deficit. (Whitney & Brooks, 2017).

Overall, the Alaskan public are younger than the national average (median 34.5 *versus* 37.8), however, the demographic composition is undergoing rapid changes. Alaska was the fourth youngest state in the USA in 2015, when only 10% of the state was 65 or older, but its senior population is among the fastest growing in the nation, doubling the number of >65s between

2000-2016. Along with aging, the factor most affecting the age structure in the state is migration (Robinson et al., 2016; (Whitney & Brooks, 2017).

The U.S. Census Bureau defines urbanity largely based on population size and density. Urban areas are broadly divided into urbanized areas (more than 50,000 people) and urban clusters (at least 2,500 people), while all populations in other areas are defined as rural, living in less dense and more sparse agglomerations (Ratcliffe et al., 2016). In 2010, 71.2% of the U.S. population was living within urbanized areas, 9.5% in urban clusters, and 19.3% in rural settlements. Based on the percent of the population considered rural, areas are categorized as completely rural, mostly rural, or mostly urban (Ratcliffe et al., 2016). The housing units in Anvik, Grayling, Holy Cross and Shageluk were all categorized as rural by the U.S. Census Bureau. Alternatively, in Anchorage and Fairbanks, respectively, 95.1% and 99.6% of the housing units were classified as urban (U.S. Census Bureau, 2010).

Migration from rural to urban areas in Alaska has shown a relatively consistent pattern over the past two decades. On average, approximately 7,700 adults, which accounts for around 11% of the rural population, have relocated from rural to urban areas in the state during five-year periods (Howell, 2015). Similarly, during the same five-year periods, an average of 4,400 urban residents relocated to rural areas, about 2% of Alaska's urban population. The age groups with the highest likelihood of relocation were the younger cohorts (18-24, 25-39, etc.), which is understandable as individuals often seek better job prospects and higher salaries through such moves. Urban areas tend to offer higher average wages compared to rural areas, and this wage disparity has been widening over time (Howell, 2015). Other types of existing migration in the state involve urban-to-urban or rural-to-rural transfers, which are much less relevant for the state.

The USA Census uses the standards for race and ethnicity of the Office of Management and Budget (OMB). It defines ethnicity as either “Hispanic or Latino” or “Not Hispanic or

Latino." It reflects heritage, nationality lineage, or country of birth of the person, parents, or ancestors, before arriving in the US. "Hispanic or Latino" are defined as people of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, who may be of any race (OMB, 1997). Race is divided into: "American Indian or Alaska Native", "Asian", "Black or African American", "Native Hawaiian or Other Pacific Islander", White", or "Some Other Race". Individuals who self-identify with more than one category are encouraged to mark multiple options in their questionnaire response. The OMB stated that these racial and ethnic categories may be thought as a reflection of sociocultural characteristics and ancestry recognized in the country and should not be interpreted as an attempt to define race biologically, anthropologically, or genetically (OMB, 1997). The practice of separating ethnicity and race into different categories has been criticized (e.g., Reynolds et al., 2006).

Alaska is home to the highest proportion of Alaskan Native/American Indian in the country, at 15%, a share that rises to 20% if including native in combination with other races. However, these shares have been much higher in the past, with Alaskan natives representing over half the population in 1929 (Whitney & Brooks, 2017). Currently, two-thirds of Alaskans are white, or 67% of the population in 2015. The remaining population can be described as Asian (6%), Black/African American (4%), Hawaiian/Pacific Islander (1%), and multiracial (7%). About 7% of Alaskans were Hispanic or Latino, of any race (Robinson et al., 2016). Anchorage, Alaska's largest urban center, concentrates the greatest proportion of American Indian or Alaskan Native population (12%; among populations of 100,000 or more) across the continental USA (Robinson et al., 2016). Alaskan Native tribal groupings in 2010 consisted of: Yup'ik; Inupiat; Tlingit-Haida; Alaskan Athabascan; Aleut; and Tsimshian (respective of number of individuals alone or in combination; Norris et al., 2012).

The state has a history of being perceived as having a higher proportion of men compared to women. During the Gold Rush in 1900, the male-to-female ratio in Alaska was 259 males for every 100 females, a proportion that narrowed along the years, reaching 107/100 in 2015, still the highest in the USA (Robinson et al., 2016; Whitney & Brooks, 2017). Typically, the urban areas exhibit lower ratios compared to rural locations (Robinson et al., 2016). The higher representation of men in the state is partly explained by Alaska's diverse industries, such as oil, construction, fishing, and the military. The military has played a significant role in Alaska's economy since World War II due to its geographical importance. This historical significance is evidenced by the highest per capita veteran population in the United States; the state has >1.5 times more veterans than the USA overall (Whitney & Brooks, 2017).

3.1.2. Hunting in Alaska

Across North America, rurality has been associated with and described as the most consistent and strongest predictor of hunting participation (Heberlein et al., 2002). Alaska is perhaps the most unique among U.S. states, likely due to its unusual history and very rich wilderness, making wildlife an integral part of Alaskan lifestyle and image. Although hunting is generally decreasing across the USA (USDOI et el., 2016), Alaskans registered record numbers of hunting license purchases in 2011 (Woodford, 2011), keeping a steady flow over the years (DAS, 2022). Part of Alaska’s unique situation is explained not only by the traditional practice of living off the land but also by federal law (Sharp, 2018). In 1980, Congress enacted the Alaska National Interest Lands Conservation Act (ANILCA), which included a provision establishing a priority subsistence law for federal lands in Alaska. It prioritized non-wasteful subsistence uses of fish and wildlife over other purposes, on public lands, with appropriate limitations based on customary dependence, local residency, and availability of alternative resources (ANILCA, 1980, § 804).

Subsistence is defined by law as "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption, for barter, or sharing for personal or family consumption – and for customary trade." (ANILCA, 1980, para. 803). Due to its limited network of only 13 state roads connecting urban centers, Alaska features extensive stretches of uninhabited lands without any road infrastructure. As a result, subsistence harvesting becomes vital for residents, serving as a primary source of sustenance. The average rural subsistence harvest of approximately 295 pounds of food per person per year surpasses the national average consumption of 255 pounds of domestic meat, fish, and poultry annually (Fall, 2016).

In 2014, based on the classification defined by state law, 83% of Alaskans resided in non-subsistence (urban) areas, while 17% lived in rural areas that were eligible for subsistence use (Fall, 2016). The state also recognizes that the wild resources serve various protected uses beyond food, including clothing, fuel, transportation, construction, home goods, community sharing, customary trade, ceremony, and arts and crafts, all of which are recognized and safeguarded by law as part of the diverse subsistence lifestyle.

Most rural families living in subsistence areas in Alaska were Native peoples in 2010 (55% *versus* 12% in urban areas) and relied on fishing and hunting regularly as their source of livelihood (Fall, 2016). In the past Alaskan Natives made up most of Alaska's overall population (e.g., 51% in 1929; when data is available); and although this population has continued to grow rapidly, the non-Native population has grown more (with migration adding an important component; Robinson et al., 2016). Today areas in northern and western Alaska have the largest *proportions* of Alaskan Natives, and 45% of these native peoples live in areas that were more than half native in 2015. Migration to urban areas in search of better

lives made Anchorage the place with the largest number of Alaskan Natives in 2015 in the whole of the USA, although it only corresponds to 8% of the city's residents. The second largest native population in Alaska lives in the Bethel census area, where 82% of the residents are classified as "native alone" (i.e., not mixed with other races; Robinson et al., 2016).

Some of the least populated areas in rural Alaska, the rural interior, western and arctic regions, show the highest proportions of household participation in subsistence hunting, harvesting and use of wildlife, which is widely shared among residents (about 70% harvesting and 90% using game as subsistence foods through the year; Fall, 2016). The subsistence food harvested by residents represents about 0.9% of the fish and game annually harvested in Alaska, which consists mostly of fish (53%), land (22%), and marine mammals (14%), providing the major food supply for rural Alaska (Fall, 2016). Sport fishing and hunting (by residents and non-residents) take 0.4% of the share, while commercial fisheries consume 98.5% of the state's supply (Fall, 2016).

The legal priority assigned to subsistence uses of wildlife has brought significant advantages to those who rely on it, safeguarding their access to resources even during periods of scarcity, and the adverse effects on recreational and commercial uses have been relatively minor thus far (Fall, 2016). Despite the influence of modernization and increasing competition, subsistence remains a prominent aspect of rural life. While both Native and non-Native populations in rural areas rely on subsistence for their livelihoods, their perspectives, beliefs, and values regarding wildlife differ significantly. For Native peoples, subsistence goes beyond a mere means of acquiring food or engaging in ceremonial practices; it is deeply intertwined with their culture, identity, and their relationship with the environment, society, and the universe at large (Decker et al., 2001).

During the early stages of Alaska's history, both native and non-native groups coexisted harmoniously, benefiting from the abundant game and fish resources (Sherwood, 1981). However, the post-World War II era brought rapid economic development and a wave of modernization, leading to a significant increase in population. The exploitation of wildlife for commercial purposes resulted in a decline in species populations, triggering a conservation movement championed by affluent sportsmen. To protect wildlife, laws and policies were implemented, often disregarding the traditional practices associated with subsistence livelihoods (Huntington, 1992). Consequently, hunting for recreation gradually replaced subsistence as the primary motivation, fueling conflicts among sport hunters, subsistence harvesters, and non-native wildlife managers (Huntington, 1992). These conflicts, which persist to this day, tend to favour the interests of certain values and groups. Throughout North America, disputes over native peoples' land and wildlife resource rights have become prevalent, necessitating the enactment of protective legislation.

3.2. Land and Governance

Alaska, like other states, operates under a multifaceted system of government and land ownership, comprising federal, state, municipal, and city entities. However, Alaska stands out due to its extensive public lands, as almost 88% of the state's total area is owned by the federal and state governments combined, significantly exceeding the national average of 35% (Goldsmith, 2008; ADNR, n.d., see Fig. 14).

Several key historical events have shaped the present land ownership in Alaska. During the mid-1700s, Russian traders arrived in Alaska and established trading posts and settlements across the region. During the period of Russian occupation, Alaska Natives maintained primary ownership of the land. Then, on October 18, 1867, Russia sold Alaska to the United States, leading to the federal government's acquisition of the Territory, approximately 365

million acres and roughly one-fifth of the size of the rest of the United States (ADNR, 2021; ADNR, n.d.).

After 1959, upon Alaska's statehood, the federal government allocated approximately 105 million acres, accounting for 28% ownership, to the new state. These lands were divided into various grant types, including community, national forest community, general, and specific grants for schools, universities, and mental health trusts. Finally, in 1971, the Alaska Native Claims Settlement Act (ANCSA) was enacted by Congress. This act provided 44 million acres of land and 1 billion dollars to village and native corporations established under its provisions. ANCSA prioritized Native selections over state land selections, thereby further influencing land ownership patterns in Alaska (ADNR, 2021; Vincent et al, 2020).

3.2.1. Federal Land

During the 19th century, laws were enacted to promote settlement and disposal of federal lands in the West. Legislation such as the Homestead Act of 1862 and the Desert Lands Entry Act of 1877 resulted in the transfer of about 1.29 billion acres of land out of federal ownership between 1781 and 2018, including transfers to private ownership, states, and, in Alaska, through state and Native selection laws. While the homesteading laws were largely repealed by 1976, homesteading persisted in Alaska for an additional decade (Vincent et al, 2020).

Alaska and the 11 contiguous western states have significant amounts of federal land ownership. Alaska has the highest proportion with about 61% of the land federally owned, while the contiguous western states have 45.9%. In contrast, in the rest of the country federal ownership is at 4.1% (Vincent et al, 2020).

In the 20th century grew concerns over the decline of the natural resources, leading to a shift in focus from transferring federal lands to private individuals to preserving and managing the

remaining federal lands. The establishment of national parks and forest reserves formed the basis for the existing federal agencies responsible for the management of natural resources on federal lands – most notably the Bureau of Land Management (BLM), United States Forest Service (USFS), United States Fish and Wildlife Service (USFWS), and the United States National Park Service (USNPS). These agencies were created separately, each with its own unique mission and purpose (Vincent et al, 2020). Numerous other federal agencies administer smaller portions of these lands.

Nationally, the USFWS and USNPS oversee 76.6 and 52.4 million acres, respectively, for resource protection and conservation purposes (as of 2018; Vincent et al, 2020). Most of the lands administered by the USFWS in the country (85.9%) are in Alaska (Vincent et al, 2020). There it manages 16 wildlife refuges, with the Yukon Delta National Wildlife Refuge and the renowned Arctic National Wildlife Refuge (ANWR) as the largest, encompassing approximately 19 million acres each (ADNR, n.d.).

Established in 1916, the USNPS was created to oversee the increasing number of park units and monuments in the United States. As of September 30, 2018, it had grown to 79.9 million acres of federal land, having a significant portion (65.6%) located in Alaska (Vincent et al, 2020). The NPS has a dual mandate of preserving distinct resources and facilitating public enjoyment of these sites. Alaska is home to important national parks managed by the NPS, including the five largest in the national park system: Wrangell-St. Elias National Park & Preserve (13,175,901 acres), Gates of the Arctic National Park & Preserve (8,472,506 acres), Denali National Park & Preserve (6,075,030 acres), Katmai National Park & Preserve (4,093,229 acres), and Lake Clark National Park & Preserve (4,030,025 acres; ADNR, n.d.; Vincent et al, 2020).

The United States Forest Service (USFS) and Bureau of Land Management (BLM) manage 22.1 and 71.4 million acres in Alaska respectively. Established in 1905 within the United

States Department of Agriculture (USDA), the U.S. Forest Service is the oldest of the four main federal land management agencies. Its responsibilities encompass conducting forestry research, offering support to non-federal forest owners, and overseeing the management of the National Forest System (NFS; Vincent et al, 2020). In Alaska the USFS manages the two largest National Forests in the U.S, the Tongass NF, with 16.8 million acres, and the Chugach NF, covering 5.5 million acres. The USFS manages these lands for a wide range of goods and services while conserving and protecting them (ADNR, n.d.).

The BLM administers more federal lands in the U.S. than any other agency; the the majority (over 99%) of these lands are concentrated in the 11 contiguous western states and Alaska. In Alaska, BLM is surveying land, managing wildland fire, contributing to the overseeing of the Joint Pipeline Office, and responding to the public demand for use of the land they manage (Vincent et al, 2020). Another 1.38 million acres of land in the state is managed by the Department of Defense and the State-Owned National Guard, providing unique training environments (REPI, 2021).

Between 1990 to 2018, federal land ownership decreased by 31.5 million acres. Most of the decline is attributed to land disposals by the Bureau of Land Management (BLM) in Alaska and reductions in Department of Defense (DOD) ownership. In contrast, the National Park Service (NPS), Fish and Wildlife Service (FWS), and Forest Service (FS) saw mostly increases in land ownership during this period (Fig. 9). The ownership and use of federal lands have been contentious issues over the years, raising questions about the extent of this ownership (Vincent et al, 2020).

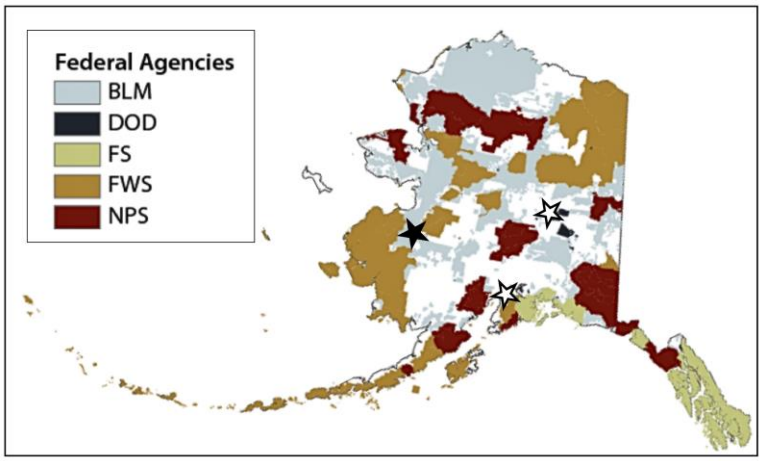

Figure 9. Federal lands in Alaska are managed by the five major federal land management agencies. The black star marks the rural locations and reintroduction site, and the white stars mark the urban locations studied in this thesis. Adapted from Vincent et al., 2020.

3.2.2. State Land

After the *Alaska Statehood Act* of 1959, the federal government allocated the newly formed state 28% ownership of its entire land area. Almost 105 million acres were divided into different types of grants to be elected (ADNR, n.d.). Approximately 95% (100.5 million acres) of Alaska's land selections have so far been granted to the state, serving various purposes. The state's goals include supporting the economy, promoting settlement, utilizing natural resources, and providing recreational opportunities. The land is allocated for public facilities, infrastructure, resource development, and wildlife conservation. State land use plans are developed based on input from experts, public input, and adherence to laws and policies established by the government (ADNR, 2021).

The Alaska Department of Natural Resources is responsible for managing all state-owned land, water, and natural resources, excluding fish and game, on behalf of the people of Alaska. Added to the 100 million acres of conveyed land, the state also holds ownership of about 60 million acres of tidelands, shorelands, and submerged lands, along with the management of 40,000 miles of coastline. Furthermore, the state has control over the freshwater resources in Alaska, accounting for about 40% of the total freshwater flow in the

entire nation (ADNR, 2020). The DNR is responsible for leasing, permitting, and regulating the use of State-owned lands, which may include areas designated for agriculture, mining, timber production, or other purposes (ADNR, 2020)

The fish and game in Alaska are the responsibility of the Alaska Department of Fish and Game (ADFG). Established by the state legislature in 1959, it oversees around 750 active fisheries, 26 game management units, and 32 special areas. It's focused on scientific integrity and implementing sustainable fish and wildlife management programs that maximize public utilization and economic advantages. Interacting with and involving the public is crucial to the mission and goals of the Department (ADFG, 2021).

3.2.3. Private Land

Private lands in Alaska are owned by individuals, corporations, or other entities. About 45 million acres are privately owned in the state. These lands are governed by the laws and regulations of Alaska, which encompass local zoning and land use ordinances. While private landowners enjoy greater flexibility in determining land use, they are still required to comply with relevant laws and secure permits for specific activities like construction or resource extraction. (ADNR, 2020; ADNR, n.d.).

3.2.3.1. Non-ANCSA Private & Local Government

Apart from Native land, private ownership accounts for less than one percent of Alaska's total land, approximately 5.9 million acres. The most desirable land for development in Alaska's communities is, or will be, in private ownership. Private land development plays a crucial role in meeting the needs of the population by offering residential, commercial, and recreational spaces. Furthermore, it contributes to the tax base of cities and communities, enabling the provision of essential public services (ADNR, n. d).

3.2.3.2. Native Lands

The state is home to numerous Indigenous communities with diverse cultures and histories. There are five types of Native lands in Alaska:

1. one *federal Indian reservation* in south-eastern Alaska, the Metlakatla Indian Community (exempt from state's jurisdiction and taxation).
2. *state Indian reservations* (lands held in trust by a state for an Indian tribe, not subject to state property tax, but subject to state law).
3. *allotted lands* (remnants of reservations broken up during the federal allotment period of the late 19th early 20th centuries; subjected to state and local taxation and laws).
4. *restricted status* lands (or restricted fee lands, where title is held by an individual Indian person or tribe, and which can only be alienated or encumbered by the owner with the approval of the Secretary of the Interior, because of limitations contained in the federal law).
5. *American Indian/Alaska Native tribes'* businesses or private properties (subject to state and local laws and taxes; U.S DOI, 2018).

Native lands in Alaska are considered private lands. Ownership and management of lands in Alaska are governed by an intricate system of laws, including the *Native Allotment Act*, the *Alaska Statehood Act*, the *Alaska Native Claims Settlement Act* (ANCSA), the *Alaska National Interest Lands Conservation Act* (ANILCA), and the 1978 *Municipal Entitlement Act*. Although federal and state ownership still predominates over most lands, Native Alaskans, Native regional and village corporations, boroughs, cities, and the state have all made land selections in accordance with the laws (DOWL HKM, 2010)

3.2.3.3. Native Corporations

The *Alaska Federation of Natives* was formed in 1966 to address land rights issues, while the discovery of oil in Prudhoe Bay in 1968 prompted the settlement of Native land claims. This ultimately resulted in the enactment of the *Alaska Native Claims Settlement Act* (ANCSA) in 1971 (Hunsinger & Sandberg, 2013). ANCSA was a significant federal legislation that aimed to resolve the long-standing issue of Alaska Native land ownership and led to the establishment of Alaskan Native corporations with specific land rights (DCCED, 2020).

ANCSA divided Alaska into twelve regions (Fig. 10), considering the cultural heritage and shared interests of the Indigenous populations. Each region was assigned a regional corporation responsible for managing the selected lands, while village corporations were also established. Additionally, a 13th Regional Corporation was formed to represent non-resident Alaska Natives. The primary objective of ANCSA was to ensure economic benefits for Alaska Natives through the utilization of the region's resources (RDC, 2020).

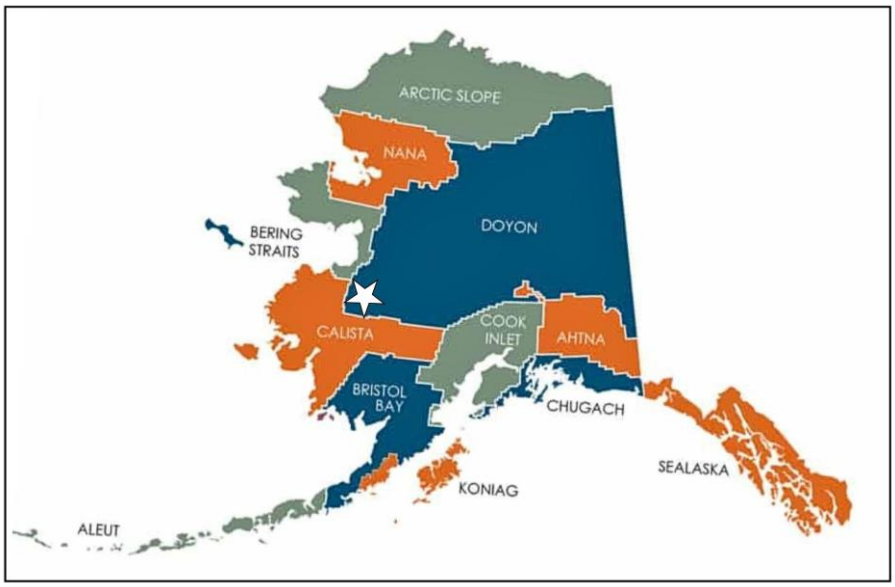

Figure 10. ANCSA Regional Corporations. Adapted from ANCSA, 2020.
The star marks the wood bison reintroduction site in Alaska.

The thirteen regional corporations were created to distribute 44 million acres of land and a one-billion-dollar payment, with twelve participating in the selection of 16 million acres and the thirteenth receiving a cash settlement. Furthermore, 224 village corporations with 25 or more residents shared 26 million acres, and the remaining acres, including historical sites and existing Native-owned lands, were placed in a land pool for smaller villages with populations under 25 individuals (ANCSA, 2020). Eligible Alaska Native people became shareholders of their respective village and regional corporations, according to common heritage and shared interests within each geographic area. This legislation introduced a unique for-profit model with corporate ownership of land titles, extinguishing aboriginal land claims in Alaska (ANCSA, 2018). In 1998, the federal government officially recognized over 200 Indian tribes in Alaska as separate entities from Alaska Native corporations. This recognition facilitated government-to-government relationships between these tribes and the federal government (ANCSA, 2020). There was one Indian community that opted out of the ANCSA settlement agreement and is designated as the only federal Indian reservation in the state of Alaska. Ongoing debates and amendments to the act address various issues that have emerged over the years (ANCSA, 2018; Doyon, 2018).

It is important to note that the regions created by ANCSA were not intended to determine land ownership by Alaska Native regional corporations, but rather to determine which of the twelve corporations would serve the communities and villages within each region. The governance structure within each region of Alaska is complex and encompasses various aspects such as land ownership, roles, and relationships. While there may be some overlapping representation among different organizations, each entity has its distinct function. Individuals and businesses navigate an intricate network that involves Alaska Native regional corporations, Alaska Native village corporations, federally recognized tribes,

city and borough governments, and Alaska Native regional non-profit organizations (ANCSA, 2020; RDC, 2020).

The Native corporations in Alaska now hold approximately 10% of the state's lands (Hull & Leask, 2000). As the largest private landowners in Alaska, these corporations are engaged in resource development and diversifying their operations into various business ventures creating jobs and economic opportunities for their Native shareholders. ANCSA's natural resource revenue-sharing provision, Section 7(i), ensures an equal distribution of revenues among the regional and village corporations, in benefit of all Alaska Natives (RDC, 2020). These corporations own major enterprises and are among the largest employers in Alaska, being vital to each region they represent and the state. They prioritize addressing the economic and social needs of Alaska Natives and have become a major force in the state, playing a significant role in the economy, and being expected to have an even greater impact in the future (Poe, 2017),

Apart from the lands owned by Alaska Native corporations, approximately 1% of the state is in other forms of private ownership, with most private lands imposing exclusions or restrictions on use (Robinson et al., 2016). The matters of Indigenous rights, land claims, and resource management in Alaska continue to be subjects of discussion and negotiation among the state, federal government, and Indigenous groups.

3.2.3.4. Doyon Limited

Doyon Limited, the largest regional Native corporation in Alaska, owns 12.5 million acres of land, a size comparable to Texas. It is the largest private landowner in Alaska and one of the largest private landowners in North America (Doyon, 2018), being responsible for managing Native lands and resources in the Interior region of the state.

The lands stretch from the Brooks Range in the north to the Alaska Range in the south. The Alaska-Canada border forms its eastern border, and its westernmost part reaches close to the Norton Sound (Fig. 10). It represents the interests of about 20,000 shareholders who are primarily Athabascan Indians, and its headquarters is in Fairbanks (RDC, 2020; Poe, 2017). This region has about 86,130 residents, 40 Federally Recognized Tribes, 34 communities, and 26 Village Corporations (ANCSA, 2020).

Doyon's vast region in Interior Alaska (Fig. 10), encompasses the villages of Grayling, Anvik, Shageluk, and Holy Cross, the focus of this study and the release of wood bison, and the relationship between Doyon and these communities is allegedly shaped by mutual engagement, consultation, and collaboration to ensure the sustainable development and preservation of the region's resources and cultural values. The corporation actively participates in community development initiatives, scholarship programs, and cultural preservation activities to support the well-being and advancement of its shareholders (Doyon, 2020). The corporation also has a strong influence on residents' views about what should and shouldn't be done on their lands.

With a focus on economic development, natural resource management, and cultural preservation, Doyon Corporation participates in various business and service activities, including oil and gas exploration and production, mining, tourism, and land development (Doyon, 2020; Poe, 2017). The corporation is also involved in the management of real estate assets and operates in the tourism industry. Its primary goal is to generate revenue and create employment opportunities for its shareholders while upholding the cultural and environmental values of the region (Doyon, 2020).

One of Doyon Corporation's significant subsidiaries is Doyon Drilling, which contributes over half of the corporation's revenues. Doyon Drilling provides drilling services in Alaska and other global locations, with active involvement in arctic drilling activities on the North

Slope. Additionally, Doyon holds promising gas resources in the Nenana Basin and the Yukon Flats (Doyon, 2020).

3.2.4. Governance

Alaska operates under a system of governance known as the "Borough System". The state is divided into 19 organized boroughs, each with its own government structure, services, and authorities. These boroughs provide a wide range of services to the public, and allow for local self-governance, providing a framework for local decision-making and administration (DCCED, 2020). Alaska's boroughs include the Municipality of Anchorage, Fairbanks North Star Borough, Matanuska-Susitna Borough, and Kenai Peninsula Borough, among others (DCCED, 2020).

3.2.4.1. The Yukon-Koyukuk Area

The villages of Grayling, Anvik, Shageluk, and Holy Cross are part of the Yukon-Koyukuk Census Area in Alaska. It is located in the central part of the state and covers a vast area, which includes numerous remote communities, primarily inhabited by Alaska Native populations. This area is known for its rich cultural heritage, subsistence-based economies, and diverse Indigenous communities. The region is home to the Athabascan people, who have inhabited the area for thousands of years and have a deep connection to the land and its resources (AET, 2013).

The governance and administration of the Yukon-Koyukuk Census Area are carried out by a local government structure. The specific services and authorities provided by the borough include education, public safety, land-use planning, public health, and other essential services to meet the needs of the communities within its jurisdiction (U.S. Census Bureau, 2020).

The estimated population density of the Yukon-Koyukuk Census Area for 2015 was 5,493 people (Robinson 2016). This region is in the intermediate area, between the most densely

populated, mostly white, urban boroughs in the state, to the southeast, and the most remote, mostly Native, and sparsely populated rural conglomerates to the northwest, west and southwest (Fig. 11).

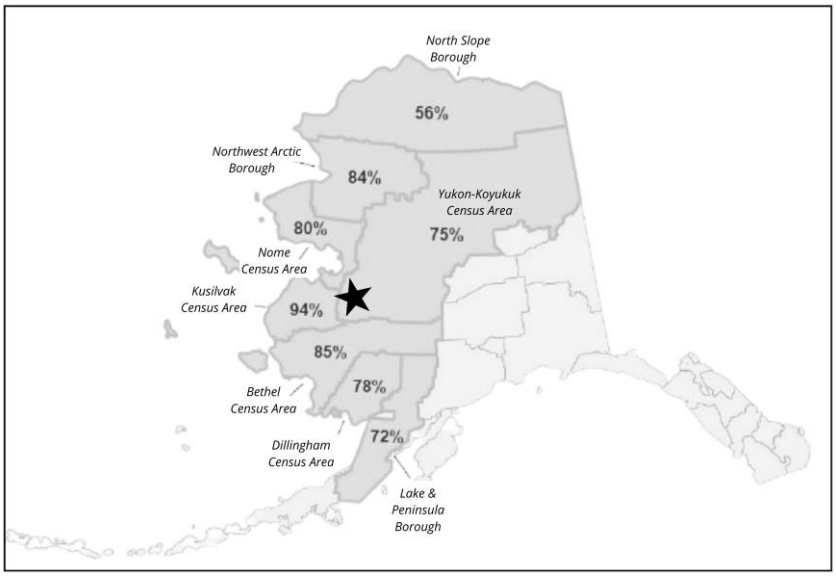

Figure 11. Percent Alaska Native for boroughs and Census Areas with more than 50% Alaska Native Populations in 2014.
*The star marks the wood bison reintroduction site in Alaska. Adapted from Hunsinger, 2016.

3.3. Alaska Native and American Indians

Alaska has the largest Indigenous population in the United States, with over 120,000 Alaskan Natives, representing 17 percent of the state's population in 2010 – 20 percent if consider mixed-race. The Alaska Native population is diverse and spread across the state's various regions. Despite historical declines, the Native population has grown significantly over the past century and is projected to continue growing. While there has been an increase in the urban Native population, the majority of Alaska Natives still reside in small villages and remote regional hubs rather than urban areas (Hunsinger & Sandberg, 2013). According to the Office of Management and Budget (OMB), "American Indian or Alaskan Native" is defined as "a person having origins in any of the original peoples of North and South

America (including Central America), and who maintains tribal affiliation or community attachment" (OMB, 1997, pg. 8).

The history of the Native people of Alaska dates back at least 15,000 years. Multiple waves of migration across the Bering Strait brought people to Alaska, with the first well-accepted evidence of human settlements dating to 12,000 years ago (Yesner, 2001). By the time Europeans arrived in the 1700s, Alaska was home to diverse cultures and tens of thousands of people. Indigenous groups such as the Inupiat, Yupik, Aleut, Alutiiq, Eyak, Athabascans, Tlingit and Haida inhabited different regions of Alaska (Raghavan et al., 2014; Fig. 12). The Alaskan Native population was estimated to be around 80,000 to 90,000 before contact with Europeans, but disease outbreaks led to a significant decline in population. The first U.S. census in 1880 recorded 32,996 Alaskan Natives and 430 white settlers, marking a substantial decrease in the Native population (Hunsinger & Sandberg, 2013).

Figure 12. The original residents of Alaska.
Note: Additional groups include the Eyak of Southcentral and the Tsimshian of Southeast.
*The star marks the area of bison reintroduction. Adapted from Hunsinger & Sandberg (2013).

The mining era in Alaska led to a further decline in the proportion of Native residents, while the non-Native population grew. Then between the 1920-39, growth of Alaska's overall population stagnated during the economic slowdown, leading to a decline in the proportion of Native residents, even though the Native population continued to grow steadily in remote areas. The discovery of oil in Alaska led to two population boom-bust periods in the 1970s

and 1980s. although the Native population experienced smaller migration shifts, it experienced significant growth due to high birth rates, resulting in a 70 percent increase over a 20-year period, and a population of 107,929 by the 2000s (Haynes & Simeone, 2007; Hunsinger & Sandberg, 2013; Howell, 2015).

The Alaskan Native population is increasingly residing in urban population centers, with a growing percentage living away from traditional village life. Migration plays a significant role in this shift, with net migration from majority-Native areas to other parts of the state and outside. Additionally, Alaskan Natives have higher birth rates than non-Natives, contributing to steady population growth, and the population remains relatively young, with a median age of 26.7 compared to the state average of 33.8 (Hunsinger & Sandberg, 2013; Howell, 2015).

Spanning across a wide region that encompasses the entire Interior to sections of the southcentral coast, the Athabascans populate a vast area in Alaska. With a population of 16,665 in 2010, they primarily reside in the Fairbanks North Star Borough and Anchorage, while the sparsely populated Yukon-Koyukuk Census Area, consisting of multiple small communities, accommodates over 3,800 Athabascans, representing more than two-thirds of the area's population (Hunsinger & Sandberg, 2013; Hunsinger, 2016).

The social structure of Alaskan Athabascans was influenced by pragmatism, kinship, and individual choice. Pragmatism shaped group formation based on resource utilization, while kinship ties connected members of local bands through their parental lineage. Marriages within the same clan were forbidden, and sib-related events often involved wars and gatherings. Individual choice allowed for the selection of local band affiliation within certain boundaries, offering flexibility and the opportunity to change memberships based on personal considerations (ANKN, 2006; Haynes & Simeone, 2007).

Athabascan life, despite regional variations, shared commonalities in subsistence activities such as fishing, hunting, trapping, and gathering. They held an animistic belief system,

considering creatures and objects to possess powerful spirits, necessitating adherence to specific rules during interactions (ANKN, 2006). Material culture included winter camps with semi-subterranean structures providing insulation and warmth, accommodating multiple families led by charismatic leaders. Activities like storytelling, singing, dancing, and teaching through legends and myths took place, while potlatches brought neighboring bands together for feasting and socializing. Potlatches also fostered connections, trade relationships, and intermarriage between bands. Nomadic in nature, Athabascans traveled in small groups for their subsistence pursuits (Haynes & Simeone, 2007).

3.4. Study Area

This study collected data from six localities in Alaska, including two urban centers and four Native rural villages (see Fig. 13, at the end of chapter), which were selected based on their proximity to the release site and the potential for conflict with the reintroduced bison. Anchorage and Fairbanks, as major urban centers with significant populations and representation in Alaska, play a crucial role in animal management and are expected to be the primary recipient of bison permits through the lottery system in the future.

3.4.1. Ethnicity

Anchorage is the most populated municipality in Alaska, with close to three hundred thousand people, mostly white (63%; U.S. Census Bureau, 2018). Fairbanks disputes place (with Juneau) as the second largest city in the state, with over thirty thousand residents, also mostly white (65.7%; U.S. Census Bureau, 2018). Other ethnicities include 5.6-9.1% Black or African American; 7.4-9.2% American Indian and Alaska Native; 9.6-4.2% Asian; 2.3-0.6% Native Hawaiian and Other Pacific Islander; 2.3-1.6% some other race; and 9.8-9.6% mixed-race (Anchorage and Fairbanks, respectively).

Each of the rural villages sampled in this study was smaller than 200 residents. About 80 people lived in Shageluk (Shageluk, 2018), 84 in Anvik (Anvik, 2016), 167 in Holy Cross (Holy Cross, 2018), and 186 in Grayling (Grayling, 2016), the largest of the four. These communities were identified as mainly American Indian and Alaskan Native, varying from about 83% (Shageluk) to 94-95% (Holy Cross and Grayling) and 100% (Anvik) made up of this ethnicity alone or in combination (U.S. Census Bureau, 2018). Comparatively, the urban populations were estimated as 296,112 and 31,677 people for Anchorage and Fairbanks, respectively, identified as mostly white alone (63% and 66% respectively). American Indian and Alaska Native (alone or in combination/mixed) comprised about 13-14% of the population of these regions (U.S. Census Bureau, 2018). The median age of Anvik's and Grayling populations in 2016 was 34 and 24, respectively (Anvik, 2016; Grayling, 2016). The median age estimated for Holy Cross was 35.3±5, and 29.5±10.6 for Shageluk (U.S. Census Bureau, 2018). In Anchorage, the median age was estimated as 33.2±0.2, and 27.8±0.7 for Fairbanks (U.S. Census Bureau, 2018). The estimated male adult population (≥18) comprised from 51% of the people in Anchorage to 70% in Anvik (46.4% Grayling; 62.2% Holy Cross; 68.4% Shageluk; 54.9% Fairbanks; U.S. Census Bureau, 2018).

The villages of Shageluk and Anvik both face larger population challenges, experiencing declines in recent years. Factors such as job availability, infrastructure development, and subsistence activities influence population fluctuations in Shageluk, while limited housing and job opportunities have contributed to the population decline in Anvik. Both communities strive to address these issues and attract more residents for sustainable growth. Additionally, Anvik's population decline is further impacted by the decrease in subsistence fishing, and the village also faces economic consequences from the decline of the once-thriving commercial fishing industry. Securing funding for essential projects, such as water and sewer systems in

Shageluk, and potential school closures in both villages due to low student counts are additional challenges they face (Shageluk, 2018; Anvik, 2016).

3.4.2. Location and Religious Influence

The sampled rural villages – Grayling, Anvik, Shageluk, and Holy Cross, together known as 'GASH' communities – are situated in western, lowland Interior Alaska, along the *Innoko River* and the lower-middle *Yukon River* (see Fig. 13, at the end of the chapter). The Yukon Delta National Wildlife Refuge is located southwest of the sampling region, and the *Innoko National Wildlife Refuge*, with approximately 3.8 million acres, is in the area of the study, northeast and neighboring the villages. The Yukon River forms the western boundary of this refuge, which includes a large portion of the upper Innoko River basin. It supports a healthy moose population, attracting many hunters, especially residents of the neighboring villages (Grayling, Anvik, Shageluk, Holy Cross), and nearby towns (Galena, McGrath, Bethel), who also target waterfowl, caribou, black bear, and other furbearers during their respective hunting seasons (USFWS, 2020).

Travel in the landscape of these four rural villages is primarily done by boat and airplane due to the conditions of the land, marked by systems of bogs, from spring to fall. During the winter, snow machines are used to travel over the frozen surface and snow (Carey, 2009). Local languages are 'Deg Xinag', traditionally spoken by residents of Anvik and Shageluk, and 'Holikachuk', traditionally spoken by residents of Grayling. Currently, however, the main language in use is English, with few of the residents educated in the traditional languages. The population of these communities is primarily "Deg Hit'an" Athabascan and "Doy Hit'an" Athabascan, due to the people historically residing in these areas (Brown et al., 2005).

Anvik is located on the west bank of the Yukon River in Interior Alaska, 34 miles north of Holy Cross and 21 miles south of Grayling. It lies in the Kuskokwim Recording District and is situated in the Innoko Lowlands, characterized by flat river flood plains. The village is positioned near the old mouth of the Anvik River, and its traditional name, Git'ringithchagg, means "the mouth of the long, long river" (Anvik, 2016). Due to the abundance of fish that migrate up the Anvik River every year, Anvik has always held significance as a gathering and living location, attracting people to summer fish camps and surrounding sites. Before the arrival of Russians and Americans, the Deg Hit'an and other Native peoples in Alaska had an extensive trade network with coastal and inland communities, utilizing the Anvik River as a significant trade route between the lower Yukon-Innoko region and Norton Sound. The Anvik-Shageluk areas were particularly known for trading items such as dried fish, wooden items, and furs. The establishment of the Episcopal Church site in 1887 led to a shift in settlement patterns, with villagers gradually moving to the mission side of the Anvik River (Anvik, 2016; Deacon, October 1993).

Shageluk is a Deg Hit'an Athabascan community situated along the Innoko River, encompassing both lowlands and uplands. It is one of the last remaining villages on this river that still completely lives off the land and water. The region features a combination of flat, marshy areas and rolling hills. Classified as a remote community, it is located approximately 350 air miles northwest of Anchorage and 400 air miles southwest of Fairbanks. It is primarily accessed by airplane throughout the year, with Aniak serving as the central hub for travel between Shageluk and Anchorage. During winter, people use snowmachines to travel to nearby communities, while boats are commonly used for transportation in the summer. The current town site of Shageluk is positioned at the northern end of a hill, chosen as the relocation site due to flooding in the old village located two miles upstream. The subsurface conditions in the area consist of silty/sandy organic materials and thick permafrost, which

pose considerations for activities such as well digging, construction of new infrastructure, and maintenance of existing infrastructure (Shageluk, 2018).

This area experiences a sub-arctic continental climate with short, mild summers and long, cold winters. In recent decades, residents have observed a decrease in snowfall and an increase in freezing rain during the winter season. Summer temperatures may reach 90 degrees Fahrenheit, whereas winter temperatures can drop to as low as -60 degrees Fahrenheit. The woodlands in the area consist of a variety of trees such as willow, alder, white spruce, black spruce, and birch, and there are abundant types of berries including high bush cranberries, blueberries, blackberries, raspberries, and salmonberries. Throughout the year, residents gather various other plants and resources from the surrounding environment (Shageluk, 2018).

Holy Cross is a remote community located in the southern part of the Athabascan region in West Central Interior, Alaska. It is situated along the west bank of the Yukon River and the Ghost Creek Slough, to the west and opposite the mouth of the Innoko River. It is part of the GASH sub-region, along with nearby villages Grayling, Anvik, and Shageluk. Accessible by air, boat, and snowmachine, it is approximately 40 miles southeast of Aniak, the nearest hub community. The community is situated in the Innoko lowlands, partially within the floodplain of the Yukon River. The terrain features a range of hills with elevations up to 600 feet (Holy Cross, 2018).

The residents of Holy Cross are primarily Deg Hit'an Athabascan and Central Yup'ik ethnic groups. Historically, the area consisted of three Athabascan villages: Anilukhtapak, Ghost Creek, and Koserefsky. Anilukhtapak, located near present-day Holy Cross, Ghost Creek situated half a mile north of Holy Cross, and Koserefsky, across from Ghost Creek. In the past, people lived in small groups and camps along the river, relying on hunting, fishing, and gathering for sustenance. The homes in the area were partially underground, and all necessary

resources for survival were derived solely from the land (Holy Cross, 2018). Religion also played a role in the area's history, as Father Aloysius Robaut of the Roman Catholic church established a mission in the winter of 1887-1888. People from the village of Koserefsky moved to the mission site, and the mission took in epidemic-orphaned children or those seeking education. The children participated in daily chores and were educated in various subjects. Over 1.4 thousand children from many villages attended the Holy Cross Mission boarding school until its closure in 1956 influenced by erosion impacting agricultural land and the formation of a sandbar hindering the transportation of supplies (Holy Cross, 2018). Holy Cross experiences a sub-arctic continental climate with short, mild summers and long, cold winters. The area has seen a decrease in snow accumulation and an increase in freezing rain during winter. The community relies on woodlands for various tree species and abundant berries. The Holy Cross airport serves as a potential hub for nearby villages, particularly during moose hunting season, with considerations for wind direction and freezing rain impacting air traffic (Holy Cross, 2018).

Grayling, a Holikachuk and Ingalik village, is also located on the west bank of the Yukon River in the western interior of Alaska. The area experiences a wide range of temperatures, from -40 to 97 degrees Fahrenheit, and receives significant snowfall. The river remains ice-free from mid-May to mid-October, and the community is known for its open beach and a creek that runs behind the village. The total land area of Grayling is approximately 27.609 square kilometers (Grayling, 2016).

3.4.3. Europeans

In early January 1834, Anvik had its first encounter with European visitors when Russian creole explorer Andrei Glazunov arrived with a small party. James VanStone (1959, p.43) describes this expedition and visit to Anvik in his article. Upon approaching the village, the

inhabitants reacted with alarm, shouting and brandishing bows and arrows. Glazunov sent a companion to assure them of their peaceful intentions, stating that they would pass by if not welcomed. The villagers were reassured and sent ten elders to invite the Russians to their village. Glazunov chose a defensible cabin and advised his men to remain alert. He then attended a gathering at the kashim, where he addressed the villagers, explaining the purpose of his journey and offering trade for furs, particularly emphasizing the provision of tobacco. The Natives received the offers gratefully and eagerly provided water, wood, fish, game, and oil to the Russian party, convinced of their goodwill (VanStone, 1959, p.43). Four years after Glazanov's visit, the Anvik-Shageluk area was devastated by a smallpox outbreak in 1838, resulting in a significant population decline. The introduction of non-Native populations and subsequent contact led to extensive disease, cultural changes, and a 20 percent population decline between 1900 and 1914, intensifying the long-lasting cultural transformations in the region (Anvik, 2005). In the aftermath of the epidemic, numerous residents who had survived and orphans relocated from the former village of Tthogi qay xitl'ot to the current location of Anvik, situated across the river. As time progressed, the old village gradually transformed into a seasonal fish camp and eventually served as a site for staging dogs (Anvik, 2000).

The first documented contact with outsiders in Shageluk was in 1839 when Petr Komakov crossed over from the Takotna River and collected beaver pelts in the Innoko River drainage. By 1861, the Russian American Company reported six major settlements along the Innoko River. The area also had interactions with Western culture through the presence of Catholic and Episcopal churches, with Shageluk specifically being chosen as an Episcopalian community. The area experienced further impacts following the development of economic activities such as gold mining and reindeer herding. The population of Shageluk has significantly declined over the last hundred years, due to the epidemics in the 1900s, and later to outmigration toward urban centers (Shageluk, 2018).

In 1834, Andrei Glazunov, an explorer with the Russian Fur Company, encountered the village of Anilukhtapak, documenting a large Kashim structure – a traditional communal gathering structure for social and cultural activities – and estimating a population of 700. However, the region was heavily impacted by smallpox epidemics in the late 1830s, leading to a significant decrease in population. Lieutenant Zagoskin of the Russian American Company reported only eight homes in Anilukhtapak and a total population of 170 in 1843 (Holy Cross, 2018).

3.4.4. Language, Culture, and Subsistence

Anvik is historically associated with the Deg Hit'an Athabascan group, one of the eleven Interior Alaskan Athabascan groups. The Deg Hit'an, known as "the People of this area," inhabited the Anvik-Shageluk area, including part of the Anvik River to the northwest, the Innoko River with Shageluk, and along the Yukon River from Anvik to Holy Cross. Anvik has been referred to by different names such as American Station, Anvig Station, and Anwig. The Deg Hit'an have close ties to the Doy Hit'an Athabascans, originally from Holikachuk but now recognized as the community of Grayling (Anvik, 2016). Historically a Deg Xinag Athabaskan-speaking community, Anvik lost its last fluent speaker in 2005, reflecting the long-term suppression of the language and culture. Today, English is the primary language used, but local efforts supported by various organizations aim to revitalize the Deg Xinag language through workshops, courses, and collaborative learning opportunities among language learners and elder speakers (Anvik, 2016).

The Deg Hit'an people of Anvik, like other Native Alaskans, have a deep cultural connection with the diverse wildlife, waterfowl, plants, and fish in the region. Their spiritual practices and traditional stories revolve around honoring the spirits of animals, fish, and plants. Moose and salmon are crucial for sustenance, while caribou, black bears, brown bears, and various

fur-bearing animals contribute to the ecosystem. The area also attracts migratory waterfowl species, such as geese and ducks, along with grouse and ptarmigan (Anvik, 2005).

Historically, these human populations travelled around the landscape, between seasonal camps, following subsistence rounds. However, due to pressure from missionaries and the local government, residents of these regions eventually centralized settlement in the current four communities. This process resulted in strong ties and high mobility patterns of people among the four villages. These patterns of relationships can be observed through various aspects such as marriages and kinship connections, shared practices of subsistence, and a collective understanding of resource utilization (Brown et al., 2005). Members of these villages continue to engage in resource harvest activities, often traveling to specific locations and maintaining seasonal camps outside of the villages (Carey, 2009). The annual subsistence cycles in these communities are shaped by the seasonal availability of wildlife, with moose and salmon serving as the primary sources of protein, supplemented by other wild foods such as blueberries, non-salmon fish species, and waterfowl (Brown et al., 2005). However, concerns have been raised about the declining salmon stocks and the potential migration of moose away from these areas, impacting the harvest security in the region (Brown et al., 2005). Furbearer species like marten, beaver, and lynx also hold significance in these communities, providing income and materials for clothing and artwork (Carey, 2009).

The village of Shageluk presently engages in numerous traditional and cultural pursuits, with families continuing to rely on the land for sustenance through fishing in the summer, hunting moose in the fall, and engaging in hunting and trapping activities during the winter. Despite the suppression of language and culture in the past, efforts are being made to revitalize the endangered Deg Xinag language and preserve traditional values in the area (Shageluk, 2018). Similarly, the population of Grayling consists of Holikachuk and Ingalik Indians, and they strive to preserve their Indigenous language (Holikachuk), culture, and subsistence practices.

Native arts, respect for elders, and the abundance of fish and berries in the area contribute to the community's way of life (Grayling, 2016).

The residents of Holy Cross mainly have ancestral roots in the Deg Hit'an Athabascan and Central Yup'ik communities. In the past and before the establishment of Holy Cross, the area was home to three Athabascan villages: Anilukhtapak, Ghost Creek, and Koserefsky (Holy Cross, 2018). Apart from these three settlements, individuals typically resided in modest clusters and encampments along the river, engaging in activities such as hunting, fishing, and foraging. The dwellings were semi-subterranean, and all necessities and materials for sustenance were solely sourced from the land (Holy Cross, 2018).

Despite the contact with Western culture, the residents of Holy Cross have also continued to sustain themselves through traditional means and to value its cultural traditions. engaging in fishing during the summer, moose hunting in the fall, and pursuing various game animals through hunting and trapping during the winter. The community has a unique and rich history, and there is a focus on restoring traditional dance and language learning as important priorities for the community's future (Holy Cross, 2018). The restoration of wood bison in the area creates opportunities for future tourism and guided hunting (Holy Cross, 2018; Shageluk, 2018).

While limited research has been conducted in these communities, available sources include subsistence use reports from the Alaska Department of Fish and Game, government census estimates, and studies related to the impacts of climate change in rural Alaska (Brown et al., 2005; DCCED, 2015; Carey, 2009). In terms of seasonal subsistence practices, the communities adhere to a cyclical pattern throughout the year. Winter (November-February) involves trapping, eeling (catching or fishing for eels), small game hunting, and ice fishing, with beaver trapping beginning in February. Spring (early March-May) sees the harvesting or trapping of various animals, including beaver, muskrat, furbearers, and waterfowl, along with

continued ice fishing (Anvik, 2016). Summer (June to mid-August) is marked by subsistence fishing, berry picking, and gardening, with an emphasis on preserving fish for the winter. Finally, fall (late August to October) brings activities such as moose hunting, occasional caribou or bear hunting, berry picking, and hunting southern migrating waterfowl (Anvik, 2016).

3.4.5. Governance

The Alaska Constitution outlines that *cities* and *organized boroughs* constitute the core of Alaska's Municipal Government, both being municipal corporations and state political subdivisions. Moreover, Alaska's Constitution mandates the division of the state into organized or unorganized boroughs, considering factors like natural geography, economic viability, and shared interests. Organized boroughs primarily developed in regions with more advanced economies, while the remaining areas constitute the unorganized borough (DCCED, 2018).

A *city* government operates as a municipal corporation and is a political subdivision within the State of Alaska. City boundaries are governed by the "limitation of community" doctrine, ensuring they encompass urban or semi-urban areas. The average size of Alaska's cities is a little over 30 square miles, though significant variations exist in their dimensions. Present State regulations restrict the inclusion of extensive uninhabited regions within city limits. Currently, Alaska hosts 144 city governments, collectively representing 22 percent of the state's total population. In 2014, city populations ranged from 31,721 residents in the City of Fairbanks to just 25 inhabitants in the City of Kupreanof. In Alaska, there are three main classifications of city governments: (1) *Home-Rule*, (2) *First-Class*, and (3) *Second-Class* cities. For a community to establish a home-rule or first-class city, it needs a minimum of 400 permanent residents. Home-rule cities possess broad legislative powers unless restricted by

law or charter, while first- and second-class cities operate under state-defined powers (DCCED, 2015b). Typically, both classes provide a broad range of municipal services including, but not limited to, police protection, parks, sewer, and water utilities. The significant difference between the two classes of city includes taxing authority, responsibility for schools, and the powers and duties of the mayor. A community must have at least 400 permanent residents to form a first-class city (DCCED, 2018).

Like cities, *organized boroughs* in Alaska function as municipal corporations and political subdivisions within the state, but on a larger regional scale. Alaska's Constitution mandates the division of the entire state into boroughs, with specific size and population criteria. Presently, there are 19 organized boroughs in Alaska, varying greatly in size. These boroughs are equivalent to 'counties' in the rest of the United States, and collectively house 89.5% of the state's population. Additionally, 103,820 residents lived within both organized boroughs and city governments. Organized boroughs encompass approximately 45% of Alaska's area, with the remaining land constituting the unorganized borough. Alaska features distinct classifications or categories of organized boroughs: (1) *Unified Home Rule Municipality*; (2) *Home Rule Borough* (non-unified); (3) *First Class Borough*; (4) *Second Class Borough*. Among these, first and second-class boroughs operate as general law governments (DCCED, 2015b; 2018).

In this study, Anchorage and Fairbanks are part of the organized boroughs. Anchorage is a *Unified Home Rule Municipality*, and Fairbanks is a *Home-Rule city*, part of the Fairbanks North Star Borough. The four rural villages are *second-class cities*, located in an unorganized borough of Alaska.

Anvik's historical governance can be understood through a comprehensive review of ethnographic studies, oral histories, archival records, church records, and Anvik Historical Society records. Men primarily held leadership in the past, and cultural protocols governed

decision-making. The Kashim, or community house, played a role in promoting community cohesiveness. Presently, the Anvik Tribal Council serves as the recognized traditional Athabascan government, operating under a written constitution adopted in 1993. The council consists of five members, with the Chief as the presiding officer. The council administers various programs and services, including education, job placement and training, scholarships, social services, agriculture, wildlife and parks, credit and finance, and aid to tribal governments. The City of Anvik, incorporated in 1969, functions as a municipal government with a seven-member council. Deloy Ges, Incorporated, also known as the Central Corporation and Ingalik, Inc., is the local village corporation established under the Alaskan Native Claims Settlement Act. The Anvik Historical Society, a nonprofit organization formed in 1981, works toward documenting and preserving the history of Anvik and the surrounding area. The society operates a museum, maintains valuable collections, and publishes newsletters for its members and interested individuals (Anvik, 2016).

Shageluk has both a City and Tribal government, with the Shageluk Native Village being a federally recognized Tribe and the City of Shageluk operating as a second-class city. Both entities have council members and employees, and they work together to meet the community's needs. Zho-Tse, Inc. is the village corporation established under the Alaskan Native Claims Settlement Act (ANCSA) and holds land in and around Shageluk. Other entities that impact Shageluk include Doyon Limited, Yukon-Kuskokwim Health Corporation (YKHC), Iditarod Area School District (IASD), Tanana Chiefs Conference (TCC), and Interior-Regional Housing Authority (IRHA; Shageluk, 2018).

The city government of Holikachuk was established in 1969, and its constitution and by-laws were approved in 1948. The community is a federally recognized tribe and a second-class city. Due to challenges with flooding and low water levels, 25 families decided to relocate from Holikachuk to Grayling between 1962 and 1966 (Grayling, 2016). Grayling has several

governance entities that serve the community. The Tribal Council consists of seven members who serve for two to three years. They oversee various projects and programs, including energy assistance, higher education, gardening, and community events. The City Council has a 3-year term and is comprised of seven members and a mayor. It manages the water and sewer systems and is involved in securing grants for community facilities. The Village Corporation, Hee-Yea Lindge, employs four people and provides services such as fuel supply at reasonable rates. The regional corporation, Doyon, aims to promote the economic and social well-being of shareholders and protect the land and resources in the area (Grayling, 2016).

Located in an unorganized borough of Alaska, Holy Cross is governed by both City and Tribal governments. The Holy Cross Tribe is federally recognized, with 7 elected council members, while the City of Holy Cross has 7 council members and was incorporated as a second-class city in 1968. Seasonal and year-long employment opportunities are available in various sectors, including construction, community projects, youth services, and more. Deloycheet, Inc., the Alaska Native Village Corporation, manages land holdings, has over 550 shareholders, and operates two subsidiaries. Other organizations impacting Holy Cross include Doyon Limited, Yukon-Kuskokwim Health Corporation (YKHC), Iditarod Area School District (IASD), Tanana Chiefs Conference (TCC), and Interior-Regional Housing Authority (IRHA; Holy Cross, 2018).

3.4.6. Access and Communication

Anvik relies primarily on satellite communication and the U.S. Postal Service, with additional communication options available through the local public radio station, satellite-based telephone, and internet services, and television through Dish Network; however, the

communication system is still in its early stages, with limited reliability and availability of satellite and telephone connections (Anvik, 2016).

Alongside this traditional lifestyle, Shageluk and Holy Cross also benefit from modern technology and resources available from nearby cities. Cell phones, internet access, and a local store offering a range of household goods and food items are accessible to most families (Shageluk, 2018). In Holy Cross, most families have cell phones and internet access, and the local stores provide a range of essential household goods and food items (Holy Cross, 2018).

Grayling receives telephone and internet services, although internet access is only available at certain locations such as the school, tribe, corporation, and city office, and it is not intended for public use. However, some individuals may have their own private internet connections (Grayling, 2016).

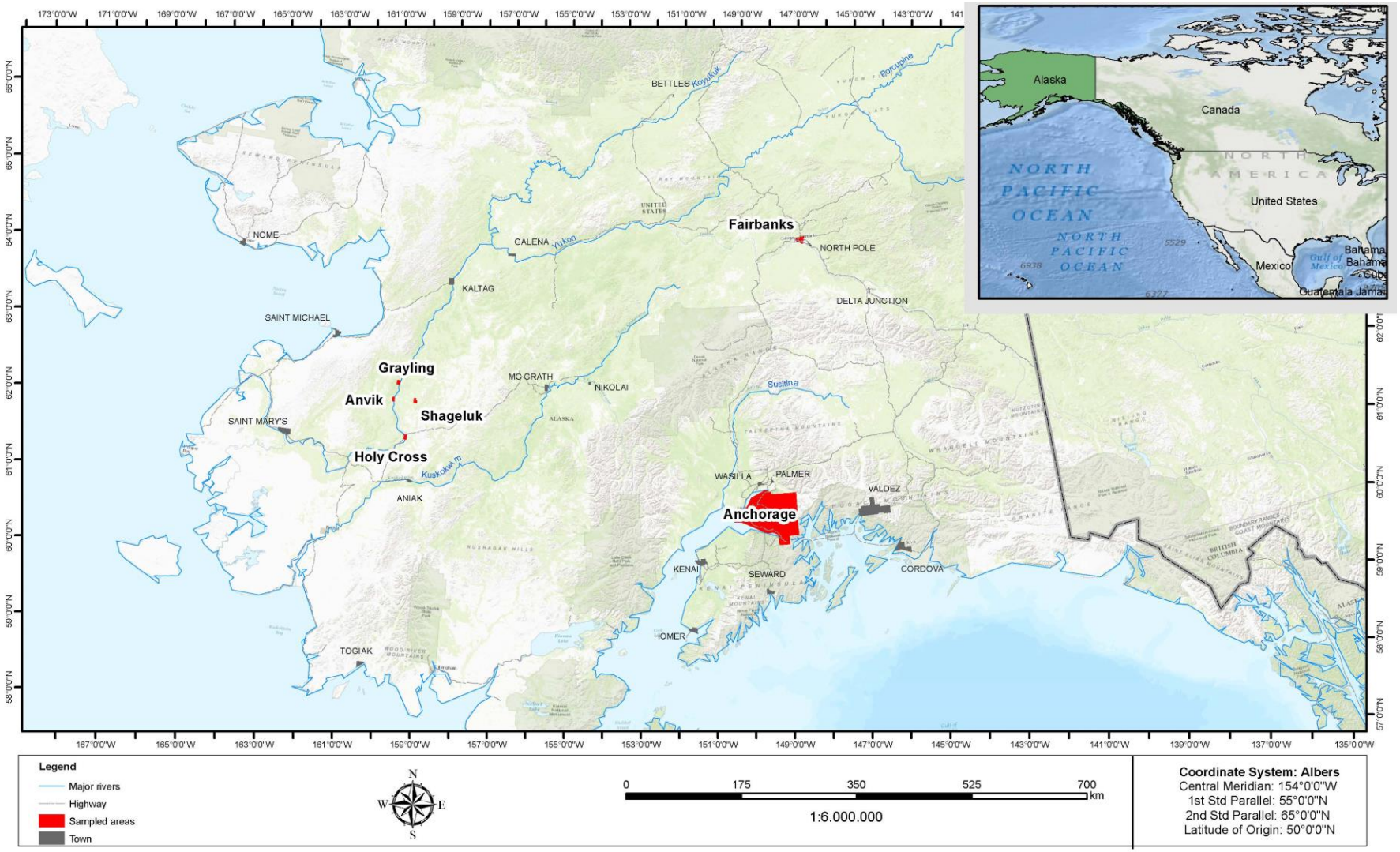

Figure 13. Map of Alaska showing this study's sampled areas in red.

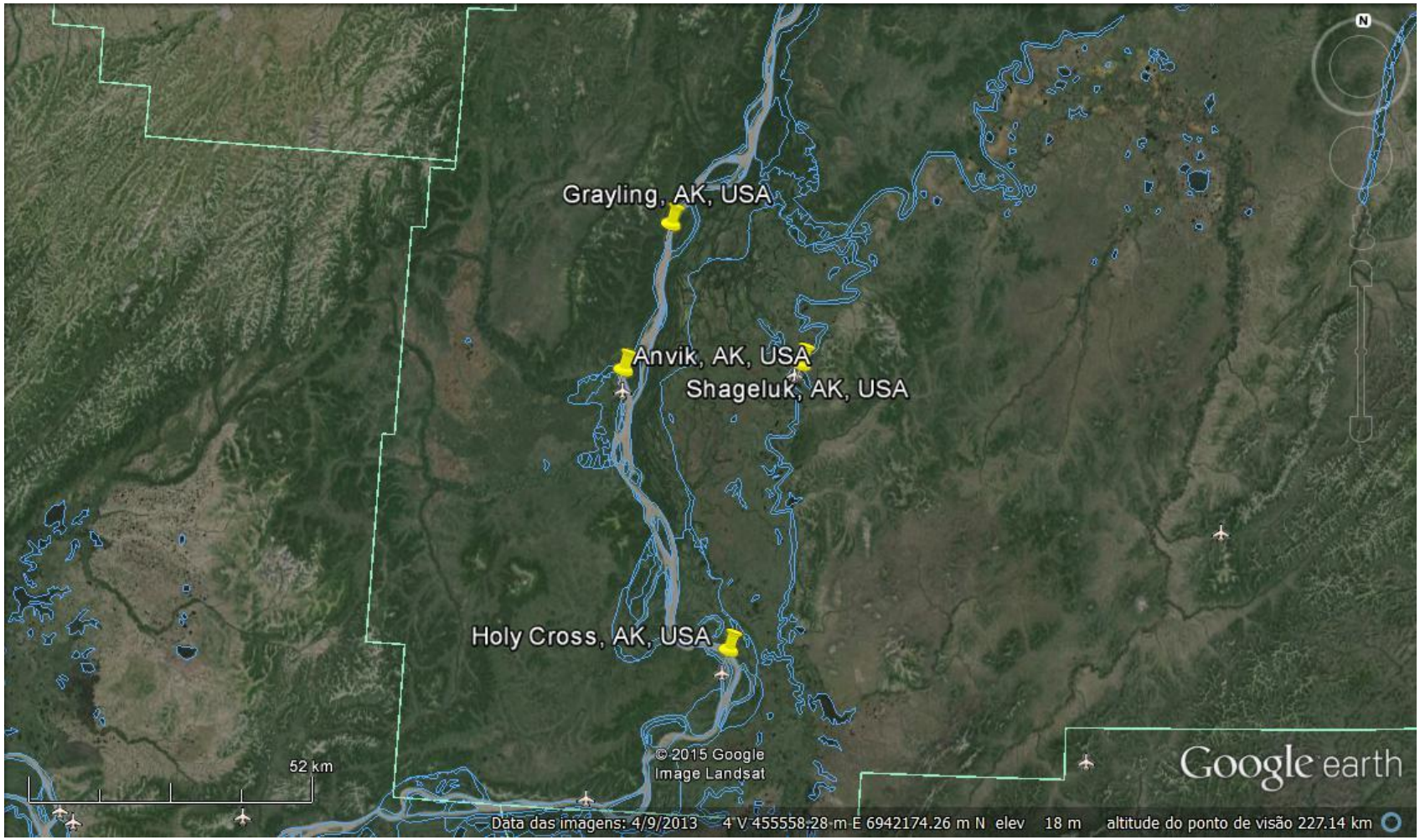

Figure 13b. Satellite image showing the terrain and water sources around the four sampled rural communities.

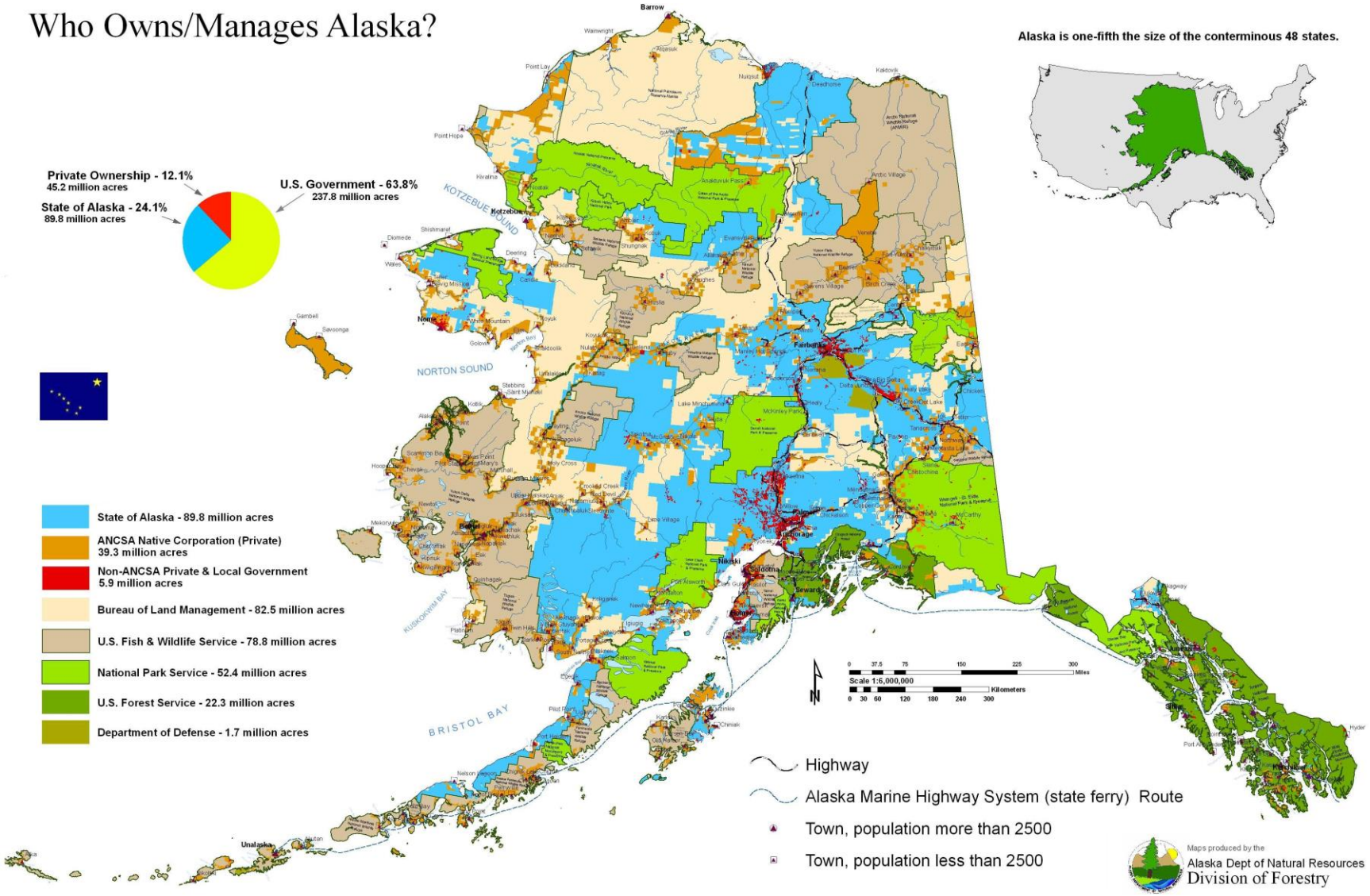

Figure 14. Land Ownership in Alaska. Adapted from Alaska Department of Natural Resources (n.d.)

4. Methodology

4.1. Sample and Data Collection

To understand how different interest groups of Alaska residents perceive wood bison reintroduction and management, residents of two urban and four rural areas were sampled between June and August 2015 (Fig. 13). Only adult residents (i.e., >18 years) were sampled in all localities. For this study, urban settlements were considered those with a population of >10,000 habitants at the time of the study, and people were divided according to their residency address. Data were obtained from Anchorage and Fairbanks through a mail survey, which has been considered the best approach for urban area sampling (Dillman et al., 2014). The samples were randomly selected in each city from the most recent telephone directories (Alaska Communications 2014a, 2014b). Potential respondents from the list were contacted by phone, before the mailing, to obtain permission and confirm the address. An adapted Dillman Tailored Design Method (Dillman et al., 2014) was employed. The mailing package contained the questionnaire, a pre-stamped return envelope, and a brief outline of the study, detailing its importance, involved organizations, confidentiality issues, and contact information (Vaske, 2008; Dillman et al., 2014). The instrument was pre-tested before distribution. Time and financial constraints prevented a second mailing from taking place. A total of 1596 questionnaires were mailed out to the urban areas, 824 to Anchorage, and 772 to Fairbanks. Structured interviews were conducted in the four rural communities (Grayling, Anvik, Shageluk, and Holy Cross). Community liaisons helped with the setting up of meetings and people were also randomly invited to participate during their trips to the Tribal Council Halls. When two adult members of

the same household were together, only one participated. Structured interviews were carried out using the same instrument used for other areas, following standard interviewing procedures, according to Fowler and Mangione (1990), and Fowler (2009). Personal interviewing is considered the most appropriate method for understanding small and remote communities, due to issues related to trust, confidence levels, residency remoteness, and literacy in small villages. Moreover, small villages allow easier access to the population through an in-person contact, where communication is frequently not possible otherwise (Decker et al., 2012).

Before the distribution of any questionnaire, ethical approval was sought and granted by the Interdisciplinary Committee on Ethics in Human Research from Memorial University, which was the appropriate procedure during the time of this study (ICEHR Number: 20160097-AR). In line with the ICHR recommendations, consent to use the data was obtained by completing the questionnaire. All individuals in this study had the option not to participate. All responses were anonymous, and no personal information was asked.

4.2. Variables Used

Demographic variables have been described as weak predictors of support or opposition to management actions (e.g., Donnelly & Vaske, 1995; Glickman et al, 2010), although it is still frequently used and useful for describing the overall characteristics of studied groups. Psychological concept measures, such as norms, trust, and perceived impacts, on the other hand, are frequently and consistently reported as good predictors of acceptance for diverse wildlife management actions

(Glickman et al, 2010). Therefore, this paper uses demographic variables to describe group features, and psychological measures to discuss differences among groups.

This study's questionnaire package and questionnaire items were designed following guidelines described by Vaske (2008) and Dillman et al. (2014). To test this study's hypothesis, survey items, or questions, to be asked to the residents of Alaska, were developed. The questionnaire contained several sections (see Appendix 2), however, for the purpose of this thesis, only the items addressing the following concepts were analyzed: perceived impacts (i.e., risks and benefits), trust (i.e., in the management agency, ADFG), and normative beliefs – related to wood bison management in Alaska. These topics were chosen based on relationships previously found and supported by the literature, which have shown strong linkages and prediction power – among these concepts themselves and with the acceptance of wildlife and management. The social trust items covered aspects related to residents' evaluation of the work conducted by the ADFG, and their confidence in the agency's future conduct. These aspects were designed based on previous research that has shown that the public forms its image of an agency based on past interactions, perceptions related to its communication, function, and personnel (Decker et al., 2012).

There is still much debate about the definition of many terms inside the science of human dimensions; "impact" being one example (Zajac et al., 2012). For this study, we adopted the terminology offered by Zajac et al. (2012), who defined *impacts* as either negative (i.e., *risks*) or positive (i.e., *benefits*) outcomes associated with the interaction with a wildlife species (Zajac et al., 2012). Perceived risk items covered in this study are related to perceptions of bison as threats to people, domestic animals, property, and travel safety. Perceived benefits items measured potential gains

residents perceived as coming from the restoration and management of the bison, in terms of harvest, income and community development.

Norms are represented by beliefs about what most people already do or "should" do in a given situation. A normative scale examines whether a behavior is considered acceptable or unacceptable, or how much of it is acceptable (Vaske & Whittaker 2004). By measuring norms at the individual level, we are referring to personal norms (Vaske, 2008). The normative scale used in this study measured people's acceptance of management actions that were proposed on the wood bison management plan (i.e., goals and strategies), covering aspects related to future bison hunting permits and land access fees to hunt wood bison or tour the locations to view the animals. The management plan items chosen for the normative test scales covered aspects perceived as most prone to conflict, according to discussions observed among members of the management planning team.

Normative beliefs are considered highly situational, being defined as judgements about what is appropriate to do in *a specific* situation (Schwartz 1977; Zinn et al. (1998). Moreover, in a previous study investigating the influence of normative beliefs on the acceptability of wildlife management actions, Zinn et al. (1998) built upon Ajzen and Fishbein (1980)'s *specificity theory* (i.e., the correspondence of *target, context, action, and time* among variables measuring attitude and behavior), to note that "**specific** questions about the acceptability of management actions undertaken in a particular *place* for a particular *purpose* […] should more closely approximate to public sentiment than broadly worded questions about the overall acceptability of the same management action" (Zinn et al., 1998; p. 651). Thus, this study's normative items were designed to best correspond to the bison management plan's goals and

strategies tested to provide more accurate normative measurements. Other questionnaire items were adapted from previously tested items (e.g., Bright & Manfredo, 1996; Vaske et al., 2007; Zajac et al., 2012; Glikman et al., 2012; Sponarski et al., 2013; 2014), adjusting for the local reality.

Demographic questions were included to describe respondents. The selected questionnaire was initially pre-tested and adjusted after taken by university students in Canada, and later by Anchorage residents in a visit to an urban park, further adjusting it to the Alaskan reality. The questionnaire was still reviewed, modified, and approved by the ADFG agency personnel, who have a long experience not only with the urban public, but also a long relationship with the rural communities. The document also offered an open-comment section at the end, where participants were encouraged to share their views on whatever they considered important concerning wood bison in Alaska.

Possible trust issues within the rural villages were addressed with the arrangement of a previous trip to the localities, during which the researchers were presented and participated in a local conference (i.e., Denakkanaaga, June/2015) when many Alaskan villagers congregate to discuss the current issues faced by the communities, share their views, discuss solutions, and engage in culture revival. All arrangements and approvals for this trip were organized by the ADFG. By participating in the conference, being presented by trusted individuals, and taking part in several traditional activities, the researchers gained respect and trust from several leaders and other residents of the communities, establishing contacts and logistics for data collection. This opportunity was also important to gain a better understanding of the culture and livelihood of these remote areas of Alaska, present the study, clarify its

goals, look for feedback to further adapt questionnaire items. Issues related to all four concepts analyzed in this research (i.e., perceived risks and benefits, trust, and normative beliefs) were taken into consideration for the necessary modifications, to suit the local rural village populations and the urban residents.

4.3. Data Analysis

This study followed a quantitative measure design. The accuracy of quantitative data (i.e., validity) was secured following expert advice in the representation of psychological concepts in the appropriate proportions (Vaske, 2008; J. Vaske, 2015, Pers. Comm.). Five-point Likert scales (i.e., *1 = Strongly disagree; 2 = Moderately disagree; 3 = neither/neutral; 4 = Moderately agree; 5 = Strongly agree*) were used to measure items addressing each of the four studied concepts (perceived risks and benefits, trust, and normative beliefs). A few dichotomous (i.e., 0 = No; 1 = Yes) and categorical questions were also used to measure demographic items. Data were analyzed using the version 23.0 of the Statistical Package for the Social Sciences (SPSS; IBM, 2015).

Because this study was interested in a conceptual analysis of participants according to hunting participation and place of residency, standard social sciences quantitative techniques were applied by combining survey items into four individual summated rating scales, one for each studied concept (i.e., trust, risks, benefits, and personal norms). Moreover, controlling for missing data to be tolerable (i.e., <10%; Vaske, 2008), it was defined that at least three of the total question items measuring trust and personal norms, and at least two of the perceived risks and benefits items should have been answered for the respondent to be included in the analysis. To test for scale

reliability, we estimated the *Cronbach's alpha*, or the inter-correlation among the items used in a scale. A 0.6 value of alfa is considered acceptable, while scores closer to one represent more consistency in the items measuring the latent variable (Vaske, 2008; Dillman, 2014). Descriptive statistics were used to illustrate overall patterns. Likert scale items were recoded when necessary for the statistical analyses.

To be able to compare different interest group's views, while considering the importance of long-term bison hunting as one restoration motivation, respondents were divided into groups. Because hunters and non-hunters are typically described as holders of different values and opinions about animal management, people were divided according to hunting participation. Furthermore, previous research has shown that dividing stakeholder groups solely based on hunting participation may not address variations in acceptance of wildlife as fully as when place of residency is considered (Lischka et al., 2008), thus studied groups also reflected locality differences such as proximity to wildlife and local cultural values, being separated into rural and urban.

Because of the large difference between urban and rural portions of native-Americans inside the populations (i.e., <10% in the urban areas, and >90% in the rural areas; DCCED, 2015), dividing respondents according to place of residency should also help accounting for cultural differences. To test the possibility of a better characterization according to both hunting participation and place of residency together, over a simpler urban/rural divide, we compared survey results analyzed using both types of stratification. Although the sampled rural communities near the bison reintroduction site that were included in the study are predominantly native communities, their perceptions are likely to be different from the rest of rural Alaska due to higher community involvement, so generalizations can't be discussed at a state level.

First, an independent samples t-test (Table 2) was performed, to test for differences comparing the means of the *four dependent variables* (i.e., trust, risks, benefits, and norms) between two levels (i.e., urban, rural) of the *independent* variable (i.e., residency). Then, the groups were subdivided according to a new *independent* variable (i.e., hunting participation). The one-way ANOVA was used to compare means among the three levels of the *independent* variable (i.e., rural hunter, urban hunter, and non-hunter), for the *four dependent variables* (i.e., trust, risks, benefits, and norms; Table 3). Differences are discussed.

Moreover, when dealing with large sample sizes, concerns may emerge regarding the significance of testing. Larger samples are more likely to detect significant differences in a population (Vaske, 2008). Thus, we also estimated the "*eta*" and "Cohen's *d*" for the ANOVA and t-test, respectively. These are measures of the *size of the effect* being observed. Effect sizes are statistical measures that indicate the magnitude of the relationship between the independent variable and the dependent variable. They quantify the extent to which the independent variable accounts for the variation in the dependent variable. Effect sizes can be categorized as small/minimal, moderate/typical, or large/substantial, depending on the strength of the observed relationship (Cohen, 1988; Vaske, 2008). Based on largely used reference scales (Cohen, 1988; Vaske, 2008), this study reports effect sizes for all comparisons shown. Moderate/typical, or large/substantial effect sizes indicate that the observed differences are genuine and not likely to result from sample size.

Finally, the qualitative information the respondents provided was summarized in the study. Opinions provided in the questionnaires' comments section or during the rural interviews were transformed into word clouds (worditout.com). A minimum repetition

of seven times for urban and three times for rural was defined for the words to be included in the clouds.

5. Results

5.1. Response to the mail survey

Of the 1596 questionnaires mailed out to the urban centers, 507 were returned, yielding a response rate of 32%, equivalent to similar studies previously held in Alaska (e.g., Manfredo et al., 2003). The response rate for Anchorage and Fairbanks was 30% (n = 237) and 36% (n = 270), respectively. In the four small rural villages, data were obtained from on-site interviews administered to all respondents who were willing to participate. 35 personal interviews were completed in Grayling, Anvik, Shageluk, and Holy Cross, representing about 10.4% of the estimated adult population for the villages (U.S. Census Bureau, 2010). Many rural residents were out pursuing their livelihood (e.g., fishing; hunting) during the data collection period, thus lowering the number of reachable residents at the time of data collection.

5.2. Descriptive Statistics

Respondents (n=542) were predominantly male in urban and rural areas (65% and 63%, respectively). They considered themselves predominantly non-native in the urban centers (95.3%), and Alaska-native or Native American in the rural villages (100%). Respondents were, on average, older in the urban centers ($\bar{x}$ = 61.75) than in the rural villages ($\bar{x}$ = 44.4). Rural residents have lived, on average, longer in Alaska ($\bar{x}$ = 42.56) than urban residents ($\bar{x}$ = 39.44). Education levels were higher in the urban areas, where many respondents had a bachelor/technical degree, or a graduate degree (38.3% and 32%, respectively). In the rural villages, most respondents have completed high school, or a little beyond high school (54.3% and 34.3%, respectively).

Hunting is a widely distributed activity across Alaska, for subsistence or recreational purposes. Active hunting participation during the past five years was higher in the rural than urban areas (about 71.4% and 38.9%, respectively), which was expected given the higher rural reliance on game for rural subsistence. Hunting participation rates in the samples were higher than the population proportions for each locality (ADFG, 2017). This may be because hunters are more likely to be interested in participating in surveys that concern hunting and a potential game species, as they are more likely to be affected by management regulations.

In the urban areas, the gender breakdown of non-hunters was similar to population averages, with 51.3% of non-hunter male respondents. Hunters, however, were predominantly male (86.3%). This is consistent with national trends, which show that hunting is a male-dominated activity (Heberlein et al., 2008).

The rural gender breakdown of non-hunters was the opposite of hunters, with 80% female non-hunters, and 20% female hunters, a higher representation than in the urban locations. This suggests that more female hunters may be in rural than urban areas. However, the sample sizes were not representative to allow for more general conclusions about gender differences in hunting participation. Further research is needed to understand better the factors that influence hunting participation in Alaska.

No significant differences ($p < 0.05$) were found in the responses of all four analyzed scales between the two urban areas (Anchorage and Fairbanks) or the four rural villages (Grayling, Anvik, Holy Cross, Shageluk). Therefore, the samples were grouped together into ‘urban’ and ‘rural’ populations.

5.3. Knowledge, Attitudes, and Values

Urban public awareness about wood bison restoration in Alaska was relatively poor. Only 45% of Anchorage and Fairbanks residents knew about the reintroduction before having contact with this study. In contrast, 89% of sampled rural residents were aware of the reintroduction previously to this study.

From the respondents who were previously aware of the restoration, approximately 68% of people in the cities and only 42% in the villages received information about the participatory planning processes for future bison management, despite representatives from all communities attending the management planning meetings. Awareness of specific management actions, such as the proposed bison hunting permit allocations, was limited, with 23% of rural and 12% of urban residents aware of these issues.

Among the informed population, 83% of urban residents relied on the media (e.g., internet, newspapers, TV, radio) as their primary source of information about the bison restoration. Other significant sources mentioned were the AWCC (Alaska Wildlife Conservation Center), where bison were reproduced and quarantined (12%) before their release into the wild, and friends or affiliated groups (9%). In contrast, rural residents predominantly acquired information through local meetings conducted with agency personnel to discuss and inform them about the bison restoration in the area. However, they also mentioned other sources, including local and broader media (e.g., radio, newspaper, TV, internet), the mail, family, friends, or through direct employment by the acting management agency. It was not uncommon for respondents to cite multiple sources of information.

As expected, the sampled public in Alaska was generally positive towards bison. Most respondents held positive attitudes toward wood bison. About 82% of the urban sample evaluated bison as positive, and 79% as beneficial. In the rural areas, 97% evaluated bison as positive, and 77% as beneficial. About 20% of the respondents were within the neutral range regarding bison as beneficial for all areas, and 16% and 3% were neutral regarding bison as positive in urban and rural areas respectively (i.e., evaluation as neither beneficial/positive nor harmful/negative). Concerning bison restoration to Alaska, most participants reported overwhelmingly positive attitudes, with 88% of the urban and 94% of the rural sample saying they liked having wood bison restored.

Most respondents across all study areas considered it 'very' or 'extremely' important to keep up to date with the restoration outcomes and were interested in having information about wood bison available to them; that wish being twice as strong in the rural areas. Study participants evaluated the issue of bison restoration as personally important to them. About 35% considered it 'very important' in the cities, while close to 46% considered it 'extremely important' in the rural villages.

Gathered information reflecting people's values showed that, across all localities, most respondents felt it was important to maintain bison for future generations to enjoy. Also, most participants from both areas agreed that the bison population should increase and allow for hunting, although bison 'becoming abundant' throughout the state showed more divided opinions. Most people disagreed that hunting would threaten the survival of the bison population (61.5% and 62.9% of the urban and rural samples, respectively).

5.4. Psychological characteristics

This study compares people's views across six areas of Alaska regarding wood bison reintroduction to the state. To do that, residents were divided according to two criteria: *residency* (i.e., urban; rural), and *hunting participation* (i.e., non-hunter; urban hunter; rural hunter). Four psychological concept scales were built to measure baseline levels of social acceptability norms; trust in the management agency; and perceived impacts (i.e., risks and benefits) potentially resulting from the reintroduction. The reliability of these scales was tested, resulting mostly in acceptable to high Cronbach's alpha estimates (Vaske, 2008; Table 1). Six items were used to measure perceived risks in both urban and rural areas, four items were used to measure perceived benefits, seven items for trust, and six items for personal norms (see items on Table 4, end of chapter).

Table 1. Internal reliability of computed variables risk, benefit, trust, and norm.

	Reliability of Computed Variable (α)			
	Risks	Benefits	Trust	Norms
Urban	0.72	0.77	0.93	0.72
Rural	0.70	0.50	0.81	0.60

5.4.1. Baseline Social Acceptability Norms

Norms here refer to the measure of baseline levels of *social acceptability norms* (support or opposition) towards proposed wood bison management strategies, especially the ones related to *land access fees* and *hunting allocation*, topics most prone to disagreements. As previously discussed in the introductory chapter, these are *subjective social norms* describing what people believe they *should* or *ought to* do in a specific situation. According to theory, these norms direct behavioral intentions and actual behavior through social pressure (Vaske & Whittaker, 2004). In this study, the terms *norms* / *acceptability norms* / *social acceptability norms* are used

interchangeably. This is a numerical discussion, with the testing of means following in the next sessions. For normative statement items, higher means (i.e., on the Likert scale) indicated that respondents agreed more with the stated proposed management action item, meaning that their social normative beliefs led them to consider the stated management action acceptable. The group most favorable toward the proposed management were rural hunters.

Among all the conceptual scales measured in this study, norms showed the largest variance and the least consensus among the groups ($\bar{x}$ = 0.15-1.63, see Table 4), highlighting areas with potential for conflict. Most of the urban hunters' norm averages ranged slightly above neutral, while most of the rural hunter opinions ranged above 'moderately agree'. Non-hunter opinions mostly averaged just below 'moderately agree', frequently mid-way between urban and rural hunter opinions.

The highest averages, closer to 'strongly agree', were rural hunter views on access fees for hunters ($\bar{x}$ = 1.63) and using the fee's resources on local resident training and student scholarships ($\bar{x}$ = 1.48; Table 4). The item regarding differential distribution of hunting permits between local and non-local Alaskans was still a neutral average issue to urban hunters, while it seems already a higher concern for the rural hunters, who agreed with it over six and a half times more ($\bar{x}$ = 0.17-1.13, Table 4). A similar trend was seen regarding common access fees for private lands ($\bar{x}$ = 0.17-1.29, Table 4), and fees for hunters ($\bar{x}$ = 0.23-1.63, Table 4), both with large variances, and over seven times more acceptability by rural hunters than urban hunters. Non-hunters agreed the least with the common fees and having land access fees for viewers, ranging neutral ($\bar{x}$ = 0.22-0.18, Table 4). The only closely neutral mean for rural hunters ($\bar{x}$ = 0.36) was

the item with the highest consensus related to access fees for viewers and photographers to access local lands ($\bar{x}$ = 0.08-0.36).

5.4.2. Baseline Calculative Trust

This study measured the respondent's *calculative trust* in the wildlife agency responsible for managing wood bison in Alaska (Alaska Department of Fish and Game, ADFG). This type of trust is related to situations where individuals place confidence in others for the management of a potential risk due to necessity and lack of possibility of controlling these risks themselves.

The ADF&G was evaluated favorably most of the time. Trust items had the highest consensus among all the scales, with averages ranging around 'moderately agree' for all items and groups ($\bar{x}$ = 0.74-1.46; Table 4), being numerically higher inside the rural ($\bar{x}$ = 1.14-1.46) than urban populations (0.74-1.01; Table 4). Urban residents slightly agreed more with general statements about the agency, while rural respondents' averages were a little higher for items more specific to the bison context, especially regarding agency communication (i.e., the agency will provide the best information on bison, and will listen to residents' concerns). Non-hunter opinions ranged closer to urban opinions, in general. The item with the most consensus in the trust scale was about the agency being well informed in general ($\bar{x}$ = 0.99-1.12). The lowest urban hunter and non-hunter averages were concerning perceptions of the agency doing a good job in managing bison; ($\bar{x}$ = 0.76; Table 4).

5.4.3. Baseline Impacts Perception

In general, all studied groups expected benefits from the wood bison restoration. Perceived benefits items ranged from more neutral to a higher 'moderately agree' ($\bar{x}$ =

0.51-1.58; Table 4). Non-hunter opinions generally ranged close to urban hunter opinions, with lower means than rural hunters. The largest overall averages concerned bison as an additional harvest for Alaskans (all groups above +1: 'moderately agree'). Regarding income, rural hunters agreed almost twice as much as urban hunters and non-hunters, showing there is an expectation for this benefit. People least believed that bison would lead to increased infrastructure development ($\bar{x}$ = 0.51-0.75; table 4) and visitation (0.65-0.96; table 4) to local villages. As expected, the rural sample believed more in the benefits resulting from the reintroduction than the urban sample. Regarding the perceived benefits of bison reintroduction, the group differences were more related to locality than hunting participation.

Perceived risks were the only conceptual group with almost completely negative item averages, with most answers ranging in the 'moderately disagree' range. Averages between groups indicated that the rural population perceived more risks (disagreed less) than the urban. Items about bison attacking humans and domestic animals showed very large variances among groups, with urban hunters disagreeing the most ($\bar{x}$ = -0.87/-0.83), rural hunters the least ($\bar{x}$ = -0.05/0.26), and non-hunters in the middle ($\bar{x}$ = -0.58/-0.41; Table 4). The highest averages for rural hunters and the rural population in general (most risks perceived) were related to bison attacking domestic animals in the villages, the only item with a positive mean for rural ($\bar{x}$ = 0.26 and $\bar{x}$ = 0.32; Table 4).

On the other hand, the general urban population and the urban hunters had positive averages related to the possibility of conflicts between landowners and users ($\bar{x}$ = 0.08 and $\bar{x}$ = 0.05), indicating an area for attention and possible concern. The highest

numerical average for non-hunters was also related to the possibility of conflicts ($\bar{x}$ = 0.12; Table 4).

With the lowest means, bison as a factor for moose decline or being a threat to private property didn't seem of higher concern to rural respondents at the time of data collection, ($\bar{x}$ = -1.05 and $\bar{x}$ = -1, moderately disagree; table 4). Bison interfering with plane routes – grazing near landing strips – was a more important concern for this sampled population ($\bar{x}$ = -0.06/-0.25/; Table 4).

5.4.4. Urban x Rural Analysis

Using an independent samples t-test, urban and rural participants differed significantly across the four measured scales ($p<0.05$; Table 2). Effect size was measured for each comparison. It estimates the variance that has been explained by the independent variable on the depended variable and quantifies the strength of the relationship between these variables. Effect sizes are categorized as *minimal* ($\eta \geq 0.10$; $d \geq 0.20$), *typical* ($\eta \geq 0.24$; $d \geq 0.50$), or *substantial* ($\eta \geq 0.37$; $d \geq 0.80$; Vaske, 2008) The measure of "Cohen's *d*" for the t-test resulted in typical (d=0.51-0.57, for risks, benefits, and trust) to large (norms d=1.14) observed effects, suggesting that the differences observed in the sample are genuine and not likely due to sample size (Table 2). Another measure of effect size, "eta (η)", indicated effects ranging from minimal (η=0.13-0.19, for risks, benefits, and trust), to the threshold between typical and substantial (norms, η=0.36; Table 2).

In general, responses were mostly positive, averaging towards disagreement only about the restoration risks. Respondents mostly agreed that it will bring benefits, and mostly trusted the wildlife management agency (ADF&G). Social acceptability

norms' averages were positive but showed the largest variance between groups of all scales.

Table 2. Results from the t-test analysis comparing the urban and rural studied populations.

	Residency		*t* -value	Sig.	Eta	Cohen's d
	Urban	Rural				
Risks	-0.61 (N=491)	-0.19 (N=31)	3.09	0.002	0.13	0.57
Benefits	0.74 (N=495)	1.14 (N=35)	3.26	0.001	0.14	0.57
Trust	0.90 (N=489)	1.29 (N=35)	4.34	<0.001	0.19	0.51
Norms	0.47 (N=491)	1.42 (N=34)	8.74	<0.001	0.36	1.14

*Variables coded on a five-point scale, from -2 (Strongly disagree) to +2 (Strongly agree).

As expected, the rural residents, compared to urban residents, were more supportive of the management strategies, showed higher levels of trust in the agency, and perceived more potential impacts from the restoration. Rural residents perceived about three times more risks than urban residents ($\bar{x}$ = -0.61 vs -0.19; Table 2). The sampled urban residents also perceived about 35% less benefits and trusted the agency about 30% less than the rural respondents. The urban sample agreed 67% less with the bison management acceptability normative statements.

5.4.5. Urban Hunter x Rural Hunter x non-Hunter Analysis

The urban sample contained more non-hunters (NH; 61.5%) than hunters (38.5%), and the rural sample contained more hunters (71%). Due to sample sizes, it's important to note that most of the non-hunter sample was made of urban residents (N=301; 96.7% urban, 3.3% rural). A one-way ANOVA analysis was made to understand if people differed according to hunting participation, comparing urban hunters, rural hunters, and non-hunters (Table 3). Numerical differences between rural and urban related to *benefits* and *trust*, that were previously significant, were no longer significant among

groups (p=0.08-0.10; Table 3). Measures of effect size (eta) were lower for the ANOVA analysis regarding benefits and trust (η=0.14-0.19; Table 2 x 0.10-0.09; Table 3), suggesting that locality may be more important than hunting participation in explaining differences in perceptions of benefits and trust (especially trust). At the time of data collection, all three groups showed positive levels of trust, and expected some benefits from bison reintroduction and management.

Table 3. Results from the one-way ANOVA analysis comparing urban hunters, non-hunters, and rural hunters.

	Participation in hunting in the past 5 years			F-value	p-value	Eta
	Non-Hunter	Urban Hunter	Rural Hunter			
Risks[1]	-0.46[a] (N=300)	-0.82[b] (N=188)	-0.33[ac] (N=23)	15.94	<0.001	0.24
Benefits	0.75 (N=305)	0.75 (N=189)	1.08 (N=25)	2.57	0.08	0.10
Trust	0.92 (N=301)	0.90 (N=188)	1.24 (N=25)	2.29	0.10	0.09
Norms[2]	0.67[d] (N=301)	0.21[e] (N=190)	1.39[f] (N=24)	31.86	<0.001	0.33

*Variables coded on a five-point scale, from -2 (Strongly disagree) to +2 (Strongly agree).
[1]Means with different superscripts are significantly different at p<0.05 based on the LSD method.
[2]Means with different superscripts are significantly different at p<0.05 based on the Tamhane's T2 method.

The test showed significant differences in the sampled population in terms of *perceived risks*, dividing it into two big groups, one composed of rural hunters and non-hunters, and another composed of` urban hunters. In general, all groups disagreed about the negative impacts from the restoration (risks). Urban hunters disagreed the most strongly ($\bar{x}$ = -0.82; Table 3), about twice as much as non-hunters and rural hunters ($\bar{x}$ = -0.46 and -0.33; Table 3). Another important aspect to note is that the effect size for the perception of risk scale almost doubled in the hunting participation

analysis, going from minimal (η=0.13; Table 2) to moderate (η=0.24; Table 3), thus indicating the importance of separating groups for explaining risk perceptions here.

The strongest divergences among groups were related to the measure of social acceptability *norms*, which split the sample into three significantly different groups ($p<0.05$). All groups averaged slightly towards support of the proposed bison management strategies. Rural hunters were the most supportive ($\bar{x}$ = 1.39; Table 3), twice as much as the non-hunters ($\bar{x}$ = 0.67; Table 3), and over six and a half times more than the urban hunters ($\bar{x}$ = 0.21; Table 3). Effect size increased slightly in the second analysis for the norms scale (η=0.33-0.36; Tables 2 and 3). Locality and hunting participation were important factors explaining the group differences, though locality seemed more important.

The results confirmed expectations that hunters would be more supportive of the management strategies, though only partially regarding the rural sample. Surprisingly, the biggest differences would be found between hunters from the different localities ($\bar{x}$ = 0.21 vs 1.39; Table 3), a difference that doubled from when comparing the localities alone ($\bar{x}$ = 0.47 vs 1.42; Table 2).

Contrary to expectations, all groups showed similar levels of trust, with no significant differences between hunters and non-hunters. Also surprisingly, the sampled hunters perceived the same (rural hunter) or less (urban hunter) potential impacts from the restoration compared to non-hunters. Results here showed the importance of separating and comparing views according to the extra layer of hunting participation for characterizing the groups, as it made it clearer to understand where differences may originate from.

5.5. Qualitative Insights

The information provided by willing urban respondents in the questionnaires' comments section or additional comments provided by rural respondents during the interviews were summarized in word clouds (Fig. 15).

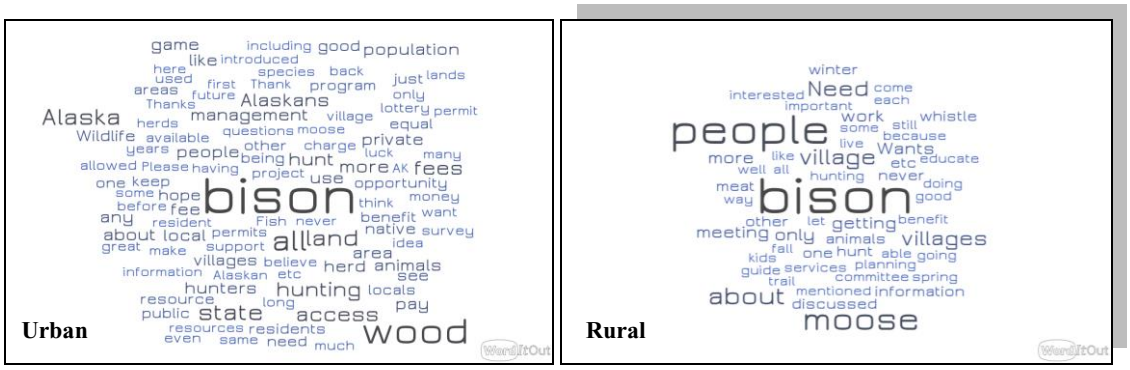

Figure 15. Word cloud showing the major themes mentioned in the comment session of the questionnaire (urban) and during the interviews (rural). Created using worditout.com.
More frequent words appear larger and darker in the picture. See Appendix 4 for full transcripts.

The highlighted words in the word clouds corroborate some of the concerns previously mentioned. Words like "state," "land," "access," "Alaskans," "fees," "hunt/ers/ing," "game," and "private" (Fig. 15) highlight concerns many times brought about by the urban respondents. It forms a picture of the status of urban views in the first year of the release when this group was concerned with bison being released into private lands while being considered public wildlife. It brings about issues of access to it as a public resource to all Alaskans, while simultaneously being subjective to access fees, questioning the division of benefits. Conversely, words such as "people," "village/s," "moose," "need," and "meat" (Fig. 15) highlight the main themes brought by the people providing comments in the rural villages. Rural respondents were primarily focused on subsistence opportunities provided by bison, in the form of resources such as meat and skin, especially as an alternative to moose, which is declining. They were concerned with bison entering the villages, presenting risks to people and their livelihoods.

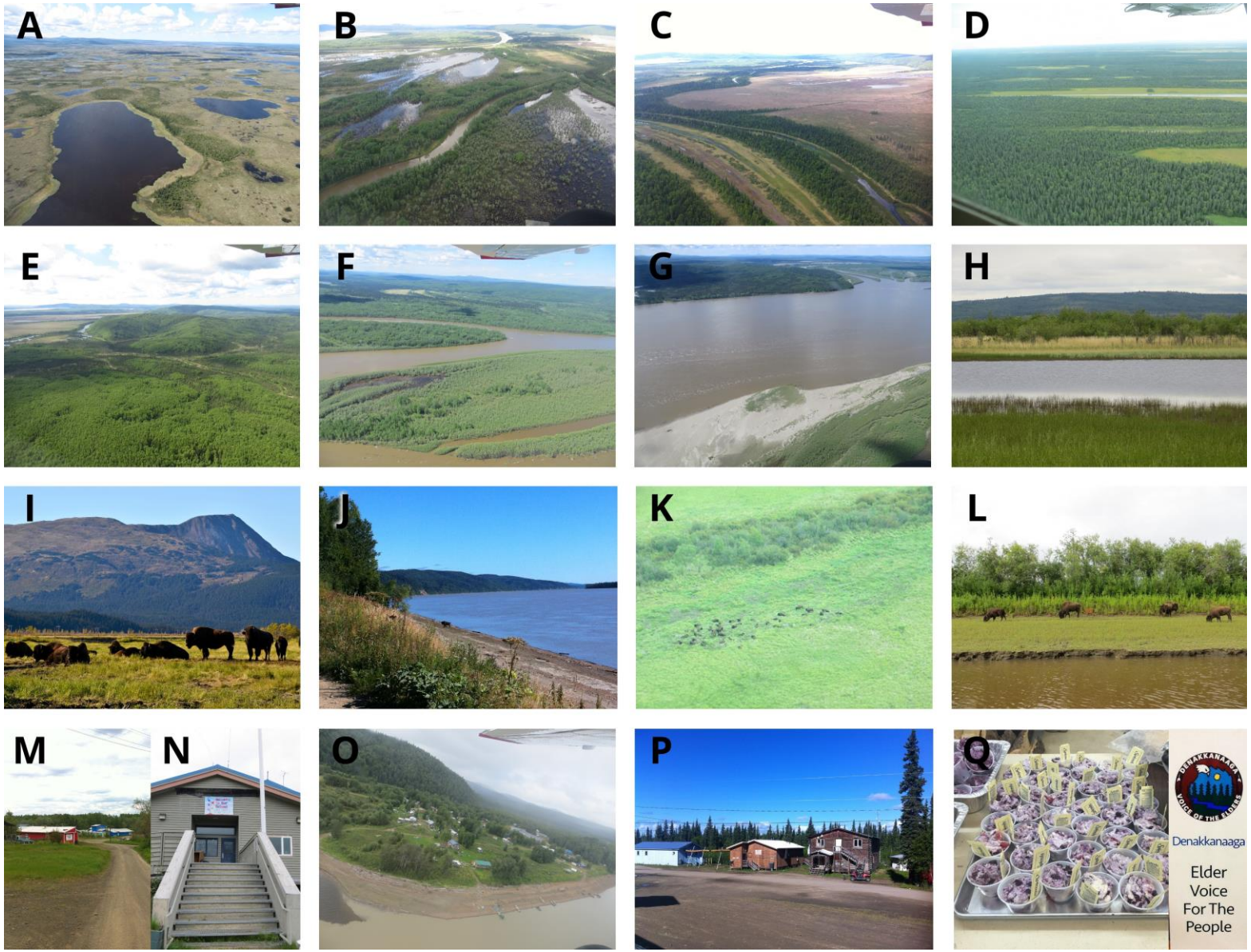

Figure 16. Photos taken by the author of this thesis during June/July 2015.
A, B, E, F, G. Aerial view between Anchorage and Anvik.
C. Aerial view near Anvik.
D. Aerial view between Anvik and Holy Cross.
H. View in Shageluk.
I. The wood bison herd at the Alaska Wildlife Conservation Center, near Anchorage.
J. Wood bison inside Grayling.
K. Aerial view of the wood bison herd near the Holy Cross.
L. The wood bison herd by the riverbank between Holy Cross and Shageluk.
M. View of Holy Cross.
N. Shageluk school.
O. Aerial view of Grayling.
P. View of Anvik.
Q. Traditional fish Ice cream made During the Denakkanaaga in Anvik.

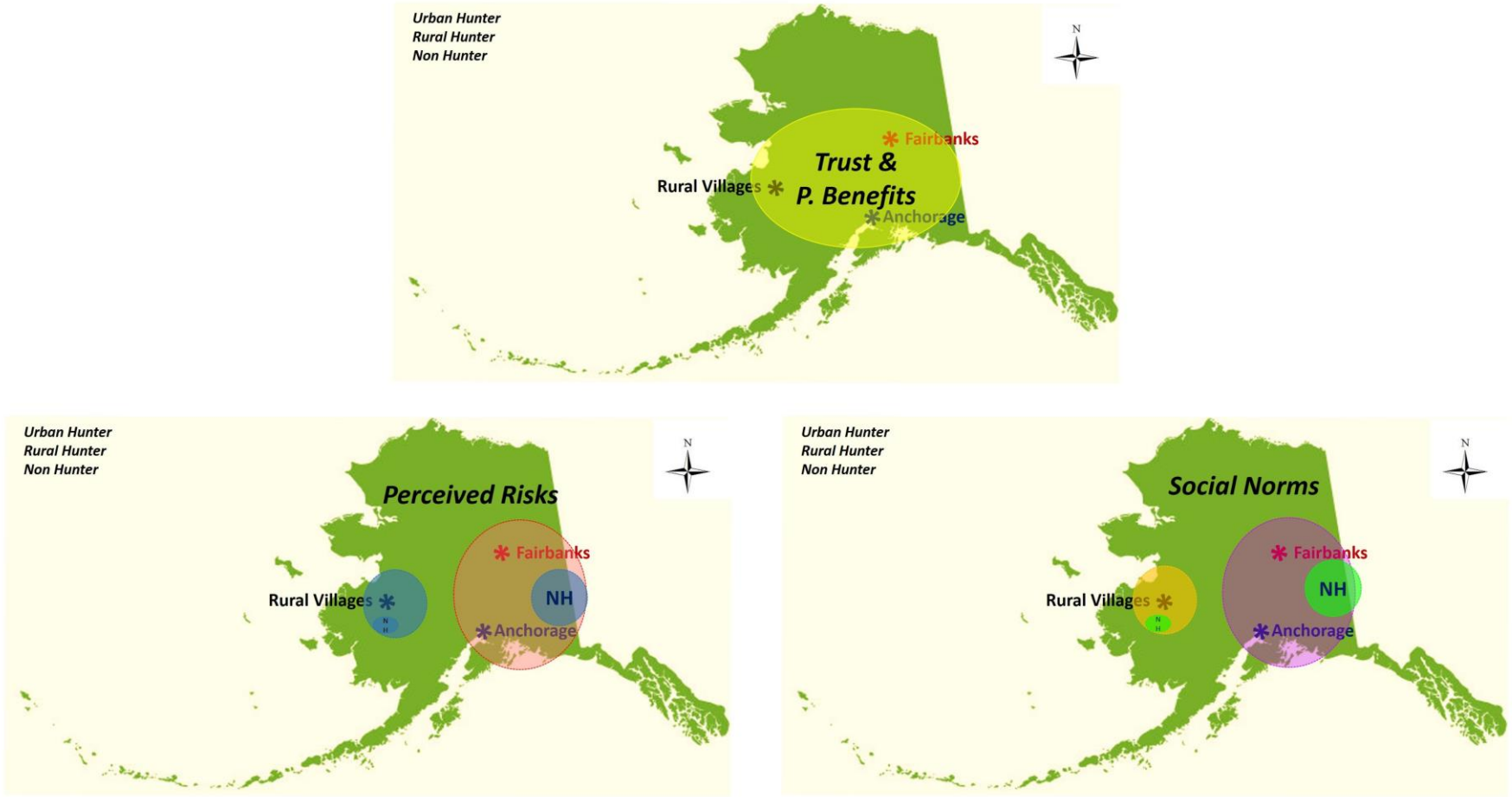

Figure 17. Interpretation of the Results, showing the different groups formed according to this research analysis (Table 3).
Views on Trust and Perceived Risks formed one big group will all respondents, in yellow. Perceived Risks divided the respondents into two groups, one composed of rural hunters and non-hunters (NH), in blue, and another composed of` urban hunters, in red. Social Norms divided the respondents into three groups, one made of rural hunters, in orange; another composed of non-hunters (NH), both rural and urban, in green; and a third formed by urban hunters, in purple.

Table 4. Selected items and their individual means used for the analysis of the concept variables among respondent's groups.

CONCEPT VARIABLE	MEAN R	MEAN U	SELECTED ITEMS*	MEAN NH	MEAN RH	MEAN UH
Perceived Risks	-0.03	-0.71	Wood bison will attack humans in the area where bison were released.*	-0.58	-0.05	-0.87
	0.32	-0.60	Wood bison will attack domestic animals in the area where bison were released.	-0.41	0.26	-0.83
	-0.93	-0.62	Wood bison will cause the moose population to decrease.*	-0.52	-1.05	-0.77
	-0.06	-0.70	The wood bison will become a threat for flying in and out of remote airport runways.	-0.51	-0.25	-0.98
			Thinking about the future. in general. do you feel the restored population of wood bison in Alaska will…			
	-0.26	0.08	…be a cause of conflicts (negative interactions) between land users and land owners.**	0.12	-0.45	0.05
	-0.73	-0.56	…be a threat to private property.	-0.44	-1.00	-0.74
Perceived Benefits	1.56	1.03	Wood bison will provide more harvest for Alaskans.	1.02	1.58	1.09
	1.00	0.70	Wood bison will increase visitation to local communities where bison were released.	0.76	0.96	0.65
			Thinking about the future. in general. do you feel the restored population of wood bison in Alaska will…			
	1.47	0.80	…be a source of additional income to local people.*	0.80	1.52	0.84
	0.91	0.50	…be a means for local community development.	0.53	0.75	0.51
Calculative Trust	1.14	1.01	The Alaska Department of Fish & Game is generally well-informed about wildlife management issues.	1.04	1.12	0.99
	1.20	0.74	The Alaska Department of Fish & Game is doing a good job of managing wood bison in Alaska.	0.76	1.16	0.76
	1.44	0.98	I trust the Alaska Department of Fish & Game to provide the best available information on wood bison issues.	1.02	1.33	0.98
			I am confident that the Alaska Department of Fish & Game…			
	1.35	0.96	…can effectively manage wood bison.	0.99	1.28	0.95
	1.26	0.89	…knows how to use appropriate wood bison management techniques.	0.90	1.24	0.88
	1.23	0.80	…will respond to wood bison conflicts properly.	0.83	1.16	0.79
	1.46	0.90	…will listen to concerns about wood bison management from Alaska residents.	0.91	1.44	0.91
Social Acceptability Norms	1.12	0.58	The distribution of wood bison hunting permits should be different for local and non-local Alaskan hunters.	0.85	1.13	0.17
	1.06	0.67	Each of the four local villages should be guaranteed a minimum of one permit at every hunting season.*	0.89	1.04	0.34
	1.41	0.16	There should be a common access fee for all private lands.	0.22	1.29	0.17
	1.56	0.61	There should be a land access fee for hunters to hunt wood bison on these lands.	0.88	1.63	0.23
	0.31	0.15	There should be a land access fee for people who wish to view bison on these lands.*	0.18	0.36	0.08
	1.60	0.67	Land access fees' monies should be used for students' scholarships and adult training in the local villages.	0.93	1.48	0.32

Variables coded on a 5-point Likert scale. from -2 (Strongly disagree) to +2 (Strongly agree). U - urban; R - rural; NH - non-hunter; RH - rural hunter; UH - urban hunter. *Variable used for urban testing only (removed from rural concept scale for t-test and ANOVA analysis to improve reliability statistics). **Variable used for rural testing only (removed from urban concept scale for t-test and ANOVA analysis to improve reliability statistics)

6. Discussion

6.1. Sample characteristics

This study's findings can contribute knowledge about perspective differences related to hunting participation, locality and Alaska Native views on wildlife and management, which have rarely been systematically studied (Shelley et al., 2011; Clark et al., 2016). Alaska has the largest Indigenous population in the United States (17-20%), most of whom still live in small rural villages and remote regional hubs rather than urban areas (Hunsinger & Sandberg, 2013), therefore this study's results not only shed light on urban/rural and hunter/non-hunter differences, but also on populations that are predominantly native (rural) and non-native (urban).

Described as weak predictors of support or opposition to management actions (e.g., Donnelly & Vaske, 1995; Glickman et al, 2010), demographic variables were used in the previous chapter's description of group features. Furthermore, research has shown that the perceived impacts of bison on property and safety are more important predictors of conflicts with bison than a descriptive factor like gender (Balčiauskas et al., 2017). Therefore, the discussion will focus on psychological measures to discuss group differences.

Overall, this study has shown that it is appropriate and helpful to characterize people's views about ungulate reintroduction and management according to 'place of residency' and 'hunting participation'. Hunting participation was important to understand the differences between how hunters and non-hunters perceived risks and their social acceptability of proposed bison management strategies through a normative analysis. For risks and norms, not only urban and rural hunters held different perspectives, but also urban hunters and non-

hunters (96.7% urban) differed, with non-hunter views located in-between the urban and rural hunters (UH<NH≤RH; Table 3).

The locality was important across all measured psychological scales, with rural respondents agreeing with items significantly more, most of the time (U<R; Table 2). It was expected due to the stronger influence and personal contact with the management agency personnel, who have been actively involved, organizing meetings with the local populations near the chosen reintroduction site for many years, taking note and considering, whenever possible, local concerns before making decisions on bison management. This is likely also the reason why awareness about bison restoration was almost twice as high for the rural sample.

Additionally, urban residents often lack preparation for coexisting with wildlife, expecting and leaning on governmental assistance for wildlife-related inquiries. As a growing share of people become urban in the USA and beyond, there's a rising public demand for information and an escalating necessity for effective strategies to transmit such information (Lindsey & Adams, 2006). The background image and trust in a wildlife management agency are influenced not only by perceptions of personnel and function but also by its communication. Therefore, managers should communicate honestly and frequently with the urban population to increase awareness, relying on the most appropriate channels for each section of society.

6.2. Psychological characteristics

6.2.1. Attitudes

Confirming expectations, the public was generally positive towards bison and its management. Attitudes were positive among respondents from all locations, but slightly more positive in rural areas. Urban residents tend to usually be more positive towards large herbivores like bison (e.g., Bergsten, 2012; Kansky et al., 2014), but there are also reports of

less positive attitudes towards bison among city residents compared to those living in farmlands (Balčiauskas & Kazlauskas, 2014; Balčiauskas et al., 2017). Studies show that local populations are generally positive towards ungulate presence, but acceptance is often conditioned to the animals not being in proximity and not directly affecting them (Balčiauskas & Kazlauskas, 2014; Decker et al., 2010; Doney, et al, 2018). Place of residency works as a marker of the potential impacts a certain population is subjected to.

Lower support towards bison has been related to concerns over bison damage, lifestyle, economic, and safety impacts, as well as lower knowledge (Decker et al, 2010; Balčiauskas & Kazlauskas, 2014; Doney, et al, 2018). The rural communities sampled in this study enjoy a long-lasting relationship with managers responsible for bison in the state, likely contributing to the observed higher awareness, more positive attitudes, and higher trust, lowering concerns about risks with the increased belief that managers will be available to help with any problems caused by bison in their communities.

Previous research has shown that there are differences in attitudes toward wildlife and policy between native and non-native Americans, with natives frequently holding more positive and protective views (Shelley et al., 2011). In the current study, the rural population, mainly native, was found to have slightly more positive attitudes towards wildlife restoration and considered it more important than the compared urban population, who are mainly non-native residents.

6.2.2. Trust

Trust is a crucial factor in the success of restoration efforts in the U.S. and is influenced by public engagement and spatial and temporal scales (Metcalf et al., 2015). In average, all sampled groups of residents in this study reported moderate trust in the work of the ADFG. It is worth noting that rural populations have been reported to trust wildlife management

agencies less than urban populations (e.g., Zajac et al., 2012). However, this study found indications of slightly higher trust in the rural than urban sample. One possible explanation for this is that the rural populations sampled here were residents of the four villages closest to wood bison release site and had a more personal and long-lasting relationship with the ADFG personnel. Nevertheless, trust levels cannot be generalized, and should be seen as only an indication of the positive beginning of a relationship that should be actively maintained.

Previous research with native populations has emphasized the importance of feeling heard and having concerns addressed by wildlife management agencies, contributing to a good relationship and the success of wildlife restoration and management (Clark et al., 2016).

Hunter cooperation and trust are thought to be influenced by perceptions of the agency's procedurally just exercise of authority and personal gains (Rudolph & Riley, 2014). However, this study found no significant differences in trust according to hunting participation among the sampled populations. Hunters may have more opportunities to relate to wildlife management agencies than non-hunters, while dealing with hunting regulation issues. Due to the relative novelty of wild wood bison in Alaska, no personal gains have yet been realized by the population, and it may be too early for the population to make judgments about the justice of procedures related to bison. Maintaining and increasing positive levels of trust may depend on future positive or negative management experiences, as perceived by the population.

Trust also plays a critical role in shaping individuals' perceptions of risk and acceptability of hazards, particularly in relation to the responsible agency. Metcalf et al. (2015) found that levels of trust vary among individuals depending on their risk exposure and vulnerabilities. In the sampled rural areas, current trust levels in the agency may be affected by factors such as slow responses to negative events, delays in the start of bison hunting, lack of updates on the bison situation, and other agency decisions, such as restrictions on fisheries, possibly

impacting food security. In contrast, urban residents' trust may be more influenced by political imperatives, the limitation of access to bison based on the decision to release animals on private rather than public lands, the perceived exclusion of non-hunters from management processes, and frustration over past programs (See Fig. 15).

Many studies suggest that the acceptance of a potential hazard is based on perceptions of risks and benefits, which are in turn affected by trust in the responsible agency (e.g., Siegrist et al., 2000; Bronfman & Vazquez, 2011). Trust may also be a consequence of public acceptability and perceived impacts (Bronfman & Vazquez, 2011). In either case, it indicates that trust, perception of impacts, and acceptability are all intrinsically related concepts that should be studied together in potential hazard management. Trust in an institution positively affects perceived benefits and negatively affects perceived risks associated with institutional products.

6.2.3. Risks

The results of this study showed that risk perception was higher among rural than urban respondents, what was expected given that the rural population is more exposed to bison on the land. However, the highest overall risk averages were still negative (disagreement) and close to neutral, indicating that the sampled rural residents were not highly concerned about risks at the time of data collection. Interestingly, non-hunters agreed slightly more with risk items than urban hunters, possibly reflecting lack of experience. Due to experience hunters are usually more knowledgeable about and may be better able to anticipate actual risks from a game species than non-hunters. However, hunters may also deny risks that they are less exposed to, especially urban hunters, who likely anticipate the opportunity to hunt bison, but disagree with rural priorities.

When personal knowledge or experience about a particular hazard is low or lacking, the public tends to rely on trust to judge possible risks or benefits (Siegrist & Cvetkovich, 2000). As respondents in this study indicated low levels of overall knowledge about bison, and it may be too soon for many residents to have formed opinions about bison risks based on experience, people may be relying on trust in wildlife management, as described, and on their belief in managers' knowledge, to keep them safe.

Nevertheless, some potential risks and challenges associated with the reintroduction of wood bison were voiced as a concern by this study's rural participants. They involved human safety, including injuries to children and adults, fear, and possible transmissible diseases. The highest variances in the risk scale means, indicating more potential for conflicts, centered around the concerns of bison attacking people and lingering at local airports, where bison have been observed grazing and resting on. Among the tested groups, rural respondents agreed the most with these items, and urban hunters the least. At the time of data collection, rural residents had already had experiences of bison entering villages, engaging with dogs, accessing airports, and causing damage to lights in there. Fear has been previously reported as an important concern involving the acceptance of European bison (Decker et al., 2010), and child safety is one of the main concerns of coexisting human populations (Balčiauskas et al., 2017). Although rare and usually provoked, the issue of bison attacking adult humans has been amply documented in Yellowstone (Conrad & Balison, 1994; Freer, 2004). Fear of wood bison in Alaska has helped predict the intention to support lethal management, together with domination wildlife value orientations (Doney et al., 2020). In the absence of accidents, however, fear of bison seems to lower over time (Balčiauskas et al., 2017).

Transmissible diseases pose a recurring concern associated with bison, affecting the species, and posing potential health and economic risks to humans. Notably, brucellosis and bovine tuberculosis are prominent, with anthrax also occasionally raising concerns in specific

regions (Harper, 2002). The reintroduced wood bison herd in Alaska is still small and disease-free (AWBMPT, 2015), but as the herd expands, the risk of disease transmission increases. Careful management of bison populations is essential to minimize the risk of disease transmission, including vaccination, surveillance, and biosecurity measures.

People's response to risk relates directly to the characteristics of a hazard, where higher familiarity and a larger perception of control get people to view it as less risky, while hazards eliciting increased emotional responses of dread appear riskier (Slovic 1987; Bidwell, 2009). The fact that the highest risk averages were negative and closely neutral at the time of data collection may indicate that the rural residents believed they could deal with such problems (together with the agency) by taking the necessary action, like chasing bison out of villages, and building fences in the airport, trusting managers to support them. It may also indicate the success of training residents in hazing bison away, what has been done since the beginning, and later results indicate that incidents of bison near the airport and villages have decreased significantly after the first few years after the release.

It is important to note however, that often people are not aware of the actual risks presented by wildlife (Dickman, 2010), and attention must be paid to identify cases of risk attenuation (Sjöberg, 2004; Needham et al., 2017), strengthened by high perceptions of control, or still if there may be cases of risk denial (Slovic et al., 1981), where people, in general, tend to believe themselves to be immune or at less risk than others. However, the high levels of trust reported in this study seem to support the mostly neutral rural views about risks, increasing perception of control and decreasing alarm.

Research has shown that coexisting with wild ungulates, such as bison, can pose a variety of threats to humans, including crop-raiding (e.g., Gipson & McKendrick, 1981), disease transmission (Harper, 2002; Bidwell, 2009), direct injury (Conrad & Balison, 1994; Freer, 2004; Thirgood et al., 2005), vehicle collision (WCPP, 2017), and opportunity costs, “where

people forgo economic or lifestyle choices due to impositions placed upon them by the presence of wild animals or conservation areas" (Woodroffe et al., 2005 apud Dickman, 2010: 458). Opportunity costs appear to be the most prominent risk regarding wood bison in Alaska, concerning the rural population sampled in this study, at least at this first moment. Other important risks noted in this study included bison-caused blockage of winter trails, damage to crops and other plants, threats to moose calves, wasting of meat by trophy hunters, and poaching by other rural villages, which may lead to conflicts also among different groups of people.

The most frequent cause of conflict with large herbivores is damage to vegetation and farmed crops (Hofman-Kamińska, & Kowalczyk, 2012; Balčiauskas et al., 2017). Clark et al. (2016) described wood bison damaging trees and shrubs, leading to a reduction in habitat quality and the displacement of other species. This research by Clark et al. (2016) also identified a decrease in trapping success, damage to areas of traditional berry picking, and the displacement of livestock from winter ranges, among other impacts. Furthermore, a reintroduced male wood bison in Canada showing exceptionally exploratory behavior, travelled up to 260 km during the summer from the release area, getting into conflict with agricultural interests (Jung, 2017). Although the areas currently occupied by reintroduced wood bison in Alaska are not farming areas, crop depredation may become an issue in the future. As the population expands (possibly supplemented by follow-up reintroductions), competition may increase and lead animals to expand their reach, ending up in and around farmlands during their search for food. Wood bison may also be found in and around road systems in the future, which, in turn, may lead them to more farmlands, starting a cycle already observed in other regions (Hofman-Kamińska, & Kowalczyk, 2012), although not as relevant to Alaska's current situation.

The encounter of reintroduced herds of wood bison with road systems may lead to growth impairment due to vehicle-collision mortality, which is previously described for the Canadian north-western boreal forests (WCPP, 2017). In Alaska, there have been reports of nuisance caused by plains bison, with a herd standing on the road at night and blocking passage for two hours on one occasion, moving only after kneading a vehicle (report mentioned during this study). There are many hypotheses about why wood bison may frequent road systems (e.g., palatable vegetation alongside roads, relief from insects, long sightlines, and easier travel), thus, taking driving security measures seems to be the best way to avoid the risk of collisions (Rea, 2003; see WCPP, 2017 for a review). Continued monitoring of wood bison movements with GPS collars will help better understand patterns of movement and road and off-road trail use in Alaska.

The tolerance of rural residents to damage caused by ungulates is inversely proportional to the likelihood of experiencing damage (Kansky et al., 2014). Those dependent on a single livelihood strategy may be less tolerant of losses. In Alaska, where moose is a year-round staple subsistence source for the rural population, residents have concerns about bison competing with moose for food or injuring calves. However, research on dietary overlap suggests there is little concern for competition between reintroduced bison and native populations of moose or caribou (Fischer, 2002). As people familiarize themselves with wood bison in Alaska, they are more likely to see them as less of a threat, which could also encourage riskier behaviors around the animals. Negative incidents involving bison could increase threat perceptions in the future, potentially lowering the acceptance of the animals. Low acceptance, poaching, and population declines have been documented in areas where no compensation is offered for losses caused by wild bison (Kerley et al., 2012). Wildlife poaching is often associated with poverty (Duffy et al., 2016), and it is important to address it comprehensively. Promoting additional income opportunities in areas coexisting with bison

populations may help avoid losing animals, as people tend to be more passionate about protecting wildlife they benefit from (e.g., Clark et al., 2016). The successful reintroduction of wood bison in Alaska will continue to require careful management and monitoring to mitigate potential risks, secure benefits, and ensure the safety of both the bison and state residents.

6.2.4. Benefits

Although rural residents are more exposed to risks from bison, benefits may also be more available to them, helping compensate for risks. Strong negative relationships between perceived risks and benefits associated with wildlife have been described, suggesting that emphasizing the benefits of a species may help reduce risk perceptions associated with it (Zajac et al., 2012). This study revealed differences in benefit perception mainly associated with locality. All sampled groups can be said to moderately expect benefits from wood bison restoration to AK, although the rural population expects it slightly more. The most important benefits anticipated were related to harvest opportunities and other local income in the form of tourism and recreation. Increased visitation and infrastructure are also expected, but considerably less. Other potential benefits mentioned by rural respondents included: the restoration of tribal-cultural links with bison; learning about hunting and processing bison; and increasing food security, by taking pressure off moose. Urban respondents also mentioned the conservation and environmental restoration values of bison, and opportunities to enjoy bison as part of nature while restoring cultural memories.

Although there's no conclusive evidence that the communities in rural Alaska have switched prey species to cope with the challenges of resource fluctuations, its likely they could use this strategy, if not constrained by prey availability or legislation (Hansen et al., 2013). Data from different localities support this as a potentially viable coping strategy (Hansen et al., 2013).

Given that one of the goals of wood bison management is to manage bison harvesting to equitably benefit people in the state, and "there is strong local interest in bison as a source of red meat to augment moose harvests" (AWBMPT, 2015; Pg. 10), it's likely that, given the opportunity, prey switching will occur to the benefit of the local people.

Two centuries of wood bison extirpation from Alaska (Stephenson et al. 2001) have created a gap in social and ecological knowledge about this species in the state. The restoration of such charismatic megafauna offers opportunities for the re-establishment of critical ecological interactions, and the reconnection of native peoples with a symbol of their ancient culture, also creating a basis for touristic and hunting business developments (Boyd, 2003; Redford et al., 2016). Wildlife conservation projects in North America frequently ignore the benefits of rescuing traditional harvesting patterns practiced for millennia by Indigenous people (Wehi & Lord, 2017). However, this study has highlighted the importance of reconnecting with nature and culture. The success of returning cultural practices can greatly help to gain local support for species conservation.

Urban and rural residents support the growth and expansion of the bison population. Many respondents support future wood bison reintroductions to more areas of the state, comprising all the historical habitat, both in more isolated areas, far from humans, and in more accessible areas, closer to settlements and roads. This would improve long-term bison survival and more democratically spread benefits. In fact, discussions have begun with communities exploring reintroducing wood bison to the Lower Tanana, Upper Tanana, and Yukon Flats in Alaska. Similarly, in the early discussions about reintroducing wood bison in the Lower Innoko/Yukon Rivers area, residents have brought concerns and envisioned opportunities the large herbivore could bring them, helping to address food security issues. Although hunters and locals are the most likely to directly benefit from bison restoration, interest was shown by non-hunters to participate in non-consumptive activities (e.g., viewing, photographing),

benefiting from bison recovery in other ways (e.g., nature integrity, artwork). Some urban respondents argued that viewing should be more explored in Alaska, and non-hunters should have more voice in wildlife management decisions in the state.

Results suggest that, perhaps, the most efficient way to reduce perceptions of conflicts and prevent poaching of wood bison could be by investing in long-term, local, and non-local benefits like hunting and ecotourism. In Yukon, Canada, the largest benefit identified from wood bison was increased harvesting opportunities. However, the local populations there demonstrated interest in renting their hunting cabins to hunters, working as extra income and a balance for negative impacts (Clark et al., 2016).

In 2016, the American bison was officially designated as USA's national mammal, embodying values of unity, resilience, and vibrant communities (http://www.nationalmammal.org/). With Alaska already renowned for its wildlife offerings, the bison's newfound iconic status, coupled with its rich cultural heritage, serves as a catalyst for heightened tourist interest in these emerging bison populations and the surrounding villages (Hofman-Kamińska & Kowalczyk, 2012; Balčiauskas et al., 2017). Establishing a locally managed tourism and hunting sector holds the potential to inject income and job opportunities into the region, addressing the current scarcity primarily centered around village services such as markets, post offices, and tribal councils.

It's important to note that perception benefits can be significantly affected by trust in leadership, which in turn is influenced by perceptions of distributional equity (Diedrich et al., 2016). Support towards management will depend on residents' capacity to adapt and benefit from the change in their environmental situation, which can limit their use and access to resources (Diedrich et al., 2016). Despite the urbanization and population growth in Alaska, the robust cultural hunting identity persists both within and outside rural areas. This enduring connection has led urban residents to sustain the tradition, often embarking on hunting trips

to the countryside The *right* to harvest animals was brought forward many times during this study, in the form of mentions of the *American citizen constitutional rights* to all wildlife. These were strongly defended views that are likely to create conflict between local and non-local residents over the right to bison once hunting is permitted. To prevent conflict and illegal takings managers need to continue monitoring residents' perceptions of equity and trust, sharing, adapting, and educating about measures, before implementing them, whenever possible.

The current wood bison management plan acknowledges non-consumptive bison viewing for Alaskans, but there's a need to explore potential conflicts between consumptive and non-consumptive activities, especially because urban respondents, in general (hunters and non-hunters), rated with higher averages the risk of conflicts between landowners and users looking for access to bison. Furthermore, Alaska has a significant wildlife-viewing culture, exemplified by many popular visitation sites like *Denali National Park.* About a third of the U.S. population aged ≥16 participated in wildlife-watching activities (e.g., observing, photographing, etc.) for recreation purposes in 2016, either "around the home" or "away from home" (U.S.DOI, 2016).

Dominated by the *Yukon* and *Kuskokwim* Rivers, the lowland *Yukon Delta National Wildlife Refuge* is the second largest in the country, with 19 million acres. It is located southwest of the sampling region and includes 35 villages in one of Alaska's most populated rural areas, sustaining one of the world's largest gatherings of water birds (recreation.gov). The *Innoko National Wildlife Refuge* is the fifth largest refuge in the country, with approximately 3.8 million acres, and is located in the study area, northeast and neighboring the villages, home to countless wildlife species. Within these regions, the wood bison's presence offers substantial new avenues for both viewing and, subsequently, hunting opportunities. This enhances the area's tourism potential, ultimately benefiting the local populace.

Increasing benefits is an effective way to mitigate risks and reduce the perception of risks, helping to increase acceptance of wildlife populations and their management (Bronfman & Vázquez, 2011; Zajac et al., 2012). For potential hazards that are poorly known, perceptions of risks and benefits have significantly correlated with trust, suggesting that the public relies on social trust for making judgements about risks and benefits when they lack information on the subject (Siegrist & Cvetkovich, 2000). Hence, factors such as availability, accuracy, comprehensibility of information, and trust in information providers are important in influencing risk/benefit perceptions.

6.2.5. Norms

Results of normative character represented the 'on-the-ground' management decisions, and showed the least consensus across all studied scales, thus representing the best indication of the potential for conflicts among groups regarding the management of wood bison, and likely being applicable to similar situations elsewhere. Urban hunters were more neutral regarding the proposed management strategies, while urban NH were slightly more accepting. Rural respondents had the most pronounced levels of agreement with the management strategies, averaging between 'moderately' and 'strongly agree' with the tested items. It indicates that their normative beliefs led them to judge the management propositions as acceptable about six times more often than the urban people.

Norms about acceptable management are influenced by values, prior experience, knowledge, trust in managers, and perceived impacts (Zinn et al., 1998; Kneeshaw et al., 2004). The perception of impacts seems to be of key importance in understanding acceptance of bison management options (Balčiauskas et al., 2017). Because direct impacts on rural village residents living nearby bison were expected, there were many opportunities to get involved in the process, and voice opinions during management planning. To ensure concerns are

addressed, and benefits are available to help compensate for problems, agency personnel must continue to strengthen their relationship with locals, managing any problematic measures when possible.

The rural population exhibits a less diverse background, primarily native and more closely related, in contrast to the urban population, which is characterized by higher diversity but is predominantly white. This difference could potentially explain the higher acceptance of management measures in rural areas. Neutral urban opinions could also stem from insufficient information or contemplation on the topic or may result from some converging strong opposing opinions into neutral averages. In any case, neutral viewpoints present a more adaptable foundation for engagement compared to strongly polarized and conflicting opinions.

Research suggests that urban residents who experience damage from wildlife are likely to have mutualistic value orientations diminished (Kansky et al., 2014). Decker et al. (2006) noted that, in Alaska, support or opposition to management actions is influenced by perceptions of impacts, suggesting people make anthropocentric and context-mediated decisions about what is or isn't acceptable in management, even when they are not personally affected by any impacts from the species or its management. Consistent with the cognitive hierarchy (Chapter 1), value orientations, can influence normative beliefs.

Most respondents in this study area and in Alaska, in general, hold utilitarian values orientations (Doney et al., 2020), as noted during this study toward wood bison and its management. Together with fear, wildlife value orientations were shown to predict intention to support lethal management for wood bison in Alaska (Doney et al., 2020). However, mutualistic concerns were also identified in urban areas, encompassing animal welfare, environmental considerations, and the local population's well-being. While mutualistic values weren't observed during interviews in rural areas, this doesn't necessarily negate their

existence. The limited sample size may have contributed to this. Indeed, across many U.S. states, wildlife-related value orientations are shifting, from utilitarian to more protection-oriented, aligned with urbanization and the amplification of environmental consciousness (Manfredo & Teel, 2008). Though it's important to note that utilitarian views toward wood bison don't necessarily mean these views are at odds with protection-oriented values. Indeed, Indigenous peoples have a long tradition of protecting and using a resource.

Urban respondents were more concerned about bison management, while rural respondents were more concerned about the impacts of bison. Some specific urban concerns included: access to public resources within private lands, prohibitive fees and expenses hindering bison visits (for viewing or hunting), rural poaching and its accountability, interference in land exploitation due to bison legal status, unforeseen bison effects on the natural environment, the risk of vehicle collisions, the influence of politics and economics on management decisions, skepticism about locals' judgments and integrity in bison management, and the utilization of locally gathered incomes. It is important to note that these are just some of the concerns that were expressed by urban and rural respondents and that there may be other concerns that were not mentioned in this study. It is also important to note that not all urban or rural respondents agreed with these concerns.

Conflicts between local inhabitants related to bison restoration have previously been reported (Balčiauskas et al., 2017). This study's findings suggest a costs/benefits conflict might occur, which happens when there is a difference perceived between involved groups about who bears the costs and who gets most of the benefits, potentially leading to feelings of unrighteousness (Bath, 2009). Moreover, urban and rural residents may perceive the same environment differently, diverging about land use. Although biodiversity is a public good, it is often found in private lands and therefore requires the owner's cooperation (Olive, 2015). Establishing trust and communication between stakeholders, with consensus over what

constitutes wilderness is a preliminary step to establishing cooperation (Lutz et al 1999; Olive, 2015). Another challenge will be to discuss the access of non-Alaskans to hunting licenses, which some participants were highly opposed to (possibly not aware of the participation of private entities in the realization of the effort).

One of the main challenges in managing ecosystems is the complexity of land ownership. Although people may support animal reintroduction, this support can be jeopardized by restrictions on recreational or commercial uses of the area where animals inhabit (Tucker & Pletscher, 1989). Often, the original habitats of extirpated animals do not exist anymore or are heavily altered (Schmitz, 2015). In Alaska, the suitable habitat for bison is spread across a very heterogeneous landscape, like a checkerboard of extremely varied ownership, from native corporations to federal and state governments. Landowners' willingness to provide access to their lands is frequently related to their concerns over damages to property and habitats, liability, and impacts on safety and personal use (Deng & Munn, 2015), concerns which were also corroborated during this study. Thus, access is likely to be provided only in the presence of fees. Indeed, issues concerning access and fees are precisely the aspects identified by this study as exhibiting the least consensus and harboring the highest potential for conflicts, especially in terms of fees associated with hunting, shared fee norms, and the allocation of fee funds, with particular emphasis on fees for hunters. The sampled rural communities (i.e., the landowners) were the most supportive of such fees since they will directly benefit from the income. Although the matter may not appear too problematic from the reported urban averages, more detailed qualitative concerns, and heated criticism emerged, most frequently associated with these issues during this study, and thus, may require the greatest management attention within the wood bison situation.

Public acceptance of fees seems more based upon who should and should not pay than on potential adverse impacts of fees for land management actions (Winter et al., 1999). While

some rural residents believe that non-locals should only benefit from bison upon paying fees to access their private lands, many urban residents voiced strong opposition to such fees, as well as any local priorities. Urban respondents based their arguments upon the use of state taxes for the project execution, constitutional rights to equality and access to bison (independent of which land they are in), and the high logistical costs already involved in flying and hunting in such remote locations.

Perceived fairness is a critical component regarding the acceptance of fees related to natural resource areas, and people concerned about fees are frequently concerned about how the collected money should be spent (Winter et al., 1999), as expressed during this study. Some urban respondents voiced alternative suggestions to the proposed fees, such as compensation for damages instead of access fees, the broadening of bison-related scholarship opportunities to all AK students, the use of fee money to cover management and species' conservation, and the use of government hunting permit monies to cover land access for hunters. Other urban respondents still argued for the lack of need for fees, considering the restoration program is expected to benefit locals through increased income and jobs related to the influx of hunters and tourists (e.g., food, lodging, guiding, transport). Some urban hunters support local guiding services as optional, while others think it should be mandatory (at reasonable prices) for all bison hunters. Nevertheless, other urban respondents support the proposed access fees, arguing for property rights, and prioritizing benefits to locals as compensation for higher potential negative impacts.

The most consensus among respondents in this study involved non-consumptive land access fees, with all groups revealing mostly neutral opinions. It will likely be mostly accepted if decision-makers fix these types of activities (i.e., viewing, photographing) as 'free' or 'cheap' access, as expressed by many respondents. Otherwise, it could be perceived as unjust since it doesn't involve resource consumption. Moreover, facilitating access to non-consumptive

activities will better foster indirect benefits to local villages through local services (e.g., guiding, transporting, accommodation, and selling of art), not constrained by the time of the year or number of permits issued.

Although many people may end up accepting access fees, it may still reduce actual participation in resource-based activities of lower-income people (More & Stevens, 2000). Access fees will likely exclude low-income residents, especially because bison are still restrained to remote areas, already bearing high travel and maintenance costs. When asked about acceptable values for hunting bison, urban responses ranged between US$0-250, while rural responses went between US$400-1500. Thus, the proposed $300 value by managers could represent a halfway point, however, one that still needs working on.

For viewers, most people seem to agree to lower or no charges. Alternatives for low-income people should also be sought. Increasing social inclusion could be based on annual income for example. When management strategies are perceived as fair, they contribute to increasing trust among stakeholders, making the resolution of conflicts more likely (Young et al., 2016)

Most respondents agreed that permits should only be issued once the wood bison population is sustainable. Once permits are released, however, divergences may arise, concerning shares and the distribution process. In this context, urban and rural individuals advocated for applying the insights gained from positive experiences with different species and regions. (e.g., Alaska's moose, caribou, or plains bison; Canadian wood bison; etc.). Responses related to the proposed permitting process (i.e., local minimum; distribution process) were, in general, moderately supported by rural respondents. The differential urban/rural permit distribution process was judged reasonable given the small numbers of the rural populations, who, without a separate process, wouldn't be able to compete for lottery-drawn permits against the much larger areas fairly. The system will, however, need to be reviewed as the bison population grows to include other small communities in hunting opportunities. Specific

shares may also need to be more thoroughly thought out and adapted with experience. Some rural respondents believed the proposed 20% local share of the permits may not be enough for some larger villages, considering moose and fish shortages. In contrast, others believed local lotteries could prevent conflicts triggered by the proposed line-ups (disagreement about who should receive the tag). Many still agree, however, that quotas may be enough if rural residents can create additional income through visitor services (e.g., guiding, accommodation, etc.). Instead, if it goes as other regions, and residents watch non-locals profiting from an industry developed around bison, while they get little in return, it may trigger a decrease in local support for the species and conflict (Nordbø et al., 2017).

Urban perceptions over bison hunting varied, with some supporting subsistence hunting and aid to local villages, as well as the proposed quotas, while others disagreed over quota amounts and distribution, perceiving locals as wrongfully trying to benefit from a state program and worrying about poaching. In rural Alaska, conflict with non-local hunters has long been an issue (Kofinas et al., 2010), especially if hunters are not Alaskans. Hunting is a very culturally ingrained activity throughout American history, with many social meanings, contrary to the analytical approach taken by the scientific field. In American society, hunting has two major contemporary contexts: hunting as a recreational activity and hunting for subsistence and ceremonial means, in which diverging purposes may put hunters in conflict (McCorquodale, 1997). Within native communities, it is traditional that single hunters may harvest several animals, and share them with different households (Johnson et al., 2016). Native cultures usually do not recognize sport as a part of hunting, being instead a form of social service, driven by need, contrary to an opportunity-driven personal pursuit (McCorquodale, 1997). Local rural respondents have expressed concerns during this study about sport hunters' behavior during moose harvests in their area, especially trophy hunters, who take only a prize, waste most of the meat, and make moose disperse further away from

their villages. People are concerned about the same kinds of behavior applying to wood bison.

Trophy hunting is often perceived as practiced by rich urban or foreign peoples, seldom bringing any benefits to local populations who coexist with such prized wildlife (Nordbø et al., 2017). Sports hunters' motivations in Alaska, however, could be compatible with the values of local communities. Because not all recreational hunters are looking for trophies, many share similar family- and nature-related values with local populations, allowing managers to explore similarities in outreach programs (Fix & Harrington, 2012). Additionally, to avoid unnecessary value conflicts between users, native hunting might be separated from recreational hunting, and thus, have different regulations, and adequate season lengths (McCorquodal, 1997). Avoiding conflicts over wildlife management is important and can prevent delays in policy implementation and reduce risks to people and wildlife. Overall, this study suggests that there are some important differences among groups pertaining to bison management. It is important to take these differences into account when developing communication. Further, to achieve consensual decisions, stakeholder communication should focus on areas of common interest and goals (Wald et al., 2013), instead of areas of disagreement (i.e., focus on the 'what' instead of arguing over the 'how').

6.2.6. Final Remarks

Given its considerable size and potential risks, the wood bison and its management can be perceived as a potential hazard to people. The *Hazard Acceptance Model* (Bruskotter & Wilson 2014; Figure 3) proposes that people's acceptance of wildlife hazards is shaped by their perceptions of the associated risks and benefits of the species. These perceptions are influenced by their perceived control over the hazard, trust in the management agency, and emotional attachment to the species. It's worth noting that affect can also have a direct impact

on acceptance, independent from perceived risk and benefit. On the other hand, the Theory of Reasoned Action/Theory of Planned Behaviour (TRA/TPB; Ajzen and Fishbein 1980; Fishbein & Ajzen 2010) suggests that behaviors result from beliefs, including normative beliefs, which in turn affect perceived norms, behavioral intentions, and ultimately behavior (Fig. 1).

Bruskotter and Fulton (2012)'s model of wildlife conservation behavior (Fig. 2) portrays a continuum ranging from behaviors that positively impact (stewardship) to those that negatively impact (intolerance) a particular species. In contrast, tolerance or acceptance is inherently passive, involving simply tolerating the presence of a species without taking any action. Conversely, both intolerance and stewardship necessitate actions, marking the point where individuals move from inaction to actions that affect wildlife populations. Although the model conceptualizes *'Acceptance of / Tolerance for*' as behavior, it can also be operationalized as a norm or other concept.

Considering these concepts, it's plausible that the positive baseline social trust levels in Alaska positively influence perceptions of benefits and negatively influence perceptions of risks, which, in turn, affect tolerance. This contributes to maintaining positive levels of tolerance towards wood bison management (measured as a norm) across all sampled groups (Tables 2 and 3), indicating support for the proposed management actions, with varying degrees of strength (UH<NH<RH). Among the measured baseline norm levels, urban hunters' average is closest to levels of Acceptance/Tolerance (inactivity; Fig. 2). This suggests that if these averages become negative, acceptance among urban hunters could shift towards intolerance, leading to behaviors that negatively impact management. Consequently, the views of urban hunters regarding proposed bison management should be a focus for managers at this initial stage. Similarly, the risk averages for the rural sample, in general, are closer to reaching intolerance levels and should also be addressed as a priority. Tolerance

levels for all groups should be continuously evaluated by managers, especially given that management acceptance exhibited the most variance among groups, indicating the potential for conflicts.

6.3. Study Limitations

There are some limitations to this study that should be acknowledged. Firstly, given that the selection of study areas in this thesis was primarily determined by geographical or urban criteria, the perspectives of Native populations cannot be precisely addressed with the attention they merit. Therefore, it's important that future work focus primarily on the views and perceptions of Native versus non-Native peoples to clarify these relationships and differentiate them from their respective locations.

On another matter, the hunting participation rates in the samples were notably higher than the population proportions in urban and rural areas (71.4% vs. 38.9%), thus it is important to recognize the potential for selection bias. This bias may indicate that hunters, more directly impacted by the study's focus on hunting and game species, were more inclined to participate in the survey.

Furthermore, quantitative surveys can only offer a partial picture of the opinions people have about wood bison, however, given the formality of public and scientific discussions, only by measuring the relevant psychological concepts we can hope to be more representative of the public opinion while making decisions (Shelley et al., 2011). Quantifying can mask many nuances in opinion; this was partially improved by the association of explanatory qualitative information provided by respondents in this study. Qualitative and mixed methods approaches contribute to delivering a much richer understanding of results. Because research will never be able to capture all necessary perspective differences in the target population, it is important to keep monitoring conflict-prone situations, aiming at longitudinal studies

whenever possible. Further investigation should better help understand the contexts presented here, confirming, or refuting the presented ideas, to achieve progress in long-term bison recovery.

It's important to acknowledge that there are limitations to this study's results. Urban survey returns, for example, were not enough to be representative of all strata of the urban population to allow for generalization of opinions inside the two sampled cities (Anchorage and Fairbanks), even less for the entire Alaskan urban population, which includes another major center, Juneau, not considered a priority for sampling at this early stage. Additionally, the coverage of a survey mode to be used depends on two factors: who has access to the contact device (e.g., phone, mail, email, personal contact), and what lists or frames are available to sample members of the target population (Dillman et al., 2014). Therefore, the choice of telephone directories as the sampling frame is another limitation of this study, as it may be excluding people who are cell-only, for example, who may have different lifestyles and opinions. Also, it's worth mentioning that people that chose not to participate in this survey might have held different positions. Sometimes people may judge their knowledge as poor about a subject and choose not to participate in a questionnaire about it (Morzillo et al., 2007); this was observed during recruitment for this study. It has been proposed, however, that people that choose to not participate in a survey may have more neutral opinions about the issue compared to the ones that choose to participate (Riley & Decker 2000), thus decreasing potential impacts of their responses on the overall patterns observed. It was not the purpose of this study, however, to generalize results inside cities or villages. Our intention was to shed some light on how many of the residents from each sampled area are thinking about wood bison restoration, differentiating existing groups to inform management officials on how to avoid conflicts.

Additionally, literacy issues and low willingness to answer a paper format survey can limit people's ability to answer paper surveys (Dillman et al., 2014). Therefore, this study's best course of action was to adapt the instrument used in the urban areas to an interview format to allow the rural population to participate more fairly. Such a change in data collection method could impact responses otherwise provided in the absence of the researcher. However, such a risk had to be taken once the self-administered questionnaire proved impractical within this study's rural setting. It was also only possible to conduct one field season, due to financial, time, and logistical constraints (geographical isolation of villages in Alaska). Added to it, unpredictable events taking place inside the villages (e.g., suicides within a small village), towards the beginning of the data collection period, limited our ability to increase interview efforts in the rural areas.

While this study was able to differentiate stakeholder groups about different concepts, exploring the divergence of perspectives inside each, it was limited in the ability to pursue a deeper understanding of how these different concepts may be interplaying and affecting each other. Thus, this study's design does not allow to infer causation among the studied elements, although it does allow for a substantiated potential of explanation around the results, based on an extensive review of the literature.

7. Summary & Contributions

7.1. Summary of Findings

This study examines how urban and rural Alaskan residents perceive wood bison restoration. It focuses on social norms, trust in management, and perceived impacts. The research compares these perceptions among different groups according to locality and hunting participation, and describes differences, to inform communication and education strategies related to wood bison reintroduction in Alaska.

7.1.1. Response to the Mail Survey

A mail survey was conducted in urban centers, with a 32% response rate (507 out of 1596 questionnaires). Additional on-site interviews were conducted in four rural villages (Grayling, Anvik, Shageluk, Holy Cross), representing approximately 10.4% of the estimated adult population for those villages. Some rural residents were engaged in livelihood activities during data collection, affecting response rates.

7.1.2. Descriptive Statistics

The urban and rural samples showed differences in gender, ethnicity, age, and education. Urban centers had more non-Native residents (95.3%) than rural villages, where residents identified as Alaska Native or Native American (100%). Urban residents were older on average ($\bar{x}$ = 61.75) than rural residents ($\bar{x}$ = 44.4). Education levels were higher in urban areas, with a significant proportion holding bachelor/technical or graduate degrees. In contrast, rural residents mostly completed high school or slightly beyond.

Hunting participation was higher in rural areas (71.4%) compared to urban areas (38.9%). Hunters were predominantly male, reflecting national trends. Non-hunters showed varying gender proportions across localities.

7.1.3. Knowledge, Attitudes, and Values

Urban public awareness of wood bison restoration was relatively low (45%) compared to rural areas (89%). Awareness of management processes and actions varied, with urban residents relying on media for information, while rural residents obtained information from meetings and other varied sources.

Overall, attitudes towards wood bison were positive, with the rural population more supportive than the urban population. Respondents showed positive attitudes toward the restoration of wood bison in Alaska and expressed interest in staying updated on restoration outcomes. Participants perceived personal importance in the issue and valued the presence of bison for future generations.

7.1.4. Psychological Characteristics

Four psychological scales were measured: social acceptability norms, trust in the management agency, perceived benefits, and perceived risks.

7.1.4.1. Baseline Social Acceptability Norms:

Social acceptability norms reflected varying levels of support for proposed bison management strategies. Rural hunters showed the most support for these strategies. Norms exhibited high variance, particularly in rural areas.

7.1.4.2. Baseline Calculative Trust:

Trust in the Alaska Department of Fish and Game (ADF&G) was generally positive across all groups. Rural residents showed slightly higher trust levels than urban residents.

7.1.4.3. Baseline Impacts Perception:

Perceived benefits were generally positive across all groups, with rural respondents expecting more benefits than urban residents. Perceived risks were negative on average, with rural residents perceiving more risks than urban residents.

7.1.4.4. Urban vs. Rural Analysis:

Urban and rural respondents differed significantly in support for management strategies, trust in the agency, and perceived risks and benefits. Rural residents showed more support, higher trust, and perceived more risks and benefits than urban residents.

7.1.4.5. Urban Hunter vs. Rural Hunter vs. Non-Hunter Analysis:

Significant differences emerged when comparing urban hunters, rural hunters, and non-hunters. Rural hunters were most supportive of management strategies, while urban hunters were least supportive. Trust levels were similar across all groups. Perceived risks were highest among urban hunters and lowest among rural hunters.

7.1.5. Qualitative Insights

Qualitative insights from questionnaire comments and interviews highlighted concerns related to land access fees, hunting, management, and the impacts of bison restoration. Urban residents were concerned about private lands, access, and equitable benefits, while rural residents emphasized subsistence opportunities and potential risks.

7.1.6. Remarks

The Hazard Acceptance Model and the Theory of Reasoned Action/Theory of Planned Behaviour highlight factors influencing acceptance and behavior. Bruskotter and Fulton's (2012) model presents a continuum from positive impact (stewardship) to negative impact (intolerance) behaviors toward a species, where tolerance/acceptance is passive, and intolerance/stewardship involves active actions. This concept can also signify norms or other ideas. Positive social trust in Alaska influences risks/benefits perceptions, affecting group tolerance levels. Urban hunters' views on management and rural on risks most closely approach passive acceptance, which could easily change towards intolerance. Therefore, these respondents need attention priority, requiring ongoing conflict management.

7.2. Contributions & Recommendations

7.2.1. Contributions to Research

> *"Resource managers are beginning to rely on normative data to help them develop standards. […] Developing evaluative standards is generally the most difficult part of resource management decisions, so normative approaches have the potential to help with a particularly thorny problem. […] The potential for normative research to be translated into policies which actually affect people's experiences sets the applied work in resource management apart from much of the more theoretical work in social psychology" (Shelby & Vaske, 1991).*

This research has contributed to several knowledge gaps within the human dimensions and bison research fields and offers insights to Native American and Alaskan fields of knowledge. It has shown the advantages of studying locality and hunting participation in combination instead of in isolation. To our knowledge, it has never been tested if samples divided according to hunting participation has helped explain perceptions about ungulate reintroduction from people at different locations.

This study is also the first case study investigating the HD concepts of perceptions of impact, trust, and norms related to a wood bison reintroduction, thus setting an important baseline for

future comparison. While Decker and Bath (2010) explored attitudes toward bison reintroduction in Germany, they took a broader approach to attitudes toward the species, exploring public and expert perceptions toward public involvement tools. Descriptive and evaluative information about views toward bison reintroduction is needed to monitor how different management decisions will impact people, identify social goals, and inform and improve future wildlife management actions (Shelby et al., 1996). Indeed, complementary research should and is likely to follow the baseline views presented in this thesis, as the Lower Innoko/Yukon Rivers wood bison management planning team in Alaska continues to develop new management plans regarding wood bison.

The present study also contributed to wildlife restoration fields of knowledge regarding wood bison. It is the first study to examine and compare multiple human dimensions' concepts related to a restored bison population. Also, it adds to the wildlife management research literature, since animal restoration management issues have received little attention in a literature dominated by recreational management issues. While numerous work has focused on deer management issues (e.g., West & Parkhurst; 2002; Lauber & Knuth, 2004; Fulton et al., 2004; Lauber & Brown; 2006), this is one of the first studies to explore beliefs associated with the management of a reintroduced large ungulate (e.g., Doney 2018; 2020), and the first to investigate *normative* beliefs associated with the reintroduction and management of a large ungulate, adding to the *normative research* literature.

This research will also contribute to Native American and Alaska Native knowledge of wildlife reintroduction and management perceptions, something rarely studied systematically (Shelley et al., 2011; Clark et al., 2016). The proportion of the population of Alaska Natives or American Indians in Alaska comprised 15% of the total state's population in 2015, a considerably higher proportion than any other state in the U.S. (For comparison, Hawaii's population was 10% Native, and New Mexico and South Dakota were each 9% American

Indian, according to the 2014 U.S. Census; Sanderson et al., 2016). It also contributes to knowledge associated with the Athabascan cultures in Alaska, since the rural sample of respondents in this study included 100% Native Alaskans. Few previous studies have taken place inside these communities, exceptions being reports about subsistence use, periodically held by the Alaska Department of Fish and Game (e.g., Brown et al., 2005), government census estimates (e.g., DCCED, 2015), and studies on climate change impacts in rural Alaska (e.g., Carey, 2009).

It's important to note that this research was executed within Alaska, where there is higher hunting participation, higher Native population proportions, and higher female participation in hunting activities than in most parts of the USA. Therefore, this research can provide insights into the study of gender, hunting traditions, and ethnicity composition, regarding perspectives on wildlife.

The results of this research can also be useful to future studies because it not only identifies the acceptability of bison management actions within different interest groups but also brings insights into the motivations behind these behavioral intentions. The qualitative information (Fig. 15; Fig 1, Appendix 4) linked to the quantitative results offers valuable insights into the challenging negotiations often involved in consensus-built management plans.

The results challenge the traditional beliefs within the human dimensions field that rural populations are less supportive of animal restoration than urban, suggesting that in Alaska a more positive influence of trust and long-term relationships between managers and residents may exist, strengthening support for management actions. Finally, it offers insights supporting the extensive literature documenting the influence of the psychological concepts of perceived risks, benefits, and trust, in the acceptance of hazards (e.g., Bronfman & Vazquez, 2011; Siegrist et al., 2000). This study advances knowledge in conflict mitigation related to a large mammal, contributes to our understanding of urban and rural societies in

Alaska, and aids in understanding factors associated with challenges and successes related to animal restoration.

7.2.2. Recommendations for Managers and Decision Makers

It's very important that managers maintain the trust and positive relationship they have built with the residents. ADFG should continue building and maintaining strong communication lines through regular community visits and sharing new knowledge about the herd. Wildlife management should never become a popularity contest (Bath, 1998) but continuing to monitor attitudes is as necessary as biological monitoring of the herd. Positive results will depend on maintaining high levels of trust.

The respondent population has expressed interest in staying informed about "their" bison project. Since many of the residents have access to the internet and make use of social media, especially the youth, managers could explore the launching of a 'bison blog,' similar to one maintained by the Banff National Park Bison Reintroduction team (see Parks Canada, 2021), and/or create a social media account, dedicated to publicizing the most recent information on the Alaskan bison, with open channels for communication. This information will also be available to other Alaskans, making connecting with people from other areas easier.

The perceptions of people regarding wildlife, especially ones that may cause damage, tend to change over the years, therefore, as people's experience grows, their views should be monitored. Education campaigns should also target the children, throughout the years, as they adapt to coexisting with bison, especially as core values and opinions tend to be formed at younger ages (Williams et al., 2002). One example led by the Banff NP team was the involvement of children in artwork related to bison, and their designation as the 'local ambassadors' for bison, allowing for a connection in the form of care towards the species.

Even after the release of wood bison in the wild in Alaska, most urban respondents had never seen a wood bison before, apart from a few people who visited the conservation center where the animals were being held captive. For city residents, such centers were and will continue to be important as a source of connection with the species. In contrast, many rural respondents have personally seen the bison nearby, inside, or near the villages. For these rural people, the rekindling of their relationship with bison has started again. If more animals enter villages, more challenges may occur as animals may approach dogs or children, necessitating the continual monitoring of feelings of vulnerability and risk.

Attitudes are not stable and may change rapidly. One potential example was observed in the village of Grayling, where some interviewed residents went from neutral to negative towards bison in the space of a few weeks after a few animals swam across the river and came into town, where they attacked dogs and did not leave until residents were trained on harassment techniques to scare away bison. Acceptance is related to people's belief in their ability to control and deal with negative situations, therefore, the training of locals on how to deal with problem animals, for any locality likely to experience bison, should be a priority.

Rural locals that were interviewed voiced many concerns about the bison, each of which should be thoroughly accessed and dealt with. To list some: 1) bison threat to children (and the necessity of their education and protection); 2) blockage of winter trails; 3) damage to crops and other plants; 4) spread of diseases; 5) threat to moose calves; 6) trophy hunters wasting meat; and 7) poaching by other villages (i.e., outside the four targeted by the agency and this study). Informal dialogues between interested parties have been proposed to reduce conflict and find common ground between diverse interests regarding bison restoration efforts (Decker et al., 2010). The new interactive channels proposed could allow residents to suggest new, or comment on proposed solutions.

Eventually bison population will expand outside their current locations, towards predicted and unpredicted range, where the people will know little about bison or their management. Further away rural locations, composed of Native or non-Native Alaskan residents will very likely have different views of the bison situation, so the ADFG should contemplate broadening their human dimensions (HD) research efforts to encompass newly proposed restoration areas, as well as areas where the existing herd is currently expanding or has the potential to expand.

Lack of trust is a common barrier faced by natural resource planners, and establishing trust requires one-to-one communication and building strong relationships with local players (Lachapelle et al., 2003), as corroborated by this study's observations. Respondents expressed different trust levels toward state and federal agencies. Previous studies also noted a clear distrust of the federal government and higher state credibility, describing trust levels associated with natural resources in the U.S. population (Davenport et al., 2007). Managers should maintain clear boundaries between each institution's involvement to ensure that trust levels remain high.

Involvement in other rural areas can be facilitated by targeting key groups, and having a representative and trusted (by both residents and management) spokesperson for each area (Kellert, 1996). It's important that the chosen partners be trained, and motivated to do the work, as representatives of local interests, and as educators. These individuals would be responsible for communicating back and forth, to the agency the residents' concerns, and to their respective organization's information from the agency, educating people about the bison, explaining, and discussing strategies for dealing with potential conflicts. During the first phase of the planning for management in the Innoko area, challenges were observed in the form of failed communication between chosen representatives and the communities. People have argued about a lack of awareness, even about having a local representative of

their interests and any meetings organized to discuss the new information and decisions being made. Thus, it's crucial that these local representatives be well chosen, with the help of each area's residents themselves, be capable and willing to do the job, and where necessary compensated appropriately for their time. One way that's helpful to reach people with and without access to the internet in those more remote rural communities is through their local radios. Every "society needs experts and laypersons with the wherewithal to serve as amplifiers for conservation opportunities serving the common good that resonate with closely held senses of self and place." (Cantrill, 2011, pg. 82).

Another contentious subject for management to face is addressing urban discontent regarding the presence of bison on private lands, their views on wildlife constitutional rights, and Native privileges. Acknowledging differences and educating the population, especially the urban, about the decision-making process, rationale, upcoming steps, and collaborative decision-making for the next phases is crucial. Preventing the wood bison from becoming a symbol of division among urban and rural communities, hunters, and non-hunters, is essential to avert potential implications inferred from this study's findings.

When working with various interest groups to resolve animal-related impacts, managers should focus on similarities, rather than differences (Glikman et al., 2010). Longitudinal research is necessary to monitor the extent of shifts in norms, beliefs, and attitudes (Glikman et al., 2010). The types of risks and concerns bringing reactive responses in people can be changed and influenced by targeted communication programs that bring consensus, in association with media coverage and social trust in key individuals (Evensen et al., 2013). Regional differences call for different approaches and open dialogues between all affected groups (Decker et al., 2010). Future research should strive to confirm and unravel new reasons explaining urban opposition to some proposed management strategies, to be able to design appropriate programs, deal with reasonable concerns, and help with acceptance levels.

Since norms about acceptable management can be influenced by values, prior experience, perceived impacts, knowledge, and trust in managers (Zinn et al., 1998; Kneeshaw et al., 2004), it will be easier to target the latter three to work on conflicts and improve acceptance by the opposition.

The reintroduction and potential hunting of bison introduce a contentious topic, particularly regarding the proposed access fees. These fees could potentially alienate low-income residents, particularly considering the remote locations of the bison that already entail significant travel expenses. Exploring alternatives for economically challenged individuals is crucial. When management strategies are perceived as equitable, they can play a pivotal role in resolving conflicts more smoothly (Young et al., 2016).

Reintroducing bison in other areas is supported by most respondents. Beliefs exist that having bison in new areas may reduce concerns over accessibility to bison, and equal rights to it, while also improving the conservation resilience of the species in the state. Many calls were made for bison to be reintroduced onto state lands, available to all Alaskans. Bison rates of expansion and range plus additional animals added to existing herds should continue to be closely monitored, especially as they may interact with humans. Bison is also considered a benefit for rural Alaskans in the form of protein, as food security has reportedly decreased in those areas, following the reduced availability of fish and moose. While bison is not available, and communities are still dependent on moose for subsistence needs, they may continue to be concerned about the impacts of bison on moose.

To address potential conflicts arising from bison damage in the Innoko area and other rural communities, a comprehensive approach involving education, awareness campaigns, and mitigation methods can be effective (Zimmermann et al., 2005). Subsistence hunting has long been the cornerstone of sustenance for these rural communities, making the possibility of protein shortages a genuine concern. Given the potential for a few problematic animals

causing damage and the absence of immediate hunting prospects for bison, the risk of illegal takings becomes a significant concern, particularly in areas with limited community involvement efforts.

To alleviate such challenges, diversification of conflict mitigation strategies and benefits for local communities sharing space with bison could prove advantageous. Investing in non-consumptive ventures, like photography tours and crafting industries related to bison, can help locals manage losses and enhance their perceived benefits and tolerance (endangeredlandscapes.org). Drawing inspiration from models such as the conservation enterprise in the Făgăraș Mountain of Romania, bison could be integrated into a rewilding initiative, supporting tourism development by establishing visitor centers (endangeredlandscapes.org).

Exploring opportunities in wildlife hunting, tourism, infrastructure, and local services is recommended. Engaging in expertise and aiding local tourism development can foster job creation, income distribution, and community well-being. Without such support, rural areas might struggle to facilitate collaborative decision-making for service systems, leading to limited development and isolated services. Managers should aid in creating an income flow and providing financial management training for the wildlife hunting/tourism industry. Additionally, trained locals should provide village services to prevent non-locals from profiting disproportionately. Non-local profits could trigger decreased local support for the bison and conflicts (Nordbø et al., 2017).

Engaging residents as partners in bison monitoring can act as a proactive strategy, ensuring vigilance against illegal activities and reporting suspicious incidents. However, it is crucial to manage this approach carefully to prevent potential conflicts among community members. Historical precedents from Europe underscore the danger of poaching incidents reducing reintroduced bison populations to near-extinction levels (Parnikoza et al., 2009). In response,

bison can adapt by avoiding poachers, shifting towards less accessible areas. Illicit hunting substantially threatens bison expansion, as highlighted by previous studies (Parnikoza et al., 2009; Sipko et al., 2010). To ensure the success of bison reintroduction efforts, a multifaceted strategy that blends awareness, local involvement, and strategic development is crucial.

Managers can also learn from many wood bison reintroduction experiences such as the growing Canadian wood bison herd in Yukon more than 30 years after the reintroduction and European bison reintroductions. These bear many similarities, as frequently noted during this research, and can be used to help address Alaskan challenges. It's important that as many as possible of the listed concerns be addressed in the next revision of the wood bison management plan. Managers and all interest groups must recognize that programs can address only a limited number of impacts and concerns, thus requiring in-depth analysis and prioritization to address the most pressing issues first (Carpenter et al. 2000).

Effective public outreach and education are paramount for ensuring the success of wood bison management in Alaska. The influence of strongly held norms on compliance highlights the importance of segmenting the public based on norm-based segments to anticipate levels of support or opposition (Tyler, 2000; Vaske et al., 2007). To maximize cost-effectiveness, educational campaigns should be tailored to unique contextual situations (Kansky & Knight, 2014). While social media effectively reaches urban populations, public meetings and interactions are more impactful for smaller communities (Tucker & Pletscher, 1989). Education about risky behaviors and acceptable distances around wood bison is crucial, as familiarity may lead to riskier behaviors over time. Monitoring media coverage, especially of negative events, is essential to prevent negative impacts on perceptions and support. Trust in information is linked to the source and individual values, influencing participation in educational and informational efforts (Steel et al., 1994; Vaske et al., 2007). Addressing misconceptions requires greater explanatory detail (Swire & Ecker, 2017). A thorough

understanding of constituents' perceptions is necessary for crafting effective educational programs. High trust encourages participation in communication campaigns, whereas low trust may prompt increased involvement in management planning (Smith et al., 2013). In the United States, where skepticism and individual autonomy are prominent, trust in information relies on the source itself and individual values, which can shape participation in educational and information campaigns.

Finally, it's important to note that this study represents the initial step in comprehending public perspectives toward a large mammal that has long been absent from the ecosystem. Initial attitudes and beliefs toward an unfamiliar species are often neutral, making it essential for the ADFG to consistently monitor evolving sentiments, beliefs, risk and benefit perceptions, trust levels, etc., as the wood bison population expands. Harvest allocation, once implemented, may introduce new complexities due to increased hunting activity. *Human Dimensions* research work, particularly this study, is much like a "first date"; it is merely the first step of building a relationship between decision-makers and all interest groups interested in wildlife.

7.2.3. Recommendations for Future Research

This research opens many opportunities for future research on ungulate reintroductions in Alaska or elsewhere. Extending this research will help create a more holistic understanding of the concepts associated with support and opposition to restoring wildlife and how much they can influence the acceptability of management actions. Following are some suggestions:

- Collaborate with local Indigenous leaders to design a study that also focuses on their priorities and is conducted in a way to coincides with their preferences, building long-term relationships and trust.

- Future research should concentrate on elucidating the perspectives and perceptions of Native and non-Native populations, aiming to clarify the intricacies of these relationships and distinguish them based on their distinct locations.
- Conduct new mixed methods or completely qualitative studies to improve understanding of the numbers presented here.
- Further investigate perceptions of risks associated with bison in Alaska, including factors such as control, familiarity, emotional responses, risk attenuation, and denial. Linking these findings to past and future trust levels.
- Explore the role of emotions in shaping attitudes and beliefs towards animal reintroduction, considering attributes like intrinsic value that influence people's perceptions of coexistence (Lute et al., 2016).
- Analyze and compare the views of the different ethnic backgrounds present (Native, non-Native, nationalized foreign, etc.) in a single area to better understand its influences on perceptions of animal restoration and management.
- While this study is quantitative and cross-sectional, consider longitudinal studies to capture the dynamic nature of concepts over time, examining concerns and new emerging issues (Vaske et al., 2007; Evensen et al., 2013).
- Explore the role of norm salience in wood bison management, as strongly held norms are influential in predicting behavior and cooperation with decision-makers (Williams et al., 1992; Shelby et al., 1996; Vaske & Whittaker, 2004).
- Incorporate personal experiences and subjective judgments into the evaluation of risk perceptions (Slovic et al., 1981), investigating how memory and exposure to information can shape perceptions and potentially lead to misdirection in management efforts.

- Investigate the specificity of variables used in surveys for better predictive potential among variables, aligning with the principle suggested by Ajzen and Fishbein (1980).
- Study the bison carrying capacity that rural populations are willing to tolerate, considering perceptions of impacts and how these change with time and experience (Decker & Purdy 1988; Marchini, 2014; Lischka et al., 2008).
- Define the key impacts that matter most to people's perceptions of wood bison reintroduction, similar to Whittaker's (1990) approach of assessing impacts on river users' overall experiences.
- Investigate how future benefits can offset negative impacts, particularly for the local Alaskan Native populations.
- Examine reasons for the elevated poaching levels reported after European bison reintroductions (Parnikoza et al., 2009; Sipko et al., 2010), aiming to prevent similar challenges for the wood bison management efforts in Alaska and elsewhere.

8. References

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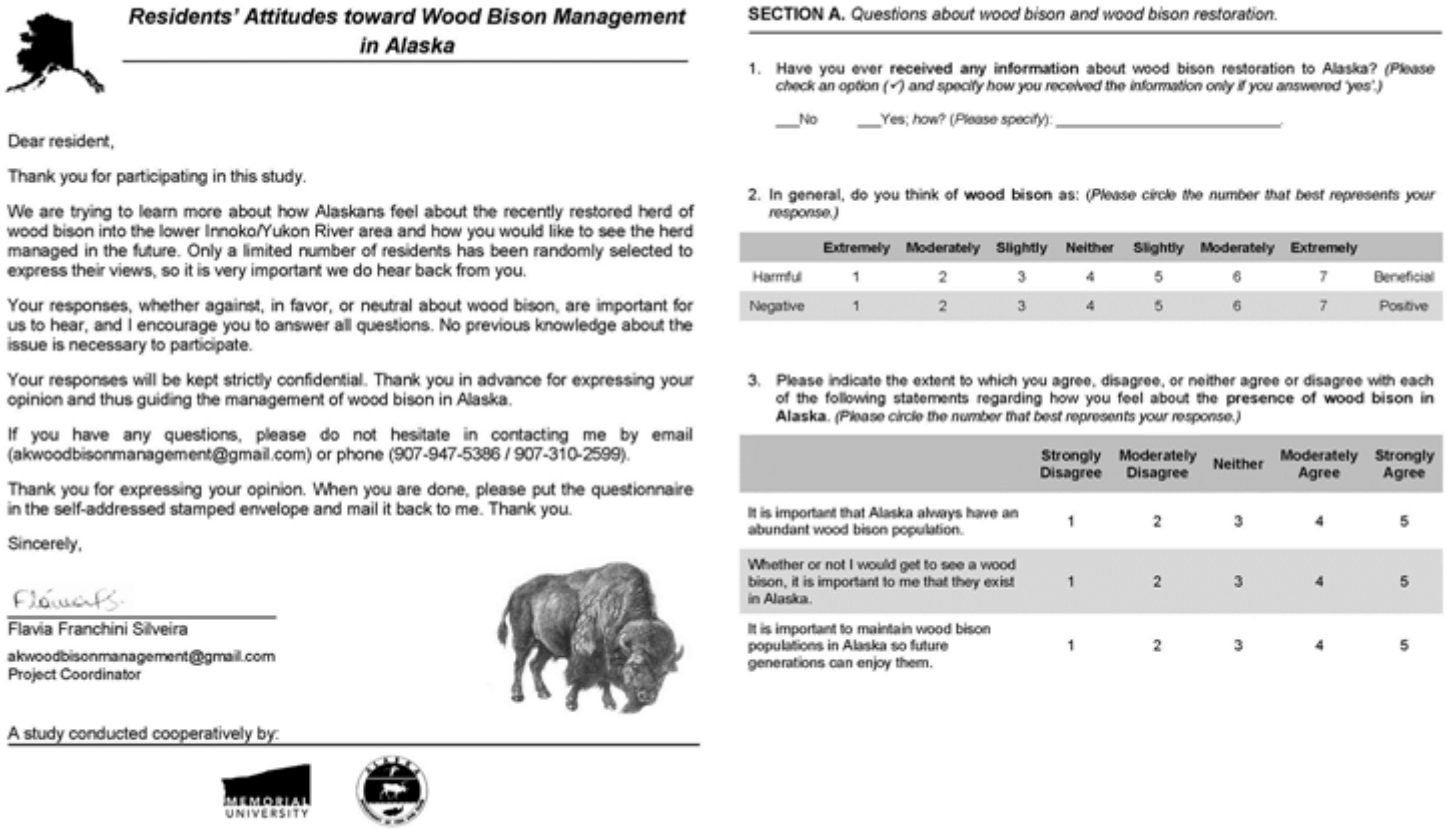
9. Appendices

Appendix 1. Management Plan Goals and Objectives

Table 5. Goals and objectives of the Alaska wood bison management plan that were important in the development of this study (AWBMPT, 2015)

WOOD BISON MANAGEMENT PLAN FOR LOWER INNOKO/YUKON RIVER IN WESTCENTRAL ALASKA, 2015–2020	
Goals pertaning to this study	***Objectives pertaning to this study***
GOAL 3: Minimize conflicts between humans and wood bison.	Educate all user groups about wood bison and their interactions with people.
	Establish procedures to accurately identify and resolve problem bison situations.
	Establish a cooperative effort between ADF&G and local communities to develop procedures and train personnel to deal with problem wood bison.
	Exempt lethal removal of problem wood bison from harvest quotas.
GOAL 4: Encourage cooperation among land managers to ensure reasonable, standardized land use to access wood bison.	Provide reasonable land use for all users of wood bison on private corporate lands.
	Provide proper orientation materials to nonlocal wood bison hunters and viewers to ensure compliance with private landowner access requirements and restrictions.
	Put all monies received for land use fees into a trust fund, agreed to and administered by the GASH villages, to be used for student scholarships.
GOAL 5: Manage harvest allocation to equitably benefit local resident, nonlocal resident, and non-resident hunters.	Enforce regulations and encourage voluntary actions that result in no wasting of meat.
	Allocate 20% of the harvest under a state limited registration permit to be issued in Grayling, Anvik, Shageluk, and Holy Cross, and allocate 80% of the harvest under a state drawing permit hunt of which at least 90 percent is reserved for residents of Alaska.
	Open the first hunting season when the size and productivity of the herd allows a harvest of a minimum of 20 wood bison so the four GASH villages will each be eligible for one permit.
	Encourage all hunters, especially nonlocal hunters, to share clean, well-cared-for meat with local communities.
	Establish hunting regulations to avoid simultaneous hunting of wood bison and moose.
	Support and encourage the establishment of local infrastructure and support services related to viewing and harvesting activities.
GOAL 6: Minimize wood bison impact on other wildlife species and the ecosystem on which they depend.	Monitor wood bison interactions with their habitat and other species.
GOAL 7: Ensure continuing communication among all user groups.	Maintain positive working relationships among the diverse user groups to help resolve future concerns and issues.
	Recognize that this plan is adaptive and it surely will be amended to reflect what will have been learned after the release. This plan should not be substantively changed for at least five years to allow adequate evaluation of its effectiveness.
	Continue and encourage additional efforts devoted to helping the public learn about wood bison, the role they play in the northern ecosystem, and the restoration program.

Appendix 2. Questionnaire



Residents' Attitudes toward Wood Bison Management in Alaska

Dear resident,

Thank you for participating in this study.

We are trying to learn more about how Alaskans feel about the recently restored herd of wood bison into the lower Innoko/Yukon River area and how you would like to see the herd managed in the future. Only a limited number of residents has been randomly selected to express their views, so it is very important we do hear back from you.

Your responses, whether against, in favor, or neutral about wood bison, are important for us to hear, and I encourage you to answer all questions. No previous knowledge about the issue is necessary to participate.

Your responses will be kept strictly confidential. Thank you in advance for expressing your opinion and thus guiding the management of wood bison in Alaska.

If you have any questions, please do not hesitate in contacting me by email (akwoodbisonmanagement@gmail.com) or phone (907-947-5386 / 907-310-2599).

Thank you for expressing your opinion. When you are done, please put the questionnaire in the self-addressed stamped envelope and mail it back to me. Thank you.

Sincerely,

Flávia Franchini Silveira

akwoodbisonmanagement@gmail.com
Project Coordinator

A study conducted cooperatively by:

MEMORIAL UNIVERSITY

SECTION A. *Questions about wood bison and wood bison restoration.*

1. Have you ever **received any information** about wood bison restoration to Alaska? *(Please check an option (✓) and specify how you received the information only if you answered 'yes'.)*

   ___No ___Yes; *how? (Please specify)*: _____.

2. In general, do you think of **wood bison** as: *(Please circle the number that best represents your response.)*

	Extremely	Moderately	Slightly	Neither	Slightly	Moderately	Extremely	
Harmful	1	2	3	4	5	6	7	Beneficial
Negative	1	2	3	4	5	6	7	Positive

3. Please indicate the extent to which you agree, disagree, or neither agree or disagree with each of the following statements regarding how you feel about the **presence of wood bison in Alaska**. *(Please circle the number that best represents your response.)*

	Strongly Disagree	Moderately Disagree	Neither	Moderately Agree	Strongly Agree
It is important that Alaska always have an abundant wood bison population.	1	2	3	4	5
Whether or not I would get to see a wood bison, it is important to me that they exist in Alaska.	1	2	3	4	5
It is important to maintain wood bison populations in Alaska so future generations can enjoy them.	1	2	3	4	5

Figure 18. Sample of the questionnaire used in the research.

4. Below are several statements that represent **potential outcomes** from wood bison restoration to Alaska.

Please **circle the option** that best represents the extent that you **agree, disagree**, or **neither** agree or disagree with ***each statement***. In sequence, please **circle the option** that best represents to what extent you evaluate each sub-statement (*below)* as **good, bad, or neutral**.

Wood bison will help keep the plant system in balance in the area where bison were released.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe a plant system in balance is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
The restoration of wood bison to Alaska will help people understand the importance of wilderness.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe understanding the importance of wilderness is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Wood bison restoration will provide more recreational opportunities for Alaska residents.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe more recreational opportunities for Alaskans is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Wood bison will wander inside the local communities close to where bison were released.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe wood bison wandering into communities is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Wood bison will attack humans in the area where bison were released.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe wood bison attacking humans is:	Very bad	Slightly bad	Neutral	Slightly good	Very good

Continue...

4. *Continuation...*

Having wood bison in Alaska will result in people poaching bison.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe wood bison poaching is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Wood bison will attack domestic animals in the area where bison were released.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe wood bison attacking domestic animals is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Wood bison will provide more harvest for Alaskans.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe increasing harvest for Alaskans is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Wood bison will increase visitation to local communities where bison were released.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe increasing visitation to local communities is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Visitors in the area where wood bison were released will leave trash at camp sites or trails.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe leaving trash at camp sites or trails is:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Visitors in the area where wood bison were released will cause an increase in forest fires.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe human-caused forest fires are:	Very bad	Slightly bad	Neutral	Slightly good	Very good
Wood bison will cause the moose population to decrease.	***Strongly Disagree***	***Moderately Disagree***	***Neither***	***Moderately Agree***	***Strongly Agree***
Do you believe reduced moose populations are:	Very bad	Slightly bad	Neutral	Slightly good	Very good

Figure 18. Continuation…

5. About 130 wood bison are currently in the lower Innoko/Yukon River area in Alaska. For you **personally**, to what extent would you agree or disagree with each of the following statements about the restored **wood bison population**:
(Please circle the number that best represents your response.)

	Strongly Disagree	Moderately Disagree	Neutral	Moderately Agree	Strongly Agree
The wood bison population should **increase greatly** to become abundant throughout the whole state.	1	2	3	4	5
The population should **increase** slightly, **just enough** to guarantee hunting seasons every year.	1	2	3	4	5
The population should stay at the same numbers they are found today.	1	2	3	4	5
The wood bison will become a threat for flying in and out of remote airport runways.	1	2	3	4	5
The wood bison will become a larger threat than moose or caribou in remote airport runways.	1	2	3	4	5
I am concerned that wood bison will attack me or my family.	1	2	3	4	5
I am concerned wood bison will attack my domestic animals.	1	2	3	4	5
The presence of wood bison will interfere with my daily activities/chores.	1	2	3	4	5

6. Thinking about the future, in general, do you **feel the restored population** of wood bison in Alaska will… *(Please circle the number that best represents your response.)*

	Strongly Disagree	Moderately Disagree	Neutral	Moderately Agree	Strongly Agree
…improve food security for local communities.	1	2	3	4	5
…be a source of additional income to local people.	1	2	3	4	5
…be a cause of conflicts (negative interactions) between land users and land owners.	1	2	3	4	5
…be a means for local community development.	1	2	3	4	5
…be a threat to private property.	1	2	3	4	5

7. For the following two questions, please respond using a **scale of 1 through 5**, with 1 representing "not at all important" and 5 representing "extremely important".
(Please circle the number that best represents your response.)

a) How **important** is it **to you personally** that you keep up to date with the outcomes of wood bison restoration to Alaska?

Not at all important:	1	2	3	4	5	Extremely important

b) How **important** is the issue of bison restoration to Alaska **to you personally**?

Not at all important:	1	2	3	4	5	Extremely important

Please continue to Section B on the next page.

Figure 18. Continuation…

SECTION B. *Questions about the organizations involved in wood bison restoration and management in Alaska.*

1. We would like to know how **you feel about the organizations** involved in wood bison restoration and management in Alaska.
   Please indicate **the extent** to which you agree, disagree, or neither agree or disagree with each statement. *(Please circle the number that best represents your response.)*

	Strongly Disagree	Moderately Disagree	Neutral	Moderately Agree	Strongly Agree
The Alaska Department of Fish & Game is generally well-informed about wildlife management issues.	1	2	3	4	5
The Alaska Department of Fish & Game is doing a good job of managing wood bison in Alaska.	1	2	3	4	5
Problems arising from wood bison management in Alaska are everyone's responsibility.	1	2	3	4	5
Problems arising from wood bison management in Alaska are the Alaska Department of Fish & Game's responsibility.	1	2	3	4	5
I trust the Alaska Department of Fish & Game to provide the best available information on wood bison issues.	1	2	3	4	5

2. I am confident that the **Alaska Department of Fish & Game…**
   (Please circle the number that best represents your response.)

	Strongly Disagree	Moderately Disagree	Neutral	Moderately Agree	Strongly Agree
…can effectively manage wood bison.	1	2	3	4	5
…knows how to use appropriate wood bison management techniques.	1	2	3	4	5
…will respond to wood bison conflicts properly.	1	2	3	4	5
…will listen to concerns about wood bison management from Alaska residents.	1	2	3	4	5

3. Of the following groups that could offer you **information** about wood bison and wood bison management in Alaska, how much, if anything, **would you believe**:
   (Please circle the number that best represents your response.

	None (0%)	A little (25%)	Half (50%)	Most (75%)	All (100%)	Not familiar with organization
Alaska Department of Fish & Game	1	2	3	4	5	6
Alaska Department of Fish & Game Advisory Committees	1	2	3	4	5	6
Alaska Outdoor Council	1	2	3	4	5	6
Bureau of Land Management	1	2	3	4	5	6
Doyon Ltd., Native Corporation	1	2	3	4	5	6
Federal Regional Advisory Councils	1	2	3	4	5	6
U.S. Fish and Wildlife Service	1	2	3	4	5	6
Regional Community's Tribal Councils	1	2	3	4	5	6
Other (*Please specify*):	1	2	3	4	5	6

_____

Please continue to Section C on the next page.

Figure 18. Continuation…

SECTION C. *Questions about wood bison management strategies in Alaska.*

1. Do you like, dislike, or are neutral about having **wood bison been restored** to Alaska? *(Please check (✓) the option that best represents your answer.)*

   ___Strongly **dislike** ___Slightly **dislike** ___Neutral ___Slightly **like** ___Strongly **like**

2. **Permits for hunting** wood bison will be available for all Alaskans in a few years, as soon as the population grows to safe levels. The term **'local'** refers to the residents of the four villages near where wood bison were released (*Grayling, Anvik, Shageluk, and Holy Cross*).
   Concerning **wood bison hunting** in Alaska, to what extent do you agree or disagree with each of the following: *(Please circle the number that best represents your response.)*

	Strongly Disagree	Moderately Disagree	Neutral	Moderately Agree	Strongly Agree
Hunting wood bison will threaten the survival of the population.	1	2	3	4	5
Bison hunting should not prevent the growth of the population.	1	2	3	4	5
Local and non-local Alaskan hunters should benefit from bison management.	1	2	3	4	5
The distribution of wood bison hunting permits should be *different* for local and non-local Alaskan hunters.	1	2	3	4	5
Each of the four local villages should be guaranteed a minimum of one permit at every hunting season.	1	2	3	4	5

3. Wood **bison hunting activities** could happen at the same time and place as non-hunting activities. To what extent do you agree or disagree that wood bison hunting activities ***should*** happen at the same time and place as **non-hunting activities** (*such as wildlife viewing, photographing, etc.*)? (*Please check (✓) one option.)*

   __Strongly **disagree** ___Slightly **disagree** ___Neutral ___Slightly **agree** ___Strongly **agree**

4. To what extent do you consider acceptable or unacceptable the following:
   (Please circle the number that best represents your response.)

	Completely unacceptable	Slightly unacceptable	Neutral	Slightly acceptable	Completely acceptable
To **leave** some harvested wood bison meat in the field.	1	2	3	4	5
To **leave** some harvested wood bison meat in local communities.	1	2	3	4	5
To **approach** a bison to take a picture (by *less than 25 yards / 23 m*).	1	2	3	4	5
To make **noises** to attract bison for hunting purposes.	1	2	3	4	5

5. The four communities closest to where the wood bison were released may receive visitors looking for viewing or hunting opportunities. If **local services** (*guiding, accommodation, transportation, etc.*) were available, to what extent would you be likely to **use** it?
   (Please circle the number that best represents your response.)

	Extremely unlikely	Slightly unlikely	Not sure	Slightly likely	Extremely likely
Guiding:	1	2	3	4	5
Transportation to and back from the area where wood bison can be found:	1	2	3	4	5
Accommodation in the closest community to the bison herd:	1	2	3	4	5

6. To what extent do **you** think it is a good or a bad thing that **local** communities **provide services** to visitors (*guiding, accommodation, transportation, etc.*)? *(Please check (✓) one option.)*

   ___Extremely **bad** ___Slightly **bad** ___Not sure ___Slightly **good** ___Extremely **good**

7. To what extent would you agree or disagree with **non-local Alaskans providing services** (*guiding, accommodation, transportation, etc.*) to visitors inside the local communities, **even if** locals offered the same kind of services? *(Please check (✓) one option.)*

   ___Strongly **disagree** ___Slightly **disagree** ___Neutral ___Slightly **agree** ___Strongly **agree**

Figure 18. Continuation…

8. The Alaskan wood bison population was released in an area with a variety of landowners, including mainly private, Native-owned lands. Land access fees have been established to access lands where wood bison may be found. All **Alaskan hunters**, **non-shareholders** of these lands, will be required to pay a single **$300 fee for land access** to look for wood bison. The monies received will be used to support scholarships for youth from the local communities and for training programs for the adult population. To what extent do you agree or disagree with the following statements about **land access fees to these private lands** where wood bison can be found? *(Please circle the number that best represents your response.)*

	Strongly Disagree	Moderately Disagree	Neutral	Moderately Agree	Strongly Agree
All Alaskans should have the right to access private lands to find wood bison free of charge.	1	2	3	4	5
There should be a common access fee for all private lands.	1	2	3	4	5
There should be a land access fee for hunters to hunt wood bison on these lands.	1	2	3	4	5
There should be a land access fee for people who wish to view bison on these lands.	1	2	3	4	5
There should be no fees for local shareholders to access any of the private lands close to wood bison herds.	1	2	3	4	5
Access rules about land use will help prevent conflicts between landowners and users.	1	2	3	4	5
Non-local Alaskan hunters should be required to have a local guide when hunting wood bison.	1	2	3	4	5
Non-local Alaskans wishing to view wood bison should be required to have a local guide.	1	2	3	4	5
Land access fees' monies should be used for students' scholarships and adult training in the local villages.	1	2	3	4	5

9. To what extent do you agree or disagree that there **should be reasonable fees** charged for people's access to private lands to look for wood bison in Alaska? *(Please check (✓) one option.)*

___Strongly **disagree** ___Slightly **disagree** ___Neutral ___Slightly **agree** ___Strongly **agree**

How do **you feel about** the following land access fees? *(Each value refers to a single access fee to local private lands to look for wood bison only. Please check (✓) one option.)*

a) *A fee of $300 for all Alaskan hunters, non-shareholders of local private lands (independent of success).*

___Very **unreasonable** ___Slightly **reasonable** ___Not sure
___Slightly **unreasonable** ___Very **reasonable**

If *unreasonable*, how much should **hunter / non-shareholder** fees be? $_____.

b) *A fee of $300 for all non-hunter Alaskans, non-shareholders of local private lands (independent of success).*

___Very **unreasonable** ___Slightly **reasonable** ___Not sure
___Slightly **unreasonable** ___Very **reasonable**

If *unreasonable*, how much should **non-hunter / non-shareholder** fees be? $_____.

10. If **you** were given the opportunity to vote **for or against** specific **land access regulations**, how would you vote concerning the following?
(Please circle the number that best represents your response.)

	Definitely against	Probably against	Not sure	Probably for	Definitely for
A $**300** land access fee for all non-local Alaskan hunters.	1	2	3	4	5
No land access fees for local communities' shareholders of the Native-private lands.	1	2	3	4	5
Different access fees for hunter and non-hunter visitors.	1	2	3	4	5
All monies from access fees being used for student scholarships and adult training in the local villages.	1	2	3	4	5

Figure 18. Continuation…

11. If **you** were given the opportunity to vote **for or against** specific wood bison **hunting permit** regulations, how would you vote on each of the following? *(Please circle the number that best represents your response.)*

	Definitely against	Probably against	Not sure	Probably for	Definitely for
80% of all wood bison permits distributed by a lottery system.	***1***	***2***	***3***	***4***	***5***
90% of all the **lottery permits** distributed to residents of Alaska, with no more than 10% for non-residents of Alaska.	1	2	3	4	5
20% of all wood bison permits distributed by first-come first-serve line-ups inside local villages in the area where bison were released.	***1***	***2***	***3***	***4***	***5***

Please continue to Section D on the next page.

SECTION D. *Background Information* ***(This information will remain strictly confidential)***

1. Do you self-identify as: ___male ___female

2. What is your age? _____

3. How many years have you lived in: ***Alaska?*** _____ years.
   This area *(city/village)* ***of Alaska?*** _____ years.

4. Have you ever heard about the wood bison **management planning process** in Alaska?
   ___No ___Yes

5. The following organizations were invited to participate in three workshops to define a **management plan for the wood bison,** from 2015 to 2020 in Alaska:

Alaska Department of Natural Resources	Central Kuskokwim Advisory Committee	Grayling Tribal Council	Safari Club International - Kenai Chapter
Alaska Outdoor Council	Deloy Ges, Inc. - Anvik	Hee-Yea Lingde Corporation - Grayling	Safari Club International - Alaska Chapter
Anchorage Advisory Committee	Deloycheet, Inc. - Holy Cross	Holy Cross Tribal Council	Shageluk Tribal Council
Anvik Tribal Council	Doyon Ltd.	Innoko National Wildlife Refuge Manager	U.S. Fish and Wildlife Service
Big Game Commercial Services Board	Fairbanks Advisory Committee	Matanuska Valley Advisory Committee	Western Interior Regional Advisory Council
Bureau of Land Management Alaska Office	Federal Subsistence Board	Northern Alaska Environmental Center	Yukon-Delta Regional Advisory Council
Board of Game	Grayling, Anvik, Shageluk, Holy Cross Advisory Committee	Office of Subsistence Management, USFWS	Zho-Tse, Inc. - Shageluk

Do you belong to any of these organizations?

___No *(If 'no', skip to question* ***6****.)*
___Yes *(If 'yes', please complete '****a****' and '****b****')*

Please continue on the next page…

Figure 18. Continuation…

a) *To what extent do you feel **you** were well **informed** about the decisions made during the wood bison planning process by your group's representative?*

___Not at all informed ____Somewhat well informed ___Not sure
___Poorly informed ____Very well informed

b) *To what extent do you feel your **group's views and opinions** were well represented during the planning process?*

___Not at all represented ___Somewhat well represented ___Not sure
___Poorly represented ___Very well represented

6. Have you **ever heard about hunting permit allocation** for wood bison in Alaska? *(Please check an option (✓) and specify how you received the information only if you answered 'yes'.)*

___No ___Yes; *how?* (*Please specify*):_____.

7. Have you **actively participated** in the past five years in any kind of: (*Please check (✓) one option).*

Hunting activities? _____ Yes _____ No
Trapping activities? _____ Yes _____ No

8. **How interested** are you in **having information** about wood bison **available** to you? (*Please check (✓) one option).*

___Strongly **uninterested** ___Somewhat **interested** ___Not sure
___Somewhat **uninterested** ___Strongly **interested**

9. Do you self-identify as: *(Please check (✓) one option).*

___Native American or Alaska Native
___Non-Native

10. What is the highest year of education that you completed? *(Please check (✓) an option.)*

____Elementary
____High School
____Some beyond high school
____Bachelor or technical degree
____Graduate degree

11. We welcome any suggestions or concerns you may have about wood bison or wood bison management strategies in Alaska. Would you like to provide any additional comments?

_____
_____
_____
_____
_____
_____
_____
_____
_____

Thank you very much for expressing your opinion!

The full management plan for the wood bison can be found at:

http://www.adfg.alaska.gov/static/species/speciesinfo/woodbison/pdfs/management_plan_lower_innoko_yukon_wood_bison.pdf

Figure 18. Continuation…

Appendix 3: A Summary of Concerns

Table 6. General comments and concerns shared by rural respondents after the end of their structured interviews.

General Comments - Villages
Q115: **When** will be able to hunt them?
Q115: The representative of the village mentioned something about the planning meeting to her in the store, but not much.
Q115: "I hope they will **not let people hunt until bison population grows and are safe** at levels at least three or four times higher than population before hunting. And, still then, release only few permits until animals are well established and abundant."
Q115: Want **more information**. Doesn't think had enough information, and they never got together to decide who would be the representative of Grayling. **Never got the results** of the meeting, never heard about the 80/20% proposed division, etc. [Author: This commentary came from an important figure within the village].
Q115: Interested in knowing **how to tan hides**. Believes someone from each village should be able to apply for the scholarships. Zho-tse **shouldn't monopolize** the opportunities, should go equally to all villages.
Q115: Concerned people **may shoot bison when they are around town**, that they will bother dogs, be a nuisance, a danger for kids, etc. Need to **educate the kids**.
Q115: Lots of people just want to kill animals, to kill things. He, instead, just wants to teach young traditional way of life. Bison are OK a**s long they don't bother people**. Should **educate kids** – they are the ones that will live with the bison.
Q115: She doesn't live in the village anymore, moved to the city to study. Thinks it is important to inform people about bison. Moose has been there, they have been interacting with moose, etc. Need to **educate people** about bison and bison habitat, its danger, how to hunt and how to live with them.
Q115: "The **allocation is too low**, need to be changed, need more! Need to be discussed same old thing." He wanted to still be part of the planning committee. He asked if people will be able to get a moose when they come for bison. The author explained that it has been proposed to have separate seasons for bison and moose, tentatively putting bison in the winter. He agreed this is a good idea, because for the villagers, if they can't get a moose in the fall, they can try a bison in the winter, and if fail, they still have another chance to try a moose in spring, so it would improve chances of getting their meat. He then mentioned that the moose spring season is available only for people that failed to get a moose in the fall. Then he suggested that the department should not let people that get a bison get a moose also, it should be permitted to get only one or the other. This way would be good, putting **one animal for each season**: summer: fish; spring and fall: moose; winter: bison. He made a mention about **trophy hunting**: people that won't take the meat should leave it in the local villages. They are against waste, against people taking only the head/antler, and leaving the rest. Need to guarantee they don't abandon the carcass headless, like they do with moose. He thinks **many things were not well discussed**, especially the **hunting quotes**. He also mentioned it is important to **not letting only some people benefit** from the services. It should be guaranteed the same number of services to each village, so to avoid some people getting a lot of service and money, and some getting nothing. Also, depending where bison will be, it should be possible that, even if they are agglomerated next to one village, people from the other villages come and be a guide, etc., so the other villages benefit too. Additionally, it also **cannot be a private benefit**, it **needs to be shared** with the whole village. They have always **gathered to decide the village's business**, and it should keep being that way. The subjects about **how these services are going to work** need to be **discussed in a large village meeting**, to put in all the details to all the people. He **was a part of the meeting committee with Randy Rogers** in his village, back in 2002. They discussed a moose he brought up. He only heard about the permit allocation for wood bison **when it was already a done deal**, when he saw it on the paper. He also didn't hear about the recent planning meeting held in Anchorage. He can't, currently, participate in the committee meetings in the city because he has to take care of his mother, so he can't travel, but he wants to participate again someday, if possible.
Q115: [Author: A villager drove us on a boat from a village to another, and, on the way, we saw a group of bison on the coast. He got very excited to see them, and mentioned that **now he likes them**.] Before he was very indifferent to the animals, but the **sight changed his attitude** towards bison. We talked about him being a guide to people to see bison from a boat, and he demonstrated interest in getting the 6-pack license. He **wasn't too convinced** though this **could become real**, of him becoming a guide, or getting the license, but did demonstrate interest in doing it.

Table 6. Continuation…

General Comments - Villages
Q115: "I am glad animals are here; **it's been a long process**". Will be watching the management of bison because of moose declining. They tried to manage, but didn't work much. "**None of us ever skinned a bison**". They don't know how to process the meat. Need training on how to skin, cut, and prepare the meat. Concerned **other villages will shoot them**, the **villages where ADFG didn't go**, didn't work with. Should work with the villages out of GASH. Bison has been going further. Observed tracks in the soft mud, bison has been crossing up and down fine. The airport is their 'home', they **always come back** to it, where were released. The **whistle is important** to not let them get too attracted to people. Every family in every village should have one. Darren got names of people to train for rubber bullets. There is a good trail between the villages, the moose like the trail, and **bison may be a problem in the trail** like moose. Are they going to stay there or leave? ADFG should train people on **what to do in case they find bison while travelling** in the winter trails. Whistle? Maybe people should carry a whistle while using the trails. May need to be prepared for rubber bullets if whistle doesn't
Q115: Not many people are doing handcrafting in Shageluk.
Q115: Wants **more updates** on how the bison are doing.
Q115: His great-grandfather used to raise reindeer, about 100 years ago. Is happy bison was sent to Shageluk. People used to hunt bison with bows in the past.
Q115: No concerns right now, he was well informed. [Author: Hwas a representative at the planning meetings in Anchorage.]
Q115: Wants to learn **how to cook bison**, never had.
Q115: Wants **more information** on bison, is very interested. Tim was supposed to send him videos. His daughter is interested. Asked to send them more information.

Table 7. General comments and concerns from the urban population in their questionnaires.

VERBATIN - General Comments - Urban
"I really hope the state is able to build a strong population of wood bison in Alaska. I am not interested or supportive of hunting these beautiful animals unless natives want to, and hope you proceed with hunting permits cautiously. Please do not make people pay just to go look at wood bison."
"Just keep helping these wonderful animals to grow and increase numbers – then open up for sports hunting. Lots of oversight. I would consider being on a committee to oversee the future of these Bison."
"Land owners should not benefit from a state/federal program. Yes. If damaged, compensation is appropriate. State fees should apply to all Alaskans, not just villages. Apply it to education? Okay, but include all of AK. But $'s should cover the cost of management first and foremost."
"I've read very little about wood bison, but this survey sparked my interest in checking out what your [*unreadable word*] websites said on the subject."
"Interesting survey. Used to write these [*unreadable word*] when I worked for the government [*unreadable word*] retired."
"The release of wood bison is a wonderful program. I support more bison being released. Keep up the good work!"
"There are organizations that should have been a part of the planning process like the Audubon Society, Nature Conservancy, World Wildlife Fund, etc. Not Greenpeace or Sierra Club (Too radical)."
"All hunters selected by this bison lottery should be charged the same fee to take an animal. Shareholders too. Not just the white guys."
"Would like a brief annual report on bison population management released to local news organizations and Fish and Game, Fish and Wildlife websites in Alaska."
"I am in favor of the program. Private landowners can charge what they want for access."
"5% or less "out of state" permits."
"Don't let this happen to the bison that happened to the Togiak caribou."
"I think the wood bison population should first be managed to spread beyond the present area to all areas where they can live or have historically lived. This could provide a viable game population which could be economically hunted by all Alaskans. The present population is accessible only by local residents of nearby villages, or those wealthy enough to fly out and back from distant parts of the state. The introduction and management costs are paid for by all residents of the state, and the games should also be available to all residents of the state."
"Hunters should pay access fees. Viewers/photographers should pay nothing. Non-Alaskan hunters should pay the highest access fees. All three of the above groups will pump money into local economies with food, lodging, guiding, transport. These three rules fall directly in line with how (non)resident fisherman x fish viewers must pay. Keep the rules consistent for wood bison hunters x viewers/photographers."
"Prior to culling herd through hunting opportunity in statewide lottery. Seed population of wood bison should be started in more than one location taking in probabilities of climate change influence on future ranges where animals could thrive."
"Do not let wood bison become food source only for rural population. No hunting of herd until an abundance of animals, which may be never. Do not allow bison to become as musk oxen when native hunters killed last of original herds."
"The $300 land use fee is unacceptable and a waste on "adult training". Spend the $ on access and accommodations to area. ADFG should be allowed to make all pertinent management decisions free from "local" entitlement pressure."
Let's cut to the chase. I'm a 68yr. Man. Having the wood bison is pretty great, but I don't really care, you've done your part, if they get a foot hold, great, if they don't, that's it. I doubt that I'll ever see them, unless they build a train from Wasilla to Nome.
"If an access fee is voted for, there should be a separate area or lottery system for a no-fee hunt, similar to the farewell bison currently. It is the only bison hunt without fees. Harder to get to? Yes, but it is an option compared to fees for a Delta hunt."
"I really don't know enough about wood bison hunt and imagine they might do like our moose population. Definitely in favor of restoring the herd."
"Accelerate the introduction if possible. The more the merrier."
"Thank you for this opportunity!"
"I do not feel natives in area should have priority. All hunters should have same access. All land fees if established should be put into the management and preservation costs of wood bison if natives in the area are given first priority."
"Dear Flavia, I'm honored to be included in this survey. Thanks. Sincerely, Tom ***."
I hope hunting is not allowed for a while. The wood bison need the chance to repopulate.
"These bison should have been released on state land somewhere and not on any Native lands. There shouldn't be any subsistence hunting going on at all and every Alaskan should have an equal chance to hunt these animals with no land use fee. They belong to all Alaskans with NO preferences.
"This is a very exciting and challenging opportunity. Good luck!"
"I would want to ensure the majority of fees generated by licensing, permitting, tags, etc, go to sustaining the wood bison herds in Alaska."
"Several years ago, when the Canadian wood bison recovery team advocated establishing a herd on the Yukon Flats National Wildlife Refuge, I was one of the lead investigators of this proposal for the FWS. After an extensive review of this charismatic animal's status and history we concluded that it would not be appropriate to introduce bison on a national wildlife refuge in Alaska because it would not maintain wildlife populations in their natural diversity as required by ANILCA. Much as I like these big shaggy creatures, I agree with this assessment. Thanks for asking for my opinions. J. S"
"The exclusion of non-hunters from the process by the ADFG makes the agency unreliable."

Table 7. Continuation…

VERBATIN - General Comments - Urban
"In allocating hunt percentages for indigenous Native American populations, poaching, etc., should be accounted for in arriving at local shore."
[*Concerns*]: "That the locals will kill them off before they are firmly established. That they belong to the state and locals will prevent other Alaskans' access."
"As I stated in section B3, I believe a cooperative communication with the Canadians managing the Wood Buffalo Park herd would be beneficial."
"Use bison access fee to develop bison habitat."
"I think it is good that you are introducing wood bison back into the wild!"
"This was sent to my husband, who probably would have answered differently. He died April 2013. I answered as best I could. I have seen wood bison at the Alaska Conservation Center near Portage."
"Generally pleased with progress of reintroduction of bison in Alaska. Pleased to see a public input/feedback program."
"It's unfair, in my view, to charge non-locals, but give locals a 'free-pass' to the bison just because they are near the area. All should have 'free' access to 'state owned' animals, introduced with tax dollars! The 'locals' may offer guide services and/or transportation services, but the hunter should have the choice of whether or not, they want to use this service! As for fees being used for 'scholarships' or 'adult training' – there has been so much corruption and abuse of previous programs that I would be against it. While it seems to be a noble pursuit, it will end up being abused as well, so should be avoided from the inception of the program. If all men are truly equal, in our great state, then level the playing field and allow all to abide by the same rules. To do otherwise, will only serve to breed ill-will towards our fellow man, and make one to be advantaged over another unequally."
"Glad to see wood bison returning. Non consumptive use of wood bison (viewing, photographing) should have lower user fees and more access than consumptive use (hunting). During hunting season NO viewing should be allowed. The two uses are NOT compatible at the same time!"
[*Comments mentioned over the phone*]: Wants more wood bison reintroduced, and expects to hunt them. He is against any fees for land access (hunter or non-hunter) for Alaskans, but is in favor for non-Alaskans. Alaskans pay their taxes and should be able to access lands for hunting.
"Glad that wood bison are back in Alaska - we need to prevent their exploitation and keep more wild areas even if I never get to see them."
"This project has great value to the state beyond hunting especially research and the attempt to renew bison to the state. Native people should benefit more than non-local, non-residents. Please keep this project in the news. Thank you."
"I am very pleased with the reintroduction of wood bison into Alaska. I hope that they can be reestablished in all of their historical habitat. In the past I have harvested big game or have been on hunts with successful results. I may not ever hunt big game again but I'm thrilled with wood bison becoming common in Alaska for viewers and hunters alike."
"I applaud the introduction of wood bison to Alaska. Before considering any hunting opportunities, I believe hunting should not be allowed for at least 4 years to study mortality, reproduction, and to see how well/poor the animal is adapting."
"Please take your time and be as smart as possible, this isn't just about hunting! T. W."
"Thank you!"
"A measure of Alaska is the quality of play baby bison may enjoy and shared by others (including humans)."
"The wildlife of Alaska belong to all Alaskans if you have fees to hunt that only some Alaskans pay, but others don't pay, it's not equal access to use the resource. Someone might own the land but they don't own the bison or any other wildlife."
"I am concerned with wood bison management areas conflicting with Alaska's need to develop oil, gas and mineral resources."
"I am glad the wood bison have been reintroduced to Alaska and support efforts to grow the herd."
"Get rid of wood bison, return the moose."
"Our state constitution guarantees all Alaskan citizens are equal shareholders of state resources. If the 4 villages named in this pamphlet wish to have a private reserve of wood bison, they should pay for it themselves; not the people of the entire state. Any land use fees should be placed in a scholarship fund for the entire state. I support the return of the wood bison to Alaska, but I strongly disagree with any policy that would spend state tax dollars to create in essence a private game reserve."
"Interesting survey, thanks!"
"Need research on effects of plant communities and soil."
"No non-Alaska resident hunters! 80% of harvest by non-local AK resident lottery. 20% by local village-AK residents: local lottery/1st in line or per village?"
"If wood bison are managed by state agency ADFG, then put them on state land, not private land. I do not expect state dollars to plant potatoes on native land and have natives eat the potato."
"Some of my concerns are: 1) How can F+G keep politics and politicians from changing the management plan? 2) Will enforcement have the resources and balls to apprehend and persecute all poachers? 3) What's to keep 'landowners' from charging outrageous trespass fees to 'non-shareholders'? 4) Will sportsman like me ever get a chance to hunt these animals?"
"Thanks for including me in your survey! This is very interesting."
"I am concerned about the possibility that the presence of wood bison in this area will in the future lead to closures for other types of resource development for which there may be potential, such as oil, gas, coal, or minerals."

Table 7. Continuation…

VERBATIN - General Comments - Urban
"It is unfortunate the wood bison were not released on state-owned properties. The shareholders can probably charge any amount for access to bison on their properties. Alaskan resident hunter and non-hunters should be subject to the same fees. Please bear in mind Article VIII, Section 3 of the Alaska State Constitution while promulgating future regulations regarding wood bison!"
[*Attached: Picture of a moose with an arrow stuck in its forehead* – www.newsminer.com]. "`A picture is worth a thousand words`, or `view from my living room window`, or `why I despise bow-hunters`. My concerns and comments."
"I don't imply that information was not available, I just was not paying attention. I wish you well on managing the wood bison."
"Family have opportunity to take bison at Delta on 4 times on partner hunts. Excellent hunts, meat was all used. H. D"
"Bison should be introduced into areas reasonably far from human populated areas – somewhat further than the Big Delta herd is from Big delta. They thrive in isolation to human activity and should be so located."
"I have a general skepticism of our ability to tamper with a system as complex as the environment. I suspect there will be unintended consequences to species that have evolved for however long the wood bison have been absent from the area. Even at a micro level, new bacteria may be introduced through these 'new' herbivores… Best of luck."
"Good luck with your project. I believe strongly in fairness to all Alaskan people. We all pay high prices for food, fuel, heat, housing, clothing, etc. We need to share Alaska's bounty, managed carefully, and promote educational opportunities to all of our people."
"I have worked for 15 years as a field representative for the United States Census Bureau in 93 villages, but never in the area in which the wood bison were released. I just finished reading Sheldon Jackson's 1901 'Introduction of Domestic Reindeer into Alaska' and am very interested in the wood bison".
"No hunting permits to non-Alaskan hunters. Should manage wood bison with scientific principles, not politics, not $. Get the Safari Club out defining the management plan."
"It's tantamount to maintain an ecological balance especially in the face of climate change."
"Put bison on public land 'NOT' on native land!"
"Next time, please leave spaces for comments after questions. It would be easier that way to leave comments."
"I have a strong feeling a land access fee of 300$ to simply view bison will keep just about everyone from viewing wood bison and or bringing business to wood bison near villages."
"I think consent efforts are a good thing, but wonder about (1) long-term sustainability of populations in Middle Yukon river valley – are the habitats appropriate? (2) potential for unanticipated 'surprises' to area ecosystems and current game populations – what are the likely impacts of bison herbivory, trampling, etc. – in other words, the dynamics? (3) have expected impacts of climate change been taken into account regarding the above issues?"
"As Alaskans, we all payed, one way or another to have this wood bison project develop and finally get done. And as such, we as Alaskans should not be subject to access fees or such by private corporations to access these animals. The native population does not own them, we as Alaskans do."
"I'm appalled by the land use fees. Only wealthy people and locals can participate. It's already expensive to fly to these communities and pay for guides and accommodations. That fee is outrageous. Bison should be introduced in other areas available to many Alaskans such as the Circle and Fairbanks area. Locals should always have priority on tags and no fees. I like at least one per village. Locals should be able to hunt a week before other hunters."
"I never even heard of wood bison before this."
"In 2012 we toured the Wildlife Center down at Portage. I came away dismayed that it had taken so long to transplant the animals. I was very glad to finally see it happen, and would hope governmental politics would stay out of wildlife management."
"The wood bison are for all Alaskans to enjoy or benefit from just like any other animal that thrives in the state of Alaska, and if managed correctly should flourish for future generations to come."
"This is a unique opportunity to restore a species that became extinct (to Alaska) within the cultural memory of the nature. Effort should be made to restore them to all areas they once inhabited."
"I could not care less whether or not there are wood bison in Alaska."
"I think it is important to have the wood bison back in Alaska. It provides a diversity of wildlife and maintenance of forage. I am not a hunter, so I don't care about maintaining a population base for that purpose. I just like the idea of having them back in Alaska."
"Some sections and/or questions were unclear."
"Great to see the bison reintroduced. Would love to see them around Nenana, Minto, Ft. Yukon, etc."
"I strongly support the introduction and propagation of wood bison herds in the state of Alaska"
"Outsiders do not need to hunt in villages. Let them hunt on the massive federal lands tied up and taken away from Alaskans – not in villages filled with families and children lining almost subsistence lines. Why this survey repeatedly say 'Alaska's people', when the impact is really on 4 villages and people. This is misleading and cannot meet a true picture. 'Alaskans' must fly to most villages."
"I lived and worked in Delta Junction, I never thought the plains buffalo were much of a problem."
"I believe non-Alaskans should pay a very large fee to hunt. Coming to view would be lower but to hunt takes away members for Alaskans who want to do this."
"Grain feeding should not be allowed, including during times of hunger stress. Commercial sale of meat should be considered."

Table 7. Continuation…

VERBATIN - General Comments - Urban
"Safari Club International, ADF+G and BOG's trophy-hunting cronies are instrumental in this, why no question on trophy hunting? If citizens have to pay for all this buffalo transporting, they should not have to pay an access fee to locals who, except for trophy hunters, will get all the benefits."
"No comments no far."
"It starts as a noble task, re-populate wood bison. Some drown in rivers, survivors learn the feed and terrain and re-populate. But the real problem for the bison is not nature, but as in the past, it will be mankind. Twenty questions on money, an equal or more on who is best to manage them. The bison will do fine, however, the humans may not! "
"No preference should be given to native people who live in the area should all be treated the same. No illegal hunting for pot latches. Only info I have seen is on TV for about 1 minute per commercial. Always same commercial."
"I expect to read your management plan soon."
"The survey needs a little background on the program and its history for people to better answer the questions. I had heard a presentation on it so am somehow informed. It is monumental to bring back a species that was natural to Alaska and then was gone. The people of village Alaska need economic opportunity and this has potential to provide some jobs for them. Thank you to Fish & Game for putting the resources into this project. I hope you expand it to other areas of Alaska. It is one of the most positive things the department has done in many years. Thank you."
"I don't care for this type of questionnaire and wonder how much real information you can get from it."
"If you spent less time developing a 'politically correct' questionnaire and more time worrying about WILDLIFE MANAGEMENT – ADFG would have far more credibility."
"I strongly support state of AK introducing and managing wood bison but not solely for benefit of local or village population. If state funds are used to manage wood bison than all state residents should benefit."
"I do not believe the local villages should have more rights to the bison than Alaskan Residents. This should be fair to all Alaska residents min. of 10 years of residency."
"Since tax dollars made the wood bison development possible, I have trouble with any fees being charged to access them. Also, it seems that a maximum of 5% of lottery draws should be made available to non-Alaskans. Give the other 5% to the villages to support their needs."
"Section 8 – land access fees – should be set by local village (shareholders) on native owned land and land access fees' monies used however they determine. PRIVATE land holders set the access fees. This is in addition to the hunting permit that must be purchased from Alaska Fish and Wildlife. Private land must be respected. If no fee at least PERMISSION to ENTER/ACCESS must be obtained. State of Alaska Fish and Wildlife set fee for permit. Two different fees involved here!"
"Keep in mind of what other bison regions have worked/ like the one in delta junction, they could help in your decision making. Have a nice day!"
"Glad many steps were taken before reintroducing them into the state from Canada. Sounded well planned from the brief mention in my UAF OLLI class – more info about the species needs to be passed along in the schools."
"I don't have issue with local preference for permit draws. I do have issue with the shareholders not having to pay to use the resource (land use). All should have to be responsible for the fee and enforced to follow the rules of the land. I love the use of the monies raised to be used for scholarships of local kids, preferably if they help with the clean up or permit process, make the people work for the $."
"1) Does research show wood bison are invasive / noninvasive? 2) Is there a training program for local (village) managers? 3) Is there a grant program for local (village) infrastructure? 4) Is there statutory support for state (legal) backup? 5) Is there tribal support for state (legal) backup? 6) ADF&G is competent to manage this program – no other agency comes close but are constrained to scientific and (or [*unreadable word*]) political imperatives – this will not change – good luck."
"This was a little long. I think it is great for the villages for all the benefits, food/income/training. I have been in all of the villages from Fairbanks to ocean. This program will help them".
"Why would you put wood bison on private lands using public monies and then charge the public for access that benefits the private entity? Seems lacking integrity ~ corrupt??"
"If bison helps maintain healthy environments, land owners should be thankful. Alaska natives have a poor record of wildlife management. They need to step up. Yes, this is a great idea. Keep going."
"I hope wood bison management proves to be a bonus for most people involved."
"Native corporations should NEVER be allowed to charge extortion fees to permitted/licensed hunters who desire to hunt/fish for Alaska's natural resources. The state should require hunters to pay for an annual license (fee based on what is reasonable to manage the Dept. of Fish and Game). Giving preference to one group of Alaskans over another is wrong; if the native groups want to extort money from hunters for being on their 'private' land then they should have to pay property taxes like the rest of us. No special considerations for ANY special interest groups; if the wood bison are to stay in Alaska (and I hope they will) they should be available to all equally. Living in the Alaska bush is a choice, no one is forcing them to stay there."
"This was a waste of money and will benefit very few people. I like the idea of having wood bison back on Alaska but this was too expensive. F + G should have had a land contract in place before the start of this project."
"Why is MUN and not UAF/UAA/UAS participating with ADFG in this data gathering process?"
"I feel sorry for the wood bison. They appear to have been introduced solely to be hunted to extermination again. As the 'Buffalo Bills' of olden days wiped out the buffalo herds on the plains, there will be a new generation of hunters wiping out the wood bison herds wherever they may roam. How far from Grayling-Holy Cross area are the bison expected to spread? I suggest the bison be protected for at least ten years. No hunting of wood bison before 2025."

Table 7. Continuation…

VERBATIN - General Comments - Urban
"No outside hunters for first 10 years to build up populations with strict fines for poaching."
"Am interested in restoring a natural resource in our state. I feel the bison could help balance our ecosystem. I'm really not interested in restoring the bison solely for our consumption. Perhaps the bison will change the tundra that may assist the continuance of the permafrost."
"The wood bison herd should be allowed to expand in number and range. Once biologists determine the herd is ready, hunting permits should be issued. Permits by lottery will ALL Alaskans having equal chance to be drawn, not by location. Land use fees should be paid to landowners by anyone that uses their land. Same fee for all! "
"Make more information about wood bison projects available to people through public TV programs and Newspaper articles."
"The Yukon experiment has gone markedly different than projected. The herd's numbers are rapidly increasing due to: a) too much work harvesting so much meat in winter in semi-distant locales; b) wolves still haven't learned to become a predator. As a consequence, there is growing concern the experiment may prove to be adverse due to flora impacts and indications moose are being forced out. Please advise. Good luck. It's all an experiment with unforeseen developments even with the best intent. But hopefully it is an experiment worth trying since the wood bison were once here. P.S: Given the Innoko's distance from most AK pop. ctrs. I think cost to hunt (transportation) will be prohibitive."
"We have a cabin near Minto Flats and would like to see wood bison in our area."
"My primary concern is similar to Alaska Wildlife management in general: Non-hunters and non-trappers have no voice in management. Wildlife viewing needs more weight in management decisions."
"Thanks for the opportunity to provide input."
"Keep in mind… fair ≠ equal."
"Incredible job by everyone at Fish + Game who worked so hard for so long to make this happen. Even if I don't ever get to see them personally, I'm thrilled that they are back in Alaska and I hope the population thrives."
"State rented ATVs to get into the field or reasonable guide/transportation fees. Part of the meat harvest going to the community is a good idea."
"We spent a lot of money just to benefit a few and create many more government jobs."
"I'm very happy this project is going on. Thank you for your continued work!"
"Why were they released on private land… Didn't we all pay for all the bills?"
"I like bison and hope there will be a larger population. Restore them to natural habitat."
"Really? You are asking me now after animals have been moved. So much for input."
"Having a thriving bison population is more important than hunting them. If the population is robust enough, hunting should be allowed. If hunting is allowed, local villages should get priority. AND Alaskan hunters should have priority over non-Alaskans."
"How can Alaska justify spending money on wood bison when their income is so low?"
"Good idea to reintroduce wood bison to interior AK."
"I have no opinion. I currently do not hunt."
"Keep the public informed with information."
"There are issues that Doyon Inc. has raised: Is exploration by Doyon on their lands interfering with long term managing of a wood bison population?"
"I would like to see wood bison introduced into more areas of Alaska. Management to maximize hunting should be encouraged. Non-Alaskan's hunting bison should minimal or non-existent. Locals poaching bison should be strongly discouraged. Overall I think the wood bison program is on the right track and very beneficial. More bison the better."
"I have been following the release of the wood bison in the news for years and have been supportive of the attempt. This flyer is the first I've seen the release was on private lands, that is wrong. To read the public may have to pay to view or hunt a publicly created resource that should have been on private land is even all the more wrong. All expenditures of public/government money on this project should be stopped. Now! If native groups want a private herd on their land for their own, personal gain, then they should be paying for the experiment. After all, there is no way any government would establish a herd of cattle on my non-native land for my personal and financial gain/enjoyment! I was leaning in favor of local reimbursement to locals for damage caused by a public, free access herd. But if this is essentially a public herd on private land, then no! The locals can not have it both ways! This is a scam! Shame on you for allowing it to progress this far!"
"I strongly am opposed to any specific allocation of this resource to any group of Alaskans. This resource should be available equally to all Alaskans."
Attached letter: "It seems obvious to me that the primary purpose of this Questionnaire is to gain support to establish regulations governing wood bison that would favor certain segments of Alaskans based on where they live, certain ethnic groups, and land ownership of the bison habitat area. Questions regarding access fees, guide requirements and remote locations for permit lottery drawings all point to an attempt to restrict the benefit of this game animal to a select group of Alaskans. As you are well aware allocation of these resources to specific groups is forbidden by the state of Alaska's Constitution. I hope that none of these animals were placed on privately owned land. If so, that would involve the transfer of a state resource to a private entity and giving up control and oversight of this resource. Reintroducing a game species close to a village is an invitation for disaster, you know what I mean!!! Also, trying to justify the charging of access fees, mandatory guiding fees, etc. by suggesting the proceeds would be used for the benefit of the children, is the lowest type of tactic to gain a favorable response to a set of bad ideas. Primarily how can a private landowner charge a fee to hunt a game animal that is a state owned resource. Anyway, thanks for the opportunity to participate in this questionnaire and hope that this wood bison resource will end up being managed for the benefit of all Alaskans."

Table 7. Continuation…

VERBATIN - General Comments - Urban
"Introduce and maintain a small herd in Minto Flats area."
"I like the idea of restoring wood bison to the wild. I am bothered by the implication in this questionnaire of the bison becoming the property of Native corporations. This questionnaire looks like it was made up by a large committee. It is long."
"Did not see questions about noise control. [*unreadable word*] jet boats, [*unreadable word*] flying airplanes, development, buildings, roads."
"More information available, including online, newspaper, and at visitor centers."
"I think permits should be for ALL Alaskans: 90% all Alaskans, 10% villages. Thanks."
"Need more information in the public press. Have not looked online, expect there is information posted to find."
"I would like to be able to go and hunt the bison for food for my family. I wouldn't mind having to hire a guide – reasonable – I am not a trophy hunter just enjoy the hunt and meat. Need accessibility to the are without having to pay soma native organization to cross their land. That's not right. I feel it is my land also. Make the bison hunt available to everyone."
"Management of game will be difficult in Alaska of because many individuals thinking the laws do not apply to them."
"I have no opinion. Do not feel I have any info/fact that would result in my providing useful info to you. Count me among your uninformed and only mildly interested in wood bison. Good question are for target audience. You have a job ahead of you. [*About the link for the management plan online*]: Did not access this website. Too much info for me."
"This is a good idea but we need more bison opportunity closer to the road system. Upper river bison is not huntable. We need bison areas that are accessible. Thank you."
"Will wood bison be designated as an endangered species thus limiting access to and use of their range?"
"Though I do not know the specifics (or the politics) of the bison herd relocation, I was thrilled that the move from the Wilderness Center to the villages was completed successfully. This was a great service to our state and to preserving the bison population. It seems that natural selection should be main focus, with hunting occurring if they become overpopulated."
"I enjoyed seeing the wood bison when driving the Alaska-Canada Highway in Canada and at the Wildlife Conservation Center. They are majestic animals."
"I have no knowledge about pros and cons of wood bison or the effect it would have on people. Especially those in remote areas. Different life style in parts of Alaska may be a benefit, but for others they could become a great problem. My only encounter with wood bison was in 61-62 and travelling to Fairbanks for college. While night driving was great until the stubborn beast did not allow my passage on the road. They delayed my travel for 2 hours. Then the herd moved on after butting my car several times. I can't judge what should be done in the future but the past encounter was not good for me!"
"It was impressive to see this news reports on how these animals were moved. Good luck with your future planning!"
"ADF&G had done very poorly on moose management for Alaska. This will carry over to wood bison management. ADF+G needs to copy Sweden's moose management practices; as Sweden harvests a lot more moose than Alaska. Without proper predator control money and time will be wasted on this project. Game wardens/troopers have to cover the herd or the big game guides will take advantage of this resource"
"I would hope any management decisions would be based on replicable research by unaffiliated scientists without interference from or restrictions by politicians who may feel the need to satisfy the demands of a specific population. Give these animals a chance to rectify what has happened in the past."
"I can't answer the questions because I do not know enough about this issue, and also what is the bottom line on the cast to do all this. And who gets the benefits to do this?" Sincerely, B. C.
"Private landowners should be able to charge any fee and use it however they want for hunting/viewing animals they have introduced to and protected upon their lands. If, however, a government entity introduces these animals, private landowners should not charge a fee to others to harvest/view the animals."
"Use federal funds and grants when possible".
"Poaching the bison by the local residents of the village Shageluk should be great concern. All Alaskans should have equal access to the resources of the state. 100% of all wood bison permits should be distributed by a lottery system. 100% of all the wood bison restored should be considered to have been located on public land and no access fees should be charged for access to a public resource paid for with public funds."
"I am concerned about the welfare of this animals. I recently read that some have been lost. Is this the learning curve? Will the survival rate be better next year? This sounds like one 'experiment' and one that is harmful/painful for the animals. Will they find sufficient food or starve? I am sure PETA will be monitoring this situation."
"I generally do not support the concept of the reintroduction of a species which has been out of the area for a hundred years or more. Instead of being considered a correction of the environment, it is in fact a change to the current environment."
"Have followed this since W.B.'s [wood bison's] corralling in Portage until 'guarantee' they wouldn't end up on an endangered list in AK. If you can drive a car from Yukon/AK border to Whitehorse, why would anyone pay much more to see them (W.B's) in Innoko?"
"Questionnaire is too long. This should not be another state give away. If the state funds the restoration fully, then all Alaskans should have an equal opportunity to exploit the result."
"20% of permits to local villages by lottery. 80% of permits to non-local by lottery. A % of permit application goes for land access."
"If we as a state fund reintroduction, we as a state deserve equal access to the resource, no matter what your race/background is. "

Table 7. Continuation…

VERBATIN - General Comments - Urban
"This issue is about the bison restoration. They were there before all of us. Any fees, or at least most of the fees should be for the bison restoration not to make it better for the villages. There are other programs for that. After all, the land belongs to the wild game more than it does to we humans of all type. I own my land but cannot charge others a fee to watch the game that uses it for travel or feeding. Profit is not the name of the game."
"It would have been helpful if you had provided a short summary of the goals and objectives of the restoration's project and an estimate of how much suitable habitat for wood bison exists in Alaska."
"Bison came from Canada (outside) and was raised at Portage. So why should the native landowners get the land fee to hunt them? Also why do the villagers get to hunt them only? Bring the next butch to Knik, that way we could hunt them as Alaskans. That should be the right of every Alaskan. We would use the native people as guides and transportation, $ lodging, etc., so why land use permits?"
"No hunting by non-residents. Permit required for ALL, including locals. Severe penalties for poaching, including loss of ALL hunting privileges, even locals."
"Never should have put herds near a village."
"I hope there is a herd maintained at AWCC – we appreciate this effort and the availability to photography the bison so close to Anchorage."
"Hunting and viewing are both good activities as long as it is fair for all and doesn't turn into a money grab by locals, guides, or land owners, at the bison's expense. Thanx"
"Please understand that I do not hunt and may be too old for even see these wood bison in the wild where they have been moved. But I am very interested in learning about how they are doing and the progress they are making."
"Caution of wood bison = endangered species = restricting land access, moose hunting, travel, etc., in these areas. Concern about control of federal government organizations in regards to all wood bison issues."
"Why not ban hunting of these creatures for many years to come – give them a fair chance to multiply because they are on the brink of extinction. Absolutely, ban sport hunting completely! I am more concerned about the animals being harassed by humans, there is no one to monitor this in remote areas. In Alaska, we have very inadequate animal cruelty laws and poor enforcement of these laws. I would like to see the herd managed by the federal government. I believe the nation would be interested in the wood bison project."
"I like the idea of restored herd of bison and would manage to [*unreadable word*] to obtain a harvest of them. Your booklet is too long to answer and some questions are of repetitive nature."
"No native preference for hunting permits. All Alaskans are equal – even Caucasians from Anchorage."
"Wood bison are beautiful majestic creatures. My hope is that we do not lose sight of this inherent worth in deciding how best to manage them as a commodity."
"I think reintroducing the wood bison is pretty amazing and hope it is very successful."
"I have no idea what the temperament of wood bison is or the likelihood that they will attack domestic animals or residents. I would hope that will be avoided. I am also against hunting unless it is for local subsistence needs. Perhaps if non-local hunters leave a portion of the meat behind to be given to the communities/charities nearby that would be a good option."
"The wood bison have been supported financially with public and private funds. Their resurgence is supported in spirit by a vast majority of Alaskans and visitors. They are 100% a public resource and should be regulated and available for the benefit, equally to all Alaskans."
"The ADN articles are very informative. I am looking forward to spring to learn how many calves are born!"
"Please keep me informed of all proceedings so I may have the option to make/submit comments. Thanks, D. J."
"Fees for 'land use' are asinine. Anyone that uses the land to either harvest of view wood bison that is an Alaska resident has already contributed via taxes or otherwise to this state. If the land is used inappropriately the offenders should be punished accordingly. Any fees from non-residents or otherwise should be given to ADF+G to help management efforts, as they are the ones responsible for creating this income in the first place."

Table 7. Continuation…

VERBATIN - General Comments - Urban
"My problem: I know little about bison in general and absolutely nothing about wood bison! 1) Why is there a need to restock wood bison? 2) If they were here naturally before, why are they no longer here? 3) what is the actual desire of Fish and Game for this program? 4) It is my impression that the state of Alaska does not deem me, Anchorage resident, for hunting and fishing privileges with the rest of the state residents, why is that? 5) Why did a resident population, if there was one, of wood bison disappear? Were they in an area easily accessed by all AK residents like myself? I find it hard to believe that the human general resident population of AK would have been instrumental in their disappearance. If the wood bison was historically a naturally occurring wildlife, I think they should be returned. If they are being returned to provide greater access for a few rural residents, I disagree with the plan! 6) As in 2, if they were here naturally, did they eat themselves out of food? How large an area does bison need to flourish in what kind of territory? Reality to me, I have lived in country where it took less than 6 acres per cow and in areas where six hundred acres were required. It seems to me that we humans have encroached on a lot of Alaska, but there still is a lot of country left. 7) As a state of entity what is the actual reason/desire for restoring the bison? Would I ever plan to hunt bison? Probably not but I might. If you are doing it to provide meat for people who have killed all the game near them, stop! My minimum experience with the people out in the bush, they have better equipment and access than I do. 8) I have hunted sheep in the Talkeetnas and Caribou in the Noatak River. What I saw on the Noatak was the 'subsistence hunters' had large houses, nice boats, aircraft, and used hand held radios to tell hunt members where the caribou were going to cross the river. Better boats than I can afford. My first float hunt on the Noatak, during which I saw several Caribou that had been killed and left. When I reported it, later the resident biologist [*'?' question mark*] called me here at home, accusing me of doing the killing, as her BOY friends would not do such a thing. I was a little perturbed. The state of Alaska may be an equal opportunity employer but is not an equal opportunity provider of access to fish and game! Finally, my feeling is that if one wants to use traditional equipment to subsistence hunt, I am all for it. If they demand to live as well as I do here in the city, use better equipment including aircraft, then let them live in a city. I did not make the choice that they live in the bush! Do not ask a question if you do not want to hear the answer! H. J. K Jr."
"This survey assumes knowledge that the average Alaskan will not possess. I am an attorney – well educated and well-read, but I have no knowledge of these issues. Thus to Google wood bison before even beginning the survey."
"Good luck on your planning efforts."
"I personally do not do the hunting in my family but If able to I'm sure my family members would go. Glad bison are being brought back. Hope it grows and can one day be hunted to feed Alaska families."
"I believe all people are equal and everyone should have the same opportunity to hunt. A lottery system is fair for everyone as long as certain people or groups don't get special treatment."
"I have been favorably impressed with ADFG management of existing plains bison herds and think the wood bison should be similarly managed."
"As I stated in section B3, I believe a cooperative communication with the Canadians managing the Wood Buffalo Park herd would be beneficial."

Appendix 4: Map Illustrating the Extermination of the American Bison

Figure 19. Map Illustrating the extermination of the American Bison, prepared by W. T. Hornaday (Hornaday, 1889).
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