

# An Integrated Assessment & Evaluation Of the Wood Bison Reintroduction Project in Alaska

## Project Report by:

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## **ABSTRACT**

The proposed reintroduction of wood bison *Bison bison athabascae* in interior Alaska (referred to as ‘wood bison project’ hence forward) is motivated by multiple objectives. First and foremost, is the ecological interest as recognized by the Alaska Department of Fish and Game (ADF&G), to restore a locally extinct species to its former ecological system (Stephenson and Rogers 2007). Second, various socio-cultural consultations indicate that wood bison may have existed in the interior of Alaska during an earlier period and Native communities might have subsisted on this resource in the past (Stephenson et al. 2001). Finally, a decline in moose populations and habitat in the Yukon Flats, has opened a window of opportunity to provide wood bison as a subsistence alternative (Stephenson and Rogers 2007). In this context, ADF&G refers to this project as the wood bison “reintroduction” project based on evidence that indicates the presence of wood bison in Alaska within the last 150 years; whereas the U.S. Fish and Wildlife Service (USFWS) uses the term “introduction” based on evidence that demonstrates wood bison have not been in Alaska for a minimum of several hundred years. The use of different terminology is an indicator of a larger ideological divide between these two agencies regarding the wood bison project. This further poses significant questions regarding the social-ecological resilience of Alaskan communities. The goal of our assessment is to determine how the wood bison project will contribute to the resilience of the local-regional social-ecological system. This study intends to perform an integrated assessment of the four components of resilience in the social-ecological system (SES): economic, cultural, ecological, and examines the associated policy framework.

We used a qualitative case study approach and worked towards an integrated understanding of management goals and identification of gaps for the wood bison project, taking into concern the goals and underlying values of a diversity of stakeholders. We conducted this study in two steps: (i) By performing extensive review and analysis of the existing literature and other available documents to understand the above mentioned four components of the SES in focus and identify major information gaps, and (ii) collect new data to fill those information gaps. Data collection was in form of expert opinions (personal interviews) and public perceptions (opinion surveys). We used conceptual models for systems understanding and information synthesis. In addition, we used a SWOT analysis technique, which provided us the required framework to analyze the strengths, weaknesses, opportunities and perceived threats in the proposed project.

This report presents the outcome of this integrated assessment. We have discussed possible implications of the wood bison project on the SES. Further we propose a suite of indicators that could be used to monitor the performance of the project against the projected objectives. Finally, we discuss the project in a theoretical framework of resilience thinking and conclude with a set of suggestions in order to increase the resilience of the project itself. Through open minded communication, synergies can develop and innovative solutions are possible. We hope this report provides assistance to different stakeholders in understanding the complexities of a SES in context of this project; and facilitates discussion towards synergistic solutions.

## **KEYWORDS**

Social-ecological system; subsistence economy; adaptive management; resilience; wildlife policy.

# 1. INTRODUCTION

## 1a. Scientific Issue and Relevance to Integrated Assessment

In Alaska, state and federal agencies, tribal governments, private land owners and non-governmental organizations have been involved in the wood bison (*Bison bison athabasca*) reintroduction process (ADF&G 2007). The proposed reintroduction is apparently motivated by ideas such as ecological restoration, socio-cultural resurrection and to create alternate subsistence resources in light of reported moose (*Alces alces*) population declines (Stephenson and Rogers 2007). Since the inception of the restoration plan, approximately seventeen years back, there have been several rounds of project assessments by the Alaska Department of Fish and Game (ADF&G) as well as independent agencies. Various meetings among stakeholders have led to the identification of several critical issues that are still disputed and need to be resolved prior to the wood bison reintroduction in Alaska, such as the status of the species (as extirpated indigenous wildlife vs. exotic), relocation sites, and ownership and management structures.

The goal of our project is to determine whether and how the reintroduction of wood bison in interior Alaska will contribute to the resilience of the local-regional social-ecological system. This study reviews the prior scientific assessments conducted by various governmental and non-governmental organizations since at least 1998 and provides an integrated assessment and an evaluation of the wood bison reintroduction project. An integrated assessment (IA), as a method for exploring the future problems which may arise (Kruse et al. 2004) is used to understand and map the complexity of the system and identify the 'unknowns'. This study focuses on the analysis of the four components of resilience in the social-ecological system: economic, cultural, ecological, and the associated policy framework.

The specific objectives of this project are to:

- 1) Review prior reports and identify information gaps in the wood bison project assessment;
- 2) Critically evaluate the prospects of wood bison reintroduction in Alaska from the stakeholders' perspective; and
- 3) Identify potential indicators that could be useful in monitoring future impacts of the wood bison reintroduction in the social-ecological system at the local and regional scale.

## 1b. Wood Bison Reintroduction Project Background

The wood bison is a subspecies of the North American bison and are the last subspecies of bison to roam the meadows and forests of interior Alaska and Canada for much of the last 5,000 to 10,000 years (ADF&G 2007). The archaeological records suggest that wood bison were present in Alaska, however their exact spatial and temporal distribution cannot be determined conclusively with the available information (van Zyll de Jong 1986). The oral narratives gathered by ADF&G from Alaska Native elders indicate that the wood bison were used by the native people as an important subsistence resource. ADF&G concludes that the wood bison probably went extinct due to a combination of discontinuity of range, fragmentation and isolation of the bison population, and possibly over harvesting of small migratory herds. Wood bison have not existed in Alaska for at least one hundred years (Stephenson et al. 2001). Currently there are approximately 4,000 free-ranging wood bison in Canada. Canada's National Recovery Plan for

the wood bison recommends that they be restored in Alaska to help secure the future of the subspecies (ADF&G 2007). The ADF&G has taken the lead to restore wood bison in Alaska 'because of the potential for substantial benefits to wood bison conservation and to people' (Stephenson and Rogers 2007).

ADF&G completed the study of the environmental and regulatory issues and proposed decisions for the restoration of the subspecies in Alaska in June 2007. The logic behind the reintroduction of the wood bison in Alaska is based on several factors as stated by ADF&G. First, the ecological consideration to restore a locally extinct species to its former ecological system is one of the foremost motivations behind the wood bison project (Stephenson and Rogers 2007). Second, the socio-cultural factors are that the wood bison: existed in the region earlier, were used by the Native people as an important subsistence resource, and probably went extinct due to a combination of discontinuity of range, fragmentation and isolation of the bison population, and over harvesting of small migratory herds (Stephenson et al. 2001). To provide subsistence alternatives in areas concerned with reported declines in moose populations and habitat is the third factor (Stephenson and Rogers 2007).

The Alaska Chapter of the Wildlife Society, in concert with the Alaska Department of Fish and Game, commissioned a study from an interdisciplinary team of scientists in 1998, to conduct formal population and habitat viability analyses and to design an explicit post-release monitoring protocol (Griffith et al. 1998). The commissioned group recommended that for continued planning purposes, the formal implementation of an interdisciplinary team include representatives from all affected user groups and government agencies. In response to the suggestion of the Wildlife Society, the Alaska Department of Fish & Game created a Wood Bison Restoration Advisory Group made up of a variety of local, statewide, and national interests, to inform the public of the efforts by ADF&G to restore the wood bison in Alaska. Although the Wood Bison Restoration Advisory Group has reached a consensus in their support of the reintroduction of the wood bison, each stakeholder seeks the reintroduction for very different and sometimes competing interests.

## **1c. Present Status of the Wood Bison Project**

There have been preliminary habitat assessment studies that led to the identification of three potential wood bison reintroduction sites. The ADF&G, Division of Wildlife Conservation (DWC) published a review of environmental and regulatory issues and proposed decisions for project implementation referred to as the Environmental Review or "ER". The review of public comment and notice of decision on the Environmental Review was approved by the DWC in December 2007. Based on positive public response at the local, statewide, and national levels, ADF&G will proceed with their conservation and restoration efforts of the wood bison in Alaska (ADF&G 2007). ADF&G is pursuing the required permits from the U.S. Fish and Wildlife Service (USFWS) and the U.S. Department of Agriculture (USDA) to import wood bison from Canada with an anticipated delivery date of mid 2008. There are three potential site locations where the wood bison will be placed after the two years of quarantine are completed. For the purpose of this report, we have limited the discussion to only two of the three locations, Yukon Flats and Minto Flats. This is done because we believe that the issues associated with these two sites addresses the critical differences reasonably. Land ownership is dramatically different

between these two locations. Three thousand eight hundred square miles are available in Yukon Flats for the wood bison reintroduction; sixty-three percent of this land is federally owned, with the remaining land divided between state and private owners (ADF&G 2007). Eight hundred twelve square miles are available for the wood bison placement in Minto Flats, with eighty-five percent of the land being owned by the state and the remainder owned by private land owners (ADF&G 2007).

To ensure a healthy population through additional health monitoring, the wood bison will be quarantined for two years prior to being released in Alaska. It is anticipated that harvest could begin 10-15 years after bison are released into the wild and the time frame depends on several factors like the number of bison originally released and the population objectives. Contrary to an earlier stated intent by ADF&G to provide subsistence alternatives in areas concerned with reported declines in moose populations, the harvest may or may not be classified as “subsistence” although it is intended to ensure that local people are able to harvest some bison.

## **2. METHODS**

### **2a. Primary Data Collection**

Primary data collection was conducted through the use of two survey questionnaires, one a cultural use survey and the other a wood bison reintroduction opinion survey. In addition to the surveys, we conducted detailed interviews with key informants who represented various stakeholder groups.

- The cultural use survey was created in order to assess whether wood bison would be valuable to Alaska Natives as a subsistence resource for food, clothing, and crafts. The survey was administered at the Tanana Chiefs Conference held during the week of March 10, 2008 at both the regional meetings and the craft bazaar. During both events, we invited people to participate in our survey. Respondents were comprised of members from various indigenous communities in interior Alaska, while at the craft bazaar skin sewers were specifically targeted to document the scope and extent of the potential use of wood bison by-products. Before participants agreed to take part in the survey, background information of the study and a consent form were explained thoroughly on an individual basis. Surveys were filled out independently and once completed individuals were given a \$5 honorarium for their participation. We were able to interview 23 people for the *cultural use survey* (8 were male and 15 were female, 22 out of the 23 were Alaska Native).
- The main purpose of the wood bison reintroduction opinion survey was to evaluate whether various constituents were proponents or opponents of the reintroduction and what their main priorities for the reintroduction would be. Participants were selected based on their scientific expertise, experience with the reintroduction project, and their positions as stakeholders. The goal was to collect a wide variety of opinions in order to represent the positions of a diverse set of interest groups. Yet, the survey was by no means a statistically valid random sample and some interests may have been represented

- Informal interviews were conducted with key informants within the Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service as well as scientists at the University of Alaska Fairbanks and the Yukon Department of Environment. In addition to this, interviews with important representatives of rural and urban user groups were also conducted. Many of the key informants were purposefully selected based on their knowledge of the wood bison project and their expertise in ecology, biology, and governmental policies. We consulted with 21 experts to arrive at our integrated assessment.

## **2b. Secondary Information Collection and Review**

An important part of our integrated assessment was to review the different wood bison restoration project reports produced by the ADF&G, which also included a cost-benefit analysis conducted in conjunction with the University of Alaska Fairbanks. Examination of these reports provided crucial information on the background of the project, the major issues involved in wood bison restoration, potential environmental impacts, and laws and policies pertaining to the project. Additionally, we evaluated a key paper focusing on past paleontological and archaeological data gathered on wood bison in Alaska and Canada. This same study also revealed oral history narratives of wood bison in Alaska through interviews with Alaska Native elders. Information presented gave insight to Alaska Natives and their relationship with the historical populations of wood bison. Furthermore, we searched for relevant scientific literature on wood bison conservation, diseases, competition and predation, and climate change impacts in order to critically assess the wood bison reintroduction project. The Alaska Chapter of the Wildlife Society and Wildlife biology students at the University of Alaska Fairbanks had also done two prior assessments on the project, evaluating the ADF&G feasibility assessment for reintroduction of wood bison. These two readings provided supplementary information from an unbiased point of view.

## **2c. Methods of Analysis**

We made use of conceptual modeling to synthesize information and to develop an understanding of the system. “The definition of a model is a description of a system, where system is defined as any collection of interrelated objects, and an object is some elemental unit which observations can be made. A conceptual model is the development of verbal statements and a graphical representation of the system’s objects and their relationships” (Haefner 1996). By creating a conceptual model, the key relationships within the social-ecological system of the wood bison project were better understood. A tool commonly used in the business management field called SWOT analysis was utilized to illustrate the possible threats and opportunities existing with each of the components of the social-ecological system (SES). The acronym SWOT stands for strengths, weaknesses, opportunities, and threats. The SWOT analysis provided useful

information on the data gaps within the wood bison project and the SES. We have presented the complexity of the SES in relation to the wood bison reintroduction through simple models and the information from our primary and secondary data sources is incorporated in the form of a SWOT analysis table.

### 3. RESULTS & ASSESSMENT: Implications of the wood bison project

#### 3a. Ecological Implications

##### *(i) Ecological framework*

Nature is expected to provide us with resources and services necessary for the well-being of present and future generations of human beings. But there are new levels of uncertainties given the threats posed by potential climate change and impacts of expansion of industrial development and human infrastructure. This calls for innovative measures to deal with novel challenges in a more complex world because innovations are akin to survival in a rapidly changing environment (Kofinas et al. 2007). In this case, wood bison restoration is an innovation or an experimental solution that will itself be a driver of change although intentional (Figure 1). Such change would be expected to exert a positive impact on the ecosystem process – increase primary productivity, build system resistance and longevity and thus contribute to its resilience. The ultimate goal would be to push the whole SES at large towards a more sustainable and resilient state.

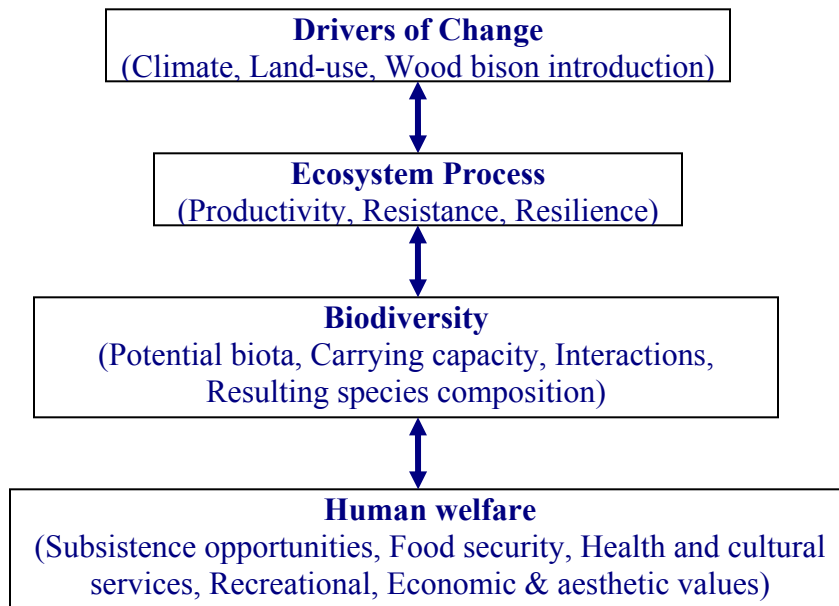


Figure 1: A social-ecological system – A framework for interactions between different levels.

However, there are various natural processes operating in a complex mechanism within the ecosystem. It is very important to understand these underlying processes for various reasons:

- 1) The natural processes as a whole are a mix of several fast and slow processes and can potentially transform the system towards a state which could be more or less beneficial for human consumption;
- 2) Some of these processes and resultant transformations may be irreversible; and
- 3) There can be a lag effect in the action and response. Hence it could be difficult to easily detect the detrimental impacts, which could be a harmful situation in itself.

Therefore, manipulation of a natural system without adequate understanding of the consequences can have undesired outcomes. Moreover, the cost of such an experiment should be justifiable in terms of its intended benefits.

The archeological evidence of wood bison presence in interior Alaska dates back to 1,700 years (Stephenson et al. 2001). In the absence of a species for several hundred years, the ecosystem can transform and shift to a new state. As a consequence, bringing back the species could still be considered as a forced change and hence it could have implications as described above. We assessed the potential impacts of wood bison reintroduction on major biodiversity components in the proposed relocation sites in interior Alaska.

#### ***(ii) Relocation site: Minto Flats State Game Refuge***

Minto Flats State Game Refuge (Refuge) is a large wetland complex encompassing approximately 0.5 million acres and provides excellent habitat for waterfowl, big game, and furbearers, as well as fish species. Being one of the highest quality waterfowl habitats in Alaska, the site supports a high density of duck nesting grounds and produces 150,000 or more ducks annually. As an important spring and fall waterfowl staging area, it sustains one of the largest trumpeter swan breeding populations in North America and high numbers of geese, swans, sandhill cranes, loons, grouse, ptarmigan as well as many species of passerines. The Refuge sustains a large moose population and provides excellent habitat for black bear. It also supports healthy populations of furbearers such as beaver, muskrat, river otter, lynx, wolverine, red fox and mink. The rivers and shallow lakes on the flats combine to make an excellent home for northern pike, burbot and grayling and several species of whitefish and blackfish. Chinook, chum and coho salmon also migrate through the area (Anon. 2008). The refuge was established in 1988 to ensure the protection and enhancement of habitat, the conservation of fish and wildlife, and to guarantee the continuation of hunting, fishing, trapping, and other compatible public uses within the area. The area has traditionally been and remains an important area for harvesting fish, wildlife, and other resources for Athabascan Indians and others living in Minto and Nenana, and also serves as an important fish and wildlife use area for Fairbanks North Star Borough residents (Rosier 1992).

#### ***(iii) Potential impacts of wood bison introduction***

Wood bison can be qualified as a 'potential biota' for this region (Benson et al. 1998). Hence, there is substantial support that wood bison will agree to the ecosystem in Minto Flats State Game Refuge. But there are questions and concerns about how the ecosystem in question will respond to and receive the new guest, namely wood bison. Major concerns are rooted in the lack of scientific information regarding potential interactions of wood bison with other species

inhabiting the region, especially the ones which are particularly important to humans – waterfowl and moose. Some of the major issues that percolate in relation to the impacts of wood bison on other biodiversity are addressed below:

***Moose:*** Moose and wood bison may not compete for resources as there is no significant overlap between their diets and habitat preferences (Cairna and Telfer 1980). Moose are browsers in general, preferring trees and shrubs including willows, aspen, and white birch. Aquatic plants such as water shield, yellow pond lily and pondweed constitute a preferred and important part of the summer diet (Runtz 1996). On the other hand, wood bison are considered grazers, primarily feeding on grasses and sedges (approx. 85% of typical diet) and some herbs. In spring, wood bison typically forage in drier, grassy meadows and shrubby savannahs, where some amount of willow leaves are also eaten (Larter and Gates 1991). However, a possibility of some indirect effects of wood bison on moose such as displacement from preferred habitats should not be discounted.

***Waterfowl:*** Low to moderate levels of grazing is believed to maintain grassland habitats. A long term grazing exclusion study conducted in Fox River Flats found that although there was some nest trampling observed, the grazed areas were more productive and were preferred by waterfowl, however intense grazing had resulted in simplification of plant community composition (Swanson 1999). According to the UAF researcher and waterfowl expert, Mark Lindberg (pers. comm.) there could be some negative impacts at a very localized level due to nest trampling but it is very unlikely that wood bison introduction may have any significant impact on overall waterfowl habitat or population.

***Predators:*** It can be anticipated that there would be less predation on wood bison by wolves and bears as compared to predation on moose because of wood bison being large bodied and group living animals. However, Larter et al. (1994) reported an increase in wolf population size as a result of wood bison population increase in the Mackenzie bison sanctuary, NWT, Canada. Within recent times, wood bison would be a new species in the habitat and therefore it may take some time for predators to learn to tackle wood bison effectively. This may cause a possible displacement of major predators themselves. So even when the predators may not be having a direct negative impact on wood bison, this may cause negative impacts on other species in the ecosystem, since such displacement of top predators can result in “meso-predator release”, which in return may mean indirect negative impact on waterfowl (Crooks and Soule 1999).

***Disease ecology:*** Tuberculosis and brucellosis are major concerns. Individual bison that have been selected for translocation are going through extensive disease testing at Elk Island National Park to satisfy USDA requirements in order to ensure import of a 100% tuberculosis and brucellosis free herd into the United States. Benson et al (1998) reported that there is a potential for disease transmission from wood bison to other species. They emphasized a possibility of transmission of pathogens from wood bison to sheep (*Pasteurella* sp., commonly found in the respiratory tract of wood bison), which may cause high mortality. Other diseases reported in bison include anthrax, anaplasmosis, lungworms, liver flukes, and tapeworms (Benson et al. 1998). A major concern, rooted in the context of climate change is that a warmer climate would have more potential for

invasions and range expansion of pathogens and emergence of new diseases (Kuhn et al. 2005).

***(iv) Impacts of climate change on the habitat***

Climate change is causing significant shifts in ecosystems across the state. Increased temperatures have caused movement of species and species habitats and increased risk of invasive species and devastating wildfires (Bachelet et al. 2004). According to the Alaska Climate Impact Assessment Commission (ACIAC 2008), this increase in temperature may cause longer, more widespread, intense as well as frequent fire seasons in Alaska and could warm interior Alaska river basins; and thus could affect the nutrient inputs in the riparian systems in the interior.

This is very likely to change availability of and accessibility to fish, large mammals and migratory birds on which subsistence users have customarily relied. For instance, the changes in (i) the seasonality of events such as river freeze up and break-up; (ii) terrestrial conditions that influence the access to harvest; and (iii) natural ranges of plants and animals are already having significant impacts on subsistence users' opportunities for customary and traditional uses of fish and wildlife (ACIAC 2008). If wildfires increase in frequency and extent, moose habitat may be adversely impacted over larger areas.

Climate change is likely to cause expansion of grazing lands in the flats in interior Alaska. According to University of Alaska Fairbanks ecologist Terry Chapin (pers. comm.), the climate would be more appropriate for grazing dominated systems in comparison to browsing-dominated systems and therefore, if there is a proposal to introduce wood bison in these habitats, now would be the appropriate opportunity.

### **3b. Socio-political Implications**

***(i) With respect to priority location***

The assumptions and recommendations made by ADF&G are based on the earlier proposed Yukon Flats site. This location provides extensive amounts of high quality wood bison habitat that has been subject to detailed feasibility and cost benefit analysis and public consultation. However, the “Environmental and Regulatory Issues and Proposed Decisions for Project Implementation” released in December 2007 indicated that the priority location for initial wood bison reintroduction efforts was shifted to the Minto Flats State Game Refuge under the recommendation of the ADF&G Wildlife Transplant Policy Review Committee.

The recommendation and decision to shift the introduction site to the Minto Flats State Game Refuge are based on several factors including lower implementation costs because of road access, control by state land managers and the Alaska Board of Game, and the allocation of more time and the opportunity for residents and others to address concerns of the potential impacts of wood bison reintroduction on oil and gas development on the Yukon Flats (ADF&G 2007). While Doyon, Limited (the Alaska Native regional corporation representing the interior) also expressed concerns that introducing wood bison to Minto Flats could have similar impact on oil

and gas development (Jim Mery pers comm), ADF&G maintains the main area of proposed development by Doyon is outside of the Minto Flats State Game Refuge. The Minto Flats location is comprised of state and private land. Plans call for the initial release of wood bison into a holding facility on Alaska Native corporation lands adjacent to the community of Minto. Bison would be expected to eventually reside on state and/or federal public lands.

The argument for establishing Minto Flats as the priority location for initial wood bison reintroduction is not without significant concern. The size of the habitat area is much smaller than the preferred Yukon Flats location and in closer proximity to potential oil and gas development. The smaller habitat size of Minto Flats State Game Refuge presents potential limits to the maximum size of the herd. Where the Yukon Flats could comfortably support a herd of 2,000 or more wood bison, the carrying capacity of Minto Flats is limited to approximately 500 animals (Bob Stephenson pers. comm.). The reduction in available habitat may increase potential for a genetic bottleneck to occur at Minto Flats. However, ADF&G has proposed to use the artificial insemination procedure to address this issue and also that increasing the number of animals initially imported increases the potential for genetic diversity (Bob Stephenson and Randy Rogers pers. comm.). The population density of wood bison will be maintained through game management and harvest policies. Additional concerns related to this, is the potential to trigger the Endangered Species Act and the resulting impact on oil and gas development. Under this scenario, the economic result is a lose-lose situation.

#### *(ii) Cooperative agreements*

The effort of ADF&G to work in close cooperation with local residents and Native organizations in wood bison restoration and management, and cooperative management is on-going. What remains unclear, however, is the status of cooperative agreements with local landowners for the use of land for temporary wood bison holding facilities, which in many cases may be located on Native village and/or regional corporation lands. In most cases, the subsurface rights of ANCSA village corporation lands are held by Doyon, Limited, the regional corporation. It appears that the concerns over oil and gas development or even metallic mining would be further exacerbated by these proposals and contrary to the efforts of ADF&G to resolve these very issues. As noted by ADF&G:

“The wood bison restoration program is not intended to continue indefinitely. The Department must work with local residents and others to implement restoration programs in suitable locations as efficiently and expeditiously as possible, while wood bison stock and other resources are available. We hope that concerns about wood bison restoration and oil development on Yukon Flats can be adequately resolved in the near future so that wood bison can be restored on Yukon Flats while the opportunity exists (ADF&G 2007).”

In this light, a cooperative agreement would direct how a healthy wood bison herd will be maintained given the existing issues over land-ownership between private land-owners and USFWS who maintains the wood bison project is an experiment. As an example, discussions with the Yukon Department of Environment (YDE), who co-manage the Aishihik herd in Canada, declared the wood bison restoration project an unqualified biological success. However,

even after twenty years the co-management effort between the YDE, the federal government, local First Nations, and other relevant co-management boards and councils remains one of the most contentious wildlife management issues in the Yukon territory.

***(iii) ADF&G Cost benefit analysis (CBA)***

The Yukon Flats cost-benefit model presented by ADF&G (2005) is based on a 25 year time horizon and several assumptions made by ADF&G on implementation costs, economic benefits and ‘other direct costs’ generated from experience with bison populations and other wildlife in North America. However, it is unclear whether discount rates are incorporated into the analysis of economic impact. The national economy, current rate of inflation, and increased energy costs have a direct impact on estimates for revenue from tourism, guided tours, and guided hunts and need to be adjusted to reflect current reality. A feasibility analysis or a CBA for Minto Flats has not been conducted. The ADF&G states the following assumption in this regards: 1) with a small herd at about 500 individuals, the cost estimates would be reduced by about half; 2) management and implementation costs would be lower because of easier access; 3) non-consumptive uses/viewing might be greater because of the closer proximity to the road system and population centers and; 4) while the economic impact would accrue at a slower rate it is estimated that revenues will sufficiently off-set the associated costs.

The initial reintroduction plan called for 40 bison to be imported from Canada and released in the Yukon Flats National Wildlife Refuge (YFNWR). As mentioned previously, the YFNWR consists of extensive high quality wood bison habitat and had a feasibility analysis and public consultation completed. Under the current scenario, the ADF&G plans on importing approximately 60 wood bison for release in the Minto Flats State Game Refuge. By increasing the number of bison imported, the harvest rate could potentially accelerate which in turn would generate greater financial benefit than estimated. On the other hand, the smaller carrying capacity of Minto Flats habitat requires an increased need to resolve management issues with the USFWS and private land owners.

In analyzing the assumptions made by ADF&G, various issues have surfaced that apply to the CBA regardless of the reintroduction location/site:

- Based on the assumptions made by the State, the economic impact appears reasonable. However, the economic benefits prove more difficult to ascertain and would require surveys that specifically ask about people’s ‘willingness to pay’ or to estimate how much something is worth to them. The effects of WTP or the economic multiplier would significantly increase the economic impact and benefits as stated in the present CBA estimated direct benefits.
- A clear distinction between economic impact and economic benefit would help to differentiate the money coming into the state compared to the willingness to pay (WTP) associated with commercial hunting and eco-tourism. WTP is considered an economic benefit but not generally a recoverable ‘benefit’ to the state (Table 1).
- The omission of willingness to pay and an economic multiplier in this model further skews the economic benefits. Based on the assumptions made by ADF&G, it is difficult to determine whether the cost of obtaining bison would be cheaper than other big game meats.

- Socio-cultural scenarios need further verification: Where is the market or tannery for bison hides? Are the shipping and tannery costs feasible to enter this market? Discussion with the owner of the Fairbanks Fur Tannery (FFT) reveals that in his many years of business in Alaska, he has never processed a bison hide. On an average year, he will process approximately 12 plains bison capes, but never a full hide. The weight of a raw bison hide makes transporting from the field economically unfeasible. According to FFT, should someone be interested in a smoke tanned bison hide, plains bison hides can be purchased from the Lower 48 at a reasonable cost. The potential for establishing a tannery specifically for wood bison is costly with several permitting processes necessary to address the chemical waste produced by such a facility.

Shifting the priority location for initial wood bison reintroduction to the Minto Flats State Game Refuge (MFSGR), and an increase in the number of wood bison being imported calls for a revised cost and benefit analysis to be conducted since the costs are increasing for the State with no long-term economic impact or economic benefit to be realized so far.

*(iv) Some socio-economic aspects*

Table 1: Potential economic impacts and benefits of the wood bison project in Alaska

<p style="text-align: center;"><b>Potential Economic Impacts</b></p> <ul style="list-style-type: none"> <li>• Hunting license fees</li> <li>• Business license fees</li> <li>• Non-resident hunting fees</li> <li>• Guiding &amp; Outfitting</li> <li>• Lodging</li> <li>• Transportation</li> <li>• Eco-tourism</li> <li>• Service industries</li> </ul> <p style="text-align: center;"><b>Potential Benefits</b></p> <ul style="list-style-type: none"> <li>• Human wellbeing</li> <li>• Food Security</li> <li>• Health/nutrition</li> <li>• Cultural identity</li> <li>• Willingness to pay</li> <li>• Sustainable wood bison herd</li> <li>• Infrastructure development</li> <li>• Traditional knowledge</li> <li>• Recreation</li> <li>• Spiritual values</li> </ul>
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Results from the cultural use survey indicate that currently, moose skin is primarily used for beadwork, slippers, jackets, vests, and gloves. Also, many people are having a difficult time acquiring enough moose hide to meet their needs because it is very expensive and most are purchasing tanned hides from Canadian tanneries. Only one person out of the 23 interviewed had experience working with bison hide. The comments made by this person were, “Bison hide is stronger than moose hide. Both are easy to sew, but I don’t know what bison hide is like when it gets wet.” When people were asked whether they would use bison hide if it were available, 9 said yes and 14 said maybe. The main reason for this result is people have not had the opportunity to use tanned bison hide and would possibly use wood bison if it were similar to moose skin. Our conclusions from the cultural use survey are that many of the people interviewed have neither cultural/traditional knowledge nor prior experience working with bison hide and currently prefer using moose skin. Given the fact that societies are adaptable, we suggest that if and when bison hide becomes available to Alaska Natives there will be some lag in time before the hide will be used for arts and crafts. In addition, if tanned bison hide were to become available and cheaper than tanned moose skin, many people would start using it in their clothing and crafts.

### **3c. Governance Issues**

The Alaska Department of Fish & Game (ADF&G) has been evaluating the possibility of reintroducing wood bison into Alaska from Canada for approximately 17 years. In December 2007, ADF&G completed an Environmental Review (ER) to thoroughly evaluate the impact of wood bison introduction and identified two phases of the project. Phase I is based on the ER and whether ADF&G should move forward with the importation of wood bison from Canada. Phase II involves site-specific planning and working with local residents, wildlife users, landowners and other users to develop a site specific plan to introduce wood bison. The development of a site-specific cooperative management and implementation plan is one of the key steps that has not yet happened but would occur during Phase II.

Introduction of wood bison into Alaska involves a complex myriad of federal and state statutory and regulatory oversight. Two major governance issues are involved with the wood bison introduction. First, the ADF&G must comply with statutory and regulatory importation requirements in order for the wood bison to enter the United States. Second, ADF&G must create a management plan that adheres to federal and state laws. Multiple federal and state agencies have regulatory responsibility over these issues.

#### ***(i) Importation***

The two primary federal agencies involved with the importation of wood bison are the U.S. Department of Agriculture (USDA) and the U.S. Fish and Wildlife Service (USFWS). The importation of wood bison presents a unique situation because they are considered ‘wildlife’ in Canada. In order to comply with USDA importation regulations, USDA must determine that the wood bison are ‘domestic animals’ (Bob Stephenson and Randy Rogers, pers. comm.).

The USDA banned the importation of breeding bovines from Canada up until November 2007 due to concerns of Bovine Spongiform Encephalopathy, also known as Mad Cow disease

(ADF&G newsletter 2007). In November 2007, USDA lifted the ban but placed stringent disease-testing restrictions on any importation of bovines. 9 CFR §93. ADF&G is currently involved in high level negotiations with USDA in order to lessen the severity of the disease-testing requirements. Complying with the USDA disease-testing requirement is not only delaying the importation of the wood bison but also is prohibitively expensive (Bob Stephenson and Randy Rogers, pers. comm.). ADF&G originally planned for the importation of wood bison to occur during the winter of 2007-2008 (ADF&G 2007). Due to the need to comply with USDA disease-testing requirements, the importation has been delayed until at least June 2008 but may not occur until the winter of 2008-2009 because of health issues related to transporting the wood bison in the heat of the summer (Bob Stephenson and Randy Rogers, pers. comm.). This delay may also prevent ADF&G from complying with the USDA disease-testing requirements because the wood bison must remain separated from all other animals prior to their importation.

ADF&G is also required to submit a permit to the USFWS because wood bison are listed as endangered under the Endangered Species Act (ESA) in the United States (ADF&G newsletter 2007). This listing is based on a previous endangered species listing by the Scientific Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (Mitchell and Gates 2002). In 1988, Canada downlisted the wood bison to threatened, but this decision has yet to change the USFWS listing. The permit application to USFWS for the importation of wood bison does not appear to be an impediment to the entry of wood bison into Alaska.

If USDA allows the wood bison to be imported, ADF&G will implement Phase II. The wood bison will be required to remain in captivity and quarantined for two years to ensure that the animals are disease free. This two year time period is critical to the future of wood bison reintroduction in Alaska because of the opportunity to resolve several legal issues regarding the bison's status prior to releasing the wood bison from quarantine.

#### ***(ii) National Wildlife Refuge System Improvement Act of 1997***

Introduction of wood bison into Alaska has been an issue addressed by USFWS since 1991 when negotiations began between ADF&G and USFWS, regarding the reintroduction of the wood bison onto federal land. ADF&G believe that the best habitat for wood bison reintroduction is in the Yukon Flats area where the National Wildlife Refuge is located.

Passage of the National Wildlife Refuge System Improvement Act of 1997 (hereinafter Refuge Improvement Act) affected these negotiations because the legislation defined the overarching mission of the refuge system and mandated the implementation of an ecosystem-based approach to wildlife conservation. The conservation and enhancement of all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered are primary goals of the Refuge Improvement Act (National Wildlife Refuge System Improvement Act of 1997).

In 2001, the USFWS promulgated a regulation entitled: "Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System". The regulation's purpose is to ensure that the 'biological integrity, diversity, and environmental health' of the System is maintained. The regulation also specifically authorizes refuge managers

to implement management decisions “to prevent additional degradation of environmental conditions and . . . . Lastly, it provides guidelines for refuge managers to follow in dealing with external threats to biological integrity, diversity, and environmental health.” 66 CFR § 10, pages 3809-3823.

This 2001 USFWS regulation directly impacted the ability of ADF&G to place wood bison in the National Wildlife Refuge at Yukon Flats. The Yukon Flats refuge manager between 1989 and 2005 “did not believe that the bison had existed in Yukon Flats for 200-300 years and that the ADF&G were introducing and not “reintroducing” wood bison “(Ted Heuer, pers. comm.). In conformity with the federal “Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System,” he promulgated a policy that stated that wood bison could not be placed on National Refuge lands at Yukon Flats (Ted Heuer, pers. comm.). He based this decision on the following information:

- 1) Historical records going back to the founding of Fort Yukon in the 1840s indicate that bison were not a significant component of the ecosystem in at least the last 200 years;
- 2) The most recent physical evidence of bison from the Yukon Flats dates to 1,700 years ago;
- 3) Recent DNA studies indicate that bison numbers in Alaska began declining about 37,000 years ago from changes in habitats and loss of genetic diversity, long before humans were a factor; and
- 4) There are no known cultural artifacts made from bison, no recent kill sites, no early ethnographical records of legends or stories about bison, and no evidence whatsoever that humans played a role in the disappearance of bison from Alaska.

The current federal Regional Director of the National Wildlife Refuge System wrote a letter to ADF&G stating that the agency would not oppose introduction of wood bison onto private lands and would prefer that the wood bison be introduced into Minto Flats which is mostly state land (Mark Bertram, pers. comm.). USFWS see introduction of wood bison as an experiment and want the experiment to occur outside of refuge lands.

### ***(iii) Harvesting Allocations***

The Endangered Species Act (ESA) forbids federal agencies from authorizing, funding or carrying out actions which may "jeopardize the continued existence of" endangered or threatened species (Section 7(a) (2)). It forbids any government agency, corporation, or citizen from taking (i.e. harming, harassing, or killing) endangered animals without a permit. Once a species is listed as threatened or endangered, the ESA also requires that "critical habitat" be designated for that species, including areas necessary to recover the species.” ESA §3(5)(A).

The U.S. Fish & Wildlife Service currently lists wood bison as an endangered species. They based their 1970 designation of wood bison on the status of wood bison in Canada. Since that time, Canada has downlisted the wood bison but this has not changed the listing of wood bison in the U.S. The Convention on the International Trade in Endangered Species (CITES) listed the wood bison in Appendix I in 1977, and downlisted it to Appendix II in 1997 (Mitchell and Gates

2002). This international agreement regulates the import and export of animals for commercial purposes.

In 1998, the USFWS decided not to delist the wood bison from the endangered/threatened species list. At that time, the USFWS analyzed the decision of the Canadian government to downlist the wood bison to “threatened” and determined that the criteria used by the Canadian government did not match the criteria of USFWS. The USFWS stated “at such time when the free-ranging disease-free populations of wood bison meet the recovery plan criteria, the Service may initiate such a downlisting. In the meantime and within available resources, the Service will evaluate the advisability of downlisting the captive population of wood bison from endangered to threatened, with a special rule to allow the import to the United States of captive-bred wood bison ([www.endangered.gov/endangered/pdfs/FR/p981125a.pdf](http://www.endangered.gov/endangered/pdfs/FR/p981125a.pdf)).”

Consequently, the relevant questions are when will downlisting to “threatened” occur and what additional regulatory actions can be taken to minimize regulatory complications from being listed under the ESA? ADF&G propose the possibility of petitioning USFWS for an ESA Section 10(j) rule to designate wood bison in Alaska as an experimental non-essential population if listed as endangered or an ESA Section 4(d) rule to authorize state management and harvest if listed as threatened (Randy Rogers, pers. comm.). If ADF&G decide to request a ruling pursuant to ESA 10(j), that ruling may make it difficult for subsistence hunters to prove the customary and traditional use of wood bison. In the process, the ADF&G efforts might end up as more of a conservation effort that compromises the earlier stated objectives related to socio-cultural factors and provision of subsistence alternative.

### ***State lands***

Nonresident hunters are only allowed to hunt when there is enough game for everyone. When there is not enough game, non-resident hunters are eliminated first. If more restrictions are necessary, seasons and bag limits may be reduced or eliminated for some residents. AS 16.05.258 Tier II Subsistence Permits may be issued when there is not enough game to satisfy subsistence needs. Only Alaska Residents are eligible for Tier II permits. Resident hunters are awarded permits based on their answers to a detailed questionnaire. AS 16.05.258

Due to conflicts with the harvesting allocations of muskoxen, another introduced species in Alaska, the State Board of Game promulgated regulations in January 2006 that specifically state that the Board of Game will “not adopt regulations to determine a hunting season and bag limit . . . for a new species of game introduced in a region of the state, where the species of game does not already naturally exist, until the board determines that there is a harvestable surplus . . . large enough for a hunt for residents and non-residents. (5AAC 85.005).

### ***Federal lands***

Subsistence activities are prioritized differently on federal lands. On federal lands, subsistence users are given priority in harvest allocations if they can demonstrate customary and traditional use. The Alaska National Interest Lands Conservation Act (ANILCA), passed by Congress in 1980, mandates that rural residents of Alaska be given a priority for subsistence uses of fish and

wildlife. In 1989, the Alaska Supreme Court ruled that ANILCA's rural priority violated the Alaska Constitution. *McDowell v. State of Alaska*, 785 P.2d 1 (Alaska 1989). As a result, the Federal government manages subsistence uses on Federal public lands and waters in Alaska and the Federal Subsistence Management Program carries out this responsibility.

In the Yukon Flats area, which includes private lands surrounded by Federal lands, state regulations (both sport and subsistence or tier II) pertain to private lands while federal regulations pertain to federal lands (both sport and subsistence). The hunter is subject to the regulations dependent on land ownership of where they are hunting.

Complex issues develop when there is a shortage of animals to support both sport and subsistence harvest. Mark Bertram, USFWS Wildlife Biologist, described the current situation in Stevens Village in the Yukon Flats area:

“In the western Yukon Flats area Stevens Village petitioned the federal and state governments in 1991 to restrict the hunting of moose due to very low moose numbers. As a consequence, the sports season has been shut down since 1991 and moose harvest is limited to 60 moose being harvested. Under the state regulations, all Alaska residents can apply for a tier II (subsistence) permit to hunt moose in the western Yukon Flats on private or state lands only. Under the federal regulations, only local residents from villages in the western Yukon Flats can hunt moose on federal lands. The sports seasons can be reopened when there is a documented increase in moose (this has not happened and the moose population remains at a low density equilibrium due to predation by wolves, bears, and human harvest of cows). In the case of a low density population, moose and bison would be treated the same.”

Specifics on the number of animals that are needed for harvest, so that both sport and subsistence user groups can participate in harvesting, needs to be addressed in the wood bison management plan. Currently the harvest strategies have not been addressed in the state planning documents for wood bison delivery to Alaska. Meetings with ADF&G, tribal government members and USFWS have echoed the concerns regarding the issue of harvest allocation. At a November 15, 2007 meeting involving Yukon Flats communities, harvest allocations of wood bison was an important issue to the communities represented at the meeting (ADF&G 2007).

Due to these conflicting and complex regulations it is critical that all potential users of wood bison create a cooperative management agreement to resolve the following issues:

1. Allocating harvest when a surplus is present after the herd has had a chance to grow.
2. How big of a surplus do you need to justify having both subsistence and sports seasons opened at the same time?
3. If the herd grows and there is a harvestable surplus of 5 animals, which users will harvest those animals?
4. If the local need can support harvest of 10 bison will local residents petition to shut down any potential harvest by sport users? Especially if the animals are all located on federal lands?

- ADF&G has obtained broad support for the reintroduction of wood bison. However, public support of the wood bison is based on conflicting purposes. Sport and trophy hunters are opposed to a subsistence priority and have already contributed substantial funding, \$50,000, to the wood bison reintroduction efforts. Local residents support wood bison reintroduction for subsistence purposes. ADF&G will possibly also need local community support in order to build temporary facilities for the wood bison on private land. ADF&G hopes to create a cooperative management agreement with all of the stakeholders. Without such an agreement on future use of wood bison as a common resource, introduction of wood bison could create conflict among the various stakeholders and negatively impact the resilience of the socio-ecological system.
- According to ADF&G, the cooperative agreement must include the following components: a) a commitment to manage the herd for population growth to meet all needs for various user groups; b) a determined number of wood bison necessary in order for subsistence hunting to occur; and 3) a defined number of wood bison necessary for non-subsistence hunting. The ADF&G Environmental Review does not discuss management decisions that would need to be made if population growth is slower than expected or threatened.
- How will designation by USFWS implicate Federal and State Game Board decisions regarding subsistence hunting? If USFWS decides to list the wood bison as experimental non-essential populations, will subsistence harvesters be able to demonstrate customary and traditional use?

### **3d. Stakeholder perspectives**

As we mentioned in the methods section, two stakeholder surveys were conducted for this project. One survey specifically targeted Alaska Natives from the interior of Alaska while the second one focused on agencies, scientists and other representatives of various stakeholder groups. Presented here are the results of the opinion survey. The results of our surveys mildly reveal that of the 13 rural artisans who were interviewed, 12 were proponents of the project (92%, Figure 2a). Of these, the majority (69%) wanted to see wood bison used as an alternative subsistence resource. We would like to emphasize here that this does not represent the opinion of Native organizations such as Doyon, Limited, Tanana Chiefs Conference, or Tribal Councils. Furthermore, as shown in Figure 2b, researchers were split down the middle with three being for the reintroduction because it would provide a subsistence resource and 3 being against it, due to the unknown effects. For Figure 2c, employees of the Alaska Department of Fish and Game represented the 67% that were for the reintroduction while the U.S. Fish and Wildlife Service made up the 33% against the reintroduction. In Figure 2d, all of the environmental nongovernmental organizations were proponents of the wood bison restoration project because it is a great opportunity for the conservation of the species.

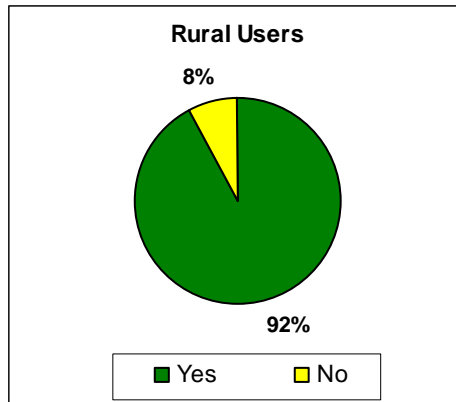


Figure 2(a)

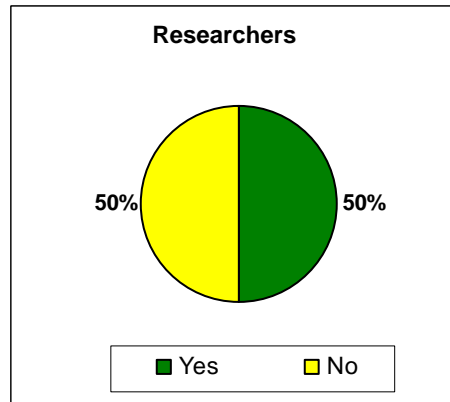


Figure 2(b)

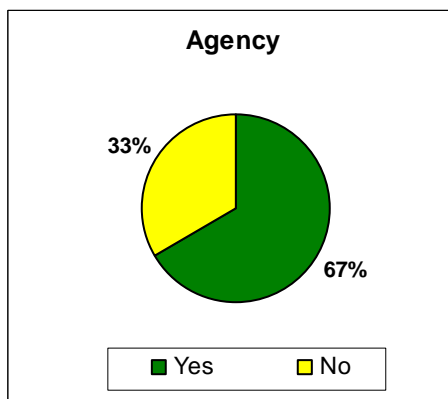


Figure 2(c)

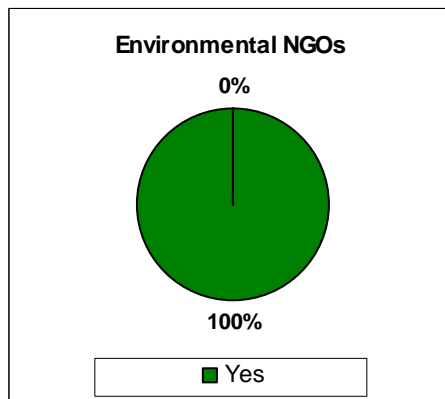


Figure 2(d)

Figure 2: Graphs presenting wood bison restoration - opinion survey results.

The fact that various stakeholders listed different goals behind the wood bison project highlights that there is a lack of consensus among different groups and this could lead to a potential conflict in the future. We would also reiterate the need for transparency and a continued dialogue between different groups regarding goals and perceived benefits of this project. Due to the small sample size of only 24 respondents, it is recognized that our ‘opinion survey’ is by no means complete. However, it offers insight into the need to understand the values and goals of the various stakeholder groups.

### 3e. Synthesis:

The integrated assessment process needs to emphasize the importance of local context in devising and using indicators (Rydin et al. 2003). We collated information and expert opinions about the strengths and weaknesses; and their perceptions of available opportunities and possible threats in the wood bison project. Here we present the information in a category-wise table:

*(i) Findings of SWOT analysis*

We synthesized all of the information gathered through reviewing the reports, surveys and personal communications using the SWOT analysis tool. This has two main benefits – on one hand it provides a simple framework to identify the data and information gaps and weaknesses. On the other hand, it serves as a useful tool to understand tradeoffs among benefits versus vulnerabilities within the wood bison project and the SES. We hope this framework would facilitate discussions among various interest groups (Table 2).

Table 2: SWOT Analysis Framework

	<b>Strength</b>	<b>Weakness</b>	<b>Opportunity</b>	<b>Threat</b>
<b>Governance Issues</b>	<p>1)Trans-boundary collaborations between US and Canada.</p> <p>2)Learning from musk-oxen reintroduction in Alaska - provided useful insights into procedural framework.</p>	<p>1)As of now no clear management agreement or directives in place.</p> <p>2)The delays in feedbacks between different agencies.</p> <p>3)The WB is listed as an endangered species "Endangered in Canada" in the US ESA 1973, which is inconsistent with the Canada Species at Risk Act.</p>	<p>1)Change in relocation site from YF to MF could initially result in simplification of land management issues.</p> <p>2) To establish a "species reintroduction" protocol for future use.</p>	<p>1) Inconsistency between the harvest policy directives by the State and Federal governments.</p> <p>2) There is a possibility that USFWS may go ahead and petition WB listing as 'endangered', which may have adverse implications for WB harvest.</p> <p>3) The above situation may have implications for natural resource development opportunities in the future.</p>
<b>Rural Economy</b>	<p>1)Additional alternate subsistence resource.</p> <p>2)Exotic trophy hunting resource.</p>	<p>1) Hunters in Alaska have limited experience of hunting WB.</p> <p>2)Lack of infrastructure to facilitate hunting (road network).</p> <p>3) Arts and crafts making is not a financially viable prospect at present. No TK* for utilization of WB by-products with communities.</p>	<p>1)Job opportunities - guiding, ground transportation needs, lodging etc.</p> <p>2)Increase in tourism opportunities.</p> <p>3)Potential use of WB by-products in arts and crafts.</p>	<p>1)Competing expectations among different hunters' groups could result in conflicts over resource sharing.</p> <p>2) Access easier for affluent hunters - not good for equity.</p>

<b>Ecosystem &amp; Natural Resources</b>	1) Increase in biodiversity.  2) Strengthening of trophic level - by redundancy of plant consumers.  3) Limited or no predator control required.  4) Conducive to climate change projections of grassland expansion.	1) Small carrying capacity of MF may limit population growth.  2) Lack of information on inter-specific interactions with vegetation, moose, waterfowl & predators.	1) Habitat management - by bringing in a grazer presently missing.	1) Genetic bottleneck, threats from inbreeding.  2) Potential threats of moose displacement and negative impacts on waterfowl nesting habitats.  3) Future threat of contracting diseases and breeding with plains bison.
<b>Cultural Opportunities</b>			1) Native elder meals program - a healthy local food option.  2) Unique cross-cultural sharing of TK* between indigenous communities from Alaska and Canadian North as well as Lower 48.	

\*TK = Traditional Knowledge

***(ii) Indicators of sustainability***

A sustainability indicator captures and measures a particular aspect of sustainability policy in an easily communicated form, allowing monitoring and the subsequent ‘steering’ of policy, whether by internal management or external political pressure. Data on the following indicators (Table 3) would be helpful in examining the links between the ecological, economic, cultural, and political components.

Table 3: List of potential operational indicators for the resilience framework

<b>Ecosystems &amp; NR</b>	<b>Rural Economies</b>	<b>Cultural Foundations</b>	<b>Governance Issues</b>
Carrying capacity	Increase in subsistence opportunities	Opportunities for health and nutrition	State & Federal harvest policies
Impacts on natural habitat eg. moose, waterfowl, predators, vegetation	Job opportunities	Spiritual connections	Agreements for fair sharing of benefits among all stakeholders
Habitat assessments in response to climate change	Infrastructure development	Arts and crafts	Cooperative management framework

These indicators were chosen to represent the social-ecological system and its capacity to attain resilience and sustainability.

#### 4. DISCUSSION: Searching for a resilience framework for the wood bison project

The following synthesis model adopted from the Millennium Ecosystem Assessment (2005, Figure 3.) illustrates the interconnections between the ecological subsystem and social subsystem, which is critically important to understanding all of the ramifications of wood bison relocation in Alaska.

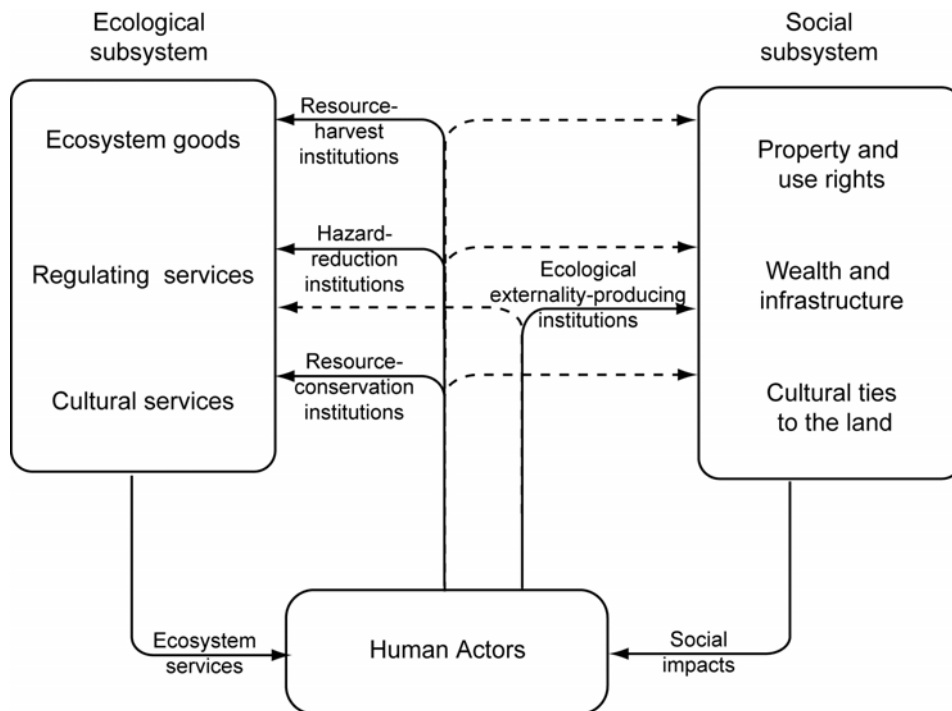


Figure 3. The interconnection between ecological and social subsystems (MEA, 2005).

The rural communities are faced with an evident reduction in subsistence opportunities, which is likely to continue in the future (ACIAC 2008). Subsistence practices are fundamentally adaptive and therefore will facilitate adaptations to changing conditions as well as the flux in available fish and wildlife resources. From the perspective of resilience of subsistence systems, bringing in a species which is well matched with the changing climate would be a worthwhile idea to explore. Bringing redundancy in subsistence options by creating additional food sources could be expected to lend strength to the subsistence resource base and resilience of the SES.

Hence, from a stand point of adaptive management (Kofinas et al. 2007) of resources, there is a potential for the wood bison project. However, how and how much it would contribute to the resilience of the SES is not so quantifiable at present. Also, there are concerns regarding the human carrying capacity. For example, how many people can be fed and how soon and at what

cost? Wood bison could provide a useful resource but this also depends on their availability and accessibility. For instance, if the species doesn't get downlisted in the ESA within two years, then there would be no immediate contributions to the resilience of Alaskan communities.

There is a conflict between the top-down vs. bottom-up solutions for sustainability issues, and the wood bison project is caught between the larger political issues related with policies and governance. The overarching question for decision makers to answer is – *what do we want to conserve*. If we focus on a single component of the social-ecological system, for instance the ecological subsystem, then our objective may be to maintain the integrity and originality of what is considered natural. Then clearly, bringing wood bison in Alaska may not be the most desired step, given the difference in opinions between the federal and state agencies over this issue. However, if we are thinking beyond the boundaries of the individual components (e.g. ecological subsystem) and focusing on the resilience of the entire social-ecological system, then our priorities would certainly include sustenance of a traditional way of life in the rural communities, which still to a large extent is subsistence based, and maintaining a rich resource base. The need of the hour is to focus on the entire social ecological system and not only on its parts. There are crucial feedbacks between *the parts* and *the whole*, and if these feedbacks and interconnections are overlooked, the result may adversely affect the resilience of the entire system in the long run.

*Conservation* as a philosophy is in a revolutionary phase right now (Bawa 2004, Chan 2008). Its ideas are being revisited and approaches redefined in the context of 'climate change'. In light of all new developments and recent information in this arena, it would be worth the effort to redefine the goals behind the wood bison project. The emphasis should be on goals that translate into boosting system resilience and insistence on conserving the present natural species composition in addition to creating newer options. Moreover, since the threats from climate change are more pronounced in the State of Alaska than other regions in the U.S. (ACIAC 2008), it makes more sense to act innovatively and to respond immediately.

Here, it is useful to think about the following circumstances that promote innovations. These are listed by Kofinas et.al (2007) as co-management conditions that facilitate innovative outcomes and are applicable to adaptive management:

- Visionary leadership and positive guidance stimulate innovative approaches to problem solving.
- Appropriate level of heterogeneity & productive friction provide for novel solutions.
- Flexible attitude and a culture that encourages new ideas and encourages risk taking promotes innovation.
- Periods of institutional transformations provide opportunities for novel changes.

In the large SES context, some questions, relevant and worthwhile to ponder are: Are we operating in a system that is rigid and conservative? Is the friction among key stakeholders lacking a constructive thrust? Are the institutions involved too resistant to change? Do we have the right kind of leadership that appreciates and encourages creativity and risk taking?

Having said that, we would like to emphasize that any innovative solution or an experiment at this scale, needs to be reasonable, very carefully crafted and implemented only after understanding its potential consequences sufficiently. There is a need to identify and

acknowledge differences in point of views held by different stakeholders – responsible agencies at the state and federal levels, resource managers as well as user groups. Only through the engagement of stakeholders and open minded communication, can synergies be developed and innovative solutions possible.

If the stakeholders proceed with the wood bison project, then we propose the following set of recommendations to be included in the project plan:

- Resolve the status – Introduction or Reintroduction
- Clarify objectives between different stakeholder groups.
- Establish explicit short and long-term indicators of success or failure of the reintroduction.
- Design an explicit post-release monitoring protocol.
- Fill in the information gaps with further assessments.
- Resolve conflicting state and federal harvest allocation policies
- Start process of formalizing a cooperative management group.
- Objectively assess benefits of wood bison to the SES; it will be necessary to monitor economic parameters that characterize the mixed cash-subsistence economies of rural Alaskan communities.
- Build local capacity for tapping into various economic opportunities.

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## **APPENDICES:**

### **Appendix 1. Informed Consent Form and Cultural Use Survey:**

#### **Description of Study:**

You are being asked to take part in a study about plans to move wood bison to Alaska from Canada. The Alaska Department of Fish and Game, working with tribal councils, hunters, conservation organizations and biologists outside the Department of Fish and Game, is in the process of importing wood bison to Alaska. With this questionnaire, the project team is interested in hearing about your use of subsistence materials for food, clothing and crafts. You are being asked to take part in this study because you have experience and knowledge in these areas. Please read this form, or we can explain it to you if you prefer, and ask any questions you may have before you agree to be in the study. If you decide to take part, you will be asked to answer questions about what kind of food you like, things you enjoy doing or making. If you want, one of us can help you to fill in the form while we visit and talk.

#### **Risks and Benefits:**

The surveys will be used as research information for a University of Alaska Fairbanks class. The information will be reviewed and analyzed by the research team of Miranda Wright, Archana Bali, Marcy Okada and Robin Bronen. The surveys will be stored in Brooks Building room 107B for three years and then destroyed. You and your community and schools will benefit from this study because it will serve to document traditional Native knowledge, experiences, and subsistence preferences. The final product will be available for all participants, communities' members and local schools. The surveys will be conducted during the annual Tanana Chiefs Conference and the Doyon, Limited annual meeting. Interviews will be in English.

#### **Confidentiality:**

The names of the people who contribute will be kept confidential. This information will be summarized by the students and the professor. Your name will not be attached to what you say. The summarized information collected could be used for presentations, reports, and for publications.

#### **Voluntary Nature of the Study:**

Your decision to take part in the study is voluntary. You are free to choose not to take part in the study or to stop taking part at any time without any penalty to you.

#### **Contacts and Questions:**

If you have questions now, feel free to ask us. If you have questions later, you may contact Miranda Wright [ffmhw@uaf.edu](mailto:ffmhw@uaf.edu) (907-474-6344) or Dr. Gary Kofinas at the University of Alaska [ffgpk@uaf.edu](mailto:ffgpk@uaf.edu). (907-474-7078)

**Statement of Consent:**

I understand the procedures described above and I agree to participate in this study. I have been provided a copy of this form.

\_\_\_\_\_ Yes, I consent.

I have received \$\_\_\_\_\_ for participating in the wood bison interview

\_\_\_\_\_  
Signature of Subject & Date

Printed name: \_\_\_\_\_

Home

Address: \_\_\_\_\_

Street, City, State, Zip code

---

Phone number: \_\_\_\_\_

\_\_\_\_\_  
Signature of Person Obtaining Consent & Date

**Appendix 2. Cultural Use Survey questionnaire:**

**Wood Bison Reintroduction in Alaska: An integrated re-assessment and evaluation**

Locator: \_\_\_\_\_

Researcher: \_\_\_\_\_

Date: \_\_\_\_\_

Do not include your name on this form.

1. I live in: \_\_\_\_\_ (Name of village, town, city) \_\_\_\_\_

2. \_\_\_ Male \_\_\_ Female

3. Age group: \_\_\_ 20- 35 \_\_\_ 36-55 \_\_\_ over 55 \_\_\_ over 70

4. I am Alaska Native

Yes

No

5. Things I do regularly:

\_\_\_ hunting \_\_\_ fishing \_\_\_ trapping \_\_\_ skin sewing

\_\_\_ crafts \_\_\_ making tools \_\_\_ beading \_\_\_ jewelry

\_\_\_ Teaching young people about our ways

\_\_\_ Native singing and dancing

\_\_\_ Storytelling

6. I prefer to eat:

\_\_\_ salmon \_\_\_ moose \_\_\_ beaver \_\_\_ bison \_\_\_ beef

\_\_\_ white fish \_\_\_ ducks \_\_\_ ptarmigan \_\_\_ spruce chickens

\_\_\_ caribou \_\_\_ rabbits \_\_\_ other \_\_\_\_\_

7. Do you use skins for crafts? \_\_\_ Yes \_\_\_ No \_\_\_ Sometimes \_\_\_ If available

8. What kind of skin do you prefer using for:

Beading \_\_\_\_\_ Gloves \_\_\_\_\_

Slippers \_\_\_\_\_ Vests \_\_\_\_\_

Jacket \_\_\_\_\_ Other \_\_\_\_\_

9. If they say they use moose ask -- > Do you currently have trouble getting enough moose hide to meet your needs? \_\_\_ Yes \_\_\_ No

10. Have you had experience using bison hide? \_\_\_ Yes \_\_\_ No

11. Would you use bison if it were available? \_\_\_ Yes \_\_\_ No \_\_\_ Maybe

12. If you had a choice between bison and moose hide, which would you prefer? (circle one)

13. What things would you make from bison if it were available?

\_\_\_\_\_

### **Appendix 3. Wood Bison Restoration Opinion Survey**

**1. Should wood bison to be introduced into Alaska?**

- a) Yes;
- b) No;
- c) Neither of the above.

**If you answered “yes”, to question #1, please answer questions #2 - #4.**

**2. Why would you like the wood bison to be introduced?  
(Please rank from 1-5, where 5 is highest priority)**

- a) For conservation of wood bison species.
- b) Create alternate subsistence hunting option for rural people.
- c) Create additional economic opportunities for local people.
- d) Alternate hunting option for hunters of all categories (rural, non-rural, sport)
- e) Increase overall opportunities in the State – tourism, recreational, economic

**3. How will this benefit you?**

**4. How do you see your organization/ yourself contributing to the management of wood bison in Alaska once they are brought in?**

**5. If your answer to question 1 was “no”, please specify the reasons.**

