MOOSE (Alces alces) BROWSE ENHANCEMENT AND SUSTAINABLE FORESTRY AS A RURAL DEVELOPMENT TOOL IN THE SUB-ARCTIC BOREAL FOREST REGION OF ALASKA

AN APPLIED COMMUNITY DEVELOPMENT PROJECT

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By

Bruce David Cain, B.A., A.A.

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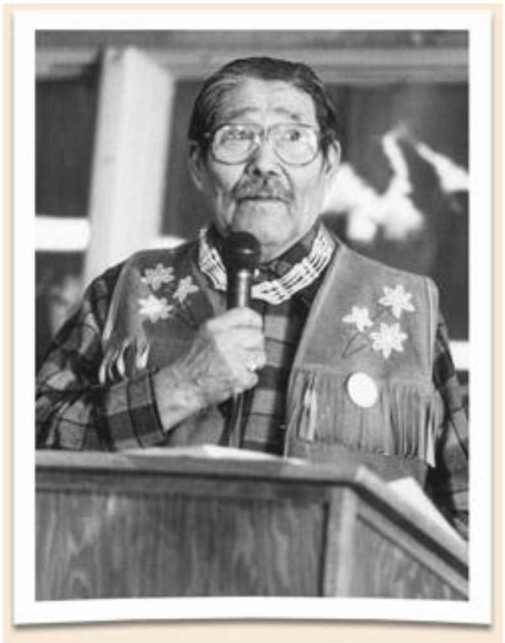
Abstract

This project studies indigenous and western moose browse management issues in the sub-arctic boreal forest and how this topic relates to rural development. Chapter one explains the methodology of the project. Chapter two describes how moose browse and biomass management support rural development and investigates productivity potential of combining moose browse management with sustainable forestry and biomass production. Chapter three investigates landscape and habitat management principles from a customary and traditional practice versus a scientific approach. It looks at management models in the following territories: Alaska, Canada, Continental US, Mongolia/Russia and Scandinavia. Chapter four investigates indigenous wildlife management systems and other indigenous wildlife policy issues. Chapter five is a selected annotated bibliography.

The project has a focus on the Ahtna region of central Alaska and recognizes the implications of these issues for this region.

In Memoriam

Walter Charley was a man who inspired many across cultural and technical boundaries. He was born in a traditional Ahtna family in 1909 at Wood Camp near the mouth of the Klutina River in the Copper Basin. He learned and successfully adapted from a background of hunting and trapping through the development and shut down of the Kennecott copper mines, the surveying and construction of the Alaska, Richardson and Glenn Highways; and the trans-Alaska pipeline through his homelands. One of his greatest passions was protecting customary and traditional hunting, fishing and trapping rights for the Ahtna people. In 1992 he challenged me by saying "you are interested in subsistence, you should get involved." I thought to myself, I am the most inappropriate person to be asked to take on such a task. My background is of Irish decent. I was born in Oregon and moved to Alaska when I was 12. This did not provide the cultural knowledge, family ties or other traditional experience that was needed for the job. My formal western education was all wrong as well. I had a degree in accounting and worked in finance. This was not exactly the ideal training and background needed to deal with the significant resource management, cultural and political issues that would be presented. Walter passed away less than three months after this conversation. I was left wondering what I would do about his call to action. A speech that he gave to bring unity at a Copper River Native Association annual meeting in 1991 came back to me. It went like this:



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"Some of us see the rough water we are in and are afraid and want to jump out of the boat. Let me tell you, when the water is rough, the safest place is right in the middle of the boat." He paused longer than expected. Then he shouted. "When I was young!" People snapped to attention. He continued after another pause; "and we were in the river; and the water was swift. We all had to paddle together!" Walter paused again. He took the time to meet the eye of every person in the audience. The room was silent and intensely focused. He almost whispered and drove the message quietly and clearly into every heart. "It was a matter of life and death."

That was the way Walter Charley was. He wanted everyone no matter who we were to work together. It took many years to get around to answering Walter's challenge in a way that I felt would help. The UAF rural development master's program provided structure and a way to put this call into action. The result is this project. I hope that this paper in a small way will serve to answer, respect and do some good in regard to Walter's request to become involved. My hope is this work will help all of us in Alaska stay in the boat and paddle together. The issue is a serious matter. Maybe even a matter of life and death.

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Chapter 1 Methodology Paper

1.1 Introduction

This project investigates how to improve the productivity of moose habitat in rural Alaska and how to use this productivity to improve the standard of living in rural Alaska communities. The project summarizes and analyzes the subject from the rural development point of view. This paper looks at ways to improve local production of healthy food, low cost energy and jobs in rural areas. These three issues, food, fuel and jobs are among the most pressing for rural Alaska and many other communities throughout the sub-arctic boreal forest (Alaska Federation of Natives, 2012). The focus of this effort is to provide hope for the future by working with what used to be an abundant resource in this region, moose. Many aspects affect moose populations and productivity, but the combination of sustainable forestry with moose browse enhancement seems to be a way to efficiently and dramatically increase production of both biomass fuel and moose habitat (Interior Alaska Moose News, 2011). This study strives to bring together in one place the ideas needed to implement a solid program. The result is expected to be increased supply of moose meat, biomass fuel and culturally appropriate rural jobs. Policy and community organization tools are also evaluated and analyzed. The project also has an annotated bibliography of selected works on the subject of moose and moose habitat management.

1.2 Family background of the author

The author, Bruce Cain was born in The Dalles, Oregon in 1957. His father was a World War II combat veteran who brought his family to Alaska when he took a job with the State of Alaska Division of Corrections in 1970. His mother worked as an executive secretary for Governor Bill Egan, was special assistant for Governor Sheffield, and worked as an executive assistant at the University of Alaska, Fairbanks.

His grandparents on his father's side were Vincent and Mary Ellen Cain. They spent most of their life in the Willamette Valley of Oregon running a family owned sawmill. His grandparents on his mother's side were Harrison and Gertrude Gilmore of Toledo Oregon. Harrison Gilmore worked in sawmills in Toledo most of his life.

Christine Craig adopted the author into the Naltsiine Clan. Christine's parents were the late Walter and Mamie Charley. Walter was from Wood Camp area near Copper Center, Alaska. Mamie's mother was from the Chitina area in central Alaska. Mamie's father was Joe Bell.

Bruce lives in Glennallen, Alaska with his wife, Shirley. Together they have seven children and nine grandchildren. Bruce also has a brother and a sister in Anchorage and a large extended family in Alaska, Oregon and many other places.

1.3 Business, education and professional background of the author

The author, Bruce Cain graduated from Lathrop High School in Fairbanks, Alaska in 1975. He earned an associate's degree in accounting from the University of Alaska Fairbanks (UAF) in 1980 and a bachelor's degree in accounting from UAF in 1984. Since graduation, Bruce has worked 30 years in finance and management for Alaska Native Villages, regional native non-profits and Alaska Native Claims Settlement Act (ANCSA) corporations. He is currently working as the Special Projects Manager for Ahtna Incorporated. The author has spent a significant amount of time and effort on management and allocation of fish and wildlife resources as it relates to Tribes on the Copper River. This has given him an opportunity to gain a small understanding of the pressure and conflict involved in the takeover and assimilation of this culture and its resources by industrial and sportsman interest groups (CRITR, 2013). The moose browse enhancement idea was developed as a positive means to focus on improving the resource and management input instead of struggling over who gets to harvest every moose.

1.4 Goals of the author

The author's academic goals are to obtain a Masters in Rural Development by May of 2014 and continue studies with a goal to earn a Ph. D in Economics. His desire is that the skills learned through this academic process could be used to improve the rural communities in Alaska.

The author's goals for this project follow.

- Restore the Moose population and productivity in the Ahtna region in a way that the Ahtna people will be able to manage this resource for the betterment of the Ahtna communities.
- Reverse Outmigration. A goal of this project is that it will help create a positive economic environment that will reverse outmigration and help the Ahtna region's population grow in a healthy way.
- Produce Healthy Food. A project goal is to produce more moose so that everyone has access to more moose for food.
- Produce Affordable Energy. A goal of this project is that it will help produce affordable heating fuel from biomass.
- Create Jobs. The goal of this project is that these ideas will be implemented to create culturally appropriate jobs for rural Alaska.

1.5 How the author came to choose this project

This project was developed over a period of years while working with people who are involved in the Alaska subsistence debate. The in-memoriam page, relates how I was asked to become involved in this issue in 1992 by an Ahtna elder. The approach this project takes is different from many of the legal, political and allocation disputes (CRITR, 2013). The idea is to use moose browse enhancement to improve moose productivity and combine it with sustainable forestry and biomass fuel production to create a local supply of healthy food, affordable fuel and local jobs. A program developed from this idea is sustainable because it uses species indigenous to Alaska such as Feltleaf willow (Salix alaxensis) and moose to provide needed food and fuel resources for local communities. It is also hoped to be a culturally appropriate model of production. Moose are a very significant part of the Ahtna culture. Ahtna families, elders and youth are culturally in tune with ways to sustainably manage, harvest, and distribute moose (Simeone W. E., 2006).

It is hoped that this approach will make life in Alaska better for all citizens by improving productivity and resources available and by reducing the substantial effort that is currently being put forth in legal and political expenses. During the years 2000 to 2010, I observed the success of moose habitat research that was started by the US Forest Service on the Copper River Delta (Stephenson, Van Ballenberghe, & Peek, 1998) while working for the Native Village of Eyak. During this time, I learned about the moose translocation project on the Copper River Delta where 24 moose calves were successfully transplanted from the Kenai and Mat-Su areas, raised in Cordova and released on the Copper River Delta during the period of 1949-1958. From this small herd over 4,800 moose have been harvested by hunters between 1965 and 2008 and the herd is over 1200 moose. (Crowley, 2010) The hunt in GMU 6 is managed with a combination of a registration hunt, a subsistence-drawing hunt and an open hunt (Crowley, 2010). This is in contrast to the intensive moose management and participation system in the Ahtna region (Tobey & Schwanke, 2010). This game management unit also experiences lawsuits, user conflicts and complicated restrictions (United States Senate, 2013) and (McDowell v. Alaska, 1989). I returned to the Ahtna region in 2010 and started to study how the situation could be improved with better local input and more productive management of the moose and habitat. 2010 is also the year I entered the Rural Development Master's program. The focus of my study has been on the issue of moose browse management as a rural development tool.

1.6 Research Methodology

The project methodology included using my experience, classroom work and researching the literature on the subject. I also gained information by participating in board meetings for the

Alaska Moose Federation, attending village council meetings in the Ahtna Region, attending Alaska Board of Game (BOG) meetings and participating in other moose, wildlife management and forestry meetings. As part of my employment duties, I have worked with a board of village appointed representatives to form the Copper River-Ahtna Inter-Tribal Resource Conservation District (CRITR), a regional tribal soil and water conservation district serving the Ahtna region. The focus of CRITR is to promote wise and productive management of wildlife, fish and plant resources in the Ahtna homeland (CRITR, 2013). Course work on rural development strategies and community based participatory research helped direct the effort.

The research has evolved into five chapters. Chapter one explains the methodology of the project. Chapter two describes how moose browse and biomass management supports rural development and investigates productivity potential of combining moose browse management with sustainable forestry and biomass production. Chapter three discusses landscape moose habitat management models in the subarctic boreal forest region. Chapter four investigates indigenous wildlife management systems and other indigenous wildlife policy issues. Chapter five is a selected annotated bibliography.

These chapters are presented as a community development project and are intended to comprise a handbook that rural communities can use to get a better understanding of the issues.

1.7 Results and Outcomes

Chapter two evaluates the impact of willow biomass productivity improvements on an example thirty-six square mile township. Many Alaska Native Villages could access this amount of land through their ANCSA Village Corporation[1]. The potential annual economic impact of biomass management from savings over fuel oil on such a thirty-six square mile township is $1,188,288 for conversion by shear blading with natural regrowth and $9,506,304 for conversion and cultivation practices.[2]

Chapter two also evaluates the impact of moose browse enhancement using the same thirty-six mile township for illustration purposes. The potential annual economic impact of moose browse enhancement from the value of the meat is $69,120 for conversion by shear blading with natural regrowth and $3,317,760 for conversion and cultivation practices.[3]

Chapter three looks at various habitat management jurisdictions and their effectiveness. There is a tremendous difference in population and harvest per square mile between Scandinavia and Alaska and Russia. The harvest rate per square mile in Scandinavia is ten times higher than Game Management Unit 13 (GMU 13) and forty four times greater than Alaska overall. A comparison of Alaska and GMU 13 to Scandinavia and Russia is as follows.

[1] See 42 USC Chapter 33 for ANCSA village land selection formula
[2] See Table 4
[3] See Table 5

Table 1 Moose population and harvest statistics comparing Alaska and the Copper Basin to Scandinavia

Data Item	Alaska[4]	GMU 13 (Copper Basin)[5]	Scandinavia	Russia
Area - square miles	571,000	23,367	283,000	5,559,871[6]
Moose population	200,000	16,245	300,000	608,167
Moose harvest	8,000	996	124,000	Not available
Moose population per square mile	0.35	0.70	1.06	.11
Moose harvest per square mile	0.01	0.04	0.44	Not available

Chapter four looks at different systems that involve indigenous people in wildlife management decisions. The models vary in a continuum from full indigenous rights to nearly autonomous western government decision making authority. Models range from informal working groups to formal coordinated indigenous agencies with research, regulatory, allocation and enforcement authority. The groups evaluated are listed as follows.

- Alaska Eskimo Whaling Commission
- Togiak Moose Management Plan
- Yukon-Innoko Moose Management Plan
- Yukon Flats Cooperative Moose Management Plan
- Native Village of Eyak Tribal Sea Otter Management Program
- Western Arctic Caribou Herd Cooperative Management Plan
- Waterhen Moose Management Project
- Confederated Salish and Kootenai Tribes-State-Tribal Fish and Wildlife Agreement
- Private Lands Wildlife Management
- Listing of other co-management examples for further study

[4] Source Alaska Department of Fish and Game
[5] See (Tobey & Schwanke, 2010)
[6] Moose habitat used for Russia, total area used for Alaska and Scandinavia

1.8 Lessons Learned

Chapter two concludes that combining moose browse management with sustainable forestry is a substantial opportunity for the economy of the sub-arctic boreal forest (Wurtz & Zasada, 2001). The potential to provide healthy food, affordable heating fuel and jobs is great[7].

Chapter three reveals that the moose habitat productivity in Scandinavian Countries is much higher than Alaska. There are places, such as Russia that the moose habitat productivity is lower than Alaska. We also learn that the fee simple land ownership status established by the ANCSA is a great opportunity to develop moose browse enhancement and biomass production on private lands. The chapter notes that this would be a big shift in emphasis for Alaska's current management policies and practices.

Chapter four recommends that Alaska Natives can and should become more involved in the natural resource management decision-making process (Osherenko, 1988). A way to test this is with a demonstration project for an indigenous wildlife management board in the Ahtna region. On a continuum of indigenous vs. western government decision making authority, the Ahtna region is about as far to the western government side as you can get. Most other jurisdictions allow more authority for wildlife decision making by indigenous groups than in the Ahtna Region of Alaska.

[7] See Tables 4, 5 and 6.

1.9 Process of how the project evolved over time

I first became aware that I would be involved in indigenous hunting and fishing rights in 1992. As I worked specifically on contentious moose management and allocation issues over the years, a thought came to some of the leaders that there had to be a better way (Morehouse & Holleman, 1994). People became weary of the conflict, court battles and expense. People began to talk about ways to improve the productivity of the land and ways to provide for stewardship of the resource by the indigenous people who manage and live off the land (Lockyer, 2013). As I entered the rural development program in 2010, the idea of moose browse enhancement as a rural development tool was put forth as the subject of my project. It evolved from a moose browse land productivity exercise into a rural development strategy. The strategy involves food, fuel and jobs; and addresses the technical, political and cultural aspects of implementing the idea. This project report is the result of that process.

1.10 Why and how that evolution took place

Landscape habitat management is a complex issue. To be successful, rural communities need to approach this issue methodically and with a solid strategy (Stoecker, 2006). I thought that there would be unanimous support for growing more moose, improving land productivity, providing low cost fuel to rural residents and jobs in rural communities. I was surprised to find out that not everyone agreed. The subject area affects land use, allocation of resources and political power (Stoecker, 2006). It is not just simply grow more moose and willows and everyone is happy. As a result, the project evolved to address not only the resource economic issues but also the

management, political, legal and policy issues. I found out that these areas all affect rural development (Dickerson, 2002).

1.11 Discussion of expected results and benefits

This project could be used to develop a plan in any community in the subarctic boreal forest and in particular rural Alaska for improving moose and biomass productivity. This project also shows ideas on how to shift the benefits of this improved resource productivity to local communities. The results of this research indicate that the potential for moose population and harvest improvement is more than 10 times higher than Alaska's current management objectives and more than 100 times higher than some areas in the Ahtna region[8]. A 36 square mile township example area has the theoretical potential to produce 922 moose with an annual harvest of 276 moose worth $3,317,760. This is in contrast to current conditions in parts of the Ahtna region where only 7.2 moose survive in the same 36 square mile area and only .32 moose per year can be sustainably harvested worth $3,802. In addition, there are often lawsuits over who gets the .32 moose (Manning v Alaska, 2010). The difference in productivity and value is substantial if this is extrapolated over large areas of currently unmanaged boreal forest. Improving productivity can reduce the intensity of the conflict but there also has to be a change in access and involvement of indigenous people in the decision making process. Otherwise, the same conflict will continue on a larger scale over more resources.

[8] See Table 5

The biomass production opportunity gap is similar in scale to the moose resource opportunity gap[9]. A 36 square mile hypothetical township has the potential to produce 46,080 dry tons of biomass on an annual basis in addition to providing browse for moose. This is worth $13,824,000 at $300 per ton and would displace $23,330,304 of heating oil from fossil fuel for a net savings annually to rural residents of $9,506,304. This annual positive benefit is nearly $13 million dollars[10].

The benefits from improved moose productivity are in the form of a healthy food supply that is available, affordable and culturally acceptable. The benefits of biomass fuel production are in the form of an affordable and sustainable fuel supply. This in turn will improve the standard of living and reduce outmigration from rural communities. Jobs will also improve the standard of living and provide a way for families to prosper in rural areas. The political and organization ideas will help insure that members of rural communities benefit from the production and that local people have a voice on boards and commissions that set policy, harvest regulations and allocation.

1.12 Conclusion

Intensive management of interior Alaska lands for moose habitat and productivity can provide needed food, fuel and jobs for Alaska's people. The positive economic benefits and resulting jobs have the potential to provide a substantial positive improvement over the current conditions. In Alaska and particularly the Ahtna Region, it is also important for rural communities to

[9] See Tables 4 and 5
[10] See Tables 4 and 5

become more involved in the policy process for wildlife management, harvest and allocation. The methods suggested by this report can have a positive effect on production of more moose and biomass fuel and it can insure that rural communities have a voice in how these resources are utilized. The implementation of moose browse management through sustainable forestry and biomass production is an important way to improve the future of rural Alaska.

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Chapter 2 Biomass management, moose browse and rural development

2.1 Introduction

Chapter 2 explores the idea that biomass management methods combined with sustainable forestry and wildlife habitat management can improve land productivity in the sub-arctic boreal forest. This in turn has the capability to improve production of biomass heating fuel and moose in rural communities. This would reduce the cost of living and improve the living conditions in these communities. The chapter is organized into three main topics: 1. Production of affordable heating fuel, 2. Improved moose productivity and 3. creation of rural jobs.

The chapter concludes that the production of biomass heating fuel and moose browse have the potential to increase tenfold with natural regeneration after converting late stage succession boreal forest to more productive early succession willow and poplar. An additional tenfold production improvement is theoretically possible with cultivation practices of willow. Heating fuel costs to rural residents have the potential to be reduced by 40% with development of a biomass pellet industry.

2.2 Biomass management for production of affordable heating fuel.

Rural Alaska has astronomical costs for heating oil. Heating fuel prices in interior Alaska January 2013 ranged from $4.12 to $10.00 per gallon with an average price of $6.70 per gallon as shown on the following table (Alaska Division of Community and Regional Affairs, 2013).

Table 2 January 2013: On the Road System and Off the Road System Heating Fuel Prices in the Interior Alaska Region[11]

Range	On Road System	Off Road System
High	$5.00	$10.00
Low	$4.12	$5.00
Average	$4.40	$6.70

People used to heat small cabins with firewood (Wade & Davis, 2002-2004). Recent advances in rural housing have put much higher energy demands on everyday living as well as motivating the use of imported fuel oil instead of locally available fuel sources (Alaska Federation of Natives, 2012). In recent years, fuel prices have soared and local economies have suffered. The tremendous outflow of oil dollars from the local economies far outstrips the ability of the communities to support it (United States Senate, 2008). As a result, the author has observed people in the Copper Basin have turned back to local sources of fuel, mainly firewood. Those who have not done so are greatly impoverished, forced to rely on government handouts or move to urban areas.

The sub-arctic boreal forest is a very productive source of biomass. It has been exploited to a much lesser extent by commercial logging due to the small diameter of trees, remote logistics and long growing time between harvests (Wurtz & Zasada, 2001). Indigenous people have fit into the pattern of succession and managed the boreal forest successfully for centuries. There is abundant heating fuel from forest fires. Fire killed spruce has been a traditional heating fuel for indigenous people for centuries (National Wildlife Refuge System, 2007). The market for firewood has gone up along with other energy costs but it is still much more affordable than heating oil (Fay, Meléndez, & Pathan, 2012). The following table summarizes 2013 fuel cost options for interior Alaska.

[11] Source Alaska Division of Community and Economic Development

Table 3 Other fuel sources available to rural Alaska[12]

Fuel Source	Price	Cost/ Million BTU	% of Fuel Oil	Price Reference
Wood Pellets	295/Ton	18.44	60%	Superior Pellet Web Site 9/21/13
Firewood (Interior AK White Spruce)	200/Cord	11.05	36%	Author experience with Glennallen market 9/2013
Fuel Oil #1	4.15/Gallon	30.97	100%	Crowley Glennallen Delivered 9/2013
Trucked Liquefied Natural Gas[13]	23.75/TCF	23.75	77%	FNG Quote 9/2013
Electricity	0.3172/KWH	92.97	300%	CVEA Average Copper Basin Consumer Price Worksheet
LPG	4.25/Gallon	46.30	149%	Hub of Alaska Quote
Coal	165/Ton	9.48	31%	Chena Power Quote

From this analysis of current conditions, firewood is running 36% of the comparative cost per BTU of fuel oil and biomass pellets are running 60% of the comparative cost per BTU of fuel oil. Price levels have gone up quite a bit but the ratio between fuel sources has been stable over a long period. Coal is running a little cheaper than firewood and deserves further study. However, coal cost/benefit analysis is beyond the scope of this paper.

[12] Energy content of fuels in Alaska taken from the UAF Cooperative Extension Service, Wood Energy Content web page http://www.alaskawoodheating.com/energy_content.php. Appliance efficiency for each fuel type taken from the Pellet Fuels Institute fuel cost comparison web page http://pelletheat.org/pellets/compare-fuel-costs/

[13] Natural gas is generally not available in rural Alaska but is shown for comparison.

Currently dry firewood in the Copper Basin in cordwood lengths goes from $150 to $250 per cord according to the author's experience buying firewood from 2011 to 2013. This is up from $80 to $100 per cord four years ago. In other parts of the state firewood, prices have increased as well. For customary and traditional harvesters, the market cost of maintaining a vehicle and vehicle fuel has gone up significantly and there is more competition for the resource. This is still the most viable long-term fuel source because it is locally available and it is renewable. Another advantage of local firewood is that most of the dollars spent on firewood stay in the community. Over the long term, in the many parts of rural interior Alaska and certainly in the Copper Basin, developing an efficient supply chain of biomass products including firewood and manufactured compressed wood products makes sense. This is especially true when the benefits of wildlife management are added to sustainable forestry practices as a part of the system.

Compressed wood products such as pellets, bricks and pucks also can be made from locally produced waste wood or brush that is generated from clearing projects, wildfire fuel breaks and moose browse enhancement projects. There is a mill in Fairbanks that is selling pellets for $295 per ton[14]. The Gulkana Village Council is building a pellet plant and is seeking funds to add a brick press to its line. The expected cost of production per ton is $245 and the current market price is $300. This is based on a small volume of 1,673 tons per year (Gulkana Village Council, 2011). The cost per ton could be significantly reduced if the volume is increased to a moderate scale of 5,000 tons per year. Interior Alaska has the production potential to supply its village energy needs locally. The following table shows the biomass potential on one 36 square mile township.

[14] See http://www.superiorpelletfuels.com/

Table 4 Comparison of possible biomass fuel available from one 36 square mile township

Item	Unmanaged	Managed conversion by shear blading natural regeneration	Conversion and cultivation practices
Willow Annual Growth Late Succession Boreal Forest[15]	Minimal	½ dry ton per acre	4 dry tons per acre
Potential Biomass Heating Fuel one 36 square mile township 50% conversion factor	Minimal	5,760 dry tons	46,080 dry tons
Value of biomass fuel at $300 per ton	-	$1,728,000	$13,824,000
BTU equivalent cost of fuel oil at $4.15 per gallon	-	$2,916,288	$23,330,304
Annual savings to rural energy consumers	-	$1,188,288	$9,506,304

Mani detailed the production costs of a 45,000 annual ton biomass plant at $50.57 per ton which included $19.97 per ton for raw materials (Mani, Sokhansanj, Bi, & Turhollow, 2006). This level of input product could be produced on one 36 square mile township if cultivation practices produced 4 tons per acre and 50% was converted into biomass pellets. According to recent studies at the University of Alaska Fairbanks, 4.5 tons per acre of willow is feasible. (Garber-Slaght, Sparrow, Masiak, & Holdmann, 2009)

The most affordable sources of biomass for compressed wood products are by-products from other activities. Traditionally this is from sawdust, limbs and other waste products from the lumber industry. In many parts of the sub-arctic boreal forest including rural Alaska, the lumber

[15] (Garber-Slaght, Sparrow, Masiak, & Holdmann, 2009)

industry is very small or not in existence due to the effort needed compared to areas with higher producing forests. This limits activities that could make biomass byproducts available inexpensively.

Moose browse enhancement especially on private lands is a possible source of biomass that can be provided as affordable inputs for compressed wood manufacture. Another source could be material incidental to constructing and maintaining fuel breaks around communities. This could potentially be supplied to a biomass producer in the field for under $10 per ton.

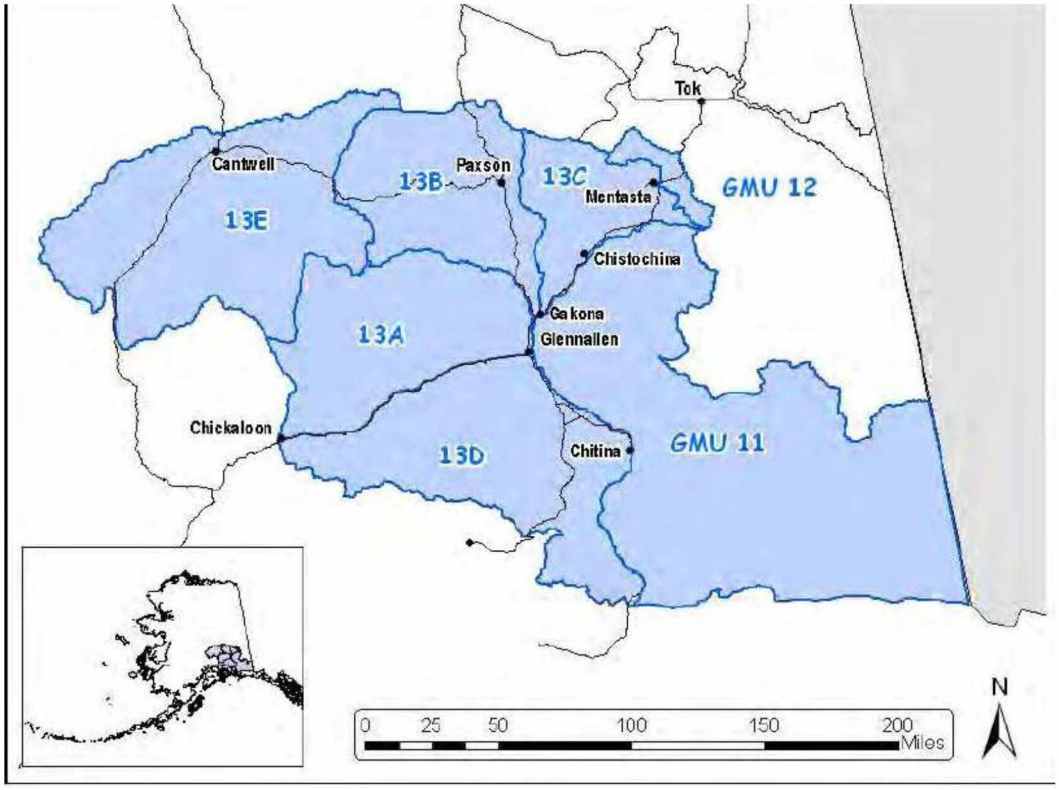
In the Ahtna region, this idea is being put into practice on a pilot scale. Ahtna Inc. is currently treating 1,507 acres of late succession boreal forest to encourage new willow and aspen growth. This is intended to promote the productivity of moose browse on these lands. This project will save the biomass that is removed by pushing it into windrows. After 12 to 24 months of field drying, the windrows can be sorted and chipped. This method could yield an affordable source of fuel for the pellet and brick plant in Gulkana. The results of this pilot project will be used to develop a long-term program to produce affordable local heating fuel. This combination of food and affordable fuel, if successful can be duplicated throughout the subarctic boreal forest region.

2.3 Biomass management for wildlife habitat and wildlife productivity.

Moose browse enhancement is needed in areas where fire suppression has resulted in advanced succession stages of the boreal forest. This activity can increase the productivity of moose habitat substantially. It is especially important to increase productivity on the road system because the demand for moose is very high and there is intense competition for the moose.

Moose management in Alaska has become a very political activity. Alaska Board of Game meetings have been known to become brawls where rural villages and urban businessmen fight it out.[16] Alaskans are not quite down to fighting over the last standing moose, but it is getting close. In 2011, the Alaska Board of Game worked with the Ahtna community to develop a Community Subsistence Harvest Hunt (CSH) in the Ahtna Region. The hunt area was defined as the Ahtna traditional use area which is the Copper River and upper Susitna and upper Nenana river areas. The allocation for the hunt was 70 moose.

Figure 1 Copper Basin Community Harvest Hunt Area Map[17]



[16] Jill Burke, "In Nelchina Basin, village caribou hunts face shutdown", Alaska Dispatch, Jul 27, 2010, http://alaskadispatch.com/dispatches/rural-alaska/6182-in-nelchina-basin-village-caribou-hunts-face-shutdown?showall=1

[17] Map source Alaska Department of Fish and Game

The subunit breakout allocation for unit 13D was only 5 moose. Ahtna and the State of Alaska were sued over this hunt. (Manning v Alaska, 2010) So literally, Alaskans have been in court fighting over five moose. The case was settled in favor of Ahtna and the community hunt. The ruling has been appealed. After the ruling, the State of Alaska relaxed its review of eligibility and allowed the hunt to be flooded with 45 hunt groups for moose and thousands of participants (Delo, 2013) without determining eligibility using the criteria for customary and traditional use.

Instead of fighting over the last moose, a positive way to spend effort is to figure out how to grow more moose. Moose population dynamics are complex, but one well established component of improving moose productivity is to improve the habitat carrying capacity. To illustrate, Alaska has 586,412 square miles. Within this area, there was an average harvest of 7,114 moose between 2000 and 2012[18] and there are an estimated 200,000 moose (Alaska Department of Fish and Game, Division of Wildlife Conservation, 2010). If we assume 80% - 90% of Alaska is moose habitat by looking at the moose range map provided by ADF&G[19], this is approximately .5 moose per square mile of moose habitat.

According to an article in Interior Alaska Moose News in 2011, Scandinavia has a harvest level of 124,000 moose and a population of 300,000 moose on 283,000 square miles of land. This is a population density of 1.06 moose per square mile. This is double Alaska's moose population density and the harvest level of Scandinavia is 17.4 times as large as Alaska's harvest.

[18] See Table 8

[19] http://www.adfg.alaska.gov/index.cfm?adfg=moose.rangemap

The interactions of climate, policy and management issues make comparison complex. However, this should serve as an example that different management systems for forestry and biomass can yield much higher productivity of moose than we currently employ in Alaska.

In the Copper Basin, Ahtna, Inc. has started a pilot project to convert late succession black spruce forest to early succession willow and poplar. The areas that will be tested are near Tazlina, Gulkana and Klutina uplands. The community of Glennallen in the Copper Basin is near the areas to be treated. This area is considered by fire suppression agencies as a wildland-urban interface (WUI) and aggressive fire suppression activities have been the policy for more than 50 years. The region is characterized by large areas of late succession stage black spruce forests. This is a climax environment with low productivity for moose browse. It also presents a high risk of fire danger to the community.[20]

In addition to the low productivity of moose habitat in the Glennallen area, the moose population is low as well according to the traditional knowledge of Ahtna elders[21] and scientific counts. ADF&G moose counts document that there are only .22 moose per square mile in Count Area 12 (CA-12); Lake Louise flats (Schwanke, 2012). This is the count area closest to Tazlina, Glennallen and Gulkana Lands. The data of .22 moose per square mile can be compared with up to four moose per square mile in unit 20, the Tanana Valley area (Young, Unit 20A moose, 2010).

[20] The Glennallen Community Wildfire Protection Plan designates the risk factor for our area as a Fire Regime IV with a condition class between D and E with Wildland-Urban Interface (WUI) (Alaska Division of Forestry, 2009).
[21] E. Marshall personal communication: 2012

Ahtna and its villages have a goal that this project will increase the moose population in these areas to four moose per square mile and that harvest levels will increase as well. In other parts of the Copper Basin, moose populations seem to be recovering from historic lows. The moose population in Game Management Unit 13 (GMU 13) has increased by 4% per year since 2001 and some areas are approaching four moose per square mile. This is due to intensive management practices that were implemented by the Board of Game around 2001 (Alaska Department of Fish and Game, Division of Wildlife Conservation, 2010).

However, the moose population in CA-12, the area that provides the best data for Tazlina and Gulkana lands, has remained stable or slightly dropping during this same time (Schwanke, 2012). The increasing moose population in the overall GMU 13 with stable or declining moose population in CA-12 fits in with the belief of our elders that there is a need to improve the moose browse and habitat in the Tazlina, Gulkana and Klutina areas[22].

The Tazlina Village council has proposed a project to restore high quality moose habitat on up to 10,000 of the 72,269 acres of Tazlina land over the next 10 years. Data from the 1,507-acre Ahtna pilot project will be used to adjust this plan as new information is learned and the plan moves forward.

In addition to the cultural and spiritual value that the moose have to Alaska Natives and rural residents, there is also the economic impact of moose to feed families. Most of rural Alaska is a high cost area with food prices 20% to 50% higher than urban centers in Anchorage and Fairbanks. ADF&G estimated the value of the meat in a moose at $3,000 using 300 pounds of

[22] N. Jackson, personal communication: 2013

usable meat and $10.00 per pound as the value[23]. To the Ahtna people, a moose will provide 800 pounds on average of usable food because of cultural practices to use all parts of the moose including the head, bones, organs and fat (Alaska Board of Game, 2006). To buy an equivalent quantity of meat at the store is $15 per pound in the Ahtna region according to the author's experience. Using these assumptions, each moose provides a family from the Ahtna region with at least $12,000 after taxes in economic value. An example of what is possible for one Village council can be demonstrated by looking at the Tazlina Village council ANCSA land base. The current moose population on the former Tazlina Village Lands of 72,269 acres (113 sq. mi) of .22 moose per square mile is estimated at 25 moose using the closest available ADF&G moose counts. This will only allow one moose per year to be harvested with a 4% harvest rate. If this can be increased to four moose per square mile then 18 moose per year could be harvested at a 4% rate. In addition to the positive social and cultural benefits, this would add an additional $216,000 worth of food to this village's economy. Ahtna Inc. has a land entitlement of 1.75 million acres and there are many millions of acres in other areas in Alaska owned by ANCSA Village and Regional Corporations. Other places in the Canadian sub-arctic boreal forest could benefit from active management of biomass and moose habitat as well.

[23] See (Interior Alaska Moose News, 2011) page 5, http://www.adfg.alaska.gov/static/species/speciesinfo/moose/pdfs/interior_moose_news_fall_2011.pdf

A table summarizing a 36 square mile township for a scalable comparison follows.

Table 5 Moose production managed vs. unmanaged for a 36 square mile township

Item	Unmanaged late succession boreal forest. Current conditions	Managed conversion by shear blading natural regrowth with predator management	Cultivated conversion practices with predator management ****
Moose Per Square Mile	.22 [24]	4 [25]	25.6 [26]
Moose Produced per year on one 36 square mile township	7.2	115	922
Harvest Rate	4%[27]	4%	30% [28]
Moose harvested per year	.32	5.76	276.48
Economic value of one moose in the Ahtna Region	$12,000	$12,000	$12,000
Annual Value of moose harvested	$3,802	$69,120	$3,317,760

2.4 Biomass management to create rural industry and jobs

Cultural and educational opportunities in rural Alaska make it hard to fill technical jobs especially in non-traditional occupations (Moore & Rutledge, 1992). Biomass management and its resultant resource production can set the stage for a culturally appropriate industry that would create a demand for employees with skills in forestry, biomass product manufacturing, wildlife

[24] ADF&G Counts in CA-12 Lake Louise Area (Schwanke, 2012)
[25] Harvest rates and population objectives generally used by ADF&G moose management plans for Unit 13 (Tobey & Schwanke, 2010).
[26] This is a theoretical maximum population level using the assumption that 4 dry tons of biomass is produced per acre, and half of this is available to moose (Garber-Slaght, Sparrow, Masiak, & Holdmann, 2009). This is higher than even high concentrated population densities observed. For example, maximum winter density rates over large areas in Scandinavia are 15.5 moose per square mile (Lavsund, Nygren, & Solberg, 2003).
[27] Harvest rates and population objectives generally used by ADF&G moose management plans for Unit 13 (Tobey & Schwanke, 2010).
[28] Harvest rates and population objectives similar to those used in some Scandinavian models (Interior Alaska Moose News, 2011).

management, traditional hunting and meat preparation, guided hunting, tourism and various support industries.

These types of jobs fit into the culture and skill set of people in rural Alaska. The author knows many who have experience working in the woods, constructing camps and exploring from an early age. This familiarity comes from participating in hunting, fishing and trapping camps, drying and storing food, getting water, getting firewood, working around the home and maintaining equipment.

The current situation on Ahtna land in the Tazlina area is over mature stands of black spruce and mature aspen stands. Productivity on such stands is understood to be very low (R.F. Grant, 2009). If active biomass management is put in place, it is expected that there will be substantial increase in the production and availability of wood biomass as a feedstock for firewood and compressed biomass products for heating fuel. This could stimulate a new industry and with it a demand for skilled workers. Estimated jobs created by biomass management and its resultant industries on one 36 square mile township in the Ahtna region are in the following table.

Table 6 Jobs relating to biomass management in compressed wood product manufacturing, ancillary industries

Direct Jobs	Unmanaged (existing conditions)	Managed	Cultivated	Notes
Forestry Management	0	1	2	
Wildlife habitat treatments/cultivation	0	1	2	[29]
Compressed wood manufacturing	0	7	26	[30]
Logging and Transportation	0	2	5	[31]
Support Industry	0	5	10	
Government	0	3	5	
Total Jobs directly funded by compressed wood product manufacturing	-	19	50	
Ancillary and indirect job creation potential	0	19	50	[32]
Total Jobs	0	38	100	

The production jobs are estimated based on 5,760 tons produced per year with a managed township with natural regeneration and 46,080 tons per year on a cultivated township (see table 4). The managed model assumes operation of a 3 ton per hour plant for one 2,000-hour shift per year. The cultivated model assumes operation of three 2,000-hour shifts per year. A recent estimate for agricultural biomass pellet production was 5 to 7 positions per shift. A typical crew would be a lead plant operator, one or two floor operators, two or three laborers for packaging and a wheel loader operator. (Campbell, 2007).

[29] (Lazarus, 2010), Minnesota Crop Cost & Return Guide for 2011 Table 4 estimates labor for willow cultivation at .1 hour per acre. This is 1.15 2080 FTE. 2 FTE were used here.
[30] Based on three - seven person shifts plus one general manager, one finance manager, one marketing and two maintenance. See (Campbell, 2007)2007.
[31] See (Timmons, Damery, Allen, & Petraglia, 2007) 2007
[32] Ibid.

On the forestry jobs, it is estimated that a 4.5 man crew can produce 43,200 tons of chips per year. Economic impact of biomass energy development in Massachusetts for power production using the IMPLAN input-output model indicated that 440 direct jobs would be created and 346 indirect jobs would be created (Timmons, Damery, Allen, & Petraglia, 2007). This is a .78 to 1 ratio for indirect to direct jobs created. I would expect a higher ratio in Alaska due to our undeveloped infrastructure. A 1 to 1 ratio was used for estimating purposes for development of a biomass pellet manufacturing industry in the Copper Basin.

2.5 Discussion

Biomass management has been going on for a long time. It is a proven method to maintain a solid rural economy. Traditional practices of controlled burns, clearing dead brush and old trees were once a major activity that was viewed as essential to taking care of the land and the people in Alaska. A more intense variation of this model is currently used with success in Scandinavian countries. In Alaska, the land was once cared for by families and clans to maximize production of game, furbearers and plants. With the recent changes in land title in Alaska from aboriginal stewardship to government-enforced title, the land has fallen into disrepair (Wade & Davis, 2002-2004). ANCSA corporations have a significant opportunity to actively manage biomass and wildlife habitat on their lands. This can be accomplished by using modern sustainable forestry practices combined with wildlife management principles for moose browse enhancement. The resulting biomass and moose production can create a sustainable industry and profits to the landowner as well as good jobs, affordable heating fuel and a healthy sustainable supply of moose meat. The methods for accomplishing this in today's world are not that much

different from the past except for advances in harvest and processing technology. The legal, political and economic picture is quite different however. ANCSA and fee simple ownership of land by Alaska Native Corporations has changed the way the land is developed and cared for. Fee simple ownership although a new concept to many Alaska Natives, could be one of the biggest unrecognized opportunities in Alaska for land owners to employ private lands wildlife management combined with sustainable forestry practices and biomass production.

2.6 Conclusion

The production of biomass heating fuel and moose for subsistence food have the potential to be increased substantially by using sustainable forestry practices in combination with moose browse enhancement in the sub-arctic boreal forest by converting late stage succession forest to more productive early succession willow and poplar.

Heating fuel costs to rural residents can be reduced by up to 40% with the development of a rural biomass industry. This industry could use production from forestry and moose browse enhancement practices. A base model using production improvements on one 36 square mile township demonstrates it is possible for up to 38 jobs to be created and up to six additional moose to be harvested annually by putting biomass management into practice. Theoretically, up to 100 jobs can be created and an additional 276 moose could be harvested by implementing biomass cultivation practices.

Chapter 3 Landscape habitat management models and their effectiveness

3.1 Introduction.

This chapter will address landscape habitat management by comparing and contrasting landscape and habitat management principles from a customary and traditional practice versus a scientific approach in the following countries/regions: Alaska, Canada, Continental US, Mongolia/Russia and Scandinavia. This chapter will describe what the author found works best in these systems.

Management of moose browse and other habitat has been a traditional practice of indigenous people of the sub-arctic boreal forest for centuries (Alaska Land Use Council, September, 1984). In Alaska, the culture of the interior Athabascan people and specifically the Ahtna people is built around the careful stewardship, harvest and use of moose (Alaska Board of Game, 2006). Such practices include controlled burns, clearing brush, cutting and using dead trees, using or burning branches[33]. Culturally an area surrounding a village needed to be kept clean and well managed (Wade & Davis, 2002-2004).

Today in Alaska, wildlife is managed by agencies of the Federal or state government. Individual families have been removed from living off the land by policies such as forced schooling, changes in land title, restrictive environmental regulations and oppressive fish and game rules (Hoffman, 1993). Commercial and recreational exploitation of fish and wildlife has reduced game populations and has in some cases decimated native people as well (Geist, 1999).

[33] G. Stickwan, personal communication 2013.

In other parts of North America, and Russia there is recognition that management of moose habitat is important (Glushkov, 2009) and (Thompson & Stewart, 1998). However, in practice, it is generally considered more cost effective to manage human harvest than habitat. Wild fires and moose habitat created incidental to forestry operations are the most significant habitat work in many jurisdictions (Thompson & Stewart, 1998). Scandinavian countries seem to have a more successful approach to moose production. They use similar methods but the approach is much more deliberate and systematic. Moose habitat and other aspects of moose management are put in the hands of private forestry companies. The companies are compensated for moose caused damage to forest resources. Hunting permits are sold and moose meat is sold on a commercial market. Moose harvest under this model is dramatically higher than in other systems (Interior Alaska Moose News, 2011).

3.2 Customary and traditional practices

Moose are adapted to thrive in disturbed areas. Glacial advances and retreats, river channel movements and wild fires are all very effective at creating moose habitat. This was known to traditional cultures and used effectively (Simeone, Valentine, & Tuttle, 2007). A semi-nomadic lifestyle developed in many parts of the sub-arctic where families moved annually in a circle of activity to take advantage of animal migration and behavior patterns that made harvest and use possible and efficient. Prior to the introduction of firearms, moose were harvested by snaring, pursuing on the water or in deep snow (Franzmann & Schwartz, 1998). Because of the difficulty of hunting without firearms, it was very important to maintain habitat that attracted and kept moose concentrated in certain known areas. The earliest records of exploration by western man in the North American sub-arctic contain evidence of the magnitude of fire occurrence during the

exploration era of this region. The journals of Canadian explorer-authors W.H. Davies (1843) and A.P. Low (1896) contain references to numerous large fires. These writers attribute large areas of burned forest to the Native population, who were known to start fires to enhance hunting, to kill insect pests, and to kill timber for firewood (Alaska Land Use Council, September, 1984).

Management of moose browse and other habitat has been a traditional practice of indigenous people of Alaska for many years (Simeone, Valentine, & Tuttle, 2007). The culture of the Ahtna people is very strong in principles of caring for the land. The Alaska Board of Game made findings that customary and traditional subsistence uses of the caribou and moose in GMU 13 were established by the Ahtna Athabascan communities within the Copper River basin over a period of centuries (Alaska Board of Game, 2006). Customary and traditional management of moose habitat is a part of this tradition.

Survival and prosperity were affected by how well the land was taken care of. Fur trapping, hunting, fishing, gathering and mining (Pratt K. L., 1998) created wealth and prosperity for Alaska Native families (Hoffman, 1993). Clans managed the habitat for high productivity and to promote efficient wildlife harvest. With the enactment of the Alaska Native Claims Settlement Act (ANCSA) in 1971 came extinguishment of aboriginal hunting and fishing rights. A promise was made during the US Congress Conference Committee negotiations for the ANCSA that the Secretary of the Interior and the State of Alaska would take care of subsistence for Alaska Natives and that they had the power to do so (Anderson, 2007)[34]. Title 8 of the Alaska National

[34] See HOUSE CONFERENCE REPORT NO. 92-746, Dec. 13, 1971, JOINT STATEMENT OF THE

Interest Lands Conservation Act (ANILCA) attempted to address aboriginal hunting and fishing rights, but the compromise language that passed created more confusion with rural preference for subsistence hunting and fishing. The result at best has been the demotivation of individual Native land and resource management and in many cases it is criminalized (Hoffman, 1993).

Prior to World War II, the Ahtna people worked to leave an area better than they found it. This was done by trimming dead branches off trees, burning up dead logs and cutting down dead trees. Once an area was looking good, they moved on and camped in a different area. This was done to make the woods prettier and the trails safer (Wade & Davis, 2002-2004). It also encouraged wildlife to move into the area and provided firewood and building materials. Katherine Wade described how this was done by her Ahtna Relatives in the Chickaloon area.

> "From where we lived in Chickaloon, we could tell where he (her grandfather) was by watching trees go up in flames. He would do that while there was snow on the ground, so the fire wouldn't spread. We could see him may miles away when he burned those trees. You could see a puff of smoke, and a little later, there's another puff of smoke, as he's coming down the trail. My Uncle John Goodlataw also did this. There was no telling them not to do that. It was one of their traditions, to keep the forest clean. They also chopped down all the big rotten trees that had a lot of limbs that might break off when the winds start blowing. They break off sometimes when the wind's not blowing. The animals like to eat it, too, like rabbits, ptarmigan and moose, if there's moose around. They like to eat the limbs. One birch tree can feed the moose for a week."

Ahtna elder Katie John reported that the Ahtna burned vegetation by lakes to make it easier to trap muskrats, encourage blueberry growth and to keep moose and caribou fat (Simeone, Valentine, & Tuttle, 2007).

COMMITTEE OF CONFERENCE. H.R. CONF. REP. 92-746, H.R. Conf. Rep. No. 746, 92ST Cong., 1ST Sess. 1971, 1971 U.S.C.C.A.N. 2247, 1971 WL 11413 (Leg.Hist.)

In the Ahtna region, the Ahtna people have relied on moose for food, clothing and spiritual wellbeing for generations. The elders have taught and passed down the proper cultural ways of caring for, harvesting and utilizing moose (Alaska Board of Game, 2006). Significant competition from non-indigenous hunters in recent years along with the loss of habitat and moose population has created a hardship for the Ahtna people. As a result, village members have had traditional hunting patterns limited by regulation. These limits include reduced bag limits; restricted methods and means; and restricted use of traditional hunting seasons and practices. This has resulted in economic hardship, hunger and related social problems[35].

3.3 Grass roots community practices

In Alaska, there is a community movement to improve the management of moose including habitat management. Groups such as the Alaska Moose Federation have pushed for moose browse enhancement, development of feeding and travel corridors to move moose away from highways and during high snow events active trail development and feeding stations (Bartz, 2012). There seems to be a new effort to cooperate on habitat management to produce more moose. Working together all groups can benefit from improved productivity of moose populations. Some of the projects that are being started in this manner include cutting trees in Kenai, active diversionary trails and diversionary feeding stations in the Susitna Valley along the Parks Highway (Carlton, 2012). Other local and private efforts using more scientific principles are also discussed in later sections.

3.4 Scientific practices

In North America, most jurisdictions with large moose populations engage in some form of vegetation management program to maintain or increase moose populations (Thompson &

[35] F. Ewan, personal communication, 2013

Stewart, 1998). Thompson and Stewart outline the moose habitat management programs that were in effect in most of the moose range in North America in 1992 as follows.

Table 7 Moose habitat management programs in North America in effect in 1992 (Thompson & Stewart, 1998)

Jurisdiction	Habitat management	Objectives	Procedural guidelines	Effects Monitoring
British Columbia	Yes	No	No	Yes
Alberta	Yes	No	No	Yes
Saskatchewan	No	No	No	No
Manitoba	Yes	No	Yes	Yes
Ontario	Yes	No	Yes	No
Quebec	Yes	No	Yes	No
Nova Scotia	No	No	No	No
New Brunswick	No	No	No	No
Newfoundland	No	No	No	No
Alaska	Yes	Yes	No	Yes
Wyoming	Yes	Yes	No	No
Idaho	Yes	Yes	Yes	No
Minnesota	No	Yes	Yes	No
Wisconsin	No	No	No	No
Maine	No	No	No	No

A summary of highlights from various jurisdictions regarding moose habitat programs follows.

3.4.1 Canadian provinces

The objectives generally are to increase the productivity and size of certain moose herds. General habitat management goals include creating/maintaining habitat mosaics; enhancing edge, setting back older succession and improving the nutritional value of winter forage. Methods include prescribed burns and mechanical overstory removal. An interesting note was that most projects in British Columbia are funded by the British Columbia Habitat Conservation Fund or through compensation agreements with British Columbia Hydro and Power Authority (Thompson & Stewart, 1998).

There may be a similar opportunity to develop a funding mechanism for a long term moose browse enhancement program as part of the mitigation of loss of moose habitat with the development of the Susitna-Watana Hydroelectric Project in Alaska (Alaska Land Use Council, September, 1984).

3.4.2 Alaska

In Alaska, moose projects and research to stimulate moose habitat have been conducted for many years as indicated in the following data from the Alaska Department of Fish and Game.

Alaska has a moose population of 200,000 on 571,000 square miles of land. The Alaska Department of Fish and Game (ADF&G) wants to maintain harvest levels of 5% for bulls and 3% for cows.

Since 2000, the statewide moose harvest data in Alaska has varied from a low of 5,863 in 2011 to a high of 8044 in 2009. The average harvest for this period is 7,114 moose[36].

[36] Data source for this information and the table are from the Alaska Department of Fish and Game moose hunting harvest statistics. http://www.adfg.alaska.gov/index.cfm?adfg=moosehunting.harvest

Table 8 Statewide Alaska Moose Harvest 2000-2012

Year	Harvest
2000	7,034
2001	6,650
2002	7,046
2003	6,955
2004	6,767
2005	6,962
2006	7,144
2007	7,474
2008	7,712
2009	8,044
2010	7,974
2011	5,863
2012	6,860
13 year average	7,114

Practices to promote moose habitat include mechanical disturbance, prescribed burns and application of herbicides and fertilizers. The response of moose forage to these activities has been documented but it is recognized that more monitoring is needed. The Kenai National Moose Range was established in 1941. Moose increased in numbers in response to major fires in 1926 and 1947. The moose range began an active habitat management program in 1954. Moose peaked at about 8,000 animals in 1971 and declined to half of that number by 1975. A mechanical tree-crushing project on 2,710 ha on the Kenai National Moose Range was conducted from 1974 to 1978. The results showed that browse densities increased in eight of 10 sample stands after four growing seasons (Oldemeyer & Regelin, 1980). The moose responded to this well with populations of six moose per square mile. The recommendations were that the

area crushed should not be too small, i.e. less than 3 square KM. It should also not be too large. The recommendations from this study follow (Oldemeyer & Regelin, 1980):

> In planning a successful crushing project, it appears to us that three factors must be taken into account: 1) The area crushed must not be so small that it is easily over-browsed by moose, 2) The width of crushing should be narrow enough to insure seeding for regeneration, and 3) The browse: spruce ratio for the entire area should be greater than 4:1 (somewhat less than the average ratio at Willow Lake and more than the ratio at the two other locations). While we do not have specific data to support the following recommendations, our experience leads us to recommend that crushed strips not be wider than 400 m and uncrushed strips not be less than 20 m. The ratio of crushed to uncrushed areas should be similar to the 60:40 ratio at the *Moose Research Center* (MRC) and no block of crushing be less than 3 square km.

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There are cases where moose populations in Alaska have grown past management goals. In game management unit 20B north of Fairbanks the moose population increased from 12,000 to 20,000 moose from 2001 to 2009. This was attributed to reduced predation, large wildfires in 2004-2005 and mild winters (Interior Alaska Moose News, 2011). This was not an active habitat management program, but it was recognized that wildfire has a significant positive impact and can be used in moose habitat management. It also shows that the combination of predator management and good habitat can be very successful in increasing moose populations. This in turn will increase hunting opportunity and food available to rural communities.

In the Ahtna region, an active moose management program in Game Management Unit 13 (GMU 13) was started in 2001 as part of a legislative mandate. GMU 13 is a major part of the Ahtna region[37]. This program has primarily involved predator control and it has been successful in parts of the region where browse conditions are good. In these areas, moose populations seem

[37] The Alaska statute on intensive management and predator control is at 5AAC 92.106-5AAC 92.126. A link to this section is provided on the ADF&G web site. Intensive Management and Predator Control section (5 AAC 92.106 – 5 AAC 92.126)

to be recovering from historic lows and have been increasing by 4% per year since 2001 approaching 3 to 4 moose per square mile in some areas (Alaska Department of Fish and Game, Division of Wildlife Conservation, 2010). However, the moose population in other areas of GMU 13 has remained low and has even dropped. For example, in Count Area 12 (CA-12), the Lake Louise Flats area has remained at or below .4 moose per square mile (Schwanke, 2012). This area and nearby Tazlina village lands is considered by fire suppression agencies as a wildland-urban interface (WUI). The region is characterized by large areas of late succession stage black spruce forests. This is a climax environment with low opportunity for moose browse productivity. It also presents a high risk of fire danger to the community (Alaska Division of Forestry, 2009)[38] . Researchers who have looked into the recent history of fires in the Copper Basin show that there have been few fires in our area compared with interior Alaska in general (Rupp, 2009). This situation has the effect of reducing moose habitat quality and carrying capacity. Ahtna Incorporated, the Alaska Native Corporation that manages the ANCSA land in this area has developed a project to improve the moose browse and habitat on Tazlina, Gulkana and Kluti-Kaah lands. They propose that this will result in improved moose population levels in these areas over the next 10 years.

3.4.3 Lower 48 United States. Private Lands Wildlife Management

The idea is built on the soil and water conservation district model, expands it, and brings in a broader group of stakeholders. Landowners, wildlife users and public land and resource managers are brought to the table. A variety of options exists for management and implementation. An interesting option is that private land owners can be contracted as the wildlife stewards even on public lands (Benson, 2001).

[38] The Glennallen Community Wildfire Protection Plan designates the risk factor for our area as a Fire Regime IV with a condition class between D and E with WUI.

This is a common model for lower 48 states with a large percentage of private land. In these states, private lands wildlife management is about the only way to provide hunting opportunities and it is strongly supported by state and federal programs and policies. In Alaska, the land base is mainly public lands and public management bodies seem to overlook this model. As ANCSA corporations finalize land patents, there is a significant and growing private land base in Alaska. This is a large untapped opportunity for Alaska Native Corporations and will no doubt be developed when this is recognized.

3.4.4 Mongolia/Russia

An article about management in the Murmansk region indicates similar population dynamics and management methods to Alaska. The article describes a moose population that had migrated into a new area in the 1950's and expanded. A hunt was put in place harvesting 7% or greater of the herd pre-hunt population. The population declined and the hunt was stopped. The population increased and a hunt of 2% to 3% of the herd was implemented. The population has not increased. There does not seem to be an active habitat management component of the system in this area in the Murmansk region. The rates of harvest are lower than Alaska (Makarova & Khokhlov, 2009).

In other parts of Russia, moose management is similar in many respects to parts of Alaska. The main influences are the human population density and associated hunting pressure. Forest inventories are also an influence (Baskin, 2009) probably more so than Alaska but certainly much less than Scandinavia.

Table 9 Moose habitat and population in Russia from (Baskin, 2009) and (Ulitin, 2002)

Moose Habitat KM^2	14,400,000	Reference
Moose Habitat Mi^2	5,559,871	Baskin 2009
1950 Moose Population	266,000	Ulitin 2002
1960 Moose Population	480,000	Ulitin 2002
1976 Moose Population	740,000	Ulitin 2002
1980 Moose Population	730,000	Ulitin 2002
1990 Moose Population	833,000	Baskin 2009
2007 Moose Population	600,000	Baskin 2009
Moose Population Average	608,167	1950-2007 (data point available average)
Moose Density Low/Sq Mi	.048	Year: 1950
Moose Density High/Sq Mi	.150	Year: 1990
Moose Density Avg./Sq Mi	.126	Years: 1950-2007

Even the highest moose density in Russia of .15 per square mile is lower than Alaska of .35 and much lower than the GMU 13 overall average of .7 per square mile.

A large portion of the total moose population in Russia are on game preserves of hunting and fishing societies, mainly those of the Russian Hunter's and Fisherman's Union (RHFU).

Table 10 Moose densities on preserves of hunters and anglers societies in Russia (Ulitin, 2002)

Region	Moose Density Moose/Mi^2
Leningrad	0.83
Novgorod	1.19
Kalinin	1.66
Moscow, Ryazan and Lipetsk	1.09
Vladimir	1.32
Ivanovo and Yaroslavl	1.84
Mari, Udmurt, ASSR	1.17
Tatar	2.20
Penza	1.45
Kuybyshev	1.42
Orenburg	1.58
Saratov	1.42

The moose densities on these ranges are quite a bit higher than the general moose habitat in Russia. These levels approach, but are lower than, the low management objectives on some Alaska game management units.

There has been an effort to increase moose populations in many parts of Russia. This has come about due to large scale clear cutting that has resulted in large increases in moose habitat. There are also areas of intensive management such as ashtree cutting, feeding of wood waste, rock salt and large scale protective measures (Ulitin, 2002). The moose population in Russia has increased from 233,000 in 1950 to a high of 833,000 in 1990 and has dropped to 600,000 in 2007. The vast areas make intensive management much more expensive and difficult, however, in areas where management is assigned to a management group; there is a substantial improvement in productivity.

3.4.5 Scandinavia

Scandinavia has a harvest level of 124,000 moose (15.5 times what Alaska harvests) and a population of 300,000 moose on 283,000 square miles of land. This is 49.5% of Alaska's land base (Interior Alaska Moose News, 2011). Alaska's recent 12-year harvest average is 7,114 moose[39] with a population of 200,000 moose (Alaska Department of Fish and Game) on an area almost twice as large. The overall moose harvest rate in Scandinavia as a percentage of the population computed from these totals is 41%. This compares to an average overall harvest rate in Alaska of 3.6%[40].

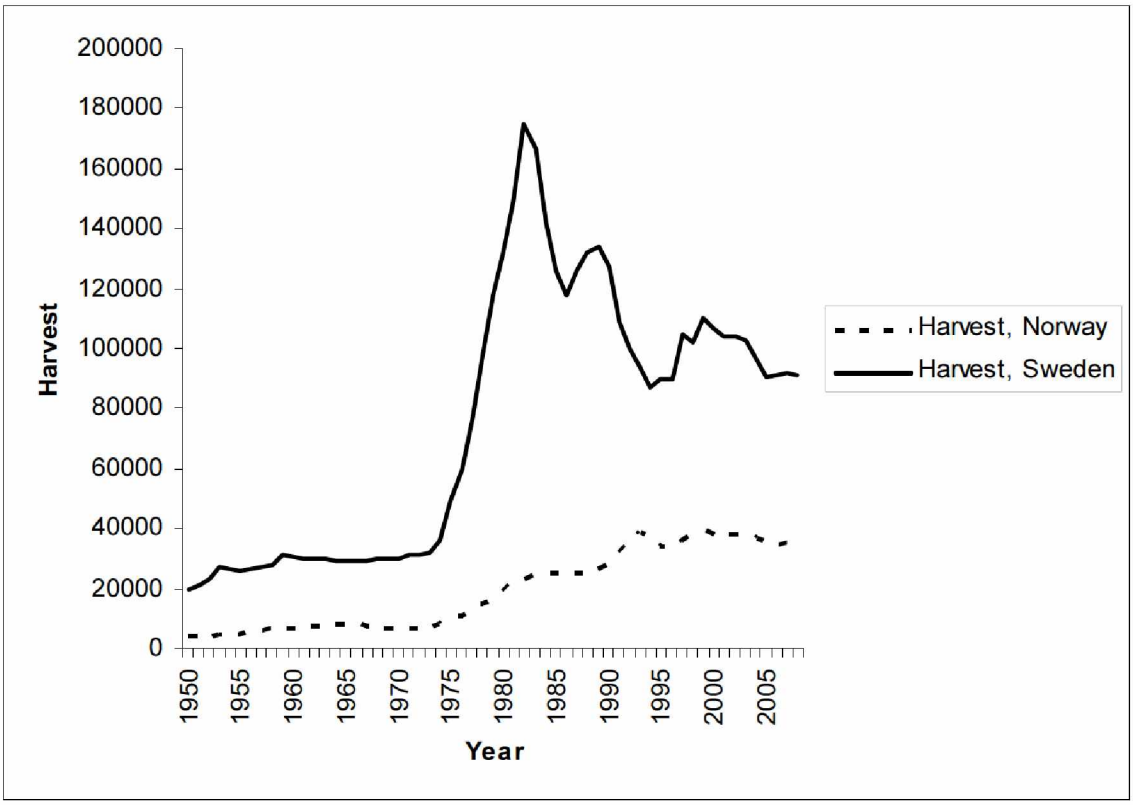
Table 11 Moose population and harvest statistics comparing Alaska and the Copper Basin to Scandinavia

Data Item	Alaska	GMU 13 (Copper Basin)	Scandinavia
Area – mi^2	571,000	23,367	283,000
Moose population	200,000	16,245	300,000
Moose harvest	7,114[41]	996 [42]	124,000[43]
Moose harvest % of herd	3.6%	4.2%	41.3%
Moose population per mi^2	0.35	0.70	1.06
Moose harvest per mi^2	0.01	0.04	0.44

Overall harvest in Scandinavian countries has increased dramatically during the 20th century. Harvest and density of moose in this region is among the highest in the world. This is attributed to forest practices that create prime moose habitat with early succession stands, harvest strategy of calves, yearlings and males and a very low predation rate (Lavsund, Nygren, & Solberg, 2003). A graph of the moose harvest in Norway and Sweden demonstrated this dramatic change.

[39] See table 8.
[40] 7114 moose harvested /200,000 moose population
[41] See table 8.
[42] See (Tobey & Schwanke, 2010)
[43] See (Interior Alaska Moose News, 2011)

Figure 2 Number of hunted moose Norway and Sweden 1952-2008. From (Olaussen & Skonhoft, 2011)[44]



3.5 Discussion.

The overall moose population density in Alaska is .35 moose per square mile. However, in many areas of Alaska the moose population is two to four moose per square mile. In Scandinavia, it is 1.06 moose per square mile but is managed in some areas as high as 30 moose

[44] Data source: SSB, Statistics Norway (2009) and Svenska Jagerforbundet (2009)

per square mile. In Russia the moose density averaged .126 moose per square mile overall and had a range of .83 to 2.2 moose per square mile on preserves managed by hunting and fishing societies.

This high productivity in Scandinavia can be attributed to an active forestry industry that is creating new habitat on a recurring basis, very low predator populations and privately controlled harvest access (Olaussen & Skonhoft, 2011). In Alaska, we have to spend money to create habitat, in Scandinavia it is being created continuously by the forestry industry. Because moose management is closely integrated with the forestry industry, Scandinavians typically manage their moose population to maximize harvest, avoid overpopulation and prevent agricultural and forestry damage (Olaussen & Skonhoft, 2011). They use selective harvest methods to maintain a highly productive moose population. This is a very different approach than that used in Alaska or Russia and much of Canada (Glushkov, 2009). The results produce a higher moose population density and a dramatically higher harvest level.

It seems like Alaska could increase its moose harvest substantially with active habitat, predator and harvest management. If this were done, it would mean an increase of high quality meat, much of it benefitting rural areas. This would be a major impact, and it could be synergistically greater if a forest products industry could be tied in with the moose population improvement. On the less enthusiastic side, it would take a lot of policy changes. For example, most of North America including Alaska has moved away from the market hunting model used in Scandinavian countries.

a. What works best?

Active management integrated with the forestry industry used in Scandinavia seems to be the best model if you are seeking to maximize production and harvest levels. Moose preserves in Russia managed by fishing and hunting societies improves productivity from non-managed or government managed areas. Even the best of these areas only approach the low end of Alaska population density management objectives. Alaska's levels are 1/3 of the population levels maintained by Scandinavia.

b. What doesn't work?

Areas left to themselves fall into low production due to degradation of the habitat, advanced forest succession and predator population increases. Much of Russia, Canada and Alaska are in this situation. Active management policies are changing this in Alaska but there is a long way to go. Rural populations suffer from poverty and related social problems when the land is not managed productively.

3.6 Conclusion

Alaska is doing better at moose management than Russia but has the potential to improve productivity by incorporating moose management practices with the development of an integrated forest industry. Alaska would do well to study the Scandinavian model and the private lands wildlife management model a lot more closely and see what can be learned and implemented to improve moose harvests. The private lands wildlife management system could be attractive to the Ahtna region. There should be a high demand for hunting and fishing in the

Ahtna region on highly productive well-managed land with controlled private access. The fee simple land tenure model used in ANCSA is a new and relatively unrecognized opportunity.

Chapter 4 Indigenous wildlife management models and policy issues

4.1 Introduction

This chapter focuses on general policy for fish and game management as it relates to rural development. The chapter reviews models used to involve indigenous people in fish and game management decisions. It examines what and how to improve the management models in Alaska and specifically the Ahtna region. The chapter will look at solutions for moose and moose habitat management but will not be restricted to just this subject.

It is now generally accepted that prior to adoption of the ANCSA in 1971, Alaska Natives possessed unextinguished aboriginal title, which included hunting, fishing, and gathering rights. ANCSA extinguished aboriginal hunting and fishing rights and a promise was made during the congressional negotiations to Native leaders that the State of Alaska and the Secretary of the Interior would take care of subsistence hunting, fishing and gathering rights for Alaska Natives. When this promise failed to materialize, an attempt to address it was the drafting and passing of Title 8 of the Alaska National Interest Lands Conservation Act (ANILCA) with a rural preference mandate for subsistence on federal lands (Anderson, 2007). Rural preference was a compromise that fell far short of Alaska Native preference for hunting and fishing rights. In the Ahtna region, rural preference has become almost meaningless because the Alaska Supreme Court ruled rural preference unconstitutional (McDowell v. Alaska, 1989). In addition the state selected most of the easily road accessible federal land in in the Copper Basin which effectively removed the federal rural preference option for most of the Ahtna region hunters; the following is the sequence of events.

After adoption of ANCSA by congress in 1971, the Ahtna people made ANCSA land selections close to their villages based on the need for hunting and fishing areas. Rural preference on State land and ANCSA land was declared unconstitutional by the Alaska Supreme Court in 1989 (McDowell v. Alaska, 1989). A dual management system for subsistence hunting and fishing was imposed in Alaska following the McDowell decision in 1990 (Norris, 2002). The State of Alaska blanket selected most of the Federal land outside national park boundaries in the Ahtna region. As a result, the federal rural preference is not available for much of the Ahtna region. In addition, ongoing lawsuits and aggressive adversarial regulatory proposals, such as the recent appeal of the Katie John decision by the State of Alaska, make traditional hunting and fishing practices difficult to maintain for the Ahtna people (Mauer, 2013).

Because of this ongoing disenfranchisement of Alaska Native subsistence rights, federal legislation is needed to make good on the yet to be fulfilled promise that Alaska Native aboriginal hunting, fishing and gathering rights are reinstated and protected. One of the models that have been discussed for such legislation is a co-management system. This chapter researches the question of what a co-management system is, does it work as a viable management tool and can it be applied in the Ahtna Region. This chapter includes a discussion, conclusions and recommendations.

4.2 Overview of co-management regimes in North America

A number of co-management systems have been in place for many years. Osherenko listed eight organizations in North America as of 1988. (Osherenko, 1988). In Addition Crichton covers eight co-management examples in Manitoba (Crichton, 2001). This chapter reviews ten co-management examples as follows:

Alaska Eskimo Whaling Commission

Structure	Incorporated Non-profit with G2G cooperative agreement with NOAA, recognized in the Whaling Act of 1949, Marine Mammal Protection Act and Endangered Species Act.
Representation	Whaling captains elect 10 commissioners.
Strengths	Established quota with International Whaling Commission, combines science with traditional knowledge; State of Alaska has no jurisdiction; AEWC manages traditional Bowhead Whale hunt, research, sets and enforces regulations.

Togiak Moose Management Plan

Structure	Informal Working Group.
Representation	Togiak AC[45]; Nushagak AC; Bristol Bay RAC.[46]
Strengths	Unifies state regulations on all lands in a way acceptable to local residents. Uses existing advisory committee structure to develop a moose management plan. Plan adopted by regulatory bodies Alaska Board of Game and Federal Subsistence Board.

Yukon-Innoko Moose Management Plan

Structure	Informal working group.
Representation	Grayling, Anvik, Shageluk, Holy Cross AC; Lower Yukon AC; Western Interior RAC; Yukon-Kuskokwim RAC.
Strengths	Worked through difficult issues on increased competition. Recommendations were adopted by regulatory bodies Alaska Board of Game and Federal Subsistence Board.

Yukon Flats Cooperative Moose Management Plan

Structure	Yukon Flats Planning committee.
Representation	Representatives from 8 recognized tribes, technical representatives from CATG, ADF&G and Yukon Flats NWR.
Strengths	Solid plan to address intensive moose management. Plan adopted by both Board of Game and Federal Subsistence Board. Goal to double moose population in 10 years.

[45] The term AC refers to local fish and game advisory committees that are authorized and recognized by the Alaska Board of Game.

[46] The term RAC refers to subsistence regional advisory councils that report recommendations to the Federal Subsistence Board set up under the Alaska National Interest Lands Conservation Act (ANILCA).

Native Village of Eyak Tribal Sea Otter Management Program

Structure	Federally Recognized Tribe in Alaska.
Representation	5 member Tribal Council and informal sea otter hunters council.
Strengths	Regulations set by Tribe recognized by USFWS and State of Alaska enforcement officers work informally with the regulations when asked. Traditional knowledge and research are combined. Group recognized for excellence in management, data and research.

Western Arctic Caribou Herd Cooperative Management Plan

Structure	Stakeholder group.
Representation	Interested users and stakeholders. Four management agencies are signatory to the plan.
Strengths	Developed non-prescriptive guidelines for policies to adopt in times of high, medium and low caribou populations.

Waterhen Moose Management Project

Structure	Informal working group.
Representation	Waterhen chief and council members, community members, Metis community member, member of Manitoba Natural Resources Department.
Strengths	Initially worked with Tribal and provincial regulators to reduce hunting pressure on herd that had declined from 1000 to 100 moose.

Confederated Salish and Kootenai Tribes-State-Tribal Fish and Wildlife Agreement

Structure	Treaty Tribe with Reservation. Formal cooperative agreement with Tribe and State of Montana.
Representation	7 member Flathead Indian Reservation Fish and Wildlife Advisory Board. 3 appointed by Tribe, 3 by the State and 1 by USFWS.
Strengths	Tribal and state regulations and enforcement recognized by both the state and tribe. Split representation shares power and is a venue to discuss and resolve issues.

Private Lands Wildlife Management

Structure	Contractual agreements between landowners and other parties including government agencies.
Representation	Landowners, stakeholders, contracting parties.
Strengths	This can be a more productive model. Responsibility rests with landowners and contracting parties.

Other co-management examples.

Structure	16 examples reviewed.
Representation	Informal to highly structured.
Strengths	Success factors: • Government grants decision-making role. • First Nations members supportive. • Remove culture and language barriers. • Dispute resolution clause.

4.3 Discussion

Co-management systems vary in a continuum from very informal community developed plans; to highly regulated systems of state and national law and even international treaties subject to intense negotiation, and rigidly enforced laws.

Wildlife management in the State of Alaska is mainly a public activity conducted by federal or state governments. Another model to address the same issues with private management is used in parts of the United States and Europe (Benson, 2001). This could be a good example to develop in Alaska where ANCSA corporations hold large tracts of private land.

Co-management is viewed by some Canadian First Nations with full tribal hunting and fishing rights as a dilution of tribal authority. In Alaska with the language in ANCSA and the State of Alaska failing to address subsistence, co-management is viewed as a way to increase tribal rights on wildlife management issues.

Co-management seems to be an option of compromise that is always available to any party that is assertive enough to get to the table with their ideas. The current situation in the Ahtna region

with the Alaska State constitution coupled with ANCSA and large state land selections is very close to the absolute extinguishment of aboriginal rights. Co-management would be an improvement in Tribal rights for the Ahtna region. There are successes with co-management. There are also significant failures. The main element of success is the commitment of the parties to pull together to make it work. Other elements of success include granting actual authority, commitment to accommodate cultural and language differences, strong support from constituent groups and funding. Another key factor is for leaders to recognize there will be controversy that they must be willing to deal with.

4.4 Conclusion

Co-management is one way among many to reach the goal of having tribal input into the management of fish and game resources in Alaska. The most important part it to get involved and do what it takes to stay involved and effective for the long term.

4.5 Recommendations

The recommendations are to continue to be diligent and involved in wildlife management issues no matter what system is being used. Alaska Natives can be effective but it will take hard work, a good spirit, the knowledge of elders and good research data.

With that general philosophy in mind, the following are specific examples of how to become more effective with improving wildlife management in most rural communities in Alaska. There

are also recommendations that are specific to the Ahtna Region. Many of these specific recommendations can be modified to fit a particular community.

1. Use the state local fish and game AC system and the federal RAC system to its maximum effectiveness.
    a. Recruit and train potential members that will represent others well, will learn the process and stick with it. Make the effort to get your representatives elected to the AC. Since the AC members are elected by those who are at the meeting, show up for the election meetings. Maintain an on-going system to recruit, train and elect future representatives.
    b. Participate in the AC process, stay engaged, do your homework and make good decisions. Stay with it over the long run even when the going gets tough.
    c. Submit proposals to the board of game (BOG) and the board of fish (BOF) through the AC process and follow through on them.
    d. Use the AC process to gain access to technical staff and other resources of ADF&G and to request research be done at state expense such as accurate game population estimates, and habitat carrying capacity studies.
    e. Develop a list of required data that is needed to make good decisions and use the AC process to get this data collected and maintained over a long period.

2. Get more involved in the State of Alaska Board of Game and Board of Fisheries appointment process.
    a. Recruit and train candidates to sit on these boards.
    b. Nominate them and follow through to secure appointments.
    c. Learn about the nominating process and get involved with this over the long term.
    d. Jump on mid-term vacancies with a candidate you have already identified, recruited and trained.
    e. Work on recruiting supportive candidates in areas that are often in opposition to our interest such as sport fishing candidates or candidates from Anchorage, Fairbanks or the Mat-Su Valley.
    f. In governors elections, ask candidates about what kind of appointments they will make to the BOG and BOF. Follow through with them after the election.

3. Get more involved with the Federal RAC and Federal Subsistence Board appointment process.

a. Recruit and train candidates to sit on these boards.
b. Nominate them and follow through to secure appointments.
c. Learn how the process works and work the process. Be proactive and identify candidates well in advance of vacancy announcements.
d. Jump on mid-term vacancies with a candidate you have already identified, recruited and trained.

4. Build a private lands wildlife management program.

    a. Use the Copper River-Ahtna Inter-Tribal Resource Conservation District (CRITR) as the coordinating body for an Ahtna Region Wildlife Management District.
    b. Get authorizing resolutions from village councils and ANCSA corporations to show unity of purpose.
    c. Establish a Tribal Wildlife Commission with Tribal representatives.
    d. Invite other stakeholders to participate in the process.
    e. Invite Technical advisors to participate from state and federal agencies, private industry and tribal staff.
    f. Ask for funding and support through the AC and RAC systems.
    g. Write grants for support through CRITR and village councils.
    h. Develop an Ahtna Region wildlife management plan that encompasses all land in the Ahtna Region and establishes clear regional goals, goals for private Native corporation land and goals for public land.
        i. Start with an Ahtna Region moose management plan.
        ii. Follow up with a caribou herd management plan.
        iii. Add other species and issues as capacity and funding develops.
    i. Develop proposals for contracting wildlife stewardship and management on public lands.
    j. Do the research.
    k. Write the plans and regulations.
    l. Submit the plan to the Alaska Board of Game and the Federal Subsistence Board.
    m. Follow up and keep it going over the long term.
    n. Coordinate and tie into any federal legislation that is proposed or passed.
    o. Modify in response to any lawsuits or new state and federal laws or regulations.

5. Pursue federal legislation for tribal management authority for game in the Ahtna Region.

    a. Start with a demonstration project in the Ahtna Region.
    b. Propose an Ahtna Region Wildlife Management District with CRITR as the coordinating body.
    c. Propose a private contracting component for research, management, allocation, regulation development and enforcement.

6. Amend ANCSA and ANILCA to re-establish subsistence hunting and fishing rights for Alaska Natives to address the failed promise made during the ANCSA negotiations that the State of Alaska would take care of subsistence for Alaska Natives. Use the results of the Ahtna Region demonstration project to guide the development of the legislation.

7. Make good plans with the involvement of Ahtna region communities. Stay alert to opportunities to advance these plans at every point in every decision making process.

8. Finally and once again, stay with it for the long term.

Chapter 5 Annotated bibliography; moose habitat issues in the sub-arctic boreal forest

5.1 Introduction

This annotated bibliography covers the subject area and issues of moose habitat management in Alaska with a focus on ways this can be used for rural development. The focus is on combining habitat management with traditional and scientific forestry practices. The rural development goals are to provide economical heating fuel, an abundant local food supply and needed jobs in a culturally relevant locally controlled manner. This annotated bibliography is organized into three sections as follows.

- 5.2. Moose habitat management and landscape level biomass management as a rural development opportunity in interior Alaska.
- 5.3 Customary and traditional; and scientific moose habitat management principles of interior Alaska, Canada, Continental US and Scandinavian countries. (broken into sections A. Traditional and B. Scientific)
- 5.4. Public policy issues regarding indigenous people and fish and game management in Alaska.

Some of the articles are general or cover relevant community development practices such as Randy Stoecker's excellent book on project based community research methods. There are also articles that cover these issues in Canada, Norway and Poland for an international perspective. This list is not intended to be exhaustive in any sense. For a much more detailed although

somewhat dated annotated bibliography on moose habitat issues, refer to the Harza-EBASCO study summarized here in the scientific principles section of section 5.3-B.

The public policy section is intended to highlight the frustrating practice we seem to have in Alaska of spending millions of dollars in court fighting over the last standing moose. Other alternatives illustrated in this section are from Norway with its order of magnitude more productive private contracting model and Canada with its indigenous priority/co-management approach. The goal of this chapter is to provide a list of resource materials for Alaska policy makers, managers and the public so that Alaskans might become less focused on fighting over moose and more focused on moose production so we have plenty for everyone.

5.2 Articles relating to moose habitat management and landscape level biomass management as a rural development opportunity in interior Alaska.

Alaska Division of Forestry, V. O. (2009, 12 14). Community Wildfire Protection Plan for Glennallen, At Risk Community Within Copper River Valley, Alaska, Cooperative Extension Service, Ahtna Inc. and Local Emergency Planning Committee. Glennallen, Alaska, USA: Alaska Department of Natural Resources, Division of Forestry. http://forestry.alaska.gov/pdfs/cwpp/Glennallen_CWPP_4-10.pdf

This is a wildfire protection plan for the Glennallen area in the Copper Basin of Central Alaska. The plan addresses the risk of wildland/urban interface and divides the area into four zones with a plan of defense for each zone. The area is characterized by tightly clustered aged spruce.

Recommendations include community outreach and education, recruitment and training of firefighter personnel, and coordinating the administration of a biomass fuels program.

Forest and Land Management, Inc. (2011). *Forest Stewardship Plan for Ahtna Incorporated Lands in the Coper River Basin and near Cantwell.* Glennallen, Alaska: Ahtna Incorporated.

This is a forest management plan for lands owned or managed by Ahtna Incorporated. Ahtna Inc. is an Alaska Native Regional Corporation formed by Congress with the Alaska Native Claims Settlement Act in 1971. There are approximately 1.77 million acres covered under this plan. The intent of this plan is to achieve the following for the landowner:

- Re-establish a vigorous young-growth stand of timber by natural regeneration where possible, or by planting if necessary.
- Promote enhanced habitat for moose and other species that are relied upon by corporation shareholders for Cultural and Traditional uses.
- Provide responsible forest management.
- Maintain water quality, conserve critical wildlife habitat, and when possible, aesthetic values.
- Comply with the Alaska Forest Practices Act and Regulations.
- Restrict uses that would substantially reduce Ahtna's ability to manage these areas for future timber production.

The goals of the plan include:

- Produce a sustainable flow of forest products and Cultural and Traditional wildlife harvest from these lands.
- Insure that healthy forests will be available for future economic benefit to the corporation and its shareholders.

Hackenberg, R. (2004). *Moose Hunting in Alaska The Secrets to Success.* Wasilla: Northern Publishing.

This is a book about hunting moose in two sections. Section 1 is a compilation of seven moose hunting stories. Section 2 is a how to manual on hunting moose. The author tells some wild stories with pictures to back them up. The section on choosing where to hunt has some good advice on locating and interpreting game harvest data. The rest of the advice is from the author's perspective as an urban resident venturing out into the wild. It contains good basic information about hunting methods and calling. The sections on conditioning and choosing a hunting partner are amusing and troubling at the same time for someone with a more traditional Alaska background.

Hanson, D. (2010). *Forest Resources on State Forest Lands in the Copper River Basin, A Preliminary Estimate.* Fairbanks, Alaska: Alaska Department of Natural Resources.

This is an inventory of State of Alaska forestlands in the Copper Basin. A total of 435,657 acres are inventoried. This area is broken into 219,550 acres of timberland, 96,880 acres of dwarf forests and 119,227 acres of non-forest. The inventory provides detailed stand type maps and internet mapping querying capability. The report tables include supply curves for Kenny Lake and Glennallen as well as cumulative volume availability charts and ten-mile circles for operable forests for these communities. Results show total net volume in MBF as follows Aspen 7,736, Balsam Poplar 15,506, Birch 441, Black Spruce 225 and White Spruce 198,542. The report also contains tables that break down and summarize the inventory for various uses.

Kesti, S., Burcham, M., Campbell, B., Develice, R., Huber, C., Joyce, T., et al. (2004). *East Copper River Delta Landscape Assessment.* Cordova: Cordova Ranger District, Chugach National Forest.

This study is an assessment that documents an understanding of the processes in the study area in order to determine how to reach the desired condition for the Chugach Forest Land and Resource Management Plan. The study area is from the Wernicke River drainage to the Kayak Island drainage. This study reports on disturbance regimes, soils, hydrology, geology, minerals, vegetative patterns and distribution, fish and wildlife species and their habitats, and human use patterns including cultural resources, subsistence, and recreation. The study includes inventory, monitoring and project recommendations for the following areas: Hydrologic Resources, Fish, Vegetation Resources, Wildlife, Heritage Resources, Mining, Recreation and Special Uses.

Northern Economics Inc. (2006). *The Value of Alaska Moose.* Anchorage: Anchorage Soil and Water Conservation District; Alaska Soil and Water Conservation District.

This study investigates the value of Alaska moose. This report provides information on the background, methodology and results of that project. The report evaluates two time periods, a single year—2005—and a 20-year period, from 2006 to 2026. Consumptive and non-

consumptive uses were considered as the two main valuation categories. Collision costs and property damage are reduced from the values to get a net value.

For 2005, the consumptive value of moose in Alaska is estimated at $38,322,000, non-consumptive value is estimated at $3,846,000. Moose costs from highway collisions and property damage was estimated at $13,892,000. Net value of moose in Alaska in 2005 was estimated at $25,276,000. The 20-year estimate of all moose value was $426,881,432, collision costs were estimated at $251,747,364 and the net value of moose in Alaska over a 20-year period was estimated at $175,134,068. The report goes through the methodology and assumptions. The methodology provides good ideas for improving the value of moose to Alaskans.

5.3 Articles relating to customary and traditional; and scientific moose habitat management principles of interior Alaska, Canada, Continental US and Scandinavian countries.

5.3.1 Customary and traditional principles:

Allen, L. H. (1985). *An Expedition to the Copper, Tanana and Koyukuk Rivers in 1885.* Anchorage, AK: Northwest Publishing Company.

This is a report of an expedition of Lieutenant Henry T. Allen up the Copper River down the Tanana and up the Koyukuk Rivers then to the mouth of the Yukon River at St. Michael where they were picked up by a steamer. The report contains background information known about the Copper River at the time of writing in 1885. There is a good description in the journal of the expedition's interactions with Natives at Taral, and Taral Nicolai's winter camp on the Chettystone (Copper Stone Creek) as well as a description of a moose hide boat and how it was

built. The journal also describes in detail travels up to Mentasta and over the pass into the upper Tanana river area. The report details the living conditions and interactions of the party with the Ahtna people. It contains drawings of people, housing and landscapes of the Chitina River and Copper River areas. It also details use of moose particularly how they used rotten meat. Taral Nicolai saved the party of three with nourishment from moose nose and fat soup and brought them back to health.

Powell, A. M. (1909, reprinted in 1997). *Trailing and Camping in Alaska.* Valdez: Prince William Sound Books.

This is a narrative of stories of travels of the author as a mineral surveyor for about a 10-year period beginning May of 1898 to 1908. The book describes the Valdez, Klutina, Chitina, Gakona, Tazlina and Chistochina areas with a lot of stories about conversations and interactions with the Native people. He describes starvation and deaths of specific Native people and Villages. Chapter XXIII is a description of the Authors interactions with the Ahtna stick people. He describes Chief Stickman who got his name by building a log cabin instead of living in a tepee. He reports on stories told to him by elders. One report was that 1500 Ahtna's were living between Tonsina and Copper Center in the past and that moose and game were much more plentiful than at the time of the writing. He also describes a system of recording camping and movements with sticks placed at campsites so they were informed of the movements of native and non-native parties in the country. This chapter also reports marriage customs, burial and how tribes are identified by their moccasin heel and the track it makes.

Pratt, K. (2009). *Chasing the Dark Perspectives on Place, History and Alaska Native Land Claims* (Vol. 1). (K. Pratt, Ed.) Anchorage, Alaska: US DOI, Bureau of Indian Affairs, Division of Environmental and Cultural Resources Management.

This is a collection of articles written by authors who have worked on the ANCSA 14(h) (1) program. There are articles from each of 11 ANCSA areas. There are also articles from a regional or general perspective. Three appendices are as follows (i) a near comprehensive listing of ANCSA 14(h)(1) field crew and office staff members from 1975 through 2008; (ii) a synopsis of the ANCSA 14(h)(1) Records Collection; and (iii) a review of BIA work on land claims filed under ANCSA Sections 14(h)(2) [Native Groups] and 14(h)(5) [Primary Places of Residence]. Articles of interest to the Ahtna Region include Nataelde, "Roasted Salmon Place" A Summary History of Batzulnetas by William E. Simeone; Ancient Hunting Camps at Dickey Lake by Matthew B. O'Leary; Ahtna Copper by Kenneth L. Pratt (with suggested reading list); and a note and photo of Dehsoon' Cheeg Jack John Justin's cabin and claim on the Nabesna river.

Pratt, K. L. (1998). Copper, Trade and Tradition among the Lower Ahtna of the Chitina River Basin: The Nicolai Era 1884-1900. *Arctic Anthropology, 35*(No. 2), 77-98

This journal article reviews the record of the Ahtna people of the Chitina River Valley before and during the discovery period of the large Copper deposits on the Nizina River. The article focuses on the power and control over the Copper resource that the Ahtna people posessed and maintained. It disputes the often reported notion that Taral Nicolai voluntarily relinquished the

Lower Ahtna rights to the regions copper. He also concludes that Nicolai's untimely death is what faciltated the unhindered exploitation of this resource by non-Natives. Includes extensive literature citations.

Simeone, W. E., & Valentine, E. (2005). *Traditional Knowledge of Long Term Changes in Salmon Runs in the Copper River.* Anchorage, AK: Alaska Department of Fish and Game, Office of Subsistence Management.

This study describes changes in the upper Copper River salmon fishery using Ahtna environmental knowledge and data from the social and natural sciences. Ahtna elders have observed that fisheries management and competition from other users have adversely affected subsistence harvests. The Ahtna attribute effects on salmon spawning in the headwaters of the Copper River to environmental pollution and interception by commercial and recreational fishermen. This is a good report of traditional information on salmon fishing and areas of use and occupancy by the Ahtna. There is a section on page 62 and 63 that documents traditional Ahtna methods of setting forest fires with muskrat fat to improve moose and caribou health. This study includes a section on climate change and describes large fire activity in 1898 reported by Abercrombie.

Simeone, W., & Kari, J. (2005). *Traditional Knowledge and Fishing Practices of the Ahtna of the Copper River, Alaska.* Juneau, AK: Alaska Department of Fish and Game, Subsistence Division.

This is a technical paper written to describe the traditional knowledge of the Ahtna people as it relates to salmon fishing on the Copper River. The report is organized into nine chapters including fish as a lexical domain in the Ahtna language, knowledge of salmon distribution, traditional management practices and harvesting, processing and oral traditional stories. The report concludes that the Ahtna have extensive knowledge of the salmon in the Copper River derived from thousands of years of experience. They recognize 21 distinct population stocks. The harvest by the Ahtna has been significantly reduced and re-allocated. The Ahtna have a system of management and research that has been impacted and changed by technology, political, regulatory, economic and social factors. The report contains an extensive bibliography.

Smith, B. (2004). *Applying the knowledge, experience and values of Yukon Indian People, Inuvialuit, and others in conservation decisions: Summaries of 55 Yukon Projects, 1985-2003.* Whitehorse: Department of Environment, Government of Yukon.

This report summarizes 55 local and traditional research projects conducted between 1985 and 2003 into short case studies. The objective of the report is to provide a set of lessons, examples and training materials for the Yukon Fish and Wildlife Branch. The 55 case studies are grouped into 12 subject areas and sorted by date with an index and a list of authors/authorities. Subject areas include Focus Groups and Group Interviews; Group Mapping; Group Problem Solving; Land Based Activities; Personal Interviews and Household Visits; Story Building and Telling; and Tissue Collection. An example of the types of studies covered is "First Nation crews assess use of habitats by large mammals in mapped vegetation plots: McArthur Mountains/ Ethel Lake

vegetation and habitat mapping, 1987. Complete Update- 2003 work associated with Ddhaw Ghro Special Management Area planning." This study used traditional crews and scientists to map habitat for designation as a special management area.

Technical Committee and Management Committee for the Parties. (2006). *Old Crow Flats Van Tat K'atr'anahtii Special Management Area Management Plan.* Whitehorse: Vuntut Gwitchin Government; Department of Environment, Government of Yukon.

This is a joint management plan for the Old Crow Flats (Van Tat K'atr'anahtii) as specified in the Vuntut Gwitchin First Nation Final Agreement, Chapter 10, Schedule C. The management plan is jointly prepared with management responsibility shared by the Yukon government and the Vuntut Gwitchin First Nation. The management plan details the history, environment, resources and people of the planning area. Recommendations include setting up a management committee with representatives from the Yukon government and the Vuntut Gwitchin Government. Each respective government will adopt the plan through regulation. This is a relevant comparative model for indigenous resource co-management that could be adapted to Alaska successfully.

5.3.2 Scientific principles:

Interior Alaska Moose News. (2011, Fall). Retrieved August 27, 2012, from Alaska Department of Fish and Game, Division of Wildlife Conservation: http://www.adfg.alaska.gov/static/species/speciesinfo/moose/pdfs/interior_moose_news_fall_2011.pdf

This is a publication to educate the public about moose biology and moose management issues. It has good articles about moose food, fire and moose, measures of moose health, tracking moose numbers, dense moose populations, antlerless moose hunts, overview of management in Alaska Game Management Units 20A, 20B, 20C, moose research and the public involvement process for moose management in Alaska. The issue also has a good discussion on Scandinavian moose management, which is much more intensive and productive than Alaska.

Alaska Department of Fish and Game. (n.d.). *Moose (Alces alces) Species Profile*. Retrieved August 29, 2012, from Alaska Department of Fish and Game, Species: http://www.adfg.alaska.gov/index.cfm?adfg=moose.main

This is a species profile for moose maintained by the Alaska Department of Fish and Game. The site has general information about moose and is easily navigated. The information is organized by tab and contains a general description, life history, range and habitat, status, trends and threats and fast facts. The site gives a good summary by game management unit of total population,

annual harvest and management objectives. There is also a photo gallery with several annotated pictures of moose in various life cycle situations.

Alaska Wildland Fire Coordinating Group. (2010, 7 28). *Alaska Interagency Wildland Fire Management Plan 2010*. Retrieved August 27, 2012, from http://fire.ak.blm.gov/content/admin/awfcg/C.%20Documents/Alaska%20Interagency%20Wildland%20Fire%20Management%20Plan/Alaska%20Interagency%20Wildland%20Fire%20Managment%20Plan%202010.pdf

This is the general inter-agency wildland fire management plan for Alaska. It can be used in conjunction with community specific plans. The plan designates four levels of wildland fire management options: Critical, Full, Modified and Limited. In addition to the management options, there are four site-specific designations Critical, Full, Avoid and Non-sensitive. The plan addresses fuel management including prescribed burns and also allows for and addresses non-standard response guidelines. This plan can be useful for moose browse habitat efforts by coordinating habitat enhancement goals with suppression designations. Habitat managers and landowners can achieve mutual goals by sharing plans with each other. Often habitat goals can be obtained by fire management personnel in a cost effective and safe manner if they just know what the desired objective is.

Bobek, B., Merta, D., Sulkowski, P., & Siuta, A. (2005). A Moose Recovery Plan for Poland: Main Objectives and Tasks. *Alces, 41*, 129-138.

This paper was written to outline a recovery plan for moose in Poland. The population of moose in Poland had declined from 5,400 animals in 1991 to 1,718 in 2000. There was a nation-wide ban on moose hunting imposed in 2001. The methods used were to collect data on population demographic variables and to understand moose habitat preferences. During 1998-2002 in the forest habitat of northeastern Poland (total area: 311,400 ha) a line intercept snow track index and plot sampling were used to estimate moose population numbers at 276 animals. By comparison, the hunter's census methods overestimated the moose population by 46.0%. The conclusion was that the decline in population was caused by overestimating the population and over harvest. Recommendations included locating two large moose management conservation units where population would be estimated by reliable methods and setting sustainable harvest levels. It also recommended that forestry practices in moose wintering areas should stimulate deciduous browse production.

Franzmann, A. W., & Schwartz, C. (1998). *Ecology and Management of the North American Moose.* (R. E. McCabe, Ed.) Washington and London: Smithsonian Institution Press. (Also Chapter 1 is good coverage of traditional moose management)

This is recognized as one of the most comprehensive technical books on moose. The book is focused on scientists as the audience and is written by experts in each field. It contains 19

chapters and covers such areas as historic and prehistoric reliance by man on moose; population dynamics; predator/prey relationships; dispersal and migration; habitat, food, nutrition and energetics; pests, parasites and disease; restraint, translocation, husbandry; and harvest management. The book focuses on North American moose only.

P. Harper, editor. (2010). *Moose Management Report of Survey-Inventory Activities 1 July 2007 - 30 June 2009.* Juneau, Alaska: Alaska Department of Fish and Game.

This is a bi-annual report of moose populations, status and trends for all Alaska Game management units that have moose. The areas of interest for the Copper Basin are units 11 and 13. Unit 13 is increasing due to predator management programs but may begin to see habitat issues. Unit 11 has low population, high bull cow ratio and very low cow/calf ratio. The habitat in unit 11 is underutilized. This is a good report to look at as it has recommendations by the area biologists and a lot of good data to help with informed decision-making.

Paragi, T. F., Seaton, C. T., & Kellie, K. A. (2008). *Identifying and Evaluating Techniques for Wildlife Habitat Management in Interior Alaska: Moose Range Assessment.* Juneau, Alaska: Alaska Department of Fish and Game, Division of Wildlife Conservation.

This study took the method developed in 2002 by Seaton of measuring production of biomass and its proportional removal and applied it to nine additional study areas. The conclusions were that they could estimate the proportion of biomass removed based on sample twigs was robust across sampling efforts. Removal based on sampled data extrapolated to plot species

composition was not robust. Proportion of browse biomass removed by moose in sampled twigs only was inversely related to estimates of moose twinning rate. This study attempts to show an alternate means to infer nutritional limitations in moose populations where twinning rates are not practical to measure.

Nichols, T. F. (2005). *Aspen Coppice with Coarse Woody Debris: A Silvicultural System for Interior Alaska Moose Browse Production.* Thesis, University of Alaska, School of Natural Resources and Agricultural Sciences, Department of Natural Resource Management, Fairbanks.

This study looked at whether clear felling mature aspen stands and leaving the mature stem would hinder moose use of the regrowth aspen. The conclusion was that leaving the mature stems did not hinder moose use of the regrowth. Aspen sucker density in the study area 2-4 years after treatment had 23,000-43,000 stems/ha. The results did show that the distance from the stand edge did make a difference. Beyond 15 meters of stand edge, browse use was low. The author concluded that clear felling without removal of stems is a viable silvicultural method to reinitiate seral aspen in lieu of prescribed fire or mechanical treatments on south facing hillsides.

Harza-EBASCO Susitna Joint Venture. (1984). *Habitat Management Methods to Increase Moose Browse Production in Alaska: A Review, Synthesis, and Annotated Bibliography of Available Information.* Final Report September 1984 Document No. 2046, Alaska Power Authority, Susitna Hydroelectric Project.

This is a report commissioned by the Alaska Power Authority to investigate the impacts on moose of a proposed hydro-electric project on the Susitna River during the first project investigation in the 1980's. The study evaluates the impact of the project on moose and computes total mitigation needed and makes recommendations. The study concludes that the project would affect 50,000 acres of habitat and would affect approximately 340 moose. The general recommendation is to designate adjacent lands for the objective of increasing the carrying capacity for moose to offset this affect. Methods proposed include treat 2 to 10 times the area affected to maintain early succession on a rotation basis, 2 times the area for mechanical treatments and 10 times the area for prescribed burns. The recommendations give a specific set of prescriptions for the project. The report also includes a comprehensive index and an annotated bibliography relating to moose habitat management.

Geist, V. (1999). *Moose Behavior Ecology Conservation.* Stillwater: Voyager Press, Inc.

This is an introductory book on all aspects of moose. The book is focused more on the general public and does an excellent job of covering the basic issues of moose biology and management. The topics covered include evolution, habitat, defense, reproduction and interaction with

humans. The book focuses on North America, but covers many parts of the world from examples of the author's extensive experience including Europe and Asia.

Shipley, L. (2010). Fifty Years of Food and Foraging in Moose: Lessons in Ecology from a Model Herbivore. *Alces, 46*, 1-13.

This article evaluates 50 years of intensive study of moose and looks at why moose are important to study, what we have learned and what we will continue to study in the future. Because moose live in a region of the world (circumpolar sub-arctic boreal forest) where the ecosystem is still intact, it is a model herbivore to study to answer questions about the environment. Three main areas of study during this time are one, dietary specialization and the issues associated with this; two, tradeoffs between feeding behavior and browse availability; and three, long term population regulation such as forage availability and predator interactions.

Walton-Rankin, L. (1977). *An Inventory of Moose Habitat of the Mackenzie Valley and Northern Yukon.* Canadian Wildlife Service, Mackenzie Valley Pipeline Investigations.

This is an inventory of moose population and habitat areas to evaluate impacts of a proposed Mackenzie Valley Pipeline. It was found that moose were widely distributed throughout the region and that important winter habitats were the islands on the Mackenzie River. The report references the Atlas of Moose Habitat Maps (Watson, et al. 1973) that mapped extensive data collection in 1972 that was used to prepare this report. The study area includes 391,000 square kilometers extending from the Alberta British Columbia border along the Mackenzie River

Valley and across the North Slope to the Alaska-Canada border. Browse surveys indicated that gravel sources on the Mackenzie River islands if used for the project would impact moose browse.

Woodford, R. (2006, December). *Assessing Moose Habitat in Alaska*. Retrieved May 7, 2012, from Alaska Fish and Wildlife News: http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=256&issue_id=45

This is an overview article on moose habitat issues in Alaska. It talks about new measurement tools being developed such as GIS and biomass generation and removal measurement methods. It also goes through other issues that need to be considered such as predation and snow levels.

Young, D. D., Boertje, R. D., Seaton, C. T., & Kellie, K. A. (2006). Intensive Management of Moose at High Density: Impediments, Achievements, and Recommendations. *Alces, 42*, 41-48.

This article discusses the intensive moose management program results 10 years after its initiation by the Alaska legislature. The intensive management legislation authorized predator and habitat management, but did not address antlerless hunts. The article focuses on a study area in Game Management Unit (GMU) 20A because it has had a history of predator control and it had the highest moose density in the state at that time. The results showed that the intensive management program was successful in achieving population objectives of the program.

However, harvest objectives were not met, even though there were high levels of moose. The reasons were listed as a need to conduct antlerless hunts in order to balance bull cow ratios and access issues. High harvest numbers were achieved in 2004 and 2005 when an antlerless hunt was instituted. Recommendations to improve the success of the intensive management program include greater flexibility to implement antlerless hunts, authorization for ADF&G to initiate prescribed burns, and increased funding for management, research and public education.

5.4 Public policy issues. Indigenous people and fish and game management in Alaska

State v. Kluti Kaah Native Village of Copper Center, S-4712 (Alaska Supreme Court May 8, 1992).

The court heard an appeal of an injunction that prohibited the Board of Game from enforcing a 7-day moose season against the members of the Native Village of Kluti-Kaah. The injunction was vacated and returned to the superior court. The court ruled that the equal protection of all subsistence users must be maintained. Rabinowitz and Compton dissented. This hunt would have allowed the Native Village of Kluti-Kaah to harvest 40 moose by Village residents with a much longer season. The vacated injunction forced the Native Village of Kluti-Kaah to live with a 7-day season.

Alaska Fish and Wildlife Conservation Fund and the Chitina Dipnetters Association, Inc. v. State of Alaska Department of Fish and Game, Board of Fisheries, and Ahtna Tene Nene', 6731 (Alaska Supreme Court December 7, 2012).

The Alaska Supreme Court ruled that the Chitina Dipnet Fishery did not meet Alaska State subsistence criteria and would remain a Personal Use Fishery. The court ruled that the regulation cited by the Board of Fisheries in its 2003 decision returning Personal Use status to the fishery was consistent with its authorizing statutes, is reasonable and not arbitrary, does not violate the Alaska Constitution's equal access provisions and was constitutionally applied when the Board made its customary and traditional use finding for the Chitina fishery in 2003. The Supreme Court reversed the superior court ruling to prohibit the Board of Fisheries from considering community per capita consumption of wild foods in community member's homes in its deliberations.

Alaska Board of Game. (2006). *Findings for the Alaska Board of Game #2006-170-BOG, Game Management Unit 13, Caribou and Moose Subsistence Uses.* Juneau: Alaska Department of Fish and Game.

The Alaska Board of Game determined the customary and traditional use patterns of the Nelchina Caribou Herd and for Moose. The use patterns were established by the Ahtna and adopted by others. The Board evaluated the eight criteria that were established by the joint boards of fish and game. The Board found that the moose and caribou in unit 13 use patterns qualified for customary and traditional subsistence use.

Alaska Department of Fish and Game Division of Wildlife Conservation in cooperation with the: Yukon Flats Moose Management Planning Committee, Yukon Flats Fish and Game Advisory Committee, CATG, Yukon Flats NWR, Yukon Flats Tribal Governments. (2002). *Yukon Flats Cooperative Moose Management Plan.* Fairbanks: Alaska Department of Fish and Game.

This is a cooperative moose management plan between the US Fish and Wildlife Service, the Alaska Department of Fish and Game, the Council of Athabascan Tribal Governments and the Village councils in the Yukon Flats area. The plan addresses the low moose population numbers in spite of the excellent moose habitat and climate for moose. The plan sets out a common vision and sets goals in the management recommendations section. Some of the goals include increasing the harvestable surplus of Bull Moose, double the size of the moose population and develop cooperative management programs involving State, Federal and Tribal management. The plan also lists implementation priorities for each party. This is a very good document and process. It should be something we work on in the Ahtna Region.

Crichton, V. (2001). Co-Management - The Manitoba Experience. *Alces, 37*((1)), 163-173.

This article discusses the experience of Manitoba wildlife management and various co-management efforts with successes and challenges. Manitoba has a much different constitution than Alaska and the political motivations by the public are different as a result. The Manitoba

constitution gives the rights to hunt to First Nations people first, other Manitoba residents next and non-residents last. First Nations people have unlimited rights to hunt and fish anywhere hunting and fishing is licensed. Alaska on the other hand has a constitution that requires equal access to fish and game resources by all citizens. Co-management efforts in Manitoba have been motivated by hunters and other resource groups to become involved in First Nations management for conservation purposes. There are examples where under-stocking of moose habitat is a big motivation for all parties to work to increase moose numbers. This has worked but also has had problems. The most successful have strong leadership, good information sharing, good research and funding for participation.

Danielsen, J. (2001). Local Community Based Moose Management Plans in Norway. *Alces, 37*, 55-60.

This is an article on the change in management structure for moose in Norway from local municipality management, to management plans developed by hunters and landowners. An interesting method of management is that no one owns the wildlife, but hunting rights are allocated to land owners. It takes at least 60 ha (148 acres) to qualify for a moose harvest permit. This has encouraged cooperation and pooling of hunting areas by landowners. Local 3-5 year long management plans prepared by landowners have been used effectively in some areas since the 1980s. The plans have primarily outlined local management goals and the desired harvest structure i.e. number of calves, adult males and adult females to be harvested within the total

quota. These plans have served as a contract between the landowners and the local authority within a defined management area.

Hull, T., & Leask, L. (2000, November). Dividing Alaska, 1867-2000: Changing Land Ownership and Management. *Alaska Review of Social and Economic Conditions, XXXII*(No. 1), 1-12.

This is a report that summarizes land ownership and transfers in Alaska from 1867 to 2000. The report investigates and reports on ownership by the Federal Government, the State of Alaska, municipalities and private ownership including Alaska Native Corporations. The report contains a bias or error in its underpinnings by stating that the United States purchased Alaska in 1867 with the incorrect assumption that the seller had clear title to the land. This fact was disputed by Alaska Natives from the beginning and an exclusion was put in the Russian Treaty of Cession. The report does not state this very significant detail or how this affected the wording in the Alaska Statehood Act, and the Alaska Constitution. The article does do a good job of documenting executive orders that established Native Reserves. There is a very useful flow chart that shows land ownership transfers up to 2000 in Alaska.

Janson, L. (1975). *The Copper Spike.* Anchorage, Alaksa: Alaska Northwest Publishing Company.

This is a thorough treatise on the background, construction, operation and retirement of the Copper River and Northwestern Railway and the Kennecott mines in the Copper River region of

Alaska. The book has many historic photos and firsthand accounts of people and events associated with the project. The book has a section that deals with the Alaska natives that were involved with the discovery of the mineral deposits, which their clans owned and controlled. Subsequent mining claims took the mineral resources from them through the mining claims laws at a time when Alaska Natives were not granted rights as citizens and could not participate legally.

Lynch, G. M. (2006). Does First Nation's Hunting Impact Moose Productivity in Alberta? *Alces, 42*, 25-31.

This article examines a question of whether unlimited First Nations hunting efforts adversely impacted moose populations in Alberta. A comparison was made of 3 areas where provincially licensed hunters were allowed to hunt only antlered moose with other areas that were hunted by First Nations hunters. Results were that the provincially licensed areas had low bull/cow ratios, high mean age of females and low reproductive rates. The First Nations hunted areas had a balanced bull cow ratio, moose population levels were sustained at a higher level, reproductive rates and twinning rates were higher. Conclusions were that the moose hunting by First Nations hunters was not detrimental and was in fact helpful to the moose populations.

Smith, L. T. (1999). *Decolonizing Methodologies Research and Indigenous Peoples.* Dunedin, New Zealand: University of Otago Press.

This is a book on indigenous methods of research and ways to remove the long established effects of colonization from indigenous people from research methods. The book examines the historical base of Western research and shows how it is a tool of colonialism and imperialism. The book also gives examples and ideas on how to decolonize research projects in the future.

Stoecker, R. (2006). *Research Methods for Community Change.* Thousand Oaks: Sage Publications, Inc.

This is a research methods textbook that outlines the Community Based Participatory Research (CBPR) method. The emphasis of the author is the project-based approach where the project is the research. The book is organized into 8 chapters including why to do research, how to do research that involves the community, diagnosis, planning, action, and evaluation. The book has appendices on strategic planning, research ethics, writing proposals and data sources and includes an index. For a solid how to book on participatory research, this is a highly recommended work.

Thomas, C. S. (1999). *Alaska Public Policy Issues Background and Perspectives.* Juneau: Denali Press.

This is a comprehensive book on Alaska politics. It is organized into four parts with 21 chapters written by various authors with expertise and experience in the Alaska political system. The four parts are I. Economic Issues and Policies, II. Major State Services, III Land, Natural Resources and Environmental Issues and Policies and IV Issues and Policies concerning the Political and Governmental System. Chapter 14 contains a case study on wolf management and is relevant to intensive management of moose as predator management is a critical part of the equation.

Thomas, C., Savatgy, L., Nakazawa, A., & Klimovich, K. (n.d.). Alaska Politics and Public Policy. Forthcoming from University of Alaska Press.

This is a comprehensive book on Alaska politics and the operation of the Alaska government from a political perspective. There are thirty chapters which cover a broad array of issues including the state constitution, the economy, the unique role of Alaska Natives, the operation of interest groups, the budget process, the role of the courts, the role of local government, and the Alaska press. Chapters 9 and 21 are relevant to Moose browse enhancement and intensive management of moose. Chapter 9 which is a discussion of the unique role of Alaska Natives and the Alaska political system including the Alaska Native Claims Settlement Act and subsistence issues. Chapter 21 is a discussion about managing Alaska's lands and the political constraints that the State of Alaska operates under. The book is guest written by a number of experienced authors including three former governors, legislators, academic experts and media leaders.

Wickersham, J. (1927). A Bibliography of Alaskan Literature 1724 - 1924. Fairbanks, Alaska: Alaska Agricultural College and School of Mines.

This is a comprehensive bibliography and literature review of publications relating to Alaska from 1724 to 1924. The subtitle explains best the purpose and contents of the document. "Containing the Titles of all Histories, Travels, Voyages, Newspapers, Periodicals, Public Documents, Etc., Printed in English, Russian, German, French, Spanish, Etc., Relating to, Descriptive of, or Published in Russian America or Alaska, from 1724 to and including 1924." The bibliography includes 10,380 citations covering many topics. There is an introductory chapter on the history of Alaskan Literature that describes the efforts of Peter the Great, Vitus Bering, Russian America Under the Russians and various Russian administrators, Russian American school books, the International Telegraph line through Russian America, Spanish Voyages, English Voyages, French Voyages, Alaska Under the United States, Missionaries in Alaska, the Klondike Stampede, Alaska Newspapers and the Yukon Territory. The listing contains published articles and government documents. It does not address directly Alaska Native issues or articles or voyages from oriental nations. There are hundreds of publications listed that relate to natural resource management and historic harvest and use of moose, forestry and agriculture in Alaska.

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