Moose Winter Range Improvement Study

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Introduction

Moose (*Alces alces*) were introduced to the Copper River Delta in the 1940's and 50's and have grown from a small founder population to well over 500 animals on the west Copper River Delta alone. This moose population has become a staple of Cordova residents and other Alaskans and is the source of an extremely popular Federal Subsistence hunt for bull and cow moose, and a State hunt for bull moose.

Uplift of the Copper River Delta by the 1964 earthquake started a period of plant succession which has largely favored moose by increasing woody species such as willow (*Salix spp.*), however, continued succession towards a climax Sitka spruce (*Picea sitchensis*) forest on the Copper River Delta could reduce browse species in the future. Additionally, recession of the Sheridan Glacier has caused river channels, formerly subjected flood events which favored willow growth, to undergo succession towards woody species such as Sitka alder (*Alnus crispa*), spruce, and cottonwood (*Populus balsamifera*).

A succession model for the Copper River Delta developed by DeVelice et al. (2001) predicted the amounts of various vegetation classes 75 years into the future (Table 1). Most pertinent to moose habitat are changes in the tall shrub classes, which indicate that moose habitat will be relatively stable over that period. These predictions assume both open and closed tall shrub habitats to be equally valuable as moose winter range, which may not be the case. If the open shrub class is examined independently, losses of 2014 and 4383 acres are expected within the outwash plain and uplifted marsh, respectively, over the next 75 years. These declines are predicted to be pronounced within the next 10 years in the outwash plain but not expected to begin within the uplifted marsh until after 2014.

Table 1. Area (acres) and percent change between time periods, of the West Copper River Delta in open tall shrub (SH3) and closed tall shrub (SH4) community types over the next 75 years (DeVelice 2001).

Uplifted Marsh								
	2004	**2014**	**2024**	**2034**	**2044**	**2054**	**2064**	**2074**
SH3	4683	5043 (+8%)	4391 (-14%)	3331 (-23%)	1984 (-29%)	1238 (-16%)	635 (-13%)	301 (-7%)
SH4	1507	1720 (+14%)	1816 (6%)	1722 (-6%)	1468 (-17%)	1107 (-24%)	771 (-22%)	511 (-17%)
Outwash Plain								
SH3	2142	1100 (-49%)	514 (-27%)	245 (-13%)	168 (-4%)	128 (-2%)	106 (-1%)	128 (1%)
SH4	12313	13232 (+7%)	13588 (+3%)	13576 (+/-0%)	13292 (-2%)	12946 (-3%)	12483 (-4%)	12044 (-4%)

In 1990, an experimental moose habitat enhancement project was conducted on the west Copper River Delta on National Forest System lands. Several techniques were used including cutting alder /willow stands by slashing with a rotary ax, hand slashing with chainsaws, bulldoze blading at ground level, crushing by running over the vegetation with a bulldozer, and planting willow. Approximately 100 acres were treated from 1990-1992.

Stephenson (1995) evaluated the use of the rotary-ax to increase willow and reduce biomass of competing species in stands that provide winter forage. As predicted by carbon/nutrient balance theory, willow leaves and current-annual-growth twigs exhibited a peak in digestible protein in summer samples of the first year after treatment, but declined afterwards. In addition, willow leaves from treatment sites exhibited greater digestible energy as a result of extended growth and large leaf size that delayed lignification. The habitats that responded most favorably to treatment were the closed alder/willow and open alder/willow communities. Cuts in these areas responded with extensive willow growth, while uncut areas tended to become alder dominated. This suggests that additional habitat improvement for moose could be made by identifying alder/willow stands suitable for treatment.

Study Area

This project is located on the west Copper River Delta which lies between the town of Cordova, Alaska and the Copper River. Land within the project area is largely managed by the Chugach National Forest, Eyak Native Corporation, and State of Alaska (Figure 1). Initial focus was on lands defined as primary moose winter range by MacCracken et al. (1997), with emphasis on primary winter range along the Sheridan River on Eyak Native Corporation land.

Methods

Existing imagery in the form of aerial photographs, orthophotos and personal knowledge of the area were used to identify tall shrub stands that had any potential to respond to rotary axe treatment and promote willow regrowth. Stands were delineated on a Geographic information system (GIS) by drawing polygons around homogeneous areas on georeferenced orthophotos using other photography as a cross-reference using ArcMap (Figure 2). Non-random points representing uniform areas within each polygon were identified on aerial photographs for field sampling (Figure 3). More than one point was placed in larger polygons. A field crew collected data from these sample points within polygons and estimated physical parameters of each shrub stand, including tall shrub canopy cover and height, with particular emphasis on alder and willow (Figure 4). Additionally, dominant ground cover, intensity of moose browsing, and overall suitability to respond to hydroaxe treatment were estimated. Photographs were taken in the 4 cardinal directions at each plot.

Suitability of stands for hydroaxe treatment was determined subjectively and was based on several factors (Stephenson pers. comm). Most importantly, was a willow component to the stand, with the most suitable sites having at least 25% willow canopy coverage,

well distributed throughout the stand. We were looking for sites where other species, namely alder, spruce, or cottonwood, are encroaching on the site with the potential to reduce the productivity of or eliminate willow over time. Older alder (with stems greater than 3" in diameter), spruce, and cottonwood, which do not re-sprout after cutting, offer the best opportunities for mechanical control. Lastly, an understory with minimal organic matter was rated higher than one with well developed soils, which could promote growth of competing grasses.

Results

On a GIS, 63 polygons representing shrub stands with potential to respond to hydroaxe treatment were identified. They were mainly located within primary winter range in the Sheridan River drainage. Secondary winter range was evaluated less intensively and existing imagery made it difficult to delineate shrub stands in the Scott River drainage. Within 5 days, representing approximately 40 2-person crew hours, 75 of 83 sample point were measured within 58 of the 63 polygons.

The sampled polygons represent 2800 acres and include 1109 acres, 943 acres, and 748 acres, of habitat that was rated as high, medium, or low suitability for hydroaxe treatment, respectively (Figure 5). Approximately 959 acres of habitat labeled high and medium suitability were found on National Forest System lands and 949 acres of high and medium suitability habitat were identified on Eyak Native Corporation Lands (Table 2). Approximately 144 acres of high and medium suitability stands were identified on lands administered by Alaska Dept. of State Lands.

Table 2. Area (acres) and suitability of sampled lands for hydroaxe treatment on lands managed by the USFS, Eyak Native Corporation, and Alaska Dept. of State Lands

	USFS	Eyak Corporation	State	Total
High Suitability	563	461	85	1109
Medium Suitability	396	488	59	943
Low Suitability	133	609	6	748
Total	1092	1558	150	2800

National Forest System lands

The highest priority sites identified on National Forest System lands were located along Alaganik Slough and just east of Eyak Native Corporation lands north of the Copper River Highway (Figure 6). Stand 54 (162 acres) appeared to have the greatest need and a very high suitability for treatment. This stand had high percentage willow canopy cover, is heavily used by moose, and is being rapidly encroached by young spruce throughout the stand. This stand and others like it would likely be lost as moose winter range within 20 years. Other browse stands nearby, including stands 56 (76 acres), 58 (73 acres), 59 (32 acres), and 60 (38 acres) show similar characteristics and currently serve as high value moose winter range. The stands identified in this block total 381 acres and represent the greatest opportunity for winter range improvement of all sites examined

Polygon 70 (123 acres), is adjacent to stand 71 (139 acres) on Eyak Native Corporation Lands, and represents a cooperative opportunity to treat winter range. These polygons have good willow canopy coverage and are being encroached by spruce and cottonwood.

Eyak Native Corporation Lands

Eyak Native Corporation Lands were the initial focus of this project and comprise a significant portion of primary winter range within the Sheridan River drainage (Figure 7). Most of the moose winter range in this area is the result of previously active channels of the Sheridan River that drained the east portion of Sheridan Lake, rather than vegetation succession due to uplift from the 1964 earthquake. Since the main flow of the Sheridan River has now shifted west, willow stands are not being created and existing stands are being replaced by spruce and cottonwood.

Stand 71 (139 acres) represents a highly suitable site for hydroaxe treatment and an opportunity for cooperative management, as the eastern half of the same stand (polygon 70 – 123 acres) is managed by the USFS. Although stand 43 (179 acres) was rated as "highly suitable" during initial field work (as well as neighboring stands 42, 92/93, and 94/95), a later visit revealed the site to be less productive than stands 37 (69 acres) and 40 (26 acres) which were initially rated as "medium suitability". The latter sites have better developed soils and appear to be more heavily used by moose.

State of Alaska Lands

A small area of State land occurs south of the Copper River Highway and west of the Alaganik Road, within primary moose winter range (Figure 8). The stands collectively represent 85 acres of high suitability and 9 acres medium suitability browse stands. These stands are dominated by alder with canopy coverage averaging 70% and willow canopy coverage ranging from 20 to 35%.

Discussion

Browse polygons investigated for this project were identified using imagery that was available on-hand at the Cordova Ranger District. Polygons were largely delineated using geo-referenced black and white orthophotos dating 1996 and color aerial photographs dating 1992 and 1993. More recent color imagery from Google Earth was also used as a cross-reference, although resolution for the Copper River Delta was poor.

This imagery was adequate for identifying older browse stands that were found in the Sheridan River drainage, but not sufficiently current for identifying younger stands that now exist in the Scott River drainage, in the upper Alaganik Slough area, and in the Salmon Creek drainage. More recent imagery, either in the form of color orthophotos (anticipated) or color aerial photography would aid in defining treatable browse stands on other parts of the Copper River Delta.

During field work, willow species were lumped and considered together, however during a post field work visit to a previously treated hydroaxe site, and a control to that treatment, some interesting observations were made (Figure 9). The treated stand largely consists of Barclay's (*S. barclayi*) and Hooker's (*S. hookeriana*) willow, with little evidence of competing alder, spruce, or cottonwood, 15 years post-treatment. Two

controls to that treatment, adjacent blocks that were not hydroaxed, consisted of 60-65% alder with 6" stem diameters and a 10 and 30% willow component. Most notable was that all the willow identified within the control blocks were Sitka willow (*S. sitchensis*). It appears that in the 15 years since the hydroaxe treatment, the alder within the control stands has matured, reducing total willow canopy cover and eliminating the 2 species of willow which responded best to the treatment.

As a result of this observation, older alder stands given high or medium suitability ratings for treatment should be carefully examined before any treatment occurs to see if the willow that persists in the stand occurs at a high enough density and if species other willow species are present, even if in trace amounts.

The greatest threat to existing willow stands identified by this project was encroachment by spruce and cottonwood. In older channels of the Sheridan River, where spruce and cottonwood have reached greater canopy cover and heights than in other polygons we sampled, willow has been all but excluded. Willow stands at greatest risk to exclusion by spruce and cottonwood are those near Alaganik Slough on National Forest System lands and those north of the Copper River Highway on Eyak Native Corporation lands.

During the initial field classification of browse stands, polygon 43 (Figure 7) on Eyak Native Corporation Lands was given a high suitability rating. This stand has 25% canopy coverage of willow and is being encroached upon by cottonwood, spruce and alder. This area represents one of the more recent channels of the old Sheridan River, with an understory of moss over cobble and gravel. Upon a follow-up visit to the site, it was noted that many of the shrubs in the area had nearly died due to some form of stress other than browsing, possibly drought, and have recently started to re-sprout from their bases. It is possible that the gravel substrate does not hold water well in a dry summer, and willow and other shrubs could be stressed or even die. As a result of this observation, it was thought that the overall productivity of the site is not as great as in nearby stands. Nearby polygons 37, 40, and 44 (Figure 7) that were initially rated as "medium suitability" might actually respond better to hydroaxe treatment.

Management Recommendations

1. The west Copper River Delta moose population currently at an all time high. Although vegetation is undergoing rapid change, predictions by DeVelice (2001) show tall shrub abundance, and therefore moose habitat, to be relatively stable over the next 75 years. This is based on the inference that willow communities represent 50% of all tall shrub dominated vegetation of the west Copper River Delta. Although the total tall shrub habitat is to remain relatively stable, the open tall shrub class is predicted to essentially disappear. If the closed tall shrub class has a lower willow component or is less valuable to moose than the open tall shrub class, then significant losses of moose forage could occur.
   Before embarking on any large scale or long-term vegetation management on the west Copper River Delta, evaluation of the tall shrub communities used in the succession model should be conducted. A relatively simple project, based on

aerial photography and vegetation models could be conducted to evaluate the willow content and forage vlaue of both open and closed tall shrub community types.

2. Previous hydroaxe treatments should be evaluated to determine best methods for treating stands identified by this project.
3. Willow stands totaling 381 acres on the upper Alaganik Slough are currently important winter browse for moose and will be lost to succession within approximately 20 years if not treated. Of all the sites examined, this area, especially polygon 54 (Figure 6) offers the best opportunity for mechanical treatment.
4. A cooperative opportunity exists for the USFS and Eyak Native Corporation to jointly manage stands 70 (Figure 7) and 71 (Figure 6) which total 262 acres. These polygons combined represent an old channel of the Sheridan River that was diverted with a dike to prevent flooding of the Copper River Highway. For this reason, succession is more advanced than in other nearby stands.
5. Stands 37, 40, and 44 (Figure 7), which total 289 acres, on Eyak Native Corporation lands represent good sites for hydroaxe treatment. These stands have 35-40% willow canopy coverage and have moderate amounts of encroaching cottonwood, spruce, or alder.
6. On Alaska State lands, polygons 1, 3, 5, 25, 27, 28, and 30 (Figure 8) represent a block of 94 acres, of mostly dense alder with a willow component that could respond well to treatment. Before developing a prescription for this area, attention should be paid to the willow species present to help predict results of any planned treatment.
7. Treated lands will provide little moose browse for 2-3 years post treatment, therefore, will be essentially removed from the moose winter forage base for this period of time. With moose populations at all-time highs, attention should be paid to the total area treated on all land ownerships within a short time frame, as well as the spatial arrangement of treated areas.
8. Treatments should be laid out as an experimental design with replicates so that results of any treatments could be evaluated in the future.
9. Existing hydroaxe plots are readily visible from the air. Future prescriptions should be designed to follow vegetation or topographical features so that they will be less of a visual impact, especially if more and larger areas will be treated over time.
10. Better imagery must be obtained to evaluate other parts of the Copper River Delta. Opportunities likely exist within secondary winter range which was not closely examined in this project. Suitable sites likely exist within the Scott River drainage, south of the airport, and in the Salmon Creek drainage.

Cooperators

This project represents a cooperative effort between the Cordova Ranger District of the Chugach National Forest, Native Village of Eyak (NVE), Eyak Native Corporation, and Alaska Department of Fish and Game (ADFG). Field work was completed with the help of Dave Crowley of ADFG, and Erika Empey and Keith Van Den Broek of NVE. Additional insight into this project was added by a site visit from Dr. Tom Hanley of the

Pacific Northwest Research Station of the U.S. Forest Service, Juneau, Grant Harris of the Chugach National Forest Supervisor's Office, and Erin Cooper and Paul Meyers of the Cordova Ranger District.

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