# TECHNICAL NOTE

**USDA NATURAL RESOURCES CONSERVATION SERVICE ALASKA**

## Alaska Biology Technical Note – No. 1

# HABITAT ENHANCEMENT for MOOSE in BOREAL ALASKA

## Introduction

Moose evolved in Eurasia and migrated to North America over the Bering Land Bridge during the Pleistocene. Moose have been an important part of Alaska Native subsistence culture for millennia. In addition to being one of the most familiar large mammals in the state, they are also one of the most sought-after wildlife species in Alaska. Harvest is over 7,000 animals per year which yields millions of pounds of meat for human consumption.

*Moose. Photo courtesy of US Fish & Wildlife Service.*

Wildlife management seeks to manage wildlife populations at an optimum abundance and provide sustainable harvest, maintain a desired nutritional or health condition of wildlife species and their forage plants, and provide for non-consumptive uses, such as wildlife viewing. Abundance of moose is constrained by hunting, predation, other sources of natural mortality (e.g., winter severity) as well as the quantity and quality of available habitat.

In the boreal forest, productive moose habitat is largely maintained by stochastic wildland fire in uplands and more regular fluvial action constrained to riparian corridors. During most years in Alaska, over one million acres of forest is burned. Many of these fires create optimal moose habitat for 20 – 30 years until preferred forage species like aspen, birch, and poplar grow out of the reach of moose or are replaced by non-forage species, typically spruce. Intensive foraging by high density moose populations can accelerate successional change from preferred forage species to non-preferred species. Moose are the best example of a big wildlife animal in Alaska for which we can create or enhance habitat by mimicking the effects of wildland fire through the use of prescribed fire or mechanical means. Habitat enhancement for moose has secondary benefits of supporting other wildlife, increasing floral diversity and site productivity. With certain design considerations, habitat enhancements can be used to create fuel breaks to protect valuable infrastructure from wildland fire.

This leaflet is intended to serve as a basic introduction to moose habitat requirements and assist private landowners and managers in developing habitat management plans for moose. The success of any individual species management plan depends on targeting the particular requirements of the species in question, evaluating the designated habitat area to ensure that such requirements are met, and determining appropriate management techniques to further improve habitat quality.

## Moose Biology

Moose are the largest member of the deer family (Cervidae) weighing as much as 1,600 pounds and reaching more than six feet tall at the shoulder. In North America, four subspecies are recognized and range from New England and the northern Rocky Mountains through most of Canada and mainland Alaska. Moose also occur across northern Europe and Asia.

Moose are generally solitary except during the fall breeding season. Calves are born in May and June and stay with their mothers for about one year. Moose can have one calf per year after cows reach sexual maturity at roughly two years of age. On good range cows often give birth to twins. Triplets are known but uncommon.

Calves are the most vulnerable to predation, typically by bears (both black and brown bears) and wolves in the first few weeks of their lives. By one year of age, most moose are able to evade predators. Survival is highest during the first six years of life after which moose succumb to predation at an increasing rate as they age. The primary causes of moose mortality in Alaska are predation and hunting. Few moose live past 12 years. Winter is the most challenging time of year for moose when mobility and access to forage can be limited by deep (>2 feet) or crusted snow. Deep snow can increase vulnerability to predation by wolves. In unusually harsh conditions, starvation can become significant by late winter.

Some populations migrate seasonally, most often to avoid areas of deep snow in winter, often to lower elevations. The size of moose home ranges can vary greatly. Home range size is influenced by a number of factors but is most importantly constrained by forage quality and availability. Home range sizes in western and south-central Alaska documented from radio telemetry studies range from 20 to over 200 square miles. Moose densities also vary quite widely. In interior Alaska densities range from well under one moose per square mile (where predation limits abundance) to greater than three per square mile. Conversely, in Scandinavia where landscapes and moose are managed intensively and large predators less abundant, densities can be much higher.

## Moose Habitat Requirements

In Alaska, moose utilize a wide variety of habitats including tundra and forest but more specifically prefer shrub thickets, early seral deciduous forest, and wooded wetlands. Their preferred forage most of the year occurs in these habitats and consists of leaves and twigs of willow (*Salix spp*), birch (*Betula spp*), poplar (*Populus spp*), and aspen (*Populus tremuloides*). Moose eat a wide variety of foods in summer when forage availability and nutrition is at its peak. Forbs and graminoids become important during spring green-up. Submerged aquatic vegetation is important in summer, where moose have access to lakes and ponds. Leaves of hardwood trees and shrubs are consumed while available throughout the growing season. During the remainder of the year, in the absence of leaves or other green plant parts, moose feed almost exclusively on the twigs and buds of hardwood trees and willow shrubs. Water needs are provided by vegetation, open water (when available), and snow in winter.

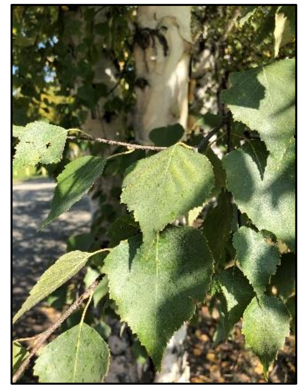
Moose prefer the concealment of dense vegetation as a predator avoidance strategy. They will venture into open areas to feed but generally seek shelter to rest and digest between feeding bouts. Moose are ruminants and have the ability to feed intensively for short periods and digest their meals later. Moose often bed in tall grass in forest openings or edges and during calving, seeking isolation in thick vegetation.

## Ecology of Woody Forage Species

Willow and hardwood tree species that make up the most important forage for moose share some ecological and biological characteristics that are relevant to habitat enhancement strategies. All require moist mineral soil for seed germination and can also reproduce asexually by stump or root sprouts. Willow, aspen and poplar (all in the Salicaceae family) seed is dispersed by wind via fine, silky hairs attached to their tiny seeds which can allow them to disperse great distances. All grow best in full sun. On warm, mesic sites growth for young hardwood trees and some preferred willows, can be over six feet per year. Under a forest canopy or in competition for light with other plants, growth is greatly reduced and plant mortality increases. Some willow species such as Bebb willow (*S. bebbiana*), can persist for decades under the shade of a mature forest canopy but growth is minimal. In addition, most of these species are relatively short lived. Willows likely don’t reach 100 years. Hardwood trees rarely reach 200 years. On the other hand, black and white spruce which are climax forest community species, can live up to 300 years or longer.

**Willow:** There are nearly 40 species of willow in Alaska. Of those, about 20 in the boreal region provide important forage for moose. Growth forms range from low prostrate shrubs to small trees. Willows grow in many different habitats and are important food sources for beavers, ptarmigan, and other species not just moose. Flowering is in spring (e.g. ‘pussy willows’) and seed dispersal occurs in early summer for most species. Mature willows will stump sprout when stems are cut or broken. Moose have been documented feeding on many species of willow and prefer tall shrub species (e.g. diamond leaf willow [*S. pulchra*]) and tree-like species (e.g. feltleaf willow [*S. alaxensis*]). Both of which are much more likely to be available during winter when prostrate species are buried under snow. Most willows grow best in moist or wet soils and only a few species have a relative degree of drought tolerance. In tundra or subalpine areas shrub thickets dominated by willow or alder are a climax seral stage whereas below tree line willows are regenerated regularly by fire or fluvial disturbance.

**Birch:** In boreal Alaska there are two species of birch shrubs (dwarf birch [*Betula nana*]) and resin birch [*B. glandulosa*]) and two species of birch trees (Kenai birch [*B. papyrifera var. kenaica*] and Alaska paper birch [*B. neoalaskana*]). All the birch species hybridize readily, sometimes making identification difficult. While moose occasionally eat birch shrub species they prefer the tree species. Moose forage preference between the birch tree species is unknown. Birch seeds disperse gradually in fall and winter, often aided by resident passerine birds who glean seeds from the cone-like fruits in treetops during foraging. Seeds are winged but relatively heavy and most do not land farther than about two tree heights from the parent tree unless aided by winter winds blowing seed across the snow. If the main stem is killed, such as by harvest, asexual reproduction can occur via stump sprouts, either in single stems or clumps, however this occurs most often on younger trees (<40 years). Stump sprouts do not live as long as seed-germinated trees. Birch trees grow best on moist sites and can tolerate wet soils better than other hardwood trees though growth is greatly reduced under saturated conditions.



**Balsam Poplar:** Often called "cottonwood" in interior Alaska, balsam poplar (*Populus balsamifera*) is closely related to black cottonwood (*Populus trichocarpa*) that occurs in south central Alaska and southward along the coast. Poplar reproduces by seed and also asexually by sending up root sprouts (clones of the parent tree) and can regenerate rapidly following disturbance. Poplar occurs throughout the Interior, most commonly in riparian situations along major drainages but also on moist soils away from rivers where it is generally less common. It also grows at or above tree line often forming clones around springs and seeps. South of the Alaska Range black cottonwood is more common but shares the same ecological niche as balsam poplar.

**Quaking Aspen:** Aspen is a fast growing and shorter-lived tree common on well drained soils and south facing slopes throughout the boreal forest. It is the most widespread tree species in North America and aspen is a preferred forage of moose. Aspen can reproduce by seed and can also root sprout and form clones which can be much more extensive than poplar clones. This reproductive strategy lends itself well to management by clear-cut logging. Thus, coppicing aspen stands on a rotational scale for a variety of objectives is a common practice.

## Boreal Forest Ecology

Life in the boreal forest is regulated by changing cycles of seasonal climate, species distributions, population levels, and (most importantly) disturbance. The primary cause of upland disturbance is fire, which can be much more extensive in area than flooding, windthrow, thermokarst, and other means. Disturbance often results in exposure of mineral soil (or deposition of a silt cap during floods) which provides a moist and fertile seedbed for a variety of plants. Many species can only regenerate from seed on mineral soil. Disturbance resets the successional clock and creates diverse vegetation patterns on the landscape, which in turn support a greater diversity of wildlife than expanses of similar vegetation type or age class.

Wildland fire is most extensive in spruce forests and can be caused by humans but most large fires are caused by lightning in remote areas. White and black spruce form climax seral stages in the boreal forest and contain highly flammable fuels. Often the most flammable stands are mature and characterized by low vegetation diversity and slow growth. This is because the ground under these stands is often carpeted with a thick layer of moss and soil temperatures are cool under this insulating layer. Soil temperature is the greatest factor limiting plant growth at this latitude. Microbial activity in cold soils is also constrained, so nutrient cycling is slowed. Well-stocked spruce stands can carry fire in dry conditions, especially when aided by wind. In high severity fires, moss and other organic matter is readily consumed, resulting in exposure of a mineral soil seed bed. Within a few years, post-fire regeneration can result in lush growth of forbs and graminoids. If aspen or poplar was present in the stand prior to a low severity fire that does not burn deep, fast growing root sprouts can number in the many thousands of stems per acre. Establishment of aspen, poplar, and willow is common if seeds blow in from the surrounding landscape. If birch trees are near enough to the fire perimeter, seedlings can also number in the many thousands of stems per acre. These regenerating forests grow on warm soils with rejuvenated microbial activity and produce an abundance of nutritious and highly palatable forage.

Nutrient content of regenerating vegetation is especially high in the first few years following fire and highly sought by moose. Even within a month of a severe fire, aspen root sprouts, though less than one foot tall, will attract moose to forage in an otherwise blackened landscape. Depending on fire severity, some hardwood trees and shrubs as well as forbs and graminoids will regenerate from existing roots or seed banks. Seeds from other species may disperse in over time, but species diversity begins to stabilize as competition for light increases and mineral soil disappears under leaf litter. Soon moss establishes and after a number of years becomes thicker and more widespread on the forest floor. As this insulating layer grows it causes underlying mineral soils to cool, allows soil active layer depths to decrease and historically has allowed permafrost to return on sites favorable to its establishment (i.e. flat ground or north facing slopes).  Under these conditions spruce will continue to grow while the abundance and availability of preferred hardwood forage species declines until the next fire or other disturbance event.

## Habitat Enhancement for Moose

Moose habitat can be created or enhanced by causing disturbance on the landscape to stimulate the growth of early seral vegetation. The general goal of habitat enhancement for moose on private lands is to attract them to an area for consumptive or non-consumptive uses and to maintain this attraction for as long as vegetation can support management objectives. The desired effect of the disturbance is to increase soil temperatures and soil microbial activity. Thus, increasing the growth, abundance, and palatability of preferred forage species. If the goal is to perpetuate this scenario, disturbance can be recreated on a rotational scale. While moose may use the management unit year round (depending on project scale and local moose movement patterns) most utilization will be in winter. That time of year is when browse is most important to moose and should be abundant on a successful enhancement site.

A successful project improving moose forage on the typical scale of 20-100 acres on private lands will attract moose to a management unit from the surrounding area. Attempting to create a detectable increase in moose abundance would require enhancing forage on several thousand acres, which would likely involve landscape-scale prescribed fire, and is beyond the scope of this document. When enhancement is conducted in areas where moose densities are high and may be forage limited, there is an increased likelihood that moose will find and utilize forage in the habitat management unit. However, low density populations are generally not forage limited (more likely predation limited) and relatively few moose are likely to utilize, or even find, a typical sized enhancement site (20-100 acres). Planning habitat projects on private land should include consideration of human access to enhancement sites for desired uses and how access by heavy equipment can positively or negatively affect user access in the longer term.

The recommended minimum size of a single treatment site is 20 acres. In smaller treatment units moose may browse every terminal leader on hardwood trees each winter and can suppress growth and eventually kill aspen, birch, and poplar. From the perspective of stand survival it is important that hardwood trees reach the "free to grow" stage above the reach of moose. Willow can withstand high levels of browse pressure for longer periods. Smaller units may be acceptable if part of a mosaic of treatment sites within a larger management area.

Other wildlife can benefit from habitat enhancement projects designed for moose. In interior Alaska, the relatively open canopy of disturbed forest or shrub communities creates suitable habitat for sharp-tailed grouse. Ruffed grouse and snowshoe hares can benefit from the high stem densities of hardwood trees, especially aspen, as enhancement sites mature past five years. Song birds that nest in early seral habitats may also utilize enhancement sites.

Habitat enhancement projects can also be designed with the dual purpose of creating fuel breaks. Since young hardwood stands have much lower fuel volumes and are much less conducive to carrying fire than spruce. If that is a desired outcome the project design should include considerations of prevailing wind direction, distance to structures, other valuable resources, fuel types, and other variables. The Alaska Division of Forestry (DOF) should be consulted when planning to include a fuel break design in an enhancement project.

## Enhancement with Prescribed Fire

Prescribed fire (broadcast burning) is commonly used in some agricultural settings and by forestry, range, and wildlife management programs in many parts of the world. Most prescribed fires are conducted at small scales in developed landscapes such that fuel breaks (e.g. roads) can be a component of a burn plan and fire crews often have access to all sides of a planned fire perimeter. In Alaska, prescribed fire is used to a lesser extent. The vast roadless nature of most of rural Alaska, and thus the lack of effective control lines, is one reason prescribed fire is used here less often. However, mechanical enhancement is meant to mimic fire. So, when it can be used, prescribed fire often produces better results.

In hardwood stands, ground fire during a narrow window in spring (e.g. after snow melt and before green-up) in light fuels of grass and leaf litter can top kill hardwoods and willows and is ideal for regenerating these vegetation types. Spring is optimal because leaf litter is driest at that time of year. Stand conversion from spruce to hardwoods is best conducted in summer when duff layers are completely thawed and dried out. Duff consumption is important to expose mineral soil. However, fire in spruce produces more smoke, is hotter, and typically will crown resulting in greater flame lengths. These stand conversion fires can be much more challenging to manage.

Prescribed fire must be conducted by an agency with mandated authority and acquired expertise. That includes the State of Alaska DOF and the US Bureau of Land Management Alaska Fire Service (AFS). Following initial consultation with DOF or AFS, one of the first steps needed is for the proponent to write a burn plan. Burn plans describe the location, size, and purpose of the proposed burn and include analyses of risk to vulnerable resources, smoke management, technical aspects of terrain and fuel types, safety concerns, equipment needs, number of staff needed including levels of expertise, and other metrics. Another important consideration is that DOF and AFS are required to forego prescribed fire implementation when their resources are needed to protect homes and property during wildfire events. Because prescribed fire is a lower priority it can sometimes take years for the right environmental conditions to occur that are also not in conflict with ongoing wildland fire management activities.

## Enhancement with Mechanical Means

Habitat enhancement projects utilizing mechanical means are more common in Alaska than use of prescribed fire. Heavy equipment can be used to crush or shear vegetation (emulating ice scouring that simulates root sprouting) or remove the organic layer and surface vegetation (“scarification” that emulates fire severity and prepares a mineral soil seed bed). Mechanical treatments are typically done with bulldozers. Dozers can be equipped with a straight blade typically used for scarification and to pile slash. However, an angled shear blade can cut trees at ground level, with a point to split the base of larger trees and can be used to windrow slash.

Alternatively, a roller chopper can be used to cut and chop smaller diameter vegetation. A roller chopper is a large circular drum pulled behind a dozer, log skidder or other type of heavy equipment. The drum has sharpened steel blades welded onto the long axis. The drum can be filled with water to add weight (or a glycol solution to prevent freezing). A roller chopper can be towed over a prescription site to crush and break up trees and shrubs up to five inches DBH but cannot remove the organic mat.

Following tree and slash removal a disk trencher can also be used for site scarification. Disk trenchers create two furrows and can be pulled behind a dozer or skidder and require less operator skill to expose mineral soil than using a blade.

Light scarification or crushing smaller willows can be done with dozers or log skidders of about 75 horsepower and 15,000 lbs., but pulling a roller chopper over 5 inch diameter trees or shearing trees up to 12 inch diameter and windrowing debris typically requires dozers of about 200 horsepower and 40,000 lbs.

Mechanical operations are best conducted in winter when snow is less than two feet deep and the ground is frozen. Operating at colder temperatures allows stems to be more easily cut or broken at ground level, allows stumps to shear rather than tear out, reduces soil compaction, and permits easier equipment travel across wet areas. A range of acceptable operating temperatures (commonly less than +10 degrees F) can be specified in the contract or scope of work. However, equipment malfunctions can occur at temperatures below -20 degrees F. Experienced contractors or operators should be aware of the challenges to equipment posed by subzero temperatures.

The goal is to cut all woody species at ground level. This produces the desired growth response from target hardwood species. It is also important to eliminate spruce seedlings which can be challenging at warmer temperatures because they have a tendency to spring back following passage of equipment. Young spruce released after removal of a hardwood canopy can grow quickly and shorten the time period of effective enhancement by shading and cooling soil and directly competing with hardwoods.

Slash should be removed if trees (or tree tops after logging) are larger than four inches base diameter. In particular, green conifer slash that could attract engraver beetles and lead to mortality in nearby spruce stands. Larger hardwood slash can be left onsite if the organic mat does not have to be removed to prepare part of the site as a seed bed. But consider that abundant slash left on site can hinder movement of moose to some extent and humans to a greater extent. If human access for hunting or other purposes is a management objective, it may be desirable to remove slash. If the organic layer must be removed (thicker than four inches), then slash will have to be removed. Slash can be pushed to the side of a project site, windrowed, or piled. If desired, piled and windrowed slash can be burned after it dries following at least one growing season. Organic matter should not be burned. If organics are included in burn piles it will slow the fire and produce more smoke and if piles take longer to burn, they may require more oversite to guard against fire escape.

If there is enough salvageable timber on a project site, it may be worth considering a logging contract or allowing firewood harvest prior to site preparation. Site preparation following a logging operation is similar in that slash and some organics may need to be removed. However, larger stumps may have to be avoided if equipment is not big enough to remove them. On sites that do not require extensive slash or organic removal, a skidder or other type of equipment may be sufficient for site prep. If birch is present in a stand scheduled for timber harvest, consider leaving two or three trees per acre as a seed source and additional habitat structural diversity.

Project work should be monitored to ensure operators are removing the specified thickness and area of organic duff, are piling slash satisfactorily, and are staying within the project boundaries. Boundaries can be delineated for the operators using flagging tape hung at heights that can be easily seen from the cab of the dozer. Some operators may have GPS-enabled tablets and can be provided with a GIS shapefile polygon of the treatment area in lieu of flagging boundaries. Shearblades and roller chopper blades need to be sharpened periodically with portable grinders to ensure performance, especially if operating on rocky ground. Blades should shear instead of tearing out stumps and chopping of debris should occur so smaller pieces can contact the ground for more rapid decay.


**Organic layer:** An organic layer is an accumulation of leaves, spruce needles, and dead moss forming a moist and fibrous insulating layer that may be more than 18” thick (e.g. a histisol). If organic layer thickness on a project site averages over four inches it should be removed. The primary cause of failure of a project to meet goals of vegetation response is failure to remove the organic layer. If the organic layer is not removed soil temperatures will not increase enough to optimize regeneration of preferred forage species via root or stump sprouting. In addition, without mineral soil exposure the site won’t be suitable to woody regeneration by seed. Organic matter on the soil surface dries quickly and generally doesn’t hold sufficient moisture for seed germination or seedling survival. If it is not removed original understory shrub species and seedling spruce will perpetuate. Moose may be attracted to the enhancement site but winter forage is generally not in sufficient quantities to hold them long. In the short term the site will become a shrub community primarily composed of species that are unpalatable to moose. In the long term the site will convert to spruce forest. As a general rule of thumb: Sites dominated by mature spruce will likely need to have the organic layer removed. Sites dominated by hardwoods generally do not.

**Invasive Species:** NRCS strongly recommends steps be taken to avoid the introduction or spread of invasive plant species. Some, such as bird vetch, are becoming more widespread in Alaska and have the potential to negatively impact early seral community growth. For example, bird vetch can smother, kill, or reduce the growth of hardwood seedlings and may have long term impacts on community composition and structure. Herbicides are the most effective treatment for established populations but will kill all broadleaf species including hardwood trees and shrubs. Preventing the introduction of weeds is the best control measure. Contracts should specify that all equipment be washed prior to arrival on site. Inspections should be conducted to ensure compliance followed by annual weed surveys for several years following treatment.

## Planning, Site Assessment, and Follow Up

A well informed and well-planned enhancement project has a much higher likelihood of success in terms of vegetation response. Goals and objectives should be well thought out and clearly stated ahead of any groundwork. Site assessment should follow the procedures outlined in the Moose Habitat Evaluation Guide. Aerial imagery and GIS can be used to delineate stand types and assess topography, access, soil type, and wetland status. A site visit should be conducted to determine tree species composition, age, and density, current browse pressure, and average duff thickness in different stand types. Use these data to determine the potential of both the site to produce sufficient forage and the moose population to respond as desired. These goals should be discussed with vegetation ecologists or wildlife biologists familiar with the area.

After project completion it is advisable to monitor the site for the expected response of vegetation and moose. Success of an enhancement project should be defined by initial goals but may best be determined by a measure of vegetation response. For example, by the end of the second growing season post-treatment stem densities above 30,000 per acre from aspen and willow are considered sufficient to provide optimum brood habitat for ruffed grouse and substantial forage for moose. Measurements can be repeated periodically to determine trends in stem density, winter browse biomass (lbs./ac), or other vegetation parameters. Trend estimates can be used to trigger management options (such as rotation timelines) based on predetermined thresholds.

## Eligible USDA Programs

| Program | Land eligibility | Type of Assistance | Contact |
|---|---|---|---|
| Conservation Reserve Program (CRP) | Highly erodible land, wetland, and certain other lands with cropping history. | 50% cost share for establishing permanent cover and conservation practices, and annual rental payment for land enrolled in 10-15-year contracts. | NRCS or FSA State or Local Office |
| Environmental Quality Incentives Program (EQIP) | Cropland, range, grazing land, and other agricultural land in need of treatment | Up to 75% cost-share for conservation practices in accordance with 1 to 10 year contracts. Incentive payments for certain management practices. | NRCS State or Local Office |

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Paragi, T. F. 2010. Density and size of snags, tree cavities, and spruce rust brooms in Alaska boreal forest. Western Journal of Applied Forestry 25:88–95. {recommends considering what older seral features can be left on treatment sites without compromising fuel reduction or early seral responses}

Paragi, T. F., and D. A. Haggstrom. 2007. Short-term responses of aspen to fire and mechanical treatments in Interior Alaska. Northern Journal of Applied Forestry 24:153–157.

## Agencies and Personnel with Expertise in Habitat Enhancement

Alaska Department of Fish & Game: Fairbanks office, Tom Paragi (Wildlife Biologist). Anchorage office: Sue Rodman (Wildlife Biologist). https://www.adfg.alaska.gov/index.cfm?adfg=contacts.employee

Alaska Division of Forestry: Fairbanks office, Kevin Meany (Resource Forester). http://forestry.alaska.gov/divdir

Natural Resource Conservation Service: Dean J Houchen (Soil Conservationist). Dean.Houchen@usda.gov

Salcha-Delta Soil & Water Conservation District: Jeff Mason (Ecologist). Jeff.mason@salchadeltaswcd.org

US Army Alaska, Fort Wainwright: Dan Rees (Forester). daniel.c.rees.civ@mail.mil

## Available Equipment

The following are some equipment implements that may be available for use in habitat enhancement operations in Alaska, either to borrow or rent at the discretion of the owner.

The State of Alaska owns a roller chopper, a disc trencher, and V-blade for shearing. Contact the Alaska Division of Forestry or the Alaska Department of Fish and Game.

The Alaska Moose Federation owns a roller chopper. http://www.alaskamoosefederation.org/