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Volunteer-assisted Invasive Plants Surveys of Riparian Corridors at Tetlin National Wildlife Refuge, Alaska – Final Report

Merben Rellen Cebrian

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Tetlin National Wildlife Refuge
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For

Invasives and Volunteers Competitive Grants Program
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by

Merben Rellen Cebrian

VOLUNTEER-ASSISTED INVASIVE PLANTS SURVEYS OF RIPARIAN CORRIDORS AT TETLIN NATIONAL WILDLIFE REFUGE, ALASKA – FINAL REPORT

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ABSTRACT

We investigated the occurrence of invasive plants along three riparian corridors at Tetlin National Wildlife Refuge. The purpose of the surveys was to provide a baseline for assessing the threat of invasive plants spread into the Refuge along a potential route of infestation. Methods employed included opportunistic sampling along the 35 km Scottie and Desper Creeks system and systematic sampling along an 88.5 km section of the Chisana River. No invasive plants were found along Scottie-Desper Creeks. However, we documented white sweetclover (*Melilotus alba*) and alsike clover (*Trifolium hybridum*) at the bridges where the creeks intersect the Alaska Highway. We encountered foxtail barley (*Hordeum jubatum*) along the Chisana River. The infestation was low and we recommend continued monitoring for invasive plants along these waterways.

INTRODUCTION

Invasive plants are defined as non-native plants that replace native flora, become self-sustaining, and dominate or disrupt the native ecosystem (Reichard and White 2001). Invasive plants affect native plant communities by altering ecosystem properties in their favor (Gordon 1998). For example, local biogeochemical processes such as carbon and nitrogen cycling may be altered by invasive plants that it may result in the displacement of native plants (Abbott 1992, Gordon 1998). Other effects of nonnative plant invasions include changes in soil structure and hydrology and changes in disturbance regimes (Huenneke 1996, Gordon 1998). Invasive plants may outcompete native plants at a location and replace them completely.

Invasive plants are a threat to ecological integrity (Bratton 1982, Asher and Harmon 1995, Cole and Landres 1996). Interior Alaska has been thought to be insulated from these threats because of extreme climatic conditions. However, recent discoveries listed by the Alaska Exotic Plants Information Clearinghouse (AKEPIC; http://akweeds.uaa.alaska.edu/NewWeeds.asp) suggest that some invasive plants thrive in Alaska. Although some occurrences have been recorded along riparian corridors (AKEPIC 2007), most encounters with invasive plants in Alaska have been recorded on roadsides and on trails (DeVelice 2003, Nolen 2002).

There are eight major highways that interconnect 7 urban areas (Anchorage, Delta Junction, Fairbanks, Glennallen, Homer, Seward, and Tok) in the eastern half of Alaska. No roads connect these urban areas to villages in the western half of Alaska. The Alaska

Highway connects the continental United States to Interior Alaska via Canada. The gateway community of Tok creates the first in-state bifurcation of this road system that can take travelers to either one of the two major population centers in Alaska – Anchorage or Fairbanks. Invasive plants are found along the Alaska Highway from the US-Canada border to Tok (Cebrian and Johnson 2006, Cortés-Burns and Carlson 2006, Cebrian and Johnson in prep) although few invasive plants species are within Tetlin National Wildlife Refuge (NWR) boundaries (Cebrian and Johnson 2006, Cortés-Burns and Carlson 2006). As such, the Alaska Highway becomes a conduit through which invasive plants travel by hitching rides in vehicles and on trans-border wildlife. Therefore, potential avenues of dispersal from these source populations were surveyed in order to monitor invasive plants spread into Tetlin NWR lands.

The likeliest avenue for invasive plants spread into Tetlin NWR is via waterways that cross the Alaska Highway and drain into Refuge lands. Invasive plants that take root along the Alaska Highway produce seeds that may end up in one of these creeks that drain into Tetlin NWR lands. Two creeks, Scottie and Desper Creeks, were surveyed as part of this project in order to assess and to provide a baseline for the extent of invasive plants spread into Tetlin NWR lands.

Tetlin NWR encompass approximately 283,280 ha (700,000 acres) located in the Upper Tanana Valley just south of the Alaska Highway. Tetlin NWR is home to moose, caribou, and other fish and wildlife that depend on an intact ecosystem in order to thrive. The Refuge also contains important nesting and breeding habitat for migratory waterfowl. The potential impact of invasive plants to fish and wildlife habitat in Alaska is largely unknown. However, it is likely important to maintain an intact ecosystem free of invasive species in order to continue to provide this nesting and breeding habitat. The purpose of this survey is to provide baseline information on current infestation status in order to monitor invasive plants spread into Tetlin NWR lands. The objectives were to 1) map invasive plants along the Scottie and Desper Creeks system and 2) map invasive plants along the Chisana River from the confluence of Scottie Creek to the Northway village bridge. The target invasive plants were white sweetclover (*Melilotus alba*; Appendix A) and foxtail barley (*Hordeum jubatum*; Appendix B), found commonly along the Alaska Highway.

Study Area

The study area was located in the Upper Tanana Valley within the boundaries of Tetlin NWR, Alaska (Figure 1). The gentle topography of low-elevation relief interspersed within wetland ideal for waterfowl habitat supports a fire-mediated boreal forest. The mostly black spruce (*Picea mariana*) forest gives way to white spruce (*P. glauca*) in drier soils and along riparian corridors. Small stands of paper birch (*Betula papyrifera*) or quaking aspen (*Populus tremuloides*) dot the landscape. The shrub community is generally described by willow (*Salix spp*), or alder (*Alnus spp*) that give way to tussock tundra in poorly drained areas underlain with discontinuous permafrost. The creeks are generally cold, muddy, and slow-moving. Desper Creek flows into Scottie Creek and ultimately drains into the Chisana River. The Chisana River is a glacially fed river originating from the Alaska Range, flowing northward towards the Alaska Highway

where it is intersected by Scottie Creek. The Chisana River is later joined by the Nabesna River to form the Tanana River and courses westward through low-lying waterfowl habitat that defines Tetlin National Wildlife Refuge.

METHODS

We conducted two field surveys of three riparian corridors on Tetlin NWR in the summer of 2007. On 25-26 June 2007, we surveyed Scottie and Desper Creeks and on 23 July 2007, we surveyed the Chisana River. We employed two methods during these surveys. For the Scottie-Desper Creeks survey, we used an opportunistic sampling scheme, while for the Chisana River survey, we used a systematic sampling scheme. Invasive plants encountered were pulled and burned.

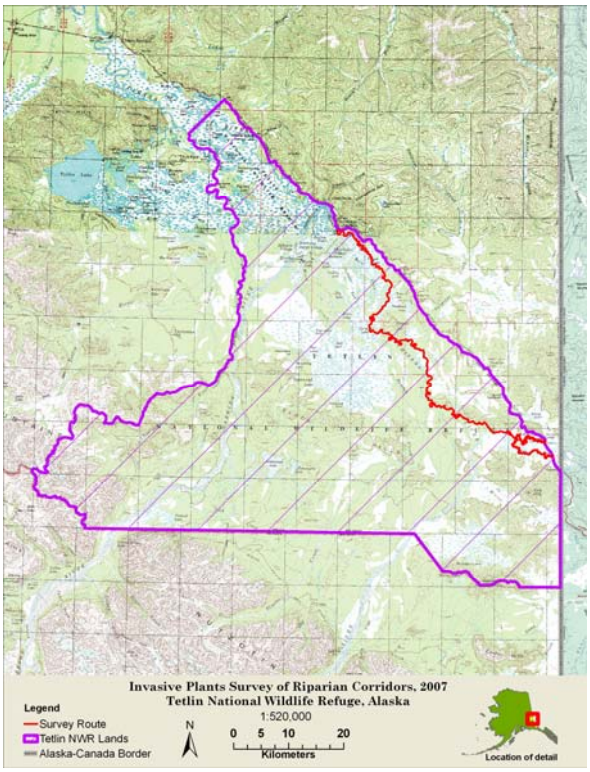

Figure 1. The invasive plants study area covering two waterways systems on Tetlin National Wildlife Refuge, Alaska in 2007.

Scottie-Desper Creeks. Two observers started the survey at the intersection of the Alaska Highway and Desper Creek, traveling south at an average speed of 4.8 kph (3 mph) on two boats equipped with 15-hp motors. We traveled 35 km (22 mi; Figure 2A) of the Scottie-Desper creek system and recorded invasive plants encountered. We used a hand-held Recon GPS receiver unit[1] (Trimble, Sunnyvale, CA) to record infestation on a segmented line GIS shapefile created using ArcGIS software (ESRI, Redlands, CA). Assessments of infestation were recorded ca 0.4 km (0.25 mi) for % cover using a 1 m x 0.5 m grid and identified to species. The survey ended when the team reached the Alaska Highway on Scottie Creek. Georeferenced data were uploaded to the Refuge Lands Geographic Information System (RLGIS) invasive plants geodatabase.

Chisana River. In order to access the Chisana River by boat, we started at the intersection of the Alaska Highway and Desper Creek and traveled down Desper Creek to its confluence with Scottie Creek and on to the confluence of Scottie Creek and the Chisana River. We started the survey at the mouth of Scottie Creek (N62.68512^{o} W141.26091^{o}) as it flows into the Chisana River, and traveled northwesterly on one river boat equipped with a 30-hp motor. We traveled 88.5 km (55 mi; Figure 2B) on the Chisana River at an average speed of 16 kph (10 mph). We monitored our speed using a Garmin® GPS III Plus receiver (Garmin, Olathe, KS). We stopped every 20 minutes to survey the shoreline. At every stop, we recorded the coordinates and walked along three parallel sections of the riverbank: waterline, halfway between waterline and high water

[1] Product names used in this report are included for scientific completeness, but do not constitute product endorsement by the US Fish and Wildlife Service.

mark, and at high water mark. Distance between survey sections varied from 5 m to 50 m. Section lengths varied from 5 m to 50 m. We targeted white sweetclover (*Melilotus alba*) and foxtail barley (*Hordeum jubatum*) while opportunistically recording other invasive plant species that we encountered. The survey ended at the Chisana River bridge (N63.00703 W141.80559) near Northway, Alaska. Georeferenced data were uploaded to the RLGIS invasive plants geodatabase.

A) Scottie-Desper Creeks

B) Chisana River

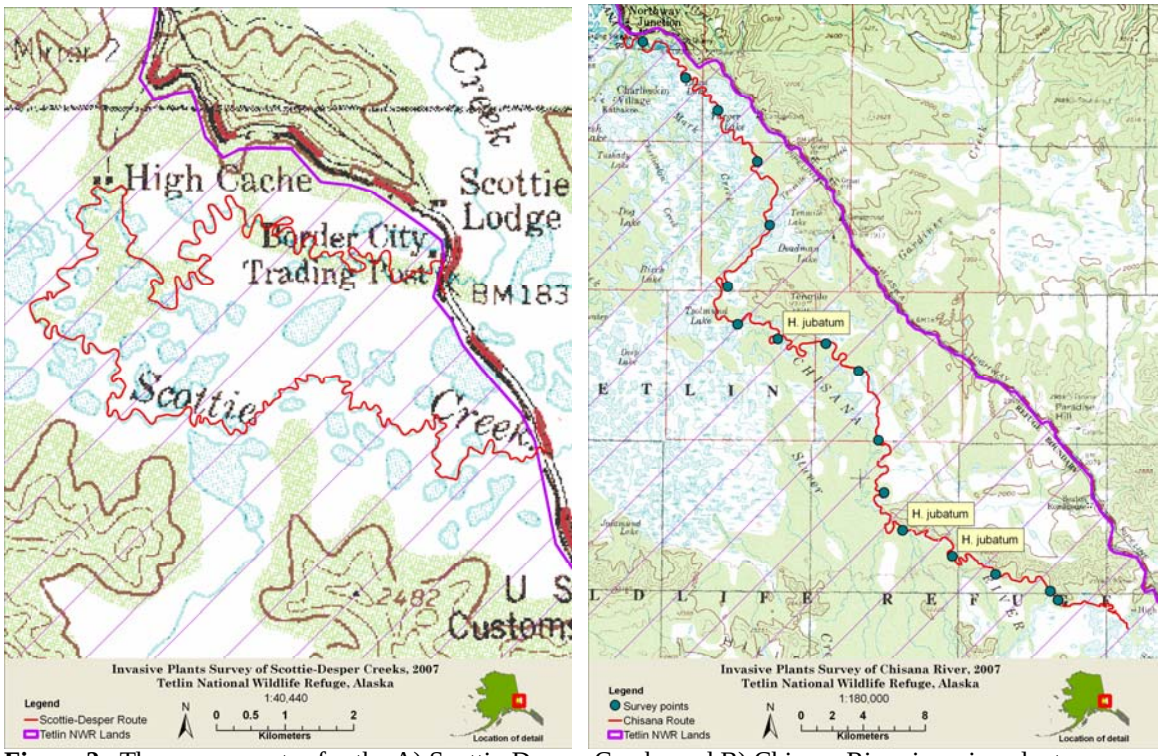

Figure 2. The survey routes for the A) Scottie-Desper Creeks and B) Chisana River invasive plants surveys at Tetlin National Wildlife Refuge, Alaska in 2007. We encountered foxtail barley (labeled) along the Chisana River. No invasive plants were found along the Scottie-Desper Creeks.

RESULTS

Scottie-Desper Creeks. We did not encounter invasive plants along Scottie and Desper Creeks. However, we encountered white sweetclover (<25% cover) and alsike clover (*Trifolium hybridum*; <25% cover) at the Desper Creek boat launch. We also documented white sweetclover (<25% cover) at the Scottie Creek parking area adjacent to the Alaska Highway. The invasive plants encountered there were in early reproductive phenology stage. We surveyed 141 acres along the 35 km (22 mi) study area using one staff biologist, one biological technician, and one volunteer working 40 volunteer hours.

Chisana River. We surveyed 17 locations along the Chisana River, including an abandoned cabin near the confluence of Scottie Creek and the Chisana River. We encountered *H. jubatum* (<1% cover) at three locations (Table1; Figure 2B) and pulled 28 plant clusters. These plant clusters ranged in size from 2-25 stems grouped together such that the whole cluster can be grabbed and uprooted in one hand. Two locations were on

stable mud substrate with horsetail (*Equisetum* spp.) intermixed with low willow (*Salix* spp.) shrubs grading into tall willow and alder (*Alnus* spp.) shrubs, while one location was at a sandbar. The foxtail barley clusters were located at the waterline and halfway between waterline and high water mark. The invasive plants were reproductively mature and vegetatively senescing. No other invasive plants were encountered. We surveyed 350 acres along the 88.5 km (55 mi) study area using one staff biologist and one volunteer working 139 volunteer hours.

Table 1. Locations of invasive plants encountered along the Chisana River at Tetlin National Wildlife Refuge, Alaska 2007. Locations are in WGS 84 datum.

Waypoint	Description	Invasive Species	Latitude	Longitude	Notes
128	cabin, abandoned	--	62.680005	-141.251149	
129	fish camp	--	62.685124	-141.260914	
130	tall shrubs	--	62.694689	-141.329973	
131	low shrub/willow/sedge/equisetum spp; mudbank	*H. jubatum*	62.705287	-141.385065	12 clumps; pulled
132	sandbar; mudbank	*H. jubatum*	62.719944	-141.448105	1 clump; pulled
133	low cutbank, tall shrub, alder, equisetum	--	62.741580	-141.471765	
134	equisetum/willow/sedge; stable mudbar 200 m long	--	62.772073	-141.479333	
135	stable low cutbank, equisetum/tall shrub /willow	--	62.812074	-141.504954	
136	low cutbank; mixed aspen-black spruce > 8m; willow/tall shrub	--	62.827919	-141.546789	
137	low mudbank; open low shrub/willow/equisetum	*H. jubatum*	62.830465	-141.607887	15 clumps; pulled
138	mudbank; equisetum/tall shrub/willow	--	62.838731	-141.659365	
139	low cutbank; sedge/low shrubs	--	62.860672	-141.672331	
140	stable mudbank; equisetum/tall shrubs /willow /alder	--	62.896566	-141.619844	
141	mudbank; equisetum/tall shrub/willow/alder	--	62.933780	-141.636139	
142	mudbank; equisetum/low shrub/willow	--	62.963079	-141.687236	
143	mudbank; equisetum/forbes/tall shrub /willow /alder	--	62.982141	-141.728852	
144	mudbank; wet; sedges	--	63.002643	-141.783839	

DISCUSSION

The level of invasive plants infestation along the three riparian corridors at Tetlin NWR is low. This finding is not surprising given that in Alaska, most invasive plants have been found in areas of human disturbance (*e.g.* roadside, parking lots, trails, airstrips). However, white sweetclover has been documented on the Stikine River and the Nenana River (AKEPIC 2007) along naturally formed gravel bars. So some rivers may be more susceptible to invasive plants colonization than others.

The absence of gravel bars along Scottie and Desper Creeks and along the Chisana River, despite the persistence of natural disturbance regimes, may have contributed to the dearth of white sweetclover along the riparian corridors surveyed. The shoreline of both Scottie and Desper Creeks were muddy except at the bridge sites along the Alaska Highway. Even though thawing ice scrape the river banks every spring, and fallen trees gouge troughs along the stream banks, the banks along both creeks and the river remained muddy. In contrast, the gross replacement of stream banks with imported gravel at the bridge crossings supports a healthy population of white sweetclover (Cebrian and Johnson in prep.). Therefore, it appears that for white sweetclover to successfully colonize rivers, either naturally-occurring or man-made gravel bars are a prerequisite.

In the case of foxtail barley, the plant appears viable on muddy substrates albeit in low density. This may not warrant an extensive eradication program, however it does underscore the need for vigilance and continued monitoring effort. To this end, the RLGIS invasive plants geodatabase provides a repository for invasive plants information that can be accessed for comparison with future invasive plants monitoring activities.

A reasonable approach to the monitoring effort would be to identify invasive plants known to occur in Alaska that have similar life histories as foxtail barley, and compare these plants with the inventory of invasive plants at the bridge sites. An adaptive management approach would necessitate a regular inventory of invasive plants around the bridges as well as consulting with the draft Tetlin NWR Integrated Pest Management (IPM) Plan regarding appropriate treatment options. Outside consultations with the right-of-way land manager at the Alaska Department of Transportation and Public Facilities (ADOT&PF) may also be required.

The fire- and flood- driven ecosystem at Tetlin National Wildlife Refuge provides openings for colonizing plants. However, climate is also a strong driver of ecosystem change. Climate change may affect both native plant species as well as invasive plant species occurring in and around Tetlin NWR. As invasive plants continue to thrive at bridge crossings and disperse their seeds into the river systems, changes in climate may allow an invasive plant to successfully colonize areas downstream from the bridges.

Current invasive plants infestation on Tetlin NWR lands is low. However, we recommend continued monitoring of potential dispersal avenues such as the riparian systems at regular intervals (*ca*. 3 years) in order to document potential sites of invasive plant infestations.

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REFERENCES

Abbott, R. J. 1992. Plant invasions, interspecific hybridization and evolution of new plant taxa. Trends in Ecology and Evolution. 7(12): 401-405.

Alaska Exotic Plants Information Clearinghouse. http://akweeds.uaa.al.aska.edu/AK_NonNativePlants_Nov2006. Accessed 24 August 2007.

Asher, J.A. and D.W. Harmon. 1995. Invasive exotic plants are destroying the naturalness of U.S wilderness areas. International Journal of Wilderness 1(2): 35-37.

Bratton, S.P. 1982. The effects of exotic plants and animal species on nature preserves. Natural Areas Journal 2(3): 3-13.

Cebrian, M.R. and W.N. Johnson. 2006. 2006 Tetlin National Wildlife Refuge Burned Area Emergency Rehabilitation (BAER) final report. US Fish and Wildlife Service, Alaska Regional Office. Anchorage, Alaska. 16pp.

_____. In prep. Invasive plants surveys at Tetlin National Wildlife Refuge. US Fish and Wildlife Service, Alaska Refuge Report. Tok, Alaska. 24 pp.

Cole, D.N. and P.B. Landres. 1996. Threats to wilderness ecosystems: impacts and research needs. Ecological Applications 6(1): 168-184.

Cortes-Burns, H. and M. Carlson. 2006. Burned Area Emergency Rehabilitation final report: Invasive plants monitoring following 2004 fires. US Fish and Wildlife Service, Alaska Regional Office. Anchorage, Alaska. 46pp.

DeVelice, R.L. 2003. Non-Native plant inventory: Kenai trails. USDA Forest Service, Chugach National Forest, Alaska Region Technical Publication R10-TP-124. Anchorage, Alaska. 24 pp.

Gordon, D. R. 1998. Effects of invasive, nonindigenous plant species on ecosystem processes: lessons from Florida. Ecological Applications 8(4): 975-989.

Huenneke, L. F. 1996. Ecological impacts of invasive plants in natural resource areas. Proceedings of the Western Society of Weed Science Conference 49: 119-121.

Nolen, A. 2002. Vetch infestations in Alaska. Alaska Department of Transportation and Public Facilities. FHWA-AK-RD-02-11. 39 pp.

Reichard, S. H. and P. White. 2001. Horticulture as a pathway of invasive plant introductions in the United States. Bioscience 51(2): 103-113.

Appendix A

White sweetclover

Melilotus alba Medikus

Synonyms: Melilotus albus Medik.
Other common names: None
Family: Fabaceae

Description White sweetclover is a biennial plant 2 to 5 feet tall, branched. The leaves are trifoliate, alternate in arrangement, and ½ to 2 inches long. Fragrant white flowers are 1/8 to 1/4 inches long and arranged in many-flowered terminal and axillary racemes. Plants generally flower and die during the second year of growth. It flowers from June to October. Pods are normally black to dark grey and single-seeded. Seeds are yellow, ovate to kidney-shaped (Hultén 1968, Royer and Dickinson 1999).

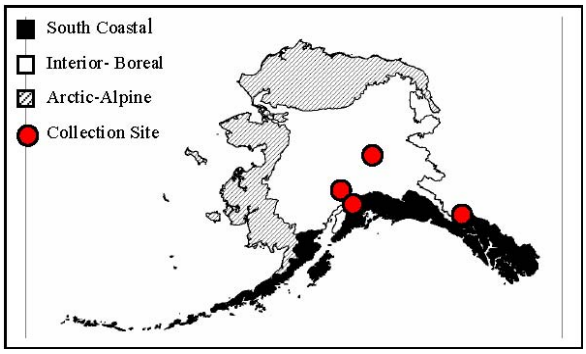
White sweetclover is erect, tall, and branching separating it from all other trifoliate lefumes in Alaska. *Melilotus alba* is distinguished from *M. officinalis* by having white rather than yellow flowers.

Ecological Impact
Impact on community composition, structure, and interactions: White sweetclover degrades natural grassland communities by overtopping and shading native species. It contains coumarin which is toxic to animals. Plants are visited by introduced honeybees, native solitary bees, wasps, and flies (Eckardt 1987). Sweetclover is associated with over 28 viral diseases (CUPPID 2003, Royer and Dickinson 1999). It is also reported as being allelopathic (USDA 2002). Impact on ecosystem process: This species alters edaphic conditions due to nitrogen fixation (USDA 2002); and also has potential to alter sedimentation rates of river ecosystems (M. Shephard – pers. comm.).

Biology and Invasive Potential
Reproductive potential: Each plant is capable of producing up to 350,000 seeds. Seeds remain viable in the soil for up to 81 years (Klemow and Raynal 1981, Royer and Dickinson 1999, Rutledge and McLendon 1996). Thus large seed banks are common (Eckardt 1987).
Role of disturbance in establishment: White sweetclover readily invades open areas. Natural or human-caused fires produce excellent growing conditions by scarifying seeds and stimulating germination. The clearings in forested land are easily colonized by sweetclover. Establishment along early successional river bars is extensive for a number of river systems in interior, south-central and southeast Alaska. This species resprouts readily when cut or grazed (Eckardt 1987, WDNR 2003).
Potential for long-distance dispersal: Seeds may be dispersed by water (Eckardt 1987, Rutledge and McLendon 1996).

Potential to be spread by human activity: White sweetclover is used extensively as a forage crop, soil builder, and nectar source for honeybees (Eckhardt 1987, WDNR 2003). It often contaminates cereal grains, and can spread from vehicle tires (Royer and *officinalis* by having white rather than yellow Dickinson 1999, Densmore et al. 2001).
Germination requirements: This species has high seed germination. Most germination and seedling development occurs in sufficient moisture in spring. Temperatures of less 59° F are optimal for germination, and germination inhibitation occurs above 59° F (Eckardt 1987).
Growth requirements: Sweetclover is adapted to all soil textures, pH levels from 5-8, it is CACO3 tolerant, and is moderately saline tolerant, it is shade intolerant, and does not require cold-stratification for germination. It is fire tolerant, withstands temperatures to -38°F, and requires 120 frost-free days for reproduction. This species has relatively porous summer vegetation and no coppice potential (USDA 2002).
Congeneric weeds: Melilotus officinalis (L.) Lam (Hultén 1968).
Listing: Melilotus alba is "Exotic Pest" in Tennessee, "Ecologically Invasive" in Wisconsin, "Weed" in Kentucky and Quebec (Canada) (Royer and Dickinson 1999, USDA 2002).

Distribution and Abundance
It was reported in North America as early as 1664 as a forage crop. Now it has spread from cultivation and thrives in waste places and roadsides. White sweetclover is found in all 50 states and all but two Canadian provinces (Royer and Dickinson 1999, USDA 2002). It establishes in aspen woodlands, prairies (Butterfield et al. 1996, Rutledge and McLendon No Year), and riverine communities (Conn 2003, Stensvold 2000).
Native and current distribution: This species is native to the Mediterranean area and through central Europe to Tibet. It is introduced into South Africa, North and South America, New Zealand, Australia, Tasmania (Hultén 1968)



Distribution of white sweetclover in Alaska

Management
White sweetclover can be managed using mechanical controls (pulling, cutting); however, several treatments may be necessary. Biological control options have not been investigated because the plant is valued as an agricultural crop. Due to the long viability of seeds, sites must be monitored for many years following control actions (J. Conn – pers. comm., Eckardt 1987).

References:

Butterfield, C., J. Stubbendieck, and J. Stumpf. 1996. Species abstracts of highly disruptive exotic plants. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/othrda ta/exoticab/exoticab.htm (Version 16JUL97).

Conn, J. 2003. White sweet clover invasions on Alaskan rivers. Paper presented at 2003 Alaska Noxious and Invasive Plants Management Workshop. Anchorage, Alaska.

Conn, J., Ph.D., Weed Scientist, USDA Agricultural Research Service, P.O. Box 757200, Fairbanks, Alaska 99775-7200. Tel: (907) 474 2423. – Pers. comm.

CUPPID - Cornel University: Poisonous Plants Informational Database. http://www.ansci.cornell.edu [Oct 29, 2003].

Densmore, R. V., P. C. McKee, C. Roland. 2001. Exotic plants in Alaskan National Park Units. Report on file with the National Park Service – Alaska Region, Anchorage, Alaska. 143 pp.

Eckardt, N. 1987. Element stewardship abstract for *Melilotus alba* – sweetclover or white sweetclover, *Melilotus officinalis* – yellow sweetclover. The Nature Conservancy,

Minneapolis. 10 pp.
Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 p.
Klemow, K.M. and D.J. Raynal. 1981. Population Ecology of *Melilotus alba* in a limestone quarry. Journal of Ecology 69: 33-44.
Royer, F. and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.
Rutledge, C.R., and T. McLendon. 1996. An Assessment of Exotic Plant Species of Rocky Mountain National Park. Department of Rangeland Ecosystem Science, Colorado State University. 97 pp. Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/othrdat a/Explant/explant.htm (Version 15DEC98).
Shephard, M. Vegetation Ecologist, USDA, Forest Service, Forest Health Protection, State and Private Forestry, 3301 C Street, Suite 202, Anchorage, Alaska 99503. Tel: (907) 7439454 - Pers. com.
Stensvold, M. 2000. Noxious weed surveys and projects conducted on the Tongass National Forest 1997-2000. Technical report on file, Tongass National Forest. Pp 2.
USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 708744490 USA.
WDNR - Wisconsin Department of Natural Resources. 2003. Yellow sweet clover (*Melilotus officinalis*) White sweet clover (*Melilotus alba*). www.dnr.state.wi.us/org/land/er/invasive/fact sheet/clovers.htm

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Appendix B

Foxtail barley

Hordeum jubatum L.

Synonyms: None
Other common name: squirreltail grass
Family: Poaceae

Description
Foxtail barley is a non-rhizomatous annual to perennial grass, native to western North America. It grows 1 to 2 feet tall, and produces a nodding pale green to purple, bushy spike that fades to a tawny color and becomes very brittle at maturity. Leaf blades are 1/8 to ¼ inch wide. Leaves are grayish green and have a rough texture. The sheath margin has numerous soft hairs. The awns are up to 3 inches long. Seeds are elliptic, yellowish brown 1/4 inch long with 4 to 8 awns. Seeds have sharp, backward-pointing barbs (Hultén 1968, Royer and Dickinson 1999, Whitson et al. 2000).

Foxtail barley is distinguished from cultivated barley (*Hordeum vulgare* L.) and the *Hordeum brachyantherum* by lemma awn length. *Hordeum brachyantherum* has awn lengths of ½ inch; foxtail barley has lengths of 1/2-3 inches; and cultivated barley of 10-15 cm in length. Foxtail barley hybridizes with *Agropyron* and *Hordeum* species. The hybrid *Hordeum brachyantherum* x *jubatum* is not uncommon in Alaska (Hultén 1968, Murry and Tai 1980, Welsh 1974).

Ecological Impact
Impact on community composition, structure, and interactions: In early summer foxtail is palatable to grazing animals. However, in late summer the sharp awns may cause damage to the mouth, eyes, and skin of animals. This plant is host for number of viruses (MAFRI 2004, Royer and Dickinson 1999, Whitson et al. 2000, Woodcock 1925).

Impact on ecosystem process: Foxtail barleyaccumulates high amounts of salt in leaves and roots,
reducing soil salinity (Badger and Ungar 1990, Keiffer and Ungar 2002).

Biology and Invasive Potential
Reproductive potential: This plant reproduces entirely by seed. Each plant is capable of producing more than 180 seeds. Test in Alaska indicated that up to 67% of seeds remained viable during first year in the soil. Germinability decreased with burial and time. Less than 1% of buried seeds remaining viable for up to 7 years (Conn and Deck 1995, Badger and Ungar 1994).
Role of disturbance in establishment: Foxtail has become more abundant in response to human activities that increase soil salinity and soil contaminations (Bardger and Ungar 1990, Robson et al. 2004).
Potential for long-distance dispersal: Seeds can be dispersed large distances by both wind and animals (MAFRI 2004, Royer and Dickinson 1999).
Potential to be spread by human activity: Foxtail barley has been grown as an ornamental. It is also potential crop contaminant (USDA, ARS 2004).
Germination requirements: Foxtail barley produces two germination cohorts: one in the spring and one in the fall. Seed germination is

inhibited by warm temperatures and salinity of more than 1 %. Seeds require a period of darkness for germination (Badger and Ungar 1994, Keiffer and Ungar 1997, Keiffer and Ungar 2002). Germination occurs only from a depth of 3 inches or less of soil (Royer and Dickinson 1999).

Growth requirements: Foxtail barley is adapted to a variety of soil textures, ranging from sandy loam to clay with pH from 6.4 to 9.5. It requires fairly moist conditions and cannot sustain itself during long dry periods (Tesky 1992). It is salt resistant and typically, restricted to soil with 0.3% to 0.9% total salts. The upper limit of soil NaCL for active growth and development is 1.0% (Badger and Ungar 1990).

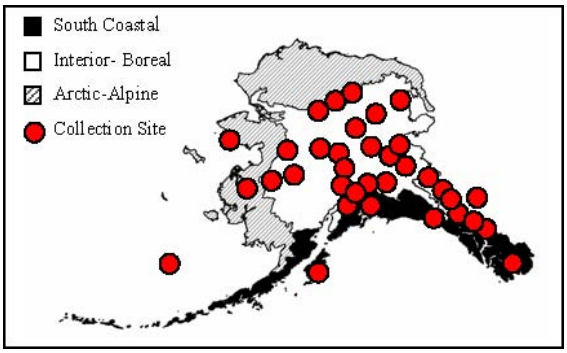
Congeneric weeds: *Hordeum murinum* L., *H. pusillum* Nutt., *H. vulgare* are considered weeds in the United States (USDA 2002, Whitson et al. 2000).

Listing: Foxtail barley declared a noxious weed in Manitoba and Quebec (Invaders Database System 2003, USDA 2002).

Distribution and Abundance

It is common on roadsides, waste ground, and open fields (Royer and Dickinson 1999). It is most prevalent on soils with a high water table and high salinity content (Badger and Ungar 1990).

Native and current distribution: Foxtail barley is native to western North America that has become naturalized in eastern North America. The current range of *Hordeum jubatum* includes most of the United States except for the south Atlantic and Gulf Coast states (ITIS 2002, USDA 2002). Judging from herbarium records (ALA 2004), it is most likely to have been present in eastern interior Alaska prior to contact. However, it appears to have spread dramatically in the last half century associated with accelerated human disturbances.



Distribution in Alaska

Management

One it is established, foxtail barley is hard to eradicate. Planting disturbed areas with desirable plants and control of water levels is effective in reducing the amount of foxtail barley (Tesky 1992). This species can be control with herbicides (MAFRI 2004).

References:

ALA. University of Alaska Herbarium. Arctos on line database. http://arctos.database.museum/home.cfm. Accessed 10 November 2004.

Badger, K.S. and I.A. Ungar. 1990. Effects of soil salinity on growth and ion content of the inland halophyte *Hordeum jubatum*. Botanical Gazette. 151(3): 314-321.

Badger, K.S. and I.A. Ungar. 1994. Seed bank dynamics in an inland salt marsh, with special emphasis on the halophyte *Hordeum jubatum* L. International Journal of Plant Sciences. 155(1):66-72.

Conn, J.S. and R.E. Deck. 1995. Seed viability and dormancy of 17 weed species after 9.7 years of burial in Alaska. Weed Science. 43: 583585.

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 pp.

Invaders Database System. The University of Montana. 2003. Montana Noxious Weed Trust Fund. Department of Agriculture. http://invader.dbs.umt.edu/.

ITIS – Integrated Taxonomic Information System. 2002. Hordeum jubatum L. Available: `http://www.itis.usda.gov/index.html. [November 10, 2004].

Keiffer, C.H. and I.A. Ungar. 1997. The effect of extended exposure to hypersaline conditions on the germination of five inland halophyte species. American Journal of Botany. 84(1): 104-111.

Keiffer, C.H. and I.A. Ungar. 2002. Germination and establishment of halophytes on brine-affected soils. Journal of Applied Ecology. 39: 402-415.
MAFRI - Manitoba Agriculture, Food and Rural Initiatives. 2004. Weeds – Foxtail Barley. Available: http://www.gov.mb.ca/agriculture/crops/we eds/index.html [November 8, 2004].
Murry, L.E. and W. Tai. 1980. Genome relations of *Agropyron sericeum, Hordeum jubatum* and their hybrids. American Journal of Botany. 67(9):1374-1379.
Robson, D.B., J.D. Knight, R.E. Farrell, and J.J. Germida. 2004. Natural revegetation of hydrocarbon-contaminated soil in semi-arid grasslands. Canadian Journal of Botany.82: 22-30.
Royer, F., and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.
Tesky, J.L. 1992. *Hordeum jubatum*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/ feis/ [2004, November 10].
USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 708744490 USA.
USDA, ARS, National Genetic Resources Program. *Germplasm Resources Information Network* bin/npgs/html/taxon.pl?300618 (November 9, 2004).
Welsh, S. L. 1974. Anderson's flora of Alaska and adjacent parts of Canada. Brigham University Press. 724 pp.
Whitson, T. D., L. C. Burrill, S. A. Dewey, D. W. Cudney, B. E. Nelson, R. D. Lee, R. Parker. 2000. Weeds of the West. The Western Society of Weed Science in cooperation with the Western United States Land Grant Universities, Cooperative Extension Services. University of Wyoming. Laramie, *-(GRIN)* [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: http://www.ars-grin.gov/var/apache/cgi-Wyoming. 630 pp.
Woodcock, E.F. 1925. Observations on the poisonous plants of Michigan. American Journal of Botany. 12(2):116-131.

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