



Invasive Plant Management for Wrangell-St. Elias National Park & Preserve

2010 Summary Report

Natural Resource Data Series NPS/WRST/NRDS—2011/128



ON THE COVER

(from top left moving clockwise): Student Conservation Association intern Melissa Booher surveys the Copper Lake Trail for invasive species; 2010 Wrangell-St. Elias National Park and Preserve group photo; Wrangell-St. Elias Exotic Plant Management Team crew leader AnnMarie Lain surveys Snag Creek airstrip for invasive species; Biological technician Nicole Liette surveys the McCarthy Road for invasive species.

Photographs by: 2010 Wrangell-St Elias National Park and Preserve Alaska Exotic Plant Management Team staff.

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established protocols and were analyzed and interpreted within the guidelines of the protocols. In addition, this report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

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Abbreviations

AKEPIC	Alaska Exotic Plant Information Clearinghouse
AKNHP	Alaska Natural Heritage Program
DNR	Division of Natural Resources
DOT	Department of Transportation
EIS	Environmental Impact Statement
EPMT	Exotic Plant Management Team
GIS	Geographic Information System
GPS	Global Positioning System
Mr. IS	WRST Information Station in McCarthy before the footbridge
NHL	National Historic Landmark
NPS	National Park Service
ORV	Off-road vehicle
SAGA	Southeast Alaska Guidance Association
SCA	Student Conservation Association
TCCC	Tribal Civilian Community Corps
USFS	U.S. Forest Service
WISE	Wrangell Institute for Science and Environment
WMC	Wrangell Mountain Center
WRST	Wrangell-St. Elias National Park and Preserve
YCC	Youth Conservation Corps
YPP	Youth Professionals Program

Abstract

This report describes the work performed by the Alaska Exotic Plant Management Team at Wrangell-St. Elias National Park and Preserve during the 2010 season. Six Alaska Exotic Plant Management Team staff members were stationed at Park Headquarters in Copper Center while working at various locations within the park and preserve. Invasive plant inventories and treatments occurred around the following locations: along the McCarthy and Nabesna roads, along the Copper, Chitina, and Nizina rivers, at other locations in the Copper Basin, and at several backcountry destinations within park lands. Invasive plant infestations were mapped using Trimble GeoXT units and manual weeding was performed with the help of volunteers, a Southeast Alaska Guidance Association crew, Youth Conservation Corps interns, Student Conservation Association interns, and seasonal National Park Service employees. Data was edited and analyzed using GPS Pathfinder Office and ArcGIS. A total of 304 bags were filled with pulled weeds, an increase of 117 bags from 2009. Weed bags were burned in the gravel pit south of the administrative building at Wrangell-St. Elias National Park and Preserve Headquarters. Four new invasive plant species were detected this year. Gross park managed acres treated increased to 18 acres in 2010, from 8 acres in 2009. A total of 804 park managed acres and 653 acres of non-park lands were surveyed in 2010. These results indicate that stationing the Wrangell-St. Elias National Park and Preserve Exotic Plant Management Team program in Copper Center to work as a united group has had a positive effect on the program.

Acknowledgments

The Wrangell-St. Elias National Park and Preserve Exotic Plant Management Team members would like to extend a big thanks to all who helped us weed this year. First and foremost, thank you to the Student Conservation Association interns Timothy Federal, Melissa Booher, John Cebe, and Chelsea Gordon for all of their hard work in the field and the office. Without them very little would have been accomplished. Thanks go out to the Wrangell-St. Elias maintenance trail crew for allowing us to join them on their trips to survey various trails and airstrips and for their assistance with the disposal of pulled weeds. Mark Keogh, park Concession's Specialist, provided multiple opportunities to accompany him on flights to various concessioners throughout the park. This allowed us to survey airstrips on park lands as well as private strips that are surrounded by park lands. In particular it allowed us to evaluate the impact of horses in the park as vectors for invasive weeds. The Southeast Alaska Guidance Association crew members Abigail Cockett, Christopher Sharp, Claire Vanderwall, Elizabeth Tyson, Grant Smith, Keller Fisch, Kim Ramoth, Tommy English, and William Jones Jr. and Youth Conservation Corps interns Anastasia Keogh, Dirck Rosenkrans, Emelia Van Wyhe, and Rachel Miner provided lots of person power to pull our largest and most persistent infestations. Thanks also to the volunteers from the Kenny Lake Fair work committee and volunteer Adam Lain. Volunteer Jim Hannah, fishery biologist Dave Sarafin, and district rangers Pete Dalton and Peter Christian coordinated rafting trips on the Copper, Nizina, and Chitina Rivers. We would also like to recognize Bonnie Million, regional Alaska Exotic Plant Management Team coordinator for the enormous amount of data she crunched and analyzed for us as well as her format editing help on this report. We would also like to thank Daniel Rhoads, the owner of Alaska Trees, for his donation of aspen trees for our restoration efforts.

Introduction

Alaska may not strike most people as a place where invasive plants would be of great concern; even local residents express surprise when informed about the threats faced in the area. While invasive plants are mostly limited to areas of human disturbance, there are indications that they are spreading and that several species may be able to colonize native ecosystems. The potential for these species to disperse via glacial river systems and potentially benefit from climatic change presents a real ecological threat to Alaska's wilderness. Climate change could play a direct role to the success of invasive species as they are better able to adjust the timing of their annual activities in regards to propagation than native species (Willis 2010). Unlike the rest of the country, Alaska still has the chance to prevent the arrival of invasive plants in most areas of the state. To accomplish this goal, the National Park Service (NPS) Alaska Exotic Plant Management Team (EPMT) has adopted the management approach of early detection and rapid response to invasive plant infestations.

Wrangell-St. Elias National Park & Preserve (WRST) is the largest U.S. national park. Encompassing 13 million acres, WRST is slightly bigger than Switzerland. In conjunction with Kluane and Glacier Bay national parks and Provincial Park Tatshenshini-Alsek in Canada, WRST forms a World Heritage Site containing one of the largest protected ecosystems on the planet. In addition WRST contains the largest area of designated Wilderness in the country (over 9 million acres) and the Kennecott Mines National Historic Landmark (NHL), the site of the richest copper mine in U.S. history. Two roads, eleven distinct off-road vehicle (ORV) trails, and 19 maintained backcountry landing strips provide access to WRST, although the majority of park lands remain inaccessible to all but foot and river traffic (Figure 1).

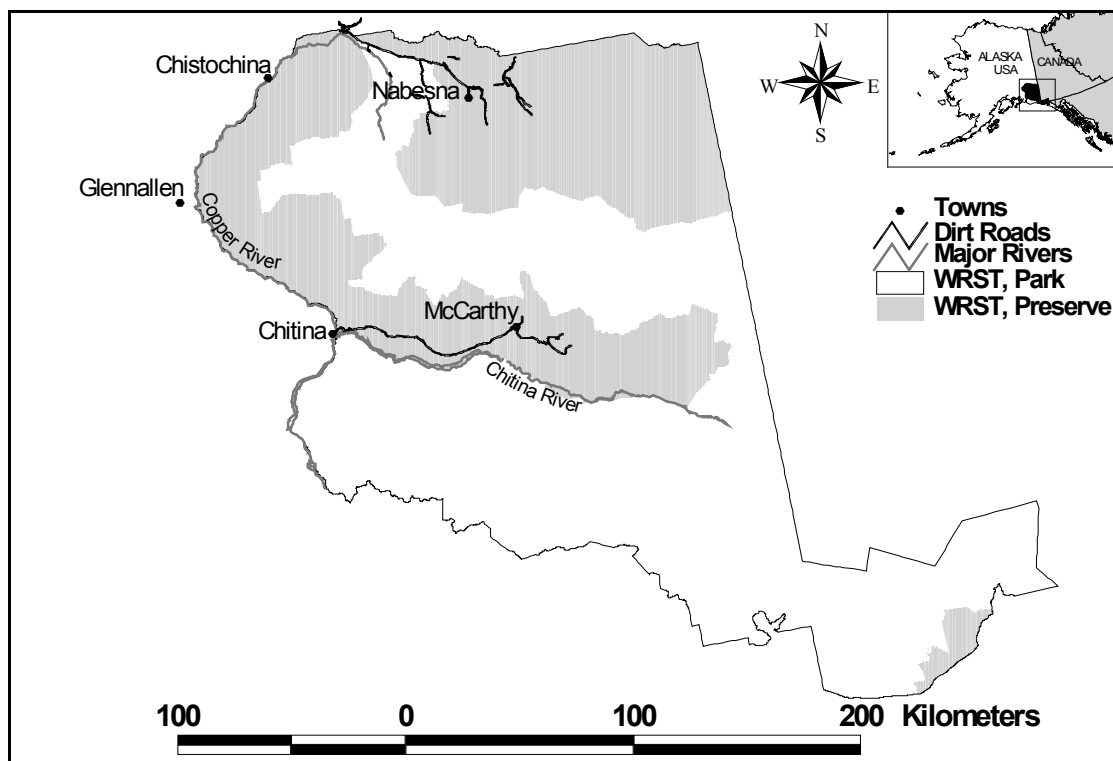


Figure 1. WRST parkland boundaries and location in relation to the rest of Alaska

Existing roads, trails, rivers, and airstrips are the primary vectors for invasive plants in the park. Human disturbed areas, such as private and native corporation lands that have been developed, logging areas, landing strips, abandoned homesteads, or camping and mining sites, offer a welcome home to invasive plants. The land status within WRST is one of the most complex situations of any unit in the NPS with over 800,000 acres of private, state, native corporation, and university lands inside the park boundaries. Due to the Alaska Native Claims Settlement Act of 1971 and the Alaska National Interest Lands Conservation Act of 1980 the ownership of these



Figure 2. ORV trails in the Nabesna District.
(Photo by Marshall Neek)

lands has not been static. Lands within the WRST boundaries have been selected for conveyance to the state of Alaska, Native Villages, and Native Corporations. Until these lands have been surveyed and conveyed they are still considered park managed. Land conveyances began in 1971 and continue today. Likewise the park continues to buy and acquire lands from individuals who wish to sell. Access to non-federal lands across park lands via ORVs (Figure 2) or aircraft, plus land uses such as commercial and residential development, logging, and mining add to the challenge of invasive species management.

Invasive plant species are a concern to resource managers because they threaten the genetic integrity of native flora through hybridization, can out-compete resident plant species for limited resources, can change the structure and function of ecosystems through alterations of geochemical and geophysical processes, and can impact fish and wildlife habitat (Vitousek et al. 1996, Gordon 1998). From 2000-2004 baseline surveys were conducted for invasive plants on Alaska NPS lands (Densmore et al. 2001, McKee 2003, Bauder and Heys 2004). The NPS established the Alaska EPMT in 2003 and WRST first obtained funding for a seasonal specific to the EPMT program in 2005 (Gilmore 2005). Since then the program has grown mostly through youth internship programs (Gilmore 2006, Gilmore and Goldsmith 2007, Gilmore and Harper 2008, Terwilliger et al. 2009). The 2010 WRST EPMT field season crew consisted of six members: 2 seasonal hires and 4 youth interns. For the first time the entire team was based out of Copper Center and the benefits afforded by this were invaluable. The group functioned more as a team and the close proximity to headquarters increased the amount of outreach and interactions WRST EPMT was able to have with other WRST staff. These interactions helped develop the WRST EPMT into a well respected, hard-working crew within the park and the region. Without this team development, the WRST EPMT crew would have been much less effective.

Objectives

The primary objectives of the WRST EPMT are to a) monitor known infestations of invasive weeds; b) contain, control and where possible eradicate these infestations; and c) to inventory areas with known human disturbance where invasive plants are likely to appear. Control work, i.e. weeding, is prioritized using the invasiveness rank from the Invasiveness Ranking System for Non-Native Plants of Alaska (Carlson et al 2008). Species with a higher rank are considered more aggressive than weeds with a lower rank and are usually considered a higher priority for treatment. Small infestations of weeds that can easily be pulled are also a high priority regardless of the species rank. Large infestations of low ranked weeds are considered the lowest priority for control but are still mapped and monitored. If time allows crews will perform control work on these infestations as well.

Some of the most aggressive known infestations that are monitored and controlled every year in WRST are white sweetclover (*Melilotus alba*) at the junction of the Tok Cutoff, oxeye daisy (*Leucanthemum vulgare*) in Kennecott, common tansy (*Tanacetum vulgare*) at the Glennallen park maintenance yard, and scentless false mayweed (*Tripleurospermum perforata*) at the Betty Freed property, named after its former owner who bequeathed the land to NPS for seasonal park housing, in Slana.

Areas with high visibility, high human activity, or high vector areas (areas likely to transfer invasive plants or seeds to other areas of the park) are also a priority. Annual monitoring and control efforts continue around WRST visitor centers in Slana, Copper Center, Chitina, McCarthy, and Kennecott Mines NHL. This year, survey efforts were focused on high use trails, public use cabin sites, remote airstrips, in-holder access routes and properties, wilderness routes, and river corridors (Figure 3).



Figure 3. WRST EPMT crew leader, AnnMarie Lain surveying the Snag Creek Airstrip for invasive plants.

Methods

Invasive plants were inventoried and monitored following the 2010 Alaska EPMT field protocol (Million & Rapp 2010). Both areas with and without invasive plants were mapped with detail sufficient to analyze any changes to infestation size. The data were collected for entry into two databases: Alien Plant Control and Management Database - the nationwide NPS database for invasive plant data - and Alaska Exotic Plant Information Clearinghouse (AKEPIC) - a collaborative, web-based database for tracking invasive weed infestations in Alaska. Attributes are based on North American Weed Management Association standards and describe the size, density, and severity of the invasive plant infestation being mapped.

Surveying and mapping were conducted primarily with a Trimble GeoExplorer 2005 Series GeoXT Global Positioning System (GPS) as well as a Trimble GeoExplorer 2003 Series GeoXT GPS. These units were used to record location and attribute information for geographic information system (GIS) analysis. GPS units can achieve sub-meter horizontal accuracy and were equipped with a standard Alaska-specific data dictionary, developed by Jeff Heys and Whitney Rapp, the former EPMT Liaison and EPMT Data Manager, enabling both precise mapping and standardized data collection. GPS data was post-processed and edited by field personnel using GPS Pathfinder Office, then transferred to the regional office for export to GIS format.

Areas of human development, frequent, and vector areas use were the main focus of invasive plant surveys. Walking and bicycle inventories were conducted along roadsides, trails, and at WRST Headquarters to identify previously unknown invasive plant infestations. Particular attention was paid to areas of obvious disturbance, such as gravel pits, pullouts, new culvert sites, airstrips, etc. Ten vouchers of unidentified plants were collected, pressed, labeled and will be sent to the Alaska Natural Heritage Program (AKNHP) in Anchorage for identification over the winter.

If invasive species were found in numbers that could be controlled within a reasonable time frame, they were removed by hand. Control work was conducted using manual methods, including pulling, digging, and cutting to remove weeds. Weeds were then disposed of in marked plastic bags which were packed full and tied tightly. These bags were stored in a connex container designated for weed storage until they could be burned at the end of the season by the WRST maintenance department.

The 2010 WRST EPMT consisted of two seasonal biological technicians: AnnMarie Lain (crew leader) and Nicole Liette, and four interns with the Student Conservation Association (SCA): John Cebe, Melissa Booher, Timothy Federal, and Chelsea Gordon. The 2010 EPMT staff members were based out of the WRST Headquarters in Copper Center. A Southeast Alaska Guidance Association (SAGA) crew comprising of six students and three supervisors assisted the WRST EPMT for four weeks and a Youth Conservation Corps (YCC) group of 4 students assisted for one week.

Results

Overview

A total of 5,608 field hours were logged by WRST EPMT members and volunteers this season. The 2010 WRST EMPT crew spent a total of 1,680 person hours in the field, while the youth groups contributed 3,808 person hours, and other volunteers added 120 hours (Table 1).

At the end of the 2010 field season WRST had mapped a total of 1,457 acres finding 213 acres infested with invasive plants, most of which are located along road and trail corridors and in communities within the park (Table 2). When the EPMT program first started in WRST the main focus was mapping infestations outside of the park to understand where the seed sources and vectors were located (Gilmore 2005). While the mapping of new infestations is still a key part of the program, the focus has now shifted to monitoring and treating known infestations (Terwilliger et al. 2009).

This year the number of surveyed acres dramatically increased while treated acres stayed at a similar level to past years. A total of 26 acres of invasive plants were treated this season (Table 2) and the total canopy acres controlled this season was 19. A total of 804 acres of park lands and 653 acres of non-park lands were surveyed in 2010, an increase from 2009 (Table 2).

This year the crew documented four new species of invasive plants within the park: alfalfa (*Medicago sativa*), Icelandic poppy (*Papaver nudicaule*), curly dock (*Rumex crispus*) and common groundsel (*Senecio vulgaris*). Alfalfa was found in the gravel pit at WRST Headquarters. Icelandic poppy was first observed at the end of the Nabesna Road on both park land and private land. Curly dock was found on a trail leading to McCarthy and again on the McCarthy Road. Common groundsel was found at May Creek. This brings the total number of known non-native plants in WRST to 41 (Table 3).

Table 1. Summary of invasive plant management field person hours for Wrangell-St. Elias National Park & Preserve staff, youth groups, and volunteers.

Year	EPMT Personnel				Youth Groups			Other Volunteers		Total Person Field Hours
	Hires	SCA	CLM ¹	Field Hours	Group(s) Involved	Persons	Field hours	Persons	Field hours	
2005	1	-	-	240	Community weed pull, DNR ² Forestry Intern Program	14	49	-	-	289
2006	1	-	-	260	SAGA, DNR Forestry Intern Program, TCCC ³	7	125.5	2	870	1,256
2007	1	-	1	303	TCCC	18	576	2	108	987
2008	2	-	-	315	SAGA, YPP ⁴	14	98	7	149	562
2009	2	1	1	948	SAGA	10	580	6	117	1,645
2010	2	4	-	1,680	SAGA, YCC	10, 4	3,808	1	120	5,608

1-Conservation Land Management intern

2-Division of Natural Resources

3-Tribal Civilian Community Corps

4-Youth Professionals Program

Table 2. Summary of Wrangell-St. Elias National Park & Preserve invasive plant management acreage accomplishments.

Year	Invasive Plant GPS Data ¹										New Invasive Species Found	Bags Pulled
	NPS Managed Lands			Non-NPS Lands inside boundary			Non-NPS Lands outside boundary			Acres Restored ³		
	Species Acres Surveyed	Species Acres Infested ²	Species Acres Treated	Species Acres Surveyed	Species Acres Infested ²	Species Acres Treated	Species Acres Surveyed	Species Acres Infested ²	Species Acres Treated			
2001	-	-	-	-	-	-	-	-	-	-	17	-
2002	-	-	-	-	-	-	-	-	-	-	-	-
2003 ^A	-	4.95	-	-	3.5	-	-	-	-	-	-	-
2004	2.46	2.46	0.18	10.03	0.10	0.02	5.03	0.60	0.13	-	1	-
2005 ^B	0.71	0.71	0.17	1.20	1.20	0.24	7.69	1.89	0.41	-	1	96
2006	284.70	5.19	2.51	16.24	2.89	0.05	30.84	5.20	<0.01	-	9	-
2007	402.63	8.29	0.37	107.64	5.07	0.18	80.82	7.32	0.36	-	2	20
2008 ^C	383.32	1.45	0.35	434.87	2.99	0.52	1557.38	0.69	0.22	-	4	99
2009	131.53	20.24	8.43	86.60	21.70	1.90	64.50	9.70	8.70	-	3	187
2010	804.40	110.40	17.60	476.70	72.30	4.30	175.80	30.30	4.30	0.05	4	304

Note: Foxtail barley acreage is included in this data.

1-All acreage was calculated using January 2010 NPS land status. Due to conveyances this may not have been the status at the time it was mapped. Land that has been selected for conveyances but was not yet conveyed by January 2010 are counted as NPS managed land.

2-Acres infested is calculated by acres mapped times the percent cover in areas greater than 0.5 acres. If under 0.5 acres, acreage mapped is counted as 100%.

3-2010 is the first year that restoration efforts were mapped & seed collections tracked.

A-Data was collected during the 2003 field season but is highly inaccurate/imprecise.

B-Problems with GPS units resulted in low mapping acres.

C-EPMT members drove and mapped the Richardson Highway and the Nabesna and McCarthy Roads looking for only for white sweetclover. This accounts for the unusually high number of survey acres.

Table 3. Summary of invasive plant species detected in Wrangell-St. Elias National Park & Preserve.

Year	#	New Invasive Plant Species Detected		2010 AKEPIC Rank*
		Latin Name	Common Name	
2001 Or Earlier	17	<i>Bromus inermis</i>	smooth brome grass	62
		<i>Capsella bursa-pastoris</i>	shepherd's purse	40
		<i>Chenopodium album</i>	common lambsquarter	37
		<i>Descurainia sophia</i>	flixweed	41
		<i>Elymus repens</i>	quackgrass	59
		<i>Lappula squarrosa</i>	European stickseed	44
		<i>Lepidium densiflorum</i>	common pepperweed	25
		<i>Leucanthemum vulgare</i>	oxeye daisy	61
		<i>Linaria vulgaris</i>	yellow toadflax	69
		<i>Matricaria discoidea</i>	pineapple weed	32
		<i>Melilotus officinalis</i>	yellow sweetclover	69
		<i>Plantago major</i>	common plantain	44
		<i>Polygonum aviculare</i>	prostrate knotweed	45
		<i>Taraxacum officinale ssp. officinale</i>	common dandelion	58
		<i>Trifolium hybridum</i>	alsike clover	57
		<i>Trifolium pratense</i>	red clover	53
		<i>Trifolium repens</i>	white clover	59
2002	-	none	none	-
2003	2	<i>Crepis tectorum</i>	narrowleaf hawksbeard	54
		<i>Melilotus alba</i>	white sweetclover	81
2004	3	<i>Lolium perenne</i>	perennial ryegrass	41
		<i>Phleum pratense</i>	common timothy	54
		<i>Thlaspi arvense</i>	field pennycress	unranked
2005	7	<i>Amaranthus retroflexus</i>	pigweed	unranked
		<i>Caragana arborescens</i>	Siberian peashrub	66
		<i>Galeopsis tetrahit</i>	hempenettle	40
		<i>Polygonum convolvulus</i>	black bindweed	unranked
		<i>Silene noctiflora</i>	night-blooming cockle	42
		<i>Tripleurospermum perforata</i>	scentless false mayweed	48
2006	4	<i>Vicia cracca</i>	bird vetch	73
		<i>Arabis glabra</i>	tower rock cress	unranked
		<i>Erysimum cheiranthoides</i>	wormseed mustard	unranked
		<i>Hordeum jubatum</i>	foxtail barley	63
2007	3	<i>Silene latifolia</i>	bladder campion	42
		<i>Papaver somniferum</i>	opium poppy	unranked
		<i>Stellaria media</i>	common chickweed	42
2008	1	<i>Tanacetum vulgare</i>	common tansy	57
2009	2	<i>Rheum rhabarbarum</i>	rhubarb	unranked
		<i>Cerastrium fontanum ssp. vulgare</i>	mouse ear chickweed	36
2010	4	<i>Medicago sativa</i>	alfalfa	64/59
		<i>Papaver nudicaule</i>	Icelandic poppy	unranked
		<i>Rumex crispus</i>	curly dock	48
		<i>Senecio vulgaris</i>	common groundsel	36

This season two WRST EPMT members joined the trail crew to conduct invasive weed inventories and treat infestations on trails and airstrips. The WRST trail crew provides general maintenance to park trails, public use cabins, and airstrips every summer. Most of the trails that were inventoried with the trail crew were near the McCarthy Road. A side benefit to these joint trips was the education and outreach to the trail crew on the importance of washing equipment and brushing off boots to stop the spread of invasive weeds to backcountry areas.

Nabesna/Slana

During the 2010 field season the 42-mile Nabesna Road was surveyed twice for invasive plants, once by car at the beginning of the field season in June and once by bicycle in mid- August (Figure 4). It should be noted that parts of the Nabesna Road were flooded in July and road work was done by the State of Alaska Department of Transportation (DOT) to fix areas that had washed away.

The first time the road was inventoried, the crew began at the end of the road near a privately owned coffee shop, wooden cabins and airstrip. Icelandic poppy was observed on private property adjacent to the airstrip. One small infestation appeared to have spread to the Nabesna Road onto park land. This small infestation was recorded however, due to the uncertainty of the species at the time, no control methods were used. Common plantain (*Plantago major*) and common dandelion (*Taraxacum officinale ssp. officinale*) were observed sporadically along the side of the road during the first survey. During the second survey common plantain, foxtail barley (*Hordeum jubatum*), and pineapple weed (*Matricaria discoidea*) were inventoried along the side of the road. One infestation consisting of nine white sweetclover plants was inventoried and manually treated by staff near the gravel pit at mile one on the Nabesna Road.



Figure 4. WRST EPMT SCA, Tim Federal, pushing his bike on a flooded section of the Nabesna Road.

The park is currently working on an Environmental Impact Statement (EIS) for all ORV trail management in the Nabesna District. This EIS evaluates the environmental impacts of ORVs and makes recommendations for a preferred alternative for management of ORVs in the Nabesna District (NPS 2010). In order to assist with the EIS, the EPMT crew surveyed the ORV trails for invasive weeds this summer. All five of the trails were saturated with water and were actually temporarily close to ORV use at the end of July due to record rainfall. In some areas the trails were not visible due to the high water levels. These trails should be inventoried in the upcoming seasons during dryer conditions to get a more accurate assessment.



Figure 5. Using a zip line to cross the creek on the Lower Copper Lake ORV Trail

The Copper Lake Trail was inventoried in two parts – an upper and lower portion (Figure 5). A few common plantain were pulled at the Copper Lake Trailhead, otherwise no invasive weeds were found on the lower portion. The upper portion of the Copper Lake Trail was inventoried until rainy weather caused swollen creeks to become too dangerous to cross. No invasive plants were observed on either the upper Copper Lake Trail or Lost Creek Trails. A single common dandelion was inventoried and pulled at the Lost Creek Trailhead.

Foxtail barley, pineapple weed, and common dandelion were inventoried at the Tanada Lake Trailhead. No invasive plants were observed beyond the trailhead to the

wilderness boundary. This trail was not surveyed beyond the wilderness boundary. The trail to the Tanada Creek fish weir and Batzulnetas Village was mapped with no invasive plants documented except for a small patch of common dandelions that were controlled by the SAGA crew. In 2007 and 2008, the Tanada Creek fish weir trail had been monitored and white sweetclover was found and controlled. Monitoring the area revealed no invasive plants in 2009 or 2010, indicating successful removal efforts (Gilmore and Goldsmith 2007, Gilmore and Harper 2008, Terwilliger et al. 2009). However, this trail should be monitored again when water levels have dropped and visibility of the plants is better.

Weeding was performed on a large infestation of white sweetclover at the Tok and Nabesna Roads, otherwise known as the Tok Cutoff. This infestation has been an intensively weeded since 2005 (Gilmore 2005, Gilmore 2006, Gilmore and Goldsmith 2007, Gilmore and Harper 2008, Terwilliger et al. 2009). The infestation is not on park lands but is in a vector location and considered a potential threat to park lands. This year the infestation was controlled in June by the WRST EPMT crew alongside a SAGA crew and Alaska EPMT staff Bonnie Million. The plant growing season appeared later than usual due to the cold and wet weather conditions. At the time of the control event the white sweetclover plants were very immature and in some cases barely noticeable. White sweetclover was pulled on the north side of the highway, as well as on the slopes on the west and east side of the Nabesna Road. Smaller infestations of common dandelion, lambsquarter (*Chenopodium album*), and European stickseed (*Lappula squarrosa*) were also controlled within this area. Two WRST EPMT members returned to the infestation in August in an attempt to pull the white sweetclover that was going to seed. The infestation was extensive and will require additional treatment in the future.

Invasive weeds have been documented at Dead Dog Hill, Long Lake, Twin Lakes Campground and Rock Lake rest stop along the Nabesna Road (Gilmore 2006, Gilmore and Goldsmith 2007, Gilmore and Harper 2008, Terwilliger et al. 2009). Control efforts were performed at all four sites this year. The SAGA crew helped control foxtail barley at Dead Dog Hill rest stop and common plantain at Rock Lake, Long Lake and Twin Lakes Campground. Foxtail barley and

common plantain were mapped around the Slana District Ranger Station, bunkhouse, garage, and cabanas. Most of the dandelions found on the Nabesna Road are the native horned dandelions (*Taraxacum ceratophorum*) but common dandelions were inventoried near Long Lake on the Nabesna Road in past seasons (Gilmore and Harper 2008, Terwilliger et al. 2009). Despite weeding in 2008 and 2009, common dandelion and common plantain were still found and weeded here in 2010.

The EPMT and SAGA crews surveyed and pulled the scentless false mayweed, common dandelion, and pineapple weed at the former Betty Freed property (Figure 6). The Betty Freed property was originally a private home that was donated to the park in 2001 where it has since been used as seasonal housing. Despite six years of weeding and control work at the Betty Freed property, scentless false mayweed does not appear to be decreasing at this location (Gilmore 2005, Gilmore 2006, Gilmore and Goldsmith 2007, Gilmore and Harper 2008, Terwilliger et al. 2009). This may be a location where alternate control methods could be applied.



Figure 6. The SAGA crew working at the NPS housing on the former Betty Freed property.

Copper Center Headquarters

WRST moved its headquarters to its current location in Copper Center in 2002 (Gilmore 2006). The surrounding area was left largely untouched during construction. The native aspen (*Populus tremuloides*), black and white spruce (*Picea mariana* and *P. glauca*) and other vegetation make an impressive backdrop. Unfortunately, building sites were cleared of all vegetation and weed infested topsoil was spread, leading to an unkempt landscape. Narrowleaf hawksbeard (*Crepis tectorum*), common dandelion, and foxtail barley have heavily established infestations around WRST Headquarters. The area also has smaller infestations of lambsquarter, European stickseed, and white sweetclover. White sweetclover is the highest AKEPIC ranked invasive plant in WRST and as such these infestations warrant some concern. Care should be taken to monitor and retreat these areas next year to prevent establishment of white sweetclover at these locations. The once abundant pigweed (*Amaranthus retroflexus*) that posed such a problem the first four years after moving to the new site seems to have all but disappeared (Gilmore 2006).

Mechanical and manual methods have continued to control infestations around WRST Headquarters. The maintenance staff has cooperated with EPMT by mowing and bagging invasive plant infestations upon request. The SAGA crew spent two weeks manually controlling known weed infestations around WRST Copper Center Headquarters, employee housing, and adjacent roadways. Youth Conservation Corps (YCC) interns controlled weeds in conjunction with the SAGA crew at WRST Headquarters for one week. The planting area around WRST's welcome sign was intensively weeded three times this season by WRST EPMT staff. Common dandelions, narrowleaf hawksbeard, alsike clover (*Trifolium hybridum*), and foxtail barley were mapped and removed. The crew continued the re-vegetation efforts that at the welcome sign that have been ongoing since 2006 (Gilmore 2006, Gilmore and Goldsmith 2007, Gilmore and

Harper 2008, Terwilliger et al. 2009). This project is discussed further below in the section entitled “Restoration Efforts”.

In other areas around WRST Headquarters there were continual efforts throughout the season to map and pull narrowleaf hawksbeard, foxtail barley and common dandelions. The SAGA and YCC crews spent a week pulling infestations at the Visitor Center, theater, exhibit building, resource buildings, behind the administrative building (Figure 7), around the visitor’s parking lot, and at the junction of the administration and visitor center driveways. The area behind the administrative building is overrun with lambsquarter, narrowleaf hawksbeard, prostrate knotweed (*Polygonum aviculare*), clovers (*Trifolium spp.*), pineapple weed, common plantain, common dandelion, and foxtail barley. This infestation is from a septic tank replacement in 2008 which was covered with weed-infested topsoil and has resulted in a bumper crop of invasive weeds. This area is a potential seed source for other areas around headquarters (Terwilliger et al. 2009). The SAGA and WRST EPMT crews spent two weeks controlling the weeds in this area. This area was also mowed by the maintenance staff twice after the control efforts by SAGA as the area still continues to sprout invasive weeds.



Figure 7. Infestations behind the administrative building, before (left) and after (right), control efforts.

Molly McCormick, a fisheries biologist, has dedicated time and effort to keep a weed-free area around the Marc building, one of the administrative buildings in the WRST Headquarters area. For the last three years, she has weeded common dandelion, narrowleaf hawksbeard, and alsike clover throughout the summer. As a consequence, the yard around this building is mostly free of invasive plants.

In the gravel pit just south of park Headquarters narrowleaf hawksbeard, common dandelion, foxtail barley, and a small infestation of white sweetclover were surveyed and weeded by SAGA, EPMT crew, and regional EPMT staff member James Sowerwine. This is the second year a small infestation of white sweetclover has been observed at the gravel pit near headquarters (Terwilliger et al. 2009). In 2009 a small patch of white sweetclover was inventoried and weeded at the junction of the administration and visitor center driveways. This patch was not observed during the 2010 season, but should be monitored closely in the future. White sweetclover in the gravel pit could be the result of WRST burning weed bags in the area. This year, the EPMT crew investigated alternative methods for weed bag disposal. In August, the park has contracted with

Entech LLC in Anchorage to incinerate the bagged weeds that were pulled in WRST during the 2010 season. This will eliminate the potential to contaminate the gravel pit area with invasive seeds and reduce the pollution from open pit burning of wet weeds in plastic bags.

An infestation of white sweetclover on the Richardson Highway across from the park entrance has been monitored and weeded on an annual basis. The infestation generally fluctuates in size from year to year. In 2010, 90 white sweetclover plants were pulled. This was a small number of white sweetclover plants compared to the larger crop in the 2009 season (Terwilliger et al. 2009). The 2010 season was predicted to have large infestations of white sweetclover. However, this was not the case and may be due to the unusually wet season.



Figure 8. SAGA crew presenting their pulled narrowleaf hawksbeard at the Copper Center seasonal housing area.

The grounds behind employee housing, located on a rise at the south edge of the gravel pit, have large numbers of narrowleaf hawksbeard, common dandelion, foxtail barley, and minor amounts of clover, all of which were surveyed and pulled by the SAGA and WRST EPMT crew (Figure 8). The remaining area surrounding the buildings has only scattered infestations of the same species.

common plantain and common tansy at the NPS maintenance yard in Glennallen. The site was revisited by the crews in early July for an additional four hours of pulling. In early August the WRST EPMT staff revisited and pulled the infestations once again.

The SAGA and WRST EPMT crews spent an entire eight hour day in late June surveying and pulling narrowleaf hawksbeard, common dandelion, foxtail barley, pineapple weed,

The SAGA crew worked for two weeks around WRST Headquarters. The YCC interns worked around WRST Headquarters for one week and together they collected about 116 bags of weeds totaling 1,706lbs from the Copper Center Headquarters area.

In 2006, WRST EPMT began monitoring the extent of white sweetclover throughout the Copper Basin along the highways (Gilmore 2006). Although this area is not in the park, it was considered important to have documentation of the explosive growth of this species in this area. In the past, most of the white sweetclover infestations were observed on the Glenn and Richardson highways throughout the Copper Basin. This year the WRST EPMT crew focused on surveying white sweetclover near areas where the highways intersected river corridors. This work is discussed in further detail in the section entitled “River Corridors.”

Chitina

WRST maintains a ranger and comfort station in Chitina in the summer. All road traffic to Kennecott travels through Chitina so careful monitoring of the area is vital. Foxtail barley, common dandelion, white clover, pineapple weed, and shepherd's purse (*Capsella bursa-pastoris*) were reported growing around the Chitina District Ranger Station this year. Two WRST EPMT members spent four hours controlling pineapple weed and foxtail barley around the ranger station. The crew also inventoried the area around the Chitina Emporium, next door to the comfort station, and found foxtail barley, red clover (*Trifolium pratense*), common plantain, and lambsquarter (Figure 9).



Figure 9. The Chitina Emporium

The Chitina airport is used by many planes traveling to and from remote locations in WRST. It is important to monitor for and control invasive plants around the airport as weed seed could easily be transported into backcountry sites aboard one of these planes or its passengers. European stickseed and foxtail barley were discovered for the first time this year at the Chitina airport, where white sweetclover has been found in the past. Narrowleaf hawksbeard, common dandelion and foxtail barley infestations were inventoried along the road adjacent to the airport. The WRST EPMT crew searched the area where white sweetclover had been reported in 2009; however, no white sweetclover was observed. Due to the invasiveness of white sweetclover this area should continue to be monitored in future years.

McCarthy Road

The McCarthy Road follows the old gravel railroad bed approximately 60 miles connecting Chitina to the west side of McCarthy, and terminates at the pedestrian foot bridge in McCarthy. The 2010 season is the first time the WRST EPMT crew inventoried the entire McCarthy Road by bicycle.

The survey was conducted by two - two person teams of WRST EPMT staff slowly riding along the McCarthy Road with Trimble GPS units attached to the bicycles. One person would scout ahead for invasive weed species while the other person would record invasive plants on the Trimble GPS as relayed from the first person. One team started near McCarthy and the other team started at mile 29. Both teams biked towards Chitina, travelling west until the whole road had been inventoried.

The road continues to have sporadic infestations of foxtail barley, various clovers, and common dandelion. Curly dock was inventoried for the first time on park land this season. An infestation of curly dock near mile nine was partially removed. The infestation was larger than when initially spotted, therefore the remainder of the infestation was mapped. An infestation of yellow toadflax (*Linaria vulgaris*) was discovered near mile 32 on the McCarthy Road. The toadflax

was inventoried and controlled. Two infestations of oxeye daisy were inventoried and controlled on the McCarthy Road near mile ten and mile 25.



Figure 10. Bicycling through the damaged Lakina Bridge on the McCarthy road.

A sizeable portion of the McCarthy Road beginning near Chitina and interspersed until approximately mile ten were under general maintenance construction. Some of the area under construction had been recently graded. Due to the grading, no plants were visible in these areas. In addition, the Lakina Bridge was severely damaged in 2010 leading to extensive re-construction and manipulation of the Lakina River bed (Figure 10). In the upcoming seasons the WRST EPMT crew should continue to survey the McCarthy Road especially the construction work zones. Bicycling proved an efficient way to survey the road without compromising on site-ability the way surveying from a vehicle would.

For the second time, white sweetclover was observed at approximately mile marker 13 on the McCarthy Road. Last year one white sweetclover plant was mapped and controlled (Terwilliger et al. 2009). This season there were two white sweetclover plants mapped and controlled at mile 13. No other white sweetclover infestations were observed on the McCarthy Road.

In addition to the road surveys, four trails that are accessed from the McCarthy Road were surveyed: Nugget Creek, Dixie Pass, Kotsina, and the Crystalline Hills. The Nugget Creek Trail, which is commonly used by ORVs, is approximately 15 miles long and terminates near a public use cabin and the Kuskulana Glacier (Figure 11). Common plantain, common dandelion, common groundsel, and white sweetclover were found on this trail. The density of these invasive species appeared greater toward the trailhead and less frequent towards the end of the trail at the public use cabin, where a small infestation of common dandelion was inventoried. Due to time constraints, no weeds were pulled in this area. This area will require additional attention in the future. On the Crystalline Hills Trail, mile 34.7 on the McCarthy Road, was also inventoried early in the season. No invasive species were found on this two-mile loop trail. Pineapple weed, common plantain, common dandelion, and lambsquarter were inventoried and controlled at the trailhead.



Figure 11. WRST EPMT SCA, Melissa Booher, on the Nugget Creek Trail.



Figure 12. The WRST trail crew hiking up the Dixie Pass trail

Kotsina and Dixie Pass trails were inventoried by the WRST EPMT on a joint trip with the trail crew. On the Kotsina Trail, several patches of common dandelion were identified and removed at the trailhead. After mile seven no invasive species were observed except for a small infestation of common dandelion at mile 15. On the Dixie Pass Trail occasional patches of common dandelion were inventoried and control work was conducted (Figure 12). No other invasive species were observed.

A resident located on the McCarthy Road at approximately mile 30 asked the WRST EPMT crew to inventory a gravel pit for invasive weeds on his property in order to sell the gravel as fill material. Although having weed-free mineral materials is not a requirement for WRST compliance, it is of best interest to inventory these sites as the material is sold and used extensively within the WRST boundary, both on and off park managed lands. An invasive weed survey was done at the site to ensure invasive weeds would not be spread onto surrounding areas through a vector such as

fill material. The WRST EPMT crew arrived at the residence house and conducted the survey. No invasive weeds were discovered near the gravel pit area which had only been slightly disturbed with a backhoe. The gravel pit area was surrounded by native vegetation. On-site burn pits were also investigated this trip. No invasive species were discovered.

The Kuskulana Bridge is located at mile 17 on the McCarthy Road. The bridge was originally built in 1910 for the railroad and is still in service for automobiles. The bridge hangs 238 feet above the Kuskulana River and is supported primarily by the metamorphic bedrock. On the east side of the Kuskulana Bridge there is a pull off with park maintained restrooms. This is a relatively popular stop for folks travelling the McCarthy Road. A local resident informed the WRST EPMT crew that foxtail barley was growing near the bathrooms and requested that the infestation be removed before spreading to private property. A two person WRST EPMT crew spent an entire day controlling invasive species consisting of lambsquarter, common dandelion, various clover species, foxtail barley, and European stickseed at the Kuskulana Bridge rest stop. An infestation of alsike clover across the road from the rest stop was not pulled due to time constraints.

McCarthy

The McCarthy Road was mapped to the footbridge and into the town of McCarthy. All of the known roads in town were mapped for invasive plant species as was the road leading up to Kennecott Mines NHL from McCarthy (Figure 13). Some of the most predominant invasive plant species in the McCarthy/Kennecott area are clover species, foxtail barley, and common dandelion.

An unnamed side road, west of the footbridge in McCarthy that is nicknamed John Adam's airstrip, was inventoried. This road is used for vehicle transportation and as an airstrip. Invasive plants along this side road were controlled by WRST EPMT and SAGA crews due to high use of the road and its potential to be an invasive weed vector via the adjacent river. Despite the high level of control efforts in this area, the road continues to be infested with foxtail barely, common dandelion, common plantain, European stickseed, pineapple weed, lambsquarter, common pepperweed (*Lepidium densiflorum*), prostrate knotweed, and field pennycress (*Thlaspi arvense*). This road was inventoried from the McCarthy Road and south to where it made a 90 degree turn to parallel the Kennicott River. The infestation is larger where the road intersects with the McCarthy Road. As the road gets closer to the river less invasive species are present.



Figure 13. Main Street, downtown McCarthy



Figure 14. The NPS McCarthy Road Information Station (Mr. IS)

On the west side of McCarthy, NPS has an information station called the McCarthy Road Information Station (Mr. IS) which is a popular stop for park visitors (Figure 14). This area was inventoried and has scattered infestations of common dandelion, clovers, and foxtail barley. Across the street from this station is a seasonal housing complex called West Side housing, for seasonal employees which contains infestations of common dandelion. All mapped infestations were controlled in both locations. Before the foot bridge, there is a privately owned parking lot called Base camp. Visitors pay a fee to park their cars in this lot and then hike across the foot bridge to downtown McCarthy. Visitors

can also pay to use the private lot as a camping area. This area is infested with foxtail barley and common dandelion. With the help of the SAGA crew, control work was conducted at Base camp and near the adjacent footbridge. It is recommended that this remain a high priority due to the high volume of vehicle/foot traffic, and the potential to be a vector into the park and into the town of McCarthy.

Trails leading into the park are prime vectors for the dispersal of invasive plants by foot traffic. This year the one campsite and a trail leading to the campsites from McCarthy were inventoried. The Glacier Campsite, near the toe of the Kennicott Glacier, does not appear to have any invasive species. However, the trail leading from the campsite to the Kennecott Road has several infestations of alsike clover and common dandelion. The SAGA crew pulled weeds leading up the trail including all of the clover species and flowering common dandelion. In pullouts along the trail, extensive infestations of common dandelion were observed. These infestations were mapped, but no control work was conducted.

The McCarthy town site has several species of invasive weeds, many on private property and along roadways with the potential to move onto park lands. Any control efforts on private lands occurred with consent of property owners. The McCarthy airstrip was monitored for foxtail barley, common dandelions, and alsike clover. All of the foxtail barley located on-site was removed. Common dandelion and alsike clover were pulled during the control event, although both were too abundant to completely remove.

The Tony Zak community building in McCarthy is where local community groups meet. It is also where the community fire truck resides. There is a small yard adjacent to the building which is seemingly mowed periodically. Foxtail barley, common dandelion, field pennycress, European stickseed, common plantain, and pineapple weed were inventoried and the majority of the infestations were pulled by the WRST EPMT and SAGA crews.

According to the 2009 annual EPMT report, yellow toadflax, night-blooming cockle (*Silene noctiflora*), Siberian peashrub (*Caragana arborescens*), and split-lip hempnettle (*Galeopsis tetrahit*) were treated in various locations on private property in downtown McCarthy (Terwilliger et al. 2009). None of these sites were revisited this year. The WRST EPMT crew discovered and treated curly dock on a side trail that parallels the main road near downtown McCarthy. This is the first time curly dock was documented in McCarthy. In upcoming seasons, the areas where these invasive species were observed should be revisited and further investigated.

Kennecott Mines National Historic Landmark

The Kennecott Mines NHL was acquired by WRST in 1998 (Gilbert et al. 2001). The landmark encompasses the land, mineral, and associated holdings of the Kennecott Copper Mines in south-central Alaska and includes structures in the historic mill town (Figure 15). The NHL designation encompasses 7,700 acres of public and private lands (Gilbert et al. 2001). Since then the park has acquired or purchased additional lands and buildings. Copper mining operations in Kennecott occurred between 1901-1938 and were among the nation's richest (Gilbert et al. 2001). The town of Kennecott and all of the man-made structures are spelled with an "e", marking the



Figure 15. Main Street at the Kennecott Mines National Historic Landmark.

historic misspelling by the company's founder Stephen Birch, while natural features are spelled Kennicott with an "i" after the geological place name (Bleakley 2002).



Figure 16. Construction in Kennecott.

The NPS and the local community have engaged in an ongoing planning effort to identify buildings that will be stabilized or rehabilitated and the NPS is currently in the process of revising their interim guidance plan. These construction projects will disturb native vegetation and can contribute to invasive weed infestations (Figure 16). In addition, outside fill material that may be used could be a vector for spreading invasive weeds into the park. Stabilization work in the Kennecott Mines NHL is expected to take many years (Gilbert et al. 2001). These areas will need attention in the future, both by pulling invasive weeds and planting native species.

The road leading up to Kennecott Mines NHL, Silk Stocking Row, and the Main Street in the town site of Kennecott were inventoried. Some of the most predominant invasive plant species in the NHL are clover species, common dandelion and oxeye daisies. Oxeye daisy was observed along the sides of Main Street in Kennecott on both park lands and non-park lands. Historically, oxeye daisies were planted by miners for their ease of growth and aesthetic reasons. Oxeye daisy remains the highest management priority in the Kennecott town site. For the seventh consecutive year, the main infestation on the slope behind the Jurick building was treated. According to previous annual reports, fewer flowering plants are being found which indicates the effectiveness of yearly treatments (Gilmore & Harper 2008, Terwilliger et al. 2009).

In 2010, work was performed on several species growing around NPS seasonal employee cottages on Silk Stocking Row. This area had previously been disturbed by construction and remodeling of the cottages. Lambsquarter, common dandelion, prostrate knotweed, various clovers, pineapple weed, flixweed (*Descurainia sophia*), common chickweed (*Stellaria media*), mouse-ear chickweed, and oxeye daisy were inventoried and controlled. The WRST EPMT and SAGA crews also focused on control work around the Recreation Hall, the Kennecott Visitor Center, and the General Managers Office. One large (>1 acre) infestation near the office contains 12 species of invasive plants: common lambsquarter, common dandelion, prostrate knotweed, two species of clover, pineapple weed, common chickweed, mouse-eared chickweed, shepherd's purse, common plantain, Icelandic poppy and oxeye daisy. The area was recently disturbed during the construction and remodeling of the General Managers Office. Large areas of topsoil and gravel were scraped from around the buildings, leaving exposed ground and piles of dirt and rocks where weeds are now thriving.

The trailhead for several trails that lead into the park are located in Kennecott Mines NHL. This year Donoho Basin, Jumbo Mine, and the Root Glacier trails were inventoried as well as the campsite at Donoho Basin, across the Root Glacier from Kennecott, which is a popular backcountry destination for visitors and use has been increasing over the past few years (Terwilliger et al. 2009). This area was inventoried twice this summer. The WRST EPMT crew discovered common dandelion on the Root Glacier Trail leading to Donoho Basin campsite and near the shore of the first lake (Figure 17). This is the first time an invasive species has been observed at this remote campsite. The WRST EPMT crew mapped and pulled the common dandelion. No other invasive plants were found in the lower campsite area or along the trail leading to the upper lake.



Figure 17. WRST EPMT SCA, Chelsea Gordon, on the Root Glacier Trail

River Corridors

Invasive plants located near a vector pathway, such as a road, trail, or waterway, are more capable of being dispersed. The proximity of an invasive plant to waterways greatly increases the likelihood of water dispersal (Davies & Sheley 2007). In Alaska, invasive weeds have been found primarily near the state's limited road system. However, due to roads, mines, agricultural development, and an increase in the recreational and subsistence use of rivers, more invasive plant species are being observed along river corridors, easements and sandbars (Macander & Wurtz 2007). The WRST EPMT crew participated in three rafting trips during the 2010 field

season to survey for invasive plants along river corridors. The season was a rainy and wet one which contributed to higher water levels on the rivers and flooded sandbars.

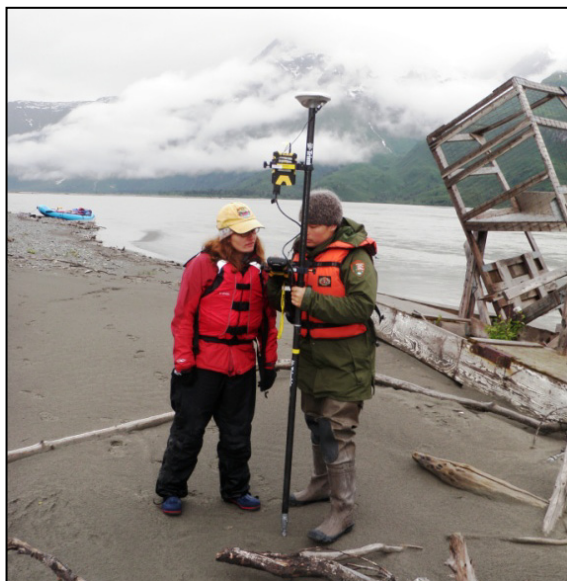


Figure 18. Miranda Terwilliger and Bonnie Million surveying a sandbar on the lower Copper.

The first raft trip was conducted on the Lower Copper River from Chitina to the Million Dollar Bridge 20 miles outside of Cordova. This was a collaborative trip between NPS and the U.S. Forest Service (USFS). The lower Copper River is bordered by WRST to the east and the Chugach National Forest to the west. Both sides of the river are interspersed with native corporation allotment lands. Six 20 meter x 3.5 meter transects were planned for every 5 km of federally managed lands along the Copper River using GPS points generated prior to the trip (Figure 18). Of the six randomly generated transects located on NPS lands, no invasive species were observed at four, one was a steep rock face and could not be

inventoried, and the one had foxtail barley. The one with foxtail barley looked like it might be regularly used as a potential campsite.

Six USFS easements, located on native corporation lands and maintained by the USFS, were also inventoried for invasive plants. All but one of these easements contained infestations of common dandelion. These infestations were all pulled except for one larger infestation found just upriver from Heney Glacier where there was only enough time to remove the seed heads. No other invasive plant species were observed on any of the USFS easements.

The second raft trip during the 2010 field season was conducted on the Nizina River from the toe of the Nizina Glacier to the confluence with the Chitina River. The purpose of this trip was to do a salmonid inventory of creeks off the rivers and WRST EPMT opportunistically joined NPS personnel to survey for invasive weeds at the same time. Since the main objective of this trip was something other than inventorying for invasive weeds, the data collected from these areas should not be considered comprehensive. Even though these rafting trips create only sporadic inventory, they are helpful in monitoring the spread of invasive plants along one of the main vectors in the park. In addition to surveying various stops along the Nizina River, two airstrips, one near the toe of the Nizina Glacier and the other near the confluence of the two rivers were inventoried for invasive plant species. Foxtail barley and common dandelion were observed at both airstrips and at several stops during the raft trip. Due to time constraints none of these infestations were pulled.

The third raft trip was also a conglomeration of various NPS staff and should not be considered comprehensive. The raft trip followed the Kennicott River to where it joins the Nizina River and finally to the confluence of the Chitina and Copper Rivers. Areas inventoried were where the rafts stopped for meals, camping, at trailheads, and locations for campsite evaluations. The take out point was O'Brien Creek (owned by Ahtna Corporation). Foxtail barley and common dandelion were observed and inventoried at various spots where the raft stopped along the river. Foxtail barley, common dandelion, and European stickseed were inventoried on O'Brien Creek. As O'Brien Creek is not park managed land, no control work was performed.

Bridges over three rivers in the Copper Basin were inventoried for white sweetclover. White sweetclover may have been introduced to Alaska when the state imported a few plants for a Mat-Su Valley farm study in the early 1920s (Rozell 2004). Until recently, the Alaska Department of Transportation (DOT) also used white sweetclover in a seed mix used to stabilize roadsides (Rozell 2004). Sweetclover is transported as its pinhead-size seeds cling to vehicles and footwear or ride river currents downstream. The plant takes root in recently disturbed areas. White sweetclover now thrives in dense clumps on the floodplains. It is thought that the plant might be moving onto riverbeds at places where roads cross rivers, and that white sweetclover may keep going down entire river drainage systems (Rozell 2004).

The WRST EPMT crew inventoried land adjacent to both bridges over the Klutina River near Copper Center. The first bridge was located over the Richardson Highway at mile 101. One small patch of white sweetclover was observed on the southwest side of the bridge (Figure 19). This small patch of white sweetclover appeared to be on a slope that could be mechanically controlled in the future. The second bridge is the Old Richardson Highway bridge over the Klutina River east and downstream of the bridge located on the Richardson Highway. No white sweetclover was observed near the second bridge. The WRST EPMT inventoried land adjacent to the bridge over the Tazlina River at mile 110.7 on the Richardson Highway. No white sweetclover was observed at the Tazlina Bridge. The WRST EPMT inventoried the land adjacent to the bridge going over the Gulkana River located at mile marker 126.8 on the Richardson Highway. Three patches of white sweetclover were observed and appeared as though they could be controlled through mechanical methods such as mowing. The NPS and the WRST EPMT crew are working in conjunction with DOT to develop a joint effort in remediating white sweetclover along these corridors by utilizing DOT mowers on known infestations before the plants go to seed.



Figure 19. White sweetclover at the Klutina Bridge.

Remote Sites

Remote airstrips are potential locations for introduction and dispersal of invasive plants onto park lands. WRST has 19 park-maintained remote airstrips, four state-maintained strips (Chisana, May Creek, and two strips in McCarthy), several privately maintained strips, and perhaps 100 or more airstrips that are not maintained but used regularly. There are at least six state-maintained airstrips adjacent to park lands from which visitors, residents, and staff members all access the interior of the park: Beaver Creek, Canada; Chistochina; Chitina; Gulkana; Tok; and Yakutat.

In 2010, two remote airstrips were surveyed in conjunction with the trail crew: Bremner and May Creek. On the trip to the Bremner Historic Mining District, south east of Chitina, WRST EPMT crew noted common dandelion near the airstrip. Two samples of what was thought to be tansy ragwort and common chickweed were collected; however, they were later positively identified as native plants back at the office.

On a separate trip to May Creek, south-east of McCarthy, WRST EPMT crew mapped an airstrip heavily infested with common dandelion, foxtail barley, and field pennycress. Some manual treatment was conducted and the weeds were burned on-site. This airstrip is controlled by the State of Alaska and joint control efforts should be made in the future.

This year the WRST EPMT crew was able to survey and additional eight remote airstrips in conjunction with the WRST Concessions Specialist, Mark Keogh. In mid-June, WRST EPMT surveyed two airstrips via helicopter on the Dadina River, one was located near an abandoned hunting camp on the Chichokna River (Figure 20), and one was located near a hunting cache on the Chetaslina River. No invasive plant species were observed during these site visits. This trip was early in the season and later blooming invasive plants may have not been observed. In the future, these areas should be monitored later in the season if possible. Also in June, WRST EPMT crew flew to the Horsfeld airstrip via fixed wing plane. This is a park owned strip and buildings that are used by a hunting guide/ concessioner with an active horse coral, visitor cabins, hot tub, and sauna. No invasive plant species were observed.



Figure 20. WRST EPMT SCA, John Cebe, surveying Chichokna River airstrip.

WRST EPMT crew also accompanied Mark Keogh to the Gilahina airstrip in late June. This airstrip is also used by a hunting guide/ concessionaire with horses. This concessionaire only has horses out when he is guiding. No invasive plants were documented. WRST EPMT crew visited the Lakina airstrip and adjacent structures were inventoried for invasive plant species in late June. Common plantain was discovered near the cabin and horse corral. The concessioner that runs a hunting business in the area informed the WRST EPMT crew that there had been foxtail barley and dandelion present in the past, it is unknown if the dandelion present was native or non-native. No other invasive plants were found during the site visit.



Figure 21. WRST EPMT staff crossing Snag Creek.

In early August WRST EPMT crew and Miranda Terwilliger, the WRST ecologist, accompanied Mark Keogh to Snag Creek to survey invasive plants. Three airstrips were inventoried during this site visit. One of the airstrips had washed out this year due to the high rainfall and the hunting guide/ concessioner had been given permission to build a new one on the opposite side of the river. The crew was lent horses to cross Snag Creek (Figure 21). Both airstrips, the horse corral, and weather port out buildings were inventoried and no invasives found. The guide did report what he thought was a feral horse in a nearby valley. On the flight back to Copper

Center, the crew opportunistically inventoried an airstrip along the Chisana River due to an unexpected weather stop but no invasives were found.

Plans had been made to accompany Mark Keogh to the privately owned Ptarmigan Lake and Ultima Thule airstrips but poor weather conditions prevented the planes from flying to these destinations. Flights were not able to be rescheduled this year. The Ptarmigan Lake airstrip is of concern due to the presence of horses and its location in a remote area of a park. This airstrip was inventoried and invasive weed infestations documented during the 2009 WRST EPMT season (Terwilliger et al. 2009). The owners of Ultima Thule have requested that the EPMT crew come out and survey their airstrip and land and advise them on invasive plants that may be present.

The WRST EPMT crew also surveyed five state-maintained airstrips: Gulkana, Chisana, Chitina, May Creek and the main airport in McCarthy (details about the later three can be found in the “Chitina”, and “McCarthy” sections respectively). No invasive plants were observed on the Chisana airstrip, however, the trip was made early in the season in mid-May. Snow was still on the ground, therefore invasive plants may not have been visible at the time of the site visit. The Gulkana airstrip was inventoried for invasive weeds and infestations of narrowleaf hawksbeard, common dandelion, foxtail barley, alsike clover, pineapple weed, and European stickseed were found. The remote park-maintained airstrip, the Nizina, was surveyed this year and is discussed in the “River Corridor” section.

In addition to these sites WRST ecologist, Miranda Terwilliger, surveyed some locations as part of compliance work. Two sites were visited via helicopter: Gilahina Butte and Lakina Ridge. The location inventoried on Gilahina Butte is also the site of earthquake monitoring equipment. No invasive plants were found at either site. Miranda also surveyed a site along Tanada Lake which proposed to be a permanent camp for ongoing fisheries research. Again, no invasive plants were found at this location.

Restoration

WRST is unusual in that the main Visitor Center and WRST Headquarters are located outside the park, so many visitors only see this area. In 2006, three white spruce trees (*Picea glauca*), several rose bushes (*Rosa acicularis*), and several soapberry bushes (*Shepherdia canadensis*) were planted around the park welcome sign at Headquarters. All white spruce trees, five rose bushes, and one soapberry bush have survived the last three winters and still appear healthy.

Efforts to seed or transplant flowers in 2006 were largely unsuccessful (Gilmore and Goldsmith 2007). Nootka lupine (*Lupinus nootkatensis*) has since disappeared, but a few Jacob’s ladder (*Polemonium pulcherrimum*), Rocky Mountain goldenrod (*Solidago multiradiata*), and alpine sweet vetch (*Hedysarum alpinum*) have survived. In an attempt to keep the invasive weeds at bay, annual ryegrass (*Lolium multiflorum*) was also seeded in 2006, but the seed was evidently mislabeled and proved to be perennial ryegrass (*Lolium perenne*) (Gilmore 2006), however not much of this remains.

This season, in order to improve the appearance of the grounds through additional restoration, the WRST EPMT crew planted seeds of pasqueflower (*Pulsatilla patens*), arctic aster (*Aster sibiricus*), fireweed (*Chamerion angustifolium*), Rocky Mountain goldenrod, staghorn cinquefoil (*Potentilla bimundorum*), pumpkin berry (*Geocaulon lividum*), and Pacific anemone (*Anemone multifida*) around the welcome sign. During the first week in September, five small quaking aspen (*Populus tremuloides*) trees were planted behind the northeast side of the welcome sign and additional Rocky Mountain goldenrod seed was planted throughout the south side of the welcome sign (Figure 22).



Figure 22. A newly planted aspen tree behind the Copper Center welcome sign.

The park is grateful for the donation of the aspen trees by Daniel Rhoads, the owner of the Alaska Trees Company. It is hoped that this will contribute to a more aesthetically pleasing and natural environment at WRST. Maintaining an invasive weed-free environment at WRST Headquarters is an important step in preventing the spread of invasive plants into nearby park lands.

Outreach/Education

The WRST EPMT spends a portion of each season educating the public about the economic and ecological costs of invasive weeds. Many people remain unaware of the negative impacts invasive weeds have on the environment and are unaware that they are a problem in Alaska. Throughout the summer, visitors often approach team members and ask them “Why are you picking all of the pretty flowers?” or “What, you’re wasting my tax money pulling the sweetclover! It smells so good!” The EPMT sees education as an important part of invasive plant management. An informed public can help slow the spread of weeds and support programs that manage them. Every year team members participate in several outreach events and spend time with volunteer youth groups.

This year Governor Sean Parnell officially proclaimed June 20-26, 2010 as Alaska Invasive Weeds Awareness Week (Parnell 2010). During this week the governor encouraged Alaskans to learn about preventing the spread of invasive weeds. The WRST EPMT crew educated park employees by making announcements via e-mail. The crew also increased the amount of invasive weed education with the youth groups that assisted with treatments this summer. While the SAGA and YCC groups were in Copper Center they brainstormed for outreach ideas. One project consisted of breaking into four smaller groups with each group creating an outreach commercial for Alaska Invasive Weeds Awareness Week. All of the groups came up with great ideas and the results were distributed around WRST, the larger invasive weeds community in the state, and posted on YouTube. EPMT SCA Melissa Booher also wrote and published an article in the local newspaper, the Copper River Record for the week (Appendix II).

In 2010 the WRST EPMT participated in four festivals in the Copper River Valley. At the Fireweed Festival in Copper Center, the WRST EPMT and SAGA crews performed a catchy

invasive weed song they came up with and displayed a booth to share information with locals and visitors (Figure 23). The crew displayed booths and shared information at the Fourth of July celebrations in both McCarthy and Chitina. Another outreach booth was displayed at the Kenny Lake Festival in August. The WRST EPMT crew staffed the booth and talked with people about how to identify invasive plants growing in the area and how to control them. All of the booths included pressed examples of invasive weed species, pamphlets with helpful information for identifying the plants, and an educational game called Wack-a-Weed for children. In August AnnMarie Lain wrote and published an article in the Copper River record about the SAGA crew and their efforts against invasive weeds (Appendix III).



Figure 23. WRST EPMT SCA's, SAGA, and YCC crews performing the "Invasive Weed Blues" at the Copper Center Fireweed Festival in June.

The WRST EPMT presented three educational talks this summer. WRST ecologist, Miranda Terwilliger, gave an orientation talk to the seasonal interpretive staff in May to help them convey issues about invasive weeds to the public. Nicole Liette gave a talk at the Recreation Center in Kennecott entitled "Weeds Are a Pain in the Grass" which introduced the WRST EPMT program, identified invasive weeds in the area, and suggested restoration and control activities. AnnMarie Lain gave a talk to a group of youth participating in watershed program put on by the Wrangell Institute for Science and Environment (WISE) and introduced the problems of invasive weeds in watersheds and basic identification of the most common weed species.

Discussion and Recommendations

Inventory and Control Work

In past seasons, the WRST EPMT has focused on mapping invasive weeds not only within the park but along the road corridors surrounding the park in order to better understand where the invasive plants seed sources were and to identify the greatest threats for the park (Gilmore & Harper 2008). Specific mapping goals for the 2010 season included: comprehensive bicycle surveys of the Nabesna and McCarthy roads, the road between McCarthy and Kennecott Mines NHL, backcountry trails that are accessible from these roads, campgrounds and pullouts, park maintained and concessioner airstrips (particularly those that keep horses), and some remote in-holder properties. A particular focus was to map remote trails and airstrips within the park and to start to map areas where there concessionaires keep horses. At this point the park does not see a reason to annually map the trails that were reported to have no infestations. These trails should be re-visited in three years.

Airports, especially the Gulkana and Chitina airports, will continue to be a priority as they have substantial infestations and many flights that travel within the park originate from there.

Likewise, the junction of the Tok Cut-off is a prime seed source for white sweetclover on the Nabesna Road and the WRST EPMT should continue to treat this area. If at all possible it is best to hit this area twice – once in early July and again in early August as the plants seem to send up a second crop.

Specific treatments will continue at WRST Headquarters and the Chitina, Copper Center, Kennecott Mines NHL, and Slana ranger stations. A long term treatment and re-vegetation plan for Kennecott Mines NHL should be a priority, as this area is under extensive renovations. This may include developing a working cooperative weeds management group for the area or seeking additional funds to collect native seeds from the areas and get them planted.

This season, the NPS conducted fire hazard fuels treatment at WRST Headquarters. Hazard fuel treatments use power saws and hand tools to thin vegetation and create defensible space around structures where fire poses a threat to property and resources. The treatment area is approximately 18 acres. Fire managers reduce fire suppression costs, protect community values, restore forest health, and improve public safety by performing these treatments (Budzinski 2010). During the hazard fuels treatment natural vegetation was disturbed, creating ideal conditions for new non-native plant infestations. The WRST EPMT should survey the treated areas next season to determine if invasive species colonized these fuel reduction areas.

Specific mapping goals for the 2011 season should include: a repeat of the comprehensive bicycle surveys of the Nabesna and McCarthy roads (taking consideration for previously mapped infestations and for areas under construction in 2010), the road between McCarthy and Kennecott Mines, backcountry trails that have not been mapped and ones that have high priority infestations, roads, campgrounds, pullouts, and unmapped airstrips.

A complete list of invasive plant vouchers collected and kept onsite in the park herbarium WRST can be found in Appendix IV. Currently, only 5 of 49 documented species are represented in the herbarium. It should be a priority for the team to collect the species not represented for preservation, and to even collect multiple samples of the same species when they are from

disjunct infestations. It is important that these specimens be mounted and submitted to the herbarium both for future reference and research. The EPMT would also like to complete an educational collection of park invasive plants that can be kept and used as reference material at the WRST EPMT office.

From at least 2005 until 2009 AKEPIC recognized foxtail barley as an invasive species. As of 2010 that status was reversed on the basis that the taxonomic evidence points to foxtail barely as a native in both Alaska and the Yukon Territory. It has clearly been in WRST for some time as it was first documented here in 1962 (Cook et al 2007). The WRST EPMT does consider this grass to be native. However, like Environment Yukon (Line et al 2008), it is considered a species of concern due to its aggressive, opportunistic spread across the landscape particularly in areas of human disturbance such as airstrips, trails, roadsides, gravel pits, campgrounds, and horse corrals. It also appears to be prone to being distributed by human activities such as supplemental feeding of livestock (Conn et al 2010). It is also considered a nuisance to wildlife, sled dogs, horses, and pets (Cords 1960, Line et al 2008). For these reasons the WRST EPMT will continue to map and control foxtail barley despite the fact that it is no longer listed by AKEPIC. Control efforts in particular will be focused on areas that serve as vectors for seed transport.

Restoration

Restoration efforts should continue at WRST Headquarters. The areas surrounding buildings should be weeded and seeded each year until native plants are re-established. In addition, a plan should be considered to seed the Kennecott Mines NHL town site with native seeds and potentially historically non-native garden plants with non invasive, historically accurate plants once the massive reconstruction effort slows down.

In order to take on the greater need for restoration, the WRST EPMT should develop a restoration protocol for collecting and cleaning native seeds for future use. Although the WRST EPMT continues to collect and clean native seed around WRST Headquarters, the EPMT program currently lacks the equipment necessary to clean and store large amounts of seed or starter plants in the spring. As restoration work continues to upgrade, the investment in equipment and storage space may become necessary.

Outreach/Education

Key elements for success in controlling invasive plants are education and community involvement. The WRST EPMT staff should continue to work with other divisions and finalize an invasive plant policy. Presentations should continue to be given to seasonal staff. Informal training should be provided both for interpreters who interact with the public as well as seasonal staff from other divisions, who are sometimes directed to do weeding around visitor centers. This will provide these staff with an understanding of the importance of the EPMT goals and allow them to contribute to the EPMT effort. In addition, staff members who are directed to complete supplemental weeding should be aware of the EPMT's mapping and reporting requirements so their work is properly documented.

In 2010 WRST EPMT technicians put together field flip books for each ranger station highlighting the "top ten" species for each area. Next year the staff should make a greater effort to encourage other resource divisions in WRST to use them. Future WRST EPMT staff should also work closely with the interpretive division to include information about invasive plants in

their ranger talks at the visitor centers, Princess Lodge, youth camps, and at teacher-ranger-teacher programs.

Radio and newspaper interviews help bring the problem to public attention. The summer craft and agricultural fairs are good venues for educational displays. Next year the WRST EPMT should have a booth at the Fair Weather Days in Yakutat (late August) in addition to the booths they sponsored in 2010. Handouts about invasive plants should be widely distributed, while site specific booklets should be distributed in Copper Center, McCarthy-Kennecott, and Slana. Libraries, laundromats, post offices, local visitor centers, and hotels throughout the Copper Basin are also good locations to display information.

One of the most important aspects of community education is the active involvement of local residents. The Copper Valley Invasive Plants Workgroup remains in existence but was unable to secure funding for a coordinator, this means that all workgroup activity is on a volunteer basis. Efforts should be made to strengthen this group and involve more community members.

Due to travel constraints the WRST EPMT should coordinate with the Yakutat area NPS staff. Yakutat is accessible to park staff mainly by driving to Anchorage and then flying to the Yakutat airport via commercial airline. It is expensive and difficult to inventory and monitor this portion of the park without a dedicated Yakutat crew who is stationed there seasonally. It would be valuable to have more information on invasive species in this part of the park, but it was logistically not possible to work there in 2010.

Education and public involvement could be increased with more talks, work groups and partnering with other organizations that have an interest in the invasive species issue, such as the Wrangell Mountains Center (WMC) and WISE. It is important that the WRST EPMT maintain informal partnership with these local groups and work with them on educational programs and public outreach. The WRST EPMT should talk with WMC College students and backcountry rangers before they go on their backcountry field trip to enlist their help with backcountry invasive plant monitoring.

Literature Cited

- Bauder, P. and J. Heys. 2004. Exotic plant management at Wrangell-St. Elias National Park & Preserve: 2004 Field season report. National Park Service Unpublished Report. Anchorage, Alaska.
- Bleakley, G. T. 2002. Contested ground: An administrative history of Wrangell-St. Elias National Park & Preserve, 1978-2001. National Park Service. Alaska System Support Office, Anchorage, Alaska.
- Budzinski, K. 2010. Headquarters hazard fuel projects. Alaska Eastern Area Fire Management. Fairbanks, Alaska, USA.
- Carlson, M. L., I. V. Lapina, M. Shephard, J. S. Conn, R. Densmore, P. Spencer, J. Heys, J. Riley, and J. Nielsen. 2008. Invasiveness ranking system for non-native plants of Alaska. USDA Forest Service, R10, R10-TP-143. Anchorage, Alaska.
- Conn, J. S., C. A. Stockdale, N. R. Werdin-Pfisterer, J. C. Morgan. 2010. Characterizing pathways of invasive plant spread to Alaska II: Propagules from imported hay and straw. *Invasive Plant Science and Management*. Sept-Nov, 3(3):276-285.
- Cook, M. B., C. A. Roland, and P. A. Loomis. 2007. An inventory of the vascular flora of Wrangell-St. Elias National Park and Preserve. Natural Resource Technical Report NPS/CAKN/NRTR-2007/067. National Park Service, Fort Collins, Colorado.
- Cords, H. P. 1960. Factors affecting the competitive ability of foxtail barley (*Hordeum jubatum*). *Weed Science Society of American* 8(4): 636-644.
- Davies, K. W., and R. L. Sheley. 2007. A conceptual framework for preventing the spatial dispersal of invasive plants. *Weed Science* 55:178-184.
- Densmore, R. V., P. C. McKee, and C. Roland. 2001. Exotic plants in Alaskan National Park units. U.S. Geological Survey report. Anchorage, Alaska.
- Gilbert, C., P. White, and A. Worthington. 2001. Cultural landscape report: Kennecott Mill Town. National Park Service Report D-75. Anchorage, Alaska.
- Gilmore, L. 2005. Exotic plant management in Wrangell-St. Elias National Park and Preserve: 2005 Field season report. National Park Service Unpublished Report. Anchorage, Alaska.
- Gilmore, L. 2006. Exotic plant management in Wrangell-St. Elias National Park and Preserve: 2006 Field season report. National Park Service Unpublished Report. Anchorage, Alaska.
- Gilmore, L. and D. Goldsmith. 2007. Exotic plant management in Wrangell-St. Elias National Park and Preserve: 2007 Field season report. National Park Service Unpublished Report. Anchorage, Alaska.

- Gilmore, L. and T. Harper. 2008. Exotic plant management in Wrangell-St. Elias National Park and Preserve: 2008 Field season report. National Park Service Unpublished Report. Anchorage, Alaska.
- Gordon, D. R. 1998. Effects of invasive, non-indigenous plant species on ecosystem processes: Lessons from Florida. *Ecological Applications* 8(4):975-989.
- Line, J., G. Brunner, R. Rosie, and K. Russell. 2008. Results of the 2007 invasive plants roadside inventory in Yukon. *Environment Yukon Report*. Whitehorse, Yukon, Canada.
- Macander, M. J. and T. L. Wurtz. 2007. A network model to help land managers predict and prevent spread of invasive plants from roads to river systems in Alaska. USDA Forest Service, Fairbanks, Alaska.
- McKee, C. 2003. Exotic plants in Alaska National Parks: 2003 field season report. U.S. Geological Survey Unpublished Report. Anchorage, Alaska.
- Million, B. and W. Rapp. 2010. Alaska Exotic Plant Management Team 2010 field protocol. National Park Service Unpublished Report, Anchorage, Alaska.
- National Park Service. 2010. Draft environmental impact statement on Nabesna off-road vehicle management plan, Wrangell St. Elias National Park and Preserve. Federal Register 75:48721. U.S. Department of the Interior, National Park Service, Copper Center, Alaska.
- Parnell, S. 2010. Governor's full proclamation: Alaska invasive weeds awareness week. June 10, 2010. Office of the Governor, Juneau, Alaska.
- Rozell, N. 2004. Invasive plants creep into Alaska. *Alaska Science Forum*, Article #1723. Nov 4, 2004. Geophysical Institute, University of Alaska Fairbanks, Fairbanks, Alaska.
- Terwilliger, M. N., J. M. Donohue, L. M. Gilmore, T. E. Harper, and K. M. Laushman. 2010. Invasive and exotic species management for Wrangell-St. Elias National Park and Preserve: 2009 Summary report. Natural Resource Data Series NPS/WRST/NRDS—2010/023. National Park Service, Fort Collins, Colorado.
- Vitousek, P. M., C. M. D'Antonio, L. L. Loope, and R. Westbrooks. 1996. Biological invasions as global environmental change. *American Scientist* 84: 468-478.
- Willis, C. G., B. R. Ruhfel, R. B. Primack, A. J. Miller-Rushing, J. B. Losos, and C. C. Davis. 2010. Favorable climate change response explains non-native species' success in Thoreau's woods. *PLoS ONE*. 5 (1): e8878.

Appendix I: Invasive Plant Synopsis

This section describes infestations of invasive plants found at WRST that are ranked 48 or above according to the Alaska Natural Heritage Program invasiveness scale in 2010 (complete information on scale is available at <http://akweeds.uaa.alaska.edu>). Plants are listed alphabetically by Latin name

***Bromus inermis* (Smooth brome grass, rank 62)**

Smooth brome exists in the gravel pit on the west side of McCarthy, and in downtown McCarthy, at the Donoho Avenue site (Terwilliger et al. 2009). Both infestations were mapped in 2009 but were considered too thick for manual control. Due to the expansiveness of these infestations they were not revisited in 2010. In past years, smooth brome was monitored along McCarthy Creek and from mile 50-60 on the McCarthy Road (Gilmore and Harper 2007). Neither location was monitored in 2009 or 2010. No new locations of smooth brome grass were mapped in 2010. The infestations from 2007 should be revisited in 2011.

***Caragana arborescens* (Siberian pea shrub, rank 66)**

This species has been found in only one location in the Kennicott Valley: on private property in McCarthy growing as a privacy hedge (Terwilliger et al. 2009). This infestation was not visited in 2010. No new locations of Siberian pea shrub were mapped in 2010. In 2011 EPMT should visit the infestation with permission from the property owner.

***Crepis tectorum* (Narrowleaf hawksbeard, rank 54)**

Narrowleaf hawksbeard is abundant at WRST Headquarters, along all roadsides, in gravel pits, and parking areas. No efforts have been made to treat the infestations on non-park lands.

Although infestations were reported in 2004 (Bauder and Heys 2004) and 2006 (Gilmore 2006) on the Nabesna Road at mile posts 29-35, narrowleaf hawksbeard has not been found at that location since 2006 (Gilmore and Goldsmith 2007, Gilmore and Harper 2008). This year a new infestation was found by the Slana school on the Nabesna Road at Mile 1. This infestation should be revisited in 2011.

On the McCarthy Road, narrowleaf hawksbeard was monitored in 2009 and weeded as the infestation continues to grow at mile 59. A new infestation was also found at Mile 5.5 on the McCarthy Road.

Narrowleaf hawksbeard remains a high priority in the McCarthy area. Control efforts continued at the footbridge and the driveway into NPS west side seasonal housing. Continual weeding and monitoring for new infestations will be critical to keep narrowleaf hawksbeard out of the park. Narrowleaf hawksbeard has not yet been found in the Kennecott Mines NHL or on the road from McCarthy to the NHL.

***Elymus repens* (Quackgrass, rank 59)**

Quackgrass has been recorded in McCarthy on the river by the Million Dollar Bridge, but the infestations were not found in 2009 and not visited in 2010. Quackgrass has been recorded on the driveway to Kennicott Glacier Lodge but due to private land ownership the infestation has not been visited since (Bauder and Heys 2004, Gilmore and Goldsmith 2007).

***Leucanthemum vulgare* (Oxeye daisy, rank 61)**

The infestation of oxeye daisy discovered in 2007 (Gilmore and Goldsmith 2007) at mile 10.9 on the McCarthy Road was monitored and weeded this season. It was also monitored and weeded on mile 25 for the first time.

The infestation in the park, located on the slope behind the Jurick building in Kennecott Mines NHL, has decreased in size and density over the past few years. This year all flowering plants were pulled before going to seed and many rosettes were removed. For a complete assessment of this eradication a stem count should be taken at this infestation in 2011. With the exception of Kennicott Glacier Lodge, all known infestations of oxeye daisy on private property in Kennecott Mines NHL are being treated and have decreased in size.

***Linaria vulgaris* (Yellow toadflax, rank 61)**

A new infestation of toadflax was inventoried and weeded on Mile 32 of the McCarthy Road. The three yellow toadflax infestations at the end of John Adam's airstrip in west McCarthy was monitored but not found. In McCarthy the infestations at the former horse corral in downtown McCarthy and in the garden bed under the Wrangell Mountains Center events sign in McCarthy need to be monitored and retreated next season.

***Melilotus alba* (White sweetclover, rank 81)**

In Slana, white sweetclover remains a high priority. The area around the junction of the Tok Cut-Off and Nabesna Road should be closely monitored as plants will need to be pulled for many years. During a routine monitoring of the Slana Fish wheel Trail in 2007, white sweetclover was found for the first time since 2004 (Bauder and Heys 2004, Gilmore and Goldsmith 2007). Plants were found in the same location in 2008, but no plants were found here during the 2009 and 2010 seasons (Gilmore and Harper 2008). Due to high flooding this trail should be monitored again for this infestation in 2011.

White sweetclover infestations growing on the Glenn and Richardson highways and side roads throughout the Copper Basin were not mapped this year. EPMT did map infestations of concern along water corridors in hopes to have DOT strategically mow these areas in 2011. White sweetclover was found both at the Klutina and Gulkana bridges. None was found at the Tazlina Bridge.

In 2010, white sweetclover growing across from headquarters at mile 106.8 on the Richardson Highway was monitored and weeded by the EPMT crew, a stem count of 90 plants was recorded. No infestations of white sweetclover were found at headquarters this season, although monitoring should be continued as two areas were inventoried and treated in 2009.

For the first time, one specimen of white sweetclover was found in 2010 on the O'Brien Creek Road near Chitina. Next season EPMT should get permission from Ahtna Native Corporation to eradicate this infestation.

The single plant infestation on the McCarthy Road at mile 13 went from one plant in 2009 to two plants in 2010. Both plants were removed, but the area should be monitored next year.

***Phleum pratense* (Common timothy, rank 54)**

Common timothy was not monitored in 2010 at the horse corral on Kennicott River Lodge and Hostel land. New infestations were inventoried on the McCarthy Road at miles 21 and 23-39. These infestations should be monitored and weeded during the 2011 season.

***Tanacetum vulgare* (Common tansy, rank 57)**

Common tansy has only been found in the maintenance yard in Glennallen where the infestation was weeded by the SAGA crew in 2009 and 2010. There has been an unconfirmed report of it on the McCarthy Road near the Crytalline Hills trailhead. This should be followed up on in 2011.

***Taraxacum officinale* spp. *officinale* (Common dandelion, rank 58)**

The common dandelion is pervasive in all areas covered by this report. At WRST Headquarters, dandelions grow thickly along the drive to the visitor center and more sparsely in other areas. The drive is weeded at least once per season.

The common dandelion is so widespread in the McCarthy-Kennecott area that the infestations are generally beyond control by manual methods. Consequently, only specific locations of concern can be monitored and managed with the resources currently available. These high-priority areas include roads, trails, airstrips and gravel pits that may facilitate spreading dandelions out of town centers and into relatively weed-free park land.

***Trifolium hybridum* (Alsike clover, rank 57)**

***Trifolium pratense* (Red clover, rank 53)**

***Trifolium repens* (White clover, rank 59)**

Clovers are found in all areas covered in this report, although not as common as the common dandelion. Infestations have been mapped in Kennecott Mines NHL, McCarthy, May Creek, WRST Headquarters, the visitor center in Copper Center, the headquarters gravel pit, Chitina Ranger Station and Emporium, McCarthy Road, Nugget Creek Trail, Kuskalana Bridge, Westside housing, Mr. IS, John Adams airstrip, Gulkana airstrip, and the Nabesna Road.

***Tripleurospermum perforatum* (Scentless false mayweed, rank 48)**

Scentless false mayweed was monitored and weeded at the Betty Freed property on the Nabesna Road during the 2005- 2010 field seasons (Gilmore 2005 and 2006, Gilmore and Goldsmith 2007, Gilmore and Harper 2008, Terwilliger et al. 2009). For an accurate assessment of the current infestation, a stem count should be documented in 2011. No new infestations were mapped in 2010.

***Vicia cracca* (Bird vetch, rank 73)**

The reported infestation of bird vetch growing south of the Lakina River was monitored and mapped this year. Although the 2009 vouchers collected were identified as *Oxytropis* spp., a native plant, this infestation should be monitored and sampled again in 2011.

Appendix II: Copper River Record June Newspaper Article

Invasive Weeds Awareness Week

By Melissa Booher

This week is Alaska Invasive Weeds Awareness Week!!! This is a great time to learn more about invasive weeds and their effects on Alaska's ecosystems. A weed is any plant considered undesirable and growing somewhere you do not want it. An invasive plant is a plant that has characteristics that allow them to "out-compete" the native vegetation. They grow quickly, mature early, and spread seeds that can survive

a long time. Invasive species are often able to hybridize or cross-pollinate with local plants. The impacts of invasive plants can lead to the reduction or even elimination of entire native plant populations. Invasive weeds can create endless problems.

If non-native ornamental flowers escape from your garden, they can potentially turn into invasive weeds. Invasive weeds impact everyone by drastically changing the scenery around us. Non-native plants

compete with native plants for space, soil, light, and water. Competition by invasive plants can prevent the establishment of native trees and shrubs. Displacement of native species can introduce changes in ecosystems that lead to loss of food sources and habitat for wildlife. Luckily, there are actions and precautions we can take to lower the threat of invasive weeds.

Everyone can take a part in

helping to preserve Alaska's native ecosystems. When planning a garden, make sure to plant only non-invasive plants and to look for "certified weed free" products. Becoming more familiar with some of the more common invasive weeds is also a good idea. Once familiar with local invasive species, you can start removing them from the land around you and encourage the growth of native plants. Education

is one of the most powerful tools available to limit the spread of invasive plants. Sharing any knowledge you gain about invasive weeds is important. Information on exotic and invasive plant in Alaska is available via the Alaska Exotic Plants Information Clearinghouse at <http://akweeds.uaa.alaska.edu/>.

Please spread the word, not the weeds!

Appendix III: Copper River Record August Newspaper Article

12 | August 19, 2010



COPPER RIVER RECORD

Fewer Invasive Weeds Invading Copper Basin Thanks to SAGA Crew

by Annie Lain, NPS

Do you remember the article Alaska Invasive Weeds Week (7/15/10 CRR)? Well, this version is the shake-up and shake-down of what youth from throughout the state of Alaska have done in the Copper Basin to help stop the spread of invasive weeds.

"Who are these 'invasive weed warriors' and where are they from?"

They are participants in the Southeast Alaska Guidance Association (SAGA)--a non-profit organization whose mission is to "improve lives, land, and communities in Alaska through Service Learning."

A nine person SAGA crew was stationed in Wrangell-St.

Elias NPP for several weeks this summer specifically to control invasive weeds. They spent two weeks in Copper Center and a week in both the McCarthy and Nabesna areas.

"What are invasive weeds and why do we combat them?"

Invasive weeds are named such for a good reason. Not only can they out-compete native species of plants but they also have the potential to destroy entire ecosystems. Invasive weeds expert Lil Gilmore explains that "for every stretch of roadside swallowed by sweet-clover or any other invasive species, an equal number of the native wildflowers that dazzle our eyes are lost."

So, as you look through



Photo Courtesy NPS

This SAGA crew was stationed in Wrangell-St. Elias NPP to control invasive weeds. They are pictured at the junction of the Tok Cut-off and Nabesna Road relaxing atop their bounties of invasive weeds--white sweet-clover.

your summer photo album admiring this year's display of wildflowers, remember

that the 'war against weeds' is a battle worth fighting for.

This year the SAGA crew pulled over two hundred and twenty seven bags of weeds! They also helped create you-tube videos to increase awareness of the threats we face from invasive plants in Alaska.

As a local resident and frequent visitor to Wrangell St. Elias National Park, I extend my gratitude to the SAGA organization and say thank you for all your hard work. If you would like to learn more about invasive plants in Alaska please visit the Alaska Exotic Plant Management team at <http://www.nps.gov/akso/NatRes/EPMT/index.html>

Appendix IV: List of Invasive Plant Herbarium Specimens Housed at WRST

Scientific Name	Collector	Collection Date	Collection #	Catalog #	Locality
<i>Crepis tectorum</i> L.	Cook, Mary Beth	6/24/1997	3037	WRST 9151	NPS Headquarters
<i>Erysimum cheiranthoides</i> L.	Cook, Mary Beth	8/7/1991	91230	WRST 1318	Orange Hill
<i>Erysimum cheiranthoides</i> L.	Roland, Carl	6/18/1996	96-146	WRST 3876	Nabesna River Lake 3219'
<i>Hordeum jubatum</i> L.	Teare, Kathleen A.	7/18/1984	1795	WRST 441	Mt. Drum
<i>Hordeum jubatum</i> L.	Miquelle, Dale	7/14/1984	84-37	WRST 442	Bryson Bar
<i>Hordeum jubatum</i> L.	Roland, Carl	7/5/1996	96-398	WRST 4126	Klawasi wetland
<i>Lappula squarrosa</i> (Retz.) Dumort	Miquelle, Dale	6/19/1984	84-04	WRST 296	Pease Grazing Lease
<i>Lappula squarrosa</i> (Retz.) Dumort	Roland, Carl	7/12/1995	95-177	WRST 3082	Blondie Ridge
<i>Lappula squarrosa</i> (Retz.) Dumort	Cook, Mary Beth	7/13/1995	95220	WRST 3327	Blondie Ridge
<i>Lappula squarrosa</i> (Retz.) Dumort	Cook, Mary Beth	6/6/1996	96241	WRST 7393	Reeves Field
<i>Polygonum aviculare</i> L.	Cook, Mary Beth	7/17/1995	95259	WRST 3358	Mt. Chitina