



Invasive Plant Management in Yukon-Charley Rivers National Preserve and Gates of the Arctic National Park & Preserve

2011 Summary Report

Natural Resource Data Series NPS/YUGA/NRDS—2012/228



ON THE COVER

Upper Left: The Yukon River close to Smith's Cabin. Upper Right: Narrowleaf hawksbeard at Slaven's Roadhouse. Middle Left: Student Conservation Association intern Matt Schultheis on the Dalton Highway close to Atigun Pass. Middle Right: Southeast Alaska Guidance Association AmeriCorps crew members left to right; Amber Lee, Heidi Clements, Zach Griswold, and Jen Callahan. Bottom: Panorama of the South Fork of the Koyukuk River crossing the Dalton Highway. Photographs by: Matt Schultheis

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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

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.

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

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Abstract

This report describes the work performed by the Alaska Exotic Plant Management Team at Yukon-Charley Rivers National Preserve and Gates of the Arctic National Park & Preserve during the 2011 season including objectives, methods, and major conclusions. This field work is a continuation of work done by the Alaska Exotic Plant Management Team in the summer of 2010. The 2011 season was divided into four main regions from highest to lowest priority: Coal Creek Camp; Slaven's Roadhouse; the Dalton Highway south of Coldfoot, AK; and Gates of the Arctic National Park & Preserve along the Middle Fork of the Koyukuk River. The main area of focus during the 2011 season was the high traffic areas along Coal Creek; a tributary of the Yukon River downriver from Eagle, Alaska. Invasive plant infestations were recorded using a 2008 Trimble GeoXH Global Positioning System unit. Data was edited and analyzed using Trimble Pathfinder Office and ESRI ArcGIS. A total of 1.896 acres were surveyed, 1.896 acres of invasive plant infestations were mapped, and 1.307 infested acres were treated during the 2011 season. Invasive plant infestations were recorded in both remote and high traffic areas, however proper plant identification was difficult in the early part of June due to late phenology. During the 2011 field season one new species was discovered, sticky chickweed (*Cerastium glomeratum*), which was found along the north side of Slaven's Roadhouse. Additional personnel will be required in future years to manually treat multiple sites in the Coal Creek area.

Introduction

There is some public misperception that Alaska's native ecosystems are buffered from non-native invasive plant invasion by the region's climate and relative isolation. Though Alaska is known for its extreme winter climate and is somewhat secluded from the population centers in the contiguous United States, sources have shown that invasive plants in Alaska are still spreading and they can possibly disturb native ecosystems without human intervention (AKEPIC 2011). It is theorized that one of the primary natural vectors of invasive plant distribution in Alaska is water; whether it be glacial melt, rivers, streams, rain, and runoff into stream crossings from roads. Since Alaska only has about 319 invasive plant species compared to the thousands of species in the contiguous United States, land managers and individuals in Alaska can still grasp the opportunity to stop the invasion (AKEPIC 2011). Some of these species were brought to Alaska intentionally and were selectively bred to withstand the cold Alaskan winters. Some of these same species are now invasive in Alaska. Invasive plant dispersal is a serious problem that needs to be proactively addressed for the sake of Alaska's native ecosystems.

The relatively weed free ecosystem found in the Yukon-Charley Rivers National Preserve (YUCH) and Gates of the Arctic National Park & Preserve (GAAR) are prime examples of areas where invasive plant management can make a difference. The Alaska Exotic Plant Management Team (EPMT) was formed in 2003 to address invasive plant management in Alaska National Park Units. In YUCH the first invasive plant management activities took place in 2005 with a survey of the Coal Creek drainage. The next survey was in 2008 when Alaska EPMT staff surveyed several public use cabins on the Yukon River during a float trip. A group of National Park Service (NPS) volunteers also conducted a survey in 2009 when they mapped invasive plants along the Yukon River. The 2010 field season was the first year of an organized invasive weed program at YUCH with two Student Conservation Association (SCA) interns stationed at the preserve for the entire summer. The 2011 season continued the work done in 2010 with one SCA intern. Alaska EPMT invasive plant management in GAAR has been less frequent given the challenges in accessing the park. Surveys were conducted in 2006 and 2007 along portions of the Noatak River. Walker Lake was surveyed during the 2010 season. A short stretch of the Middle Fork of the Koyukuk River was surveyed this season.

Compared to some other Alaska NPS units YUCH does not have a high number of recreational visitors. In 2010 YUCH had 6,211 visitors compared to 378,855 visitors at Denali National Park & Preserve (NPS 2011). These statistics directly correlate to the low abundance of invasive plants in YUCH, making the Alaska EPMT's presence even more significant. To illustrate how isolated YUCH has become, the town of Eagle had a population of 800 in the late 1800's when gold was abundant and currently only hosts a population of 110 (Census 2010). The Yukon River section of the preserve lies between the villages of Eagle and Circle. The Yukon River is the main route of travel to reach Slaven's Roadhouse and Coal Creek Camp (CCC).

During the summer the largest amount of recreational traffic consists of visitors floating the Yukon River. Visitor's gear and clothing may inadvertently transport invasive plant seed into the park and potentially downriver from Eagle. The Yukon River is a consistent source of seed dispersal throughout the northern part of the preserve. YUCH attracts many visitors in the winter during the Yukon Quest International Dog Sled Race between Fairbanks, Alaska and Whitehorse, Canada. Several public use cabins along the river serve as checkpoints during the

race. There is some concern that hay used for the sled dog's bedding could be a vector for new invasive plant introduction.

The Coal Creek valley is a designated Historic Mining District that started out as a mining camp in the late 1800's. Due to its remote location, CCC now rarely has visitors. Although some of the invasive plants currently in YUCH can be traced back to the mining sites, the spread of the new species is much more potent. In addition to the historic landmarks within the preserve, YUCH hosts one of the largest peregrine falcon nesting sites in the north western hemisphere. The preserve has ample fish and wildlife present including: king salmon, pike, bald eagle, peregrine falcon, moose, caribou, black bear, and grizzly bear. The spread of the invasive plants taking over native ecosystems could drastically alter the fish and wildlife habitats.

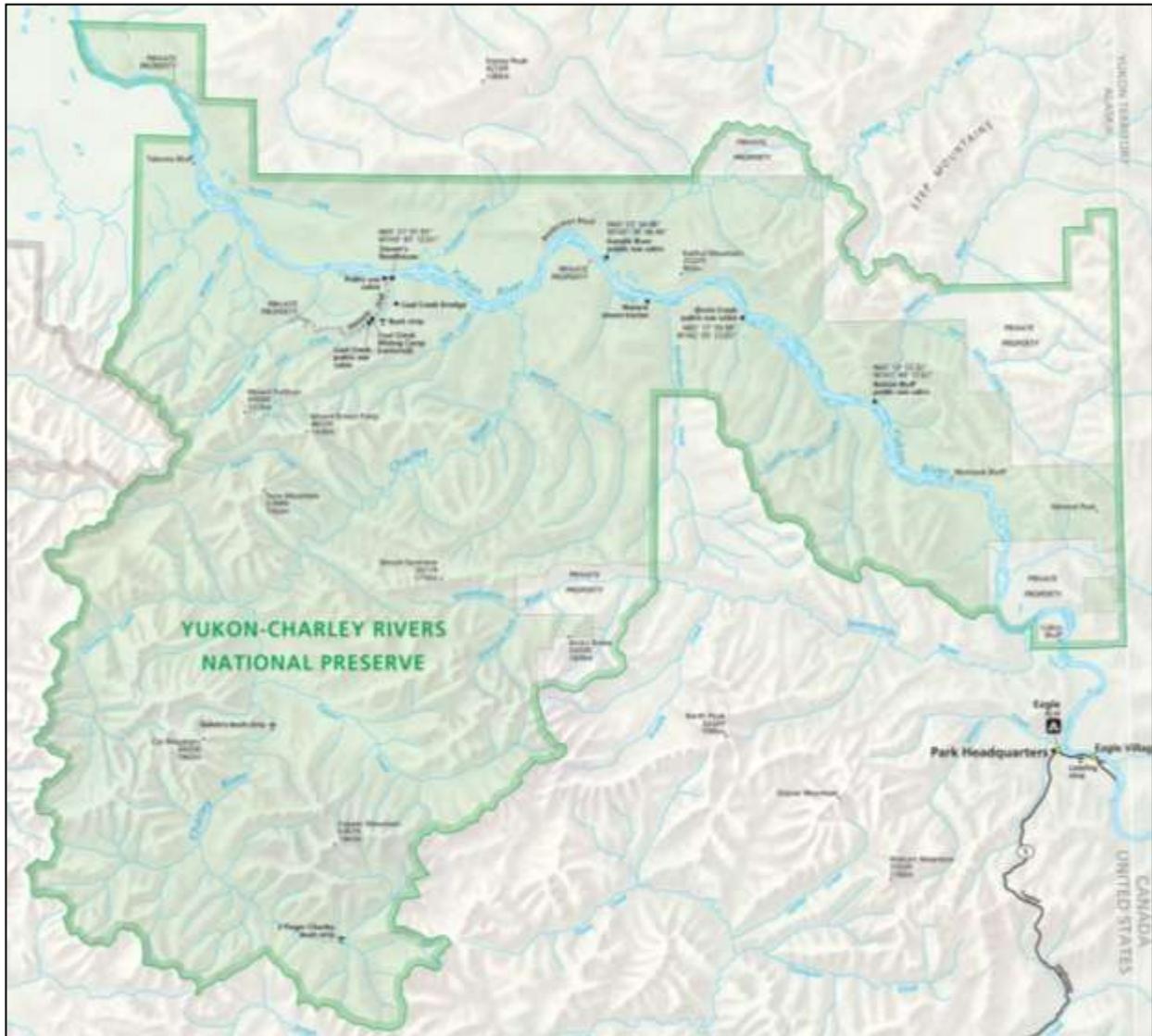


Figure 1. A map of the Yukon-Charley Rivers National Preserve.

Methods

The 2011 YUCH EPMT survey efforts primarily focused on high traffic areas in camps and areas along Coal Creek and along some major vectors into GAAR. The major sites include: Slaven's Roadhouse, CCC, stream crossings along the Dalton Highway south of Coldfoot, and several sites along the Middle Fork of the Koyukuk River along the GAAR boundary. The YUCH EPMT surveyed areas, recording infestations and controlling manageable areas with manual (hand-pulling) methods. It took nearly seven weeks for the YUCH EPMT to survey and pull plants in the previously mentioned areas, between early June (when plant phenology was very limited) and late July. The work sites were either reached by plane to CCC or by automobile along the Dalton Highway from Fairbanks to Coldfoot.

The 2011 treatments of invasive weed infestations in YUCH were prioritized based on both the size of the infestation, with smaller areas receiving higher priority, and the Alaska invasiveness ranking system for non-native plants. The invasiveness rank is on a one to 100 scale, with a higher rank being more invasive. Rankings are based on ecosystem impacts, biological attributes, distribution, and control measures of a given species (Carlson et al. 2008).

The methods for the monitoring and control of invasive plant were derived from the Alaska EPMT 2011 Field Protocol (Million and Rapp 2011). A 2008 Trimble Geo XH Global Positioning System (GPS) receiver was used to accurately record, to within 40 cm, any invasive infestations in the field. The Alaska EPMT customizable data dictionary was then used to input information describing the site, species, and infestation characteristics such as percent cover and disturbance type. After the data was collected, it was transferred via Trimble Pathfinder Office software. Data was differentially corrected and all attribute data edited. Once edited, the data was transferred to the Alaska Regional Office for export to Geographic Information System format and input into NPS and other statewide public-access databases.

Coal Creek Camp

Coal Creek Camp is a fairly large area that consists of a mess hall, tool shed, shower room, outhouse, seven employee cabins, a public use cabin, and a generator shed. There is also a cabin with an incinerator next to it across a bridge, as well as a large field called the Boneyard which contains old shops, broken vehicles, supplies and storage buildings. Most of the invasive plants in this area were mechanically treated with a lawn mower multiple times throughout the season, which was seemingly ineffective as the plants still produced seeds.

The goal of the 2011 season in this area was to map invasive infestations with as much detail as possible, especially in the more remote locations. There was only one SCA intern posted in Coal Creek from early June to late July. Mapping was more of a priority since there were not enough people to manually treat the multiple infested areas. The small areas of Coal Creek that could be managed were controlled but most of them were simply mapped. This technique will allow for future monitoring to locate and contain existing infestations. The high traffic areas were the top priority at all of the sites visited this season such as: all-terrain vehicle (ATV) trails, highways, public use cabins, river banks, tributary creeks, game trails, rest stops, maintenance yards, work sites, burn piles, and visitor attractions. During the YUCH EPMT's second stay in early July most of the infestations were again only mapped due to their size and density. More species were

mapped on this second visit as most plants had flowered and gone to seed between visits making them easier to identify.

Between June 6th -17th, 2011, a four-person Southeast Alaska Guidance Association (SAGA) crew was stationed at CCC. During these first two weeks almost all of the manageable infestations were hand-pulled by the SAGA crew with guidance from the YUCH EPMT. The number of species pulled by this crew was minimal due to early phenology stages of the plants which made identification difficult. Plants that were hand-pulled were stored in trash bags and all burned in the incinerator. Bags which were too damp for immediate incineration were set out to dry for a couple days prior to burning.

Slaven's Roadhouse

Slaven's Roadhouse had a larger variety of species due to the higher visitor traffic from the river. After the YUCH EPMT mapped the visible infestations in early June, the SCA intern and the SAGA crew manually treated all known species which was difficult due to the early phenology stages of the plants. A public use cabin is located about one hundred yards up the trail to the upper Coal Creek Road from Slaven's Roadhouse. This road was also mapped up to the cabin where traffic was present. The entire area was mechanically treated using a lawn mower towards the end of June; however, the invasive plants were still present in early July.

Dalton Highway

The YUCH EPMT partnered with Bureau of Land Management (BLM) in mid-June to control white sweetclover (*Melilotus albus*) infestations along the Dalton Highway. BLM biologists Ruth Gronquist and Ryan Lane inventoried along the highway with Trimble GeoXT GPS receivers while the YUCH EPMT, two BLM SCA interns, and four volunteers manually treated the infestations. Multiple stream crossings, ranging from two to 75 miles south of Coldfoot, AK, were surveyed as well as around the Coldfoot truck stop and Pump Station 5. The crew treated 95% of the areas manually. One section of Pump Station 5 was cut with a weed wacker, so that a tarping treatment could be tested.



Figure 2. Dalton Highway by Atigun's Pass.

Gates of the Arctic National Park & Preserve

YUCH EPMT work in GAAR was limited due to scheduling restrictions. The main project during the 2011 season was a float of the Middle Fork of the Koyukuk River which runs along the southeastern GAAR boundary. The YUCH EPMT surveyed from about a half a mile before the start of the boundary line all the way to the end of the boundary along the river. Although the finds were minimal the team mapped a small infestation of foxtail barley. Approximately 20 miles of the river were surveyed, most of which was shoreline along the north side.

Results

At the end of the 2011 season 1.896 acres of invasive plant species were recorded. A summary of YUCH EPMT invasive plant management history is summarized in Table 1. A summary of species acres and associated location is summarized in Table 2. Most of the invasive plants were found along ATV trails with the most diversity found in front of Slaven's Roadhouse. The more densely infested areas tended to be around the mess hall at CCC where NPS employees are present and active during the time the plants spread their seeds. This year during July the YUCH EPMT recorded one new species of invasive plant, sticky chickweed (*Cerastium glomeratum*) in front of Slaven's Roadhouse (Table 3).

Table 1. Summary of Yukon-Charley Rivers National Preserve Exotic Plant Management.

Year	EPMT Personnel		Volunteers		Total Person Field Hours	Invasive GPS Data NPS Lands(non-NPS lands)			New Spp.
	# pers.	Field Hours	# pers.	Field hours		Species Acres Surveyed	Species Acres Infested*	Acres Treated	
2005	2	40	-	-	80	133.152	10.582	0.464	11
2006	-	-	-	-	-	-	-	-	-
2007	1 ¹	8	-	-	8	18.843 ²	0.056 ²	0	-
2008	2 ¹	60	-	-	120	20.725 (36.957)	2.653 (0.370)	0.030	3
2009 ³	-	-	2	40	80	11.070	3.934	-	-
2010	2 ⁴	1040	13	2	1066	YUCH: 110.024 GAAR: 0.149	YUCH: 9.135 GAAR: 0.033	YUCH: 0.608 GAAR: 0.033	2
2011	1 ⁵	480	8	640	1120	YUCH: 1.818 GAAR: 0.078	YUCH: 1.818 GAAR: 0.078	YUCH: 1.307 GAAR: 0	1

* 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%.

1-Includes one YUCH staff member

2-These numbers are interpreted from a verbal description of findings – not GPS data

3-2009 efforts were conducted entirely by volunteers

4-Includes two SCA interns

5-Includes one SCA intern

Table 2. Summary of the infested acres mapped by the YUCH EPMT during the 2011 season.

Species		Coal Creek Camp	Slaven's Roadhouse	Gates of the Arctic
Latin Name	Common Name			
<i>Capsella bursa-pastoris</i>	shepherd's purse	-	0.003	-
<i>Cerastium glomeratum</i>	sticky chickweed	-	0.005	-
<i>Chenopodium album</i>	common lambsquarter	0.002	0.001	-
<i>Crepis tectorum</i>	narrowleaf hawksbeard	-	0.009	-
<i>Hordeum jubatum</i> ¹	foxtail barley	0.599	0.039	0.039
<i>Lepidium densiflorum</i>	common pepperweed	0.012	-	-
<i>Matricaria discoidea</i>	pineapple weed	-	0.004	-
<i>Plantago major</i>	common plantain	0.456	0.054	0.039
<i>Polygonum aviculare</i>	prostrate knotweed		0.009	-
<i>Stellaria media</i>	common chickweed	-	0.014	-
<i>Taraxacum officinale</i> spp. <i>officinale</i>	common dandelion	0.533	0.058	-

Infested acres are 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%.

1-Foxtail barley has, until recently, been considered a non-native. However as of 2010 it is being considered as a native to Alaska but may still be controlled in certain areas due to the impacts on domestic animals (AKEPIC 2011).

2-species found but not GPSed

Table 3. Summary of new invasive plant species detected in YUCH and their associated invasiveness rankings.

Season	#	New Invasive Plant Species Detected		Inv Rank
		Latin Name	Common Name	
2005	11	<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>Crepis tectorum</i>	narrowleaf hawksbeard	56
		<i>Elymus repens</i>	quackgrass	59
		<i>Lepidium densiflorum</i>	common pepperweed	25
		<i>Matricaria discoidea</i>	pineapple weed	32
		<i>Plantago major</i>	common plantain	44
		<i>Polygonum aviculare</i>	prostrate knotweed	45
		<i>Stellaria media</i>	common chickweed	42
		<i>Taraxacum officinale</i> spp. <i>officinale</i>	common dandelion	58
2008	3	<i>Poa annua</i>	annual bluegrass	46
		<i>Rumex acetosella</i>	common sheep sorrel	51
		<i>Trifolium hybridum</i>	alsike clover	57
2010	2	<i>Hordeum jubatum</i> ²	foxtail barley	63
		<i>Vicia cracca</i>	bird vetch	73
2011	1	<i>Cerastium glomeratum</i>	sticky chickweed	36
TOTAL	17			

1-Alaska invasiveness rank (Carlson et al. 2008).

2-Foxtail barley has, until recently, been considered a non-native. However as of 2010 it is being considered as a native to Alaska but may still be controlled in certain areas due to the impacts on domestic animals (AKEPIC 2011).

Coal Creek Camp

The two most problematic and consistent invasive plants at CCC are common dandelion (*Taraxacum officinale* spp. *officinale*) and common plantain (*Plantago major*). Another major infestation at the camp was foxtail barley (*Hordeum jubatum*), however its nativity to Alaska is debatable. Other invasive species that were documented around CCC were pineapple weed (*Matricaria discoidea*), shepherd's purse (*Capsella bursa-pastoris*), lambsquarters (*Chenopodium album*), and common peppergrass (*Lepidium densiflorum*). The species acreage is noted in Table 1.



Figure 3. Common dandelion growing around cabins in Coal Creek Camp.

The invasive species around CCC are not a recent occurrence. In June of 2002 a US Geological Survey project surveyed all of CCC finding pineapple weed, common lambsquarters, common dandelion, and common plantain (McKee 2002). In early June 2011 when the YUCH EPMT and the SAGA crew arrived there were hardly any flowering or visible plants besides basal rosette leaves of common dandelions, which are very similar in appearance to the native dandelions. The only approachable route was to pick what was certain, so the crew worked to remove the dense infestations of common dandelion immediately surrounding the CCC structures. The densest infestation in camp, with 70%+ ground coverage, was between the mess hall door steps and the fire ring. In early June after completely mapping and treating that infestation area there was no trace of common dandelion. The removal process was proved ineffective when the site was revisited nearly a month later and showed the same, if not more, ground coverage than the June visit. During the last week of the season a new mechanical technique was tried on this area: about $\frac{3}{4}$ of an inch of topsoil was scraped off by the front-end loader over the ten by ten foot square area between the mess hall and the fire ring. The infestation that was strictly invasive common dandelion was in a mound of dirt that was then sifted through to remove all trace of the common dandelion. This area should be carefully monitored next season.

In June another infestation of common dandelions was found on the northwest side of camp, along the west side of the public use cabin trail, in front of the well, the Susie Paul Cabin, and the other employee cabins in that area. The YUCH EPMT and the SAGA crew worked to channel movement along the main trail by placing logs along the sides to keep visitors on the path, rather than straying into the infested area and potentially spreading seed. The invasive plants also spread from that area down the trail towards the pump shed. The invasive plants along the trail, which were identified as the common dandelion and common plantain, were mapped and removed.

Another common dandelion infestation was mapped and treated during the June 2011 site visit, between the second and third cabin on the right side of the trail. On the back side of the mess hall common dandelions were selectively pulled from amidst a patch of what appeared to be native dandelions. Most of the common dandelion infestations with 50%+ ground coverage were found growing again in July. A species with the invasiveness and fast regrowth characteristics of common dandelion cannot be effectively removed with manual or mechanical methods. The

most effective way to completely removed common dandelion from an area such as CCC would to incorporate a chemical treatment.



Figure 4. Before (left) and after (right) photos of the common dandelion treated between the 2nd and 3rd cabins in Coal Creek Camp.

On the second visit to CCC during early July, many more species were noted around camp. Common plantain had become the most abundant invasive species outweighing the common dandelion coverage. Common plantain seems to spread very easily from any light or medium traffic, whether along walking paths or vehicle trails. Common plantain seems to have dispersed into more remote areas than common dandelion and it grows heavily along the edge of trails. Common plantain was densest in camp in between the back steps and the shower room entrance. Most of the species mapped during July were not treated due to the lack of time and sudden appearance of many invasive plants. Common plantain infestations were found along nearly every trail or walked upon area in camp, whether from the mess hall to the outhouse or from the tool shed to the end cabin.

During July infestations of common peppergrass, pineappleweed, and patches of small prostrate knotweed (*Polygonum aviculare*) were inventoried on the northwest side of the tool shed where vehicles park.. The area between the front steps and the fire ring also contained scattered patches of pineapple weed. The large field behind the horse shoe area contained common plantain, common dandelion, and a large amount of foxtail barley. The foxtail barley also spread into the open area between the fire ring and the outhouse. The entire field and camp area were mechanically treated with a lawnmower multiple times during June and July. While there was no discernable decrease in the infestation size or density after these treatments, the treatment may have aided in reducing the amount of seed dispersal in the area.

Another problematic area close to CCC is the maintenance yard an overgrown open area with multiple storage buildings located between the first creek crossing and CCC. The maintenance yard had a large infestation of foxtail barley between the buildings and the road which was mapped. There was a large infestation of common dandelion and common plantain by the wood stack, as well as other infestations dispersed throughout the area.

Cheese Creek, an area 2.6 miles south of CCC, was also mapped for invasive plants. There is a low road and a high road from CCC towards Cheese Creek that meet up about a half a mile before the split that turns to Cheese Creek. There were not many invasive plants discovered in the actual Cheese Creek area besides common plantain, probably due to less ATV and foot traffic. However, both the low road and high road have sections where common plantain lines the trail. The YUCH EPMT surveyed both of the roads between the camps. The YUCH EPMT also surveyed the road from CCC to the airstrip and found no evidence of invasive species.

Slaven's Roadhouse

Slaven's Roadhouse was monitored throughout the season but it became more of a priority during the month of July when the invasive species began to flower. In early June the YUCH EPMT and the SAGA crew started by working along the Yukon River side of the road extending up from the boat parking area towards the Roadhouse. Initially the area seemed to have the most invasive plants, where the crew believed they had found fall dandelion and bird vetch (*Vicia cracca*) before any flowering was apparent. Once the two invasive plants were correctly identified they were actually identified as a native horned dandelion (*Taraxacum ceratophorum*) and alpine sweetvetch (*Hedysarum alpinum*). In addition the SAGA crew that floated the Yukon River inventoried the same public use cabins as the YUCH EPMT did in the 2010 season also temporarily mistook all alpine sweetvetch for bird vetch before realizing the lack of tendrils. GPS data collected in 2010 indicated that these areas all had infestations of bird vetch. Future seasons should include a careful inventory of these areas along with collection of plant specimens for proper identification.

The YUCH EPMT and SAGA group worked on controlling the common dandelion infestation on the north and the west sides of Slaven's Roadhouse, along the south side of the road going up the hill from the shore towards the Roadhouse, and at the triangle split slightly down the trail headed towards the public use cabin.

During the revisit in early July, the YUCH EPMT found common dandelion along with common plantain on the west side of the Roadhouse. Common plantain, pineapple weed, and foxtail barley was also scattered in the open area on the east side of the Roadhouse. Across the road from the Roadhouse, a common plantain infestation was recorded south of the greenhouse and along the road hiding underneath the foxtail barley south of the screened shed. On the south side of the Roadhouse about five feet in front of the door step were two infested areas of light green common chickweed and one small patch of shepherd's purse. Also an area of prostrate knotweed was recorded wrapping around the south side of the Roadhouse about a foot away from the planted rhubarb. A thick patch of pineapple weed was slightly covering the prostrate knotweed patch in front of the southwest corner of Slaven's Roadhouse near the water barrel. The only visible lambsquarters found in the area was right under the trim along the west side of the Roadhouse, close to the small storage shed.

The two species of highest concern at Slaven's Roadhouse were narrowleaf hawksbeard (*Crepis tectorum*) and the newly identified species sticky chickweed (*Cerastium glomeratum*). The narrowleaf hawksbeard was first found at the split between the trail running to the public use cabin and the road towards Slaven's Roadhouse in 2005 by Penny Bauder (Passmore and Sherman 2010). The same spot was revisited and treated by Jobe Chakuchin, Jeff Heys, and Carl Stapler in 2008; they hand pulled approximately 1,400 flowering stems in the 0.29 acre

infestation at the traffic triangle. The area was not surveyed again until the 2010 season where only 13 stems were identified and pulled. One narrowleaf hawksbeard plant can produce from 3,000-50,000 lightweight seeds with extensive pappus that allow for easy dispersal by wind or moving water (AKEPIC 2011).

During the 2011 season, EPMT found two narrowleaf hawksbeard infestations; one at the traffic triangle between the public use cabin trail and Roadhouse trail and another infestation area further down the ATV trail past the screened shed on the north side of the road, right before the wood thicket. Both of these infested areas were found on July 6 and were immediately mapped and manually controlled; 67 stems (both flowering and seedling) were pulled from the triangle and 15 stems were removed from the area southeast of the screened shed. There was a second visit to both infestations a week later on July 13 after the entire Slaven's Roadhouse area had been mowed. Six days after mechanical treatment 122 both flowering and non-flowering narrowleaf hawksbeard stems were pulled in 393.89 ft² of scattered area around the traffic triangle. There was no evidence of narrowleaf hawksbeard in the other area southeast of the screened shed upon second visit.



Figure 5. Narrowleaf hawksbeard at the Slaven's traffic triangle.

On July 6, 2011 a twenty meter line of sticky chickweed was found a foot away from the trim at the base of the north side of Slaven's Roadhouse. This invasive plant was identified by SCA intern Matt Schultheis and fire ecologist Jennifer Barnes. It is a congeneric species with common mouse-ear chickweed (*Cerastium fontanum*) with the same invasiveness rank of 36, as they share similar biological and ecological attributes (Carlson et al. 2008). The patch had approximately 65%+ ground coverage and was low to the ground. The YUCH EPMT believes that this species is not a major concern due to its low invasiveness rank but it should be monitored closely in the following years.

From following the spread of the narrowleaf hawksbeard over a seven year period on the Alaska Exotic Plant Information Clearinghouse (AKEPIC) data portal, the species seems to have moved along the Steese Highway from Fairbanks to Circle and eventually an infestation was found at Slaven's Roadhouse. From this it is thought that the Slaven's narrowleaf hawksbeard infestation originated with river traffic instead of air travel as it is found only near the river and not anywhere in CCC or the airstrip. Since it is believed that most of the invasive species found at Slaven's Roadhouse come from people traveling on the Yukon River, it is believed that another potential threat to watch for in the future should be the white sweetclover that recently infested multiple areas close to Circle, Alaska. Narrowleaf hawksbeard only has an invasiveness rank of 56 compared to white sweetclover's rank of 81. Anyone traveling upriver from Circle needs to take serious precautions to prevent carrying white sweetclover seeds with them.

Dalton Highway

The YUCH EPMT paired up with two BLM employees and several volunteers in Coldfoot, AK, to work on white sweetclover (*Melilotus albus*) infestations along the Dalton Highway. The second priority behind white sweetclover was bird vetch (*Vicia cracca*) which has an invasiveness rank of 73 (Carlson et al. 2008). White sweetclover, with an invasiveness rank of 81, has exponentially dispersed across Alaska in a short amount of time (AKEPIC 2011). Each plant has the potential to produce 350,000 seeds and can withstand temperatures as low as -39° C (Carlson et al. 2008). The first infestation recorded on the Dalton Highway was in August of 2004 at the Yukon Crossing (AKEPIC 2011). Since then it has spread north all the way past Coldfoot nearly to Galbraith Lake.

Along the highway at most of the rest stops, as well as at the visitor's centers, the YUCH EPMT dropped off invasive plant pamphlets outlining the importance of invasive plant prevention as part of a visitors outreach. Manual work started out at the Prospect Creek crossing along the Dalton Highway, controlling small white sweetclover infestations in patches along the roadsides. The group then headed farther south to the Fish Creek crossing and found a small amount of white sweetclover but instead ended up removing an infested area of bird vetch under the bridge. The group's next project was to eliminate the bird vetch infestation on the northwest and southeast side of the Rosie Creek culvert. The entire area was controlled at the time but a second visit by volunteers a couple weeks later showed that some of the overlooked seedlings had grown larger and that segment was controlled again.

The BLM biologist implemented a method that required the clearing of shrubbery, the mowing of invasive plants and any seedlings, and finally laying out a black plastic tarp over the area. The tarp was then nailed tight to the ground with minimal air flow. The method was essentially to smother and overheat the plants; the only downfall was that native plants were harmed in the process. YUCH EPMT worked with BLM to implement this technique on bird vetch at Pump Station 5. The area should be monitored closely in the future to determine the treatment efficacy.



Figure 6. Tarping project to control bird vetch at Pump Station 5.

Since white sweetclover has the potential to keep spreading farther north, the objective was to control the farthest north point and continue south, basically controlling the species from the outside edges of its current distribution. After working at Pump Station 5 the group moved south to mappand treat a large infestation of white sweetclover on the east side of Dalton Highway Mile Post (DHMP) 121. There was a call in from a truck driver stating that he saw bird vetch at DHMP 210, which would have been the farthest north recording of bird vetch. The YUCH EPMT and a BLM employee drove to the mile post and found no evidence of the bird vetch.

Gates of the Arctic National Park and Preserve

Gates of the Arctic National Park and Preserve (GAAR) is 8.5 million acres and is one of the most pristine wilderness areas remaining in North America. Because of its extremely remote location, not many visitors make it into the park. The YUCH EPMT and volunteer David Hite,

surveyed the GAAR boundary along the Middle Fork of the Koyukuk River. The river can be accessed by car from either Wiseman or Coldfoot.

The most critical site found along the river between Coldfoot and Bettles, the area the YUCH EPMT floated, was an operation mining site near the old Tramway Bar along the south side of the river less than half a mile before the GAAR boundary. The site was accessible from a road branching off of DHMP 161. At the mining site there were multiple excavating machines at what seemed to be a one or two man operation with a large hillside already dug out and turned over. The water used to operate the gold filtering machine was drawn from and emptied back into Chapman Creek. All the traffic from the highway to the mining site has already brought multiple invasive species along. The entire area was not surveyed due to unknown land status in the area and the danger of trespassing on a mining claim however, on one of the mining paths near the Koyukuk River common plantain and foxtail barley was recorded. This site needs to be monitored closely in the following years due to its proximity (less than half a mile upstream) from GAAR.



Figure 7. The Tramway Bar mining site along Chapman Creek

Only one invasive species, foxtail barley, was identified along the 20 mile boundary of GAAR along the Middle Fork of the Koyukuk and it was found on July 24th. It was found on the north side of the Middle Fork of the Koyukuk about 3 miles before the end of the GAAR boundary. There were two small infestation areas approximately 70 meters apart in a dry creek bed. While foxtail barley is currently considered to be native to Alaska it does exhibit some highly invasive qualities depending on the area (AKEPIC 2011). This site should be monitored in the future.

Discussion

The YUCH EPMT overall had an productive 2011 season. In early June the YUCH EPMT staff strived to follow the Alaska EPMT field protocol by monitoring the established locations of concern documented the previous season. The strategies in the field protocols were used more effectively in early July after most of the invasive species flowered. The narrowleaf hawksbeard was effectively controlled this year by pulling both flowering and non-flowering stems during two visits. Every cabin at Coal Creek Camp and Slaven's Roadhouse was thoroughly inventoried multiple times. A request from the previous year's report to survey the entire ATV trails system at Coal Creek was surveyed as time allowed but was not fully completed. The bird vetch infestation recorded the previous year was never found at any of the sites along Coal Creek including Slaven's Roadhouse, the Dredge, airstrip, or CCC. After some research the 2011 YUCH EPMT established that the previous year's identification of this species may have actually been alpine sweetvetch (*Hedysarum alpinum*).

Species of Concern

Narrowleaf hawksbeard and white sweetclover were the two largest ecological threats discovered in the 2011 field season.

Since the 50 narrowleaf hawksbeard stems were found in 2005 by EPMT staff member Penny Bauder, the density and area of the 2011 infestation has slightly increased. In 2008, 1,400 flowering heads alone appeared and were pulled. Then nearly two years later only 14 stems were identified in the same area during the 2010 season. This dramatic fluctuation could be a result of heavy flooding in 2009 which may have scoured the area. Furthermore, the 2010 season seemed to be for the most part effective in controlling most of the infested area since the only seeds that spread were only found about 80 meters farther down the road during 2011. The YUCH EPMT controlled both infestation areas in the 2011 season. The narrowleaf hawksbeard is currently the top species of concern in the Coal Creek Camp area due to its invasiveness rank of 54 and the small infestation area that has yet to spread.



Figure 8. Narrowleaf hawksbeard at Slaven's Roadhouse.

White sweetclover, as mentioned early, is a flourishing invasive species in Alaska. This plant has the potential to disperse at great speed, taking over native ecosystems with ease. Although the concern of white sweetclover along the Dalton Highway is constantly growing, the YUCH area might be at stake in the near future. Although no documentation of white sweetclover has been reported anywhere in YUCH, there are recorded areas at both the Central Airport, which is only 25



Figure 9. White sweetclover lining the Dalton Highway corridor.

miles from the YUCH boundary, and along the Steese Highway approximately 20 miles south of Circle. This species needs to be monitored closely around Circle and should be reported if sighted.

Both quackgrass and lambsquarters need to be monitored closely in the future. There has only been one quackgrass infestation ever recorded at Coal Creek and that was at the southwest corner of the airstrip in 2005 by Alaska EPMT staff. It was not found during the 2011 season. Quackgrass needs to be continually monitored because of it has a moderately invasive rank of 59. Since lambsquarters was only found in a small area at Slaven's Roadhouse during 2011 it can be controlled easily in the future due to its low invasive rank of 37.

Recommendations for the 2012 Field Season

During the second year of the invasive plant program in YUCH and GAAR, multiple speed bumps were encountered. These challenges were unexpected and should be considered in the future as opportunities for the YUCH EPMT staff to achieve even more success in upcoming seasons.

Timing

The largest struggle of the 2011 season revolved around predicting the short flowering season and timing the field work accordingly. When the field work started in early June there were five able people ready to manually treat infestations during their two week time period at Coal Creek. However, this season the invasive plants did not start to flower in the area until early July, which ended up being an efficiency problem for the team. The staff's potential was limited to controlling only the few species that could be identified. It is recommended that if any volunteer crews (SAGA, Boy Scout troops, NPS volunteers, etc.) are sent to YUCH they should be scheduled to work during July or early August when the infestations can be more easily identified. In addition, more people should be utilized in order to control the large infestations at CCC or Slaven's Roadhouse. It is suggested that an additional team such as the Youth Conservation Corps be sent around the same time as the SAGA crew to eradicate large infestations in a timely manner.

Relating to the timing issues, it is suggested that project schedules/calendars should be designed early, preferably before the season starts in early spring or even late winter. Since the logistics were altered multiple times due to general scheduling and logistical errors this season, an organized plan would be more suitable for the future EPMTs. Travel, housing, and equipment needs should all be considered when making the logistics schedule.

Surveys

During the 2011 season the YUCH EPMT was successful in completing solid surveys at the YUCH sites that were visited. One point that could have used more attention during the 2011 season was the data collected at additional sites in previous years. It is critical to stress that all known infestations should be revisited and mapped at least once each year. If the infestation is not detected the species should be identified and marked with the phenology of "not_detected." This information is all found in the Alaska EPMT field protocol.

It is recommended that the future YUCH teams have access to a computer and internet at CCC or, if that is not possible, that some office time is added to the summer schedule at biweekly intervals. This would allow better access to the AKEPIC data and more effective data processing. Along the same lines, it is suggested that each park's EPMT crew should be briefed separately during the week-long spring training regarding their park's specific species versus learning ample broad information covering all the invasive species of Alaska.

Almost all of the high traffic areas in the Coal Creek region were surveyed during the 2011 season. The YUCH EPMT staff should also survey other sites along the Yukon River and different regions of the park; possibly the south or east sides or any area with visitor traffic. The YUCH EPMT should survey the Taylor Highway from Chicken to Eagle. Eagle, Alaska should

be surveyed since invasive species have been recently seen in the area and it is a common starting point for Yukon River float trips.

Visiting sites multiple times in a season is also a key issue when managing invasive plants. The YUCH EPMT surveyed Slaven's Roadhouse and CCC every couple of days, which should be continued next season. The team should also consider visiting the public use cabins along the river twice during the season with at least a full days visit per cabin.

For invasive plant surveys in GAAR, it would be logical to survey the more heavily visited areas to maximize on the limited amount of time available in that park.

Treatment

The Coal Creek region's survey has been fairly detailed with many areas mapped but the treatments there had different results. There is simply too much area to be manually control by one person. Control work at Slaven's Roadhouse and CCC done by the SAGA crew was only limited to ten inefficient days due to their early arrival in the season. It is suggested that more work crews or volunteers are hired in the future to manage the overwhelming work load of the CCC region.

Although the YUCH EPMT worked to the best of their abilities to control the dense common dandelion and plantain infestations at CCC, some of the hand-pulling methods proved inefficient. In multiple areas the controlled species reappeared after merely two weeks. This led the team to undertake a new method at the end of the season: scraping off the top layer of the soil then removing any remnants of invasive plant from the dirt pile, overall ensuring that any seedlings would be removed. Even with the use of digging picks, the ineffective hand-pulling method mimicked the result of the previous season and the staff's inability to pull the entire root of the invasive species because of the hard dry soil.



Figure 10. SAGA and SCA crew members working at Coal Creek Camp.

About every two weeks during the summer the maintenance crew was instructed by the NPS to mow the entire camp, which continued the spread of invasive seed amidst CCC and Slaven's Roadhouse. YUCH EPMT should be informed of the mowing schedule so they can control and record the area prior to mowing. This will require the YUCH EPMT supervisor to communicate with maintenance crew about the mowing, possibly around the infestation patches, as well as road construction schedule since the movement of soil has a high potential of spreading seed. Every time the yard was mowed the common dandelion heads that were in seed were cut off and the seeds were blown over the surrounding area. This could have been the cause of the rapid dispersal of common dandelions in the area.

YUCH FirePro defensive space program requires all vegetation is kept a certain distance from any historic structure to protect the structure in case of wildfire. This rule is applied around CCC which gives minimal chance for native vegetation regrowth. The only reasonable method remaining in this case is selective herbicide treatment, which could be slowly integrated and monitored for ecological harm. Not only does the maintenance of the vegetation-free zone allow potential spread of invasive species but the crew doing the work often tracks seed from one site to another on their clothes and equipment. The spread of invasive plants could be prevented if the fire crew allowed a YUCH EPMT crew member to scan the area prior to cutting. The YUCH EPMT supervisor should consult the fire management team with this request.

Since this is the first year that several herbicide treatments were used by the Alaska EPMT it is suggested that certain areas of CCC may be applicable for this new treatment. At CCC multiple typically effective methods have been tested on infestations around the mess hall with no positive result recorded. The next step may be to incorporate a broadleaf selective herbicide, safely applied by an Alaska State Pesticide Applicator, along with the manual treatment techniques. There are only invasive species and gravel along the southeast side of the mess hall between the front steps and the fire ring. In the same area no native plants can compete against the common dandelion infestation for moisture and nutrients due to the invasive overgrowth. With each plant producing up to 5,000 seeds that remain viable for nearly 5 years, along with all the human traffic around the mess hall, selective herbicide use could be a very valid resource.

Outreach

The 2011 YUCH EPMT made public outreach a higher priority than in previous years. This year the team was supplied with several different kinds of informational invasive plant pamphlets and packets to hand out. The YUCH EPMT gave each of the SAGA crew members multiple pamphlets to hand out to the general public along their trips at visitor areas and at other parks. Multiple outreach brochures were left in the Fairbanks NPS office as well. The YUCH EPMT also left two kinds of invasive species pamphlets at the BLM Yukon Crossing Contact Station and the Arctic Interagency Visitor Center in Coldfoot, where thousands of visitors passed through per week. The BLM biologist, Ruth Gronquist, made and distributed invasive species lists for the Dalton Highway and left them at the Marion Creek Campground. The YUCH EPMT personally talked to several civilians at the Coldfoot gas station as well as the maintenance and fire crews at CCC about the invasive plant invasion.



Figure 11. SAGA crew members celebrating a successful day.

The YUCH EPMT also created multiple laminated booklets which list Coal Creek invasive species, ranked by abundance with enlarged pictures of each plant to make identification easier. These booklets were distributed at the campground. The team member left pamphlets at the Eagle Visitor's Center as well. In future years more should be done than leaving pamphlets because this growing concern cannot be stressed enough. Invasive plants may make a major ecological impact if they are not monitored and controlled. YUCH EPMT needs to relay this

message firsthand to NPS employees, fire staff, private landowners, miners, and visitors. Private landowners should have access to the outreach whether it is by personally communication or leaving a pamphlet on their door. For an example of outreach in a community, YUCH EPMT members could ask homeowners if they could pick invasive weeds from the homeowner's front yard. Public outreach materials should be made available to the Alaska Public Lands Information Center, the Department of Fish and Game, as well as to students at the University of Alaska Fairbanks.

Prevention

Nature has the capability to spread invasive species once they have already infested an area, but nearly every time the initial infestation is established by human actions. The spread of invasive species across Alaska is a major concern that can be prevented. Spreading these harmful plants should be considered by all NPS staff so prevention can be practiced daily. All NPS employee's clothing and equipment should be wiped down before entering any national park or exiting an infested area. Anyone can spread seeds but those who follow the safety precautions will help prevent the invasive epidemic from taking grasp of Alaska's native ecosystems.

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