

**BAER Accomplishment Report – September 2005**  
**Invasive Plant Monitoring Following 2004 Fires**  
**USFWS National Wildlife Refuges – Alaska Region**

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**1) Introduction**

Severe fires throughout Alaska's interior region in 2004 may have served as a vector for non-native plants to expand into National Wildlife Refuges in Alaska. As part of the Burned Area Emergency Rehabilitation and Stabilization plan for Alaska's 2004 fires, the U.S. Fish and Wildlife Service (FWS) received funding to investigate fire related sites that may now have introduced invasive plants and is entering into a cooperative agreement with the Alaska Natural Heritage Program, University of Alaska to study the interaction of fires and weed invasion.

Invasive plants pose a serious threat to native ecosystems and are considered to be one of the greatest threats on National Wildlife Refuge Lands in the Lower 48 states. Land managers in Alaska have a unique opportunity to be proactive in managing exotic and invasive plants because the establishment of most non-native species in the state is restricted to the few regions of greatest anthropogenic disturbance.

The AKNHP agreed to investigate sites where people and equipment were located on refuge lands, such as helispots, camp sites, staging areas, dozer lines, hand lines, etc. Potential 'source' locations (where invasive plants are known or are reasonably expected to occur) were also being investigated within Refuge boundaries or off-refuge if appropriate landowner permission was obtained. High severity burn sites located within 1 mile of source sites (communities, cabins, roads, travel corridors etc...) were monitored since the exposed mineral soil at these high burn severity sites may be particularly susceptible to the establishment of non-native plants. The FWS provided local expertise at each refuge, and participated in one of the field sampling trips. The AKNHP is in the process of analyzing the data collected, and will work with FWS and others to determine if pathways of spread can be distinguished from these data. Copies of the results and reports will be provided to the FWS in time to seek funding for 2006 and 2007 continuation of this project.

**2) Treatment Specification**

V-2 Noxious and Invasive Plant Monitoring and Control, CESU Agreement # 10100-0-J001

**3) Progress: 1 April to 1 September 2005**

a) Overview

We have completed inventories for specific fires in the Kenai, Tetlin, Kanuti and Yukon Flats Refuges. In general, non-native establishment has been minimal in each of these refuges, with a few established populations recorded that were associated with high-intensity human use. Areas burned in 2004 do not appear to harbor greater numbers of non-native plants than unburned regions at this time.

b) Pre- fieldwork

AKNHP and additional UAA staff set up the grant, hired, and assigned personnel to work on the project. With assistance and guidance from USFWS staff, we identified priority sites within specific 2004 fires in each of the refuges. The priority sites included cabins, allotments, helispots, camp sites, trails, rivers, and associated high severity burned areas near these locations. We made

further refinements to the locations of priority sites as well as constructing a time table and making logistical arrangements. We contacted the local refuge personnel from each of the refuges harboring priority sites to coordinate our sampling and get more detailed logistical information. Special use permits were obtained from refuges requiring them. Transportation arrangements were made for each of the refuge trips.

Last, we have been coordinating with USFWS regarding the use of Trimble geospatial-personal computer units to facilitate data collection.

From early May to mid-June we coordinated with USFWS staff on sampling protocols and developed datasheets to best address the type of problems most likely to be encountered in the field.

### c) Fieldwork/Activity Accomplishments

#### Fieldwork methodology

In the temporary plots we inventoried the plant species diversity (including percent cover for each species) within a 10m<sup>2</sup> area. We described the surrounding habitat/landcover classes, and made soil profiles. For non-native taxa, we recorded the size of the infestation, the age and type of disturbance, and control methods employed, if any. In burned areas we took note of any vegetation and soil fire indicators (% ground burned, % trees dead from fire, burned needles, fire scars, etc.), and also assigned a soil and vegetation severity burn code to each plot (these codes have been established by FWS fire ecologists). Permanent plots, of which only two were erected, followed protocols developed in coordination with FWS.

#### Kenai Wildlife Refuge

On 27 July 2005 the two principal investigators (M. L. Carlson and K. W. Boggs) and research associate botanist (Helen Cortes-Burns) traveled to the Glacier Creek Fire on Tustumena Lake. While waiting for the USFWS at the upper Kasilof River landing we conducted an AKEPIC plant survey and observed a number of non-native species (*Taraxacum officinale* ssp. *officinale*, *Matricaria discoidea*, *Trifolium hybridum*, *Phleum pratense*, *Poa annua*, and *Polygonum aviculare*). These species were observed at the transition from imported fill and the vegetative margin of the boat launch parking lot, down to the river's edge. We did not observe any highly invasive species such as *Phalaris arundinacea*, *Melilotus alba* or *M. officinale*, or *Hieracium aurantiacum*. However, we did observe the extremely invasive *Hieracium aurantiacum* along roadsides in a new development adjacent to Longmere Lake (Mere Circle and Edgington Road), Soldotna. Once at Tustumena Lake, we surveyed five cabin sites, the Emma Lake Trail, and lower section of the Moose Creek Trail. Non-native plants species were observed in four of the five cabins and in two points along the Emma Lake Trail.

#### *Indian Creek*

On 28 July 2005 we found a small population of the non-native *Capsella bursa-pastoris* in a marsh along the banks of Tustumena Lake, southeast of Indian Creek. The plants were growing on the back side of a beach ridge, submerged in 20 cm of seasonally flooding water, in an otherwise native community. *Capsella bursa-pastoris* is a weed of gardens and roadsides, so it was surprising to observe it along the lake margin far from obvious human activity.

We also surveyed (in addition to establishing and reading a non-permanent 20 x 20 m vegetation plot) around the nearby Blakely Cabin, which is located on a former beach terrace, in a white spruce forest clearing. No non-native species were observed here. However, a thick stand of the

native grass *Hordeum brachyantherum* was found adjacent to the cabin entrance. This grass often appears weedy and establishes in areas of human disturbance.

North of Indian Creek, we tried to retrace Emma Lake trail, which starts uphill from the Taylor cabin pasture, and was obliterated in the 2004 fire. The forest in this area had been severely burned (severity burn code "1"), with more than 95% of the trees completely burned and downed, and 95% of mineral soil exposed. Although largely unvegetated, there were trace amounts of *Chamerion angustifolium* (= *Epilobium angustifolium*), *Linnaea borealis*, *Calamagrostis canadensis*, and *Betula papyrifera*. We also found a single *Taraxacum officinale* ssp. *officinale* here, which we destroyed (Fig. 1). It is most likely that this plant survived the burn and resprouted. The burned, lower slope appears to be most susceptible to invasion from the multiple, nearby sources at Taylor cabin.



Fig. 1. *Taraxacum officinale* ssp. *officinale* site at the beginning of Emma Lake Trail, Kenai Refuge.

We followed the trail as closely as possible and found sections of it in a number of locations where the fires had been less intense. A second population of *Taraxacum officinale* ssp. *officinale* was observed along the trail (approximately 1.5 km west of Emma Lake) in a well established, open, *Calamagrostis canadensis* meadow (Fig. 2). Approximately 50 plants spaced across 1 acre were pulled, but there were too many individuals to eradicate the entire population. The meadow was lightly burned in some areas (burn severity code "4" to "5"), and untouched by fire in others. It is therefore most likely that this infestation was there prior to the 2004 fires, and can be attributed to human use of the trail.

A large diversity of non-native plants was observed at Emma Lake Cabin. This included *Trifolium repens*, *Poa annua* (dominant species around cabin), *Matricaria discoidea*, and *Stellaria media*. All of these species were clustered on the compacted soil at the cabin entrance. We pulled most of the

pineapple weed and the clover infestations, but the other species were too numerous and well established for immediate manual control.

#### *Moose Creek*

On 29 June 2005 we surveyed the Moose Creek region, including the beach, cabin, and approximately 1 mile of the Moose Creek Trail. A small population of *Matricaria discoidea* and *Alopecurus pratensis* was located on the beach adjacent to the confluence of Moose Creek and Tustumena Lake. We pulled all individuals of both of these species at this site. The Moose Creek Cabin site was very rich in non-native plants. The dominant species here were the native *Chamerion angustifolium* and the non-native forage grass *Alopecurus pratensis* (>60% cover), , as well as smaller populations of *Phleum pratense*. Additionally, numerous non-natives were found in areas of compacted soil near the cabin and at the beginning of the Moose Creek Trail. These non-natives included: *Taraxacum officinale* ssp. *officinale*, *Matricaria discoidea*, and the extremely rarely

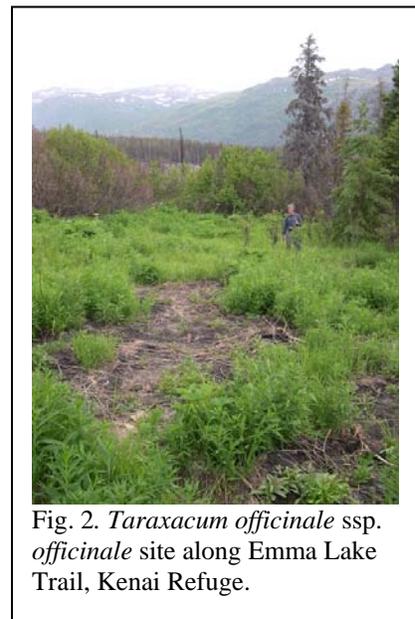


Fig. 2. *Taraxacum officinale* ssp. *officinale* site along Emma Lake Trail, Kenai Refuge.

collected *Asperugo decumbens* (no collections are present in the UA Museum database). We surveyed for non-natives along the first mile of the trail, in an unburned white spruce forest, but found none outside of the immediate cabin area. The trail was largely overgrown and did not offer disturbed substrates for the establishment of non-native species.

The Taylor Cabin also harbors a very large repository of non-native species (Fig. 3). This includes the lawn grass, *Poa subcoerulea* (70% cover), and forage grasses, *Alopecurus pratensis* and *Phleum pratense*. Additional non-natives were *Trifolium repens*, *Leucanthemum vulgare*, *Elymus repens*, *Polygonum aviculare*, and *Capsella bursa-pastoris*. Many of these species are known to be quite invasive in south-central Alaska.

The Andrew Berg Cabin had a small infestation of *Matricaria discoidea* at the cabin entrance, but was otherwise free from non-native plants. We pulled the larger plants, but were not able to eradicate the entire population because there were many, small plants growing underneath the cabin's porch floorboards.

#### Clear Creek

We also visited the Clear Creek Cabin site (the cabin was destroyed in the 1960's). Interestingly, there was a healthy population of the forage grasses *Alopecurus pratensis*, *Phleum pratense*, and *Poa pratensis* (30% cover) on a beach ridge that was the likely site of this cabin (Fig. 4). We surveyed the surrounding areas but did not observe any other non-native infestations. Assuming this was not a more recent introduction, it appears that once established these grasses can persist for a considerable length of time, but do not appear to be very successful in spreading in native vegetation.

To conclude, we found exotic plant species in four of the five cabin sites (Taylor, Andrew Berg, Blakely, Moose Creek and Indian Creek cabins) we visited in Kenai NWR, even though none of these had been burned in 2004. We did locate a small number of non-native plants along severely and lightly burned sections of the Emma Lake Trail. Non-native plant infestations seem to be more closely linked to high-use areas than to fires in the first year following the fire. Nonetheless, it is important to note that the cabins and remaining section of the Emma Lake trail are potential sources of non-native propagules. This is especially the case for the Taylor Cabin site: the proximity of this cabin, with eight moderately invasive plant species, to a severely burned section of the Glacier Creek Fire, makes it a likely focus of dispersal for exotic plant species into the new, yet to be colonized habitats created by the fires.



Fig. 3. Dandelions (front) and white clover (back) at Taylor Cabin, Kenai Refuge.



Fig. 4. Timothy grass and meadow foxtail at Clear Creek Cabin site, Kenai Refuge.

#### **4) Treatment Effectiveness**

In both Kenai and Tetlin NWR we were able to visit 100% of the priority sites listed, and even do additional plots in areas of special interest (e.g.: Indian creek marsh, Tetlin's 1990 and 1998 burned areas). In the case of the Kanuti and Yukon Flats refuges, most but not all priority sites were targeted. The primary reason for this was not the methodology used, but rather a series of logistical problems we encountered once we were in the field (non-navigable sloughs and marshes, Trimble units not working, etc.). In this context, it is unlikely that changes in the methodology or in the pre-fieldwork plans could have improved locating the remaining sites.

During our trips to the refuges we set up both temporary and permanent plots. However, we found that we were often unable to establish permanent plots for future monitoring in sites with invasive species because they were either in high-use zones (e.g. winter trails, campground clearings), or near/in private parcels. We suggest that only temporary plots be used in future field seasons, as they provide all the key information needed to revisit an infestation site at a later stage, such as the extent of the infestation, age of disturbance and control method (through the AKEPIC data table), severity of the surrounding burn, and GPS coordinates to relocate the plot. However, more detailed information on the spatial patterns of non-native plant invasion, the interaction of native and non-native species, and the impact of non-native plants on community and ecosystem function requires a more thorough and permanent plot approach.

## 5) Future Directions & Recommendations

We have finished the 2005 surveys and are working on analysis and the final report. A small number of plants (mainly grasses and sedges) still remain to be identified, and all specimens are to be mounted.

During the month of October we plan to visit biologists at the Kanuti, Yukon Flats and Kenai (and probably Tetlin) refuges to give a brief presentation on our findings. We are also in communication with the Tanana Chiefs foresters, and plan to exchange information collected from our respective surveys inside/outside of the Yukon Flats native allotments, which will provide us with greater insight into the patterns of dispersal and establishment of non-native plant species in this refuge.

We strongly recommend revisiting the Kenai and Tetlin sites, given that: a) these had a wider range of burned/unburned habitat types infested by exotics (cabins, unburned marshes, trails, campgrounds, etc.), b) they are more easily accessible, and therefore more likely to be monitored in the following years, and c) in the case of Tetlin, there are burns of different ages that should be further investigated for the presence of non-native plants (priority areas would be those known to have been used by firefighters). Given that we did not find any non-native species in Kanuti, and that this refuge seems to be the one least used, we would suggest not revisiting any of the sites sampled in 2005. We were unable to organize fieldwork with Innoko Refuge personnel this field season and the proximity of the town of Galena (with known non-native plant populations) to both refuge lands (burned and unburned) and the Yukon River warrants future attention.

To conclude, we emphasize that the observations made in this work on the relationship (or lack thereof) between burns and non-native plant infestations are preliminary, especially given that most burned sites visited this summer were still largely unvegetated and could become colonized by exotics during the next growing season. It is therefore central to the success of this project that some of the sites surveyed this year be revisited over the following growing seasons. Finally, we propose that experimental plots be set up in burned/unburned areas that are readily accessible and can be carefully and regularly monitored over time. This could be done in an area such as Tetlin NWR, where there are different age burns, various kinds of habitats infested (roadside areas, campgrounds, etc.), and refuge biologists that are already carrying out weed inventories. It would also be worthwhile to seek collaboration with other landowners in selected areas (e.g. BLM), as this would give us access to study sites in and around refuge lands.

## 6) Appendices

Table 1. List of non-native plant species found in Kenai National Wildlife Refuge (this is not a final list, as some specimens collected have yet to be keyed out and could result in new exotics records for a site).

Refuge name	Collection Locality	Genus	Species	Voucher	Invasiveness Rank	Control action	
Kenai NWR	Indian Creek marsh	<i>Capsella</i>	<i>bursa-pastoris</i>	X		none	
	Emma Lake Trail (1)	<i>Taraxacum</i>	<i>officinale</i>		62	pulled	
	Emma Lake cabin	<i>Matricaria</i>	<i>discoidea</i>				pulled most of it
		<i>Poa</i>	<i>annua</i>	X	51	none	
		<i>Stellaria</i>	<i>media</i>	X		none	
		<i>Trifolium</i>	<i>repens</i>		59	pulled most of it	
	Emma Lake trail (2)	<i>Taraxacum</i>	<i>officinale</i>		62	pulled some of it	
	Moose Creek cabin	<i>Alopecurus</i>	<i>pratensis</i>	X		pulled	
		<i>Matricaria</i>	<i>discoidea</i>	X		pulled	
		<i>Asperugo</i>	<i>procumbens</i>	X		none	
		<i>Phleum</i>	<i>pratense</i>	X	56	none	
		<i>Taraxacum</i>	<i>officinale</i>		62	none	
	Taylor cabin	<i>Alopecurus</i>	<i>pratensis</i>			none	
		<i>Capsella</i>	<i>bursa-pastoris</i>			none	
		<i>Elymus</i>	<i>repens</i>	X		none	
		<i>Leucanthemum</i>	<i>vulgare</i>	X	61	none	
		<i>Matricaria</i>	<i>discoidea</i>			none	
		<i>Phleum</i>	<i>pratense</i>		56	none	
		<i>Poa</i>	<i>pratensis</i>	X	57	none	
		<i>Polygonum</i>	<i>aviculare</i>			none	
		<i>Taraxacum</i>	<i>officinale</i>		62	none	
	<i>Trifolium</i>	<i>repens</i>	X	59	none		
	Andrew Berg cabin	<i>Matricaria</i>	<i>discoidea</i>			none	
	Clear Creek cabin	<i>Alopecurus</i>	<i>pratensis</i>	X		none	
		<i>Phleum</i>	<i>pratense</i>	X	56	none	
		<i>Poa</i>	<i>pratensis</i>		57	none	

Table 2. List of non-native plant species found in Tetlin National Wildlife Refuge (this is not a final list, as some specimens collected have yet to be keyed out and could result in new exotics records for a site).

Refuge name	Collection Locality	<i>Genus</i>	<i>Species</i>	Voucher	Invasiveness Rank	Control action
Tetlin NWR	Lakeview Campground	<i>Hordeum</i>	<i>jubatum</i>	X	63	none
		<i>Matricaria</i>	<i>discoidea</i>			none
		<i>Plantago</i>	<i>major</i>		44	none
		<i>Trifolium</i>	<i>hybridum</i>		57	none
		<i>Crepis</i>	<i>tectorum</i>		43	none
		<i>Melilotus</i>	<i>alba</i>		80	none
		<i>Taraxacum</i>	<i>officinale</i>		62	none
	Deadman's Campground	<i>Hordeum</i>	<i>jubatum</i>	X	63	pulled
		<i>Matricaria</i>	<i>discoidea</i>			none
		<i>Plantago</i>	<i>major</i>		44	none
		<i>Taraxacum</i>	<i>officinale</i>		62	none
		<i>Trifolium</i>	<i>hybridum</i>		57	none
	Gardiner Creek	<i>Trifolium</i>	<i>hybridum</i>		57	none
		<i>Hordeum</i>	<i>jubatum</i>	X	63	none
		<i>Lappula</i>	<i>squarrosa</i>	X	43	none
		<i>Matricaria</i>	<i>discoidea</i>			none
		<i>Melilotus</i>	<i>alba</i>	X	80	none
		<i>Polygonum</i>	<i>aviculare</i>	X		none
		<i>Taraxacum</i>	<i>officinale</i>		62	none
		<i>Trifolium</i>	<i>hybridum</i>	X	57	none
		<i>Chenopodium</i>	<i>album</i>		35	none
		<i>Lepidium</i>	<i>densiflorum</i>			none
<i>Plantago</i>		<i>major</i>		44	none	
<i>Trifolium</i>		<i>repens</i>		59	none	
1990 burn: roadside plot	<i>Melilotus</i>	<i>alba</i>		80	none	
	<i>Taraxacum</i>	<i>officinale</i>		62	none	

Table 3. List of non-native plant species found in Yukon Flats National Wildlife Refuge (this is not a final list, as some specimens collected have yet to be keyed out and could result in new exotics records for a site).

Refuge name	Collection Locality	Genus	Species	Voucher	Invasiveness Rank	Control action
Yukon Flats NWR	Tivehaun lake parcel	<i>Chenopodium</i>	<i>album</i>		35	none
		<i>Chenopodium</i>	<i>album</i>		35	pulled
		<i>Descurainia</i>	<i>sophia</i>		47	none
	Winter Trail burn: allotment 1	<i>Chenopodium</i>	<i>album</i>		35	pulled
	Winter Trail burn: allotment 2	<i>Chenopodium</i>	<i>album</i>		35	none
	Shovun Lake cabin	<i>Chenopodium</i>	<i>album</i>		35	none
		<i>Hordeum</i>	<i>jubatum</i>		63	none
		<i>Lepidium</i>	<i>densiflorum</i>			none
	Shovun Lake old cabin site	<i>Chenopodium</i>	<i>album</i>	X	35	none
		<i>Hordeum</i>	<i>jubatum</i>	X	63	none
		<i>Lepidium</i>	<i>densiflorum</i>	X		none
	Canvasback Lake FWS cabin	<i>Hordeum</i>	<i>jubatum</i>		63	none
Lower Mouth fire: Winter Trail section	<i>Chenopodium</i>	<i>album</i>		35	pulled	
	<i>Hordeum</i>	<i>jubatum</i>	X	63	none	

Table 4. List of non-native plant species found in near the Kanuti and Yukon Flats refuges.

Town	Collection Locality	Genus	Species	Voucher	Invasiveness Rank	Control action
Bettles	Float Plane Pond	<i>Hordeum</i>	<i>jubatum</i>	X	63	none
		<i>Matricaria</i>	<i>discoidea</i>	X		none
		<i>Plantago</i>	<i>major</i>	X	44	none
Fort Yukon	Airport	<i>Matricaria</i>	<i>discoidea</i>			none
	Boat put-in	<i>Chenopodium</i>	<i>album</i>		35	none
		<i>Descurainia</i>	<i>sophia</i>	X	47	none
		<i>Lappula</i>	<i>squarrosa</i>		43	none
		<i>Lepidium</i>	<i>densiflorum</i>			none
		<i>Polygonum</i>	<i>aviculare</i>			none
	<i>Taraxacum</i>	<i>officinale</i>		62	none	
Boat put-in and airport	<i>Hordeum</i>	<i>jubatum</i>		63	none	

Maps of sites visited and surveyed in each refuge.

Approximate areas surveyed on foot are shown as a dotted line and by boat are shown as a dashed line.

### Sites surveyed in Kenai NWR



**Legend**

-  2005 survey sites
-  Tustumena Lake
-  Glacier Creek burn