

**BAER Accomplishment Report
April 2007**

**Invasive Plant Treatment and Monitoring
Following the 2004 Glacier Creek Fire
Kenai National Wildlife Refuge**

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&
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Introduction

The Glacier Creek Fire (#599) was one of 17 wildland fires on the Kenai National Wildlife Refuge in 2004. It was discovered on 14 August 2004 in the Andrew Simons Wilderness Unit, in a Limited Fire Management Option area, on the glacial outwash plain below the Tustumena Glacier at the southeast end of Tustumena Lake. A fire cause investigation was inconclusive because the precise point of origin was not discovered, but the cause was most likely from human activity.

The Refuge Manager decided to not commit firefighting resources to the remote fire and selected a monitoring response. Over the following weeks the fire spread to the north and west into the Indian Creek canyon, and eventually as far as Moose Creek. A number of public use, historic and privately-owned cabins along the north shore of Tustumena Lake were eventually threatened by the fire, and suppression activities were implemented to protect those resources. No standing structures were lost. Private cabins and outbuildings (Blake, Taylor, Dolchok and the Bear Creek Subdivision) were protected. Refuge public use and historic cabins (Andrew Berg, Emma Lake, Pipe Creek and Moose Creek) were protected. ADF&G bear research platforms on Glacier Creek were protected. Defensible space was created around all of the structures listed above (except ADF&G platforms - valuable equipment was removed). Live and dead hazard fuels were removed within 30 feet of all structures. Dead spruce were removed, and live spruce were thinned and pruned, 30-100 feet from structures. All activity fuels were piled and burned.

The Emma Lake, Moose Creek and Bear Creek Trails were closed for a time to protect visitors from the fire. All three trails have been re-opened including the Emma Lake Trail, of which about one and a half miles were essentially obliterated by the fire.

The Refuge managed the fire for four of the six weeks and successfully transitioned to a Type 3 incident management organization (Alaska Division of Forestry). A Wildland Fire Situation Analysis was completed and revised twice during the management of the incident, which eventually involved ~ 70 personnel at one time or another.

Wet weather and suppression operations finally eliminated the threat in late September, and the fire was declared officially out on 5 October 2004. The final acreage has not yet been determined, but the most recent estimate (from the BAER team satellite imagery analysis) is about 6000 acres burned within the 8000+ acre perimeter.

During the following summer (27 - 28 June 2005), Matt Carlson, Keith Boggs, and Helen Cortes-Burns (Alaska Natural Heritage Program) conducted exotic plant surveys at six cabin sites, the Emma Lake Trail, and the lower section of the Moose Creek Trail. The six cabin sites included one public use cabin (Lake Emma), one recently-restored historical cabin (Andrew Berg), two private inholdings (Taylor, Blake), and two historical sites with only remnant structures remaining (Moose Creek, Clear Creek). The Emma Lake Trail runs for 3.4 miles from the Tustumena Lake shoreline (adjacent to the Taylor cabin) to the Emma Lake cabin above treeline; most of the trail was destroyed by the Glacier Creek Fire (Fig. 1). In contrast, the Moose Creek Trail is on the west side of Moose Creek, just outside the perimeter of the Glacier Creek fire; the trail is largely overgrown and does not offer disturbed substrates for the establishment of exotic plants.



Figure 1. *Taraxacum officinale* ssp. *officinale* site at the beginning of Emma Lake Trail, June 2005 (photo from Carlson & Cortes-Burns 2005).

Thirteen exotic plant species were found during the 2005 survey (Carlson & Cortes-Burns 2005): *Alopecurus pratensis*, *Asperugo procumbens*, *Capsella bursa-pastoris*, *Elymus repens*, *Leucanthemum vulgare*, *Matricaria discoidea*, *Phleum pratense*, *Poa annua*, *Poa pratensis*, *Polygonum aviculare*, *Trifolium repens*, *Stellaria media*, and *Taraxacum officinale* ssp. *officinale*. Except for the common dandelion, which was found at two sites on the Emma Lake

Trail, all others were associated with historical and current cabin sites. German-madwort (*A. procumbens*) was a new record for Alaska (Fig. 2). At least some of the *Poa pratensis* was identified as subspecies *irrigata*. *Erysimum cheiranthoides* was also found at several sites, but this species is currently thought to be native by the AKNHP.



Figure 2. German-madwort (*Asperugo procumbens*) was found at the Moose Creek cabin site in 2005. This is the first record of this species in Alaska.

In addition, the AKNHP staff identified *Taraxacum officinale* ssp. *officinale*, *Matricaria discoidea*, *Trifolium hybridum*, *Phleum pratense*, *Poa annua*, and *Polygonum aviculare* at the USFWS boat landing on the upper Kasilof River. 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 (Carlson & Cortes-Burns 2005). This landing is used by both public and USFWS staff to access Tustumena Lake by boat.

The purpose of this report is to summarize the results of a second exotic plant survey, in 2006, of the Glacier Creek Fire by staff from the Kenai NWR and AKNHP.

Methods

We estimated percent cover for each native and non-native vascular plant species within the area of infestation; consequently, plot size was variable. We estimated percent ground cover of vegetative life forms (needleleaf, broadleaf, tall shrub [$>1.52\text{m}$] low shrub [$20.3\text{cm}>1.52\text{m}$] dwarf shrub [$<20.3\text{cm}$] forb, grass, sedge, moss, lichen, bare, water, and other). We described the surrounding habitat/landcover classes. For non-native taxa, we recorded the size of the infestation, the age and type of disturbance, and whether or not any individuals were pulled. Previously, in 2005, any vegetation and soil fire indicators (% ground burned, % trees dead from fire, burned needles, fire scars, etc.) were noted.

For completeness, we also include data from 39 plots that were sampled during 13-16 July 2005. Vegetation was quantified following field protocols established by the National Burn Severity Mapping program for measuring the Composite Burn Index (CBI; Key & Benson 2006). These plots were randomly selected within strata of relatively homogeneous differenced normalized burn ratio (dNBR) values; to facilitate access, selection was constrained to sites within one mile (1.6 km) of Tustumena Lake. These sites were not re-surveyed in 2006.

Results and Discussion

Sites which had infestations in 2005 were revisited during 1 - 2 August 2006 (Fig. 3) including Moose Creek Cabin, Blake Cabin, Taylor Cabin, the Clear Creek cabin site, Andrew Berg Cabin, and the Emma Lake Cabin (Figs. 4 - 9). The Indian Creek marsh was revisited but it was too flooded to survey. Field staff included Matt Bowser, Todd Eskelin and Susie Grimes from KENWR, and Helen Cortes-Burns from AKNHP.

In addition to the 13 species identified in 2005, six new species of exotic vascular plants were found: *Agrostis capillaris*, *Plantago major*, *Hordeum jubatum*, *Trifolium hybridum*, *Trifolium pretense*, and *Lolium perenne* (Table 1). Also, although no exotics were found at the Blake Cabin in 2005, three non-native species were identified there in 2006 including colonial bentgrass (*A. capillaris*), the first record of this species on the Refuge (Table 1).

It is unlikely that the identification of additional species in 2006 is the result of re-colonization two years after the Glacier Creek Fire. Most of the areas initially identified during the 2005 survey were not burned; i.e., the cabins. The finding of additional species during the second survey is likely due to the timing of these surveys; the first was at the end of June and the second was at the beginning of August. More anecdotal evidence is provided by the fact that Shepherd's purse (*Capsella bursa-pastoris*) was found in June 2005 but not in August 2006 at the Taylor Cabin. This is consistent with the flowering and seeding phenology of this particular species. On the other hand, common dandelion was found in 2006, but not in 2005, at the Moose Creek beach; this could certainly be a case of post-fire establishment.

Treatment specification (mechanical treatment)

In 2005, plants were removed at four sites. Dandelion was pulled where it was first encountered at the start of the Emma Lake Trail (Fig. 1). Approximately 50 individuals of *Taraxacum officinale* ssp. *officinale*, spaced across 1 acre, were pulled from a well-established *Calamagrostis canadensis* meadow ~1.5 km west of Emma Lake, but there were too many individuals to eradicate the entire population. Carlson & Cortes-Burns (2005) suggested that this infestation was there prior to the 2004 fire, and can be attributed to human use of the trail.

Similarly, most of the pineapple weed and clover were pulled at the Emma Lake cabin, but the other species were too numerous and well established for immediate manual control. Lastly, the few individuals of *Matricaria discoidea* and *Alopecurus pratensis* that were found at the mouth of Moose Creek were pulled. In total, we treated ~2 acres of the Glacier Creek Fire.

The efficacy of this limited plant removal on the Glacier Creek Fire is questionable. The Lake Emma Trail is contaminated by well-established populations of exotic plants at its beginning (Taylor cabin) and end (Emma Lake cabin). Any control efforts along this trail will almost certainly be negated by dispersal from these two cabins. Similarly, other private inholdings (Blake cabin) and historical cabin sites continue to be sources for non-native propagules. Until these sites are treated, probably with herbicides, and some agreement is reached with private landowners regarding acceptable plants for landscaping, onsite treatment of exotic plant populations on adjacent refuge lands will likely have limited success.

Implementation costs

We originally proposed to do more mechanical treatment at both the Kasilof River boat launch and cabins. However, because of the dispersed nature of many of these exotic plant populations and because the most highly-infested site (Taylor Cabin) was privately-owned, we decided that the control effort would not result in tangible gains. Of the original \$20,000 grant, we spent \$3956.55 on salaries and \$2484.79 on equipment purchases and food; the remaining \$13,558.66 was returned.

Recommendations

Nineteen species of exotic vascular plants were identified as a result of these surveys in 2005 and 2006 including two species (*Asperugo procumbens*, *Agrostis capillaris*) previously unrecorded on the refuge; German-madwort (*A. procumbens*) was a new record for Alaska! The addition of these two species brings the total number of exotic vascular plants known to be on Kenai NWR to 62; to put this in context, there are > 90 species of exotic vascular plants known to occur on the Kenai Peninsula (Caleb Slemmons, pers.comm).

There were no exotic plants found on the 39 CBI plots surveyed in 2005. Indeed, these sites were so scorched that few native flora had germinated by July of that year; many of the individuals found were re-sprouting from existing roots (e.g., cottonwood). These sites should have been re-surveyed in 2006. Certainly any future re-sampling of the Glacier Creek Fire should include at least some of these sites, accompanied with appropriate mechanical treatment for any exotic plants found. These sites offer a more unbiased sample of post-fire colonization by exotic plants than do the cabins and trails surveyed in 2005 and 2006.

Surveying the aftermath of the Glacier Creek Fire has highlighted the potentially significant role that public and private cabins may play in introducing and harboring populations of exotic flora. Not only are cabins and their associated landuse (e.g., lawns, gardens, grazing) sources for exotic plant re-colonization of areas disturbed by fires, visitors to cabins are also vectors for the introduction and dispersal of new exotic species to remote areas of the refuge. Until the Kenai NWR has a comprehensive exotic/invasive plant management plan in place, post-fire treatments for exotic and invasive plants are not likely to be effective.

Literature Cited

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Key, C.H., and N.C. Benson. 2006. Landscape Assessment: Ground measure of severity, the Composite Burn Index; and remote sensing of severity, the Normalized Burn Ratio. In D.C. Lutes, R.E. Keane, J.F. Caratti, C.H. Key, N.C. Benson, S. Sutherland, and L.J. Gangi. 2006. FIREMON: Fire Effects Monitoring and Inventory System. USDA Forest Service, Rocky Mountain Research Station, Ogden, UT. Gen. Tech. Rep. RMRS-GTR-164-CD:LA1-51.

Table 1. Percent cover (NV = not visited, TR = trace, NR = not recorded) and removal of exotic vascular plant species at 12 sites on the 2004 Glacier Creek Fire in June 2005 and August 2006.

SPECIES	2005 REMOVAL	% Cover	
		2005	2006
Indian Creek Marsh (60.11062, 150.61344)			
<i>Capsella bursa-pastoris</i>		*5	**NV
Blake Cabin 1 (60.112410, 150.61540)			
<i>Agrostis capillaris</i>		0	5
<i>Erysimum cheiranthoides</i> ***		0	TR
<i>Poa pratensis</i>		0	TR
Blake Cabin 2 (60.112660, 150.61530)			
<i>Erysimum cheiranthoides</i>		0	4
<i>Taraxacum officinale officinale</i>		0	TR
Lake Emma Cabin (60.122371, 150.556960)			
<i>Matricaria discoidea</i>	MOST	TR	15
<i>Plantago major</i>		0	TR
<i>Poa annua</i>		5	5
<i>Poa pratensis</i>		0	1
<i>Stellaria media</i>		5	0
<i>Trifolium repens</i>	MOST	TR	TR
Lake Emma Trail (60.12255, 150.62934)			
<i>Taraxacum officinale officinale</i>	ALL	5	NR
Lake Emma Trail (clearing; 60.13059, 150.57574)			
<i>Poa annua</i>		TR	NR
<i>Taraxacum officinale officinale</i>	SOME	5	NR
Moose Creek Cabin beach (60.152740, 150.706470)			
<i>Alopecurus pratensis</i>	ALL	TR	1
<i>Matricaria discoidea</i>	ALL	TR	0
<i>Poa annua</i>		TR	0
<i>Poa pratensis</i>		TR	0
<i>Taraxacum officinale officinale</i>		NV	TR
Moose Creek Cabin (60.153350, 150.705730)			
<i>Alopecurus pratensis</i>		60	15
<i>Asperugo procumbens</i>		TR	TR
<i>Erysimum cheiranthoides cheiranthoides</i>		TR	0
<i>Hordeum jubatum</i>		0	TR
<i>Matricaria discoidea</i>		5	0
<i>Phleum pretense</i>		5	15
<i>Poa annua</i>		0	5
<i>Taraxacum officinale officinale</i>		5	1

<i>Trifolium hybridum</i>		0	TR
Taylor Cabin (60.121570, 150.630970)			
<i>Alopecurus pratensis</i>		TR	0
<i>Capsella bursa-pastoris</i>		TR	0
<i>Elymus repens</i>		5	0
<i>Erysimum cheiranthoides cheiranthoides</i>		TR	2
<i>Leucanthemum vulgare</i>		TR	0
<i>Matricaria discoidea</i>		TR	4
<i>Plantago major</i>		0	2
<i>Phleum pretense</i>		TR	0
<i>Poa annua</i>		0	10
<i>Poa pratensis</i>		70	70
<i>Poa pratensis irrigata</i>		5	0
<i>Polygonum aviculare</i>		TR	2
<i>Stellaria media</i>		0	5
<i>Taraxacum officinale officinale</i>		5	3
<i>Trifolium hybridum</i>		0	3
<i>Trifolium pretense</i>		0	3
<i>Trifolium repens</i>		20	3
Andrew Berg Cabin (60.117460, 150.630100)			
<i>Erysimum cheiranthoides cheiranthoides</i>		TR	5
<i>Lolium perenne</i>		0	TR
<i>Matricaria discoidea</i>		TR	3
<i>Phleum pretense</i>		0	5
Clear Creek Cabin site (60.046410, 150.644630)			
<i>Alopecurus pratensis</i>		TR	4
<i>Phleum pretense</i>		TR	5
<i>Poa pratensis</i>		30	4

*Values reported as 1 - 10% cover in 2005 converted to 5%.

**Site was visited in 2006 but was flooded.

*** *Erysimum cheiranthoides* is currently recognized as native by AKNHP.

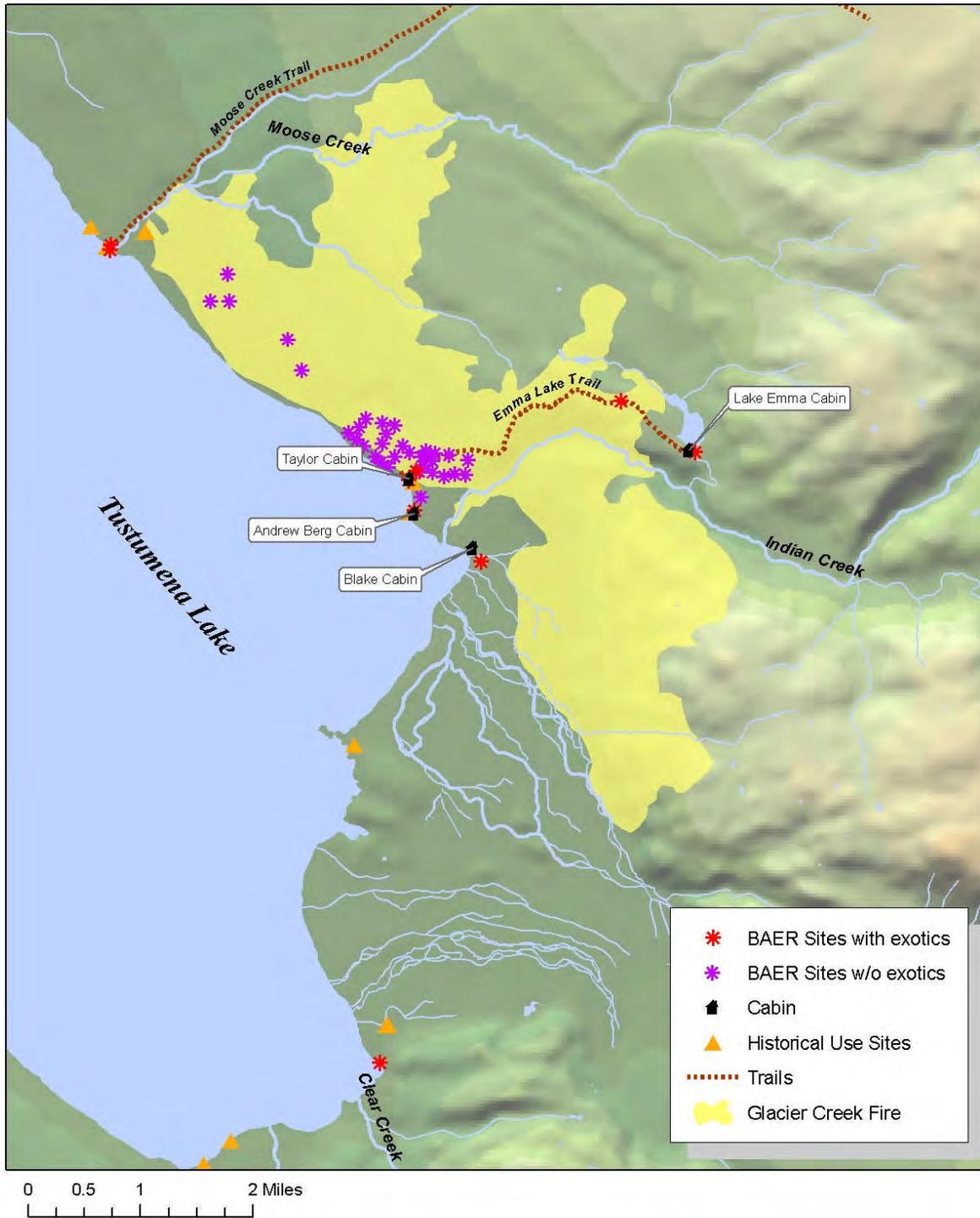


Figure 3. Location of cabins, historical sites, and areas sampled for exotic flora on the 2004 Glacier Creek Fire, Kenai National Wildlife Refuge.



Figure 4. Timothy and meadow foxtail (and *Calamagrostis canadensis*) at the Moose Creek cabin.



Figure 5. *Calamagrostis canadensis* surrounding Blake cabin.



Figure 6. Lawn of *Poa annua*, *Poa pratensis*, and *Trifolium* spp. At Taylor cabin.



Fig. 7. Timothy grass and meadow foxtail at Clear Creek Cabin site (photo from Carlson & Cortes-Burns 2005).



Figure 8. Pineapple weed at the Andrew Berg Cabin.



Figure 9. Dandelion, annual bluegrass, common chickweed, pineapple weed, and white clover were found at the Lake Emma Cabin.

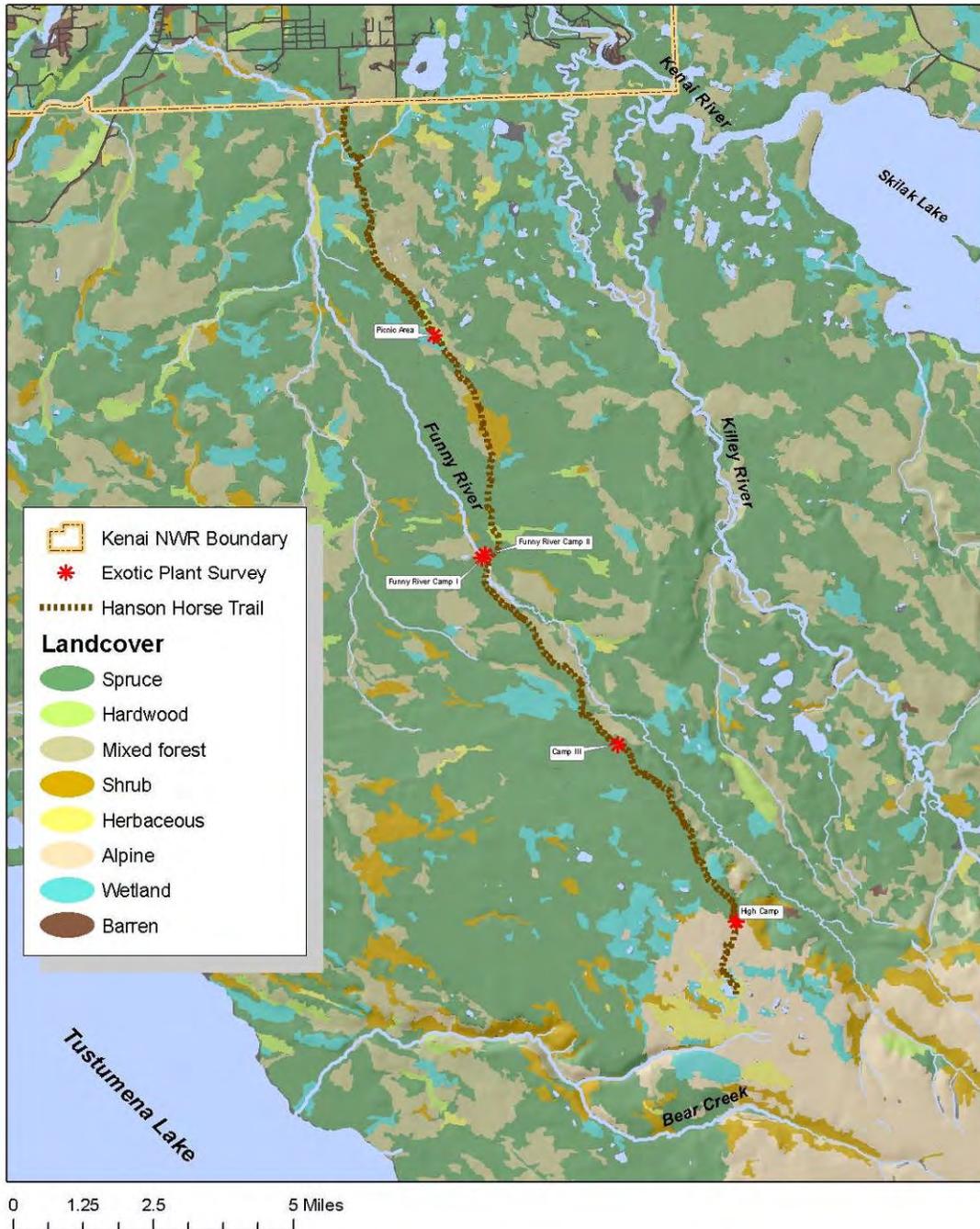
APPENDIX 1

EXOTIC PLANT SURVEY HANSON HORSE TRAIL AND ASSOCIATED CAMPING AREAS KENAI NATIONAL WILDLIFE REFUGE



U.S. Fish & Wildlife Service
Kenai National Wildlife Refuge
Soldotna, Alaska

Hanson Horse Trail Exotic Plant Survey



Exotic vascular plant species observed (14 -17 Aug 2006)

ALGE2	<i>Alopecurus pratensis</i>	Meadow foxtail
CABU2	<i>Capsella bursa-pastoris</i>	Shepherd's purse
LUPO2	<i>Lupinus polyphyllus</i>	Bigleaf lupine
MADI6	<i>Matricaria discoidea</i>	Pineapple weed
PHPR3	<i>Phleum pretense</i>	Timothy
PLMA2	<i>Plantago major</i>	Common plantain
POAN	<i>Poa annua</i>	Annual bluegrass
STME2	<i>Stellaria media</i>	Common chickweed
TRRE3	<i>Trifolium repens</i>	White clover

MADI6, PHPR3, LUPO2, and PLMA2 were observed along the first 2 miles of the Hansen Horse Trail between the trailhead and the first bridge.

1. Picnic spot (N 60.41261, W 150.72031)

Open meadow area (5 miles from trailhead). Meadow area is ~ 20m x 40m. There is evidence of horses having been tethered to trees, some trampling, but doesn't look like there's much sign of campfires or overnight use. Species present include PHPR3 (sparse), LUPO2, and PLMA2 on the trail through meadow.



Figure 1. Open meadow at the Picnic Spot.



Figure 2. Phleum pretense (Timothy) at the Picnic Spot.

2. Funny River Camp I (also called Halfway Camp) N 60.35484, W 150.69901

Very well used site, trampled 10m x 15m centralized area with fire ring and cut logs. Social trails lead out from campsite and end in large trampled areas (tent sites or where the horses have been tied). Doesn't seem like the plants listed below have established much outside the disturbed area: STME2 carpet in main campsite, MADI6, PLMA2 widespread throughout area, TRRE3 (trace), CABU2 (trace), and PHPR3 outside main campsite.



Figure 3. Main camping area at the Halfway Camp.



Figure 4. Trampled vegetation outside main camping area.

3. Funny River Camp II (N 60.35562, W 150.69753)

Across the river is a large open meadow area (20x70m) that leads to a campsite (10x15m). This isn't as well used as the last site. Species present include PHPR3 throughout the area, ALPR3 (trace), and POAN.



Figure 3. Funny River Camp II.



Figure 6. Fire pit area at Funny River Camp II.

4. Camp III (N 60.30522, W 150.63208)

Open meadow area. This spot is not nearly as established as the Funny River camps; doesn't look like this area is used much. There's some trampling but is hard to find a good tent spot, no fire ring. The trail goes right through the meadow (20m x 80m). Overall this spot doesn't seem very impacted by non-natives (PHPR3 is seen mostly along the trail through the meadow, and PLMA2 (few)).



Figure 7. Open meadow at Camp III.



Figure 8. Camping area at Camp III.

5. High Camp (N 60.25870, W 150.57373)

This camp is roughly 15m x 40m. It is on the toe of the Tustumena Bench in an open flat area surrounded by willow. Great views! A lot of this area has been grazed recently so identifying all the grasses could be difficult. PHPR3 is the predominant grass; also PLMA2.



Figure 9. Timothy growing at High Camp.



Figure 10. Tents at High Camp.



Figure 11. View from High Camp on Tustumena Benchlands.