

# **Exotic Plant Survey of Katmai National Park and Preserve: Summer 2005 Field Season Report**

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## Introduction

Summer 2005 marked the fifth year that baseline surveys for non- native plant species were carried out on National Park Service (NPS) lands in Alaska, and the second year for Katmai National Park and Preserve (KATM). These surveys serve as the first source of data to be used in formulating a long- term control and monitoring plan for these species in Alaska's NPS units. Invasive plant species are a concern to resource managers because they threaten the genetic integrity of native flora through hybridization (D'Antonio et. al 2001), can out- compete resident plant species for limited resources, can change the structure and function of ecosystems through alterations of geochemical and geophysical processes (Ruesnik et. al 1995, Gordon 1998), and can impact fish and wildlife habitat. By 1996, invasive plant species had infested an estimated 7 million acres of NPS lands, with 4,600 acres of new infestations occurring daily (NPS 1996).

In Alaska, NPS lands have been considered immune to the establishment of many pernicious invasive species found in the lower 48 states (Westbrooks 1998). Several factors have contributed to this immunity. The first is climate. Circumboreal plants are adapted to a wide range of climatic conditions that invasive plants cannot tolerate. In addition, many parklands in Alaska have remained relatively free of man- made disturbances such as livestock grazing, wildfire suppression, and altered hydrological regimes that encourage the introduction of invasive species. The remote wilderness parks in Alaska still have all of their major floral and faunal ecosystem components (Densmore et. al 2001). Despite these protective factors, the threat of plant invasion is increasing in Alaska due to global warming and increases in human activity and development. Fortunately, the NPS has the opportunity to head off invasive plant introduction in Alaska before it becomes a major problem, but research and active management must begin now (Spencer 2001).

Two factors contribute to KATM's vulnerability to invasion: first, it protects a large land area that houses fifteen active volcanoes, and so the terrestrial landscape is undergoing transformation through the ongoing colonization of areas covered by deposits of volcanic ash and sand from past eruptions. Second, Brooks Camp, located in the western interior of the park, is home to the park's only established campground and maintained hiking trails and is a popular destination for both national and international travelers. Access into Brooks Camp is typically by floatplane via King Salmon, Homer, Kodiak, or Anchorage. So far, there are relatively few species present in King Salmon and KATM, but the threat of invasive plant introduction and spread grows every year with increasing numbers of summer visitors, the escape of planted ornamentals from private residences, and ongoing construction and maintenance activities that disturb the soil and facilitate weed establishment.

On the other hand, there are very limited avenues for the introduction of invasive plants into KATM: primarily the Lake Camp road, Brooks Camp, the Valley of Ten Thousand Smokes, and coastal use areas. The road to Lake Camp is the only section of the park accessible by private vehicles, since the use of vehicles in Brooks Camp and the Valley of Ten Thousand Smokes is limited to park employees and lodge staff. Perhaps for this reason alone, KATM has fared well in its isolation and has a real opportunity to avoid the problems other parks are experiencing, but park managers must remain vigilant. The purpose of surveys in KATM during the 2005 field season was to document the current distribution, abundance, and species composition of invasive plants in the four areas mentioned above and control infestations where feasible. This information will be used to develop a long- term monitoring and control strategy for the park, to coordinate efforts among all the parks in the Alaska Region, and to contribute to the statewide effort to evaluate and address this rapidly growing problem.

## Methods

The 2005 summer field season marked the second year that extensive surveys for invasive plants were conducted in Alaskan parks using highly accurate Trimble GeoXT GPS units. These units can achieve sub- meter accuracy and can be equipped with data dictionaries, enabling both precise mapping and standardized data collection. They were used to map both infested areas and areas without invasive plants with detail sufficient for annual monitoring of spread. The data were collected for entry into two distinct databases: APCAM – the nationwide NPS database for invasive plant data – and AKEPIC – a collaborative, web- based database for tracking Alaskan weeds. Attributes were designed to describe the size, diversity, and severity of invasive plant infestations in a given area (Table 1), as well as to satisfy database requirements. Digital photos were taken at many sites to augment the data recorded on the GPS units. If invasive species were found in sufficiently low numbers, they were removed by hand.

The method used to survey lands for invasive plants was opportunistic sampling, focused on areas of human development and frequent use as reported by park staff. The Lake Camp road was exhaustively surveyed from the park boundary to Lake Camp, by vehicle along the road. Brooks Camp was examined by foot for all NPS and concessionaire housing, the Brooks Falls Trail, the campground, the maintenance complex, all trails, and the cultural site. The Valley of Ten Thousand Smokes road was surveyed from a slow- moving vehicle with stops and foot- based searches of all associated trails and vehicle pull- offs. The social trail commonly used for overnight access to the Valley itself was surveyed by foot, as were Hallo, Kaguyak and Switshak Bays on the coast after arrival by fixed- wing aircraft. The roads of King Salmon were also surveyed by vehicle with attention to major infestations and high priority species. ArcGIS (ESRI 2002) software was used to generate a shapefile that includes all GPS records, from

which maps of survey results were generated (Figures 1- 4). The GIS shapefile (KATM\_EPMT\_2005) is recommended for data viewing and analysis.

## Results

A total of 12 invasive plant species were documented through our surveys of KATM (Table 2). Results are addressed below by site.

### Lake Camp

Along the KATM Lake Camp road from the park entrance to the Lake Camp boat launch, three common invasive species were recorded, all of which were found growing in or around the boat launch area: shepherd's purse (*Capsella bursa-pastoris*), pineappleweed (*Matricaria discoidea*), and common sheep sorrel (*Rumex acetosella*). A species of greater concern, oxeye daisy (*Leucanthemum vulgare*), was documented growing at a single site on private property, about a mile and a half before reaching the lake on the south side of the road along a driveway, and appeared to have escaped from a garden planter. This is the first time this species has been reported from KATM and the only area where it was found. It was limited to a small enough area that it could be eradicated through hand pulling over multiple years, given landowner permission. Besides the boat launch area at the end of the road and the oxeye daisy on private property, the rest of the road, including all pull-outs and trailheads, was free of exotic plants.

### Brooks Camp

The largest and most vigorous populations of invasive plants in KATM were found in Brooks Camp and surrounding areas. Common species recorded were shepherd's purse, pineappleweed, common sheep sorrel, annual bluegrass (*Poa annua*), Kentucky bluegrass (*Poa pratensis*), and prostrate knotweed (*Polygonum aviculare*). Common dandelion (*Taraxacum officinale*) was also found growing in scattered patches and was particularly thick at the campground and cultural site. One thick population of plantain (*Plantago major*) was found growing next to the generator vent just outside of the maintenance building. Additionally, extremely small patches of white clover (*Trifolium repens*) were discovered near the lodge commons. These infestations of plantain and white clover are some of only a few occurrences of these species within KATM park boundaries. Of special interest is "the corner," where some very large specimens of shepherd's purse occur in a linear patch along the trail from Brooks Camp to the footbridge. Additionally "the corner" housed a few isolated individuals of wormseed mustard (*Erysimum cheiranthoides*), a species never before documented in KATM. A few patches of pineappleweed and shepherd's purse were found along the beginning of the Brooks Falls Trail. Further down the trail, single specimens of dandelion were found growing under and near the raised walkway leading to the Brooks Falls platform, where thick patches of pineappleweed and shepherd's purse were recorded growing under and around the platform. Control of species at this site will prove extremely difficult due to the high concentration of bears.

### Valley of Ten Thousand Smokes Road

Along the first half of the road, populations of Kentucky bluegrass and a few small populations of pineappleweed were found growing in occasional pull-offs. The pull-off between the second and third river crossing marked the furthest extent of pineappleweed along the road. The Margot Falls trail, Uyak trail, Three Forks Cabin and parking lot, and most of the Valley road were found to be free of exotic plants.

The largest and most worrisome population of invasive plants on the valley road was found at the gravel pit on the north side of the road at mile 4.3. A population of 145 individuals of narrowleaf hawksbeard (*Crepis tectorum*) was found growing just left and forward of the gravel pit entrance, between the black containers and the sawhorses. This is the only area within KATM park boundaries where this species was found and the first time this species has been reported in the park. Scattered patches of shepherd's purse were found growing near the narrowleaf hawksbeard and also on the southeastern side of the gravel pit in a patch composed of 43 individuals.

Finally, several hundred yards down the social trail that leads to the southern edge of the Valley of Ten Thousand Smokes, a small patch of plantain was found directly on the trail. We had no GPS unit at the time, but the plant should be easily relocated in late June with a careful eye for the species' broad leaves. This source infestation could potentially spread into the backcountry quite easily, and so it should be repeatedly revisited and treated over the next few years.

### Katmai Coast

One population of pineappleweed was encountered in Kaguyak Bay, growing on the trail from the beach to Hallo Bay Lodge. No other invasive species was found in Kaguyak Bay, despite the moderate use of this bay by Hallo Bay Lodge visitors. Hallo Bay and Switshak Bay were found to be entirely free of exotic plants.

## **Discussion and Management Recommendations**

Most of the invasive species found growing in KATM do not currently pose a serious threat to the natural resources of the park because they are limited to areas of repeated anthropogenic disturbance and have not yet invaded native ecosystems. However, all of these species should be prevented from moving into more remote areas of the park through control efforts, and the most valuable measure would be to prevent establishment of new species and to eradicate the species not yet firmly established. Species that could potentially be eradicated from KATM include oxeye daisy, shepherd's purse, and sheep sorrel at Lake Camp; shepherd's purse, prostrate knotweed, plantain, white clover, dandelion, and wormseed mustard at Brooks Camp; and shepherd's purse, plantain, and narrowleaf hawksbeard on the Valley of Ten Thousand Smokes road.

Development of an invasive plant management plan is critical for KATM and should include control projects to arrest the spread of current invaders and a monitoring plan so that more pernicious species do not gain a foothold in the park. Because many more species are likely to arrive in the area in the future, KATM should initiate efforts towards early detection of and rapid response to new species and significant expansions of current infestations.

Oxeye daisy is a species that is rapidly spreading in other parts of Alaska and can even outcompete dandelion in some cases. There exists only one population in the park itself: on private property just off the Lake Camp road. With the landowner's permission, this infestation should be controlled in early summer 2006 through hand- pulling, which can be effective for small populations, or herbicide application, and it should be revisited and retreated multiple times over several summers. It is also extremely important to engage the local community in discussion about the perils of using oxeye daisy, often sold under the name "Shasta daisy," and other invasive species as garden plants.

Narrowleaf hawksbeard is considered highly invasive and has been spreading throughout the frontcountry of Denali National Park and Preserve at an alarming rate (R. Densmore, pers. comm. 2004). Narrowleaf hawksbeard is easily pulled up by hand, although several weedings are necessary to eliminate plants overlooked when they were in the small rosette stage, not yet flowering, or newly emerging from a seedbank. The area in the gravel pit where the population was found growing (controlled July, 2005) should be monitored and retreated repeatedly for the next few years to ensure its eradication.

Common dandelion, ubiquitous across most of the United States, appears to be rapidly colonizing Brooks Camp and is in the initial phase of establishment at many sites. With targeted control efforts and regular surveys, its spread to the Valley of Ten Thousand Smokes road may be halted. In the vicinity of the lodge, visitor center, cultural site, and campground, control efforts may reduce the ability of dandelion to disperse via visitors and employees. Hand- pulling of this species can be moderately effective, while herbicides are likely to provide more effective treatment, especially where regular visits are not an option. With the use of minimum tool analysis and execution, impacts of herbicides to native vegetation and the environment are likely to be minimal. Dandelion control must be timed in the spring, because they flower earlier than most other species in Alaska, and sites may have to be retreated multiple times during a single summer season due to their aggressive behavior and ability to recover and flower again even after treatment. With focused effort over the next five years, the eradication of dandelions from Brooks Camp is conceivable.

Several other species deserve mention and management in KATM. White clover, prostrate knotweed, and wormseed mustard were only found in isolated, very small patches, and therefore they could be easily eradicated through hand-

pulling several times a summer over several summers. The prostrate knotweed should be positively identified, because it was not in flower during our visit and could have been misidentified. Plantain and shepherd's purse are more narrowly distributed than dandelion, and so both of these species also make good candidates for proximate eradication. Especially important for control is the patch of plantain on the social trail that leads into the Valley of Ten Thousand Smokes, which could offer the species the opportunity to be the first exotic plant to colonize the Valley.

Pineappleweed is the only non- native plant species in KATM that is unlikely to be eradicated in the near future, due to its widespread distribution and the ineffectiveness of hand- pulling on this species. It is fortunate that, given its extremely small stature and restriction to disturbance, pineappleweed likely presents the least concern of all species found in KATM. The two grasses found in the area – Kentucky and annual bluegrasses – should be monitored for now, because they would be more difficult than other species to manually control and they have not invaded undisturbed plant communities elsewhere in Alaska.

To summarize, short- term management priorities should be to:

- 1) annually survey KATM developed use areas in search of new species;
- 2) control the patches of narrowleaf hawksbeard at the gravel pit, oxeye daisy on the Lake Camp Road, and plantain on the social trail into the Valley of Ten Thousand Smokes, hand- pulling each patch multiple times a summer for the next several summers;
- 3) contain all species except pineappleweed to Brooks Camp through control projects targeting all infestations on the far side of the footbridge;
- 4) control the species present in Brooks Camp, beginning with the three scattered species; and,
- 5) collect seeds of native pioneer species for revegetation of sites following significant removal of invasive plants.

### Education

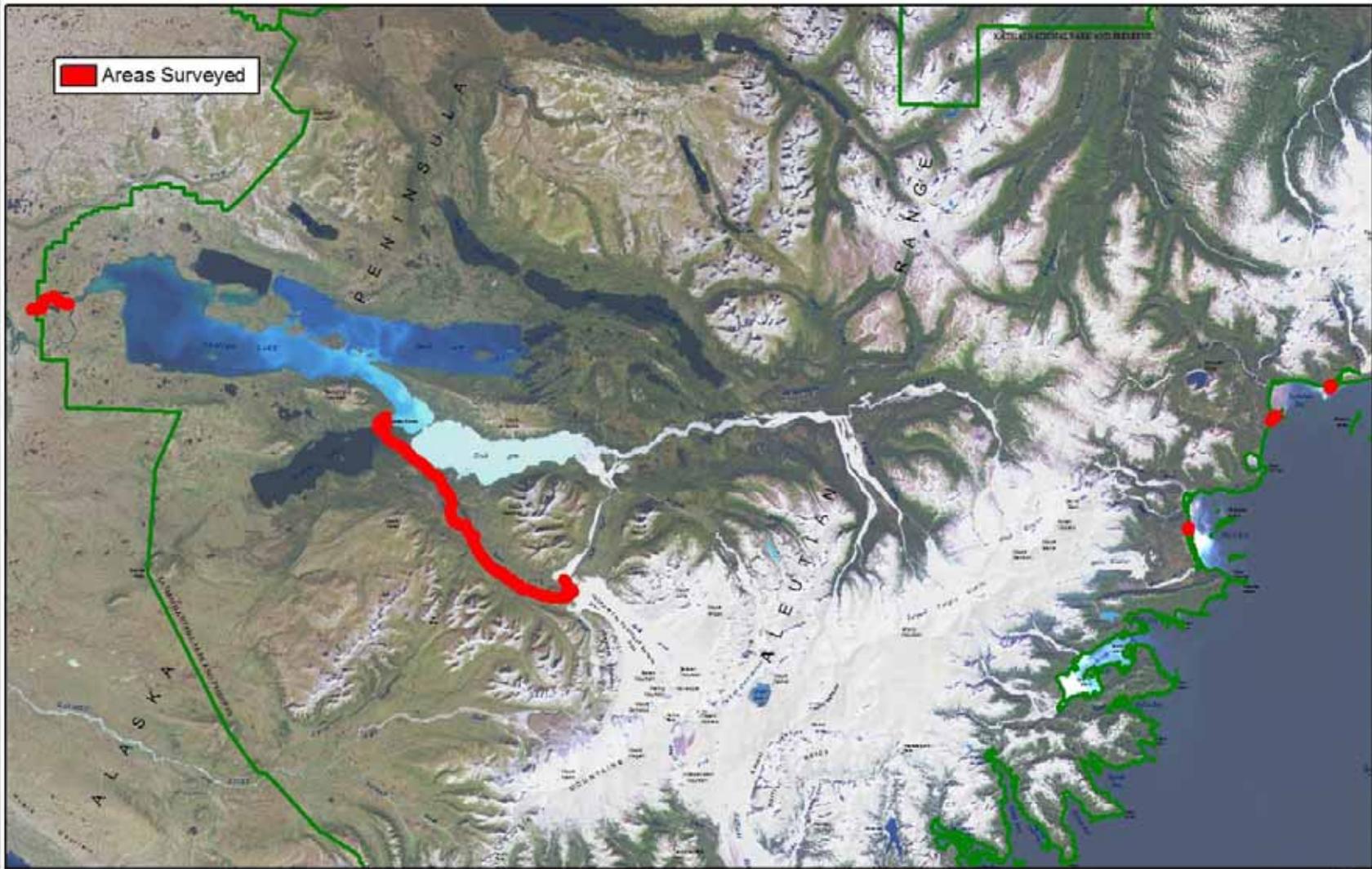
Education is the most critical element of the prevention and detection of new invasive plant infestations in KATM. On the prevention side, park staff, concessionaires, visitors, and local residents alike should be informed about this potential threat to park resources. This should include the message that invasive plants are a growing problem in Alaska and new species are likely to appear in the area over coming years. Two primary vectors of invasion exist: seeds or plant material arriving on gear and clothing, and the importation of soil, gravel, nursery stock, or heavy equipment into the area. Soil, gravel, and nursery stock should be obtained from weed- free sources wherever possible, and sites should be carefully monitored for weed establishment after material has been deposited. Any heavy equipment and vehicles should be washed before entering KATM, with special attention given to tires, undercarriage, and any stray clumps of dried material. The best preventive measure of all would be to encourage all visitors,

employees, and outfitters to wash their boots, clothing, and outdoor gear prior to arriving in King Salmon or KATM through pre-season mailings.

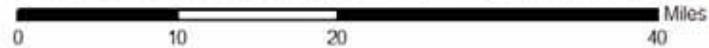
To ensure early detection of new infestations and/or species in KATM and King Salmon, species already present and those that are likely to arrive in the future should be identified for the audiences cited above (see Selected Invasive Plants of Alaska field guide, 2004, or Invasive Plants of Alaska, 2005). A short training for all field employees could focus on what species to look for while performing other duties, how to record their locations using GPS technology, and how to report them to resource managers.

# Exotic Plant Management Team Survey 2005 Katmai National Park and Preserve

National Park Service  
U.S. Department of the Interior



AKEPMT coverages collected with a Trimble GPS receiver  
Date: 3 Nov 05

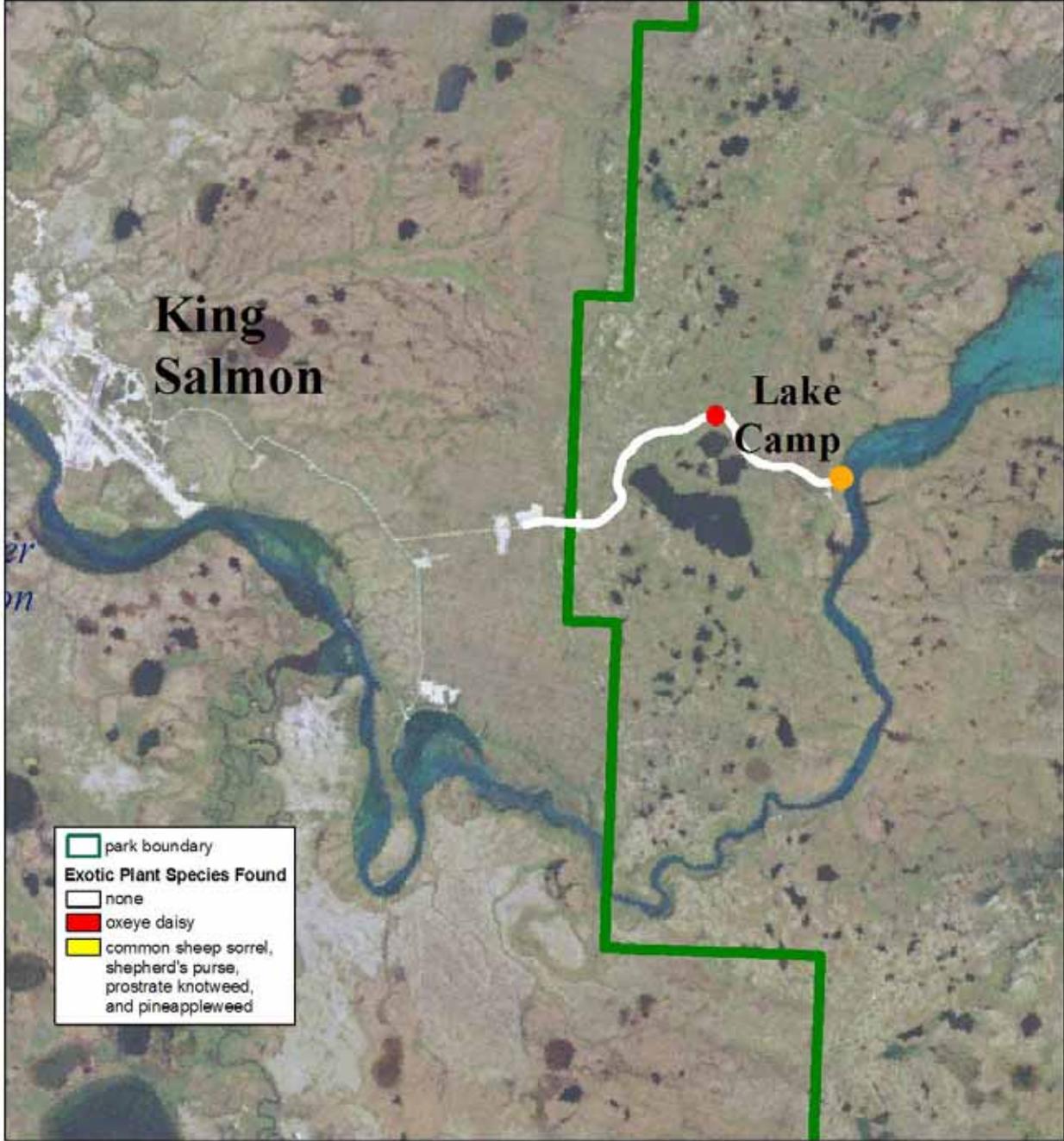


1:700,000

# Exotic Plant Management Team Survey 2005 Lake Camp Road Katmai National Park and Preserve



National Park Service  
U.S. Department of the Interior



- park boundary
- Exotic Plant Species Found**
- none
- oxeye daisy
- common sheep sorrel, shepherd's purse, prostrate knotweed, and pineappleweed

0 0.5 1 2 3 4 Miles

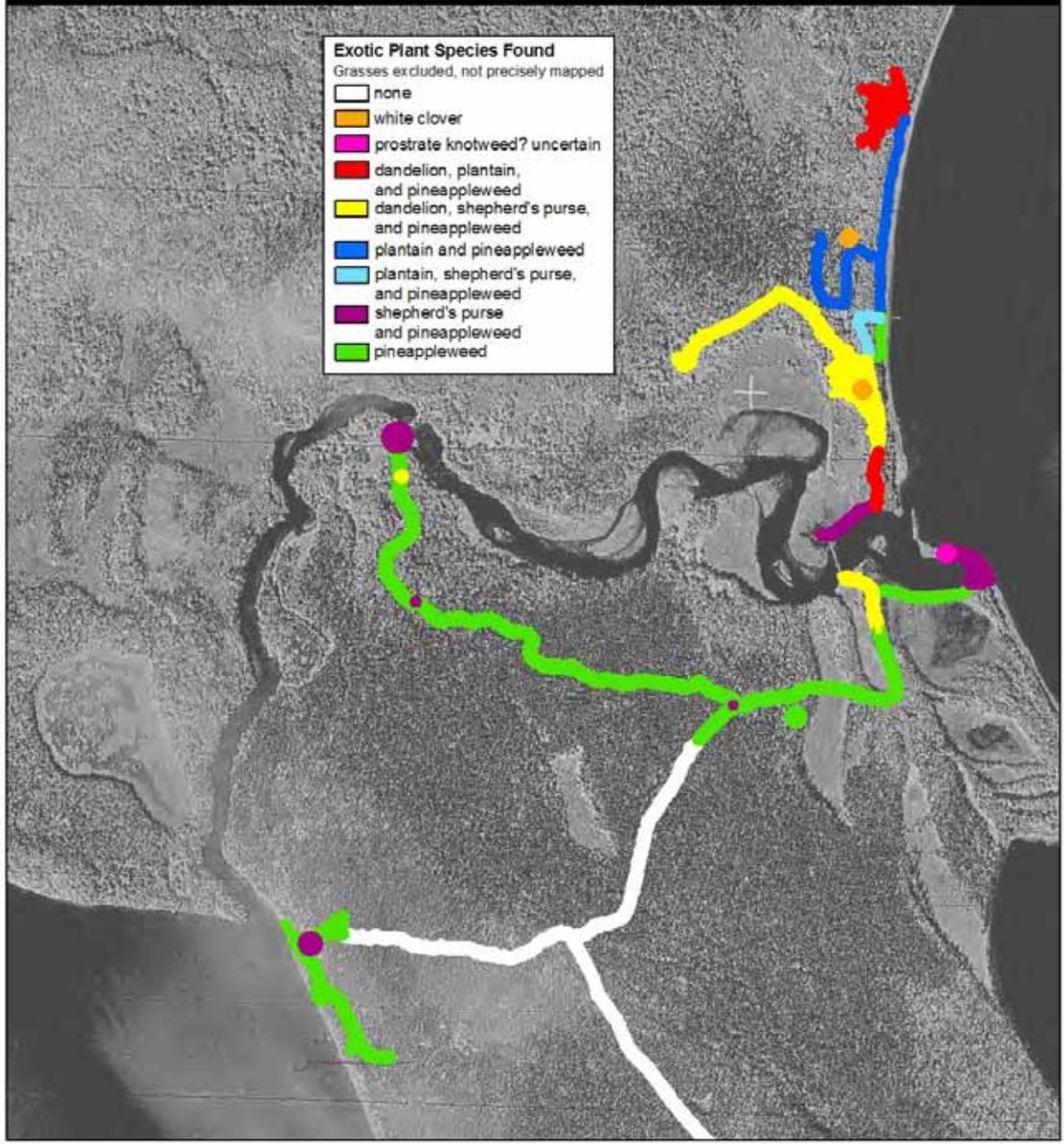
N  
1:80,000

Source: AKEPMT coverages collected with a Trimble GPS receiver  
Date: 03 Nov 05

# Exotic Plant Management Team Survey 2005 Brooks Camp Katmai National Park and Preserve



National Park Service  
U.S. Department of the Interior



- Exotic Plant Species Found**  
Grasses excluded, not precisely mapped
- none
  - white clover
  - prostrate knotweed? uncertain
  - dandelion, plantain, and pineappleweed
  - dandelion, shepherd's purse, and pineappleweed
  - plantain and pineappleweed
  - plantain, shepherd's purse, and pineappleweed
  - shepherd's purse and pineappleweed
  - pineappleweed

0 0.1 0.2 0.4 0.6 0.8 Miles

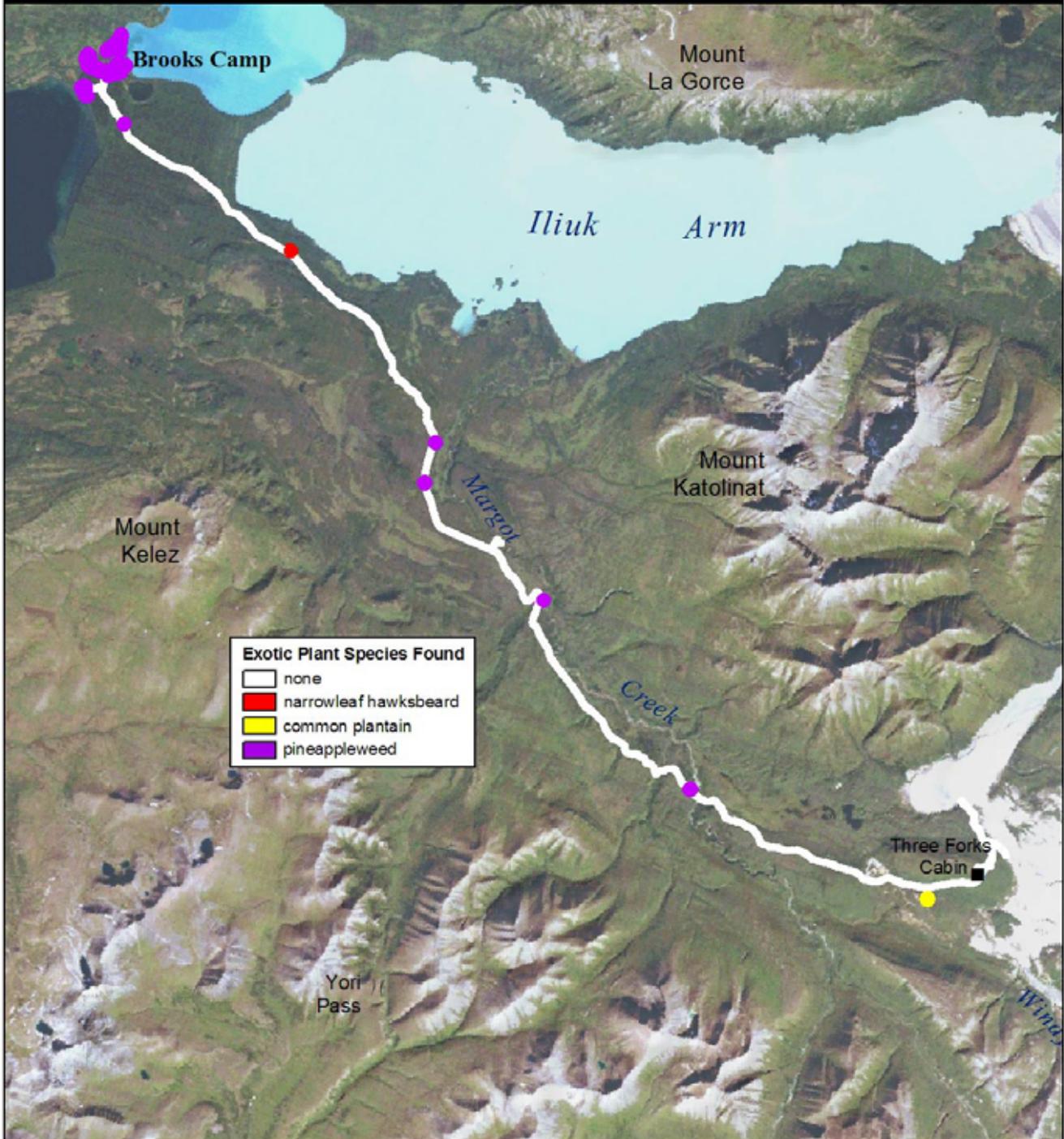


Source:  
AVEP/MT coverages collected with a Trimble GPS receiver  
Date: 03 Nov 05

# Exotic Plant Management Team Survey 2005 Valley of Ten Thousand Smokes Road Katmai National Park and Preserve



National Park Service  
U.S. Department of the Interior



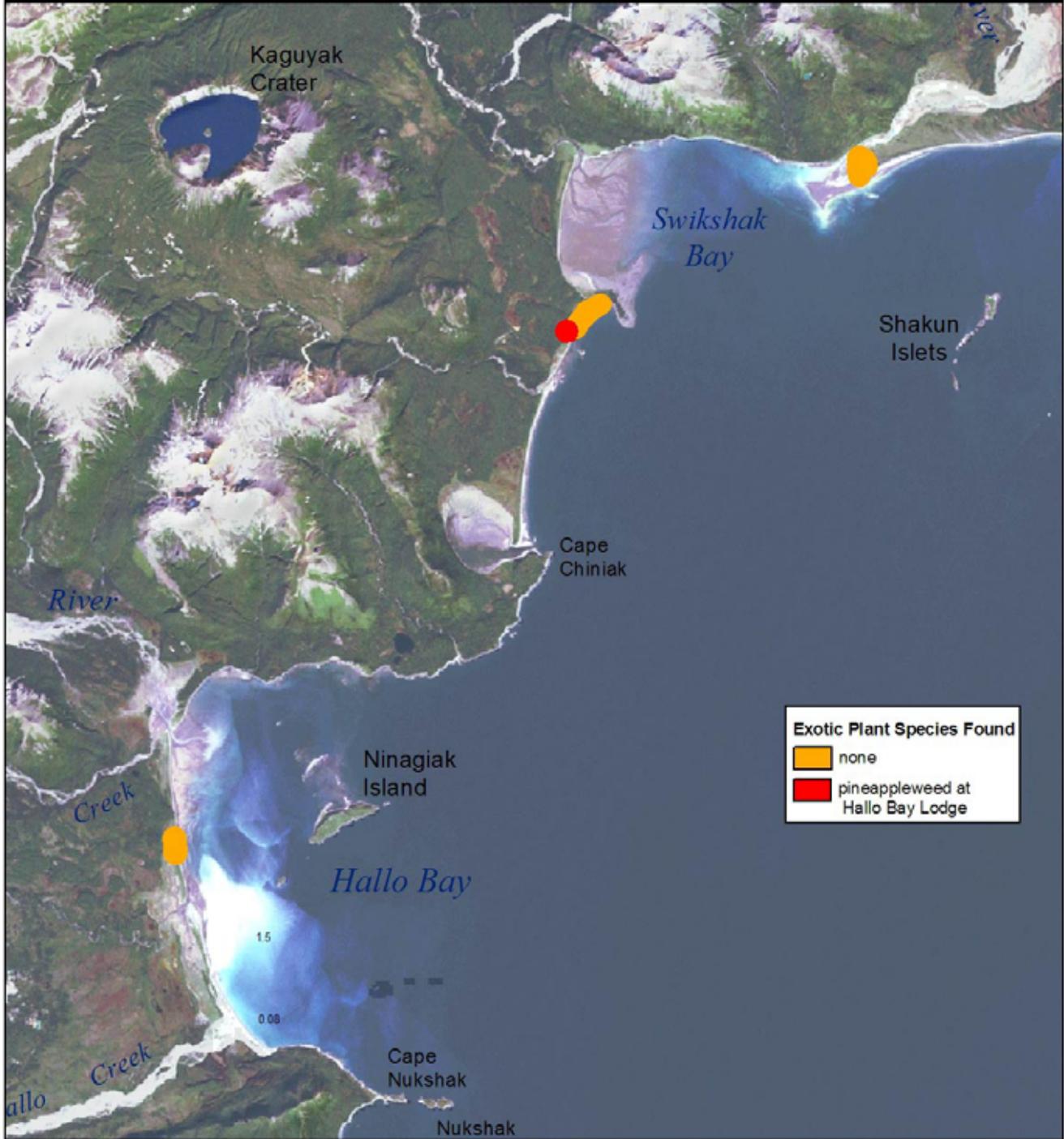
Source:  
AKEPMT coverages collected with a Trimble GPS receiver  
Date: 03 Nov 05

N  
1:140,000

# Exotic Plant Management Team Survey 2005 Outer Coast Katmai National Park and Preserve



National Park Service  
U.S. Department of the Interior



**Exotic Plant Species Found**  
[Yellow] none  
[Red] pineappleweed at Hallo Bay Lodge

0 1.25 2.5 5 7.5 10 Miles



1:135,000

Source:  
AKEPMT coverages collected with a Trimble GPS receiver  
Date: 03 Nov 05

Table 1. Selected fields used in GPS data dictionary and GIS shapefile for invasive plant surveys, summer 2005.

LocationID	Location ID (lake_camp, brooks_camp, 10,000_smokes_rd, katmai_outer_coast)
Dstrbncs	Disturbance Type (coastal, stream, river, glacier, fill importation, trampling, wind throw, slide, animal, material extraction, ORV disturbance, mowing, wildfire, logging, mining, grazing, plowing, brush cutting, herbicide, wind, thermal, volcano, abandoned homesite, or other)
LctnDscrpt	Location Description
BufferM	Buffer distance (in meters) to convert points and lines to polygons
Taxon	Dominant exotic species
Phenology	Phenology of dominant exotic species (rosette, no_flower, full_flower, in_seed, stand_dead, or none)
CvrClsPer	Cover class percentage of dominant exotic species (0, 1, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100)
Action	Inventory, Monitor, Treatment, or Retreatment
Treatment	Treatment type (none, Pull/Dig-Manual, Cut, Basal Bark, Basal- thinline, other)
CntrlEffrt	Projected/actual control effort for one person through hand pulling (low <1 hour, medium 1-8 hours, high >8 hours)
Undetermined	Stem count of dominant exotic species
Remarks	Remarks
StartDate	Date of site visit
StartTime	Time of site visit
AssocPark	Associated park (KATM)
Recorder	Recorder (PSB = Penny Bauder, JAH = Jeff Heys)
Taxon2, Taxon3...	Additional 4 fields for 4 other exotic taxa for each unique site including fields for Phenology, Cover Class Percentage, and Stem Count
Spatial Accuracy Fields	Range of attributes to describe spatial information and precision
Acres	GIS-calculated acreage of each infested or uninfested area

Table 2. KATM Exotic Plant List

<b>Scientific Name</b>	<b>Common Name</b>	<b>Location Description</b>
<i>Capsella bursa-pastoris</i>	shepherd's purse	Lake Camp, Brooks Camp
* <i>Crepis tectorum</i>	narrowleaf hawksbeard	gravel pit on Valley of Ten Thousand Smokes road
* <i>Erysimum cheiranthoides</i>	wormseed mustard	Brooks Camp
* <i>Leucanthemum vulgare</i>	oxeye daisy	Lake Camp road
<i>Matricaria discoidea</i>	pineappleweed	Lake Camp, Brooks Camp, Valley of Ten Thousand Smokes road, Kaguyak Bay
<i>Plantago major</i>	common plantain	Brooks Camp, Valley of Ten Thousand Smokes social trail
<i>Poa annua</i>	annual bluegrass	Brooks Camp
<i>Poa pratensis</i>	Kentucky bluegrass	Brooks Camp, Valley of Ten Thousand Smokes road
<i>Polygonum aviculare</i>	prostrate knotweed	Brooks Camp
<i>Rumex acetosella</i>	common sheep sorrel	Lake Camp, Brooks Camp
<i>Taraxacum officinale</i> ssp. <i>officinale</i>	common dandelion	Brooks Camp
<i>Trifolium repens</i>	white clover	Brooks Camp

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