

Survey and Mapping
of 14 Invasive and Exotic Plants
on the University of Alaska Fairbanks Campus



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Introduction

A seasonal IPM (integrated pest management) technician was hired at the Cooperative Extension Service for the purpose of creating a map of key invasive plants on the UAF campus. The project was funded through a USDA Forest Service grant partnership as part of the IPM program, which includes a focus on invasive species.

The maps and data resulting from this project will be the first step toward creating an invasive plant management plan for campus. The community of Fairbanks, as well as agencies such as the US Forest Service, Fairbanks Soil and Water Conservation District, and the Cooperative Extension Service, are witnessing a growing need for the strategic management of invasive plants in our community. Several invasive plants have been expanding their range at an almost exponential rate and action is needed to save our native plant communities, gardens, and roadsides. Before strategic actions can be taken, however, people must know the locations and numbers of invasive plants within a management area.

Goals of Project

The goals of this project were to:

1. Create a map, or series of maps, to show the locations and densities of key invasive plants on the UAF campus in a way that is easy to interpret and understand.
2. Collect other data such as disturbance type, vegetation classification, and phenology to provide a more comprehensive picture of invasion ecology in interior Alaska.
3. Produce a final report summarizing the results of the project and recommendations for controlling invasive and exotic plants on campus.

Methods

Field Work (Surveying and Mapping)

A team of scientists was consulted to come up with a list of plant species to be mapped based on the plants' ability to survive the winter, their invasiveness ranking, and whether they would be expected to occur in Fairbanks. The scientists consulted included Dr. Jeff Conn of the Agricultural Research Service, Michele Hebert of the Cooperative Extension Service, and Tricia Wurtz of the USDA Forest Service. Fourteen plant species were selected to be mapped on the University of Alaska Fairbanks campus. These species were:

<u>Common Name</u>	<u>Scientific Name</u>	<u>Exotic Plant Species Code</u>
Annual hawksbeard	<i>Crepis tectorum</i>	CRTE3
Bird vetch	<i>Vicia cracca</i>	VICRC
Black bindweed	<i>Polygonum convolvulus</i>	POCO10
Brittlestem hempenettle	<i>Galeopsis tetrahit</i>	GATE2
Butter and eggs	<i>Linaria vulgaris</i>	LIVU2

Canada thistle	<i>Cirsium arvense</i>	CIAR4
Common tansy	<i>Tanacetum vulgare</i>	TAVU
European bird cherry	<i>Prunus padus</i>	PRPA5
Oxeye daisy	<i>Leucanthemum vulgare</i>	LEVU
Perennial sowthistle	<i>Sonchus arvensis</i>	SOAR2
Siberian pea	<i>Caragana arborescens</i>	CAAR18
Tansy ragwort	<i>Senecio jacobea</i>	SEJA
White sweetclover	<i>Melilotus alba</i>	MEAL12
	<i>Medicago sativa ssp.</i>	
Yellow alfalfa	<i>Falcata</i>	MESAF

Almost all of the disturbed soils on campus were surveyed for invasive plants. Several areas were avoided due to construction or other barriers. Survey methods involved walking back and forth across a given survey area until the entire area had been visually inspected.

Data was taken using a variation of the AKEPIC Field Data Sheet¹, and included:

1. Surveyor's name
2. Date of survey
3. Site Code
4. Area Surveyed (using standardized options- 0.001 acres, 0.01 acres, 0.1 acres, 0.5 acres, 1 acre, etc.)
5. Site Vegetation Community Description (Vioreck Code, according to AKEPIC manual)
6. Disturbance Type (AKEPIC options, with several new ones added, including 'roadside', 'parking lot perimeter', 'trail', 'trailside', and 'landscaping')
7. Exotic Plant Species Code*
8. Infested area* (standardized acre divisions, same as area surveyed)
9. Canopy cover* (standardized percentages: 1%, 5%, 10%, etc.)
10. Stem count* (standardized options: 1-5, 6-25, 26-50, 51-150, 151-500, 500+)
11. Phenology* (vegetative= v, budding= b, flowering= f, seeding= s)
12. Notes

*These data slots were filled out in chart form, allowing multiple species to be recorded on each data sheet (for each polygon).

In ArcView GIS, a grid was placed over the top of an aerial photo of campus, and each grid square was printed off to be the size of an 8.5x11 inch sheet of paper. These enlarged aerial photos of campus were taken out in the field. At the location of every invasive plant population, a polygon was drawn on the map representing the distribution of the plants. Each polygon was labeled with a site code, corresponding to the grid number plus an identifying letter (i.e. N14A, which would be the grid square N14 and the first polygon drawn, A). For the trails, larger sections were printed off and the polygons were named using letter codes based off of the actual trail names (e.g. Skarland trail has code SK followed by a polygon number such as SK3).

Sixteen GPS points were also recorded throughout campus at central locations. In the future, the data collected can be entered in the AKEPIC database using these GPS coordinates if so desired.

¹ The data sheet used can be referenced in Appendix A.

Data Entry and Map Creation (GIS)

The survey data was all entered in an Excel spreadsheet. The polygons that had been drawn in the field were entered into ArcView GIS. This was done by creating polygon layers in GIS and entering the site code, each species code, and the species density (based on stem count divisions: 1-25 = low, 26-150 = medium, and 151+ = high) for each polygon, as well as a special number code for each species-density combination.

Separate GIS layers were then created for each exotic plant species/density combination (i.e. VICRC-Low, VICRC-Medium, and VICRC-High) by querying for the given number codes of each combination, so that each of these combinations will show up as a different colored polygon on the map.

A GIS layer was also created for each number of exotic plant species per polygon. This was the easiest way to make a good overview map showing the distribution and diversity of invasive plants across campus.

Phenology of Target Invasive and Exotic Plants

While surveying for invasive plants on the UAF campus, the phenological stages of plants were also recorded. It was noted whether the plant population was growing vegetatively, budding, flowering, or seeding. The data presented here represents the first time an individual of each species was noticed in that phenological stage:

Species	<u>First date of:</u>		
	Budding	Flowering	Seeding
CAAR18	?	6/12	6/23
CRTE3	6/10	6/11*	7/7
GATE2	?	7/24	7/24
LEVU	?	7/7	?
LIVU2	?	7/10	7/11
MEAL12	6/4	6/26	7/28**
MESAF	6/11	6/17	7/14
POCO10	7/17	7/17	7/24
PRPA5	?	6/4	6/17
SOAR2	7/11	7/11	8/1**
VICRC	6/10	6/11	6/24

* Most plants started flowering around 6/26

**Observed outside of surveying

Many of the dates will be later than the reality because it was only possible to record the phenology of those species that were currently being mapped. Therefore, if actions are taken to control a species, the manager should make sure there is a time buffer before the first recorded seeding date. Other factors, especially weather, will also result in variability. No data was collected before 6/4/2008 and there are several instances where a species did not occur in the survey route until it was at the flowering stage.

Results

Eleven out of the 14 plant species surveyed for were found on campus. The three species not found were Canada thistle, common tansy, and tansy ragwort. 461 polygons were mapped over the duration of the project.

The number of polygons that each species was present in and the percent of the total sites (461) where each species was found was calculated (Table 1).

Table 1.

<u>Species</u>	<u># of polygons present in</u>	<u>% of total sites where found</u>
<i>Vicia cracca</i>	391	84.8
<i>Melilotus alba</i>	145	31.5
<i>Crepis tectorum</i>	121	26.2
<i>Prunus padus</i>	117	25.4
<i>Medicago sativa ssp. Falcata</i>	95	20.6
<i>Caragana arborescens</i>	41	8.9
<i>Sonchus arvensis</i>	34	7.4
<i>Linaria vulgaris</i>	16	3.5
<i>Polygonum convolvulus</i>	11	2.4
<i>Galeopsis tetrahit</i>	5	1.1
<i>Leucanthemum vulgare</i>	4	0.9
<i>Cirsium arvense</i>	0	0.0
<i>Senecio jacobea</i>	0	0.0
<i>Tanacetum vulgare</i>	0	0.0

The number of locations where each density range of each species was found was also calculated (Table 2)*.

Table 2.

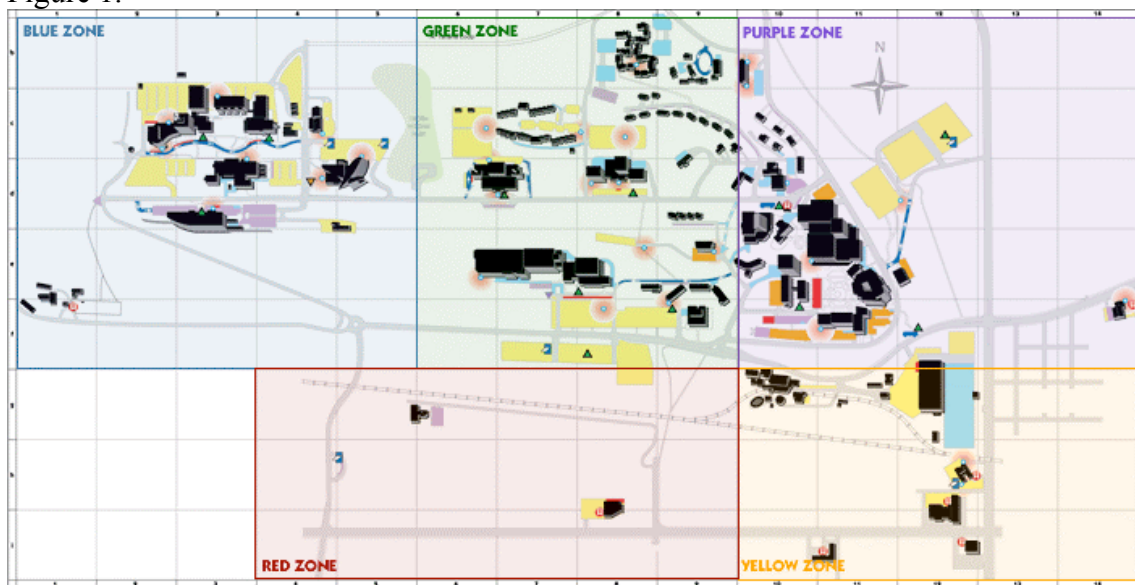
<u>Species and Density*</u>	<u># of polygons</u>
<i>Vicia cracca</i> - Low	28
<i>Vicia cracca</i> - Medium	62
<i>Vicia cracca</i> - High	301
<i>Melilotus alba</i> - Low	48
<i>Melilotus alba</i> - Medium	49
<i>Melilotus alba</i> - High	48
<i>Crepis tectorum</i> - Low	70
<i>Crepis tectorum</i> - Medium	34
<i>Crepis tectorum</i> - High	17
<i>Prunus padus</i> - Low (Wild)	65
<i>Prunus padus</i> - Medium (Wild)	11
<i>Prunus padus</i> - High (Wild)	1
<i>Prunus padus</i> - Low (Planted)	26
<i>Prunus padus</i> - Medium (Planted)	8
<i>Prunus padus</i> - High (Planted)	6
<i>Medicago sativa ssp. Falcata</i> - Low	28
<i>Medicago sativa ssp. Falcata</i> - Medium	28
<i>Medicago sativa ssp. Falcata</i> - High	39

<i>Caragana arborescens</i> - Low (Wild)	5
<i>Caragana arborescens</i> - Medium (Wild)	6
<i>Caragana arborescens</i> - High (Wild)	10
<i>Caragana arborescens</i> - Low (Planted)	7
<i>Caragana arborescens</i> - Medium (Planted)	2
<i>Caragana arborescens</i> - High (Planted)	11
<i>Sonchus arvensis</i> - Low	13
<i>Sonchus arvensis</i> - Medium	14
<i>Sonchus arvensis</i> - High	7
<i>Linaria vulgaris</i> - Low	1
<i>Linaria vulgaris</i> - Medium	4
<i>Linaria vulgaris</i> - High	11
<i>Polygonum convolvulus</i> - Low	6
<i>Polygonum convolvulus</i> - Medium	5
<i>Galeopsis tetrahit</i> - Low	1
<i>Galeopsis tetrahit</i> - Medium	2
<i>Galeopsis tetrahit</i> - High	2
<i>Leucanthemum vulgare</i> - Low	4

*Density is based on stem count: Low= 1-25 stems, Medium= 26-150 stems, High= 151+ stems

The distribution of each species was also examined in reference to the campus map found on the University of Alaska Fairbanks website². This map contains five different zones that are color-coded and represent different parts of main campus (Figure 1). An additional zone was added to represent the North Campus trail system for the purpose of this project. The trails zone includes all of the trails and roads that are not included on the campus map but that were surveyed by the IPM technician.

Figure 1.



² University of Alaska Fairbanks. 2008. Campus Map. [On-line] Available <http://www.uaf.edu/campusmap/>. 26 August 2008.

The data resulting from this analysis showed that most of the species were distributed throughout campus (Table 3). Five species were found in all zones including the trails and seven of the target species were found along the trail system. Maps showing the distributions of each individual species can be found at the end of this report.

Table 3.

<u>Species</u>	<u>Locations (campus zones) where species is present</u>					
	<u>Blue</u>	<u>Green</u>	<u>Purple</u>	<u>Red</u>	<u>Yellow</u>	<u>Trails</u>
<i>Crepis tectorum</i>	x	x	x	x	x	x
<i>Vicia cracca</i>	x	x	x	x	x	x
<i>Polygonum convolvulus</i>	x	x	x	x		
<i>Galeopsis tetrahit</i>	x					
<i>Linaria vulgaris</i>	x	x		x		x
<i>Cirsium arvense</i>						
<i>Tanacetum vulgare</i>						
<i>Prunus padus</i>	x	x	x	x	x	x
<i>Leucanthemum vulgare</i>	x	x				
<i>Sonchus arvensis</i>	x	x	x	x	x	
<i>Caragana arborescens</i>	x	x	x	x		x
<i>Senecio jacobea</i>						
<i>Melilotus alba</i>	x	x	x	x	x	x
<i>Medicago sativa ssp.</i>						
<i>Falcata</i>	x	x	x	x	x	x

Invasive & Exotic Plant Recommendations for the UAF campus

Fourteen exotic and invasive plant species were mapped during the summer of 2008 on the University of Alaska Fairbanks campus. It is important to note that there are other invasive and exotic plant species on campus that were not mapped and will not be covered in this set of recommendations, but that could have an equally significant impact on the natural vegetation of UAF.

For these recommendations, the 14 species were divided into three groups:

- The first group is composed of species that are already a significant problem on campus.
- The second group is made up of species that are still fairly limited in distribution and could be eradicated through volunteer efforts or other small-scale approaches.
- The third group contains species that were not found on campus, were found in such small numbers and distribution as to be inconsequential, or whose impact is questionable at this point in time.

Group 1- Problem Species

The species in Group 1 have a widespread distribution on campus and are posing a significant threat to native vegetation, wildlife habitat, and/or human activities. Actions to

control these species from expanding further and prevent them from distributing large amounts of seeds should be conducted every summer.

1. *Vicia cracca* (bird vetch):

Bird vetch is a perennial plant that has multiple vine-like stems with small tendrils and leaves comprised of 8-10 leaflets. It has purple flowers and the fruits are contained in dehiscent pods. Seeds disperse by the seedpods popping open and shooting the seeds out³. Bird vetch is the most invasive weed on the University of Alaska Fairbanks campus. It is a resilient plant that can be difficult to control and has been found moving into natural, undisturbed vegetative communities⁴. Bird vetch can have numerous negative effects on the natural ecosystem, wildlife habitat, and human activities. Controlling bird vetch from expanding further into undisturbed ecosystems should be a priority.

Recommendations for controlling bird vetch are as follows:

- 1- Mow and weed-whack bird vetch along roads and trails and in open places such as fields on a monthly basis (starting in early June) to keep the plants from producing seed, to reduce root reserves, and to prevent the bird vetch from choking out other species
- 2- Coordinate volunteer efforts to dig up bird vetch along the trail system (or possibly apply small amounts of herbicide) during June and early July



Vicia cracca at the end of Range Road on campus (Photo taken 8/22/08 by Jessica Guritz)

³ Alaska Committee for Noxious and Invasive Plants Management. 2004. Invasive Plants. [On-line] Available <http://www.uaf.edu/ces/cnipm/plants.html>. 21 August 2008.

⁴ Conn, J., Z. Baer, N. Werdin-Pfisterer, and K. Mohrmann. 2007. Susceptibility of Alaska Plant Communities to Invasion by Bird Vetch (*Vicia cracca* L.). USDA Agricultural Research Service, Fairbanks, Alaska. [On-line] Available <http://www.uaf.edu/ces/cnipm/docs/8thAnnual/1340-Conn-VICRPP-r.pdf>. 21 August 2008.

2. *Melilotus alba* (white sweet clover):

White sweetclover is a biennial legume with branching stems and 3-part leaves. Plants can grow 2 to 6 feet tall. The flowers are small and white and are arranged in spikes at the tops of branches³. Seeds are distributed by wind and water⁵. White sweet clover is found along many roads and other disturbed soils on campus and is prevalent throughout the road systems of Alaska. While this species is especially unwanted along waterways⁶, it is also undesirable in other locations because it takes habitat from native plants and tends to become the dominant species along roadways.

Recommendations for controlling white sweet clover are to:

- 1- Mow and weed-whack white sweet clover where possible in June and early July (before it produces seeds)
- 2- Prevent the transfer of gravel or other materials containing white sweet clover seeds into weed-free locations
- 3- Hand-pull (best done in fall of 1st-year growth or in May/June for 2nd-year plants⁷) or apply low doses of herbicide in the few locations where it is invading the UAF trail system

3. *Medicago sativa ssp. falcata* (yellow alfalfa):

Yellow alfalfa is a perennial plant that is less than 3 feet tall and has multiple stems. The leaves are alternate, hairy, and made up of 3 leaflets. Flowers are small and yellow and the fruit is a small pod enclosing several seeds. Seeds are dispersed by falling off of the plant or by herbivores eating and dispersing them⁸. Yellow alfalfa primarily occurs near old agricultural fields and research areas on campus. It has spread along the trail system to some degree, but does not appear to be invading undisturbed ecosystems.

Recommendations for yellow alfalfa are:

- 1- Weed-whack where possible in late June to early July
- 2- Consider digging up plants or using spot herbicides to prevent spread of this species along the trail system (the plant's growth habit and root system makes hand-pulling difficult)

4. *Crepis tectorum* (narrow-leaf hawksbeard):

Narrow-leaf hawksbeard is an annual plant with a single, branching stem that grows 1-2 feet tall. Leaves are narrow and toothed³. Flowers are yellow and the seeds are dispersed by wind⁹. Populations of narrow-leaf hawksbeard are scattered throughout campus around buildings

⁵ USGS. 2006. An Assessment of Exotic Plant Species of Rocky Mountain National Park. [On-line] Available <http://www.npwrc.usgs.gov/resource/plants/explant/melialba.htm>. 21 August 2008.

⁶ Conn, J. *et al.* 2008. Alaska *Melilotus* invasions: Distribution, Origin, and Susceptibility of Plant Communities. Arctic, Antarctic, and Alpine Research, Vol. 40, No. 2, pp. 298-308.

⁷ Wisconsin Department of Natural Resources. 2004. White Sweet Clover. [On-line] Available http://dnr.wi.gov/invasives/fact/clovers_white.htm. 31 July 2008.

⁸ Alaska Natural Heritage Program. 2005. Non-Native Plant Species of Alaska: Yellow alfalfa. Environment and Natural Resources Institute, University of Alaska Anchorage.

⁹ Alaska Natural Heritage Program. 2006. Non-Native Plant Species of Alaska: Narrow-leaf hawksbeard. Environment and Natural Resources Institute, University of Alaska Anchorage.

and roads and near agricultural areas. Population densities are usually low, but the species occurs in small numbers almost everywhere on campus (but not on the trail system...yet).

Recommendations to control narrowleaf hawksbeard are to:

1- Hand-pull and bag the plants before they produce seeds¹⁰ (before early July), especially near trailheads

5. *Caragana arborescens* (Siberian peashrub):

Siberian peashrub is a large shrub to small tree with an oval crown and alternate, deciduous, pinnately compound leaves. The flowers are bright yellow and the fruits are peapod-like. Siberian pea pods split and release 3-5 seeds each during late summer¹¹. Siberian peashrub occurs in several general locations on campus, where it grows densely and invades the natural ecosystems nearby. This shrub has been planted as a landscaping shrub in many locations, either before its invasive potential was known or in disregard to its invasive potential.

Recommendations for this species are:

- 1- Do not plant any new Siberian pea shrubs anywhere on campus (especially adjacent to natural vegetation)
- 2- Either replace existing shrubs with a non-invasive shrub or try to trim them more meticulously to prevent the seed from being distributed
- 3- Contain existing populations by pulling up new seedlings and killing mature plants where possible through hand pulling and/or herbicide use¹²



Caragana arborescens invading the boreal forest on campus (Photo taken 8/11/08 by Jessica Guritz)

¹⁰ Densmore, R., P. McKee, and C. Roland. 2001. Exotic Plants in Alaskan National Park Units. National Park Service, Alaska.

¹¹ Virginia Tech Forestry Department. 2008. Pea tree. [On-line] Available <http://www.cnr.vt.edu/dendro/dendrology/Syllabus2/factsheet.cfm?ID=763>. 25 August 2008.

¹² Minnesota DNR. 2008. Siberian peashrub. [On-line] Available <http://www.dnr.state.mn.us/invasives/terrestrialplants/woody/siberianpeashrub.html>. 31 July 2008.

Group 2- Species of Limited Distribution

The species in Group 2 have a fairly limited distribution and abundance on campus and should be targeted for eradication. This will probably require a significant effort by volunteers, hopefully in coordination with maintenance and landscaping crews. Some of these species will be easier to eradicate than others. The number of locations where each species is found can be referenced in Table 4. Despite the effort required to eradicate these species from campus, destroying the populations before they spread will be a great step forward for the University of Alaska Fairbanks campus.

1. *Sonchus arvensis* (perennial sow thistle):

Perennial sow thistle is a perennial plant that grows from 2-4 feet tall. Leaves are prickly and occur as a basal rosette as well as sparse, clasping stem leaves. The plant oozes a white milky sap when damaged. Flowers are yellow and look similar to dandelion flowers. Perennial sow thistle reproduces from seeds and rhizomes³. Perennial sow thistle occurs in small, scattered populations throughout campus, and is a good target for eradication.

Recommendations for perennial sow thistle are to:

- 1- Dig up the plants or kill them using herbicides (hand-pulling is not effective due to its extensive root system)
- 2- The area around the physical plant should be targeted especially, because this is where the largest perennial sow thistle population is on campus and the seeds can be transported to other locations on machinery and in soil or fill materials. Herbicides could be used at the physical plant

2. *Polygonum convolvulus* (black bindweed):

Black bindweed is an annual with heart-shaped leaves and slender stems that trail on the ground and twine around other plants. It has triangular black seeds and each plant can produce up to 1,000 seeds¹³. Black bindweed is found in only a few small populations on campus.

Recommendations:

- 1- Mechanical control methods generally do not work that well on black bindweed¹⁴ but they may be tried, especially on very small populations. Digging up the plants or using herbicides will probably work the best.
- 2- Black bindweed should also not be spread through the movement of gravel, soil, and other materials on campus.

¹³ Government of British Columbia, Ministry of Agriculture and Lands. n.d. Field Guide to Noxious and Other Selected Weeds of British Columbia: Wild Buckwheat. [On-line] Available <http://www.agf.gov.bc.ca/cropprot/weedguid/buckwht.htm>. 25 August 2008.

¹⁴ Alaska Natural Heritage Program. 2006. Non-native plant species of Alaska: Black Bindweed. Environment and Natural Resources Institute, University of Alaska, Anchorage.

3. *Galeopsis tetrahit* (brittle stem hempnettle):

Hempnettle is an annual plant that usually grows 1-1.5 feet tall. It has a square stem and white, pink, or purple flowers that are clustered in the axils of the upper leaves. Hempnettle produces very large numbers of seeds³. Hempnettle was only found in two locations on campus: near the experimental farm and in a research equipment storage area on West Ridge.

Recommendations:

- 1- Repeated hand-pulling or herbicide use is recommended
- 2- Workers should be careful not to spread hempnettle by moving soil from near the experimental farm
- 3- Researchers should clean their equipment when moving it out of the storage area on West Ridge to prevent the accidental distribution of hempnettle seeds.



A dense population of *Galeopsis tetrahit* on campus (photo taken 7/24/08 by Jessica Guritz)

4. *Linaria vulgaris* (butter & eggs/yellow toadflax):

Yellow toadflax is a perennial plant that grows 1-2 feet tall. It has pale green, narrow, pointed leaves and yellow-orange flowers. It reproduces by seed and by creeping rootstock (rhizomes)³. There were not many populations of yellow toadflax found on campus. This species should be targeted for eradication. When established, it can be highly unpleasant to deal with, mostly due to its extensive root system and ability to reproduce using rhizomes¹⁵.

¹⁵ Densmore, R., P. McKee, and C. Roland. 2001. Exotic Plants in Alaskan National Park Units. National Park Service, Alaska.

Recommendations:

- 1- There is a large population of *Linaria vulgaris* along the railroad tracks that run through campus. Other invasive plants also have high densities in this location. Using herbicides along the railroad tracks to eliminate these dense populations before they are able to spread any more will be the most efficient and effective option (although this may be controversial).
- 2- Carefully digging up the plants or using herbicides should work to control other populations on the UAF campus.

Group 3- Not Present, Insignificant, or Questionable Species

1. *Leucanthemum vulgare* (oxeye daisy):

Oxeye daisy is a perennial plant with white ray and yellow disk flowers. The leaves are larger toward the bottom of the plant and range from crenate to toothed³. Only a few populations of oxeye daisy were found on campus, and each contained fewer than 25 individuals. At this point in time, oxeye daisy is not a problem on campus.

Recommendations:

Future monitoring can be done to ensure that the daisy does not become a problem species.

2. *Tanacetum vulgare* (common tansy):

Common tansy is a perennial plant that grows 3-5 feet tall. The leaves are pinnately compound and irregularly lobed. Flowers are button-like and consist of yellow daisy-like disks that are up to 0.5" wide. Seeds are dispersed by wind and water, and the plants can spread vegetatively from their roots as well¹⁶. Common tansy was not found anywhere on campus.

Recommendations:

Monitoring can be done in the future for this species.

3. *Senecio jacobea* (tansy ragwort):

Tansy ragwort is a biennial or short-lived perennial plant that grows from 1 to 6 feet tall. It has a deep taproot and the leaves are 2-3 times pinnately lobed. Flower heads consist of yellow disk and ray flowers. This plant can be toxic to livestock³. Tansy ragwort was not found on the UAF campus.

Recommendations:

Monitoring efforts should be continued for tansy ragwort.

4. *Cirsium arvense* (Canada thistle):

Canada thistle is a perennial plant that reproduces through both seed and rhizomes. It can grow from 1-4 feet tall. The leaves have spine-tipped lobes and flowers are purple³. This species was not found on campus, but is a very difficult plant to eradicate once established.

Recommendations:

Monitoring should be continuously done for Canada thistle.

¹⁶ Minnesota Department of Natural Resources. 2008. Common tansy (*Tanacetum vulgare*). [On-line] Available <http://www.dnr.state.mn.us/invasives/terrestrialplants/herbaceous/commontansy.html>. 25 August 2008.

5. *Prunus padus* (European bird cherry):

European bird cherry is a small deciduous tree with oval, dark green leaves. It has small, aromatic white flowers and the fruit is a black cherry¹⁷. The fruit is very attractive to birds, and as such, is distributed throughout campus in bird droppings.

European bird cherry is found in many locations on campus, but is usually found at low densities, and almost always as small seedlings. Due to the low densities of seedlings found on campus and the apparently low survival probability of these seedlings (based on observation, not scientific study), it is doubtful what impact this species is having or could have on native vegetation.

Recommendations:

- 1- European bird cherry should be monitored in the future, and if it seems to be becoming a problem, control efforts can be carried out
- 2- Not planting any new European bird cherries on campus would also be a very good idea. Other *Prunus* varieties or different ornamental trees and shrubs could be planted instead

Table 4. Summary of Invasive Species Recommendations

Species	# of locations on campus	Invasiveness Ranking ¹⁸	Action	Control Method(s) ¹⁹	Timing	Resources needed			
<i>Vicia cracca</i>	391	73	Prevent further expansion	Mowing/weed-whacking & digging up or herbicide use	June (preferably before 6/20)	Landscape/maintenance crew cooperation and volunteer efforts			
<i>Melilotus alba</i>	145	80	Prevent further expansion	Mowing/weed-whacking & hand-pulling or herbicide use	June-early July	Landscape/maintenance crew cooperation and possible volunteer efforts			
<i>Caragana arborescens</i>	41	66	Prevent further expansion	Prevention, hand-pulling, and/or herbicide use	May- June (preferably before 6/20)	Volunteers			
<i>Medicago sativa ssp. falcata</i>	95	64	Prevent further expansion	Weed-whacking & digging up or herbicide use	late June-early July (before 7/10)	Landscape/maintenance crew cooperation and possible volunteer efforts			
<i>Crepis tectorum</i>	121	54	Prevent further expansion	Hand-pulling	late June-early July (before 7/7)	Volunteers			
<i>Linaria vulgaris</i>	16	69	Eradicate	Digging up and/or herbicide use	June-early July (before 7/11)	Volunteers and possible cooperation with railroad staff/management			
<i>Sonchus arvensis</i>	34	61	Eradicate	Prevention, digging up	June- mid July	Physical plant cooperation and workers, plus volunteer efforts			

¹⁷ AKEPIC-Alaska Exotic Plant Information Clearinghouse. 2005. Invasive Plants of Alaska. Alaska Association of Conservation Districts Publication. Anchorage, Alaska.

¹⁸ Alaska Natural Heritage Program. 2005. Weed Ranking Project. [On-line] Available http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm. 27 August 2008.

¹⁹ Herbicide information can be found in Appendix B. on page 21

				and/or herbicide use				
<i>Galeopsis tetrahit</i>	5	40	Eradicate	Repeated hand-pulling or herbicide use	June- mid July (before 7/20)	Volunteers and cooperation with experimental farm workers and research scientists		
<i>Polygonum convolvulus</i>	11	Not ranked	Eradicate	Prevention, digging up and/or herbicide use	June- mid July (before 7/20)	Lanscaping crew cooperation and volunteers		
<i>Cirsium arvense</i>	0	76	Monitor					
<i>Prunus padus</i>	117	74	Monitor	Prevention		Cooperation of landscaping staff		
<i>Senecio jacobea</i>	0	63	Monitor					
<i>Leucanthemum vulgare</i>	4	61	Monitor					
<i>Tanacetum vulgare</i>	0	57	Monitor					

Priorities for Invasive Plant Management

Priorities for volunteer efforts include:

- (1) Removing the bird vetch along the UAF trail system
- (2) Working toward eradication of the four species in Group 2 (perennial sow thistle, black bindweed, brittlestem hemp nettle, and yellow toadflax).

Priorities for landscaping, maintenance, and construction crews include:

- (1) Using weed-free soil, fill, and other materials
- (2) Cleaning equipment to prevent the transfer of invasive plant seeds
- (3) Where soils are disturbed, re-vegetate with native plants
- (4) Control the invasive plants around the Physical Plant
- (5) Help eradicate the species in Group 2



Sonchus arvensis infestation in a sand pile at the Physical Plant (Photo taken 6/11/08 by Jessica Guritz)

Education and Outreach

The IPM technician participated in monthly CNIPM (the Alaska Committee for Noxious and Invasive Plant Management) teleconferences. The technician will also be attending the CNIPM conference in October and presenting a poster about the mapping of invasive plants on the UAF campus.

An article describing the project was written by the IPM technician. It will be published on the front page of the September issue of the Master Gardener's Newsletter.

An Invasive Plant Workshop and Guided Tour was held on August 16, 2008. There were over 30 participants and the workshop was an overall success, with participants expressing their interest and appreciation for the event. During the guided tour, the mapping of invasive plants on the UAF campus was discussed and a poster was displayed showing the number of target invasive plants per polygon.



Seasonal IPM technician Jessica Guritz displaying a map of invasive plants on campus (8/16/08)

Conclusions and Suggestions for Further Study

This project was unique in the choice of methods used. Past research conducted on invasive plants at the Cooperative Extension Service has used the AKEPIC system for entering data. This system relies on GPS coordinates and is generally used on large areas, such as highways. The mapping of invasive plants on the UAF campus presented difficulties in that a higher degree of precision was needed due to the relatively small size of campus. Using printed maps from GIS to record precision data turned out to be an excellent strategy. High-quality maps were produced and the data can now be more easily understood and used by the public than it would be in the AKEPIC database.

Survey results showed that several species had already taken over large portions of campus property and present a serious problem to ecosystem diversity and human activities, such

as recreation and landscaping. These species include *Vicia cracca*, *Melilotus alba*, *Crepis tectorum*, *Medicago sativa ssp. Falcata*, and *Caragana arborescens*. Other species possess somewhat limited distributions on campus and are a good target for eradication, or at least control, through volunteer efforts. These species include *Linaria vulgaris*, *Sonchus arvensis*, *Galeopsis tetrahit*, and *Polygonum convolvulus*. One species, *Prunus padus*, is still questionable as to its impact on native vegetation on the University of Alaska Fairbanks campus. Specifically monitoring this species would be a good idea, in order to make sure it does not become a problem. On a positive note, three of the target invasive plants were not found on campus. This is a good sign.

Due to time limitations, the IPM technician was only able to map fourteen species on campus. In an ideal study, more species would have been mapped. However, this leaves plenty of opportunities for further study. Mapping the invasive grasses on the UAF campus would be a very good project. The most important research to follow this project will be monitoring efforts. It will be crucial to monitor the success of any control efforts as well as the expansion of invasive plants into other areas.

The groundwork has now been laid for invasive plant management and future monitoring on the University of Alaska Fairbanks campus. It will be important to take action quickly and efficiently, before invasive plants succeed in completely taking over the campus!

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Disturbance Type : Fill Importation (e.g., Road or Railroad Grade), Material Extraction (e.g., Rock Quarry or Gravel Pit, ORV Disturbance, Mowing, Trampling, Logging, Mining, Grazing, Plowing, Mechanical Brush/Tree Cutting, Herbicide Application, Other Mechanical Substrate Alteration Or Removal, Abandoned Homesite, River Action (i.e., Flooding, /Erosion-Ice Scour/Deposition, Stream Action, Forest Fire, Land Slide/Avalanche, Caribou/moose/animal related disturbed site, Windthrow, Wind Erosion/Deposition, Thermal Disturbance (Solifluction, Thermokarst, Permafrost Melt, etc.), Glaciation, Volcanic Action, Coastal/Beach, **Parking Lot Perimeter, Trail, Roadside/Ditch/Berm, Trailside, Landscaping**

Exotic Plant Species Code: use USDA name code provided in the appendices or find it at <http://akweeds.uaa.alaska.edu>

Infested Area: 1/1000 acre minimum area for data collected (**0.001 acre** = 3.7 ft radius, **0.01 acre** = 12 ft radius, **0.1 acre** = 37 ft radius, **1/2 acre** = 83 ft radius, **1 acre** = 118 ft radius)

Canopy Cover: recommended 1%, 5%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 95%, 100%

Stem Count: 1-5, 6-25, 26-50, 51-150, 151-500, 500+

Collection Location: ALA, Not Collected, Not Curated, TNES, WTU, Other, None

Control Action: Manual (Pulling/Digging), Mechanical (Mowing/Weedwacking), Broadcast Herbicide, Spot Herbicide, Aerial Herbicide, Other, None

Aggressiveness: Low, Medium, High

There are many registered herbicides that will work to control different invasive plant species. There are several helpful resources that can be used when deciding which herbicide(s) to use:

The Pacific Northwest Weed Management Handbook lists herbicides that will work on different invasive plant species. Look under the section 'Control of Problem Weeds' or search by species.

Oregon State University. 2008. Pacific Northwest Weed Management Handbook: Control of Problem Weeds. [On-line] Available <http://pnwpest.org/pnw/weeds>. 28 August 2008.

To find out which herbicides are registered for Alaska, go to the Alaska Department of Environmental Conservation's Division of Environmental Health Pesticide Control Program. Here, you can search for products by pest, product name, active ingredient, or other options. This is probably the best resource available online for herbicide selection.

Kelly Registration Systems. 2007. Pesticide Control Program. [On-line] Available <http://www.kellysolutions.com/AK/>. 28 August 2008.

If you would like to find out more information, or talk to someone about your options, contact the UAF Cooperative Extension Service at (907) 474-7246.