Invasive Plant Management Guidance
McGrath, Alaska

Report prepared by Casey Greenstein & Helen Cortés-Burns

Alaska Natural Heritage Program
University of Alaska Anchorage

The Alaska Natural Heritage Program – University of Alaska Anchorage
707 A Street
Anchorage, Alaska 99501

Prepared for

Bureau of Land Management
Anchorage Field Office
4700 BLM Road
Anchorage, AK 99507-2599

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Introduction

The establishment, growth, and persistence of non-native[1] plant species pose a serious threat to natural ecosystems. Even though not all non-native species cause significant economic or ecological harm, a smaller proportion of these plants may be invasive[2] and may significantly alter community composition, successional pathways, nutrient cycling, hydrology, and fire regimes, as well as to reduce or eliminate threatened and endangered native species populations (U.S. Congress 1993, Busch 1995, Myers 1997, Brooks 1999, Stein et al. 2000).

While invasive plants (hereafter also referred to as weeds) constitute a major problem in the lower 48 states (Randall 1996), Alaska has remained much less affected. However, over the last ten years there has been a marked acceleration in the rate of introduction of non-native plants to the state, probably driven by movement of goods and people (Carlson and Shephard 2007). Invasive species management has become costly in Alaska, with an annual average of $5.8 million spent between 2007 and 2011 (Schwörer et al. 2012).

The susceptibility of native plant communities to invasion is largely a function of the degree of natural or anthropogenic disturbance (Hobbs and Huenneke 1992). In Alaska, non-native plant occurrence is most strongly correlated with high-use, and therefore highly disturbed, areas such as urban centers and transportation routes. Invasive plants are able to establish in these types of areas because there are more opportunities for introduction, less competition from native plants, and an abundance of disturbed substrates on which invasive species thrive. However, in some cases invasive weeds have been documented moving off the human footprint into natural ecosystems. In interior boreal Alaska, these species include, but are not limited to *Caragana arborescens, Crepis tectorum, Hieracium umbellatum, Melilotus albus,* and *Vicia cracca* (Lapina et al. 2007; Cortés-Burns et al. 2007, 2008; Conn et al. 2008; Villano and Mulder 2008).

In addition to direct anthropogenic factors, climate change may also affect non-native plant establishment. At higher latitudes climate change is more pronounced (Holland and Bitz 2003), which may lead to a higher rate of non-native species establishment and accelerated population growth in the future. Non-native species are often better adapted and more competitive (Prentis et al. 2008) relative to native species, so they may be at an advantage with changing weather and temperature patterns. Native species have slower migration rates (Malcolm et al. 2002, van Grunsven et al. 2007) and thus are likely to lag behind invasive species in their response to environmental changes. The compounding impacts of climate change on invasive species augments the need to prevent and manage non-native species in Alaska.

In Alaska's boreal forests – as delineated by Nowacki et al. (2003) - in which McGrath is situated, 169 non-native plant species were present as of 2013. Many native species of the boreal forest are stress tolerant, including bryophytes, lichens, and ericoid shrubs, but are difficult to reestablish once they are removed

[1] Non-native plants are those whose presence in a given area is due to the accidental or intentional introduction by humans (AKEPIC 2005).

[2] Invasive plants are non-native plants that produce viable offspring in large numbers and have the potential to establish and spread in natural areas (AKEPIC 2005). Some invasive plants have strong negative impacts on native ecosystems, cause important economic losses, or can be detrimental to human health.

(Grime 1979, Haeussler et al 2002); if eliminated from an area (e.g. by fire, clear cut logging, roads, resource extraction, pipelines) habitats are opened up for more opportunistic species. Consequently, as the frequency and scale of these types of disturbances increase, so does the chance that invasive species will be introduced and successfully establish (Byers 2002). Some specific examples of the deleterious effects non-native plants have on boreal forests are included in Appendix I. Moreover, a large number of non-native species currently inhabiting boreal forests are intentionally introduced in conjunction with revegetation aimed at preventing erosion and stabilizing soil after disturbance. Roadside reseeding is responsible for the introduction of several non-native species in remote areas. For these reasons, prevention, risk assessment, and proper restoration approaches should be a top priority in areas undergoing development (Sanderson et al. 2012).

The community of McGrath is a special case for non-native plant management in the state because it is a relatively large community compared with other villages in interior Alaska. Many people stop in McGrath while traveling between larger urban centers, such as Anchorage, Fairbanks, and the Mat-Su, and more remote parts of the state. As such, this rural travel and economic hub is subject to the movement of people, goods, boats and vehicles, and earth-moving equipment that may serve as vectors for invasive species introductions. Additionally, the community is located along the Iditarod Trail and is susceptible to straw-associated weed species. Inventory and management of McGrath's invasive plant species can help keep the local ecosystem in good condition and can also prevent the spread of weeds into Alaska's undeveloped natural areas.

Background information and objectives

The Bureau of Land Management Anchorage Field Office (BLM-AFO) entered in to an agreement with the Alaska Natural Heritage Program (AKNHP) to conduct a non-native plant inventory of disturbed sites throughout McGrath and to provide support in establishing a local Cooperative Weed Management Area (CWMA). Although the Bureau of Land Management does not have a presence in the town, they do have management responsibilities for lands in the surrounding ecoregion. The BLM has a strong interest in establishing a CWMA for McGrath to manage and control unwanted plant populations. Environmental agencies that do have headquarters in McGrath are the U.S. Fish and Wildlife Service, Alaska Department of Fish & Game, and the Alaska Department of Natural Resources. Cultivating interest in cooperative weed management among these agencies and the community is the central goal of this project.

The town of McGrath is located 355 kilometers (221 miles) northwest of Anchorage and 433 kilometers (269 miles) southwest of Fairbanks. It is located approximately 100 m (350 ft) above sea level, is adjacent to the Kuskokwim River, and is roughly 140 square kilometers (55 square miles) in size, with a population of just under 350 people (ACDCIS undated). The surrounding boreal forest is composed of white spruce-black spruce-mixed deciduous forest (aspen, poplar, birch), with an understory of common boreal forest plants, including willow, dwarf birch, crowberry, blueberry, lichens and mosses.

This report describes the findings from the 2012 McGrath non-native plant study, outlines best management practices (BMPs) and early detection rapid response (EDRR) measures, explains control methods to manage

and limit future unwanted introductions, and illustrates the importance of developing a CWMA. Additionally, Appendix VII consists of several single-page materials that can be printed out and distributed for educational purposes.

2012 Weed survey results

On August 17, 2012, AKNHP conducted an invasive plant inventory in McGrath, targeting areas of high traffic and human disturbance. These areas were selected based on conversations with BLM personnel, locals, and included the construction site of a new water treatment facility near the Iditarod Race checkpoint. Incidental observations of native and non-native plant species were made while moving between the survey plots. No new or highly invasive species were encountered between sites. Figure 1 shows the locations of each survey plot in McGrath. Table 1 provides a summary of all non-native plants found across all sites. Detailed site descriptions, species presence, and photos can be found in Appendix V. Percent frequency of occurrence and total infested areas for all species documented in this survey can be found in Appendix IV. For a complete list of non-native species found in McGrath, including those noted by other agencies at different dates, see Appendix III.

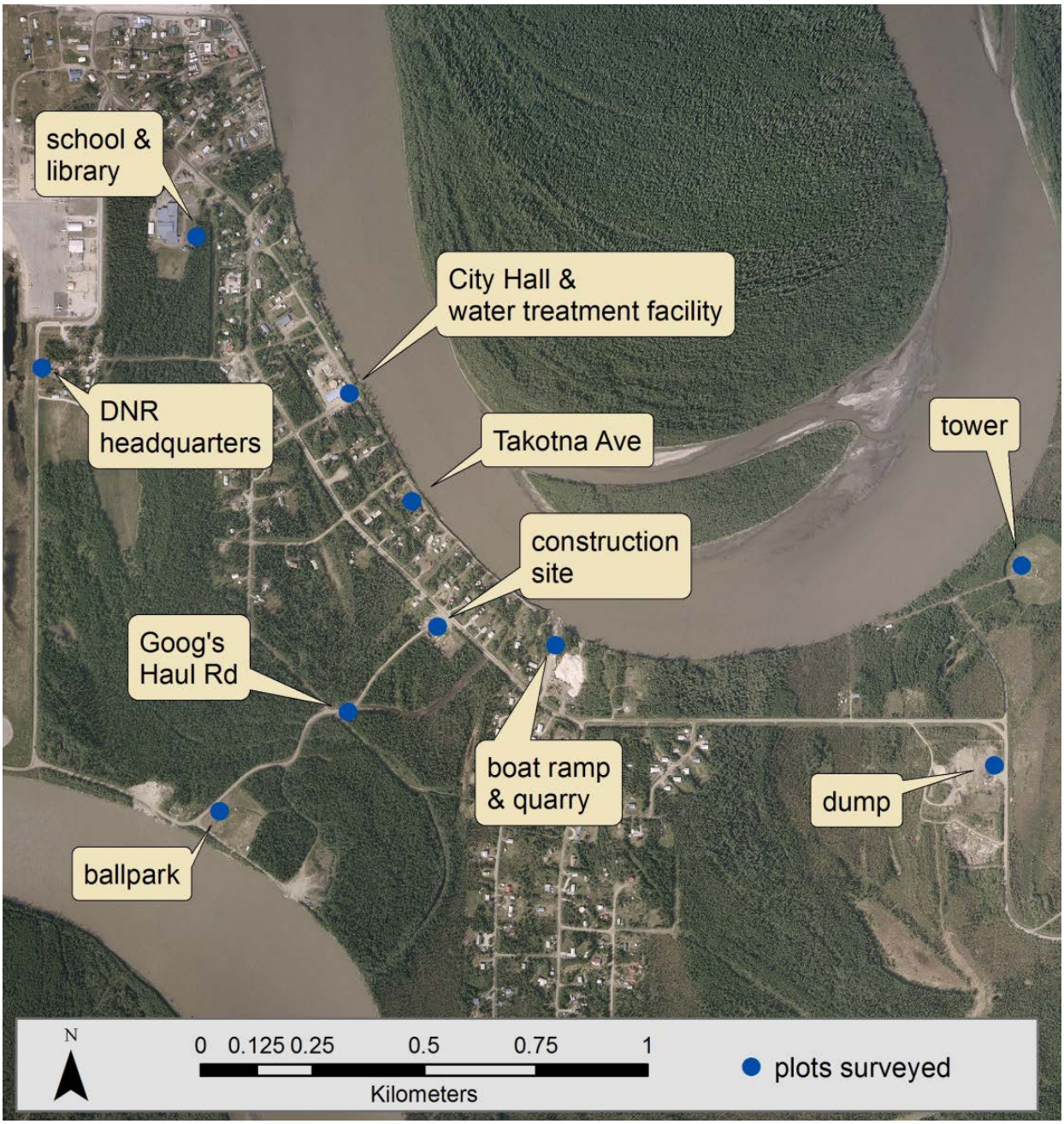

Figure 1. Locations of plots surveyed for non-native plants in McGrath, Alaska. The Kuskokwim River boarders the town on the north and south ends of the figure.

Table 1. Non-native plants identified in McGrath, Alaska, their locations in town, and infested acres at each site, August 2012

Scientific name	Common name	Invasiveness Rank*	ballpark	Goog's Haul Rd	construction site	boat ramp & quarry	City Hall & water treatment facility	school & library	tower	dump	Takotna Ave	DNR headquarters
Bromus inermis ssp. *inermis*	smooth brome	62		.5								.5
Capsella bursa-pastoris	shepherd's purse	40									.001	
Campanula rapunculoides	rampion bellflower	64						.5				
Caragana arborescens	Siberian peashrub	74						.5				
Chenopodium album	lambsquarters	37			.5		.5	1				
Crepis tectorum	narrowleaf hawksbeard	56		.5		.25	.5	.5		.01		.01
Elymus repens	quackgrass	59		.5	.5	.25	.5	1				
Hordeum jubatum†	foxtail barley	63	.5	.5	.5	.25	.5	1		.25		.5
Hordeum vulgare	common barley	39					.5					
Leucanthemum vulgare	oxeye daisy	61						.01				
Lolium multiflorum±	Italian ryegrass	41			.5							
Lolium perenne	perennial ryegrass	52		.5			.5					
Matricaria discoidea	pineappleweed	32		.5	.5		.5	1				.01
Plantago major	common plantain	44	.001	.5	.5	.25	.5					.25
Poa annua	annual bluegrass	46	.5	.5			.5					
Polygonum aviculare	prostrate knotweed	45			.5							
Prunus padus	European birdcherry	74	.001					.01				
Prunus virginiana	chokecherry	74	.001					.01				
Stellaria media	common chickweed	42						1				.01
Taraxacum officinale	common dandelion	58	.5		.5	.25	.5	1		.25		.25
Trifolium hybridum	alsike clover	57	.5	.5	.5		.5	1				
Trifolium repens	white clover	59						.5				.25

Numbers in cells indicate infested acres

* Invasiveness Rank is calculated based on a species' ecological impacts, biological attributes, distribution, and response to control measures. The ranks are scaled from 0 to 100, with 0 representing a plant that poses no threat to native ecosystems and 100 representing a plant that poses a major threat to native ecosystems (see Carlson et al. 2008).

† *Hordeum jubatum* appears to be native to the eastern and central interior of Alaska, but has expanded its range dramatically in the last few decades and can cause health concerns for dogs and wildlife (Cortés-Burns et al. 2012).

± *Lolium multiflorum* and *Lolium perenne* may be hybridizing.

Weed management in McGrath

Presently, McGrath hosts a number of non-native plant species, of which many are considered to represent a minor threat to the ecology of the region (i.e. relatively low Invasiveness Rank). No new species were noted in 2012 that had not been documented in previous surveys. The most widespread species throughout town are *Hordeum jubatum, Taraxacum officinale, Crepis tecotrum,* and *Plantago* major. Sites with the greatest diversity of weeds are the school/library, City Hall/water treatment facility, Goog's Haul Road, and the construction site.

Non-native plants common throughout town include *Bromus inermis* ssp. *inermis, Capsella bursa-pastoris, Chenopodium album, Crepis tectorum, Elymus repens, Hordeum jubatum* (native to eastern and central interior Alaska but spreading considerably into areas affected by human disturbance), *Hordeum vulgare, Lolium* spp., *Matricaria discoidea, Plantago major, Poa annua, Polygonum aviculare, Stellaria media, Taraxacum officinale, Trifolilum hybridum,* and *Trifolium repens*. These weeds are common to roadsides and other disturbed sites throughout McGrath, and are widespread throughout roadside habitats in Alaska. For the most part, roads in McGrath are lined with a mix of typical boreal forest understory plants and non-native species.

Three sites had been surveyed in past years and were revisited for this project: the library, the dump, and the Iditarod checkpoint behind City Hall. The library and area around City Hall were surveyed in conjunction with a project tracking weeds along the Iditarod Trail in 2009; it focused only on the trail and did not provide a comprehensive survey of the town. The weeds noted at the dump were a casual observation by U.S. Forest Service personnel in 2003.

- At the dump, *Linaria vulgaris* had been recorded in 2003. However, this species was not noted in 2012. *Crepis tectorum, Hordeum jubatum,* and *Taraxacum officinale* were found in 2012.
- At City Hall/Iditarod checkpoint four species were found in 2009 that were not documented in 2012: *Euphrasia nemorosa, Polygonum aviculare, Stellaria media*, and *Viola tricolor* (see Appendix III for Invasiveness Ranks). Four species were found in 2012 but not noted in 2009: *Elymus repens, Lolium* sp., *Poa annua,* and *Trifolium hybridum.*
- In 2012 the library and school were surveyed in combination; the 2009 survey included only the library. A total of three species were identified at this site: *Bromus inermis* ssp. *inermis* was not subsequently found in 2012, while *Caragana arborescens* and *Trifolium repens* were still growing in the vicinity.

In all instances, non-native plant composition, population size, and percent cover have changed little over the years. Populations were small (0.001-1 acres) with sparse cover (0.5-12%, with the exception of an infestation of *Taraxacum officinale* (1 acre with 50% cover) at the library in 2012).

Those species with the highest Invasiveness Rank found in McGrath were intentionally introduced as landscape ornamentals, and include *Prunus padus, Prunus virginiana, Caragana arborescens, Leucanthemum vulgare,* and *Campanula rapunculoides*. These species can be found at the school, library, and ballpark, among other places. *Prunus* spp. were first planted in McGrath 15-20 years ago; they were gifted as part of a fundraising activity. *Caragana arborescens* hedges planted at the school and public library are moving a few

meters outside of their original planted area, but are being mowed down regularly thereby containing the infestation. Otherwise, both ornamentals and roadside weeds do not yet appear to be moving into undisturbed or natural areas. However, invasive plants often have a lag time between establishment and rapid spread, so they may exhibit more aggressive behavior in the future.

The differential distributions between low-ranked widespread roadside species and discrete populations of high-ranked ornamental species indicates that an emphasis should be put on educating the community about non-native plants and responsible landscaping, rather than going after populations of widespread weeds that pose little threat to the local ecosystem. Worldwide, intentional introductions are the greatest source of invasive species problems, and sadly these are the most preventable problems (Mack 2000). Additionally, an emphasis should be placed on preventing the introduction of new, more aggressive, species to the region. This can be accomplished by developing a Cooperative Weed Management Area (CWMA) in McGrath, which is responsible for instating best management practices (BMPs), early detection and rapid response (EDRR) measures, and ongoing monitoring, particularly of sources of introduction and dispersal vectors. While education and prevention are recommended as a top priority, eliminating unintentionally introduced infestations is an important secondary priority.

Partnerships and the Cooperative Weed Management Area (CWMA)

Developing broad networks with many partners is beneficial to effective weed management. The purpose of a CWMA is to provide a partnership among agencies, organizations, and individuals to minimize the introduction and spread of non-native plants into and within the CWMA. The boundaries of the CWMA replace jurisdictional boundaries and allow weeds to be managed within natural delineations instead. Partners jointly prioritize management efforts based on species or geographic area and pool labor and resources to manage infestations. Partners may include those individuals or entities that hold easements or special use permits, own private property, or manage state and federal land.

A CWMA for McGrath could include, among other private organizations and interested citizens, the following agencies and organizations:

- U.S. Fish and Wildlife Service
- U.S. Bureau of Land Management
- Alaska Department of Natural Resources
- Alaska Department of Fish & Game
- The City of McGrath
- McGrath Native Village
- Lime Village
- MTNT, Limited
- Doyon, Limited
- Iditarod Area School District (to educate youth in environmental stewardship by participation in the CWMA)

Best management practices (BMPs)

In order to minimize impacts to natural resources, construction projects, such as the construction of a new water treatment plant in McGrath, should assess risks associated with weeds in the planning stage, including the likelihood of spread into the project area, and the potential effects of weed establishment in the area. Similarly, maintenance operations should also evaluate the potential impact of weeds. If a risk or threat is identified in the planning stages, weed prevention practices should be developed. Not all weed management actions are appropriate for all sites; management plans need to be site-specific. Prevention practices should be evaluated to ensure they meet project-specific goals and stipulations, can be feasibly implemented, and are cost-effective. The latter should compare the costs associated with implementing a project, versus the cost associated with doing nothing and dealing with the consequent ecological damage (USDA Forest Service 2001).

The most effective, economical, and ecologically sound approach to managing invasive plants is to prevent their invasion in the first place. A CWMA would be the logical mechanism to enact the following BMPs across the region, which are central to actively preventing the introduction of weeds into McGrath and to managing infestations as they appear (modified from USFS 2001):

Ground disturbing activities and maintenance projects

- Incorporate weed prevention and management into project design, evaluation, and decisions.
    - Assess the risks of possible introduction and spread, analyze treatment options for high-risk sites, and identify prevention practices.
    - Determine necessary actions to control weeds at the start of project planning (e.g. determine how to obtain herbicide permits, if needed).
    - Manage sources of weed propagules and seeds to prevent and limit their spread.
- Prior to ground-disturbing actions, inventory weed populations at the project site and along access routes, and prioritize populations for control. Take control actions where necessary.
    - Start projects in areas not infested or minimally infested with weeds, then move into weed-infested areas later, as necessary.
    - Use staging areas that are weed-free. Restrict or minimize travel through weed-infested areas, or move through these areas only when propagules and seeds are not likely to spread (e.g. before plants begin to flower and produce seed).
    - Identify sites for equipment cleaning. Plant parts, mud, and dirt should be removed from equipment before moving into the project area, when exiting the project area if the site has weeds, or traveling to weed-free sites. Where practical, seeds and plant parts should be incinerated.
    - Consider closing off access to sensitive areas to allow native vegetation to reestablish.
- Clean equipment and gear
    - Workers should inspect their clothing, boots, tool bags, and other gear. These should be free of plant parts, seeds, and mud; debris should be removed and double bagged for later incineration.
    - Inspect and clean equipment, vehicles, machinery, and other gear. When cleaning

equipment, areas to target include the insides of bumpers, wheel wells, undercarriages, belly plates, excavating blades, buckets, tracks, rollers, drills, buckets, shovels, and any digging tools. High pressure washing is recommended to clean heavy equipment and vehicles.
    - Cleaning gear is particularly important when moving from a site infested with non-native plants to a weed-free site. Attention should be paid when vehicles and gear are moved from outside regions that have high non-native plant densities and diversity (e.g. Anchorage, Fairbanks, Mat-Su, and Kenai).
    - Much equipment is barged into McGrath. The off-loading site for barges (the clearing/gravel area 0.25 km southeast of the ball park) should be the initial point of inspection for equipment and materials, before they move throughout town or to outlying areas.
- Prevent weed introduction and dispersal via gravel, sand, or other fill materials. When multiple agencies are involved in a project, they should work cooperatively to adopt the practices listed below.
    - Maintain stores of materials in weed-free condition. Regularly inspect material source areas for weeds. As necessary, treat these sites and strip off contaminated material before use of pit material. Do not use any materials contaminated with weeds.
    - During construction activities, do not dump invasive plant contaminated waste on established, desired vegetation; instead, dispose of waste and invasive plant contaminated soil at a designated disposal site.
    - Where soil has been disturbed and/or where weed treatment takes place, continue monitoring and control actions for at least five years after project completion.
- Minimize sources of non-native plant seed along roadsides to limit transportation to other areas.
    - Roads and right-of-ways should be inspected periodically for weeds. Maintenance staff should be trained to recognize weeds and report their locations to the proper agency. Inventory and schedule treatment for infestations.
    - Ensure proper equipment cleaning, as mentioned above.
    - If acquiring water for dust abatement during road construction projects requires travel through weed-infested areas, alternative sources should be used.
    - When decommissioning a road, treat weeds on the road before they become impassible. Monitor and do follow-up treatments as necessary.
    - Consult a professional before pulling or cutting weeds to ensure effective methods are used. Schedule treatment for when propagules and seeds are least viable and likely to be spread. Work from areas with fewer weeds to areas more densely infested. Minimize soil disturbance. Properly dispose of weed waste or keep it contained on-site.
- Maintain intact ecosystems as much as possible.
    - In areas with a naturally dense canopy cover, maintain this cover as much as possible in inhibit the establishment of weeds. Keep as much native vegetation as possible in and around the project area.
    - Minimize soil disturbance as much as possible to avoid conditions in which weeds thrive.

Revegetation

- Revegetation can include planting, seeding, mulching, fertilizing, liming, and topsoil replacement.
    - Restore disturbed sites in a timely manner. Site reclamation should take place immediately after a soil-disturbing project is completed.
    - Revegetate sites in a site-specific manner.
    - Where practical, set aside sod and/or topsoil before projects commence on weed-free sites, and use the sod or topsoil to restore disturbed ground.
    - Where sod and/or topsoil are not set aside for site restoration, reseed with weed-free perennial grasses and forbs that are quick to establish; this encourages the growth of native species and provides competition for non-native species.
    - All revegetation projects should use certified weed-free products; weed-free, locally-sourced material is recommended. Use of locally-produced certified weed-free straw and plant materials will decrease the potential for seed contaminants. More information about sources of these materials and planting guidelines can be found at the Alaska Plant Materials Center website (see Appendix VI).

Recreation

- Avoid introducing or remove weed propagules and seeds at recreation sites to limit establishment and spread.
    - High-use recreation locations, particularly those open to public vehicle use, should be monitored and, if warranted, treated annually. These areas include airstrips, picnic areas, campgrounds, boat launches, access roads, trailheads and trails for foot, horse, and ATV traffic.
    - Encourage the public to inspect and clean cars, trucks, four wheelers, snow machines, dogsleds, boats, footwear, clothing, and gear to minimize the movement of weed seeds and propagules.
    - In areas susceptible weed establishment or of conservation concern, limit the use of vehicles to maintained and designated routes. Inspect, treat, and document weeds along transportation corridors.
    - Recreation areas with a diversity of weed species and/or a large infested area may need to be closed until the populations can be controlled, to minimize the likelihood of spread to other locations.
    - Require the use of certified weed-free, locally-sourced mulch, straw, and hay when possible.
- Iditarod Trail considerations
    - Use certified weed-free straw for sled dog bedding during the Iditarod race. Offer dog team owners in the area information on where weed-free straw is available and encourage its use.
    - Monitor checkpoints and other areas that tend to have larger concentrations of people, equipment, and dogs as well as higher levels of disturbance.

Education

- Raise awareness throughout the community regarding non-native plants. Particular emphasis

should be placed on: 1) understanding risks to the regional natural resources that may be impacted by invasive plants, and 2) measures to prevent intentional and unintentional introductions of invasive plants from outside of town.
    - Provide training and educational materials regarding plant identification, impacts, and preventative actions to the public, as well as state and federal agencies and their contractors that are involved in ground disturbing activities (educational materials are provided in Appendix VII).
    - Have at least one individual trained in weed management involved in ground-disturbing projects. Create incentives for workers to look out for new weeds.
    - Post educational displays, including prevention practices, at susceptible areas such as roads, boat launches, trailheads, and along weed-infested areas.
    - Where applicable, educate agencies and individuals about aquatic weed prevention and control.
- Lead by example. Prevent and treat weeds around administrative sites.
- Develop a CWMA to unify interested citizens, landowners, private organizations and state and federal agencies in implementing proactive weed management measures as a cooperative group committed to the conservation of common weed-free areas.

Aquatic weeds

- Limit sources of weed seeds and propagules to avoid the introduction and spread of aquatic, wetland, and riparian weed species.
- Prevention practices for boats:
    - Inspect boats, trailers, gear, etc. and remove mud, plant and animal matter before leaving boat launch areas. Drain all water from live well, transom wells, bilge, and motor while on land at the boat launch. Wash and dry: trailers, axles, propellers, nets, anchors, downriggers, tackle, and entire boat (including the floor), and other equipment.
    - Before moving into a different water body, either allow boat and equipment to dry for at least five days, spray boat and trailer with high-pressure water, or rinse boat and equipment with clean hot (104°F) water.
    - Avoid running boats through aquatic plants near boat access spots. Instead, winch or push watercraft without running the engine. Once the vessel is out of the water, run the engine for 5-10 seconds to remove any vegetation and water. Turn off the engine and manually remove weeds from the steering nozzle. Examine the trailer, boat, and other equipment for plant fragments and remove them before traveling off-site.
- Prevention practices for float planes:
    - Prior to flight, clean off any visible plant material from the water rudders and leave them up during take-off.
    - Before take-off, avoid taxiing through water with a heavy surface growth of weeds, and raise the lower water rudders several times to help dislodge plant material; do so while over the original water body or land.
- Cleaning personal gear
    - Wash and dry all equipment, including boots, waders, float tubes, and tackle.
    - Waterfowl hunters should remove mud, and aquatic plants and animals attached to anchors and decoy lines. They should use bulb-shaped, elliptical, or strap anchors on decoys because

they are less prone to collecting submersed and floating aquatic vegetation. All plant parts and mud should be removed from hip boots and waders and should be rinsed off before leaving the water, when possible.

- Docks and boat launches
  - Maintain a buffer of at least 100 feet around boat launches and docks that is weed-free.
  - If aquatic weeds are found, post information at sites and confine the infestation. It may be necessary to close a facility until a weed infestation is contained or removed.
  - Install new boat launches and ramps and deep-water locations. Limit the use of motorized boats in areas infested with invasive vegetation.
  - Move contaminated sediment to quarantined or upland sites when cleaning around irrigation, canals, or culverts.

Early detection and rapid response (EDRR)

Early detection and rapid response (EDRR) is the process of locating, assessing, and eliminating invasive species populations before they have a chance to spread to unmanageable levels. Invasive plant populations often exhibit a lag time before they begin to spread rapidly. EDRR enables land managers to find incipient populations of invasive plants and eradicate or contain them during this lag period, consequently reducing environmental and economic impacts.

This strategy includes monitoring, assessment and control of new and emerging non-native species. Early detection of new infestations requires regular monitoring of the managed area and surrounding ecosystem. In McGrath, EDRR efforts should focus on areas of high traffic and disturbance (e.g. construction sites, roads, and trails), which should be surveyed at least once a year, preferably in July when most plants have flowered but not yet set seed; unfamiliar species should be identified. Populations identified through EDRR should be submitted to the Alaska Exotic Plants Information Clearinghouse[3] (AKEPIC) database at the Alaska Natural Heritage Program to augment the knowledge base of new infestations and movements of known populations within Alaska. Comprehensive knowledge of the state-wide distribution of non-native species and infestations is important for the development and adaptation of effective management strategies. Education is an integral component of EDRR and Appendix VII provides additional educational material for those species prioritized for EDRR in the McGrath area.

The species listed in Table 2 are recommended for EDRR based on their likelihood to become established if introduced to McGrath and their potential to alter the structure and function of ecosystems; those species listed that are already present in McGrath should be closely monitored for movement into natural areas and population expansion. While many non-native species persist without causing damage to ecosystem processes, other species interfere with ecosystem functions (Sanderson et al. 2012). For example, nitrogen-fixing species can significantly alter soil-nutrient regimes in nitrogen-limited boreal forests (Hobbie 1992). Similarly, the often higher-volume of litter produced by non-native plants increases soil nitrogen, which can

[3] Available at http://aknhp.uaa.alaska.edu/botany/akepic/. The Alaska Exotic Plants Information Clearinghouse (AKEPIC) is a database and mapping application that provides geospatial information for non-native plant species in Alaska and the Yukon Territory.

perpetuate the establishment of more non-natives (Maron and Connors 1996). The growth forms and habit of other weed species can inhibit forest regeneration or cause other negative impacts on ecosystem function.

The species listed on the EDRR watch list are included for different reasons. Three are already present in McGrath: *Prunus padus, Prunus virginiana,* and *Caragana arborescens.* These ornamental tree species are able to move outside of landscaped areas and invade natural areas; *Prunus* sp. are a particular concern for riparian areas. Although they are already present in McGrath, they are included in the watch list because they should be monitored carefully for movement outside of landscaped areas; any individuals found outside of landscaped locations should be removed immediately. *Phalaris arundinacea* and *Lythrum salicaria* can have significant negative impacts along rivers and wetlands. *Melilotus* spp. and *Vicia cracca* thrive in the interior boreal forest and are difficult to remove once they have become established. *Hieracium aurantiacum* is also extremely difficult to eradicate, often requiring the use of herbicides; this species does well in organic soil and does not require human disturbance to establish. *Elodea* sp. grows in slow-moving fresh water and can clog up waterways, destroying fish habitat and limiting recreational use of rivers and wetlands. The seven species not yet reported from McGrath have a high likelihood of introduction as infestations are known from Anchorage and Fairbanks International Airports and/or Seaplane Bases. For more details about species' impacts visit the Alaska Natural Heritage Program's website, listed in Appendix VI.

Table 2. Early detection and rapid response (EDRR) watch list for McGrath, Alaska

Scientific name	Common name	Invasiveness Rank
Caragana arborescens	Siberian peashrub	74
Elodea sp.*	waterweed	79
Hieracium aurantiacum	orange hawkweed	79
Lythrum salicaria	purple loosestrife	84
Melilotus albus	white sweetclover	81
Melilotus officinalis	yellow sweetclover	69
Phalaris arundinacea	reed canarygrass	83
Prunus padus	European birdcherry	74
Prunus virginiana	chokecherry	74
Vicia cracca	bird vetch	73

*Both *Elodea nuttallii* and *E. canadensis* have been known to form fertile hybrids, which exhibit morphologically intermediate vegetative characteristics and are only distinguishable by their floral structures, which are rarely found. In the absence of floral structures, genetic techniques are necessary to determine taxonomic identity. Both species share geographic ranges. To date, a determination of the species found in Alaska has not been made.

Prioritizing infestations for control work

Infestations should be prioritized for control work based on their distributions and abundance, known or perceived risk to natural ecosystems, as well as government mandates for control (e.g., presence on the State of Alaska Noxious Weed List, which can be found in Appendix II). Tools for prioritizing populations for control can be found in Cortés-Burns et al. (2012).

Control of invasive species that are still locally uncommon should take precedence over invasive species that are widespread on regional and local scales. Control of such incipient populations should take place regardless of perceived invasiveness. Similarly, populations that are small and disjunct, or that are actively invading – or capable of invading – undisturbed native vegetation, should be prioritized over populations that are continuous and large, or that tend to remain restricted to anthropogenically disturbed habitats.

When prioritizing species with similar distributions and abundances, control first those species present on the State of Alaska Noxious Weed List, with higher Invasiveness Ranks, or with demonstrated aggressiveness. In general, species with invasiveness ranks of >50 represent species considered modestly to extremely invasive (Carlson et al. 2008) and is a reasonable target for control in areas with low levels of infestation and non-native plant diversity, such as McGrath.

Inventory and monitoring

Monitoring involves periodic observation and documentation. It is an ongoing and dynamic process and is an integral part of a successful weed control program. Monitoring includes gathering information to gauge the effectiveness of management actions in meeting predetermined objectives. A monitoring program can elucidate objectives that are not being met, actions that need to be modified, and actions that are not working and should be stopped. An inventory and monitoring plan should be evaluated annually, if possible, or at least every three years, so that its efficacy can be assessed, and modifications can be implemented where appropriate to increase the plan's success.

Non-native plant surveys in McGrath should be conducted once a year, in July, when most non-native plants are easily identifiable but have not yet produced seed. Ideally, CWMA members should be continuously on the lookout for new or unfamiliar plants.

Sources and dispersal vectors to prioritize for monitoring

Areas that should be top priority for monitoring include potential points of introduction, transportation corridors, material source and storage sites, and other high-use or high-disturbance locations. Specific sites for survey work include:

- Airstrip and loading zones
- Roadsides
- Iditarod Trail and other trails
- Quarries
- Snow and soil storage sites
- Boat ramps
- Barge offload site (0.25 km southeast of the ball park)
- Banks of the Kuskokwim River and other local water bodies. Natural aquatic habitats are often more damaged by, and more susceptible to, invasive plant introductions than non-aquatic habitats. Additionally, a highly invasive *Elodea* species (thought to be *E. nuttallii* or *E. canadensis*) has been

showing up in a number of lakes, ponds, and sloughs in a number of regions in the state; these populations may have originated from material discarded from aquarium tanks. Therefore water bodies that are adjacent to residential areas have a higher probability for introduction of this species.

Education and outreach

Developing active awareness of threats posed by invasive species through educational programs, outreach activities, and the establishment of a CWMA can help promote effective weed management. Educational materials covering topics such as threats posed by and diagnostic characteristics of EDRR species should be made available throughout the community. A number of educational materials are included in Appendix VII of this report.

Community involvement

Any community weed prevention and weed pull events should be advertised on the local KSKO radio station and on the McGrath Community Message Board at http://members2.boardhost.com/MCG-Community/index.html. For example, this could include announcements during Iditarod on the risks posed by using weed-contaminated straw, or more general public service announcements promoting the replacement of certain ornamental plant species with alternative native species.

Control methods

Effective control relies on a number of factors. For one, it is essential to clearly establish treatment goals (e.g. does a species need to be eradicated or just contained?). It is also necessary to understand the biology of the target species (e.g. whether it reproduces vegetatively, sexually or by both plant propagules and seeds). It is important to recognize the pathways associated with a species' introduction and to understand the ecosystem that has been invaded. It is also critical to know which control methods are effective for which species, as there is no single panacea for treating all infestations and that effective control often depends on a combination of manual, mechanical, chemical and biological techniques implemented over several years. To learn more about the control methods discussed below, see additional resources in Appendix VI.

Integrated weed management

A single technique is rarely adequate for successful control of multiple species or infestations; under an integrated approach, all control methods are considered and often applied in combination. Specific treatment prescriptions are determined by the biology of the particular plant species, site characteristics, management objectives and resources available. Management techniques fall into three categories:

- **Manual/Mechanical:** Hand pulling, mowing, tilling, and burning are commonly used to physically destroy weeds or interfere with their reproduction and can be used on small infestations of annual or biennial species. To be most effective, treatment should take place before seed production. Plants that have flowered must be removed from the site and destroyed. Plants can be double

bagged and transported to a designated disposal site; if possible, they should be incinerated. Repeated mowing or tilling during the growing season can effectively control or contain many weed species. Generally, manual/mechanical methods are not recommended as the sole approach for control of species that spread vegetatively.

- **Chemical:** Herbicides are likely to be the best option for larger infestations and for perennial species that do not respond well to manual and mechanical methods. The particular herbicide used and its rate of application depend on specific site characteristics, target plants, non-target vegetation, and land use. Herbicides are a particularly important method of treatment when complete eradication of a population is the management objective. Treatment at the earliest stage of invasion will greatly reduce the future need for additional herbicide applications. Herbicides often provide the only effective and feasible control of rhizomatous species, and species for which hand pulling or cutting is not effective. If applied in a specific manner and according to the label, herbicides can be extremely efficient in selectively removing weeds that are mixed in with native vegetation. This approach can reduce the amount of revegetation needed after the treatment is complete.

- **Biological:** This method involves the use of herbivores and pathogens that are known to attack or eat the non-native species of interest in its native range. Introduced biological control species often have few natural enemies and consequently have the potential to become invasive themselves and attack non-target species. Permitting release of biological control agents requires many years of host specificity testing and evaluation by the U.S. Department of Agriculture's Animal and Plant Health Inspection Service. This type of control is only used on very large infestations (big enough to support the insect or pathogen population) and to date, has not been implemented in Alaska.

Conclusions

The invasive plant survey in McGrath highlights three main findings. First, that the most aggressive and potentially damaging species known to occur in McGrath are ornamental trees and shrubs, which were intentionally introduced to the area. Second, areas with high human traffic and soil disturbance are more susceptible to the introduction and establishment of non-native and potentially invasive species. Third, those non-native species presently found in McGrath that were unintentionally introduced are generally of low Invasiveness Rank, but should be controlled or eliminated as time and money allow. These three points illustrate the need for increased education and outreach throughout McGrath, and community involvement in weed monitoring and management. Establishing a CWMA for McGrath would address these issues, and through increased stewardship, help conserve the area's natural resources for future generations.

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Appendix I – Examples of non-native plant effects on boreal forests

Species	Invasiveness Rank	Effect on boreal forests
Caragana arborescens (Siberian peashrub)	74	fixes nitrogen, forms dense stands, is highly competitive, shades and smothers native plants (Cortés Burns et al. 2007, Carlson et al. 2008)
Centaurea stoebe (spotted knapweed)	86	allelopathic; interferes with native plant germination and growth (Bais et al. 2003)
Cirsium arvense (Canada thistle)	76	may be allelopathic; reduces seedling emergence and performance of firs (*Abies s*pp.) (Humber and Hermanutz 2011)
Cirsium vulgare (bull thistle)	61	can out-compete conifer seedlings in clear-cuts (Randall and Rejmanek 1993)
Crepis tectorum (narrowleaf hawksbeard)	56	inhibits native species reestablishment after fire (Villano 2008)
Lonicera tatarica (Tatarian honeysuckle)	66	interferes with forest succession and limits tree regeneration (Batcher and Stiles 2000)
Senecio jacobaea (tansy ragwort)	63	invades clearcuts but does not extend into undisturbed forests (Carlson et al. 2008)
Trifolium pratense (red clover)	53	invades clearcuts but does not extend into undisturbed forests (Carlson et al. 2008)
Vicia cracca (bird vetch)	73	can smother young conifers, causing branch dieback and inhibiting regeneration (Buchholdt et al. 2010)

Developed from Sanderson et al. 2012

Appendix II – Prohibited noxious weeds in Alaska

Provided by the Alaska Department of Natural Resources, Division of Agriculture
Available at http://plants.alaska.gov/invasives/noxious-weeds.php
A new, updated list will be released in 2013; check this website for future revisions.

Convolvulus arvensis (field bindweed)
Rorippa austriaca (Austrian fieldcress)
Galensoga parviflora (galensoga)
Galeopsis tetrahit (hempnettle)
Solanum carolinense (horsenettle)
Acroptilon repens (Russian knapweed)
Lactuca pulchella (blue-flowering lettuce)
Elymus repens (quackgrass)
Sonchus arvensis (perennial sowthistle)
Euphorbia esula (leafy spurge)
Cirsium arvense (creeping thistle, Canada thistle)
Cardaria draba, Cardaria pubescens, Lepidium latifolium (whitetops and its varieties)
Lythrum salicaria (purple loosestrife)
Hieracium aurantiacum (orange hawkweed)

Appendix III – Species reported from McGrath to date, based on AKEPIC records

Scientific name	Common name	Invasiveness Rank
Bromus inermis ssp. *inermis*	smooth brome	62
Campanula rapunculoides	rampion bellflower	64
Capsella bursa-pastoris	shepherd's purse	40
Caragana arborescens	Siberian peashrub	74
Chenopodium album	lambsquarters	37
Crepis tectorum	narrowleaf hawksbeard	56
Elymus repens	quackgrass	59
Euphrasia nemorosa	common eyebright	42
Hordeum jubatum	foxtail barley	63
Hordeum vulgare	common barley	39
Leucanthemum vulgare	oxeye daisy	61
Lolium multiflorum	Italian ryegrass	41
Lolium perenne	perennial ryegrass	52
Matricaria discoidea	pineappleweed	32
Plantago major	common plantain	44
Poa annua	annual bluegrass	46
Polygonum aviculare	prostrate knotweed	45
Prunus padus	European birdcherry	74
Prunus virginiana	chokecherry	74
Stellaria media	common chickweed	42
Taraxacum officinale	common dandelion	58
Trifolium hybridum	alsike clover	57
Trifolium repens	white clover	59
Viola tricolor	johnny jumpup	34

Appendix IV – Percent frequency of occurrence and total infested areas of each non-native species found in McGrath, Alaska, August 2012

Scientific name	Common name	% Frequency	Total infested acres
Hordeum jubatum	foxtail barley	12.1	4
Taraxacum officinale	common dandelion	10.6	3.3
Crepis tectorum	narrowleaf hawksbeard	9.1	1.8
Plantago major	common plantain	9.1	2
Elymus repens	quackgrass	7.6	2.8
Matricaria discoidea	pineapple weed	7.6	2.5
Trifolium hybridum	alsike clover	7.6	3
Chenopodium album	lambsquarters	4.5	2
Poa annua	annual bluegrass	4.5	1.5
Bromus inermis ssp. *inermis*	smooth brome	3.0	1
Lolium perenne	perennial ryegrass	3.0	1
Prunus padus	European birdcherry	3.0	0.01
Prunus virginiana	chokecherry	3.0	0.01
Trifolium repens	white clover	3.0	1.3
Capsella bursa-pastoris	shepherd's purse	1.5	0.01
Campanula rapunculoides	rampion bellflower	1.5	0.5
Hordeum vulgare	common barley	1.5	0.5
Leucanthemum vulgare	oxeye daisy	1.5	0.01
Lolium multiflorum	Italian ryegrass	1.5	0.5
Polygonum aviculare	prostrate knotweed	1.5	0.5
Stellaria media	common chickweed	1.5	0.01
Total		100%	28

Appendix V – Site descriptions and species presence

Ball park; surveyed field and edges

The ball park is surrounded by mixed deciduous forest. This park has an abandoned plant bed, areas with mulch, and the planted cherry trees. None of the non-native species were observed moving into undisturbed areas.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Hordeum jubatum	foxtail barley	63	0.5	1	6-25
Plantago major	common plantain	44	0.001	1	26-50
Poa annua	annual bluegrass	46	0.5	25	N/A*
Prunus padus	European birdcherry	74	0.001	0.25	1-5
Prunus virginiana	chokecherry	74	0.001	0.25	1-5
Taraxacum officinale	common dandelion	58	0.5	40	500+
Trifolium hybridum	alsike clover	57	0.5	30	51-150

*N/A indicates data was not collected

Goog's Haul Road from the park until Chinana St.; plot read near intersection with Amos St.
All roads in McGrath have a similar non-native species composition. Roadsides are lined with understory plants typical of a mixed deciduous-white spruce forest. The *Lolium* sp. found here is possibly a hybrid of *L. perenne* and *L. multiflorum*, as awn lengths in individuals throughout town vary greatly from 0-5+ mm.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Bromus inermis ssp. *inermis*	smooth brome	62	0.5	3	N/A
Crepis tectorum	narrowleaf hawksbeard	56	0.5	0.5	N/A
Elymus repens	quackgrass	59	0.5	3	N/A
Hordeum jubatum	foxtail barley	63	0.5	3	N/A
Lolium sp.*	ryegrass	52	0.5	0.5	N/A
Matricaria discoidea	pineappleweed	32	0.5	0.5	N/A
Plantago major	common plantain	44	0.5	1	N/A
Poa annua	annual bluegrass	46	0.5	1	N/A
Trifolium hybridum	alsike clover	57	0.5	0.5	N/A

* *Lolium* sp. is possibly a hybrid of *L. perenne* and *L. multiflorum*, as awn lengths in individuals throughout town vary greatly from 0-5+ mm.




Construction site; largely unvegetated clearing

This site is home to construction equipment, heavy machinery, and gravel trucks. The *Lolium* sp. found here is possibly a hybrid of *L. perenne* and *L. multiflorum*, as awn lengths in individuals throughout town vary greatly from 0-5+ mm.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Chenopodium album	lambsquarters	37	0.5	0.5	6-25
Elymus repens	quackgrass	59	0.5	4	151-500
Hordeum jubatum	foxtail barley	63	0.5	7	500+
Lolium sp.	ryegrass	41	0.5	1	6-25
Matricaria discoidea	pineappleweed	32	0.5	3	500+
Plantago major	common plantain	44	0.5	3	51-150
Poa annua	annual bluegrass	46	0.5	0.5	6-25
Taraxacum officinale	common dandelion	58	0.5	3	51-150
Trifolium hybridum	alsike clover	57	0.5	3	26-50

Boat launch/quarry
Plot read along gravel road between the boat launch and the quarry.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Crepis tectorum	narrowleaf hawksbeard	56	0.25	0.025	N/A
Elymus repens	quackgrass	59	0.25	1	N/A
Hordeum jubatum	foxtail barley	63	0.25	1	N/A
Plantago major	common plantain	44	0.25	1	N/A
Taraxacum officinale	common dandelion	58	0.25	1	N/A

City Hall, Iditarod checkpoint, and water treatment facility
Plot includes roadside areas all around the building, the Iditarod checkpoint, and the current water treatment facility. The *Lolium* sp. found here is possibly a hybrid of *L. perenne* and *L. multiflorum*, as awn lengths in individuals throughout town vary greatly from 0-5+ mm.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Chenopodium album	lambsquarters	37	0.5	1	N/A
Crepis tectorum	narrowleaf hawksbeard	56	0.5	10	N/A
Elymus repens	quackgrass	59	0.5	7	N/A
Hordeum jubatum	foxtail barley	63	0.5	10	N/A
Hordeum vulgare	common barley	39	0.5	0.5	N/A
Lolium sp.	ryegrass	52	0.5	1	N/A
Matricaria discoidea	Pineappleweed	32	0.5	7	N/A
Plantago major	common plantain	44	0.5	1	N/A
Poa annua	annual bluegrass	46	0.5	0.5	N/A
Taraxacum officinale	common dandelion	58	0.5	2	N/A
Trifolium hybridum	alsike clover	57	0.5	0.5	N/A




McGrath school and public library; entire perimeter surveyed, including species that had been planted
Caragana arborescens individuals were observed sprouting about 1-2 m from the planted hedge, but are mowed regularly. *Leucanthemum vulgare* is planted here but does not appear to be spreading outside of the landscaped area.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Campanula rapunculoides	rampion bellflower	64	0.5	3	6-25
Caragana arborescens	Siberian peashrub	74	0.5	3	6-25
Chenopodium album	lambsquarters	37	1	1	N/A
Crepis tectorum	narrowleaf hawksbeard	56	0.5	0.5	151-500
Elymus repens	quackgrass	59	1	3	500+
Hordeum jubatum	foxtail barley	63	1	5	500+
Leucanthemum vulgare	oxeye daisy	61	0.01	1	51-150
Matricaria discoidea	pineappleweed	32	1	3	N/A
Prunus padus	European birdcherry	74	0.01	2	1-5
Prunus virginiana	chokecherry	74	0.01	2	1-5
Stellaria media	common chickweed	42	1	15	500+
Taraxacum officinale	common dandelion	58	1	50	500+
Trifolium hybridum	alsike clover	57	1	5	151-500
Trifolium repens	white clover	59	0.5	3	6-25

Tower site on outskirts of town.
Cursory drive-by survey only. No non-natives observed.

Dump on outskirts of town
Cursory drive-by survey only.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Crepis tectorum	narrowleaf hawksbeard	56	0.01	2	N/A
Hordeum jubatum	foxtail barley	63	0.25	10	N/A
Taraxacum officinale	common dandelion	58	0.25	10	N/A

Takotna Ave.
Plot read to record the presence of *Capsella bursa-pastoris* here, so that its existence in town is documented. It was also seen elsewhere in town, but not captured in plots.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Capsella bursa-pastoris	shepherd's purse	40	0.001	0.5	1-5

Department of Natural Resources (DNR) site
Surveyed the area surrounding the offices, bunkhouses, and other structures.

Scientific name	Common name	Invasiveness Rank	Infested acres	Percent cover	Stem count
Bromus inermis ssp. *inermis*	smooth brome	62	0.5	25	N/A
Crepis tectorum	narrowleaf hawksbeard	56	0.01	0.5	N/A
Hordeum jubatum	foxtail barley	63	0.5	20	N/A
Matricaria discoidea	Pineappleweed	32	0.01	5	N/A
Plantago major	common plantain	44	0.25	10	N/A
Stellaria media	common chickweed	42	0.01	5	N/A
Taraxacum officinale	common dandelion	58	0.25	10	N/A
Trifolium repens	white clover	59	0.25	10	N/A

Appendix VI – Additional resources

University of Alaska Cooperative Extension Service (CES)
http://www.uaf.edu/ces/

General information and links
http://www.uaf.edu/ces/pests/plants/

Integrated Pest Management (IPM) and reporting portal
http://www.uaf.edu/ces/ipm/

Alaska Invasive Species Working Group (AISWG)
http://www.uaf.edu/ces/pests/aiswg/

Committee for Noxious and Invasive Plants Management (CNIPM)
http://www.uaf.edu/ces/pests/cnipm/
1-877-520-5211

Alaska Natural Heritage Program (AKNHP)
Alaska Exotic Plants Information Clearinghouse (AKEPIC), link to submit invasive plant data, and link to AKEPIC data portal
http://aknhp.uaa.alaska.edu/botany/akepic/

Alaska non-native plant species list, ranks, and biographies
http://aknhp.uaa.alaska.edu/botany/akepic/non-native-plant-species-biographies/

Alaska Department of Fish and Game toll-free hotline for invasive species reporting
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Appendix VII – Educational materials

Educational materials are provided on the following pages. Pages numbers have been omitted, as these pages are intended to be printed out (double-sided) and distributed.

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Get to Know Invasive Species

Siberian peashrub (*Caragana arborescens*)

Identifying characteristics

- Shrub or small tree, up to 3 m tall
- Yellow-green bark on young stems; green-grey bark and lenticels (small lense-shaped marks or horizontal lines) at maturity
- Alternate or whorled compound leaves
- Each compound leaf has 8-12 leaflets
- Leaflets oblong to elliptical
- Spiny stipules where the leaflet meets the stem
- Yellow tubular flowers borne singly from leaf axils
- Fruit looks like a large, tough, greenbean; flattened in the spring then becoming round; green, yellow, red, or brown

Habitat

- Ornamental that escapes cultivation
- Outside of landscaped areas, can be found in meadows, forest edges, and open woodlands

Distribution

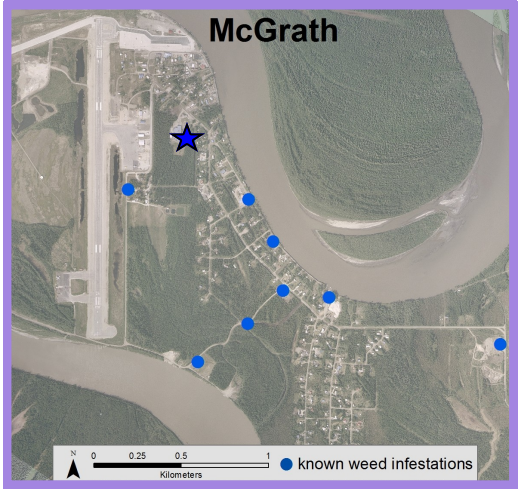
- Planted in towns and villages throughout Alaska

Environmental impacts

- Forms dense, spreading root systems
- Invades natural areas
- Creates soil conditions that favor other invasive and native ruderal plants by fixing nitrogen

There are no native plant species in Alaska that resemble Siberian peashrub

There are many weed infestations in McGrath, including those indicated on the map below. Siberian peashrub was found in 2009 & 2012 at the location marked with a star.



Alaska Natural Heritage Program
University of Alaska Anchorage 2013

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- Displacing native vegetation
- Modifying habitats to favor other invasive or native ruderal species
- Reducing the presence and abundance of native plants, including threatened and endangered species
- Changing forage quality and quantity, thereby affecting wildlife use and habitat, and subsistence users
- Altering physical and biological systems, including soils, nutrient cycling, productivity, successional pathways, hydrology, and fire regimes

Economic impacts

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[1]Schwörer, Tobias, R. Federer and H. Ferren. Managing invasive species: How much do we spend? Institute of Social and Economic Research, University of Alaska Anchorage.

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Get to Know Invasive Species

spotted knapweed (*Centaurea stoebe*)

Identifying characteristics

- Deep taproot
- 1-3 feet tall with many branches
- Basal rosette of deeply lobed leaves, up to 6 inches long
- Leaves and branches have fine hairs that give the plant a grayish appearance and a sandpapery texture
- Flowers purple-pink, rarely white, solitary at end of branches, 1 inch across
- Bracts beneath each flower are stiff with dark tips

Habitat

- Well-drained soils
- Meadows, shrublands, open forests, disturbed sites
- Thrives in both disturbed and undisturbed areas

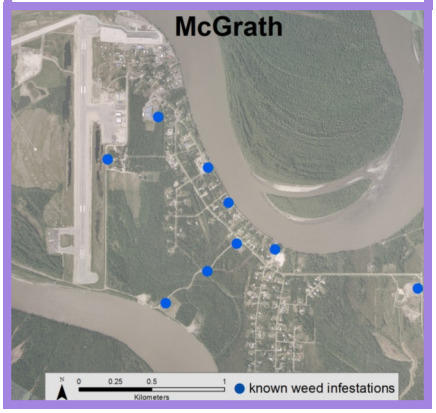
Distribution

- Southeast, Valdez, Kenai, Kodiak, Turnagain Arm, Anchorage

Environmental impacts

- Spread by seeds; each plant produces 1,000-20,000 seeds, which remain viable in the soil 8+ years
- Seed can be transported in contaminated hay and seed mix, and by wildlife, people, and vehicles
- Releases chemicals that inhibit the growth of other plants (allelopathic)
- Displaces native vegetation by creating large infestations
- Reduces wildlife habitat
- Increases runoff and erosion
- Thrives in both disturbed and undisturbed areas

There are many weed infestations in McGrath, including those indicated on the map below. However, knapweed species have not yet been reported.



perennial cornflower (*Centaurea montana*)

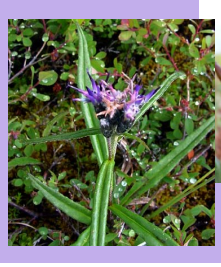
- Blue-purple flowers similar to spotted knapweed
- Unlike spotted knapweed, perennial cornflower has stolons, grows in clumps, and leaves are entire and lance-shaped
- Garden escapee; grows in disturbed areas, woodlands
- Similar distribution as spotted knapweed

Other look-a-likes

- Other knapweeds present in Alaska look similar; all are non-native
- Thistles (*Cirsium* spp., both native and non-native) resemble knapweeds but have spiny leaves

Not to be confused with NATIVE saw-worts (*Saussurea* species)

- Similar flowers but have few to no branches and leaves are undivided



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Get to Know Invasive Species

Canada thistle (*Cirsium arvense*)




Identifying characteristics

- Young plants emerge as basal rosettes
- Up to 2 m tall, with stiff branching stems
- Prickly leaves and stems; soft spines on flower head
- Oblong leaves 4-15 cm long, alternate, unstalked, wavy, irregular lobes, prickly teeth, smooth above, smooth or hairy beneath
- Pink-purple flowers, 1-2 cm across; mature flowers become fluffy whitish seed head
- The only thistle in Alaska that has narrow flower heads and lacks winged stems

Habitat

- Disturbed organic or mineral soils
- Prefers wet sites

Distribution

- Fairbanks, southeast, and south central Alaska
- Transported in root balls of ornamental trees, as a contaminant of hay and straw, by wind, animals droppings, and vehicles

Environmental impacts

- Forms dense colonies, outcompeting native plants and degrading habitat and recreation areas
- Secretes a chemical that inhibits the growth of other species (allelopathic)
- Spines can injure livestock and wildlife
- Spreads by rhizomes, root fragments, and seed; roots can expand 7 m a year, with new buds emerging from underground roots
- 1 cm of root fragment can create a new plant
- Seeds remain viable for up to 21 years
- Seeds continue to mature after a plant is pulled, so they must be disposed of properly
- Very difficult to eradicate

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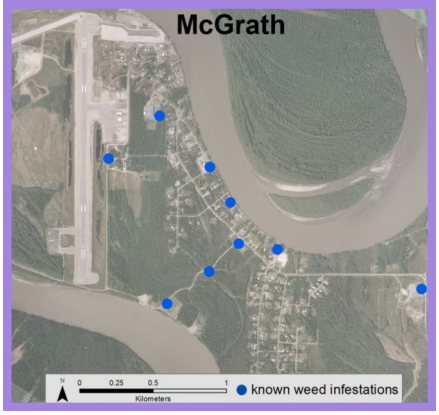

Bull thistle (*Cirsium vulgare*)

- Stems are thicker, more robust, with spiny wings
- Leaves prickly-hairy above and cottony beneath, lower leaves clasp the stem
- Flower heads are wider (2-5 cm), urn-shaped, spiny below
- Biennial; spends first year as rosette and flowers the second year (creeping thistle is perennial and forms a rosette then flowers in the same year)
- Reproduces by seed only, and has a taproot (no creeping rhizomes)

Not to be confused with NATIVE thistles

- Flowers >1 cm across
- Restricted to southern Alaska

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Get to Know Invasive Species

narrowleaf hawksbeard (*Crepis tectorum*)

Identifying characteristics

- 0.1 - 1 m tall
- Starts out as a basal rosette
- Stems are branched, erect, and leafy
- Basal leaves are lance-shaped, 5-15 cm long, and stalked; may have smooth edges, many backward-pointing teeth, or deep lobes
- Stem leaves are smaller, alternate, linear and have extensions at the base that clasp the stem; sometimes edges curl under
- Yellow flowers, 1 cm across, in clusters; turn into white fluffy seed head when mature
- Bracts below flower are smooth and arranged in two distinct rows
- Entire plant exudes milky sap when broken

Habitat

- Disturbed soil and burned and open areas
- Prefers coarse, dry soil

Distribution

- Widespread throughout the state
- Can be dispersed long distances by wind, water, wildlife, and people, and is a contaminant of straw and potting soil

Environmental impacts

- Competes with native plants and crops; reduces available soil moisture
- Delays the establishment of native plants in recently disturbed areas
- May alter native plant-pollinator interactions
- Easier to remove than some other invasive plants; repeated hand pulling or herbicides can be effective

narrowleaf hawkweed

Look out for other NON-NATIVE look-a-likes...

May be confused with invasive narrowleaf hawkweed (*Hieracium umbellatum*), but can be easily distinguished by the bracts beneath the flower. Narrowleaf hawksbeard has two distinct rows, narrowleaf hawkweed has many different lengths (see photo above for comparison).

Not to be confused with NATIVE hawksbeards (*Crepis* species)

- Much smaller
- More hairy
- Found in gravelly sites in natural areas

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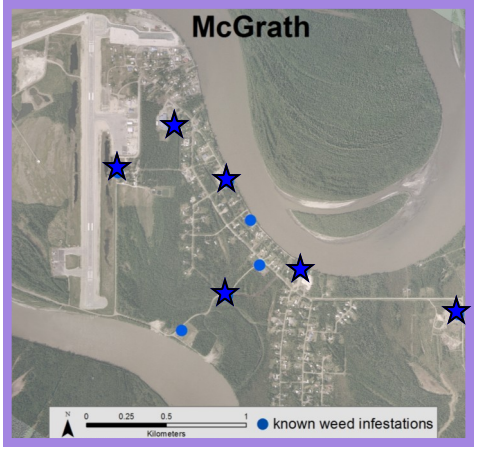

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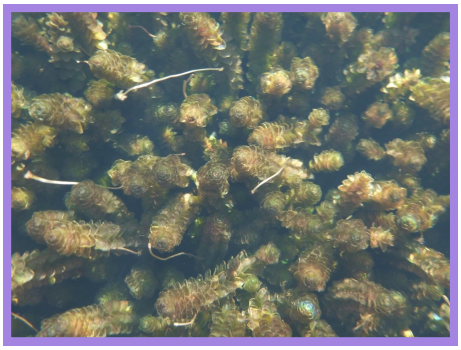
Get to Know Invasive Species

waterweed (*Elodea canadensis, E. nuttallii*)

Identifying characteristics

- Perennial freshwater aquatic forb
- Usually without flowers
- Fruit is a capsule, narrowly ovoid, 5-6 mm long, 2-3 mm wide, 5-6 mm long beak
- *E. canadensis*: leaves dark green and crisp, in whorls of 3, 5-17 mm long, 1-5 mm wide, linear with rounded tips, recurved with minutely toothed margins
- *E. nuttallii*: leaves pale green and flaccid, in whorls of 3 but may appear as 6, 4-15 mm long, 1-2 mm wide, linear with pointed tips, recurved with undulate margins, folded along midrib



Habitat

- Slow-moving or standing freshwater
- Grown as an aquarium plant, introduced to natural water bodies by people dumping aquariums

Distribution

- Anchorage, Cordova, Fairbanks

Environmental impacts

- Creates dense mats and reduces available sunlight to underlying layers
- Displaces native species thereby reducing biodiversity
- Restricts water flow, increases turbidity and pH, alters nutrient and oxygen concentrations in substrate and water, decreases plankton productivity
- Degrades fish habitat
- Reproduces from stem fragments and spreads readily by wildlife, boats, trailers, vehicles, and float planes
- Extremely difficult to get rid of
- Resilient to freezing and desiccation

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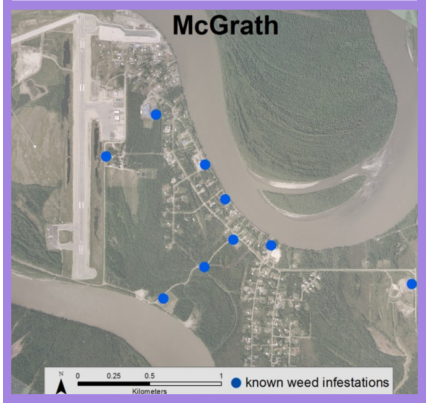

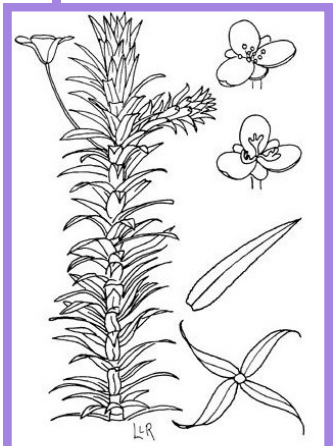
Brazilian waterweed

Similar aquatic invasive species

It can be extremely difficult to tell the difference between waterweed species. Waterweeds may also resemble other aquatic plants, including watermilfoil (*Myriophyllum* spp.), Brazilian waterweed (*Egeria densa*), and hydrilla (*Hydrilla verticillata*). These are all invasive, with the exception of Siberian watermilfoil (*Myriophyllum sibiricum*). When in doubt of a species' identity, consult your local Cooperative Extension office - contact information on reverse.

Not to be confused with NATIVE Siberian watermilfoil (*Myriophyllum sibiricum*)

- Short rhizome
- Leaves are purplish, pinnate, feathery

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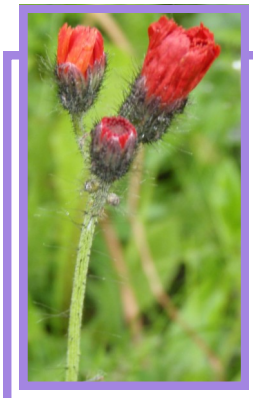

orange hawkweed (*Hieracium aurantiacum*)




Identifying characteristics

- 15-30 cm tall
- Stem usually leafless; sometimes with 1-2 small leaves
- Stem is covered with stiff black hairs
- Stems and leaves exude milky sap when broken
- Basal leaves are oblong or lance-shaped, 10 cm long, with dense white to black hairs
- Bright orange-red flowers, 1-2 cm across, in clusters; fluffy white seed head at maturity

Habitat

- Introduced as an ornamental; escapes cultivation
- Open, disturbed areas
- Tolerates a wide variety of conditions but prefers full sun to partial shade and coarse, well-drained soils
- One of the few invasive plants able to establish in organic soils and/or in subalpine habitats

Distribution

- Throughout southeast and southcentral Alaska, west to Dillingham

Environmental impacts

- Forms dense mats that displace native vegetation
- Spreads by seeds, rhizomes (horizontal belowground stems), and stolons (horizontal aboveground stems)
- Can infest an area 1 m in diameter in one year of growth; sends out 4-8 stolons per year
- Seeds remain viable for up to 7 years
- Pollen grains release chemicals that inhibit growth of other plants (allelopathic)
- Dispersed by wind, water, humans, animals; soil contaminant; in some wildflower seed mixes
- Extremely difficult to eradicate

Other native and non-native hawkweeds are present in Alaska, but none have orange flowers

narrowleaf hawkweed

Not to be confused with NATIVE orange agoseris (*Agoseris aurantiaca*). Unlike orange hawkweed, orange agoseris:

- Has a single flower per stalk
- Is mostly hairless
- Lacks stolons
- Is rare in Alaska; found only in the southeast in alpine meadows, moist open woodlands, and glacial till

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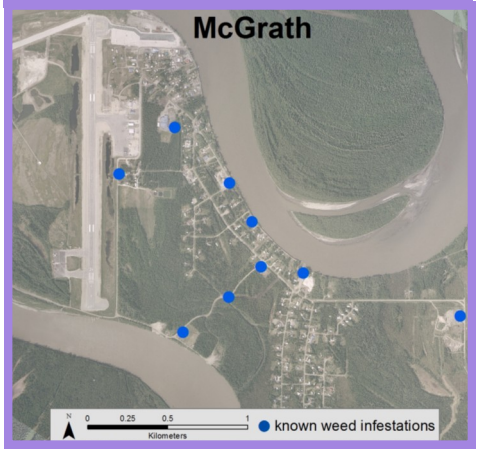

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Get to Know Invasive Species

yellow-flowered hawkweed species

meadow hawkweed (*Hieracium caespitosum*), mouse-ear hawkweed (*H. pilosella*), narrowleaf hawkweed (*H. umbellatum*)




Identifying characteristics

- Generally have clusters of 2-10 flowers, <30 cm tall, hairy, basal rosette of ovate to lanceolate leaves
- Meadow hawkweed up to 1 m tall, stem is covered in coarse, black, gland-tipped hairs, stolons with white hairs, stem usually leafless
- Mouse-ear hawkweed usually with one flower, sticky hairs, no stem leaves
- Narrowleaf hawkweed has leafy stems, but no basal rosette, leaves are serrated and somewhat hairy; like native hawkweeds, it has no stolons

Habitat

- Open, disturbed areas

Distribution

- Scattered throughout southeast, south central, and interior Alaska

Environmental impacts

- Spreads by rhizomes, stolons, and highly mobile seeds
- Forms dense patches that crowd out other vegetation
- Releases chemicals that inhibit the growth of other plants (allelopathic)
- Reduces forage value of natural habitats
- Alters soil properties and community structure
- Extremely difficult to control

Additional non-native species in the *Hieracium* genus include *H. murorum, H. atratum, H. laevigatum, H. lachenalii*

H. caespitosum *H. pilosella* *H. umbellatum* *H. lachenalii*

Not to be confused with NATIVE hawkweeds (*H. triste, H. gracile, H. albiflorum*) which differ from non-native yellow-flowered hawkweeds in that they:

- Are generally <30 cm tall
- Lack stolons
- Have basal rosette of long stalked leaves, stems with 2-3 smaller leaves
- Have flowers <1 cm across
- Have 2-10 flower heads (rarely 1)
- Have bracts below the flower head that are often densely hairy
- Are most commonly found in high-elevation meadows, rocky slopes, stream sides

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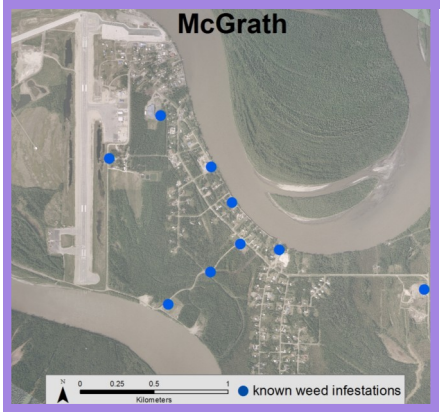

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Get to Know Invasive Species

oxeye daisy (*Leucanthemum vulgare*)

Identifying characteristics

- Short-lived perennial
- 30 cm - 1 m tall
- Single flower head at the end of each stem
- White petals with a yellow center, 2-4 cm in diameter
- Leaves alternate along the stem, <10 cm long, lance to spoon-shaped with coarsely toothed edges
- Disagreeable odor

Habitat

- Garden plant, often in wild flower seed mixes, escapes cultivation
- Disturbed sites, meadows, grasslands, pastures

Distribution

- Widespread throughout Alaska

Environmental impacts

- Spreads by rhizomes and seeds
- Forms dense stands, displacing native vegetation
- Not used by insects or grazing animals due to disagreeable odor and toxicity
- Hosts a number of plant viruses

Shasta daisy (*Leucanthemum xsuperbum*)

- Leaves are toothed, lance-shaped, up to 20 cm long
- Not as aggressive as oxeye daisy

Not to be confused with NATIVE arctic daisy (*Arctanthemum arcticum*)

- Similar flowers
- Low-growing
- Wedge-shaped leaves
- Found on rocky seashores and estuaries in coastal areas
- All other plants with similar flowers in Alaska have either entire leaves or highly dissected leaves

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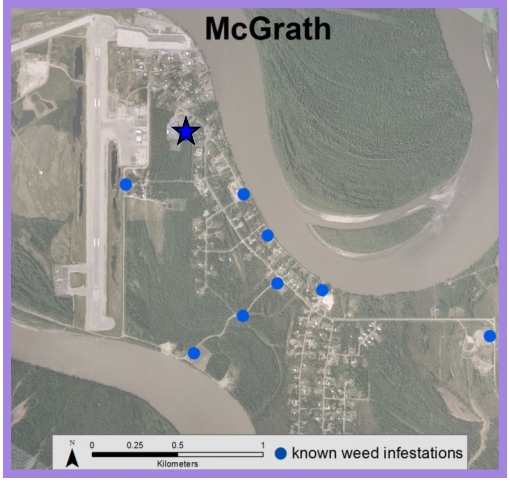

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Get to Know Invasive Species

purple loosestrife (*Lythrum salicaria*)

Identifying characteristics

- Up to 2.5 m tall, forms bushy clumps of 30-50 stems
- Leaves are lance-shaped, 2-10 cm long and slightly hairy
- Flower clusters resemble native fireweed, but with 5-7 petals (fireweed has 4 petals)
- Entire plant resembles native fireweed, but can be distinguished by more slender spikes of flowers, 4-edged stems with soft hairs, and leaves that are opposite or whorled

Habitat

- Thrives in wetlands, ditches, and river banks

Distribution

- Only reported from Juneau and Anchorage to date

Environmental impacts

- Grows quickly, clogs waterways, and alters wetlands
- Forms large monocultures, displacing native plants
- A single plant can produce over 2 million seeds a year; also reproduces from creeping roots, cut stems, and from stem and root fragments
- Seeds are transported by water, wind, wildlife, and people

Not to be confused with NATIVE fireweeds (*Chamerion angustifolium, C. latifolium*)

- Round stems
- Alternate leaves
- Flowers have 4 petals

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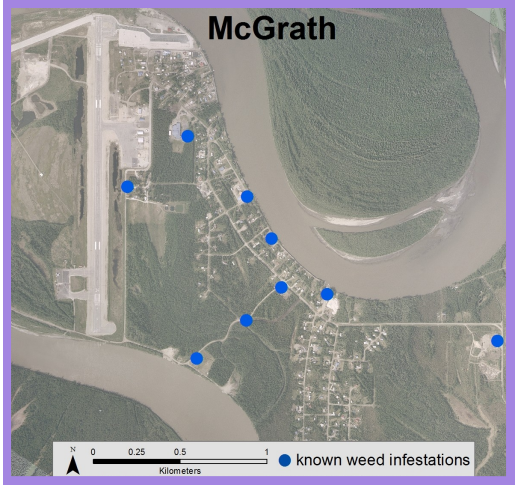

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Get to Know Invasive Species

White sweetclover (*Melilotus alba*)

Identifying characteristics

- 1-1.5 meters tall
- Compound leaf with 3 leaflets
- Leaves toothed two thirds down the leaflet
- White, fragrant spikes of flowers

Habitat

- Thrives in disturbed, fine-grained mineral soil
- Often growing along roadsides
- Found on gravel river bars
- Tolerates inundation
- Sunny locations; does not tolerate shade

Environmental impacts

- Interferes with salmon migration and moose habitat
- Helps other invasive and native ruderal species establish by fixing nitrogen in the soil
- Seeds readily disperse in water
- Very difficult to eradicate because seeds remain viable for 20 years

Distribution

- Currently found along all Alaskan highways and some major Alaskan rivers
- Few occurrences in interior Alaska off of highway and river systems

yellow sweetclover (*Melilotus officinalis*)

- Looks identical to white sweetclover except it has yellow flowers
- Not as widespread or aggressive as white sweetclover
- White and yellow sweetclover are often treated as subspecies or varieties of the same species

There are no native plant species in Alaska that resemble sweetclovers

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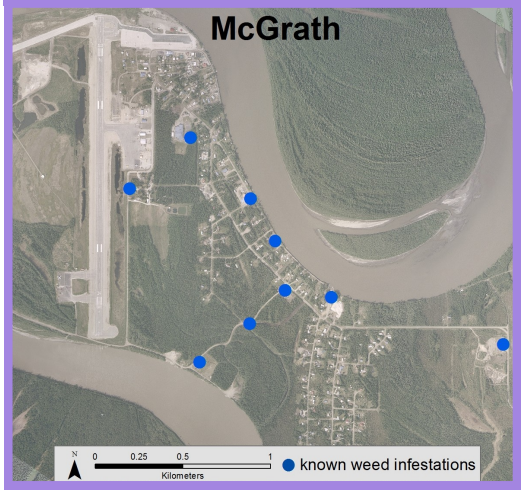

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Get to Know Invasive Species

reed canarygrass (*Phalaris arundinacea*)

Identifying characteristics

- Tall grass, ≥ 1.5 meters
- Leaves are broader than most other grasses, ≥ 1 cm wide
- Leaves branch off stem at right angles
- Flower clusters are dense, 6-18 cm long, and purplish to straw colored
- Flowers are compact when young then opening when mature
- Stays green later in the fall than native bluejoint grass
- Conspicuous creeping rhizomes

Habitat

- Prefers wet soils and is often found in wetlands and river banks; tolerates inundation
  - Also found on roadsides and in ditches

Distribution

- Common throughout southern Alaska with some occurrences in the interior

Environmental impacts

- Increases siltation, interfering with salmon migration and egg laying
- Spreads quickly and aggressively
- Forms persistent monocultures in riparian corridors
- Very difficult to control

Not to be confused with NATIVE Canada bluejoint (*Calamagrostis canadensis*)

- Ligules 3-6 mm long
- Nodding panicles, looser and thinner than reed canarygrass
- 1 floret per spikelet
- Lemmas have a short awn and a diagnostic tuft of hairs at the base
- Abundant throughout Alaska; found in most open lowland habitats

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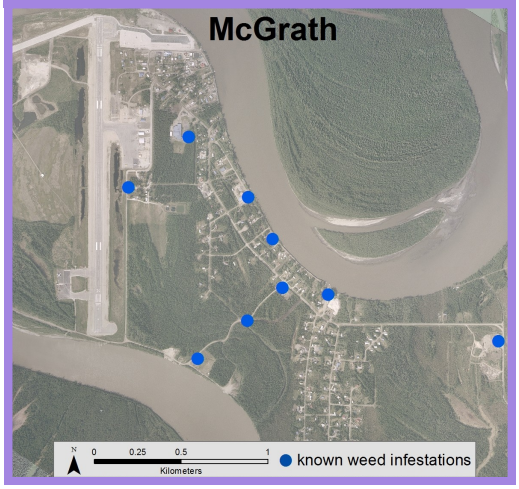

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Economic impacts

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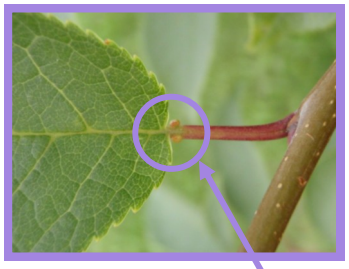
Get to Know Invasive Species

European birdcherry & chokecherry (*Prunus padus* & *P. virginiana*)



Identifying characteristics

- Tree up to 12 m tall
- Purplish/gray/greenish bark
- Long stalks on leaves
- Leaves oval to egg-shaped and sharply serrated
- Two greenish glands at the top of the leaf stalk, not always easily visible
- Flowers in whitish clusters of long (10 cm), showy spikes
- Fruits are small, round, black, and bitter
- Chokecherry foliage turns dark red in the summer
- European birdcherry stays green late in the fall, longer than all other deciduous trees and shrubs

Habitat

- Often planted as ornamentals; escapes cultivation
- Riparian corridors and open forests
- Recently found growing in muskeg and along glacial river bars

Distribution

- European birdcherry: abundant in Anchorage and Fairbanks; also found in Juneau, Palmer, Talkeetna, Delta Junction, and Fort Yukon
- Chokecherry: Anchorage, Palmer, McGrath; likely also planted in but not reported from other locations

Environmental impacts

- Birds eat the cherries and deposit them in natural areas
- Spreads quickly and displaces native vegetation in natural areas, particularly along creeks
- Berries are toxic and known to have killed moose calves in Anchorage

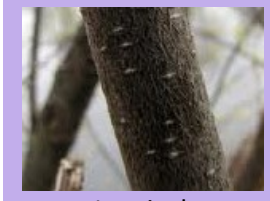
Prunus padus

Prunus virginiana

Not to be confused with NATIVE trees

Some superficial resemblance, but look closely and it is easy to see the difference. Cherry trees have:

- An oval or egg-shaped leaf that narrows toward the base
- Even serrations (tiny teeth) along the leaf edge
- Smooth bark, often purplish-reddish-grey
- Bark has lenticels (short horizontal lines or dots)

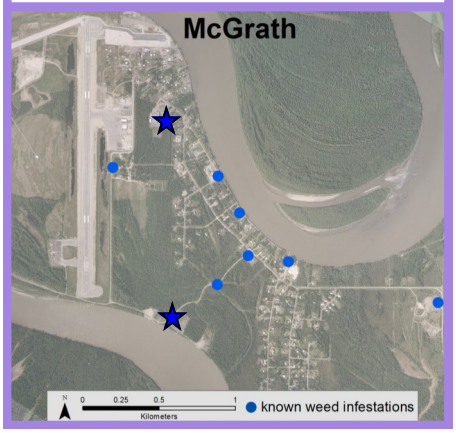

Lenticels


Cherry


Birch


Alder

There are many weed infestations in McGrath, including those indicated on the map below. Invasive cherry trees were found in 2012 at those locations marked with a star.



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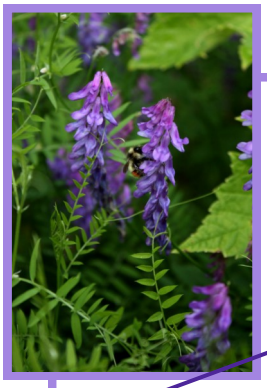
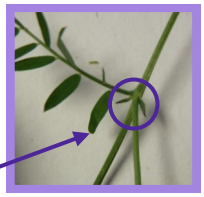


bird vetch (*Vicia cracca*)



Identifying characteristics

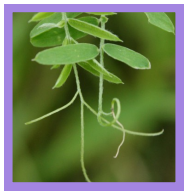
- Climbing or trailing vine
- 40-150 cm tall
- Stem has multiple branches
- Leaves are alternate, compound, with 8-10 leaflets
- Leaflets are linear to oblong, 1-3 cm long, 2-4 mm wide
- Small, branched, curling tendrils at the tip of the compound leaf
- Stipules where the leaf meets the stem
- Flowers are purple-blue, arranged in a one-sided spike of 20-60 small flowers
- Seeds pods are brown, 2-3 cm long, lance-shaped, not constricted between seeds

Habitat

- Disturbed sites, roadsides, trails, grassy areas, forest edges and openings, thickets
- Planted as forage or as a cover crop; escapes cultivation
- Tolerates drought and fire

Distribution

- Widespread throughout Alaska



Environmental impacts

- Reproduces by seed and rhizomes
- Aggressive climber, smothers other plants
- Alters soil by fixing nitrogen
- May alter native bee behavior and pollination patterns
- Develops large seed banks; many years of repeated treatment are needed to remove populations

Similar-looking non-native species:

winter vetch (*Vicia villosa*)

- Very hairy
- Flowers distinctly 2-toned (purple and white, pink and white)

garden vetch (*Vicia sativa* ssp. *nigra*)

- 5-7 leaflet pairs per leaf
- Leaflets have a needle-like tip
- Flowers in leaf axils (not a hanging cluster)

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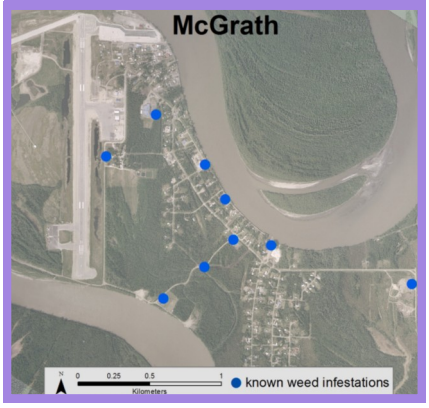

Similar-looking NATIVE species include *Vicia gigantea, V. americana, Lathyrus* spp., *Oxytropis* spp., *Hedysarum* spp., and *Astragalus* spp.

Bird vetch can be distinguished from other native and non-native look-a-likes by these characteristics:

- Flower clusters are longer than the leaves
- Spikes of flowers are one-sided
- Forked tendrils on the tips of leaves
- Stems do not have wings
- Leaflets are not needle-tipped

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