Non-native plant management plan for Campbell Tract, Anchorage, Alaska

Report prepared by: Helen Cortés-Burns & Lindsey Flagstad

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

Alaska Natural Heritage Program
University of Alaska Anchorage

Submitted to:

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

February 20, 2013

Acknowledgements

The authors want to thank the Bureau of Land Management, and particularly Laurie Thorpe, for their support and funding of this project. We also want to thank Steven Seefeldt for assistance with herbicide recommendations and Matt Carlson for his comments and suggestions on an earlier draft.

Table of Contents

List of Figures

List of Tables

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 harm, the spread of invasive[2] species is a primary cause of degradation to ecological systems. Aggressive invaders threaten native biodiversity, plant community structure and composition, and ecosystem processes (Cronk and Fuller 1995, Walker and Smith 1997, Stein *et al.* 2000). The ecological disturbance caused by invasives translates into economic losses and expenditures each year, measured in billions of dollars, for land managers nationwide (Schmitz and Simberloff 1997, Westbrooks 1998, Pimentel *et al.* 2005). Specifically, the average annual spending between 2007 and 2011 on invasive species in Alaska is $5.8 million (Schwörer *et al.* 2012).

The number of non-native plant taxa documented in Alaska (ca. 290) represents roughly 14% of the state's total flora (Carlson *et al.* 2008), with new invasive species recorded every year. This is not a particularly high percentage relative to most other states: 18% of California's flora (Hickman 1993), approximately 20% of Oregon's flora (Kaye pers. comm.), and 49% of Hawaii's flora (Randall and Hoshovsky 2000) are non-native. However, over the last ten years there has been a marked acceleration in the rate of introduction of non-native plants to Alaska, presumably driven by increases in the movement of goods and people (Carlson and Shephard 2007).

While many of Alaska's non-native species are restricted to high-use and thus disturbed areas, such as transportation routes, urban centers and recreational areas, some species have been documented moving off the human footprint into natural ecosystems. For instance, in Interior Alaska, *Caragana arborescens*[3], *Crepis tectorum*, *Hieracium umbellatum*, *Melilotus albus* and *Vicia cracca* have been recorded moving off roadsides into adjacent fields and burned areas (Cortés-Burns *et al.* 2008, Conn *et al.* 2008); in Southcentral Alaska, *Hieracium aurantiacum* has been found on alpine trails in the Chugach Mountains; and in Southeast Alaska, thistles (*Cirsium* spp.) and the giant knotweed species complex (*Fallopia* spp.) have invaded undisturbed areas (Borchert 2004, Schrader and Hennon 2005).

In at least some of these instances, these invasions are starting to impact ecological conditions (Carlson and Shephard 2007). For example, in Southeast and Southcentral Alaska *Phalaris arundinacea* is rapidly invading ditches, encroaching active channels and forming mono-specific stands in the region's wetlands (Schrader and Hennon 2005, Spellman 2009). Similarly, the widely planted *Prunus padus* has replaced much of the native shrub and tree riparian vegetation along Anchorage's creeks (Cortés-Burns and Flagstad 2009, Roon 2011), is starting to spread along the Chena River in Fairbanks and has caused fatal poisoning of moose calves in Anchorage (Woodford *et al*. 2011). Yet another example of a non-native species that has been documented affecting Alaska's ecosystems is *Melilotus albus*; this legume out-competes native species along Alaska's glacial river bars (Spellman and Wurtz 2010) and impacts native plant-pollinator networks (Schneller and Carlson in prep.). Nonetheless the overall number, distribution and impacts of invasive weeds in Alaska are still minor; land managers in this state have a unique opportunity to be proactive in managing invasive plants and reducing current and future negative impacts they cause.

[1] Non-native plants are plants 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 – this definition follows that of Executive Order 13112 (1999, see Appendix I)

[3] This document refers to plant species by their scientific name. For associated common names see Appendix II.

The mission of the Bureau of Land Management (BLM) is to sustain the health, diversity and productivity of public lands for the use and enjoyment of present and future generations. Among other lands in Alaska, BLM manages the 730-acre Campbell Tract (herein also referred to as the Tract), which is located in Anchorage and constitutes BLM's most heavily used land parcel within the state. In 2009, the BLM Anchorage Field Office (AFO) and the University of Alaska Anchorage (UAA) Alaska Natural Heritage Program (AKNHP) entered into an agreement to develop a weed management plan for BLM's Campbell Tract.

The purpose of this document is to guide the implementation of a weed[4] management program at Campbell Tract, the boundaries of which are delineated in Figure 1. This weed management plan makes recommendations that aim to minimize the introduction of non-native plant species into the Tract, as well as manage and control existing populations of invasive plant species already established within the Tract. The management plan is intended to guide policy and action for the next ten years; the monitoring plan, also included in this document, is intended to guide survey and control efforts for the next five years.

This plan has been prepared to establish BLM-AFO policy concerning the coordination and management of invasive species actions in Campbell Tract. The contents of this plan follow the structure of other Alaska weed management plans, namely those developed by the Municipality of Anchorage (Gary 2010), the Kenai Peninsula Cooperative Weed Management Area (Slemmons 2007), the University of Alaska Fairbanks (Heidemann *et al.* 2010) and the BLM Central Yukon Field Office (BLM 2012). It also borrows elements from Lower 48 weed management plans (Fletcher *et al.* 2005, Duncan 2008).

[4] Herein, the term "weed(s)" is considered synonymous with "non-native plant(s)"

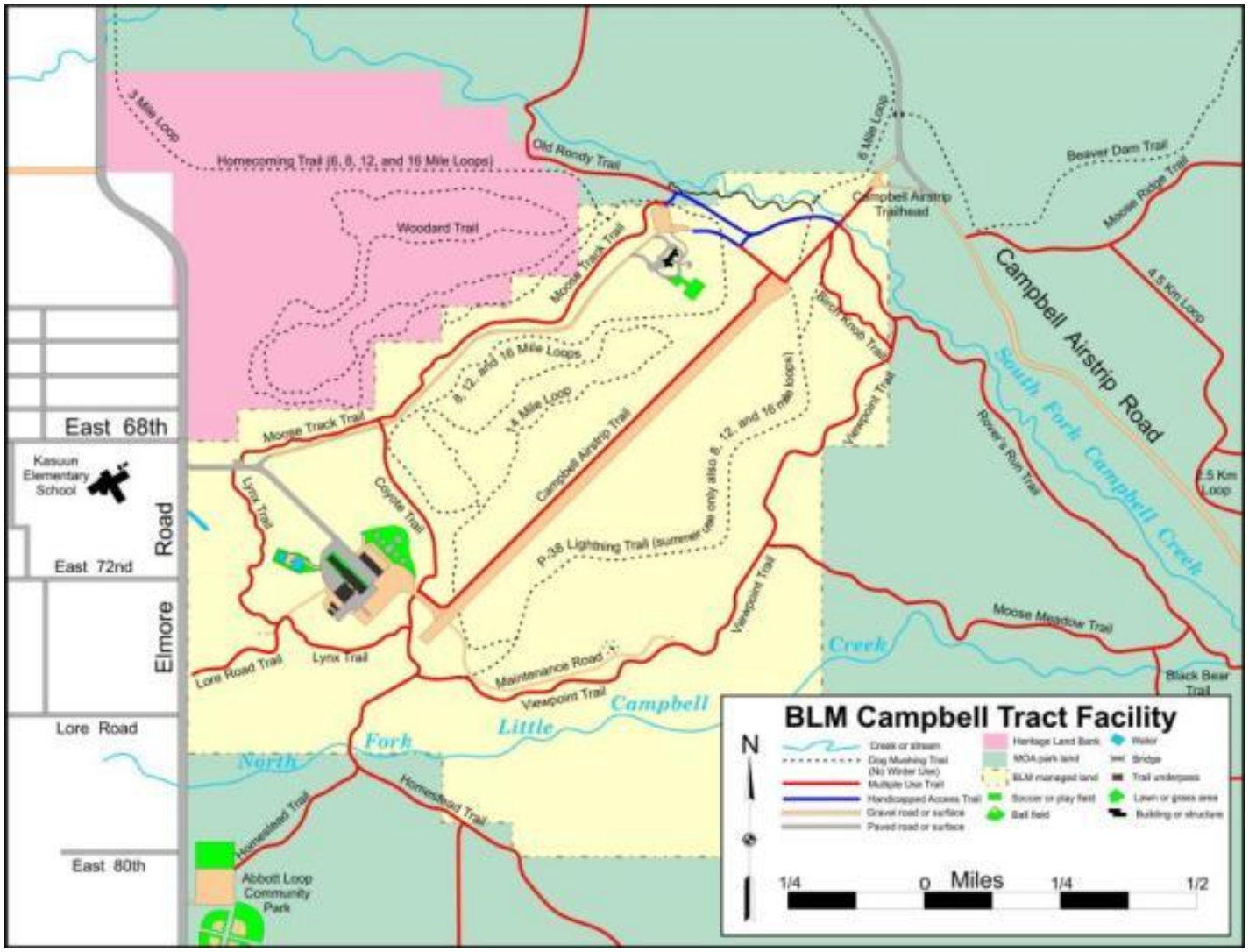

Figure 1. Map of the BLM Campbell Tract Facility, Anchorage, Alaska, showing trails, streams, roads and aviation facilities.

Objectives

Within this 10-year plan to manage invasive species at Campbell Tract, a five-year monitoring program has been outlined for potential on-the-ground implementation. The management and monitoring plans aim to provide guidelines for BLM-AFO staff on how to:

1. Utilize best management practices (BMPs) to prevent the establishment of invasive plants in weed-free areas and minimize the spread of high-priority infestations.
2. Adaptively monitor infested areas to:
    a. detect changes in each population's size or impacts over time
    b. and/or determine treatment efficacy
    c. and/or detect incipient infestations to be followed by a rapid, coordinated response to eradicate or contain the new infestations (Early Detection and Rapid Response, EDRR)
3. Use and make adjustments to the Campbell Tract-specific Treatment Prioritization tool, in conjunction with local and state weed geodatabases, ranking lists and expert knowledge, to establish strategies on managing weeds on a priority basis.
4. Implement prioritized treatment recommendations utilizing an integrated weed management approach that incorporates ecosystem processes.
5. Promote awareness, stewardship and activities that aim to prevent or minimize the presence of invasive plants.
6. Support science-based studies of invasive plants that align with Campbell Tract's management goals and inform the adaptation of management priorities and strategies.

To meet these objectives, this document first partitions Campbell Tract into units according to each area's vegetation, uses and management goals. It also outlines pertinent weed management tools and concepts and provides a summary of the abundance and diversity of invasive weeds found in Campbell Tract through 2011. Finally, it identifies non-native plant species or populations that should be prioritized for eradication, containment or monitoring on a unit by unit basis and proposes ways in which to increase stewardship among visitors and recreational trail users.

Campbell Tract

Multiple factors determine the diversity and abundance of invasive plant species at a given site. Some of the most important factors are land use (historical and current), vegetation types and soil characteristics, of the site itself and of adjacent areas. In the following sections we provide a brief summary of the Tract's history, vegetation, wildlife and current vegetation management units.

History

The lands that today constitute Campbell Tract were part of the public domain from 1867, when Alaska became a United States territory, until World War II. In 1942 approximately 7,680 acres of public domain land near Anchorage, including today's Campbell Tract, were transferred to the War Department; the Army built an access road fording Campbell Creek and constructed the 5,000-foot gravel runway (now known as the airstrip) and associated taxiways (Guyer 2000). By 1971 the BLM had taken over the administration of the 5,000 acre Campbell Tract Facility, which included the administrative offices, the Campbell Creek Fire Control Station, the airstrip and the surrounding undeveloped area. In 1980 over 80% of the Tract's lands were conveyed to the State of Alaska, which in turn transferred most of these to the Municipality of Anchorage (including today's Far North Bicentennial Park); BLM retained 730 acres. The last stage in the development of Campbell Tract came in 1996, when the Campbell Creek Science Center (CCSC) opened (Guyer 2000). Thus, even though Campbell Tract is now one of Anchorage's largest parcels of undeveloped land, this area has been in considerable use for nearly a century. Consequently, many of the more widespread species found in the Tract today have likely been present in the area for several decades. This would include species such as *Alopecurus pratensis, Capsella bursa-pastoris, Matricaria discoidea, Plantago major, Poa annua, Stellaria media,* and *Taraxacum officinale,* which have been recorded in Campbell Tract, and also in villages, historic abandoned cabins and mines in rural Alaska (Hultén 1968; Cortés-Burns and Carlson 2006 a, b; Cortés-Burns *et al.* 2010).

Wildlife and vegetation

The vegetation of Campbell Tract is a typical mix of Southcentral Alaska boreal forest types. Mid-successional paper birch forest classes dominate the area, probably as the result of fire and other disturbances, while black spruce forests dominate poorly drained sites, and alder, willow and cottonwood mosaics of forests and shrublands are found in natural or anthropogenically-disturbed sites (Guyer 2000). Landscaping with primarily native species is occurring at the Science Center. Roadsides and the airstrip margin appear to have been seeded with mixes of non-native clover-grass seed for stabilization and erosion control. Approximately 15 % of the Tract's lands, mostly coinciding with the South Fork of Campbell Creek and the North Fork of Little Campbell Creek riparian corridors, have been designated for wetlands preservation[5] (Municipality of Anchorage 2012).

The Tract supports resident populations of black bears, brown bears, moose, snowshoe hares, porcupines, small mammals, waterfowl and passerines, as well as transient species such as lynx, fox, coyote and wolf. The area supports approximately 40 species of migratory and resident birds, and the

[5] Class "A" Wetlands (formerly Preservation Wetlands): These wetlands are considered of the highest resource value. They perform at least two, and typically more, significant wetland functions. Class "A" wetlands are considered most valuable in an undisturbed state, as most uses or activities, especially those requiring fill, negatively impact known wetland functions. "A" wetlands are not to be altered or otherwise disturbed in any manner, except as outlined in Anchorage's Wetlands Management Plan's enforceable policies (Municipality of Anchorage 2012).

South Fork of Campbell Creek provides habitat for Rainbow Trout, Dolly Varden and King and Coho salmon (Alaska Department of Fish and Game 2011).

BLM vegetation management units

To tailor a weed management plant to the Tract's various needs and activities, we identify the following "land use/land management" units within Campbell Tract (Figure 2):

1. Riparian corridors

The vegetation adjoining to both the North Fork of Little Campbell Creek and the South Fork of Campbell Creek are herein treated as a single vegetation management unit. These two creeks intersect Campbell Tract and provide a natural corridor between the Chugach Mountains to the east and the Cook Inlet to the west. The creeks provide fish spawning habitat, and the associated vegetation provides a habitat corridor for Anchorage's wildlife. In addition, much of Campbell Creek's riparian vegetation has been designated for wetlands preservation (Municipality of Anchorage 2012), a regulation that is adopted by the BLM within the Anchorage Bowl area.

BLM vegetation management goals: To maintain the health and function of these riparian corridors, to ensure that there is sufficient high-quality habitat for the area's fish and wildlife and to allow trail users to experience intact ecosystems.

2. Trails and trailheads

There are over 12 miles of trails in the Tract, and these are connected to the city-wide trail system that is maintained by the MOA, which are in turn connected to the trails of Chugach State Park. Trails provide year-round outdoor recreation and education opportunities for Campbell Tract's visitors, as well as habitat for Anchorage's wildlife.

BLM vegetation management goals: To provide the public with a broad range of outdoor recreation opportunities and to encourage people to safely enjoy and appreciate the Tract's biological diversity by providing interpretative and wildlife safety information. Vegetation management goals also include allowing natural vegetation to grow along the trails and at trailheads as long as trail management specifications are met (e.g. vegetation should be six inches tall or less in areas around fencing, sign posts, bulletin boards and other structures).

3. Fuel Break

The fuel break intersects with the easternmost section of Campbell Tract and with the North Fork of Little Campbell Creek. It is maintained as a shaded fuel break, and every ten years all spruce trees with a diameter of eight inches or less are removed.

BLM vegetation management goals: To allow for natural diversity in the area while removing hazardous fuels, namely spruce trees, in a 200 foot wide corridor that connects to municipal lands and adjoining fuel break corridors.

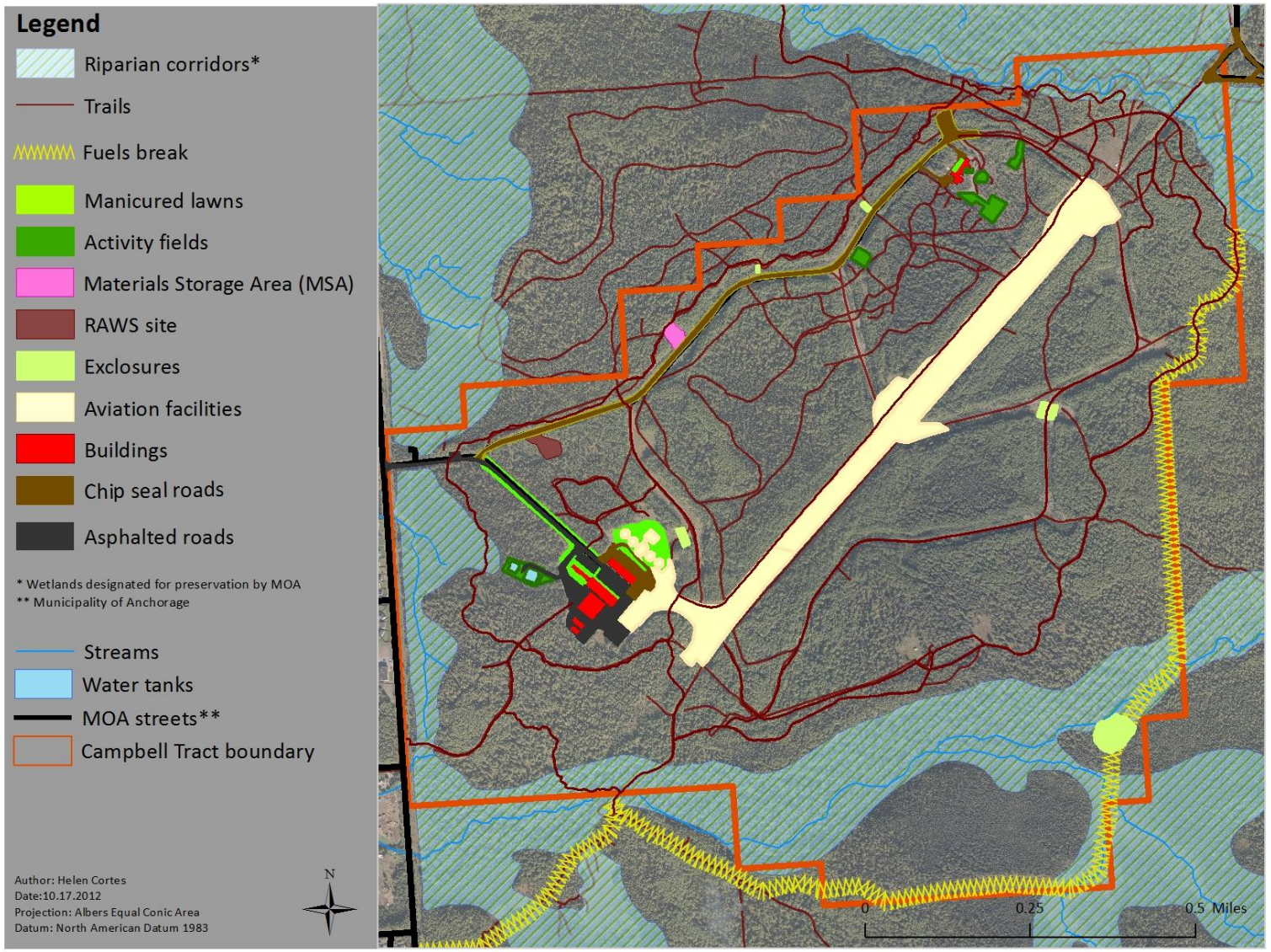

Figure 2. Map of Campbell Tract's vegetation management units.

4. Manicured lawns

This unit comprises the grassy road shoulder that extends from the BLM Road gates to the administrative buildings' parking lot, the lawns that surround the Science Center and administrative buildings and the grassy patches around the helipads.

BLM vegetation management goals: To provide an open, safe and aesthetic landscape around structures. Arctic turf lawns are kept to two inches, so that no vegetation protrudes above the elevation of the asphalt edge. Woody species are not allowed.

5. Activity fields

There are three activity fields in the Tract: two are close to the CCSC and are used for outdoor education and outreach events, while the third is near the administrative buildings and used to be the sewage lagoon. The system is now hooked up to Municipality Services and the lagoon has been filled in.

BLM vegetation management goals: The long term goal is to grow durable turf that could withstand the impact of the activities carried out at these sites. The turf would be kept under two inches and the fields would be surrounded by natural vegetation.

6. Materials Storage Area (MSA)

Most of the materials that are brought into Campbell Tract for immediate use in construction and maintenance projects are deposited close to the project area. However, importated fill (especially gravel and mulch) that is not going to be used right away is stored at the MSA, located along Science Center Drive.

BLM vegetation management goals: To remove and preclude the growth of any vegetation (native or otherwise) below and around the imported material piles, as well as to control woody vegetation that might impede access from the road. Native, natural vegetation is allowed to grow around the perimeter of the storage area.

7. RAWS site

The Remote Automated Weather System (RAWS) is located in a largely cleared area that abuts the Science Center Drive. However, spruce trees have been planted to screen the view of the structure from the road.

BLM vegetation management goals: To promote vegetation screening of the structure from the road viewshed while keeping vegetation around the station low enough to permit foot access and accurate functioning of the station.

8. Exclosures

Six vegetation exclosures have been established in Campbell Tract to restrain moose from browsing plant species that occur naturally in the Tract and are over-browsed.

BLM vegetation management goals: To protect some patches of vegetation from moose herbivory while promoting the full and fast growth of native plants within them, with the intention of using these native plants for the revegetation of heavily used or disturbed sections of the Tract (e.g. via willow cuttings, aspen and birch sapling transplants). Unfortunately, many of the exclosures have

instead become hotspots of invasive weeds within the Tract (probably because the topsoil brought in when they were erected was contaminated with invasive plant propagules).

9. Aviation facilities (airstrip, helipads, and associated structures)

This unit consists of the gravel airstrip and associated runway safety area, object free area, ramp, taxiway, approach areas and run-up pads, as well as the six helipads. The landscaped lawns around the helipads are merged into the 'manicured lawns' unit. The airstrip and helipads are used for federal operations by the BLM and other agencies. The airstrip also serves as an emergency runway for the region.

BLM vegetation management goals: To ensure safe aircraft operations. BLM vegetation management goals vary among subunits.

- The helipads, airstrip, apron areas, taxiways and run-up pads should be clear of all vegetation regardless of nativity or invasiveness. The runway safety area (RSA, designed to prevent damage to aircraft that stray to either side of the runway) has a two foot tall vegetation tolerance, such that nothing protrudes above the graveled airstrip elevation edge. Only grasses are allowed; no woody vegetation of any height is allowed.
- The object free area (OFA, includes and stretches beyond the RSA to provide aircraft an added measure of safety) has a three foot tall vegetation tolerance. Grasses, forbs, and some woody species are allowed as long as they do not exceed three feet in height).
- The approach areas consist of select clearings of coniferous and deciduous trees that facilitate the approach to the runway.

10. Buildings

The BLM administrative buildings, warehouse, communication sites and CCSC are merged into a single unit because they have a combination of chip-seal or asphalted roads and manicured lawns in their immediate vicinity.

BLM vegetation management goals: Any unvegetated area surrounding the buildings (chip-seal or paved) should be kept as such, with zero tolerance for both native and non-native vegetation. For management objectives relating to the adjacent lawns and activity fields see above. It is especially important that all landscaped areas around the CCSC that are used to display native plant species or provide examples of natural plant communities for educational purposes should be kept free of non-native species.

11. Chip-seal roads

From a vegetation management perspective, there are three main sections of road in Campbell Tract:

1. the Science Center Drive (chip-seal road, surrounded by natural vegetation)
2. the BLM Road section between the entrance on Elmore Road and the gates (asphalted road surrounded by natural vegetation)
3. the BLM Road section from the gates to the administrative buildings (asphalted road lined with manicured lawns)

The Science Center Drive road shoulder is lined with natural, native vegetation. The goal is to allow the road to blend into its natural surroundings, to enhance the outdoor experience of visitors to the CCSC and the Tract's trails.

BLM vegetation management goals: To ensure the safety of area users and drivers by preventing the encroachment of both native and non-native vegetation onto the drivable surfaces and to allow adequate sight distances between vehicular and pedestrian/non-motorized traffic. A specific objective for the vegetation along the chip-sealed Science Center Dr. is to maintain a natural diversity of vegetation along the roadside; vegetation is mowed or cut back only to maintain adequate visibility.

12. Asphalted roads

The BLM Road connects the Elmore Road to the BLM Administrative buildings area. However, the road is divided into two sections based on how the roadside vegetation is managed:

1. From the entrance on Elmore Road to the gates, natural vegetation is allowed to grow but is cleared and cut back to ensure good visibility. We include the asphalted Smokejumper's Trailhead and other trailheads in the 'Trails' unit.
2. From the gates to the administrative buildings, manicured lawns run parallel to the road; these lawns provide soil stabilization, good visibility, and are maintained for aesthetics. The lawns are included in the 'manicured lawns' unit.

BLM vegetation management goals: To keep the asphalted areas free of both native and non-native vegetation, and to allow for natural or landscaped vegetation to grow on the road shoulders while promoting good visibility and safe driving conditions.

Non-native plant inventory efforts to date

The BLM in Alaska has shown a strong commitment to invasive weed prevention and management across the state (Cortés-Burns *et al.* 2007; Cortés-Burns *et al.* 2008; Cortés-Burns *et al.* 2010; Flagstad and Cortés-Burns 2010; Cortés-Burns *et al.* 2011a, b; BLM 2012). More specifically, multiple efforts have been made to document invasive species at Campbell Tract. The first non-native plant infestations recorded from Campbell Tract were documented by Cooperative Extension Service biologist Michael Rasy, who surveyed the CCSC amphitheater for weeds in 2003 (AKEPIC 2012). Since then, AKNHP has conducted two non-native plant inventories in the Tract: one in 2006 (Carlson *et al.* 2006) and the other, led by BLM-Chicago Botanic Garden intern Carl Norlen, in 2010 (AKEPIC 2012). The AKNHP also revisited long-term monitoring transects that were established during the 2006 surveys in 2008 (Cortés-Burns 2009) and in 2009 (Flagstad 2010). High priority infestations recorded during 2010 were revisited and controlled by (BLM-funded) AKNHP youth hires in 2011; these youth hires also helped develop a number of non-native plant outreach and education products (trailhead posters, weed identification workshops and community weed pull events) for the Tract in 2011 and 2012. Finally, University of Alaska Fairbanks graduate student Dave Roon surveyed riparian areas in and near Campbell Tract as part of his research on the ecological effects of *Prunus padus* on Anchorage streams (Roon 2011).

During the initial Tract-wide inventory a total of 175 acres were surveyed for non-native plants ranked 60 or higher. All the major trails, roads and developed areas, as well as Campbell Creek and Little Campbell Creek, were inventoried. In all, 46 non-native plants were recorded (Carlson *et al.* 2006). As a result of this initial survey, and based on the threat of invasive plants moving into natural habitats, Carlson *et al.* (2006) identified the following areas as being of greatest concern: (1) the Materials Storage Area, (2) the meadow adjacent to Campbell Airstrip parking lot, (3) a number of isolated invasive plant populations in the forests, and (4) the airstrip margins.

In addition, nine monitoring plots were established to facilitate detecting changes in the size, aggressiveness and plant species composition (native and non-native) of select sites over time (Carlson *et al.* 2006). The long-term monitoring plots were revisited in 2008 (Cortés-Burns 2009) and 2009 (Flagstad 2010). Revisit work in both 2008 and 2009 resulted in the documentation of new weeds or new infestations of highly invasive species in the Tract; by 2012, more than 10 new species had been recorded in the Tract that were not found in 2006, and some of these are aggressively invasive (e.g. *Cirsium arvense* and *Phalaris arundinacea*).

Subsequent surveys conducted by AKNHP in 2010 and 2011 (AKEPIC 2012) and by Roon (2011) indicate that many of the more aggressive weeds are spreading throughout the Tract and into neighboring parklands. *Hieracium aurantiacum* infestations have now been recorded along the Science Center Drive, near the exclosure on the fuel break, and along the Campbell Airstrip Road, which leads up into the Chugach Mountains. *Vicia cracca* is found at multiple locations throughout the Tract (roadsides, by the administrative buildings, in the helipad exclosure and on the airstrip). *Prunus padus* has been recorded at over 50 locations in or near the Tract, as well as in adjacent parklands along Campbell Creek. New invasive species have also started to encroach into the Tract, with *Phalaris arundinacea*, *Prunus virginiana* and *Cirsium arvense* posing the greatest threat (AKEPIC 2012).

In summary, although much of Campbell Tract supports a diversity of temperate boreal plants and wildlife in a relatively unaltered landscape, connectivity to the surrounding urban area through trails, roads and creeks makes this area highly vulnerable to invasion by non-native plants. Non-native plants are common in disturbed habitats of the Tract and new species are introduced each year. The most likely vectors for weed introduction and dispersal are contaminated materials imported for construction and maintenance projects, gear and equipment of BLM staff and recreational trail users, and from nearby infestations that are spreading along the broader network of Anchorage's roads, trails and stream corridors. Indeed, non-native plant species appear to establish preferentially in human-disturbed areas and naturally open habitats (Carlson *et al.* 2006, Flagstad 2010, Flagstad and Cortés-Burns 2010). Past construction projects that may have facilitated non-native plant establishment include the resurfacing of the airstrip and road, Smokejumper trailhead expansion and installation of a waterline from Elmore Road to the administrative building and the (RAWS) weather station. Finally, the accessibility and use of Campbell Tract makes it a highly visible section of the BLM's holdings in the state and is an excellent place to institute progressive policies, such as proactive weed management.

Plan of Action

Under the auspices of the directives outlined in Appendix I, this document provides the BLM with a 10-year plan to manage invasive species at Campbell Tract. This document is intended to serve as an adaptive tool for the BLM. It should be reviewed prior to implementation and updated periodically during its 10-year life. The document is divided into seven sections, following strategies considered central to effective weed management:

1. **Management:** Utilization of available information and resources to effectively manage non-native plants within Campbell Tract in an adaptive and integrated manner.
2. **Prevention:** Identification of vulnerable habitats and utilization of best management practices (BMPs) to reduce the potential for the introduction and establishment of non-native plants as well as to minimize spread of existing infestations.
3. **Early Detection and Rapid Response:** Detection of non-native plant infestations whose population size and distribution are limited to the extent that a rapid, coordinated response has the potential to locally eradicate or contain the infestations.
4. **Monitoring:** Regular quantification of non-native plant populations to evaluate change in infestation size, the impact on surrounding native vegetation and/or treatment efficacy.
5. **Control:** Implementation of manual, mechanical, chemical, biological or cultural methods to eradicate or contain populations of non-native plants. The most effective control strategies often prioritize on the basis of invasiveness, integrate multiple methods and incorporate ecosystem processes.
6. **Education and Outreach:** Increase the awareness of invasive plant issues and promote stewardship of natural lands within the greater community of Campbell Tract users.
7. **Research:** Science-based studies of invasive plant issues that are aligned with Campbell Tract management goals and would inform the future adaptation of management priorities and strategies.

Overarching principles

The BLM supports the use of an Integrated Vegetation Management program to ensure that native plant communities are managed, conserved and/or restored for multiple uses. Such an approach uses all available management strategies and techniques for the prevention, containment and/or control of undesirable plant species or plant species groups. When implemented in an integrated manner, these strategies and techniques are often more economically and environmentally effective than any single option alone.

Weed management concepts

- **Prevention**

  Prevention of weed introductions is the most successful, cost effective and least environmentally damaging means of weed management. However, prevention is often an unattainable goal. Where an unwanted non-native species is introduced, the infestation is most efficiently eradicated or contained in the short period of time preceding colonization. Once the species is established or has become naturalized, this invader can become a long-term and costly management problem (Figure 3).

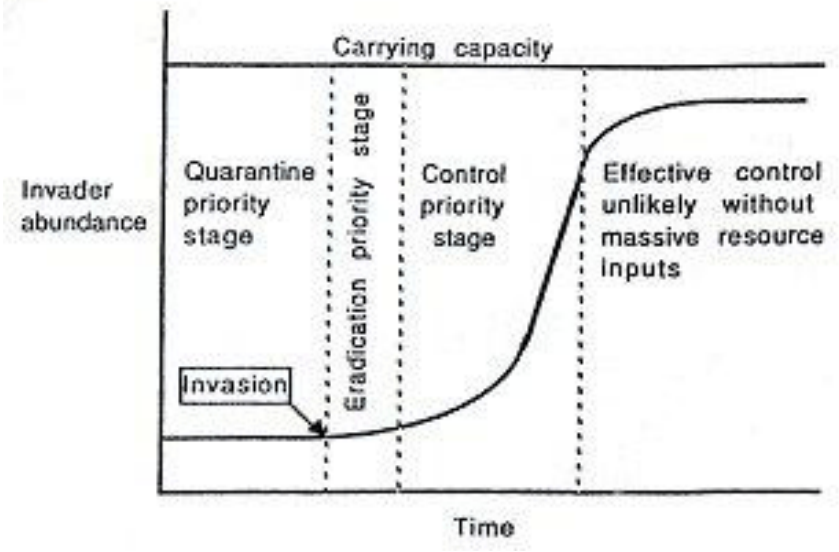

Figure 3. Management strategies in relation to invasion process (Source: Radosevich 2002).

Within Campbell Tract, emphasis should be placed on identifying and protecting habitats that are currently weed-free, as well as monitoring areas that have recently experienced ground disturbance. Finally, effective prevention tactics require the development of Best Management Practices (BMPs) that are tailored to Campbell Tract's uses and BLM's needs and resources. We introduce the concept of BMPs subsequently. A list of BMPs that can serve as a starting point for Campbell Tract's managers is available in Appendix IV.

- **Best Management Practices**

  Best Management Practices (BMPs) are a series of guidelines of practical methods designed to prevent or reduce the introduction, establishment and spread of weeds. In the absence of BMPs, weeds may spread rapidly beyond management capability through a variety of vectors. These practices must be feasible in the context of technological, economic and institutional considerations while maintaining ecological integrity. BMPs specific to Campbell Tract should aim to minimize the negative impacts of non-native species while allowing the responsible use and development of natural resources.

  BMPs offer site-specific prevention or control measures, and there may be more than one appropriate BMP for any given site. Hence, BMPs may be different for the BLM maintenance department, construction crews, field managers and recreationists. A thorough understanding of

BMPs and flexibility in their application is of vital importance in selecting which practices to use. Although it is unrealistic to expect that all weeds can be prevented or eliminated, BMPs should be used to minimize the introduction and impact of these species.

Appendix IV outlines environmentally responsible weed management practices which, when applied properly, minimize adverse impacts on ecosystems. Unusual situations may arise or strategies other than those recommended here might be more appropriate. BMPs are intended as concepts to be tailored by individuals or user groups. Although the specific language may change, the message should remain the same.

- **Early Detection and Rapid Response (EDRR)**

  Sometimes considered the "second line of defense" after prevention, early detection and rapid response is a critical component of any effective invasive species management program. The goal for EDRR is to find incipient populations of invasive plants and eradicate them before they begin to spread, reducing environmental and economic impacts and avoiding costly control treatments. This strategy includes surveys, collection, identification, risk assessment and response to new and emerging species. Early detection of new infestations requires regular monitoring of the managed area and surrounding ecosystem. Early detection and rapid response efforts should be focused first on lands within Campbell Tract that are not already infested with species of concern and to keep "clean" lands free of weeds. However, EDRR must also focus on aggressively invasive species that are not yet in the Tract but are the most likely to be introduced (watch list species). This approach, as defined by the National Invasive Species Council (2003), is the most effective means for eradicating invasive species and results in lower cost and less resource damage than implementing a long-term control program after a species is established. Vulnerable areas and watch-listed species based on data collected through 2012 are presented on page 22).

  The BLM is well suited to improve its early detection capabilities through collaborative and coordinated efforts of numerous agency programs, field offices and partners. Developing broad networks with many partners to detect, contain and eradicate new invasive species before they become established is critical to the implementation of this plan. Several of these collaborative and coordinated efforts are already in place, including: baseline Campbell Tract weed surveys (see page 10), an Alaska-specific Invasiveness Ranking System (Carlson *et al.* 2008), a non-native plant list for Anchorage and the State of Alaska (Appendix II) and an invasive plant "watch" list (page 22). Furthermore, there are individuals with invasive plant expertise, organized stakeholders, ongoing education on priority EDRR species, interested and active citizens and a reporting database (AKEPIC) in place. These efforts must be ongoing to stay abreast of new infestations and movements of known populations.

- **Monitoring**

  Monitoring requires the periodic survey and documentation of known non-native plant infestations within an area and is a vital component of a successful weed management plan. Quantifying the density and rate of spread or reduction of infestations over time helps determine the effectiveness of management actions in meeting the prescribed objectives. When crafted as an adaptive process, monitoring can identify for which infestations control should be initiated, modified or ceased.

  The "Eradication, control and EDRR priorities for each vegetation management unit" section indentifies which infestations and areas should be monitored on a unit by unit basis. In general,

areas that are highlighted for EDRR work, areas in which infestations are being controlled and areas in which ground-disturbing activities are carried out should be monitored. Depending on the availability of resources and personnel, most of these areas should be inspected once or twice annually, during the growing season, to detect changes in existing weed populations or prevent the establishment of new ones.

- **Control**

  Effective control relies on a clear understanding of the target species, including its biology, the ecosystem it has infested, associated introduction pathways and effective control methods. Furthermore, because resources (time, funds) are limited, it is important to carefully assess which infestations should be prioritized for treatment.

  For any given management area, the first step is to determine which infestations pose the greatest threat to the area's management goals. Decision-making tools available for this first step include:

  1. the Alaska Invasiveness Ranking System, as well as Municipal and State listings* (helps identify which species might pose the greatest threat)
  2. the Treatment Prioritization Tool developed specifically for Campbell Tract* (helps prioritize infestations within a given area)
  3. Expert input (resource managers, biologists, weed scientists, etc.)

  * These tools are described in greater detail in the next section ("Management tools," page 18), as well as in Apendices II and III.

  Once the highest priority infestations have been identified, a cost-benefit analysis should be conducted to determine which of these infestations are most likely to respond to control work given the following constraints:

  1. the biology of each particular plant species
  2. site characteristics
  3. how much time and funds are available
  4. what control methods are allowed in the area

  Control work can aim to eradicate or simply contain an infestation. Eradication occurs when there is no regrowth of the targeted species after controlling it for a period of time in excess of the species' seed viability. If control of an infestation becomes an inefficient use of resources or becomes contrary to management goals, efforts should be redirected onto another set of high priority infestations.

  Successful eradication of invasive plant infestations typically requires several years of treatment and follow-up monitoring. Effective strategies prioritize eradication in areas where populations are small, yet current or potential future growth is the greatest, and control work is likely to have the greatest impact. This often means first treating outlying infestations (generally speaking, we consider two patches of the same plant species to be distinct populations if they are separated from one another by at least 50 m; however, this is an arbitrary distance and should be adjusted to each species based on its ecology and reproductive strategies). Treatment of larger, source infestations can be conducted next, starting at the edge and moving to the center of the population (Randall and Hoshovsky 2000).

  A single technique is rarely adequate for successful control of multiple species or infestations, and

under an integrated approach all control methods listed below are considered for greater success.

- *Physical/Mechanical*: The use of physical or mechanical methods for weed control can be effective on small infestations of annual or biennial species. Hand grubbing, mowing, tilling and burning are commonly used to physically destroy weeds or interfere with their reproduction. To be effective, treatment must typically take place before seed production. Plants that have flowered must be removed from the site and destroyed. Plant material can either be burned in an on-site incinerator or bagged and transported to a sanitary landfill where it will be isolated from the environment until degraded. Repeated mowing or tilling during the growing season is required with most weed species. This approach is not generally recommended as the sole control method for species that spread vegetatively or that are prolific seed producers. For example, dedicated hand-pulling and grubbing over an eight year period have not been effective in eradication of *Alliaria petiolata*, a fast growing annual with a capacity for prolific seed production, in two small infestations in Juneau (Lamb 2012). While hand-pulling appears to be effective in reducing the number of individuals in these infestations, the spatial extent of the infestations has grown, potentially due to seeds being moved during weed control activities (Paddock 2009).

- *Chemical:* Herbicides are an effective and efficient tool for the control of noxious weeds. Chemical control methods, along with appropriate cultural practices (e.g. applying herbicides prior to seed set, revegetating with weed-free seed, etc.) are likely to be the best option for larger infestations and for tough to control species. Herbicide application and rates are dependent on specific site characteristics, target plants, location, 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, infestations in remote areas and on species for which hand pulling or cutting is not effective or feasible. Herbicides can be extremely effective in monoculture settings and in selectively removing weeds that are mixed with native vegetation. This approach reduces the amount of revegetation needed after the treatment is complete.

    - It is critical to follow all label instructions, site-specific directions and safety precautions when using any herbicide. When used inappropriately, herbicides may damage or kill non-target plants, weeds may develop a resistance to certain herbicide, and herbicides may move beyond the area in which they were applied. Herbicides classified as “restricted-use herbicides” are those whose application is limited by federal and state regulations.

- *Biological:* Intentional introduction and establishment of natural enemies (e.g. competitors, predators and pathogens) can be an effective management strategy in some cases. This strategy will reduce the density and rate of spread, but not eradicate a species. For this reason it works best on dense infestations, large enough to support the predator population. This method takes longer to be effective compared to physical and chemical control options, often requiring 10 to 20 years to produce results (Slemmons 2007). Introduced control agents can become permanently established within this new habitat, causing a permanent reduction in the invasive species’ population. It is important to balance benefits with the potential consequences of introducing additional non-native organisms, as they might negatively affect non-target species and further disrupt the habitat. There are few studies reporting the impacts of biocontrol agents

released against invasive weed species (Tu *et al.* 2001). The BLM encourages use of biological control agents as one of the tools in a balanced Integrated Pest Management program. Consideration and approval of the use of biological control agents involves many facets of review, monitoring, inventorying and informing the public of intended management goals. Specific guidelines have been set for the planning and implementation of biological control agents within BLM lands; consult BLM Manual section 9014 for specific policy (USDI 1992c, also see Appendix I).

To date, treatment of invasive plant populations on the Tract has been limited to manual or mechanical control methods. For instance, Anchorage Parks Foundation (APF) and BLM crews have been pulling and cutting weeds, primarily *Prunus padus*; CCSC staff, SAGA crews and AFO employees have been digging up *Hieracium aurantiacum* plants for over four years; community weed pulls have been centered on the *Cirsium arvense* infestation at the RAWS site; and AKNHP staff have assisted with all of these efforts, as well as high priority infestation at some other locations (trailheads, trails and contaminated gravel piles, the latter in conjunction with the BLM Recreation Specialist). However, while APF is using herbicides to treat infestations on adjacent lands, BLM has yet to conduct the National Environmental Policy Act (NEPA) process for using herbicides as part of an integrated plant management plan.

Management tools

Because the distributions and impacts of non-native plants vary widely among taxa, ecoregions and habitats, Alaska's natural resource managers, botanists and weed scientists have recognized the importance of developing and reviewing a state weed database and weed lists. These tools help land managers make informed decisions on how to prioritize non-native plant infestations for prevention, control and eradication efforts. Of these, four are relevant to the objectives of this document and are cited and used throughout this document, in conjunction with other Tract-specific tools, to establish weed management priorities in Campbell Tract. These are:

- **Invasiveness Ranking System for Non-native Plants of Alaska**
  The Invasiveness Ranking System for Non-native Plants (Carlson *et al.* 2008, Nawrocki *et al.* 2011) was developed for Alaska to help land managers use limited resources more efficiently. This system assigns a rank to a species based on that species' known or perceived 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.

- **Alaska Exotic Plants Information Clearinghouse**
  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 neighboring Canadian Territories. These data are primarily intended to support identification of problem species and areas requiring particular attention, thus promoting early detection and rapid response across the region of interest.

- **Municipality of Anchorage A, B, C, U species lists**
  This prioritized list of invasive species was created for the Municipality of Anchorage Invasive Plant Management Plan (Gary 2010), through a collaboration of natural resource managers and weed scientists, to serve as a guideline for the development of weed control, monitoring, and research projects. Placement of the non-native plant species known to occur in the Municipality of Anchorage at the time of publication was determined by many factors including but not limited to: invasiveness rank; number, distribution and annual increase of recorded infestations in the AKEPIC database; biology and treatment potential of individual species; public perception of individual species, etc. (See Appendix II).

- **Treatment prioritization tool**
  As part of this weed management plan, AKNHP has developed a treatment prioritization tool specific to Campbell Tract (Appendix III). This prioritization is not a solitary indicator and should be evaluated in the context of other considerations such as population size and location, and available resources, when determining final treatment priorities. Infestations assigned a higher point total (out of a possible 14) are given a higher priority for treatment.

- **City-wide, cooperative weed management efforts**
  As Alaska's largest urban center and transportation hub, the management of non-native plants within Anchorage has state-wide implications and thus necessitates collaboration among federal, state, municipal and local land owners. BLM's Campbell Tract is surrounded by lands belonging to the Municipality of Anchorage, Chugach State Park and the Heritage Land Bank, and therefore weed

prevention and treatment plans will be most efficient when common goals are found and partnerships are developed.

The BLM has a strong history of effective cooperation with local and state weed management groups such as the Anchorage Cooperative Weed Management Area (CWMA), the Committee for Noxious and Invasive Plant Management (CNIPM), Citizens Against Noxious Weeds Invading the North (CANWIN) and the Cooperative Extension Service (CES). Group members meet regularly to share information on species, legislation, grant opportunities and research, as well as to plan educational events and weed pulls. An excellent example of these collaborative efforts is that in 2012 BLM AFO established a new cooperative agreement with the Anchorage Parks Foundation (APF) to continue their CWMA participation/activity. Tim Stallard, the APF Invasive Plant Coordinator, is the contact for the agreement, and will be utilizing BLM funds to support crew time and leadership to conduct treatment activities at the Tract. In recent years, this teamwork lead to the treatment of over 30 *Prunus padus* infestations (roughly 180 plants) that were covering approximately 10 acres of land located along Campbell Creek on both MOA (Bicentennial Park) and BLM (Campbell Tract) lands.

Leadership roles

The 2010 BLM Alaska Invasive Species Management Policy document assigns weed management responsibilities for BLM staff at both the State and Field Office levels. The BLM AFO Field Office Invasive Species Coordinator, with support and in conjunction with the State Office Invasive Species Coordinator, will be the primary contact and coordinator for all weed management activities at Campbell Tract. It is anticipated that BLM facilities maintenance personnel will implement control and prevention measures, as well as best management practices, at the administrative buildings and along the road corridors. It is anticipated that CCSC staff, and in particular the CCSC education specialist workforce, will be integrally involved with education and outreach efforts and that trail crews and the Recreation Specialist will play an active role in EDRR work along the trail system.

Abundance, diversity and distribution of non-native plants in Campbell Tract

The Anchorage Bowl has the highest concentration of human-altered landscapes in the state and is likely the largest portal for non-native plant introductions. This renders our local park lands and the margins of the surrounding wilderness particularly vulnerable to infestation. One-hundred and thirty-six non-native species have been documented in the Anchorage Bowl area (AKEPIC 2012). Approximately 12% of these are considered extremely or highly invasive while 58% are either low-ranked or unranked species of concern. Additionally, seven are prohibited noxious, five are restricted noxious, eight are A-listed and 19 are B- listed species (Table 1).

Of the 136 species known to the Anchorage Bowl, 55 have been found in Campbell Tract (AKEPIC 2012). Seven of these (approximately 13%) are considered extremely or highly invasive while almost 50% are either low-ranked or unranked species of concern. Using State and Municipal listings, four of these 55 species are prohibited noxious, five are restricted noxious and 12 are B- listed species (Table 1). In general, this pattern mirrors that of the Anchorage Bowl, making a good case for integrated weed management on a city-wide basis.

Table 1. Diversity and invasiveness of non-native plants within Anchorage and Campbell Tract.

		Anchorage Bowl		Campbell Tract	
Total species		**136**		**55**	
AKEPIC Invasiveness Rank[1]	Extremely invasive (≥80)	6	4%	2	4%
	Highly invasive (70-79)	13	10%	5	9%
	Moderately invasive (60-69)	12	9%	5	9%
	Modestly invasive (50-59)	26	19%	16	29%
	Weakly or very weakly invasive (<50)	44	32%	24	44%
	Unranked	35	26%	3	5%
State lists[2]	Prohibited	7	5%	4	7%
	Restricted	5	4%	5	9%
MOA lists[3]	A-list	8	6%	0	0%
	B- list	19	14%	12	22%
	C- list	37	27%	26	47%
	U- list	19	14%	4	7%

Notes:
Data compiled from AKEPIC and AKNHP records as of 2012.

[1] Invasiveness rank refers to the number of points assigned to a potentially invasive non-native plant species based on that 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 (Carlson *et al.* 2008). See Appendix II for a complete list of non-native plant species ranked to date.

[2] A noxious weed is a plant species that has been defined as undesirable by legal statute. Prohibited noxious weeds ("P") are barred entry to the state. Restricted noxious weeds ("R") may be brought into the state at concentrations below their maximum allowable tolerances (seeds per pound) (Alaska State Department of Natural Resources 2010).

[3] "A", "B", "C", "U" correspond to Municipality of Anchorage weed rankings. "A" listed species are the least frequent and highest treatment priority, and "C" listed species are the most widespread and lowest treatment priority. Non-native plant species that are of unknown invasiveness and priority in the Municipality of Anchorage are listed as "Uknown" or "U".

Monitoring and control priorities for Campbell Tract

Tract-wide overview of treatment priorities and weed distributions

This section provides a synthesis of our understanding on invasiveness in and around the Tract. It highlights invasiveness hotspots within the Tract, lists invasive species that should be on the Tract's 'watch list' because they have been found near but not in this management unit and separates existing species infestations according to their priority for treatment. Table 2 contains a complete list of all non-native plants recorded in Campbell Tract to date.

Table 2. Invasiveness rank and percent frequency of non-native species within Campbell Tract, listed in order of decreasing frequency.

Scientific Name	Common Name	Invasiveness Rank[1]	State/City Listings[2]	Percent Frequency[3]
Trifolium repens	white clover	59	C	14.7
Taraxacum officinale	common dandelion	58	C	11.0
Crepis tectorum	narrowleaf hawksbeard	56	C	8.5
Melilotus albus	white sweetclover	81	B	8.0
Trifolium hybridum	alsike clover	57	C	8.0
Plantago major	common plantain	44	C, R	6.3
Vicia cracca ssp. *cracca*	bird vetch	73	B, R	3.9
Matricaria discoidea	pineappleweed	32	C	2.9
Poa pratensis ssp. *irrigata*	spreading or Kentucky bluegrass	52	C	2.8
Linaria vulgaris	yellow toadflax	69	B, R	2.7
Chenopodium album	lambsquarters	37	C	2.6
Phleum pratense	timothy	54	C	2.6
Polygonum aviculare	prostrate knotweed	45	C	2.4
Tripleurospermum inodorum	scentless false mayweed	48	C	2.4
Stellaria media	common chickweed	42	C	2.0
Prunus padus	European bird cherry	74	B	1.9
*Hordeum jubatum**	foxtail barley	63	C	1.9
Leucanthemum vulgare	oxeye daisy	61	B	1.9
Capsella bursa-pastoris	shepherd's purse	40	C	1.4
Cerastium fontanum ssp. *vulgare*	big chickweed	36	C	1.4
Hieracium aurantiacum	orange hawkweed	79	B, P	1.1
Elymus repens	quackgrass	59	C, P	1.1
Galeopsis tetrahit	brittlestem hempnettle	50	C, P	0.9
Poa annua	annual bluegrass	46	C, R	0.9
Erucastrum gallicum	common dogmustard	NR	C	0.9
Cirsium arvense	Canada thistle	76	B, P	0.6
Descurainia sophia	herb sophia	41		0.6
Rumex acetosella	common sheep sorrel	51	C	0.6
Trifolium pratense	red clover	53	C	0.6
Bromus inermis	smooth brome	62		0.4
Phalaris arundinacea	reed canarygrass	83	B	0.4
Lolium multiflorum	Italian ryegrass	41	C	0.2
Lolium perenne	perennial ryegrass	52	C	0.2
Persicaria lapathifolia	curlytop knotweed	47		0.2
Rumex longifolius	dooryard dock	48		0.2
Fallopia convolvulus	black bindweed	50	U, R	0.2
Lamium album	white deadnettle	40		0.2
Lepidium densiflorum	common pepperweed	25	C	0.2
Silene dioica	red catchfly	42		0.2
Elymus sibiricus	Siberian wildrye	53	U	0.1
Melilotus officinalis	yellow sweetclover	69	B	0.1
Persicaria maculosa	spotted ladysthumb	47		0.1

Scientific Name	Common Name	Invasiveness Rank[1]	State/City Listings[2]	Percent Frequency[3]
Alopecurus pratensis	meadow foxtail	52		0.1
Brassica rapa	birdsrape mustard	50		0.1
Centaurea montana	perennial cornflower	46		0.1
Cerastium glomeratum	sticky chickweed	36	U	0.1
Hypochaeris radicata	hairy catsear	44	U	0.1
Prunus virginiana	chokecherry	74	B	0.1
Ranunculus repens	creeping buttercup	54	B	0.1
Rumex crispus	curly dock	48	C	0.1
Saponaria officinalis	bouncingbet	NR		0.1
Senecio sylvaticus	woodland ragwort	41		0.1
Silene armeria	sweet William silene	NR		0.1
Silene latifolia	bladder campion	42	B	0.1
Spergula arvensis	corn spurry	32	C	0.1

Notes:
Data compiled from AKEPIC and AKNHP records as of 2012.
[1] NR – not ranked using the Invasiveness Ranking System (Carlson *et al.* 2008).
[2] "A", "B", "C", "U" correspond to Municipality of Anchorage weed rankings; "P", "R" correspond to "Noxious Prohibited" and "Noxious Restricted", respectively, and refer to the State of Alaska's Noxious Weed list. See Appendix II for more information.
[3] Percent frequency for a given species is calculated as the number of occurrences of that species divided by the total number of non-native plant populations recorded at Campbell Tract to date; the quotient is multiplied by 100. For example: *Vicia cracca* represents 66 of the 1696 records and therefore its percent frequency is: 100*(66/1696) = 3.9%
* The non-nativity of *Hordeum jubatum* is disputed, the species is included here as a nuisance weed.

- **Invasiveness hotspots**

  Locations of concern within the Tract include the materials storage area (MSA), the Elmore Road entrance, the Smokejumper and Campbell Airstrip trailheads, the helipad and the airstrip (Figure 4).

  The diversity and abundance of non-native plant species at the MSA suggests that the imported landscaping and construction materials stored here are often contaminated with non-native plant propagules. The non-native plant propagules found here are likely to spread to more undisturbed sections of the Tract in materials used for construction and maintenance projects. Infestations at the helipad and airstrip present a unique situation. Because firefighting and disaster relief teams are mobilized from the BLM AFO, there is potential for invasive plant propagules to be transported from these two landing zones to remote locations in Alaska, where they could successfully establish given the high levels of substrate disturbance that generally result from firefighting and rescue efforts. See Appendix IV for a series of best management practices that could help stem the spread of invasive plant propagules from these locations of concern within the Tract to other parts of the Tract or the State.

- **Early Detection and Rapid Response (EDRR) targets**

  In an effort to identify non-native plant species that are proximal to but not yet established within the Tract, the road and trail corridors intersecting or bordering Campbell Tract were surveyed in 2010, and AKEPIC records falling within 2.5 km of Campbell Tract boundaries were extracted from the database. The species records compiled were used to develop a watch-list for early detection and rapid response efforts in the Tract.

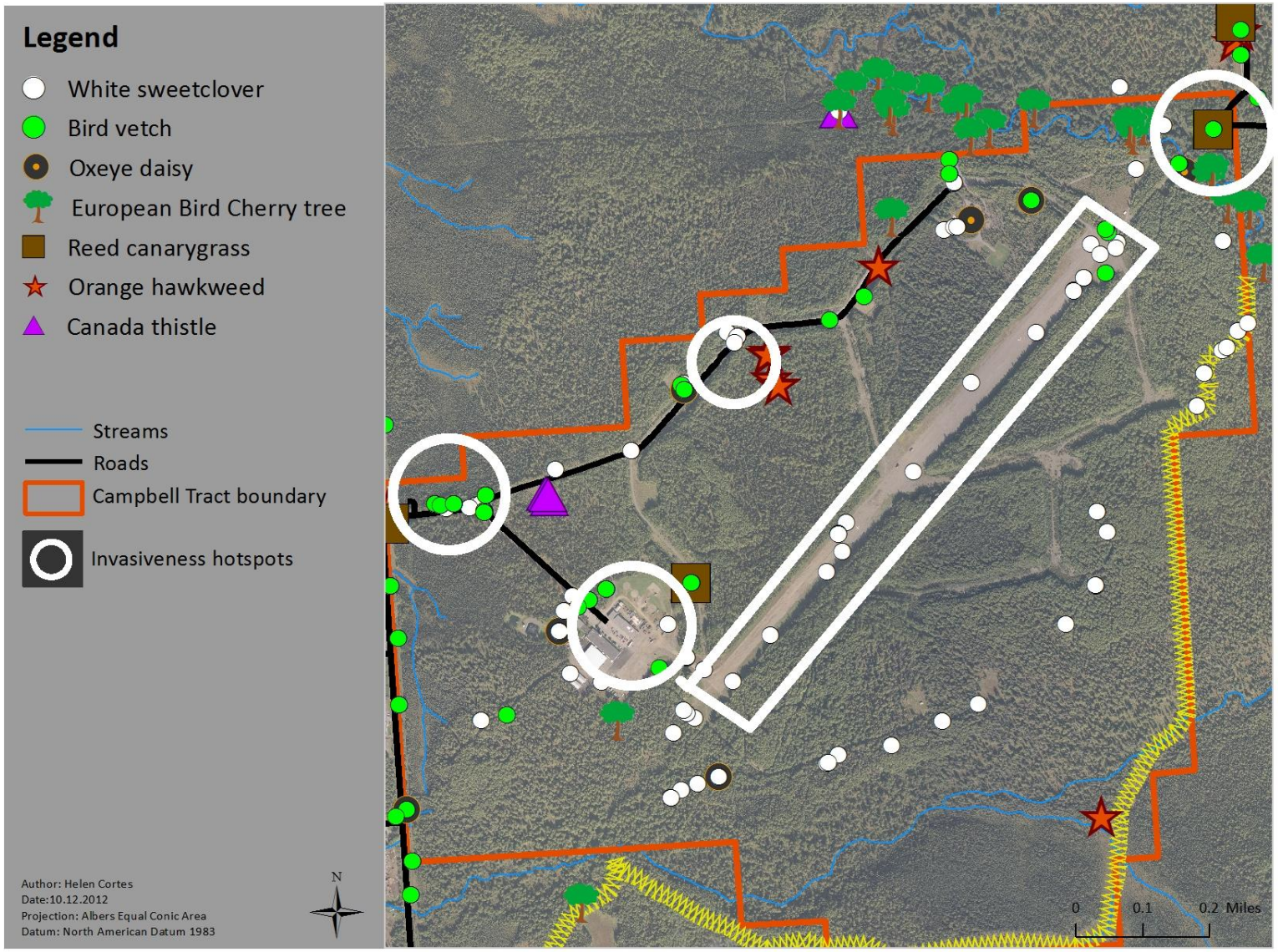

Figure 4. Distribution of highly invasive plants and invasiveness hotspots in Campbell Tract.

Watch-listed (or EDRR) species are listed in Table 3. Many of the EDRR species listed here are problematic within the greater Anchorage area and should therefore be targeted for eradication if detected in Campbell Tract. Emphasis should be placed on species that are either new to Alaska or that are new to the area and are either on the Municipality of Anchorage A- and B-lists or ranked greater than 60 points by the Alaska Invasiveness Ranking System (Carlson *et. al.* 2008; Nawrocki *et al.* 2011). The watch-list presented here must be revised and updated annually to reflect changes in the diversity and distribution of weeds within the Anchorage Bowl.

Table 3. Non-native plant species recorded near Campbell Tract, listed in order of decreasing frequency.

Scientific Name	Common Name	Invasiveness Rank[1]	State/City Listings[2,3]	Percent Frequency[4]
Bromus hordeaceus	soft brome	NR		7.7
Tanacetum vulgare	common tansy	57	B	6.4
Sonchus arvensis	field sowthistle	73	B, P	3.7
Ranunculus repens	creeping buttercup	54	B	1.8
Lotus corniculatus	birdsfoot trefoil	65		1.6
Amaranthus retroflexus	redroot amaranth	45		0.9
Lupinus polyphyllus	bigleaf lupine	55	B	0.7
Caragana arborescens	Siberian peashrub	66		0.3
Hieracium umbellatum	narrowleaf hawkweed	51	B	0.1

Notes:
Data compiled from AKEPIC and AKNHP records as of 2012.
[1] NR – not ranked using the Invasiveness Ranking System (Carlson *et al.* 2008).
[2] "A", "B", "C", "U" correspond to Municipality of Anchorage weed rankings; "P", "R" correspond to "Noxious Prohibited" and "Noxious Restricted", respectively, and refer to the State of Alaska's Noxious Weed list. See Appendix II for more information.
[3] Percent frequency for a given species is calculated as the number of occurrences of that species divided by the total number of non-native plant populations recorded at Campbell Tract to date; the quotient is multiplied by 100. For example: *Vicia cracca* represents 66 of the 1696 records and therefore its percent frequency is: 100*(66/1696) = 3.9%

Areas that are particularly susceptible to invasion by new non-native plant species in the Tract, and where EDRR efforts should focus the most, include:

- Areas of recent construction/trail work
- Trailheads (Smokejumper and Campbell Airstrip) plus 500 meters down all departing trails
- Grounds surrounding the Science Center and administrative buildings
- Airstrip and helipads
- Riparian corridors
- Materials Storage Area

Two potentially important sources of new, invasive weeds to the Tract are imported construction materials and equipment. BLM can include stipulations in their agreements with contractors that provide fill materials and/or ground disturbing equipment to request that equipment be cleaned prior to use in the Tract or that materials be certified weed free. If weed-free materials are not available, BLM could request that weed surveys be conducted at the site where the contractors store their materials; the results of these surveys would allow BLM to make more informed decisions on where to store the imported materials, how to treat them for weed control (and for how long) prior to using them at a project site. In addition to taking precautions on the front end, contract specifications could also request that the project site(s) be kept weed free for a specified time after project completion. Such initiatives would be in support of BLM policies, for instance, the "Weed-Free Seed Use on Lands Administered by the Bureau of Land Management" memorandum (BLM 2006).

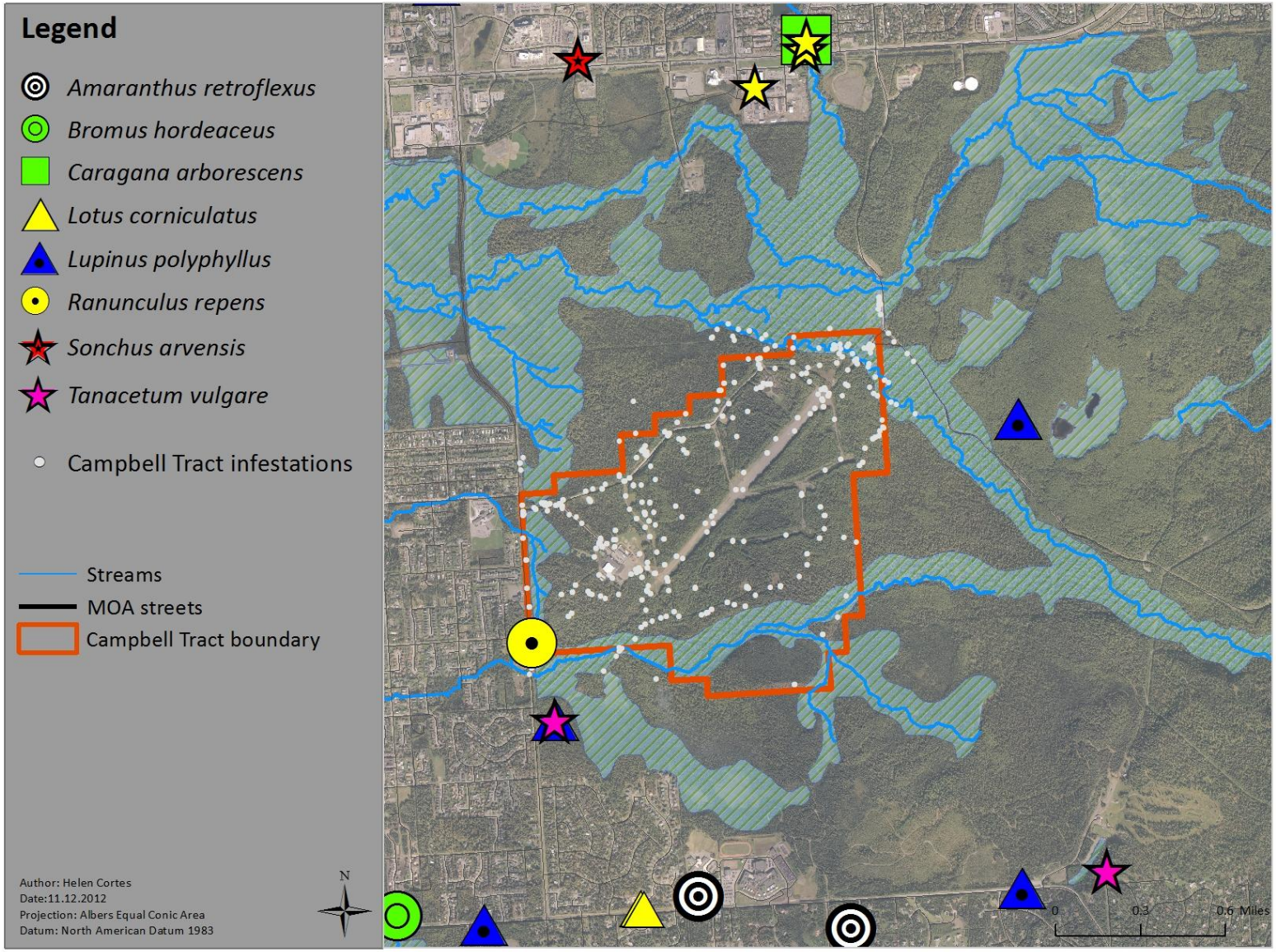

Figure 5. Locations of invasive species proximal to Campbell Tract (EDRR targets).

- **High-priority targets**

  Eradication, control and monitoring efforts should primarily focus on species that are known or suspected to be highly invasive in Alaska. Among these, species whose distribution in the Anchorage Bowl is still fairly restricted with respect to either population size or distribution should be given topmost priority (Figure 4). For instance, the discrete and often small infestations of *Cirsium arvense, Hieracium aurantiacum*, *Melilotus officinalis, Phalaris arundinacea* and *Prunus virginiana* are good candidates for complete eradication from the Tract. On the other hand, the large yet discrete populations of *Leucanthemum vulgare, Prunus padus* and *Vicia cracca* are recommended to be treated on a site-specific basis, depending on the areas' use and accessibility. These areas constitute good targets for long term control work, and ultimately, for eradication. Finally, broadly distributed, semi-continuous infestations of *Melilotus albus* would be most effectively controlled by a Tract-wide prescription. Complete eradication of this species from the Tract is unlikely, but infestations in more natural, undisturbed areas could be targeted for containment and/or eradication. Table 4 shows the most invasive species and frequency of occurrence in the Tract.

Table 4. Extremely and highly invasive species recorded in Campbell Tract, listed in order of decreasing frequency.

Scientific Name	Common Name	Invasiveness Rank[1]	State/City Listings[2]	Percent Frequency[3]
Melilotus albus	white sweetclover	81	B	8.0
Vicia cracca ssp. *cracca*	bird vetch	73	B, R	3.9
Prunus padus	European bird cherry	74	B	1.9
Leucanthemum vulgare	oxeye daisy	61	B	1.9
Hieracium aurantiacum	orange hawkweed	79	B, P	1.1
Cirsium arvense	Canada thistle	76	B, P	0.6
Phalaris arundinacea	reed canarygrass	83	B	0.4
Prunus virginiana	chokecherry	74	B	0.1
Melilotus officinalis	yellow sweetclover	69	B	0.1

Notes:

Data compiled from AKEPIC and AKNHP records as of 2012.

[1] NR – not ranked using the Invasiveness Ranking System (Carlson *et al.* 2008).

[2] "A", "B", "C", "U" correspond to Municipality of Anchorage weed rankings; "P", "R" correspond to "Noxious Prohibited" and "Noxious Restricted", respectively, and refer to the State of Alaska's Noxious Weed list. See Appendix II for more information.

[3] Percent frequency for a given species is calculated as the number of occurrences of that species divided by the total number of non-native plant populations recorded at Campbell Tract to date; the quotient is multiplied by 100. For example: *Vicia cracca* represents 66 of the 1696 records and therefore its percent frequency is: 100*(66/1696) = 3.9%

Species that fall into this category and that **we recommend be prioritized for monitoring, control, or eradication are**:

- ***Melilotus albus***

  Melilotus albus is widespread throughout the Tract and has been recorded in or near all the management units. Small infestations can be controlled by hand-pulling. Larger and more continuous infestations could, at a minimum, be mowed multiple times during the growing season to prevent flower production or to at least impeded seed set. Herbicides, chlorsulfuron in particular, have been shown to be effective in controlling *M. albus* in Alaska (Conn and Seefeldt 2009). However, repeated use of the same herbicide can lead to populations that are resistant to that particular chemical. Ultimately, an integrated approach that uses a range of herbicides as well as other control methods is thought to be the most effective strategy for control (Conn and Seefeldt 2009).

  As the seeds of this species can remain viable in the soil for many years (up to several decades), eradication is not likely. A more realistic objective is to eradicate small infestations and to reduce the size or vigor of larger ones. This should be done by prioritizing populations in undisturbed or sensitive areas as well as smaller and more disjunct infestations. Additionally, we recommend particular attention be paid to avoid moving soils where *M. albus* populations have been present to reduce the spread of seeds.

- ***Melilotus officinalis***

  Melilotus officinalis has only been recorded at the Smokejumper Trailhead. Similar to its congener, *Melilotus albus*, *M. officinalis* plants should be pulled on a regular basis to prevent seed set, and the site monitored for seedlings for 5-10 years, to ensure the seedbank has been depleted.

- ***Leucanthemum vulgare***

  Leucanthemum vulgare is still largely absent from the Tract and as such could be locally eradicated. Large infestations of *Leucanthemum vulgare* such as the one at Campbell Airstrip Trailhead could be controlled in a manner similar to that recommended by Alvarez (2000): hand-dig as many plants as possible early in the growing season, spread 3-4 inches of topsoil over the site and reseed with fast growing perennial native grasses (e.g. *Calamagrostis canadensis*). Because *Leucanthemum vulgare* prefers low-fertility soils, treated sites could be fertilized to encourage growth of native species (Seefeldt 2007, unpubl. res.). Due to this site's proximity to Campbell Creek and the type of herbicides required to effectively control *Leucanthemum vulgare*, chemical control of this infestation is not recommended. Revegetation of this well-used trailhead could be leveraged as an opportunity to inform the public on weed management in Alaska.

  Control of smaller populations of *Leucanthemum vulgare*, such as those located on the west side of the Campbell Creek Bridge, and on the Coyote Trail near the helipad exclosure, is also recommended. Hand digging and removal of the above and belowground portions of plants is likely to be most effective for these small infestations.

- ***Prunus padus***

  Populations of *Prunus padus* are well-established on public and private lands along the Campbell Creek corridor and seeds are bird dispersed; thus ongoing introduction of propagules is likely. Flagstad *et al*. (2010 a, b) show that *P. padus* seeds only remain viable for up to two years. Therefore, targeting fruit-producing trees should greatly increase the possibility of eradicating the infestation (barring new introductions of seed by birds or other dispersal vectors).

  For the Campbell Creek infestations, we suggest a goal of eradicating outlying, mature (flower/fruit producing) trees located along the upstream portions of Campbell Creek to prevent this species from spreading into new, largely uninfested areas, such as the upper reaches of Campbell Creek closer to the Chugach Mountains. Control work should also aim to prevent smaller/younger *P. padus* individuals from achieving tree heights and/or fruit producing stage. Control work could also progress downstream.

  A separate infestation of *Prunus padus* has been recorded near Abbot Loop Community Park, by the North Fork of Little Campbell Creek. It is likely the result of intentional plantings by Municipality gardeners. Monitoring and eradication work in this case should focus on individuals that are spreading onto intersecting trails (e.g. Viewpoint Trail) or along the banks of the North Fork of Little Campbell Creek.

  In both areas, mature *Prunus padus* trees should be cut at the ground surface and treated with herbicide. Painting or injecting stumps is generally a very effective way of delivering very small and localized doses of herbicides and in *Prunus padus*. This is necessary to prevent basal and root sprouting. Herbicide should be applied to fresh-cut stumps late in the growing season so that the chemical is transported with other phloem-born resources to the roots for storage. *Prunus padus* is more easily identified in the spring when flowering or in the fall as its foliage remains green longer than most native shrubs. Therefore, monitoring and control work on this species can be carried out early or late in the growing season.

- ***Prunus virginiana***

  Prunus virginiana has a much more restricted distribution in the Tract than *P*. *padus*. It is only known from the area near Abbot Loop Community Park, and less than 10 individuals were reported at this site. This population can be eradicated by pulling seedlings and saplings; larger trees should be cut and their remaining stumps treated with herbicide.

- ***Vicia cracca***

  Vicia cracca is a candidate for local eradication due to the relatively short seed viability of the species and the discrete distribution of plants within the Tract. The seeds of *Vicia cracca* remain viable in the soil for up to five years (Roberts and Boddrell 1985). Although infestations of *Vicia cracca* are scattered throughout the Tract, they are relatively small and isolated from one another. We recommend manually controlling these infestations annually (and multiple times within each growth season) to prevent seed production and deplete the seedbank. In addition, efforts should be taken to avoid spread to new areas. Specifically, we recommend that plants be hand-dug early in the growing season before flowering and sites be retreated every six weeks through the remainder of the growing season. Spot application of herbicide is recommended if plants persist after five years of manual treatment. Clopyralid has provided effective control of *Vicia cracca* seedlings in greenhouse studies in Alaska (Seefeldt *et al.* 2007).

- ***Cirsium arvense***

  Eradication of *Cirsium arvense* from the Remote Automated Weather Station (RAWS) site is strongly recommended. This site has been controlled for at least the past two years. The infestation has been contained but not eradicated. We recommend continued annual monitoring of the site early and throughout the growing season. Digging the plants out and carefully disposing of them (e.g. incinerating them) will help contain the infestation.

  Given this species' ability to spread sexually (wind dispersed seed) and vegetatively (rhizomes), an integrated treatment plan that uses chemical, manual and mechanical control methods is preferable. *Cirsium arvense* has been controlled at other sites within the Anchorage Bowl with multiple mowing treatments followed by application of an appropriate systemic herbicide in September (Graziano 2011).

  In 2010, an infestation of *Cirsium arvense* was reported on the Old Rondy Trail about 0.5 miles downstream of the Campbell Airstrip bridge (N 61.166571°, W 149.782713°). This site was revisited in 2011 but no stems were found. It is likely that the 2010 record was a mis-identification. However, we recommend that the site be checked again.

- ***Hieracium aurantiacum***

  Hieracium aurantiacum has been recorded at four locations in the Tract: by the Elmore Road entrance; on Science Center Drive across from the Science Center exclosure; on the Inner Loop dog mushing trails; and on the fuel break south and west of the fuel break exclosure, close to Homestead Trail. An additional population was recorded to the north of the Tract along Campbell Airstrip Road in 2011 (AKEPIC 2012). In most cases the infestations are medium to large (50-500+ stems).

  A concerted effort is needed to eradicate the Tract's populations and contain or eliminate those on Campbell Airstrip Road because *Hieracium aurantiacum* can spread vegetatively through runners and underground rhizomes, as well as by wind-dispersed seed. This species is difficult to eradicate using mechanical and manual control methods. Its shade tolerance and ability to establish in relatively undisturbed organic soils has enabled it to successfully invade and spread along forested portions of dog mushing trails in the Tract.

  Manual or mechanical control is only efficiently conducted on small (less than 50 stems) infestations. This involves removing above- and below-ground parts by digging. Control of larger (more than 50 stems) or persistent populations will require the use of herbicides if no reduction in population size is evident after one year of hand-digging. Aminopyralid has been found to be effective with *H. aurantiacum* at reduced rates based on greenhouse and field research (Seefeldt and Conn 2011). Given that the infestations on the Inner Loop dog mushing trails have been manually controlled for at least four years (i.e they are persistent), this species is a good candidate for herbicide treatment in the Tract.

- ***Phalaris arundinacea***

  Phalaris arundinacea was first observed in Campbell Tract in 2009 at Smokejumper's Trailhead. However, the population was not documented with a voucher specimen and revisits to this site in 2010 and 2011 have failed to confirm its presence. Nonetheless, the 2010 and 2011 surveys did find new populations of this extremely invasive grass at the following sites: by the helipad exclosure, at the Campbell Airstrip Trailhead extending along Campbell Airstrip Road, near the

dog mushing tunnel and at the Elmore Road entrance to the Tract extending down to the intersection with 68th Street.

These infestations should be a very high priority for eradication. Small (1-5 stems) infestations can be effectively removed by digging out the plants and underground biomass, which is extensive but shallow (usually less than six inches deep; Slemmons 2007). Larger infestations can be mowed and tarped or treated with herbicides (Slemmons 2007). We suggest using mechanical-cultural methods for sites in Class "A" wetlands similar to those used by the Municipality of Anchorage to treat a reed canarygrass infestation along Westchester Lagoon. These methods involved controlled burning of the site to remove as much above- and below-ground biomass as possible and subsequent tarping of the burned area for a minimum of two growing seasons to prevent germination of the species. Once the tarps were removed the sites were revegetated with quick-growing native species and will be monitored for 5-10 years after the treatments have ended. If tarping is too costly or ineffective, wetland-approved herbicides should be considered; aquatic formulations of glyphosate and imazapyr are commonly recommended to kill *P. arundinacea* in wetlands. The large, non-wetland infestation near the helipad would be most effectively treated with an herbicide (e.g. glyphosate). Slemmons (2007) provides a detailed review on the various treatment options for this species in Kenai wetlands.

- **Moderate priority targets**

  The species below are modestly to very weakly invasive. However, their distributions in the Anchorage Bowl and Campbell Tract are more restricted (e.g. *Erucastrum gallicum*, *Persicaria* spp.) and/or they have been documented moving off high-use areas in at least some parts of the state, thus posing a potentially greater threat to native ecosystems (e.g. *Crepis tectorum*, *Hypochaeris radicata*). As such, their infestations in Campbell Tract can be targeted for eradication or control work but do not constitute a top priority. Species that fall into this category that **we recommend for monitoring, control or eradication where time and money allow** are:

  - *Alopecurus pratensis*: only one population recorded in the Tract, by the BLM administrative buildings
  - *Brassica rapa*: one infestation at Smokejumper Trailhead and another by the administrative buildings
  - *Bromus inermis*†: recorded at the MSA (Materials Storage Area), Campbell Airstrip Trailhead, and around the administrative buildings
  - *Centaurea montana*: only one infestation recorded to date, at Smokejumper Trailhead
  - *Crepis tectorum**: one of the most widespread species in the Tract; Tract-wide treatment plan needed
  - *Elymus sibiricus*: only recorded in 2008 at the MSA
  - *Erucastrum gallicum*: this species has only been recorded along recently developed, high-use areas such as the BLM Road, Smokejumper Trailhead, MSA, a contaminated fill site on Moose Track Trail
  - *Galeopsis tetrahit* s.l.: documented along the BLM Road (by the AFO entrance sign), at the MSA, by the Science Center building, and by the two most heavily used trailheads - Campbell Airstrip and Smokejumper.
  - *Fallopia convolvulus*: recorded at Smokejumper Trailhead and in the northeast corner of the airstrip; associated with contaminated gravel piles
  - *Hypochaeris radicata*: recorded at the MSA in 2006, not reported since; a good EDRR species

- *Lamium album*: on the BLM Road by the AFO entrance sign and at Smokejumper Trailhead
- *Linaria vulgaris*†: widely distributed in the northern half of the Tract
- *Persicaria maculosa*, *P. lapathifolia*: isolated and disjunct infestations in the northeast end of the airstrip, near the dog mushing bridge by Campbell Airstrip Road, at the MSA (only in 2008) and at Smokejumper Trailhead; associated with contaminated gravel piles
- *Ranunculus repens*: recorded on the boundary of the Tract at Elmore Road
- *Rumex acetosella*, *R. crispus*, *R. longifolius*: populations of these three species are few and isolated from one another. Specifically, infestations are known along the BLM Road, near the helipad exclosure, on the P-38 Trail, at the MSA, and at the Science Center amphitheater
- *Saponaria officinalis*: recorded on the BLM Road along the section leading to the buildings
- *Spergula arvensis*: recorded in 2009 at the Smokejumper Trailhead, not reported since; a good EDRR species
- *Senecio vulgaris*: recorded in 2006 at the MSA, not reported since; a good EDRR species
- *Silene armeria*: Smokejumper Trailhead
- *Silene dioica*: Smokejumper Trailhead and the BLM Road along the section leading to the buildings
- *Silene latifolia*: recorded on the boundary of the Tract at Elmore Road
- *Tripleurospermum inodorum*: confined to the Tract's roadsides, the two ends of the airstrip, and near the Campbell Airstrip musher's bridge at a revegetation site and at the intersection with the Old Rondy Trail; not found in the southern half of the Tract or in any of the inner dog mushing trails

†We also include two highly invasive species in this section. The first species is *Bromus inermis*. There are only a few, isolated *Bromus inermis* infestations in the Tract and these could be controlled by repeated mowing, which would prevent the infestations from setting seed. Although *Bromus inermis* forms monocultures in clearings and open areas, it does not pose as great a threat to native ecosystems as the high-priority species outlined in the previous section. The other highly-invasive but low treatment priority species is *Linaria vulgaris*. This yellow flowered species is fairly widespread in the northern half of the Tract. It can spread vegetatively as well as by seed and is widespread across the Anchorage Bowl. Control work for this species would therefore be resource-intensive and inefficient. Consequently, we suggest that resources should first be allocated to the species which have as great or greater detrimental impacts on native vegetation but are more localized in the Tract and/or are easier to eradicate. These high-priority species are discussed in the previous section.

**Crepis tectorum* is too widespread in the Tract for control work to be effective unless it is conducted on an annual, Tract-wide basis. Not only is this species widely distributed in the Tract, but there is high propagule pressure outside of the Tract, so that even if the Tract infestations are eradicated, reintroduction is highly likely. Due to the distribution of this species in the Tract as well as the commitment of time and resources necessary to control this species manually or mechanically, we suggest that if this species is targeted for control, herbicides are included in the treatment plan.

- **Low priority targets**

Nearly 2,000 non-native plant infestations have been recorded to date in Campbell Tract, of which 78% are comprised of modestly, weakly or very weakly invasive species whose distributions are

widespread in the Anchorage Bowl (Table 1, Table 2). These widespread but low-ranked species are generally unable to establish without soil disturbance and rarely persist outside of high-use areas. Furthermore, their actual distributions in the Tract are not adequately reflected by the records in AKEPIC (2012), as most of the surveys conducted in the Tract focused on documenting the occurrence of highly invasive species and did not require reporting modestly, weakly or very weakly invasive species ranked below 59 points. Controlling these species should be the lowest priority for the following reasons:

- they have a minimal impact on ecosystems
- there is high propagule pressure that makes the reintroduction of these species into the Tract highly likely even if current infestations are eliminated
- control work may result in increased soil disturbance, making the area more vulnerable to the establishment of other, more aggressive weeds

The Treatment Prioritization Tool (Appendix III) does, at times, assign relatively high values to these species, but it does not take into account the underrepresentation of these species within the Tract or the long term feasibility of controlling them. While we do not think these species represent a treatable threat to the Tract, populations may change over time and could interfere with management objectives. We therefore recommend informal monitoring.

Species that fall into this category that **we recommend for informal monitoring** are:

- *Capsella bursa-pastoris*
- *Cerastium fontanum* ssp. *vulgare*
- *Cerastium glomeratum*
- *Chenopodium album*
- *Descurainia sophia*
- *Elymus repens*
- *Hordeum jubatum*
- *Lepidium densiflorum*
- *Lolium multiflorum*
- *Lolium perenne*
- *Matricaria discoidea*
- *Phleum pratense*
- *Plantago major*
- *Poa annua*
- *Poa pratensis* ssp. *irrigata*
- *Polygonum aviculare*
- *Stellaria media*
- *Taraxacum officinale*
- *Trifolium hybridum*
- *Trifolium pratense*
- *Trifolium repens*

Eradication, control and EDRR priorities for each vegetation management unit

Each vegetation management unit is used by the public and maintained by the BLM in a unique way and we therefore provide monitoring and control recommendations for each unit. The priorities and recommendations listed below mirror these differences and account for variations in habitat, use, disturbance regime, accessibility for treatment and likelihood of non-native propagule reintroduction.

Species record locations were clipped to management units using ArcMap. A buffer of 15 meters was generated around each management unit prior to clipping species infestation localities, to account for GPS accuracy errors. In general, all species infestations recorded within a given unit were considered as a single target population for monitoring, control or eradication work. However, because some management units are large, infestations of a single species can vary in character or potential impact across the unit. To account for this variability, larger management units were split into subunits, within which all infestations for a given species were considered a single 'target' population. Species were identified for treatment or monitoring within each management unit using a prioritization tool developed for Campbell Tract (Appendix III). Following this initial prioritization, professional judgment of invasive plant ecology, as well as knowledge of the site character and use, was used to refine treatment recommendations and priorities. Below, monitoring and control priorities are identified for each management unit.

1. Riparian corridors

Wetlands classified as "Type A," denoting the highest priority for preservation, were used as a proxy for riparian corridors. In addition, we buffered these wetland polygons by 15 meters to both account for GPS accuracy errors and to capture nearby populations of non-native plants. The treatment prioritization tool was then run for all infestations that fell within these buffered perimeters. In addition, given that two distinct creeks run through Campbell Tract, we divided this management unit into two subunits: North Fork of Little Campbell Creek and Campbell Creek (Figure 6).

Riparian subunit 1. Campbell Creek riparian corridor

Within this riparian subunit, *Prunus padus* is distributed as multiple small infestations scattered along the banks of Campbell Creek, where it intersects Campbell Tract. *Vicia cracca* and *Leucanthemum vulgare* are currently found at the Campbell Airstrip parking lot (trailhead) and across the bridge from the parking lot. *Melilotus albus* is distributed as multiple, small populations along trails that fall within this riparian subunit. In addition, there are small populations of *Phalaris arundinacea* in this subunit that are currently restricted to the Campbell Airstrip parking lot.

Although *Bromus inermis*, *Galeopsis tetrahit, Tripleurospermum inodorum* and *Persicaria maculosa* are considered low priority species for treatment work, their isolated, controllable populations in Campbell Tract make them good secondary targets for containment or eradication work. In this riparian subunit, *G. tehrahit* and *B. inermis* were found at the Campbell Airstrip Trailhead. Small, distinct infestations of *Tripleurospermum inodorum* and *Persicaria maculosa* have been documented near the dog mushing bridge by Campbell Airstrip Road. Using the treatment prioritization tool as a guideline, we identify the following goals for the Campbell Creek riparian area:

Eradication targets, listed in order of decreasing priority:

1. *Phalaris arundinacea*
2. *Vicia cracca*
3. *Galeopsis tetrahit*
4. *Bromus inermis*
5. *Tripleurospermum inodorum*
6. *Persicaria maculosa*

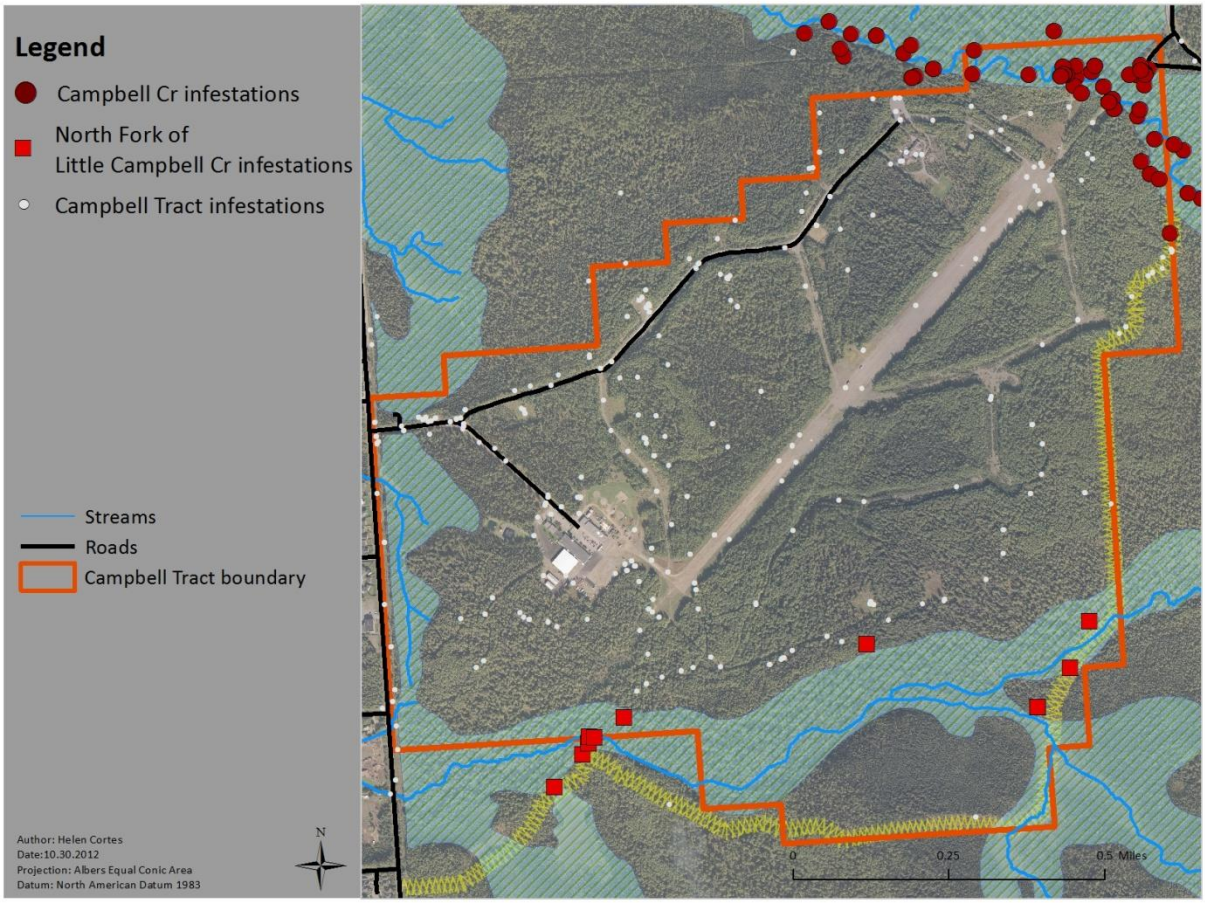

Figure 6. Locations of riparian corridor subunits and associated infestations in Campbell Tract.

Control and long-term monitoring targets, listed in order of decreasing priority:

1. *Prunus padus*
2. *Leucanthemum vulgare*
3. *Melilotus albus*
4. *Crepis tectorum*

Early detection and rapid control targets:

- *Hieracium aurantiacum*: While *H. aurantiacum* infestations have not been recorded in this subunit, populations have been documented along Campbell Airstrip Road and near the entrance to the Campbell Airstrip trailhead parking lot. Efforts should focus on treating the roadside infestation and monitoring nearby trails for incipient infestations, to prevent this species from becoming established on the eastern end of the Tract.

Riparian subunit 2. North Fork of Little Campbell Creek riparian corridor

The areas of this riparian subunit that have been surveyed coincide with portions of the fuel break. Therefore, many of the infestations we identify as priorities here are also listed in the 'Fuel break' unit, discussed later.

The North Fork of Little Campbell Creek riparian corridor that traverses the Tract is still largely weed-free. However, periodic forest clearing work along the fuel break, and the intersection of this unit with Elmore Road, and with the popular multi-use Tour of Anchorage Trail (known as the Viewpoint and Homestead trails within the Tract) and Moose Meadow Trail, renders it highly vulnerable to invasion by non-native plant species.

Currently there are several highly-invasive plants that occur within this subunit as distinct infestations. *Prunus padus* and *P. virginiana* have been recorded on the Homestead Trail near Abbott Loop Community Park. Two populations (one large, ca. 500+ stems, another small, 26-50 stems) of *Hieracium aurantiacum* were recorded near the exclosure in the fuel break, which falls within the boundary of the creek's riparian zone. *Phalaris arundinacea* was recorded at the Campbell Airstrip Trailhead, and could spread along the trail systems onto the fuel break or be introduced during fuel break maintenance work, thus reaching the riparian zone. Finally, *Crepis tectorum* was detected at two sites along the fuel break, within the riparian zone. We identify the following goals for the North Fork of Little Campbell Creek subunit:

Eradication targets:

- *Hieracium aurantiacum**
- *Prunus virginiana*‡

Control and long-term monitoring targets, listed in order of decreasing priority:

1. *Prunus padus*‡
2. *Crepis tectorum*

Early detection and rapid control targets:

- *Hieracium aurantiacum*
  Prunus padus
  Prunus virginiana
  In addition to controlling the existing infestations, the subunit should be inventoried at least twice per growing season (mid-July and mid-August for *Hieracium aurantiacum*, late May and early Fall for the *Prunus* trees) to detect and eliminate any new plants that might establish in the area
- *Melilotus albus* - small, semi-continuous infestations of *Melilotus albus* are found along the Tour of Anchorage Trail, which intersects both the riparian and fuel break units; this species readily grows in open areas with disturbed mineral soil
- *Phalaris arundinacea* - the nearest known infestation is at Campbell Airstrip Trailhead; EDRR work should be conducted annually along trails and corridors that intersect with this trailhead; emphasis should be placed on areas in the Tract that have undergone recent maintenance or construction work, as this species is common in contaminated fill
- *Ranunculus repens*
  Lupinus polyphyllus

Even though *Ranunculus repens* and *Lupinus polyphyllus* are not highly invasive, they are not currently known from the Tract but have been recorded along Elmore Road, proximal to the southwest corner of the Tract and within the North Fork of Little Campbell Creek riparian corridor

*Recommendations for the *Hieracium aurantiacum* infestation documented near the exclosure are provided in the 'Fuel Break' unit.

‡Recommendations for the *Prunus virginiana and P. padus* populations documented at the intersection of Homestead trail and the fuel break are provided in the 'Fuel Break' unit.

2. Trails and trailheads

To facilitate the control and management of weed infestations on Campbell Tract's trails, we separate the trail system into six subunits (Figure 7). The top control and monitoring priorities for each subunit are described below.

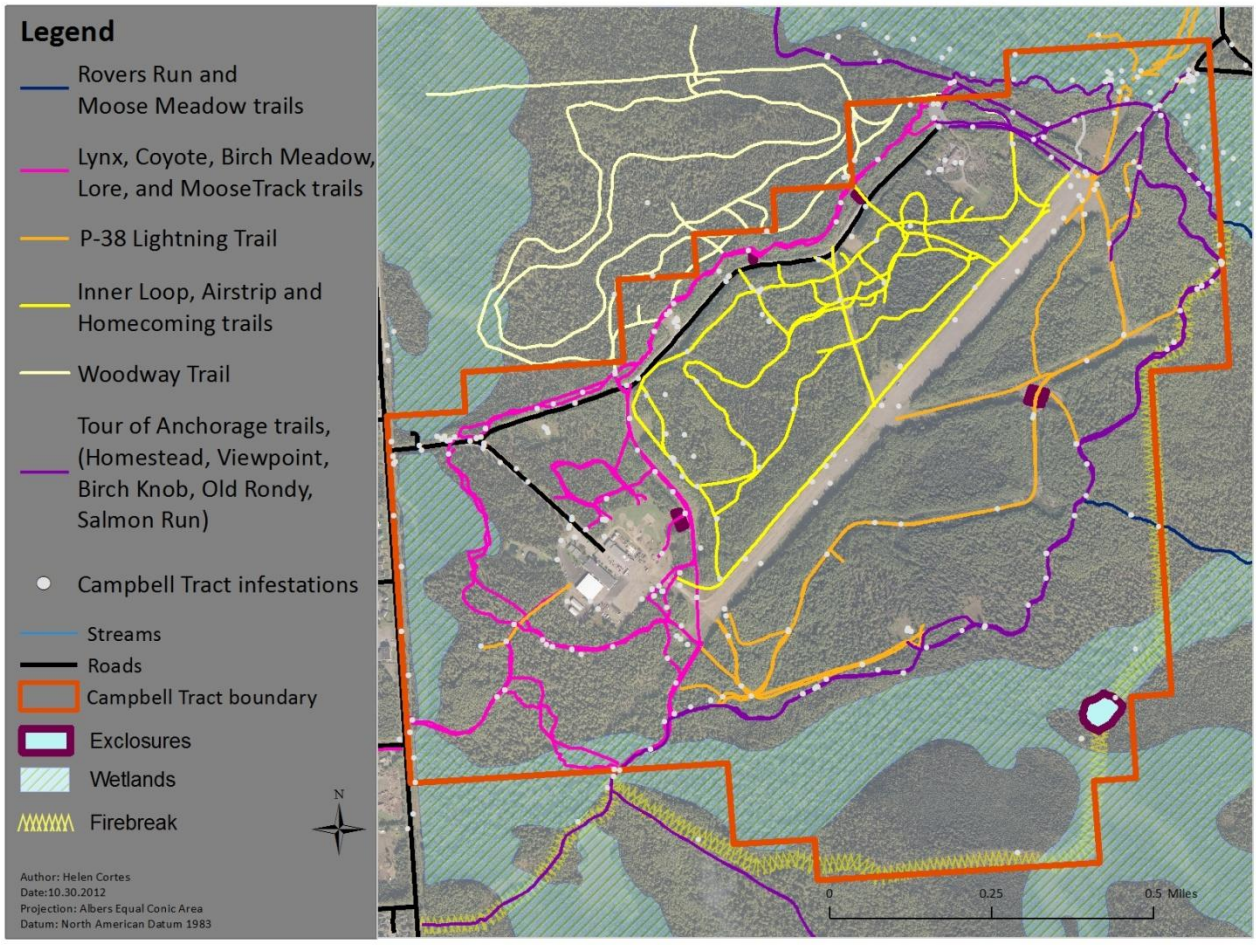

Figure 7. Location of trail subunits and associated infestations in Campbell Tract.

Trails subunit 1. Woodway Trail

The Woodway Trail forms its own unit as it lies just north of Moose Meadow Trail and the Science Center Drive and is a dog mushing-only trail in the winter. It only has weakly to modestly invasive species that we do not consider priorities for control or eradication work. However, it does intersect with the Moose Track Trail and connects to the Inner Loop Trail system, both of which support more problematic species.

Early detection and rapid control targets:

- *Crepis tectorum* - this species is widespread in the Tract but currently absent from the Woodyway Trail.
- The following species are also good candidates for EDRR work because they are shade tolerant and, if introduced, could become established in the forested Woodway Trail:
  Vicia cracca
  Galeopsis tetrahit
  Hieracium aurantiacum

Trails subunit 2. Lynx, Moose Track, Coyote, Lore and Birch Meadow trails

The Lynx, Moose Track, Coyote and Birch Meadow trails form a natural cluster largely confined to the north and east ends of the Tract. In addition, they share the following traits: they are adjacent to one or more roads, are multiuse, heavily visited and easily accessed from the Smokejumper's Trailhead. The Smokejumper's Trailhead is an often used access point from which non-native plant propagules are likely dispersed by both foot and vehicle traffic. Therefore, infestations at this location pose a threat to intersecting trails, especially the Moose Track Trail, which leaves directly from the Smokejumper's Trailhead. The following species are found at Smokejumper's Trailhead:

- *Centaurea montana*
- *Crepis tectorum*
- *Erucastrum gallicum*
- *Fallopia convolvulus*
- *Galeopsis tetrahit*
- *Lamium album*
- *Linaria vulgaris*
- *Melilotus albus*
- *Melilotus officinalis*
- *Persicaria lapathifolia*
- *Tripleurospermum inodorum*
- *Vicia cracca*

Another hotspot of weed diversity found in this subunit is the intersection of Coyote Trail with the helipads and helipad exclosure, where *Leucanthemum vulgare*, *Linaria vulgaris*, *Melilotus albus*, *Phalaris arundinacea*, *Rumex acetosella*, *Tripleurospermum inodorum* and *Vicia cracca* have been documented. Most of these infestations are associated with the exclosure or the helipads and are therefore treated in those units.

In addition, small (1-50 stems) and disjunct infestations of *Melilotus albus* were recorded on the Lynx Trail, and a small (1-5 stems) infestation of *Prunus padus* was recorded on the Lore Road Trail.

Of greatest concern is the association of uncommon and/or highly invasive species with imported and contaminated gravel. Imported fill was found on Moose Track Trail near the MSA, and small populations of *Erucastrum gallicum* and *Linaria vulgaris* were documented at this location. Also on Moose Track Trail but closer to the Science Center parking lot, a small (1-5 stems) infestation of *Prunus padus* was recorded in an area with new gravel. Finally, *Vicia cracca* was found in association with imported gravel that was spread at the intersection of the Lynx Trail with Lore Road Trail.

Eradication targets, listed in order of decreasing priority:

1. *Prunus padus** - on Moose Track Trail and on Lore Road Trail
2. *Vicia cracca** - Smokejumper's Trailhead and intersection of Lynx and Lore Road trails
3. *Melilotus officinalis** - Smokejumper's Trailhead
4. *Centaurea montana** - Smokejumper's Trailhead
5. *Melilotus albus** - Lynx Trail
6. *Galeopsis tetrahit* - Smokejumper's Trailhead
   Lamium album - Smokejumper's Trailhead[6]
7. *Erucastrum gallicum* - Smokejumper's Trailhead and contaminated fill site on Moose Track Trail
8. *Persicaria lapathifolia* - Smokejumper's Trailhead
   Fallopia convolvulus - Smokejumper's Trailhead
9. *Tripleurospermum inodorum* - Smokejumper Trailhead

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Vicia cracca** - Smokejumper's Trailhead, Lynx Trail contaminated pile
2. *Melilotus albus** - Smokejumper's Trailhead, Moose Track Trail, intersection of Coyote and Viewpoint trails
3. *Crepis tectorum* - survey results suggest its less abundant in the eastern half of Moose Track Trail, and therefore control efforts could focus on that area first
4. *Linaria vulgaris* - Smokejumper's Trailhead and contaminated site on Moose Track Trail

Early detection and rapid control targets, listed in order of decreasing priority:

1. *Prunus padus** - monitor for new infestations spreading from the two current ones
   *Phalaris arundinacea** - documented at the helipad exclosure, close to Coyote Trail
   Hieracium aurantiacum - documented at the BLM entrance on Elmore Road and along Science Center Drive across from road exclosure
   *Cirsium arvense** - documented at the RAWS site
2. *Leucanthemum vulgare* - documented at the helipad exclosure, close to Coyote Trail
3. *Bromus inermis**
   *Elymus sibiricus**
   Galeopsis tetrahit
   Persicaria lapathifolia
   All recorded at the MSA
4. *Linaria vulgaris* - documented at the BLM administrative buildings, at the MSA and in contaminated fill on Moose Track Trail
5. *Rumex acetosella* - documented at the helipad exclosure, close to Coyote Trail

*These species easily grow much taller than six inches, which is the maximum vegetation height desired by BLM for signposts, fencing, etc. along the Tract's trails.

[6] Species listed together indicate that they were either assigned the same Treatment Prioritization rank value, or that subsequent discussions among botanists determined that they should be given the same priority.

Trails subunit 3. Homecoming, Airstrip and Inner Loop trails

The Homecoming, Inner Loop and Airstrip trails are delimited by the Science Center Drive to the north, the airstrip to the south, the Tour Trail to the east and Coyote Trail to the west, and the former two are dog mushing-only trails in the winter. Although largely free of highly invasive species, there are three infestations of very highly invasive *Hieracium aurantiacum* in this subunit. Three are located on narrow forest trails (8-, 12- and 16-Mile dog mushing loops), growing on soils with a thick organic layer. An additional infestation has been documented on the Science Center Drive, across from the Science Center exclosure and adjacent to this trail system.

The Science Center Amphitheater, which lies at the intersection of the Homecoming/Poleline Trail with the maintenance road that connects the Science Center to the airstrip, constitutes a hotspot for invasive species. *Melilotus albus*, *Crepis tectorum*, *Rumex crispus*, *Leucanthemum vulgare*, *Vicia cracca* and *Linaria vulgaris* have been documented here.

Finally, because the trail system is delimited by the airstrip to the south and the Science Center Drive to the north, invasive species found in these two high-use areas can spread into the dog mushing loops. For example, small infestations of *Crepis tectorum* currently extend along sections of the Homecoming/Poleline Trail that connect the airstrip to the road and the airstrip to the Science Center.

Eradication targets, listed in order of decreasing priority:

1. *Hieracium aurantiacum* - 8-, 12- and 16-Mile Loops
2. *Vicia cracca** - at the Amphitheater
3. *Leucanthemum vulgare* - at the Amphitheater
4. *Rumex crispus** - at the Amphitheater

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Crepis tectorum* - at the Amphitheater
2. *Linaria vulgaris* - at the Amphitheater

Early detection and rapid control targets, listed in order of decreasing priority:

1. *Vicia cracca** - shade-tolerant, could spread from the airstrip and Science Center Drive
2. *Cirsium arvense** - documented at the RAWS site
3. *Phalaris arundinacea** - documented at the helipad exclosure and Smokejumper's Trailhead
4. *Galeopsis tetrahit* - documented at the MSA and Science Center building
5. The following species tend to grow in more open habitats than those of this unit, and are therefore unlikely to spread into the densely forested (shaded) trails. However, given their invasiveness and presence in adjacent units, it is worth monitoring for them:
   - *Melilotus albus**
   - *Linaria vulgaris*
   - *Tripleurospermum inodorum*

*These species easily grow much taller than six inches, which is the maximum vegetation height desired by BLM for signposts, fencing, etc. along the Tract's trails.

Trails subunit 4. The P-38 Lightning dog-mushing trail

The P-38 Lightning Trail lies on the southeast side of the airstrip and north of the Tour Trail, and connects to dog mushing trails in Bicentennial Park via a mushing-only bridge that crosses Campbell Creek.

There are no high priority species that occur on this trail system per se, but there are several infestations that lie at the intersection of this trail with the airstrip (*Fallopia convolvulus*, *Melilotus albus*, *Persicaria lapathifolia*, *Tripleurospermum inodorum*, *Vicia cracca*) and with the Viewpoint Trail (*Leucanthemum vulgare*, *Melilotus albus*). In addition, the two lowest priority species with respect to treatment are found on the P-38 Trails: *Crepis tectorum* (a moderately invasive and widespread species) and *Rumex acetosella* (a moderately invasive species found at a single infestation site). Finally, a number of invasive species were recorded near the dog mushing bridge that crosses Campbell Creek, growing in association with trail construction materials and revegetation work. Species found in this easternmost portion of the P-38 Trail are *Crepis tectorum*, *Melilotus albus*, *Persicaria maculosa*, and *Tripleurospermum inodorum*.

Eradication targets, listed in order of decreasing priority:

1. *Melilotus albus** - trail construction site by dog mushing bridge
2. *Leucanthemum vulgare* - infestation at the intersection of Viewpoint and P-38 trails
3. *Tripleurospermum inodorum* - revegetation area on the east side of the musher's bridge
4. *Persicaria maculosa* - revegetation area on the east side of the musher's bridge
5. *Rumex acetosella** - a single infestation recorded on P-38

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Vicia cracca**
   *Melilotus albus**
   Focus on Viewpoint Trail and airstrip populations that are at the intersection with the P-38 Trail
2. *Crepis tectorum* - on P-38 Trail proper and near the dog mushing bridge
3. *Fallopia convolvulus*
   Persicaria lapathifolia
   Tripleurospermum inodorum
   Control airstrip populations that are associated with contaminated gravel found at the intersection with the P-38 Trail

Early detection and rapid control targets, listed in order of decreasing priority:

1. *Vicia cracca** - documented at the airstrip and Campbell Airstrip Trailhead
2. *Melilotus albus** - documented at the airstrip and Viewpoint Trail
3. *Cirsium arvense** - documented at the RAWS site
4. *Phalaris arundinacea**- documented at the helipad exclosure, as well as the Campbell Airstrip and Smokejumper trailheads
5. *Galeopsis tetrahit* - documented at the MSA and Science Center building
6. *Leucanthemum vulgare* - documented at the airstrip and on Viewpoint Trail

*These species easily grow much taller than six inches, which is the maximum vegetation height desired by BLM for signposts, fencing, etc. along the Tract's trails.

Trails subunit 5. Homestead, Viewpoint, Birch Knob, Salmon Run and Old Rondy trails

The Homestead, Veiwpoint and Old Rondy trails are combined into a single subunit that lies on the south side of the Airstrip, south and east of the P-38 Trail, and at the north end of the airstrip. This subunit constitutes a major throughway for skiers and bikers going from Hillside Park towards downtown (locally also known as the Tour of Anchorage Trail) that can be easily accessed from trailheads at Abbott Loop Community Park and Campbell Airstrip Road. These trails also connect seamlessly to Moose Meadow and Coyote trails, forming a four-mile long multi-use loop around the Tract. Birch Knob Trail and Salmon Run trails are also included here.

Crepis tectorum and *Melilotus albus* form semi-continuous infestations on this trail system and are therefore not a priority for immediate control unless they are at the intersection of another trail system where these two species are still infrequent.

The main invasiveness hotspot for this area is the Campbell Airstrip Trailhead. The following species have been recorded here:

- *Bromus inermis*
- *Galeopsis tetrahit*
- *Leucanthemum vulgare*
- *Phalaris arundinacea*
- *Vicia cracca*

In addition, *Prunus padus* and *P. virginiana* are common along Campbell Creek as well as on the Homestead Trail, near Abbot Loop Community Park. However, these infestations are discussed in the 'Fuel Break' section below. Finally, there is a small infestation of *Leucanthemum vulgare* between Viewpoint and P-38 Trails (see P-38 Trail for recommendations) and a small and isolated infestation of *Tripleurospermum inodorum* between Woodway and Old Rondy Trails.

Eradication targets[‡], listed in order of decreasing priority:

1. *Phalaris arundinacea** - Campbell Airstrip Trailhead
2. *Vicia cracca** - Campbell Airstrip Trailhead
3. *Tripleurospermum inodorum* - between Old Rondy and Woodway Trail
4. *Leucanthemum vulgare* - Campbell Airstrip Trailhead, also at intersection with P-38 Trail
5. *Galeopsis tetrahit* - Campbell Airstrip Trailhead

Early detection and rapid control targets, listed in order of decreasing priority:

1. *Phalaris arundinacea** - documented at Campbell Airstrip Trailhead
2. *Cirsium arvense** - continue to monitor an infestation site reported in 2010 at N 61.166589, W 149.782731, even though subsequent surveys have not found this species there
3. *Linaria vulgaris* - documented on trails and roads north of the airstrip
4. *Vicia cracca** - documented at the airstrip, the Science Center and Campbell Airstrip Trailhead

[‡]Recommendations for the *Prunus virginiana and P. padus* populations documented at the intersection of Homestead Trail and the fuel break are provided in the 'Fuel Break' unit.

*These species easily grow much taller than six inches, which is the maximum vegetation height desired by BLM for signposts, fencing, etc. along the Tract's trails.

Trails subunit 6. Rovers Run and Moose Meadow Trails

These two narrower trails connect the gas line and Hillside Park with the multi-use Viewpoint (Tour of Anchorage) Trail. They are included in a separate unit as they are less accessible and less used than the Viewpoint Trail they feed into. Although they have not been surveyed in their entirety or with the level of detail that other trails in Campell Tract have received, it appears that these trails are relatively weed-free.

Prunus padus is the only high treatment priority species that is found within this subunit. However, we do not cover this species here, as we have already discussed its infestations along Campbell Creek in the 'Riparian corridors' unit.

Early detection and rapid control targets, listed in order of decreasing priority:

1. *Vicia cracca** - documented at Campbell Airstrip Trailhead and the airstrip
2. *Melilotus albus** - semi-continuous along Viewpoint Trail
3. *Crepis tectorum* - this species is prevalent on other Tract trails but was not documented on Rovers Run or Moose Meadow; trails should be monitored on a regular basis to identify and pull new infestations

*These species easily grow much taller than six inches, which is the maximum vegetation height desired by BLM for signposts, fencing, etc. along the Tract's trails.

3. Fuel Break

The fuel break runs along the southern border of the Tract. It is a relatively weed-free swath of land; few infestations have been recorded here and most are weakly to modestly invasive. The species highlighted for monitoring or control work below are also cited as targets under other management units and should be prioritized for control to prevent this area of the Tract from becoming heavily infested and also to minimize the spread of invasive species along the North Fork of Little Campbell Creek.

Notable infestations on the fuel break include three small populations (5-150 stems) of *Crepis tectorum* and a large and small population (ca. 500+ stems and 26-50 stems) of *Hieracium aurantiacum*. All populations were recorded near the exclosure along the fuel break, close to the boundary of the North Fork of Little Campbell Creek's riparian zone.

In addition, multiple populations of *Melilotus albus* and *Crepis tectorum* have been documented along the intersection with the Viewpoint Trail. *Crepis tectorum*, *Prunus padus* and *P. virginiana* have been found at the intersection with Homestead Trail.

Eradication targets, listed in order of decreasing priority:

1. *Hieracium aurantiacum* - near the exclosure, along the fuel break
2. *Prunus virginiana** - by Abbot Loop Park, on Homestead Trail and fuel break
3. *Melilotus albus* - spreading from Viewpoint Trail onto the fuel break

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Prunus padus** - medium to large infestation close to Abbott Loop Park, along Homestead Trail
2. *Crepis tectorum* - populations along the fuel break are isolated, mainly concentrated at the intersection with Viewpoint and Homestead Trails and near the fuel break exclosure

Early detection and rapid control targets, listed in order of decreasing priority:

1. *Melilotus albus* - documented at Viewpoint Trail
2. Monitor for new infestations of:
   Prunus spp.*
   Hieracium aurantiacum
   Vicia cracca - documented at Campbell Airstrip Trailhead
   Phalaris arundinacea - documented at Campbell Airstrip Trailhead
   Crepis tectorum

*Eradication of woody species is further encouraged to help meet vegetation management goals for this unit. Vegetation goals are to allow for natural diversity in the area while removing small trees.

4. Manicured lawns

Most of this unit's infestations of concern occur on the lawns that run parallel to the BLM Road. Species documented on or within 15 m of the BLM Road lawns include:

- *Bromus inermis*
- *Crepis tectorum*
- *Erucastrum gallicum*
- *Fallopia convolvulus*
- *Galeopsis tetrahit*
- *Lamium album*
- *Linaria vulgaris*
- *Melilotus albus*
- *Persicaria maculosa*
- *Rumex longifolius*
- *Saponaria officinalis*
- *Silene dioica*
- *Tripleurospermum inodorum*
- *Vicia cracca*

As indicated in the previous section of this report ('Abundance, diversity and distribution of non-native plants in Campbell Tract'), many of the species highlighted below can be controlled by repeated hand pulling or digging, and others (e.g. *Bromus inermis*) can be contained or even eliminated by repeated mowing, which is done here in any case as part of lawn maintenance. To effectively control these species through mowing, infestations must be mowed prior to seed set.

Eradication targets, listed in order of decreasing priority:

1. *Vicia cracca**
2. *Silene dioica**
   *Saponaria officinalis**
   *Rumex longifolius**
   Persicaria maculosa
   *Lamium album**
   *Fallopia convolvulus**
   *Erucastrum gallicum**
   *Bromus inermis**

Infestations of all these species are small and isolated, and repeated controls could successfully eradicate them from the Tract

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Melilotus albus**
2. *Galeopsis tetrahit**
3. *Tripleurospermum inodorum**
4. *Linaria vulgaris*
   Crepis tectorum

Early detection and rapid control targets:

1. *Hieracium aurantiacum* - found at the Elmore Road entrance
2. *Phalaris arundinacea** - documented at the helipad and Smokejumper's Trailhead
3. *Lotus corniculatus* - documented on Abbott Road

*Eradication of these species is further encouraged to help meet vegetation management goals for this unit. Vegetation goals are to maintain the vegetation on the lawns under two inches, so that no vegetation will protrude above the elevation of the asphalt edge. No woody species are allowed here.

5. Activity fields

Priorities are identified for each of the following three subunits:

1. The activity field by the Administrative building, which currently holds the water tanks
2. The activity field that is almost directly across from the road exclosure
3. The field that is close to the Science Center and is crossed by the Homecoming/Poleline dog mushing trail

Activity Fields subunit 1. Water tank field

Although no invasive species have been documented at the activity fields by the admininstrative buildings, *Melilotus albus*, *Linaria vulgaris* and *Leucanthemum vulgare* have been recorded around the perimeter of the nearby parking lot. Controlling these infestations at the parking lot will prevent their spread to the water tank fields. **Early detection monitoring and rapid response** work should be conducted on any high ranked or high treatment priority that is found moving into this subunit.

Activity Fields subunit 2. Science Center Drive activity field

Eradication targets, listed in order of decreasing priority:

1. *Vicia cracca*
2. *Tripleurospermum inodorum*

Control and long term monitoring targets:

- *Linaria vulgaris* and *Crepis tectorum*, if resources are available

Early detection and rapid control targets:

- Monitor and eradicate new infestations of
  - *Vicia cracca*
  - *Melilotus albus*

- Monitor for new "arrivals" including
  - *Cirsium arvense* - from RAWS site
  - *Hieracium aurantiacum* - currently documented across the road from the Science Center exclosure and on the 8-, 12-, and 16-Mile Loop Trail, which is part of the Inner Loop/Homecoming Trail system

Activity Fields subunit 3. Amphitheater field

Eradication targets, listed in order of decreasing priority:

1. *Vicia cracca**
2. *Leucanthemum vulgare**
3. *Rumex crispus**

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Melilotus albus**
2. *Crepis tectorum**

Early detection and rapid control targets:

- Monitor and eradicate new infestations of
  - *Vicia cracca*
  - *Leucanthemum vulgare*
  - *Galeopsis tetrahit*
  - *Melilotus albus*
- Monitor for new "arrivals" including
  - *Hieracium aurantiacum* (from the Inner Loop/Homecoming Trail or Science Center Drive)

*Eradication of these species is further encouraged to help meet vegetation management goals for this unit. Vegetation goals are to keep vegetation on the lawns under two inches and allow for natural vegetation to grow surrounding the fields (i.e not manicured).

6. Materials Storage Area

At the materials storage area (MSA), eradication of the populations of *Hypochaeris radicata* and *Elymus sibiricus* is recommended, as the distributions of these species within the Tract are currently limited to the MSA. Although *Vicia cracca*, *Leucanthemum vulgare, Tripleurospermum inodorum* and *Galeopsis tetrahit* s.l. do occur outside of the MSA, their distributions are limited enough that eradication from the Tract is realistic.

In general, we strongly recommend that all the species listed below for eradication be treated, regardless of their priority ranking. Eradication of these species and reduction of the *Melilotus albus* population at this site are important, as the MSA is a source area and dispersal node for non-native plant species within the Tract. Moose Track Trail and Science Center Drive, which abut the storage area, likely act as dispersal corridors for non-native plant propagules. Potentially contaminated materials stored at this site may also serve as a source of weed propagules which could disperse throughout Campbell Tract.

Finally, control of all the species listed below is also desirable because it would follow BLM vegetation management goals for the MSA; these goals are to keep the gravel piles free of all

vegetation, and allow for natural plants (weed-free, native species) to grow around the perimeter of this site. Currently most of the weeds can be found growing on and between the different imported fill materials. In this context, it is possible that a single unit-wide treatment could be implemented to reduce or eliminate (depending on each species' seed viability and abundance) the amount of non-native plants growing at the MSA.

Eradication targets, listed in order of decreasing priority*:

1. *Vicia cracca*‡ - multiple small infestations (5-50 stems)
2. *Galeopsis tetrahit*‡
   Leucanthemum vulgare‡
   Tripleurospermum inodorum‡
3. *Elymus sibiricus* (only recorded in 2008)
   Hypochaeris radicata (only recorded in 2006)
   Senecio sylvaticus (only recorded in 2006)
4. *Bromus inermis*
   Erucastrum gallicum
   Persicaria lapathifolia
   Rumex acetosella
   Rumex longifolius

Control and long term monitoring targets, listed in order of decreasing priority*:

1. *Melilotus albus*‡
2. *Linaria vulgaris*‡
3. *Crepis tectorum*‡

Early detection and rapid control targets*:

- Monitor and eradicate new infestations of
  - *Vicia cracca*
  - *Leucanthemum vulgare*
  - *Galeopsis tetrahit*
  - *Melilotus albus*
- In addition, conduct EDRR work for
  - *Hieracium aurantiacum* (documented at the Elmore Road entrance and along Science Center Drive)
  - *Phalaris arundinacea* (recorded at the main trailheads and the helipad exclosure)
  - *Cirsium arvense* (documented at the RAWS site)

*Eradication of these species is further encouraged to help meet vegetation management goals for this unit. The BLM vegetation management policies for this area include zero tolerance for any vegetation (native or not) below and around the imported material piles and zero tolerance for woody vegetation that might impede access from the road. It allows for native, natural vegetation to grow around the rest of the perimeter.

‡These species do not meet the standards for an Alaska State Department of Natural Resources weed-free certified gravel pit, as indicated in the Alaska Weed Free Gravel Certification Program (Alaska State Department of Natural Resources, 2012)

7. Remote Automated Weather Station (RAWS)

Eradication of *Cirsium arvense* from the Remote Automated Weather Station site is strongly recommended. Please refer to page 29 for a more detailed discussion on how to control this infestation.

8. Exclosures

There are six exclosures in Campbell Tract (Figure 8). Two lie adjacent to each other on the P-38 dog mushing trail, two run parallel to Science Center Drive (one is on Moose Track Trail while the other is on the roadside), one is by the helipads, and there is also an exclosure on the fuel break. We treat each exclosure as its own subunit, except for the two P-38 exclosures, which we treat as a single subunit.

Most exclosures remain unsurveyed from within. However, weeds have been observed in and around the helipad and fuel break exclosures. In addition, non-native plants have been recorded within a 30 foot radius of the Moose Track Trail and P-38 Trail exclosures. Most notably, *Hieracium aurantiacum* has been recorded across the Science Center Drive from the roadside exclosure.

The BLM's goal in setting up these exclosures was to protect some patches of vegetation from moose, to promote the full and fast growth of native plants within them. These exclosures would then be used to aid in the revegetation of heavily used or disturbed sections in the Tract (e.g. via willow cuttings). Unfortunately, the topsoil and gravel used in these exclosures was imported, and they have instead become hotspots of invasive weeds within the Tract. In order to meet BLM's objectives for these exclosures, eradication of all highly to extremely invasive non-native species is imperative.

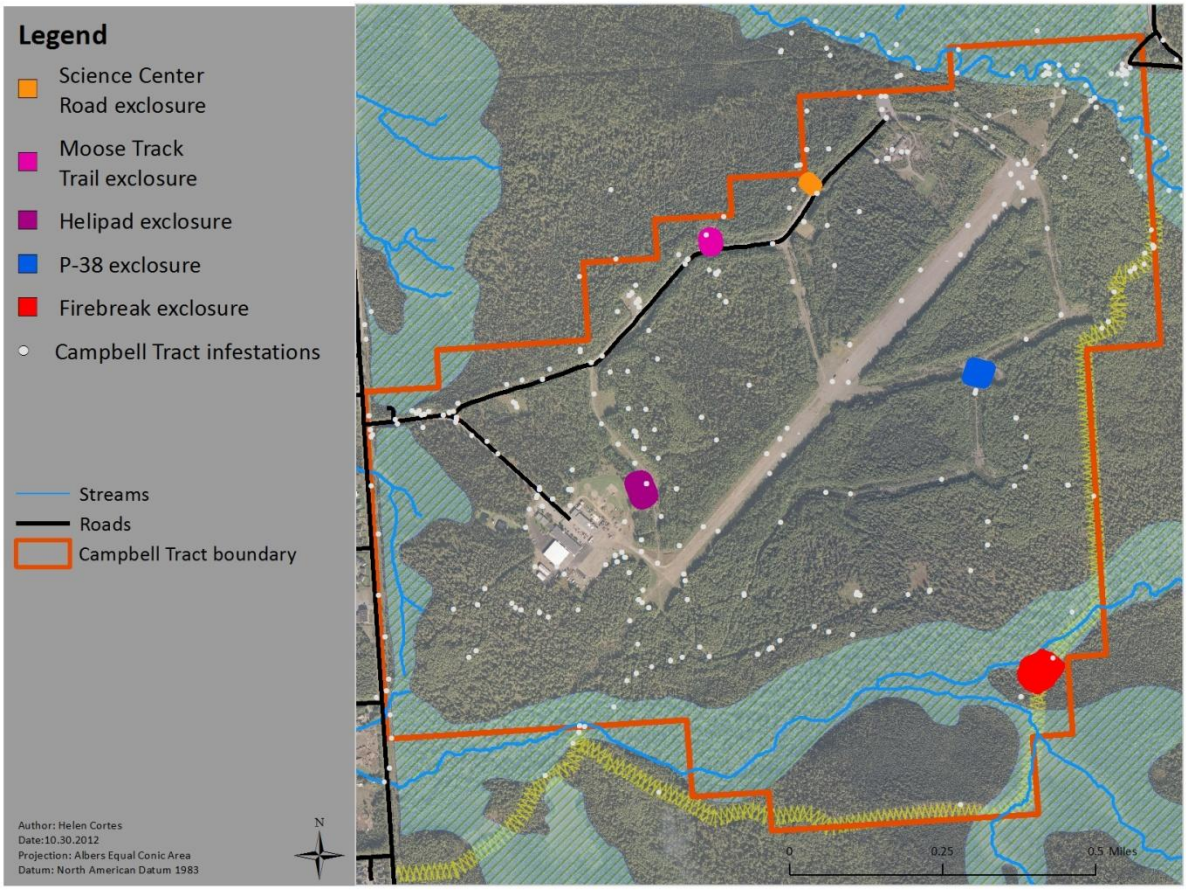

Figure 8. Locations of herbivore exclosure subunits in Campbell Tract.

Exclosure subunit 1. Helipad exclosure

Eradication targets:

A number of highly invasive species are present in the exclosure in small numbers (1-50 stems) and can therefore still be successfully eliminated. These include, in order of decreasing priority:

1. *Phalaris arundinacea*
2. *Leucanthemum vulgare*
3. *Tripleurospermum inodorum*
4. *Rumex acetosella*

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Vicia cracca* - the helipad exclosure infestation is very large, with over 500 stems
2. *Melilotus albus*
3. *Crepis tectorum*

Early detection and rapid control targets:

The bulk of the work at this subunit should be to eradicate or contain the existing populations of *Phalaris arundinacea* and *Vicia cracca*, which are extremely invasive and currently restricted in their

distribution within the Tract. However, EDRR work in and around this exclosure can be done and should focus on other highly invasive species, including

- *Cirsium arvense* - currently only present at the RAWS site
- *Hieracium aurantiacum* - documented at the Elmore Road entrance to the Tract, and on Science Center Drive

Exclosure subunit 2. Moose Track Trail exclosure

Only weakly to modestly invasive species have been recorded near this exclosure. The site should be monitored annually to detect and eradicate any highly invasive species that could be introduced here (e.g. species spreading from Smokejumper's Trailhead, the MSA and the Science Center parking lot).

Exclosure subunit 3. Science Center Drive exclosure

The objective at this exclosure is to prevent non-native invasive species that are currently distributed along the road or Moose Track Trail from becoming established in the exclosure, especially *Vicia cracca* and *Hieracium aurantiacum* (both are shade tolerant and could colonize the exclosure even though it is already vegetated). Other species to conduct EDRR work for are *Melilotus albus*, *Crepis tectorum* and *Phleum pratense.*

Exclosure subunit 4. P-38 exclosures

Monitor and eradicate infestations of highly invasive weeds that might establish in or near this exclosure. In particular, monitor this site for the detection and immediate eradication of new, small infestations of *Vicia cracca, Crepis tectorum, Galeopsis tetrahit, Melilotus albus, Rumex acetosella* and *Tripleurospermum inodorum.*

Exclosure subunit 5. Fuel Break exclosure

Eradication target: It is absolutely essential to target the *Hieracium aurantiacum* infestation that lies on the fuel break at the exclosure for eradication. This infestation has already been highlighted for eradication in the previous 'Fuel Break' unit.

Control and long term monitoring target: Aim to contain and reduce *Crepis tectorum*, as mentioned in the previous 'Fuel Break' unit.

Early detection and rapid control targets: Focus EDRR work on new populations of *Hieracium aurantiacum*, as well as the arrival of new species to the area, including *Melilotus albus* (from Viewpoint Trail), *Prunus* spp. (Homestead Trail and Campbell Creek), and *Vicia cracca* and *Phalaris arundinacea* from the Campbell Airstrip Trailhead.

9. Aviation facilities (airstrip, helipads, and associated structures)

Many of the invasive species recorded on and around the aviation facilities are widespread elsewhere in the Tract (*Melilotus albus, Crepis tectorum, Linaria vulgaris*). Almost all of the invasive plants recorded on the airstrip should be eradicated to meet BLM vegetation management goals for

this unit, which include keeping all the taxiways, run-up pads and landing zones vegetation-free, allowing for only grasses to grow (no more than two feet tall) in the RSA and keeping vegetation to under three feet tall in the OFA.

Eradication targets, listed in order of decreasing priority:

1. *Vicia cracca**
2. *Fallopia convolvulus*
3. *Tripleurospermum inodorum*
4. *Persicaria lapathifolia*

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Melilotus albus**
2. *Crepis tectorum*
3. *Linaria vulgaris*
4. *Alopecurus pratensis**

*While all the species listed above could exceed the two foot limit on vegetation height for the RSA, the species marked with an asterisk can also grow up to about three feet tall, and should therefore be removed, for aviation safety reasons, from the Aviation Facilities as a whole.

Early detection and rapid control targets:

- *Vicia cracca* - currently documented in the northeast corner of the airstrip and in the helipad exclosure
- *Hieracium aurantiacum* - documented at the Elmore Road entrance, Science Center Drive and the 8-, 12-, and 16-Mile Loop Trails
- *Phalaris arundinacea* - documented at the helipad exclosure
- *Cirsium arvense* - documented at the RAWS site

10. Buildings

Recommendations for key infestations found near the BLM administrative buildings or the Science Center are provided in other units (e.g. lawns, aviation facilities, roads). Furthermore, BLM's vegetation management goals for this unit indicate that any unvegetated areas surrounding the buildings (chip-seal or paved) should be kept as such, with a zero tolerance for vegetation, native or otherwise. Therefore, if BLM's goals are followed, many of the infestations that are currently within 30 feet - 45 feet of a building should be eradicated, regardless of their invasiveness or distribution elsewhere in the Tract.

11. Chip seal roads

Melilotus albus and *Crepis tectorum* form nearly continuous infestations along the roadside (Figure 9). Other species like *Vicia cracca*, *Hieracium aurantiacum* and *Tripleurospermum inodorum*, are only found at a few locations and should be prioritized for eradication work. Because Science Center Drive directly connects to the MSA as well as the road exclosure, any species introduced into the MSA could spread along the roadside, also.

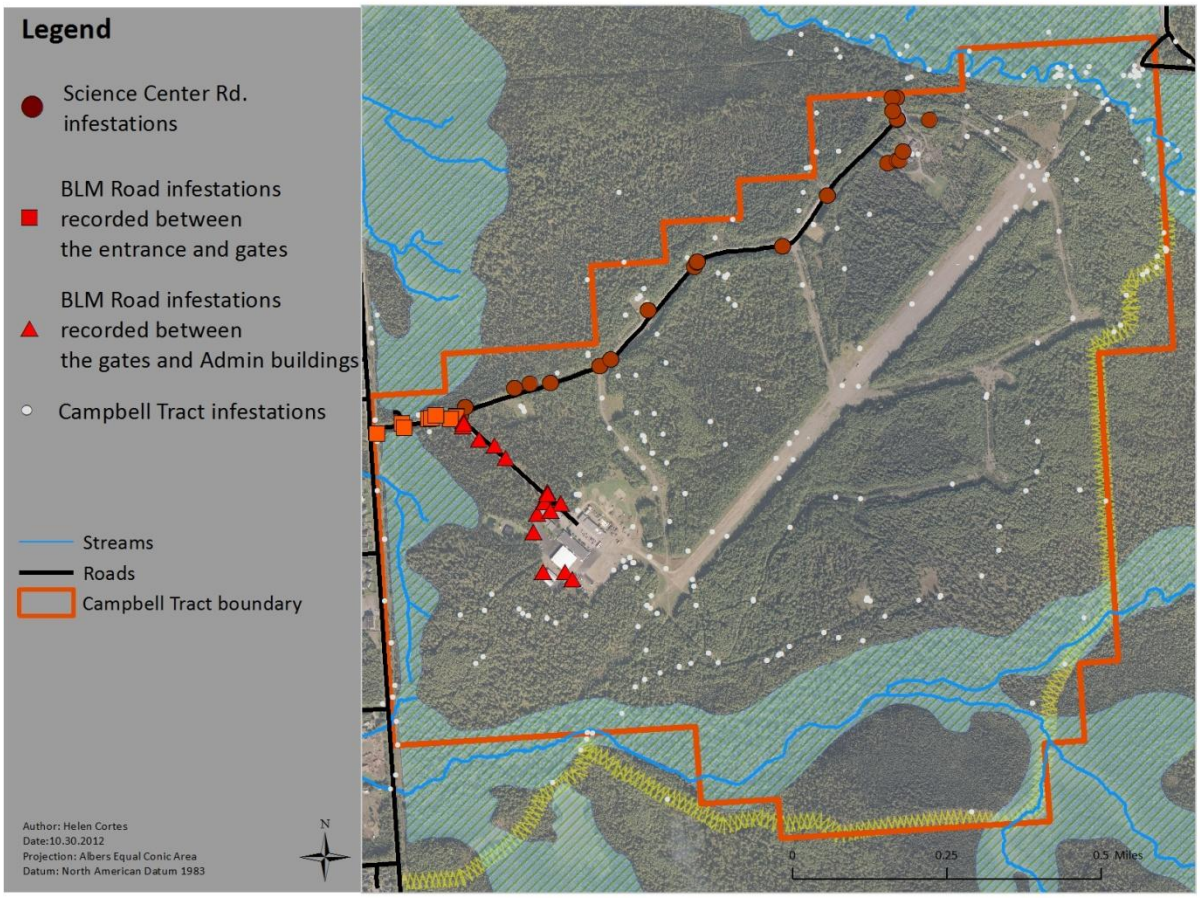

Figure 9. Infestations associated with the chip seal and asphalted road subunits.

Eradication targets, listed in order of decreasing priority:

1. *Hieracium aurantiacum* - infestation located across from the road exclosure
2. *Vicia cracca* (BLM Road gate, at the intersection of the road with one of the Homecoming Trail paths, at the Science Center parking lot and the MSA
3. *Tripleurospermum inodorum* - by the BLM Road gates and the MSA

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Linaria vulgaris* - by the BLM Road gates, and the MSA
2. *Melilotus albus*
3. *Crepis tectorum*

Early detection and rapid control targets:

- *Hieracium aurantiacum*
  Cirsium arvense
  Centaurea montana
  Phalaris arundinacea
- Any invasive species located at the MSA

12. Asphalted roads

We divide the asphalted road that connects Elmore Road to the BLM administrative buildings into two sections: the section that leads from the entrance on Elmore to the BLM gates and the section that goes from the gates to the buildings' parking lot, which is lined by manicured lawns (

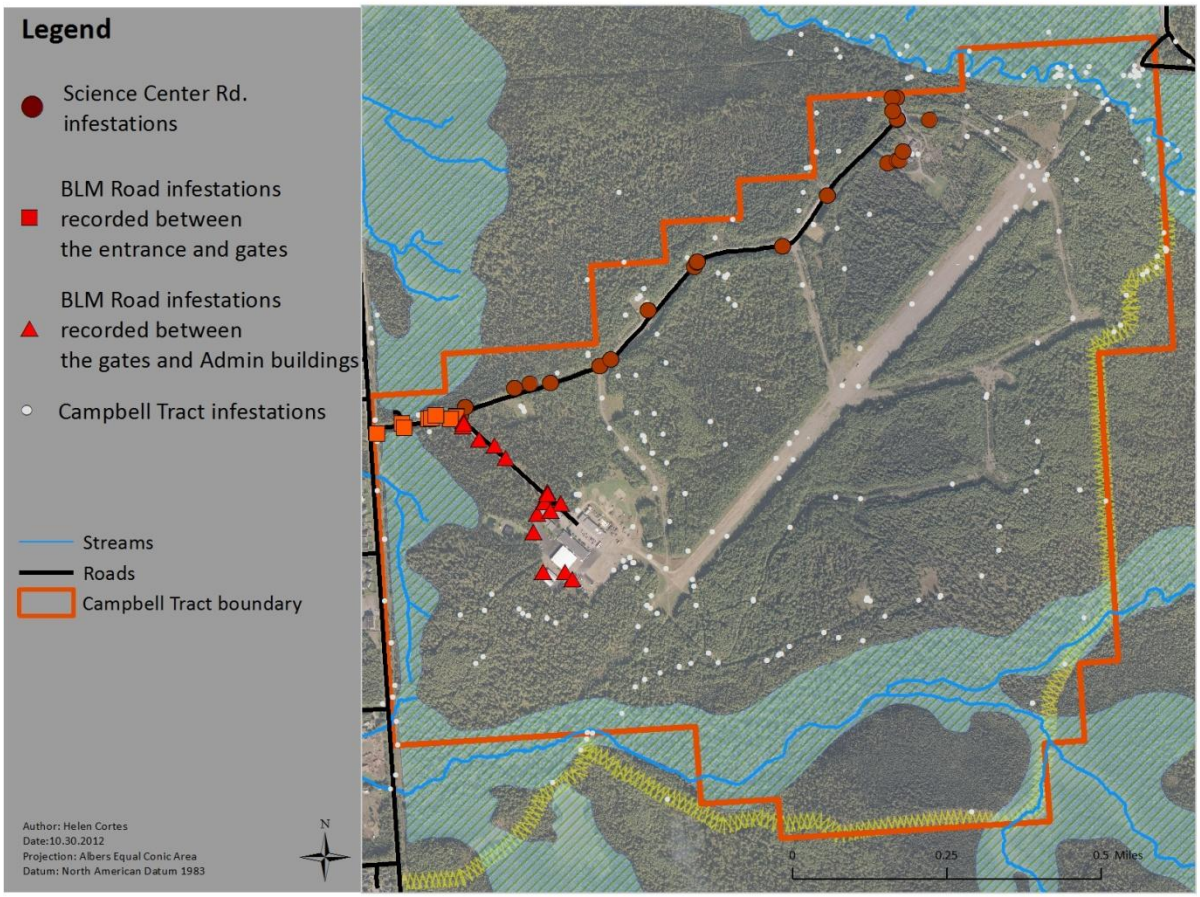

Figure 9). Infestations for the latter area are dealt with under the 'manicured lawns' section.

There are two major invasive plant hotspots in the section leading from the entrance to the gates: the Smokejumper's Trailhead (see 'Trails' unit) and the landscaped area around the gates. As priorities for the trailhead have already been determined in the 'Trails' section, we focus only on infestations recorded elsewhere along the road and especially by the gates.

Eradication targets, listed in order of decreasing priority:

1. *Hieracium aurantiacum* - Elmore Road entrance
2. *Vicia cracca*
3. *Galeopsis tetrahit* - gates
   Lamium album - gates
4. *Tripleurospermum inodorum*
5. *Erucastrum gallicum* - gates

Control and long term monitoring targets, listed in order of decreasing priority:

1. *Melilotus albus*
2. *Crepis tectorum*

3. *Linaria vulgaris*

Early detection and rapid control targets:

- *Hieracium aurantiacum* - Elmore Road entrance
- *Phalaris arundinacea* - possible contaminant in future construction work; documented at the helipad exclosure
- *Cirsium arvense* - RAWS site
- *Centaurea montana* - Smokejumper's Trailhead
- *Lotus corniculatus* - Abbot Road
- *Tanacetum vulgare* - Abbot Community Park

Education and outreach

Developing an active awareness of invasive species threats through educational programs and outreach activities provides a successful defense against weeds. The defense is based on investing stakeholders in the management process. A partnership between agencies and organizations, internal training programs and public involvement by different user groups in weed management is essential for a successful long-term program. Education and outreach should encompass all aspects of the weed management plan (prevention, detection, control, monitoring and research). Weeds are not limited by management boundaries. Education on weed management will help bridge the gap between different land owners and user groups.

Goal 1: Educate and actively involve BLM-AFO employees.

Target group: BLM-AFO employees

Strategies:

- **High Priority**
  - Provide basic training to BLM-AFO employees on national and local invasive species threats. Include examples of impacts invasive species have on ecosystem processes. Encourage discussion on methods to minimize the spread of weeds in Campbell Tract, and provided specific examples of techniques that can be used. Information can be disseminated though posters, meetings, seminars and/or websites.
  - Conduct annual training sessions for BLM-AFO employees on identifying invasive species at Campbell Tract and on reporting infestations through the Alaska Exotic Plants Information Clearinghouse (AKEPIC). See Flagstad and Cortés-Burns (2012) for detailed descriptions of Alaska's plant invaders and how to distinguish them from native look-alikes. Emphasis should be placed on learning how to identify and report high-priority species (see page 27 for current list of top priority plants) and/or species that are on the EDRR watch-list (see page 22 for current watch-list). Because both these lists will change over time as existing infestations are controlled and new ones become established, the contents of these workshops must be revised annually.

- **Moderate Priority**
  - A BLM-AFO representative should participate in Anchorage's Cooperative Weed Management Area (CWMA) group, attend the monthly Committee for Noxious and Invasive Plants Management (CNIPM) teleconference and attend the annual CNIPM weed conference.
  - Provide links to invasive species' websites internally for educational purposes. Develop an internal website on invasive species specific to Campbell Tract to help with species identification.
  - Informational pamphlets could be generated for BLM-AFO employees on how to identify weeds, areas of known infestations, approved methods for control and ways to minimize weed introductions to Campbell Tract.
  - Identify knowledgeable BLM-AFO employees to function as "weed trainers" that can work with the BLM employees, volunteers and the public.
  - BLM-AFO staff could be involved in Alaska Invasive Weeds Awareness Week by hosting events related to invasive species in Campbell Tract.

Goal 2: Educate and actively involve the community, Campbell Tract users and youth groups.

Target groups: general public, Alaska Native Plant Society members, University of Alaska Anchorage and Alaska Pacific University students, Service Alaska Guidance Association, part of AmeriCorps Alaska group, Weed Warriors, Friends of Campbell Creek Science Center, gardening groups, dog owners, dog mushers, equestrian groups, Nordic skiers, Boy and Girl Scouts of America and Kindergarden-12th Grade students

Strategies:

- **High Priority**
  - Annual training open to target groups listed above should be provided on identification of weeds specific to Campbell Tract. See Flagstad and Cortés-Burns (2012) for detailed descriptions of Alaska's plant invaders and how to distinguish them from native look-alikes. The target groups should be encouraged to participate and actively minimize the spread of weeds through various methods specific to each user group.
  - Once or twice a year a presentation should be given as part of the CCSC educational program for adults (e.g. at the BLM Fireside Chat and the Midsummer Night Science Lecture series). Presentations should include information on identification of high priority and EDRR targets, methods to report exotic species in Campbell Tract and methods to control the spread of established invasive species populations.
  - Regularly scheduled youth activities that occur at the CCSC should include an educational component on invasive species and, when appropriate, could include control efforts. For example, Outdoor Week, in which all Anchorage 6th grade students participate in science-based activities, could include elements of invasive species education and control.
  - Environmental education summer camps such as the Trailside Discovery Program at the CCSC should continue to include a component on invasive species ecology and continue weed pulling efforts.
  - At a minimum, semi-annual weed pulls should be scheduled to include the general public as well as involvement from target groups. Advertise events through applicable list-serves, mailing lists, newspapers and public and college radio announcements.
  - Informational signs on invasive species could be placed at a few trailhead locations. Signs could, for example, provide information on general invasive species threats or information on a specific weed infestation and what the BLM is doing to control it.

- **Moderate Priority**
  - Present and provide informational material to target groups as part of their speaking series or for inclusion in community events. This could include presentations to The Alaska Native Plant Society as part of their monthly speaking series at the CCSC, supporting an 'invasive species of the month' program or hosting free events for the Master Gardeners' Association to discuss weed management.
  - Pressed specimens and photographs of invasive species found in Campbell Tract can be made available to the public and displayed at the CCSC to help with species identification and to promote public awareness. Informational material appropriate for elementary and high school student activities could be developed for Campbell Tract.
  - An informational sign should be placed at sites within the Tract at which weeds are being actively managed.

- Programs like “adopt a weed pull area” should be considered for both target groups and the general public to elicit responsibility for certain areas in Campbell Tract.
- A public plant walk identifying invasive species at Campbell Tract should be considered as an annual event followed up by a weed pull at a few known infestations.
- Regularly scheduled events such as National Public Lands Day, National Trail Day and Winter Trail Days at Campbell Tract could include informational material to participants on invasive species and techniques to avoid invasive species’ spread. A weed pull could be suggested as part of this effort. Weed detection is particularly important in areas where trail maintenance is underway.
- Activities for older children, teens and adults could be developed to educate them on invasive species in Campbell Tract. A possible activity could be geocaching invasive species and learning appropriate control techniques at different infestations in Campbell Tract.

- **Low Priority**
  - An invasive species poster and informational pamphlets can be developed for training purposes and to provide general information on the priority invasive species infestations.
  - Encourage University of Alaska Anchorage classes that incorporate plant identification to participate in a field trip at Campbell Tract to identify invasive species.
  - Develop a regular radio snippet on invasive species found in Campbell Tract and have it aired throughout the growing season.
  - Provide relevant links to exotic species websites or develop a new website on invasive species found in Campbell Tract through existing BLM websites.

Research

Goal: Encourage research of invasive species in Campbell Tract.

Target groups: undergraduate and graduate students from the University of Alaska and Alaska Pacific University, as well as government agencies.

Strategies:

- Target groups could develop and implement studies that investigate the impacts of invasive plants on Campbell Tract’s native vegetation or local fauna, or evaluate the effectiveness of one or more control methods on a specific type of infestation and/or species using Campbell Tract as a Research Natural Area. Campbell Tract provides a good case study for Alaska; it acts as a corridor of invasive species migration in a fairly pristine location adjacent to urban development.

Literature cited and sources used

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

AKEPIC. 2012. Alaska Exotic Plant Information Clearinghouse database (http://aknhp.uaa.alaska.edu/maps/akepic/). Alaska Natural Heritage Program, University of Alaska, Anchorage. Accessed (October 2012).

Alaska Department of Fish and Game. 2011. Campbell Tract, Wildlife Viewing. Online article available at: http://www.adfg.alaska.gov/index.cfm?adfg=viewinglocations.campbelltract

Alaska State Department of Natural Resources. 2010. Prohibited and Restricted Noxious Weeds. List available at: http://plants.alaska.gov/invasives/noxious-weeds.php

Alaska State Department of Natural Resources. 2012. Alaska Weed Free Gravel Certification Program. Publication available at: http://plants.alaska.gov/invasives/pdf/Gravel-pit-inspection-standards.pdf

Alvarez, M. 2000. *Leucanthemum vulgare*. In: Bossard, C. C., J. M. Randall, and M. C. Hoshovsky. Invasive Plants of California's Wildlands. University of California Press. Berkeley, CA, 360 pp.

BLM 2006. Weed-Free Seed Use on Lands Administered by the Bureau of Land Management. Electronic transmission available at: http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/national_instruction/2006/im_2006-073__.html

BLM 2012. Dalton Management Area Integrated Invasive Plant Strategic Plan, Environmental Assessment. Bureau of Land Management, Central Yukon Field Office, Fairbanks, Alaska. September 2012.

Borchert, N. 2004. Final Report on Invasive Plants in Southeast Alaska. Sitka Conservation Society, Sitka, Alaska.

Carlson, M. L. and M. Shephard. 2007. Is the spread of non-native plants in Alaska accelerating? In: Meeting the challenge: invasive plants in Pacific Northwest ecosystems, Portland, OR. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, En. Tech. Rep. PNW-GTR-694: 111-127.

Carlson, M.L., I.V. Lapina and H. Cortés-Burns. 2006. Campbell Tract weed inventory – Invasive non-native plant survey – 2006. Prepared for the Bureau of Land Management- Anchorage Field Office. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, AK. 37 pp.

Carlson, M.L., I.V. Lapina, M. Shephard, J. S. Conn, R. Densmore, P. Spencer, J. Heys, J. Riley and J. Nielsen. 2008. Invasiveness ranking system for non-native plants of Alaska. USDA Forest Service, R10-TP-143. 218 pp.

Conn, J., K. Beattie, M. Shephard, M. Carlson, I. Lapina, M. Hebert, R. Gronquist, R. Densmore, and M. Rasy. 2008. Alaska *Melilotus* Invasions: Distribution, Origin, and Susceptibility of Plant Communities. Arctic and Alpine Research. 40(2): 298-308.

Conn, J.S and S.S. Seefeldt. 2009. Invasive white sweetclover (*Melilotus officinalis*) control with herbicides, cutting, and flaming. Invasive Plant Science and Management 2(3): 270-277.

Cortés-Burns, H. 2009. 2008 Campbell Tract non-native plant survey: Revisiting permanent monitoring transects established in 2006. Prepared for the Bureau of Land Management- Anchorage Field Office. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 39 pp.

Cortés-Burns, H. and M. L. Carlson. 2006a. BAER Final Report: Invasive plant monitoring following 2004 fires. USFWS National Wildlife Refuges (Kenai, Tetlin, Kanuti, Yukon Flats) – Alaska Region. Prepared for the U.S. Fish and Wildlife Service- Alaska Regional Office. Alaska Natural Heritage

Program, Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, AK. 46 pp.

Cortés-Burns, H. and M. L. Carlson. 2006b. BAER Final Report: Invasive plant monitoring following 2004 fires. USFWS National Wildlife Refuges (Yukon Flats, Innoko) – Alaska Region. Prepared for the U.S. Fish and Wildlife Service- Alaska Regional Office. Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska Anchorage, Anchorage, AK. 25 pp.

Cortés-Burns, H., I. Lapina, S. Klein and M. Carlson. 2007. Invasive plant species monitoring and control – Areas impacted by 2004 and 2005 fires in interior Alaska: A survey of Alaska BLM lands along the Dalton, Steese, and Taylor Highways. Prepared for the Bureau of Land Management- Alaska State Office. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 91 pp.

Cortés-Burns, H., I. Lapina, S. Klein, M. Carlson and L. Flagstad. 2008. Invasive Plant Species Monitoring and Control – Areas impacted by 2004 and 2005 Fires in Interior Alaska: A survey of Alaska BLM lands along the Dalton, Steese, and Taylor Highways. Prepared for the Bureau of Land Management- Alaska State Office. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 162 pp.

Cortés-Burns, H., L. Flagstad, M. Carlson, and T. Nawrocki. 2010. Non-native plant surveys along the Delta and Gulkana National Wild and Scenic Rivers. Prepared for the Bureau of Land Management- Glennallen Field Office. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 68 pp.

Cortés-Burns, H., T. Nawrocki, E. Johnson and D. Collet. 2011. Unalakleet Wild River Invasive Plant Management Plan. Prepared for the Bureau of Land Management- Anchorage Field Office. Alaska Natural Heritage Program, University of Alaska Anchorage, AK. 30 pp.

Cortés-Burns, H., T. Nawrocki, M. Duffy and K. Walton. 2011. Salmon Lake-Kigluaik State Recreation Management Area Invasive Plant Management Plan. Prepared for the Bureau of Land Management- Anchorage Field Office. Alaska Natural Heritage Program, University of Alaska Anchorage, AK. 31 pp.

Cronk, Q., and J. Fuller. 1995. Plant Invaders: The threat to natural ecosystems. Chapman & Hall. New York.

Duncan, C. and M. Brown. 2008. Montana Weed Management Plan. Montana Department of Transportation, Helena, MT. 100 pp.

Flagstad, L. 2010. 2009 Campbell Tract non-native plant survey: Revisiting permanent monitoring transects established in 2006. Prepared for the Bureau of Land Management- Anchorage Field Office. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 45 pp.

Flagstad, L. and H. Cortés-Burns. 2010. Tracking weeds along the Iditarod National Historic Trail. Prepared for the Bureau of Land Management- Anchorage Field Office. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 51 pp.

Flagstad, L. and H. Cortés-Burns. 2012. Identification of Non-native Plants in Alaska. 2012. Alaska Natural Heritage Program, University of Alaska Anchorage, AK. 241 pp.

Flagstad, L., H. Cortés-Burns, and T.L. Roberts. 2010a. Invasive plant inventory and Bird Cherry control trials. Phase II: Bird Cherry distribution, demography and reproduction biology along the Chester and Campbell Creek trails, Anchorage, Alaska. Prepared for The Municipality of Anchorage and The Anchorage Parks Foundation. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 61 pp.

Flagstad, L., H. Cortés-Burns, E. Johnson, L. Simpson and A. Brownlee. 2010b. Viability of European bird cherry (*Prunus padus* L.) seed after two year retention in traps along the Chester and Campbell

Creek Trails, Anchorage, AK. Prepared for the Municipality of Anchorage. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 12 pp.

Fletcher , R. ans B. Johnson. 2005. McDonald-Dunn Forest Plan -Invasive Plant Species Management Plan. Oregon State University College Forests. Available online at: http://www.cof.orst.edu/cf/forests/mcdonald/plan/

Gary, G. 2010. Municipality of Anchorage Invasive Plant Management Plan. Report for Municipality of Anchorage and Anchorage Cooperative Weed Management Area. Anchorage, AK. 62 pp.

Graziano, G. 2011. *Cirsium arvense* (Canada thistle) management plan within the Anchorage Borough boundaries. Division of Agriculture, Plant Materials Center. Url: http://plants.alaska.gov/invasives/pdf/Canada-Thistle-Management-Plan-Final.pdf

Guyer, S. 2000. Vegetation survey of Campbell Tract, Anchorage, Alaska. BLM Alaska Tehcnical Report 35, 75 pp.

Woodford, Riley, and C. Harms. 2011. Cyanide-poisoned Moose Ornamental Chokecherry Tree a Devil in Disguise. Alaska Fish and Wildlife News. March 2011. http://www.adfg.alaska.gov/index.cfm?adfg=wildlifenews.view_article&articles_id=501&issue_id=96 Downloaded 1/27/12.

Heidemann, M., G. Aguiar, C. Ashlock, A. Christie, J. Day, G. Finstad, G. Garcia, J. Guritz, M. Herbert, J. Jack, D. Masiak, N. Nordstrand, S. Seefeldt, and A. Tonne. 2010. UAF Campus Invasive Plant Management Plan. Recommedations from the Invasive Plant Task Force. School of Natural Resources and Agricultural Sciences, University of Alaska Fairbanks. Fairbanks, AK, 33 pp.

Hickman, J.C. 1993. The Jepson Manual of Higher Plants of California. University of California Press, Berkeley, California. 1400 pp.

Hultén, E. 1968. Flora of Alaska and Neighboring Territories. Stanford University Press, Stanford, CA. 1008 pp.

Lamb, M. 2009. Garlic mustard eradication continues; Juneau's fight may benefit entire state. Article published in the Juneau Empire newspaper and available at: http://juneauempire.com/stories/071209/nei_462411182.shtml

Municipality of Anchorage 2012. Wetlands Public Hearing Draft. Prepared by the Physical Planning Division, Community Development Department, Municipality of Anchorage, AK. Url: http://www.muni.org/Departments/OCPD/Planning/Projects/Documents/AWMP-March2012PHD-5-6-12.pdf

National Invasive Species Council. 2003. Progress report on the National Invasive Species Management Plan. Available at: http://www.invasivespeciesinfo.gov/docs/council/progressrpt2003.pdf

Nawrocki, T., H. Klein, M. Carlson, L. Flagstad, J. Conn, R. DeVelice, A. Grant, G. Graziano, B. Million, and W. Rapp. 2011. Invasiveness Ranking of 50 Non-Native Plant Species for Alaska. Report prepared for the Alaska Association of Conservation Districts. Alaska Natural Heritage Program, University of Alaska Anchorage, Anchorage, AK. 253 pp.

Paddock, R. 2009. Garlic Mustard Invasion History in Juneau. 2009 Alaska Invasive Species Conference presentation, Ketchikan AK.

Pimentel, D., R. Zuniga and D. Morrison. 2005. Update on the environmental and economic costs associated with alien-invasive species in the United States. Ecological Economics, 52 (3): 273–288.

Radosevich, S.R. 2002. Plant Invasions and Their Management. Chapter 3 in CIPM (ed.), Invasive Plant Management: CIPM Online Textbook. Bozeman, MT: Center for Invasive Plant Management. http://www.weedcenter.org/textbook/index.html (accessed Dec. 22, 2012)

Randall, J.M. and M.C. Hoshovsky. 2000. California's wildland invasive plants. In Bossard, C.C., J.M. Randall, and M.C. Hoshovsky (eds.) Invasive Plants of California's Wildlands. University of California Press, Berkeley, California. pp. 11–27.

Roberts, H.A. and J. E. Boddrell. 1985. Seed survival and seasonal pattern of seedling emergence in some Leguminosae. Ann. Appl. Biol. 106: 125–132.

Roon, D. A. 2011. Ecological effects of invasive European bird cherry (*Prunus padus*) on salmonid food webs in Anchorage, Alaska streams. M.Sc. thesis, University of Alaska Fairbanks, Fairbanks, AK. 111 pp.

Schmitz, D.C. and D. Simberloff. 1997. Biological Invasions: a growing threat. Issues in Science and Technology, 13: 33-40.

Schrader, B. and P. Hennon, compilers. 2005. Assessment of Invasive Species in Alaska and its National Forests. USDA Forest Service, Regional Office, Anchorage, AK. 26 pp.

Schwörer, Tobias, R. Federer and H. Ferren. 2012. Managing invasive species: How much do we spend? Institute of Social and Economic Research, University of Alaska Anchorage.

Seefeldt, S. 2007. Control methods for non-indigenous plant species found in the Yukon and Interior. Unpublished document.

Seefeldt, S. and J. Conn. 2011. Control of orange hawkweed (*Hieracium aurantiacum*) in Southern Alaska. Invasive Plant Science and Management 4(1): 87-94.

Seefeldt, S.S., J.S. Conn, B.E. Jackson, and S.D. Sparrow. 2007. Response of seedling bird vetch (Vicia cracca) to six herbicides. Weed Technology 2(1): 692-694.

Slemmons, C. 2007. Integrated Weed Management Strategy Focusing on Early Detection / Rapid Response for the Kenai Peninsula – Cooperative Weed Management Area. Homer Soil Water and Conservation District. Homer, AK. 19 pp.

Spellman, B.T. 2008. The impacts of invasive Sweetclover (*Melilotus alba*) in early-successional floodplain habitats of Alaska. M.Sc. thesis, University of Alaska Fairbanks, Fairbanks, AK. 94 pp.

Spellman, B.T. and T.L. Wurtz. 2010. Invasive sweetclover (*Melilotus alba*) impacts native seedling recruitment along floodplains of interior Alaska. Biological Invasions. Published online: January 6, 2011.

Stein, B., L. Kutner, and J. Adams. 2000. Precious heritage: The status of biodiversity in the United States. Oxford University Press, Oxford.

Tu, M., C. Hurd, J.M Randall, and The Nature Conservancy. 2001. Weed Control Methods Handbook: Tools & Techniques for Use in Natural Areas. All U.S. Government Documents (Utah Regional Depository), paper 533. Available at: http://digitalcommons.usu.edu/govdocs/533

Walker, L.R. and S.D. Smith. 1997. Impacts of invasive plants on community and ecosystem properties. In J.O. Luken and J.W. Thieret (eds.). Assessment and Management of Plant Invasions. Springer, New York.

Westbrooks, R. 1998. Invasive plants, changing the landscape of America: Fact book. Federal Interagency Committee for the Management of Noxious and Exotic Weeds (FICMNEW). Washington, DC.

Appendix I. Directives

1. **Instruction Memorandum IM-AK-2011-001 on Noxious Weeds and Invasive Species Management**
   - Establishes BLM-Alaska policy concerning the coordination and management of invasive species actions on public lands within the State to protect the environment with effective prevention, management and treatment strategies of invasive species that cross-cut most subactivities. Goals are:
     a) To integrate invasive species prevention, detection and control activities into all on-the-ground activities conducted on BLM administered land in the State.
     b) To provide guidelines for consistent management and reporting of invasive species occurrences, treatment and monitoring activities.
     c) To ensure compliance with applicable federal and state laws, Executive Orders, regulations and policy.
     d) To encourage development of cooperative relationships with adjacent landowners, state and local governments and agencies, to prevent and control noxious and invasive species. Maintain these relationships for the benefit of all parties involved.
     e) To protect the health and safety of those individuals involved with implementing the invasive species management program and for those certified to apply herbicides or pesticides.

2. **Federal Land Policy and Management Act of 1976 (FLPMA)**
   - Directs the BLM to take any action necessary to prevent unnecessary and/or undue degradation of public lands and authorizes the BLM to enter into cooperative agreements.

3. **Executive order 13112, Invasive Species 1999**
   - "…prevent the introduction of invasive species and provide for their control and to minimize economic, ecological and human health impacts that invasive species cause."

4. **Carlson-Foley Act of 1968 (PL 90-583)**
   - Directs agency heads to enter upon lands under their jurisdiction with noxious plants and destroy noxious plants growing there.

5. **Federal Noxious Weed Act of 1974, as amended by Sec. 15, Management of Undesirable Plants on Federal Lands, 1990 (PL 93-629)**
   - "…cooperate with other federal and state agencies and others in carrying out operations or measures to eradicate, suppress, control or prevent or retard the spread of any noxious weed."

6. **BLM Manual Sections**
   - 1745 (USDI 1992a): Introduction, transplant, augmentation and reestablishment of fish, wildlife and plants- Provides policy and guidance on the introduction of exotic species and reestablishment of native and naturalized exotic species. The objective is to ensure that management is ecologically sound and does not adversely impact natural ecosystems or biodiversity.
   - 9011 (USDI 1992b): Chemical pest control - Provides policy for conducting chemical pest control programs under an integrated pest management approach.
   - 9014 (USDI 1992c): Use of biological control agents of pests on public lands - Provides guidance and procedures for planning and implementing biological control in Integrated Pest Management Programs.

- 9015 (USDI 1992d): Integrated weed management - Provides policy relating to the management and coordination of noxious weed activities among BLM, organizations and individuals.
- 9220: Integrated pest management - Provides guidance for implementing integrated pest management on lands administered by the BLM. The objective is to ensure optimal pest management with respect to environmental concerns, biological effectiveness and economic efficiency while achieving resource management objectives.

7. Departmental Manual Parts

- 517 (USDI 2007a): Pesticides - Prescribes policy for the use of pesticides on the lands and waters under its jurisdiction and for compliance with the Federal Insecticide, Fungicide, and Rodenticide Act as amended.
- 609 (USDI 2007b): Weed Control Program - Prescribes policy for conducting chemical pest control program under an integrated pest management approach.

8. Federal Seed Act of 1939 (7 USC 1551-1611)

- Requires accurate labeling and purity standards for seeds in commerce and prohibits the importation and movement of adulterated or misbranded seeds. The law works in conjunction with the Federal Noxious Weed Act to authorize the Animal and Plant Health Inspection Service to regulate the importation of field crop, pasture, forage or vegetable seed that may contain noxious weed seeds.

9. Final Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Programmatic Environmental Impact Statement (PEIS)

- Analyzes the potential direct, indirect and cumulative impacts associated with the BLM's use of herbicides on the human and natural environment.

Appendix II. Weed lists and classifications

State of Alaska Prohibited and Restricted Noxious Weeds

A new, revised list is expected to be released in 2013-2014. Please check the Alaska State Department of Natural Resources Plant Materials Center website for updates (http://www.plants.alaska.gov/invasives/noxious-weeds.php).

Prohibited Noxious Weeds

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 (Canada thistle)
Cardaria draba, C. pubescens, Lepidium latifolium (whitetops and its varieties)
Lythrum salicaria (purple loosestrife)
Hieracium aurantiacum (orange hawkweed)

Restricted Noxious Weeds with Maximum Allowable Tolerances

Poa annua (annual bluegrass), 90 seeds per pound
Lappula echinata (blue burr), 18 seeds per pound
Brassica juncea, Sinapis arvensis (mustard), 36 seeds per pound
Avena fatua (wild oats), seven seeds per pound
Plantago sp. (buckhorn plantain), 90 seeds per pound
Raphanus raphanistrum (radish), 27 seeds per pound
Linaria vulgaris (yellow toadflax), one seed per pound
Vicia cracca (tufted vetch), two seeds per pound
Polygonum convolvulus (wild buckwheat), two seeds per pound

Municipality of Anchorage classification

A prioritized list of non-native plant species was compiled by the Municipality of Anchorage with input from local land managers and weed scientists as part of an invasive plant management plan drafted for the Municipality in 2010. All non-native plant species known to occur in the Municipality at the time of compilation were evaluated and categorized based on their biology, potential invasiveness, known distribution, feasibility of control and status as an ornamental, horticultural or agricultural plant. The following categories were developed (Gary 2010):

A-list: Non-native plant species that are considered invasive and have a limited distribution in the Municipality of Anchorage. Eradication of these species from the Municipality must be the highest priority for management.

Species	Common name	AKNHP Rank
Fallopia japonica	Japanese knotweed	87
Fallopia x bohemica	bohemian knotweed	87
Centaurea stoebe	spotted knapweed	86
Lythrum salicaria	purple loosestrife	84
Impatiens glandulifera	ornamental jewelweed	82
Bromus tectorum	cheatgrass, downy brome	78
Medicago sativa ssp. *falcata*.	yellow alfalfa	64
Senecio jacobaea	tansy ragwort, stinky Willie	63
Cirsium vulgare	bull thistle	61
Hypericum perforatum	common St. Johnswort	52
Tragopogon dubius	yellow salsify, goatsbeard	50
Myosotis scorpioides	marsh forget-me-not	54
Thlaspi arvense	pennycress	42

B-list: Non-native plant species that are considered invasive and generally widespread throughout the Municipality of Anchorage. Preventing the spread of these species outside of the Municipality and into critical habitats within the Municipality is a high priority for management. Control and containment efforts must be focused along transportation corridors, near to or on public lands and on outlying infestations.

Species	Common name	AKNHP Rank
Phalaris arundinacea	reed canarygrass	83
Melilotus alba	white sweetclover	81
Hieracium aurantiacum	orange hawkweed	79
Cirsium arvense	Canada thistle	76
Prunus padus	European birdcherry	74
Sonchus arvensis	perennial sowthistle	73
Vicia cracca	bird vetch	73
Linaria vulgaris	butter and eggs	69
Melilotus officinalis	yellow sweet clover	69
Campanula rapunculoides	creeping bellflower	64
Bromus inermis spp. *inermis*	smooth brome	62
Leucanthemum vulgare	ox-eye daisy	61
Tanacetum vulgare	common tansy	60
Lupinus polyphyllus	large-leaf lupine	71
Ranunculus repens	creeping buttercup	54
Hieracium umbellatum	narrow-leaf hawkweed	51
Silene latifolia ssp. *alba*	bladder campion	42
Prunus virginiana	choke cherry	74
Ranunculus acris	tall buttercup	54

C-list: Non-native plant species that are widespread throughout the Municipality of Anchorage and the state of Alaska. Control of these plants is encouraged, where practical, to reach desired site conditions. Monitoring of these species for invasiveness is recommended where feasible.

Species	Common name	AKNHP Rank
Caragana arborescens	Siberian peashrub	74
Hordeum jubatum	foxtail barley	63
Elymus repens	quackgrass	59
Sorbus aucuparia	European mountain ash	59
Trifolium repens	white clover	59
Taraxacum officinale ssp. *officinale*	common dandelion	58
Trifolium hybridum	alsike clover	57
Crepis tectorum	narrow leaf hawksbeard	56
Phleum pratense	Timothy	54
Trifolium pratense	red clover	53
Poa pratensis spp. *pratensis* & spp. *irrigata*	Kentucky & spreading bluegrass	52
Rumex acetosella	sheep sorrel	51
Medicago lupulina	black medic	48
Rumex crispus	curled dock	48
Tripleurospermum inodorum	scentless false mayweed	48
Poa annua	annual bluegrass	46
Polygonum aviculare	Prostrate knotweed	45
Plantago major	common plantain	44
Anthemis cotula	stinking chamomile	41
Lolium perenne ssp. *perenne*	perennial rye grass	41
Capsella bursa-pastoris	shepherd's purse	40
Galeopsis bifida & *G. tetrahit*	splitlip hempnettle	50
Poa compressa	Canada bluegrass	39
Chenopodium album	lamb's quarters	37
Cerastium fontanum spp. *vulgare*	mouse-ear chickweed	36
Senecio vulgaris	common groundsel	36
Matricaria discoidea	Pineappleweed	32
Spergula arvensis	Corn spurry	32
Lepidium densiflorum	common pepperweed	25
Alopecurus pratensis	meadow foxtail	52
Bromus hordeaceus	soft brome	Not ranked
Erucastrum gallicum	common dogmustard	Not ranked
Erysimum cheiranthoides	wormseed wallflower	Not ranked
Lolium perenne ssp. *multiflorum*	Italian rye grass	41
Papaver rhoeas	corn poppy	Not ranked
Persicaria lapathifolia	willow weed	47
Rosa rugosa	rugosa rose	72
Stellaria media	common chickweed	42
Viola tricolor	pansy	34

U-list: Non-native plant species that are of unknown invasiveness and priority in the Municipality of Anchorage. There are fewer than 10 recorded populations of each species, so swift action may be more critical than further study. A U-list ranking indicates that more information (e.g. state-wide distribution, observable impacts, spread rate, invasiveness) and monitoring are required. Control and eradication efforts should not divert substantial resources from high priority species (A- and B-lists) but should otherwise be taken at the earliest opportunity.

Species	Common name	AKNHP Rank
Descurainia pinnata	western tansy mustard	Not ranked
Amaranthus retroflexus	redroot pigweed	45
Astragalus cicer	chickpea milkvetch	Not ranked
Berteroa incana	hoary false madwort	Not ranked
Brassica napus	turnip	47
Cerastium glomeratum	sticky chickweed	36
Cerastium tomentosum	snow in summer	Not ranked
Chaenorhinum minus	dwarf snapdragon	Not ranked
Conyza canadensis	Canadian horseweed	Not ranked
Coronilla varia	crownvetch	68
Elymus sibiricus	Siberian wild rye	53
Erodium cicutarium	redstem stork's bill	Not ranked
Euphrasia nemorosa	common eyebright	42
Hypochaeris radicata	cat's-ears	44
Leontodon autumnalis	fall dandelion	51
Linaria pinifolia	pineneedle toadflax	Not ranked
Lotus corniculatus	birdsfoot trefoil	65
Lychnis chalcedonica	maltesecross	Not ranked
Papaver nudicaule	Iceland poppy	Not ranked
Phalaris canariensis	Canary grass	Not ranked
Poa trivialis	rough bluegrass	52
Fallopia convolvulus	black bindweed	50
Persicaria maculosa	lady's-thumb	47
Raphanus sativus	cultivated radish	Not ranked
Rumex longifolius	garden dock	48
Senecio sylvaticus	woodland ragwort	41
Silene dioica	red catchfly	42
Silene latifolia	bladder campion	42
Sonchus asper	spiny sowthistle	46
Sonchus oleraceous	common sowthistle	46
Sorbaria sorbifolia	false spiraea	Not ranked
Spergularia rubra	purple sand spurry	34
Trifolium aureum	golden clover	Not ranked
Veronica peregrina ssp. *peregrina*	neckweed	Not ranked
Veronica serpyllifolia	thyme-leaf speedwell	36

Alaska Invasiveness Ranking System

The background and specifics of the Alaska Invasiveness Ranking System are provided in Carlson *et al.* (2008). Rank assessments for 113 non-native species that occur or are likely to occur in Alaska are also presented in Carlson *et al.* (2008). Nawrocki *et al.* (2011) assessed the ranks for an additional 50 species, and re-evaluated the ranks for five previously ranked species.

The Alaska Invasiveness Ranking System calculates ranks 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 (Carlson *et al.* 2008). More information can be found at http://aknhp.uaa.alaska.edu/botany/akepic/.

Plant species (synonyms provided parenthetically)	**Common name**	**Invasiveness**[1]
Achillea ptarmica	sneezeweed	46
Acroptilon repens†	Russian knapweed	66
Aegopodium podagraria	bishop's goutweed	57
*Alchemilla mollis**	lady's mantle	56
*Alchemilla monticola**	hairy lady's mantle	56
Alliaria petiolata	garlic mustard	70
Alnus glutinosa†	European alder	61
Alopecurus geniculatus	water foxtail	49
Alopecurus pratensis	meadow foxtail	52
Amaranthus retroflexus	redroot pigweed	45
Anthemis cotula	mayweed chamomile	41
Arctium minus	common burdock	49
Brachypodium sylvaticum†	false slender brome	70
Brassica napus	rapeseed mustard	47
Brassica rapa	birdsrape mustard	50
Bromus inermis ssp. *inermis*	smooth brome	62
Bromus tectorum	cheatgrass	78
Campanula rapunculoides	rampion bellflower	64
Capsella bursa-pastoris	shepherd's purse	40
Caragana arborescens	Siberian peashrub	74
*Carduus acanthoides**†	plumeless thistle	61
*Carduus nutans**†	musk thistle	61
*Carduus pycnocephalus**†	Italian thistle	61
*Carduus tenuiflorus**†	slender-flowered thistle	61
Centaurea montana	perennial cornflower	46
*Centaurea solstitialis***	yellow star-thistle	
Centaurea stoebe	spotted knapweed	86
Cerastium fontanum ssp. *vulgare**	big chickweed	36
*Cerastium glomeratum**	sticky chickweed	36
Chenopodium album	lambsquarters	37
Cirsium arvense	Canada thistle	76
Cirsium vulgare	bull thistle	61
Convolvulus arvensis	field bindweed	56
Coronilla varia	crownvetch	68
Cotula coronopifolia	common brassbuttons	42
Crepis tectorum	narrowleaf hawksbeard	56
*Crupina vulgaris****	common crupina	
Cytisus scoparius	Scotch broom	69
Dactylis glomerata	orchardgrass	53

Plant species (synonyms provided parenthetically)	**Common name**	**Invasiveness**[1]
Deschampsia elongata	slender hairgrass	35
Descurainia sophia	herb sophia	41
Digitalis purpurea	purple foxglove	51
Elodea canadensis	Canadian waterweed	79
Elymus repens	quackgrass	59
Elymus sibiricus	Siberian wildrye	53
Euphorbia esula	leafy spurge	84
Euphrasia nemorosa	common eyebright	42
Fallopia ×bohemica (Polygonum xbohemicum)*	Bohemian knotweed	87
Fallopia convolvulus (Polygonum convolvulus)	black bindweed	50
Fallopia japonica (Polygonum cuspidatum)*	Japanese knotweed	87
Fallopia sachalinensis (Polygonum sachalinensis)*	giant knotweed	87
*Galeopsis bifida**	splitlip hempnettle	50
*Galeopsis tetrahit**	brittlestem hempnettle	50
Geranium robertianum	herb Robert	67
Glechoma hederacea	ground ivy	48
Gypsophila paniculata	baby's-breath	57
Hedera helix	English ivy	73
Heracleum mantegazzianum	giant hogweed	81
Hesperis matronalis	dames rocket	41
*Hieracium aurantiacum**	orange hawkweed	79
*Hieracium caespitosum**	meadow hawkweed	79
Hieracium lachenalii	common hawkweed	57
Hieracium pilosella	mouse-ear hawkweed	63
Hieracium umbellatum	narrowleaf hawkweed	51
Holcus lanatus	common velvetgrass	56
Hordeum jubatum	foxtail barley	63
Hordeum murinum ssp. *leporinum*	leporinum barley	60
Hordeum vulgare	common barley	39
Hydrilla verticillata†	hydrilla	80
Hypericum perforatum	common St. Johnswort	52
Hypochaeris radicata	hairy catsear	44
Ilex aquifolium	English holly	67
Impatiens glandulifera	ornamental jewelweed	82
Iris pseudacorus	yellowflag iris	66
Lamium album	white deadnettle	40
Lappula squarrosa	European stickseed	44
Lapsana communis	nipplewort	33
Leontodon autumnalis	fall dandelion	51
Lepidium densiflorum	common pepperweed	25
Lepidium latifolium	broadleaved pepperweed	71
Leucanthemum vulgare	oxeye daisy	61
Linaria dalmatica	Dalmatian toadflax	58
Linaria vulgaris	yellow toadflax	69
Lolium multiflorum (*Lolium perenne* ssp. *multiflorum*)	Italian ryegrass	41
Lolium perenne (*Lolium perenne* ssp. *perenne*)	perennial ryegrass	52
Lonicera tatarica	Tatarian honeysuckle	66
Lotus corniculatus	birdsfoot trefoil	65
*Lupinus polyphyllus***	bigleaf lupine	71
*Lythrum salicaria**	purple loosestrife	84
*Lythrum virgatum**	European wand loosestrife	84
Matricaria discoidea	pineappleweed	32
Medicago lupulina	black medick	48
Medicago sativa ssp. *falcata*	yellow alfalfa	64
Medicago sativa ssp. *sativa*	alfalfa	59

Plant species (synonyms provided parenthetically)	**Common name**	**Invasiveness**[1]
Melilotus alba	white sweetclover	81
Melilotus officinalis	yellow sweetclover	69
*Mentha ×piperita**	peppermint	43
*Mentha spicata**	spearmint	43
Mycelis muralis	wall lettuce	31
Myosotis scorpioides	European forget-me-not	54
Myriophyllum spicatum	Eurasian watermilfoil	90
Nymphaea odorata ssp. *odorata*	American white waterlily	80
Papaver croceum	Icelandic poppy	39
Persicaria lapathifolia (Polygonum lapathifolium)*	curlytop knotweed	47
Persicaria maculosa (Polygonum persicaria)*	spotted ladysthumb	47
Persicaria wallichii (Polygonum polystachyum)	Himalayan knotweed	80
Phalaris arundinacea	reed canarygrass	83
Phleum pratense	timothy	54
Phragmites australis	common reed	83
Plantago major	common plantain	44
Poa annua	annual bluegrass	46
Poa compressa	Canada bluegrass	39
Poa pratensis ssp. *irrigata**	spreading bluegrass	52
Poa pratensis ssp. *pratensis**	Kentucky bluegrass	52
*Poa trivialis**	rough bluegrass	52
Polygonum aviculare	prostrate knotweed	45
Potentilla recta†	sulfur cinquefoil	57
Prunus padus	European bird cherry	74
Prunus virginiana	chokecherry	74
*Ranunculus acris**	tall buttercup	54
*Ranunculus repens**	creeping buttercup	54
Rosa rugosa	rugosa rose	72
Rubus discolor	Himalayan blackberry	77
Rumex acetosella	common sheep sorrel	51
*Rumex crispus**	curly dock	48
*Rumex longifolius**	dooryard dock	48
*Rumex obtusifolius**	bitter dock	48
Sagina procumbens	birdseye pearlwort	39
Saponaria officinalis	bouncingbet	34
Schedonorus arundinaceus	tall fescue	63
Senecio jacobaea	tansy ragwort	63
Senecio sylvaticus	woodland ragwort	41
Senecio vulgaris	common groundsel	36
Silene chalcedonica	Maltese cross	42
*Silene dioica**	red catchfly	42
*Silene latifolia**	white cockle	42
*Silene noctiflora**	nightflowering silene	42
*Silene vulgaris**	bladder campion	42
Sonchus arvensis	perennial sowthistle	73
Sonchus asper	spiny sowthistle	46
Sonchus oleraceus	annual sowthistle	46
Sorbus aucuparia	European mountain ash	59
Spartina alterniflora†*	smooth cordgrass	86
Spartina anglica†*	common cordgrass	86
Spartina densiflora†*	denseflower cordgrass	86
Spartina patens†*	saltmeadow cordgrass	86
Spergula arvensis	corn spurry	32
Spergularia rubra	red sandspurry	34
Stellaria media (non-seabird sites)	common chickweed	42

Plant species (synonyms provided parenthetically)	**Common name**	**Invasiveness**[1]
Stellaria media (seabird colonies)	common chickweed	54
Symphytum officinale	common comfrey	48
Tanacetum vulgare	common tansy	60
Taraxacum officinale(*Taraxacum officinale ssp. officinale*)	common dandelion	58
Thlaspi arvense	field pennycress	42
Tragopogon dubius	yellow salsify	50
Trifolium dubium	suckling clover	50
Trifolium hybridum	alsike clover	57
Trifolium pratense	red clover	53
Trifolium repens	white clover	59
Tripleurospermum inodorum	scentless chamomile	48
Verbascum thapsus	common mullein	52
Veronica serpyllifolia ssp. *serpyllifolia*	thymeleaf speedwell	36
Vicia cracca ssp. *cracca* (*Vicia cracca*)	bird vetch	73
Vicia villosa	winter vetch	53
Viola tricolor	johnny jumpup	34
Zostera japonica†	dwarf eelgrass	53

Table modified from Nawrocki *et al.* 2011.

† Species not known from Alaska or neighboring Canadian Territories (per AKEPIC and ALA Herbarium databases as of February 2012)

* Congeneric species ranked together

** The native status of *Hordeum jubatum* and *Lupinus polyphyllus* is debated

****Centaurea solstitialis* and *Crupina vulgaris* were rejected from consideration in the climate screening phase 1

Invasiveness Scores (Carlson *et al.* 2008): >80 = Extremely Invasive; 70-79 = Highly Invasive; 60-69 = Moderately Invasive; 50-59 = Modestly Invasive; 40-49 = Weakly Invasive; < 40 = Very Weakly Invasive

Appendix III. Treatment prioritization tool

Treatment Prioritization Tool for Infestations at Campbell Tract*

To tally up points to determine a species' level of priority, enter 1 next to those statements that apply to the species in question, and 0 for those that do not

1. Legal mandate or other listing

____ Species is listed on AK "Prohibited or Restricted Noxious Weed" list[1]

____ Species ranked greater than 50 by AKNHP Invasiveness Ranking System[2] (complete section 2 if plant is not ranked)

____ Species is listed as an "A" or "B" species on the Municipality of Anchorage's non-native species list[3]

____ This is a rare or new sighting in Alaska (not currently tracked as a non-native species on the AKNHP tracking list) [2]

See Appendix II, or

[1]List available at http://dnr.alaska.gov/ag/PMCwebsite/PMCPublications/NOXIOUSWEEDS.pdf

[2] List available at http://aknhp.uaa.alaska.edu/botany/akepic/

[3] List available in Appendix II only

2. Ecological impacts (Complete this section ONLY if the species is not ranked by the Invasiveness Ranking System for Non-Native Plants in Alaska)

____ Enter "1" if at least six of these statements apply

- Plant propagules dispersed by wind
- Plant propagules dispersed by water
- Plant propagules dispersed by human or animal vectors
- Species is known to reproduce sexually (by seed)
- Species is known to reproduce vegetatively
- Species is known to be allelopathic
- Species is known to be toxic to animals or people
- Species is a highly competitive and/or is an early successional species
- Species is a known invasive in similar climates
- Seeds of species are known to remain viable for more than five years in soil
- Infestation is known to impact ecosystem processes, structure and/or community composition

3. Location and character of infestation

____ Infestation cannot be treated by mechanical methods such as hand pulling (≤ 100 stems or approximately 1 hour of work)

____ Plants are climbing or smothering native vegetation

____ Plants growing in undisturbed soil

4. Cultural concerns

____ Infestation is damaging infrastructure (airstrip, helipad, roads, parking lots, trailheads, trails)

____ Infestation is degrading the aesthetic qualities of the natural landscape

____ Infestation impairs the recreational experience

____ Infestation undermines the mission of the Campbell Creek Science Center†

† The Campbell Creek Science Center's mission is to (a) promote discovery and learning experiences that increase awareness, understanding, and appreciation of nature; (b) use of the best science for the management of Alaska's natural resources; and (c) promote behaviors, practices, and lifestyles that minimize impact on the environment

---

*Prioritization tool adapted from:

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

Carlson, M.L., I.V. Lapina, M. Shephard, J. S. Conn, R. Densmore, P. Spencer, J. Heys, J. Riley and J. Nielsen. 2008. Invasiveness ranking system for non-native plants of Alaska. USDA Forest Service, R10-TP-143. 218 pp.

Darin, G.M. 2008. "Taking Weed Risk Management to the Population Level" Proceedings CA Department of Food and Agriculture.

Washington Invasive Species Council. "Invasive Species Impact and Prevention/Early Action Assessment Tool". Available online at: Invasive Species Impact and Prevention/Early Action Assessment Tool

Garry Oaks Ecosystem Recovery team, Nature Conservancy Canada. "General Decision Process for Managing Invasive Plant Species in Garry Oaks and Associated Ecosystems". Available online at: http://www.goert.ca/publications_resources/invasive_species.php#GDP

Appendix IV. Best Management Practices: a primer

The BLM AFO is well placed to identify Best Management Practices (BMPs) that are feasible and could help minimize future introductions of invasive plants into the Tract and prevent the spread of existing infestations within the Tract. The BMPs can be used as a primer in the process of developing Tract-specific BMPs.

- **Ground-disturbing projects**
  - Before starting a project, survey the site and access routes for weeds; control weeds as necessary.
  - Once a project starts (road and trail maintenance, trail construction, airstrip and fire break vegetation management, etc.), always move equipment and machinery from uninfested or weakly infested areas towards heavily infested areas.
  - Clean construction equipment and gear that has been used in a heavily infested area before moving it to another site (incinerate any plant parts and propagules).
  - Contracts for large-scale projects:
    - Include stipulations in the contracts requesting that equipment be cleaned prior to use in the Tract or that materials be certified weed free.
    - If weed-free materials are not available, request that weed surveys be conducted at the site where the contractors store their materials.
    - Include specifications that request that the project site(s) be kept weed free for a specified time after project completion.

- **Imported construction materials**
  - Inspect imported material sources on site to determine whether they are weed-free or not before using them in other locations in the Tract. Treat weed-infested sources for eradication.
  - If contaminated materials have accidentally been used at a new project site, inspect the site annually for 3-5 years after project completion, to ensure that any weeds transported to the site are promptly detected and controlled.
  - Work towards ensuring that all construction materials brought into the Tract are weed-free.

- **Vegetation management practices**
  - Whenever possible, leave native vegetation in or around a project area.
  - If bare ground becomes exposed, revegetate using weed-free (if available) native seed sources.
  - Always monitor a project area for 3-5 years after completion, to ensure that no invasive weeds germinate and establish there or move in from nearby infestations.
  - All vegetation management practices (mowing, pulling, digging, etc.) in areas with invasive species should occur prior to seed set (repeat as needed starting in the spring and until the plants senesce in the fall).
  - Remove and bag the resulting plant material from these areas, as many of the invasive weeds that occur or are likely to occur in Campbell Tract can reproduce vegetatively from root and stem fragments.

- **Disposal of infested materials and invasive plant parts**
  - Cover or bag all materials (both soil and plant propagules) during transport and storage.
  - All removed materials should be disposed of in the Campbell Tract incinerator (if incineration is not an option, double bag the materials using black heavy duty-type bags).

– **Education and training**
  * Provide information, training and appropriate weed identification materials to BLM employees, contractors, volunteers and visitors.
  * Create incentives for BLM employees and volunteers to become key players in the detection and reporting of new invaders.
  * Encourage public land users to clean their gear, dogs, or horses' hooves prior to recreating on public lands.

– **Identifying new threats**
  * Annually review which new invasive species are encroaching the Tract from surrounding trail and road systems (use AKEPIC or quick, targeted surveys) or may have invaded the Tract via contaminated materials or equipment.
  * Revise the Early Detection and Rapid Response species watch-list on an annual basis.
  * Educate employees, visitors, and volunteers on how to identify and help remove these new invaders before they become established.