MUNICIPALITY OF ANCHORAGE NON-NATIVE PLANT SURVEY

A survey of non-native plants along major and secondary roads in the Municipality of Anchorage, Alaska

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Abstract

Non-native plant occurrence in Alaska is well correlated with high-use and thus, highly-disturbed areas such as urban centers and transportation corridors. Anchorage experiences the greatest movement of goods and people and supports the highest concentration of human-altered landscapes in the state. As such, it is presumably the largest portal for non-native plant introductions to the state and particularly vulnerable to infestation. To assess the identities and distribution of non-native plant species along the Municipality of Anchorage road system, the Alaska Natural Heritage Program conducted systematic surveys from June to September 2011 at 813 sites along 513 km (319 mi) of major and secondary roads. Particular attention was given to sensitive areas such as wetlands, parklands and riparian corridors.

This survey confirms the high diversity and abundance of non-native plant species in the Municipality of Anchorage. Non-native species were detected at 609 out of 813 plots with 279 of the 481 (58%) systematic plots supporting non-native plants. A total of 1,615 non-native plant species records representing 64 non-native taxa were recorded. Four of the taxa documented represent new records for the state and six represent new records for the Municipality; three of the non-native taxa detected are classified as A-listed species on the Municipality's prioritized list of non-native species. Of special concern are the apparent introductions of highly invasive *Lepidium latifolium* (broadleaved pepperweed) to the state and moderately invasive *Medicago sativa* ssp. *sativa* (alfalfa) to the Municipality. Detecting new arrivals and refining the documented distribution of resident non-native plants is invaluable for the eradication of newly-introduced and potentially invasive species, and is also important for evaluating the invasiveness of resident, non-native plant species.

Acknowledgements

This project was funded by the Anchorage Parks Foundation and Municipality of Anchorage. We are grateful to Tim Stallard (Anchorage Park Foundation Invasive Plant Program Coordinator) and Scott Stringer (Municipality of Anchorage Forester) for their support and advice. We would also like to extend a special thanks to Alaska Natural Heritage Program (AKNHP) technicians Jen McGrath, Erin Johnson, Abe Schmidt and Annie Brownlee for assistance in the field and office.

Introduction

The establishment, growth, and persistence of non-native[1] plant species can pose a serious threat to natural ecosystems. Although not all non-native species cause significant economic or ecological harm, invasive[2] plants are well known to alter natural community composition, structure and function (U.S. Congress 1993).

Infestations of non-native plant species in Alaska have not yet reached the extent of distribution or level of impact experienced in the contiguous United States. However, the rate of introduction of new taxa to the state is accelerating, presumably driven by constant increases in the movement of goods and people. Approximately one plant taxon per year was introduced to Alaska between 1941 and 1968 with this rate increasing to three taxa per year between 1968 and 2006 (Carlson and Shephard 2007). Since 2006, an average of 10 new non-native species have been reported annually (AKEPIC database 2011). While the majority of introductions are poorly-adapted species that rarely persist in Alaska, several highly to extremely invasive species have established and spread in undisturbed natural areas (Cortés-Burns et al. 2007, 2008; Lapina et al. 2007; Villano and Mulder 2008). It is likely that Alaska is only now experiencing the influx and impacts of non-native plant species that the contiguous United States experienced in the early 1900s (Carlson and Shephard 2007).

The susceptibility of native plant communities to invasion is largely a function of the degree of natural or anthropogenic disturbance (Hobbs and Huenneke 1992). In Alaska, non-native plant occurrence is most strongly correlated with high-use, and therefore highly disturbed areas such as urban centers and transportation routes. As the state's largest city, Anchorage experiences the greatest flow of traffic and supports the highest concentration of human-altered landscapes in the state. As such, Anchorage is likely the largest portal for non-native plant introductions and particularly vulnerable to infestation. A more complete understanding of non-native species distribution and abundance within the Municipality of Anchorage (hereafter referred to as the Municipality) is not only important for rapid responses to incipient populations of new species or new infestations in sensitive habitats, but also for the design of effective weed management plans to be implemented over a longer term.

[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.

Methods

Alaska Natural Heritage Program (AKNHP) staff conducted systematic surveys along major and secondary roads during the 2011 field season to better quantify the distribution and abundance of non-native vascular taxa present in the Municipality. This survey focused on species listed as A, B or U on the Prioritized Non-native Plant Species List for the Municipality of Anchorage (Gary 2010 and Appendix I, this report); species previously unreported within the State of Alaska or Municipality were also reported. C-listed species are non-native species that are widespread locally and across the state. Because control of C-listed species is typically not an efficient use of limited resources, their occurrence was not a focus of this survey and was not consistently recorded. The Municipality (Gary 2010) defines the prioritization categories as follows:

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

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

U-list: Non-native plant species that are of unknown invasiveness and priority in the Municipality. Their distribution is limited and control may be more critical than further study. A U-listing indicates that more information about distribution, impacts, dispersal and invasiveness is needed. Control and eradication efforts should not divert substantial resources from those dedicated to A- and B-listed species.

Previously unreported species are those non-native plant species not represented by AKEPIC records in either Alaska or the Municipality as of March 2011. All potentially new records for the Municipality and Alaska were confirmed with additional sources such as species occurrence maps included in Hultén's Flora of Alaska (1968) and herbarium specimens housed at the University of Alaska Fairbanks Museum of the North (official herbarium acronym: ALA).

I. Study area

Survey points were completed along 513 km (319 miles) of major and secondary roads within the Municipality (Figure 1). Major and secondary roads were designated in accordance with geospatial information provided by the Municipality. Road sections that were excluded from this survey include the New Seward Highway from Potter Valley Road south to Girdwood, and all roads within Girdwood. To the north, the following roads were surveyed in the Eagle River area: Hiland Road, Eagle River Loop Road, Driftwood Bay Drive, Eagle River Road, Artillery Road, Old Glenn Highway as far north as Needles Loop Road, Glenn Highway as far north as the interchange at South Birchwood Loop Road, and Eklutna Lake Road to the parking area at the northwest end of the lake.

Figure 1. Municipality of Anchorage study area, Alaska

II. Survey methodology

Two different types of roadside plots were completed as part of this survey. Systematic plots were completed at regular intervals regardless of the presence or absence of non-native plant species, whereas outlier plots were completed where high-priority non-native plants or populations occurred between systematic plots. The methodology used for each plot type is described in the following.

Systematic plots

Systematic plots were completed at least every 0.5 miles along alternate sides of the road (Figure 2). For each plot a 4 x 25-foot transect was set up perpendicular to the road. Transects originated where the pavement or gravel graded to vegetated cover.

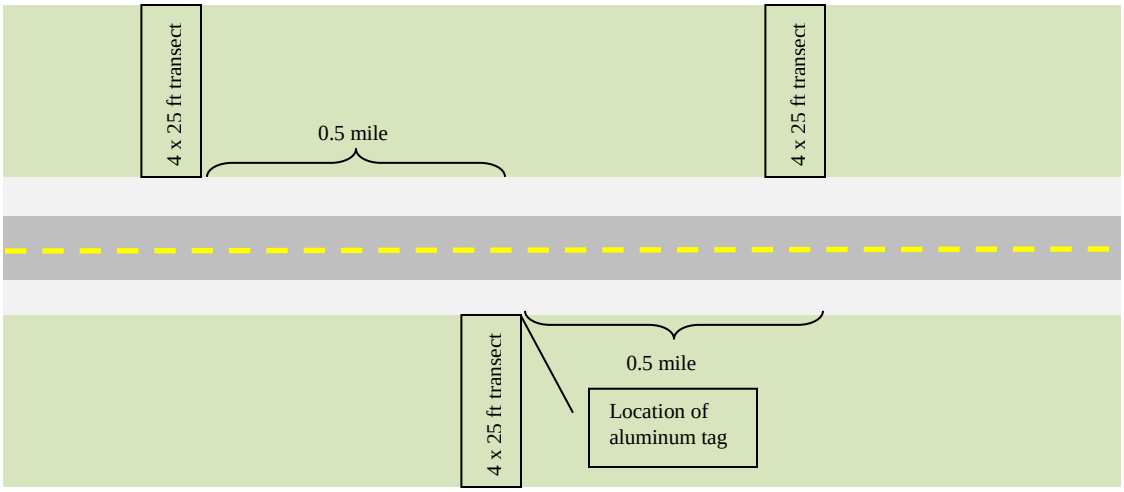

Figure 2. Schematic diagram of a systematic plot location and orientation.

Outlier plots

Non-native plant populations encountered between systematic plots were documented as an outlier plot if one of the following four conditions were met:

1) An A-listed or non-native plant species that was not previously recorded within the Municipality or the State occurred along a major or secondary road. These populations were documented following procedures for a systematic plot, except that plots were sized to encompass the entire population.

2) A B-listed species whose population was greater than 0.1 acres, and was located more than five miles from the closest recorded occurrence of that same species occurred along a major or secondary road. Where such populations did occur, they were documented following procedures for a systematic plot, except that plots were sized to encompass the entire population.

3) A population of A-listed, B-listed or non-native plant species new to Alaska or the Municipality occurred within 50 m (164 ft) of a surveyed road's intersection with a sensitive area. These intersections were typically surveyed by walking 50 m (164 ft) along the road on either side of the feature that defined the area as sensitive. For the purposes of this project, sensitive areas were defined as that within 50 m (164 ft) of a natural area, parkland, Class A wetland or major or secondary stream. The surveyed distance was often adjusted based on the connectivity of the habitat. For example, the survey was expanded in areas of continuous, relatively undisturbed habitat and was reduced where habitat was discontinuous or modified in such a way that would minimize the spread of plant propagules (e.g. extensive pavement). When a long stretch of roadside qualified as a sensitive area (e.g. where a greenbelt was oriented parallel to and located within 50 m (164 ft) of a surveyed road) the roadside was surveyed by driving slowly.

    a. Natural areas were identified based on professional judgment and were usually represented by relatively undisturbed forest or wetlands

b. Parklands were delineated in accordance with shapefiles provided by the Municipality.

c. Class A wetlands were delineated in accordance with shapefiles provided by the Municipality.

d. Streams were defined as all major and secondary waterways in accordance with shapefiles provided by the Municipality.

4) An A-listed, B-listed or non-native plant species not previously recorded in the Municipality or State occurred at highway interchanges. For the purposes of this project, highway interchanges were defined as a grade separation and one or more ramps between roads. Interchanges often include islands of vegetation, which were surveyed in their entirety.

Different from a systematic plot, the boundaries of an outlier plot were adjusted to include the target species as well as all other non-native plant species occurring within 10 m (32 ft) of the plot center. The presence of locally abundant species that tend to form continuous populations along roadsides such as *Bromus inermis* ssp. *inermis*, *Linaria vulgaris*, *Leucanthemum vulgare* and *Vicia cracca* were reported each time they co-occurred with an A- or B-listed species in an outlier plot, but were not documented as separate outlier plots.

Work performed at each plot

At each systematic and outlier plot containing an A- or B-listed species, an aluminum tag was nailed to the ground within a meter of the GPS coordinate center. Along roadsides where cars might pull off, tags were placed slightly farther from the road to minimize the risk of nails damaging tires or tires damaging tags. Information recorded on the tag included: our affiliation (AKNHP), the date, site code, and USDA species codes for all A- and B-listed species present within the plot.

Locality information (latitude, longitude, elevation and estimated accuracy) was collected using a handheld Garmin GPSMAP 76CSx unit. Digital photos were taken in four directions: 1) road to end of plot, 2) downroad, 3) uproad, and 4) across road. Additional photos were taken of all A-listed, B-listed and unknown species. All photos were taken within one meter of the GPS coordinate center. Percent cover and abundance of individual non-native species, infested area (acres) of individual infestations, vegetation type (in accordance with Viereck et al. 1992), and disturbance type (i.e., imported fill, brush cutting/mowing, trampling, stream erosion, or none) were also recorded. A blank field data sheet is provided as Appendix II.

Plot naming and numbering convention

Survey plots were named using the following convention: *First three letters of the road name, plot number, outlier plot number*. Generally, whole integers denote a systematic plot and any number subsequent to the decimal point indicates an outlier plot (e.g. GLE224 is a systematic plot on the Glenn Highway, whereas GLE224.01 represents an outlier plot located between systematic plots GLE224 and GLE225). In order to avoid repeated codes, not all street name abbreviations use the first three letters of their name; a list of street name codes is provided as Appendix III.

III. Post-field work deliverables

Voucher collections

Voucher specimens of all A- and B-listed species, as well as any species previously unreported within Alaska or the Municipality, were collected over the course of field work. The taxonomic identities of collected specimens were confirmed by AKNHP botanists, with the exception of a collection of *Myosotis* that has been sent to the Department of Botany and Plant Pathology at Oregon State University for identification. Select specimens have been mounted following standard practices and curated at the University of Alaska Anchorage Herbarium (official herbarium acronym: UAAH). A total of 116 specimens, representing 64 species, were archived to augment a reference herbarium of non-native species present in the Anchorage area. Vouchers are curated at UAAH and are available for loan on request; a list of vouchered specimens is provided as Appendix IV.

Photo library

A photo library was compiled and is included as an electronic supplement to this report. The photos include the general locations of sites visited and close-ups of all A-listed, B-listed and unknown species found at each site. The photo library is intended to aid relocation of plots as well as provide images of the diversity of non-native plant taxa encountered. The library is organized primarily by road name and secondarily by site code.

Database

Species and plot data were entered into an Excel spreadsheet at the end of each day of field work. Geopositional data were downloaded weekly to ArcMap (a GIS program) and joined to the Excel spreadsheet using the shared site code field. The final dataset has been included electronically with this report as an ArcMap geodatabase. Geospatial data has also been uploaded to the statewide non-native plants database (AKEPIC) and can be accessed online through the AKEPIC data portal (http://aknhp.uaa.alaska.edu/maps/akepic/).

IV. Post-fieldwork analyses

Two calculations related to the abundance and occurrence of non-native species within the study area are reported in this work:

Percent cover of non-native species was calculated by dividing the sum of plot cover values by the number of plots within the study area. For example, if the cover of Species A was recorded at 40%, 30% and 30% in three of the 1,615 plots throughout the Municipality, then the total cover for Species A would be: (40%+30%+30%)/1,615 = 0.06%.

Frequency of occurrence was calculated for each non-native species by dividing the number of times the species was recorded by the total number of plots (n=1,615) completed in the study area. For example, if Species A was recorded three times within the study area, then its frequency of occurrence would be: 3/1,615 = 0.001.

Geospatial analyses were performed using ArcMap, a geographic information system developed by ESRI. The positional data (latitude and longitude) presented herein is

reported in decimal degrees and references the North American Datum of 1983 (NAD83).

Sensitive areas: Shapefiles defining Class A wetlands, parklands and major and secondary streams were buffered by 50 m (164 ft) and intersected with non-native plant occurrences. Class A wetlands are categorized as the highest value wetland and may only be developed with a permit from the Army Corps of Engineers.

Designation of outlier populations: Outlying populations are those greater than 0.1 acre located more than 8 km (5 mi) from the nearest population of the same species. Straight-line distances, opposed to distances along the road corridors were used to determine proximity. Populations satisfying these criteria were identified by buffering all species records by 2.5 mi (4 km); buffered populations that did not intersect with another buffered population of the same species were designated outliers. Only the non-native plant locations documented in this survey were used to designated outlying populations, pre-2011 records cataloged in the AKEPIC database were not used.

Road maintenance areas: Shapefiles defining summer road maintenance were buffered by 18 m (60 ft) – the estimated Right-of-Way width for major and secondary roads – and intersected with non-native plant population where stem counts exceeded 500. These larger populations were selected to identify areas where management by mowing is likely to be more efficient than manual methods.

Results

A total of 813 plots (481 systematic and 332 outlier plots) were completed along 513 km (319 mi) of road. A cumulative area of approximately 37 acres was surveyed. Non-native species were detected at 609 out of 813 plots, with 279 of the 481 (58%) systematic plots supporting non-native species. By intent of the sampling plan, which located outlier plots to encompass non-native plant populations, all 332 outlier plots supported non-native species (Figure 3). This survey recorded 1,615 locations of non-native plants representing 64 non-native taxa. Three of the taxa documented are on the Municipality's A-list, four taxa represent new records for Alaska, and six taxa were not previously recorded within the Municipality. The taxa occurring most commonly across the surveyed area were also the taxa most commonly occurring in or proximal to sensitive areas such as natural areas, parklands, wetlands, and streams. A complete list of the non-native plant species documented in this survey is provided as Appendix V. Biographies of species meriting control are presented as Appendix VII.

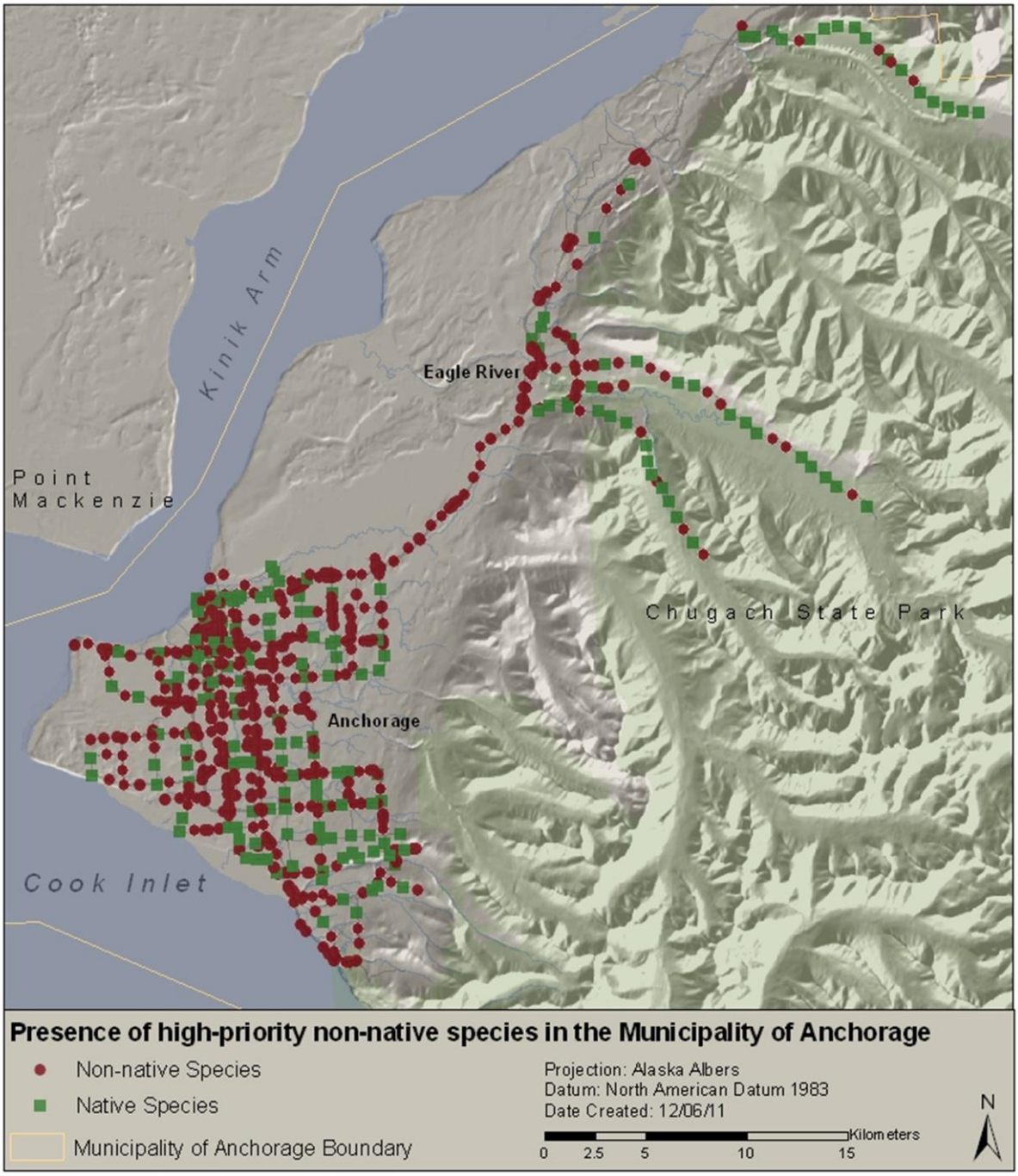

Figure 3. Presence of high-priority non-native species at systematic and outlier plots completed for the Municipality of Anchorage roadside survey.

Prioritized species detected within the Municipality

Three of the 64 non-native taxa documented in this survey are A-listed due to their predicted invasiveness and presumed limited distribution in the Municipality: *Medicago*

sativa ssp. *falcata* (yellow alfalfa; 64[3]), *Myosotis scorpioides* (European forget-me-not; 54) and *Thlaspi arvense* (field pennycress; 42)

- Six populations of the moderately invasive species *Medicago sativa* ssp. *falcata* were documented in this survey including two large (greater than 500 stems) populations located on Driftwood Bay Drive in Eagle River and at the top of Canyon Road in Anchorage. Prior to this survey only two populations of *Medicago sativa* ssp. *falcata* had been documented in the Municipality: on the Tony Knowles Coastal Trail (ANC_MUNI_COA_006; 61.217911, -149.908461; see Cortés-Burns and Flagstad 2009 for discussion), and on the Chester Creek Trail near the stairs to I Street (61.217911, -149.902461, 151-500 stems, hand pulled in 2010).
- Of the five *Thlaspi arvense* populations, two large populations (greater than 150 stems) were documented off the Old Glenn Highway in Eagle River and at the intersection of Dimond Boulevard and the New Seward Highway. Prior to this survey *Thlaspi arvense* had only been reported in 2007 from Elmendorf Air Force Base.
- *Myosotis scorpioides* is relatively common within the Municipality (27 populations documented) and is associated with moist to wet habitats with 59% (16 of 27) of populations occurring in drainage ditches or creek sides.

All 19 B-listed species were detected over the course of the survey. These species are generally widespread across the Municipality; the four most frequently occurring B-listed species are listed in Table 1, all B-listed species are listed in Appendix I.

Table 1. Non-native species occurring most frequently in the Municipality of Anchorage, Alaska.

Scientific Name	Common Name	List	Invasiveness Rank	Percent Cover	Frequency of Occurrence
Linaria vulgaris	yellow toadflax	B	69	1.02	0.18
Vicia cracca	bird vetch	B	73	2.57	0.17
Melilotus alba	white sweetclover	B	81	0.75	0.14
Bromus inermis ssp. *inermis*	smooth brome	B	62	1.63	0.13

Twelve of the 35 U-listed species were detected in the study area. These species are discussed below and listed in Table 2:

- *Astragalus cicer* was first recorded in 2000 on the west side of the Glenn Highway 300 m (984 ft) south of the bridge over Eagle River and in 2002 along Turnagain Arm. The Glenn Highway population was revisited as part of this survey (GLE234.01, .04, .05, GLE328.04 and GLE329). The area of the Glenn Highway infestation has increased from 0.5 ac to 1 ac; the status of the Turnagain Arm populations is not known, however the species has not been re-reported since their initial detection.

[3] The Invasiveness Ranking System for Non-Native Plants of Alaska (Carlson et al. 2008) assigns a rank to non-native plant species based on potential ecosystem impacts, biological attributes, known distribution, efficacy of control measures, and the potential for establishment in the different ecogeographic regions of Alaska. Based on this evaluation, species are ranked between zero and 100, where zero indicates low invasiveness and 100 indicates high aggressiveness. In this document, species that have not yet been ranked are indicated by "NR" (Not Ranked) in place of a number.

- *Berteroa incana* has been previously reported from several locations within the Municipality. The earliest detection was in 2004, this survey detected a single population at an intersection of Northern Lights Boulevard and Chester Creek Trail (NLI060.01). This species is more common in southeast Alaska.
- *Cerastium tomentosum* was previously reported from Elmendorf Air Force Base in 2007 where it was suspected to have been planted. This survey detected a single population on C Street (CST085.01). This species is uncommon statewide.
- *Chaenorhinum minus* was first recorded on Fort Richardson in 2007 and again in 2010. This survey also documented a population in front of the Billiard Palace on C Street (CST073). These are the only populations known in the state.
- *Coronilla varia* was previously known from a single population spanning Spenard Road along the Chester Creek Trail, which was first reported in 2006. This survey documents this same population (SPE165.02). This is the only population known in the state.
- *Elymus sibiricus* was first recorded in the Municipality in 1999 from Fort Richardson and later from Campbell Tract in 2008. This survey documented the species at two additional locations: Eklutna Lake Road (EKL321.01) and Northern Lights Boulevard (NLI060.01). This species is common statewide, especially in the agricultural regions of Alaska (e.g. Matanuska-Susitna and Delta).
- *Leontodon autumnalis* has been recorded from several locations in the Municipality. Twelve locations were reported in 2007, and eight additional locations were documented in this survey. Notable populations are along Chester Creek (AST080.02, AST080.03, NEW205, NEW221.02) and Campbell Creek (CST083.02, ELM535.01). This species is relatively common statewide.
- *Linaria pinifolia* was previously reported from Elmendorf Air Force Base in 2007. This survey recorded an additional location along Campbell Creek at its intersection with the Old Seward Highway (OLD617.01). This species is very uncommon statewide.
- *Lotus corniculatus* was previously recorded on Abbot Road in 2010. This survey documents two additional populations, one on Potter Valley Road (POT043.01) and a second at the intersection of Minnesota Drive and Raspberry Road (RAS544.09). This species is uncommon statewide.
- *Papaver croceum* was previously known from several locations in the Municipality reported in 2007. This survey documents one additional population in David Green Park (36A193). This species is relatively common statewide.
- *Silene chalcedonica* is relatively common in the Municipality and less common statewide. This survey added one additional location at the intersection of the Glenn Highway and Bragaw Road (GLE224.03).
- *Sonchus asper* was previously known in the Municipality from several locations along the Tony Knowles Coastal Trail, which were reported in 2008. This survey added one additional location at the intersection of C Street and O'Malley Road (MIN647.01). This species is more common in southeast Alaska.

Table 2. Occurrence of all U-listed non-native plant species recorded in the Municipality of Anchorage roadside survey.

Scientific Name	Common Name	List	Invasiveness Ranking	Number of Occurrences
Astragalus cicer	chickpea milkvetch	U	NR	5
Berteroa incana	hoary false madwort	U	NR	1
Cerastium tomentosum	snow in summer	U	NR	1
Chaenorhinum minus	dwarf snapdragon	U	NR	1
Coronilla varia	crownvetch	U	68	1
Elymus sibiricus	Siberian wildrye	U	53	2
Leontodon autumnalis	fall dandelion	U	51	8
Linaria pinifolia	pineneedle toadflax	U	NR	1
Lotus corniculatus	birdsfoot trefoil	U	65	2
Papaver croceum	Icelandic poppy	U	39	1
Silene chalcedonica	maltese cross	U	42	1
Sonchus asper	spiny sowthistle	U	46	1

Notes: NR = not ranked

Fifteen non-native species detected in this survey have not been prioritized for management by the Municipality (Table 3). Of these taxa, four were previously unreported within the State of Alaska and six were previously unreported within the Municipality. See Figure 4 for the locations of these previously unreported taxa within the Municipality.

Table 3. Occurrence all of non-listed non-native plant species recorded in the Municipality of Anchorage roadside survey.

Scientific Name	Common Name	List	Invasiveness Ranking	Number of Occurrences
Achillea filipendulina+	fernleaf yarrow	NA	NR	1
Achillea ptarmica	sneezeweed	NA	46	1
Centaurea montana	perennial cornflower	NA	46	4
Clematis tangutica var. *tangutica*+	golden virginsbower	NA	NR	1
Dactylis glomerata	orchardgrass	NA	53	1
*Erysimum cheiri**	Aegean wallflower	NA	NR	2
Hordeum vulgare+	common barley	NA	39	1
Lamium album	white deadnettle	NA	40	1
*Lamium amplexicaule**	henbit deadnettle	NA	NR	1
*Lepidium latifolium**	broadleaved pepperweed	NA	71	1
Leucanthemum maximum	shasta daisy	NA	NR	1
*Linaria maroccana**	Moroccan toadflax	NA	NR	1
Medicago sativa ssp. *sativa*+	alfalfa	NA	59	3
Nemophila menziesii+	baby blue eyes	NA	NR	1
Veronica spicata+	spiked speedwell	NA	NR	2

Notes: NR = not ranked
*New to Alaska
+New to Municipality

Species previously unreported within Alaska

Four non-native species detected in this study were previously unreported within the State of Alaska.

- *Erysimum cheiri* (Aegean wallflower) was detected at two locations located along Eagle River Loop Road. The infestations were moderately large (151-500 stems) and occurred in a disturbed area of the roadside. *Erysimum cheiri* is a widely cultivated ornamental of European origin that establishes in disturbed sites, lawns and abandoned gardens (Al-Shehbaz 2010); it is likely that the Eagle River populations have escaped cultivation. This species has not been ranked for invasiveness in Alaska and is not considered noxious by any state, territory or province in North America. *Erysimum cheiranthoides,* a closely related species, is considered noxious in Alberta Canada (Invaders 2010). Based on the low ecological impact of *Erysimum cheiri* on other species and low aggressiveness within introduced habitats, we would expect this species to rank as modestly invasive.
- *Lamium amplexicaule* (henbit deadnettle) was detected at one location within a landscaped section of C Street. *Lamium amplexicaule* reproduces by seed and vegetatively through rooting stems. This species is currently listed as noxious in Alberta and Manitoba Canada (Invaders 2010). It is tracked as an invasive species by Alaska and has been documented from one location in the Yukon Territory (in a garden at the Whitehorse Airport). This species has not been ranked for its invasiveness in Alaska, but based on its known distribution and the invasiveness of closely related species in Alaska (*Lamium album* 40) we expect that it would be moderately invasive.
- *Lepidium latifolium* (broadleaved pepperweed; 71) was detected at one location within the Municipality. This medium-sized infestation (51-150 stems) is located along the New Seward Highway at the Lore Road onramp. *Lepidium latifolium* is highly ranked due to its ecological and biological impacts and its invasive potential. This species increases the salt content of surrounding soil, favoring halophytes and eliminating other species. It also tends to accumulate significant litter, reducing light availability and preventing the emergence of annual plants (Renz 2000). *Lepidium latifolium* is considered noxious in 14 North American territories and states: BC, CA, CO, HI, ID, IN, MT, NV, NM, OR, SD, UT, WA, WY. The seeds of *Lepidium latifolium* are classified as noxious within the state of Alaska (Invaders 2010).
- *Linaria maroccana* (Moroccan toadflax) was detected at one location within the Municipality. This small infestation (1-5 stems) occurred along Campbell Creek where it intersects Old Seward Highway. *Linaria maroccana* is a common component of 'wildflower' seed mixes and can escape cultivation (Jepson 1993). This species has not been ranked for invasiveness in Alaska and is not considered noxious by any state, territory or province in North America. This annual plant self-seeds willingly but is unable to germinate in spring if average temperatures are not warmer than 50^{o}F. It is modestly invasive in some areas of California and can potentially naturalize in more northern climates, but it is reportedly not nearly as aggressive as closely related *Linaria vulgaris*.

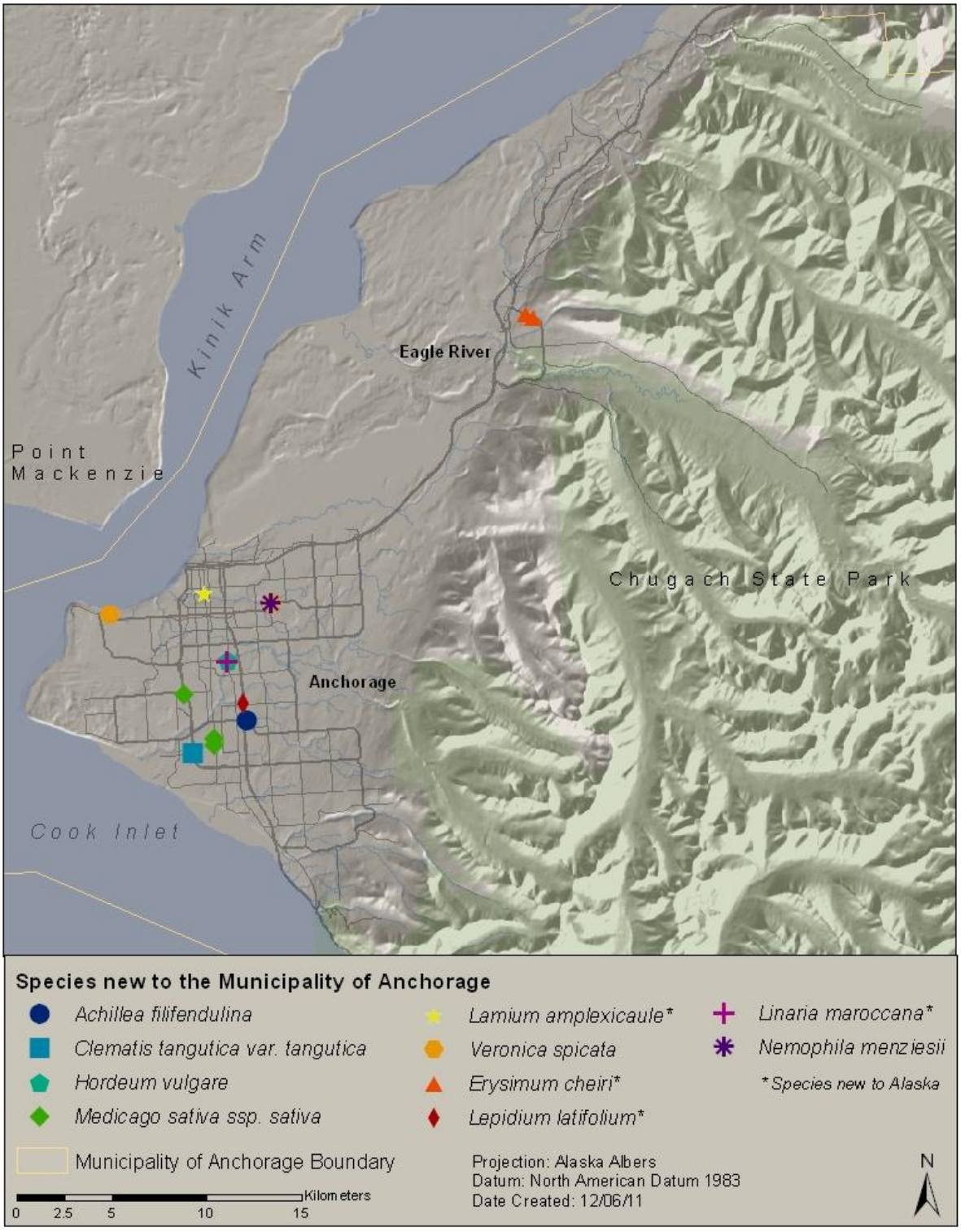

Figure 4. Location of non-native plant species previously unrecorded in the Municipality and the State of Alaska.

Species previously unreported within the Municipality

Six non-native plant taxa detected in this study were previously unreported within the Municipality; their locations are shown in Figure 4.

- *Achillea filipendulina* (fernleaf yarrow) was detected at one location within the Municipality. This small population (1-5 stems) was located at the New Seward Highway and Dimond Boulevard interchange. One population was previously known from this area, behind Sam's Club, which is west of the Seward Highway and south of Dimond Boulevard (T. Stallard pers. comm.). In Alaska, *Achillea filipendulina* has also been recorded around Yakutat in the Pacific Maritime ecogeographic region (AKEPIC 2011). Horticultural literature advises against its inclusion in seed mixes and warns of its ability crowd other species. It is not considered noxious by any state, territory or province in North America. *Achillea filipendulina* is common throughout British Columbia and tolerates a wide habitat range. This species reproduces by rhizomes and does not set seed (Klinkenberg 2010). *Achillea filipendulina* has not been ranked for its invasiveness in Alaska, though it is expected to be moderately to highly invasive due to its ability to dominate and proliferate in various habitat types.
- *Clematis tangutica* var. *tangutica* (golden virginsbower) was detected at one location within the Municipality. This small infestation (1-5 stems) occurred along 100th Avenue below the Minnesota Drive overpass. *Clematis tangutica* var. *tangutica* is commonly grown as an ornamental and has likely escaped cultivation. Elsewhere in Alaska, *Clematis tangutica* var. *tangutica* has been recorded from a gravel bar in the Matanuska River outside of Palmer and has been recorded from several locations in the Yukon Territory (Haines Junction, Whitehorse and Carcross; AKEPIC 2011). While this species has not been ranked for invasiveness in Alaska, it is listed as noxious in Alberta, Canada where it is an aggressive species once established (Alberta Invasive Plant Council 2011).
- *Hordeum vulgare* (common barley; 39) was detected at one location within the Municipality. This small infestation (1-5 stems) occurred within a landscaped section of Old Seward Highway in front of the Peanut Farm restaurant. *Hordeum vulgare* is a known contaminant of locally-produced straw as well as straw imported from Washington and Oregon (Conn et al. unpublished data). While this species has not been ranked for invasiveness in Alaska, multiple infestation of *Hordeum vulgare* have been documented throughout the Interior-Boreal region of Alaska and the Yukon Territory (AKEPIC 2011). This species is not considered noxious anywhere in North America.
- *Medicago sativa* ssp. *sativa* (alfalfa; 59) was detected at three locations within the study area. This species is uncommon but present throughout the state. The closest, and coincidentally largest, populations are found along Exit Glacier Road in Seward. *Medicago sativa* ssp. *sativa* is cultivated worldwide as an agricultural crop, which likely contributes to its spread. In Alaska, this species is not well adapted for cultivation (J. Conn pers. comm.), and its establishment appears to be restricted to disturbed ground. This species has not been declared noxious anywhere in North America.
- *Nemophila menziesii* (baby blue eyes) was detected in an abandoned garden along Northern Lights Boulevard in the vicinity of Earthquake Park. *Nemophila menziesii* is an annual plant and common in wildflower seed mixes. This species has not been ranked for invasiveness in Alaska and is not considered noxious anywhere in North America. Although this collection represents a new species for the AKEPIC database, *Nemophila menziesii* is described as an introduced weed or garden escapee in the vicinity of Sitka (Hultén 1968) and was collected from the Fort Wainwright Military Reservation in Fairbanks in 1995 (UAM 2011). Additionally, it

was detected in Kincaid Park along the Multi-use Trail across from the Raspberry Road parking lot during the 2008 Municipality Trails survey (Multi-use Plot 6: 61.15502955, -150.01691638; Cortés-Burns and Flagstad 2009; Figure 5) but was not reported due to a late confirmation of its taxonomic identity.

- *Veronica spicata* (spiked speedwell) was detected at two locations within the Municipality. One moderately large infestation (51-150 stems) was located within an abandoned garden along Northern Lights Boulevard in the vicinity of Earthquake Park. The second smaller population (1-5 stems) was located well off the roadside along the Chester Creek Trail on eastern Northern Lights Boulevard. *Veronica spicata* is commonly grown as an ornamental. In Alaska, *Veronica spicata* has been recorded from a garden in Gustavus, although it had not escaped cultivation (AKEPIC 2011). This species has not been ranked for its invasiveness in Alaska and is not considered noxious anywhere in North America.

Figure 5. Location of *Nemophila menziesii* detected in 2008 at Multi-use plot 6 in Kincaid Park, Anchorage, Alaska

Non-listed species detected within the Municipality

The five remaining species do not appear on any of the Municipality's prioritized lists and do not represent new arrivals to the Municipality.

- *Achillea ptarmica* (sneezeweed; 46)
- *Centaurea montana* (perennial cornflower; 46)
- *Dactylis glomerata* (orchardgrass; 53)
- *Lamium album* (white deadnettle; 40)
- *Leucanthemum maximum* (Shasta daisy; NR)

With the exception of *Dactylis glomerata*, which is a grass used for erosion control, all species are, or are presumed to be, modestly to moderately invasive ornamental plants that have likely escaped cultivation.

- *Achillea ptarmica* was previously detected on Fort Richardson in 2002. This species is relatively uncommon statewide.
- *Centaurea montana* - was previously detected on Campbell Tract in 2009. This species is relatively uncommon statewide.
- *Dactylis glomerata* was previously detected on the west end of the Whittier Tunnel. This species is more common in southeast Alaska. The population documented by this survey at the intersection of International Airport Road and Minnesota Drive represents the first urban location in the Municipality. This grass is also present on Birch Road (C. Greenstein pers. obs.)
- *Leucanthemum maximum* was previously detected on Elmendorf Air Force Base in 2007. This species is uncommon statewide.

I. Sensitive area trends

For the purposes of this survey, sensitive areas were defined as the lands within 50 m (164 ft) and including natural areas, parklands, Class A wetlands or major or secondary streams. Natural areas were identified using professional judgment whereas parklands, wetlands and streams were designated as such by the Municipality. Special attention was given to these areas based on their relative ecological integrity, susceptibility to invasion and potential to act as dispersal corridors. The Municipality describes 'A' wetlands as those with "the highest wetland resource values…'A' wetlands are not to be altered or otherwise disturbed in any manner, except as outlined elsewhere in the (Anchorage Wetlands Management) Plan's enforceable policies" (MOA 2012).

Of the 1,615 non-native plant records, 654 (40%) occurred within sensitive areas The five taxa most commonly occurring in sensitive areas include four of the most commonly occurring taxa across the Municipality. The taxa and their occurrence across the different types of sensitive areas are presented in Table 4. Please note, because single infestation can occur in multiple sensitive area types, there is some overlap in occurrences.

Table 4. The most commonly occurring non-native species and their number of occurrences within 50 m (164 ft) of sensitive areas in the Municipality of Anchorage, Alaska.

Scientific Name	Common Name	List	Invasiveness Ranking	Wetland	Parkland	Riparian Corridor
Bromus inermis ssp. *inermis*	smooth brome	B	62	33	55	39
Leucanthemum vulgare	ox-eye daisy	B	61	22	48	36
Linaria vulgaris	yellow toadflax	B	69	35	81	48
Melilotus alba	white sweetclover	B	81	26	47	40
Vicia cracca	bird vetch	B	73	41	64	59

II. Special note on additional Anchorage area infestations

The study area for this survey did not include military land or the New Seward Highway corridor south of its intersection with Potter Valley Road. A group of AKNHP colleagues (Mike Duffy, Alyssa Epstein and Emily Capelin) surveyed the New Seward Highway from the Beluga Point Rest Area (milepost 110) to Windy Trailhead (milepost 106.5) as part of the Bureau of Land Management's Seeds of Success program. Mr. Duffy also surveyed the Joint Base Elmendorf-Richardson as a contractor for a local consulting firm. Notable populations of non-native species were reported to the Alaska Exotic Plant Information Clearinghouse (AKEPIC) and are discussed here to alert Municipality land managers to their presence.

Most collection sites were disturbed habitats located near human development and supported many non-native species common to the Anchorage Bowl area. However, two A-listed species were reported from New Seward Highway along Turnagain Arm: *Tragopogon dubius* (yellow salsify; 50) and *Centaurea stoebe* (spotted knapweed; 86). To our knowledge, the *Tragopogon dubius* population along Turnagain Arm is the most extensive in Alaska. This species is a prime candidate for control because it has not been reported within urban areas of Anchorage.

Similarly, *Centaurea stoebe* is not well-established in Anchorage and is uncommon in the state. A single infestation of *Centaurea stoebe* was reported from Jewel Lake in 2009 and has since been eradicated. The *Centaurea stoebe* population at Beluga Point on Turnagain Arm is one of seven known populations in the state. *Centaurea stoebe* was first detected along Turnagain Arm in 2003; the Beluga Point population was first reported in 2008 and has been hand-pulled at least once annually since its initial detection (Graziano 2010). The single plant found by Mr. Duffy at Beluga Point in the summer of 2011 was pulled.

Non-native species of note detected on Joint Base Elmendorf-Richardson by Mr. Duffy during the 2011 field season include:

- *Chaenorhinum minus* (dwarf snapdragon) - first recorded on base in 2007
- *Onobrychis viciifolia* (sainfoin) - first recorded in 2000 on the east side of the Glenn Highway at the Hiland Drive Exit
- *Astragalus cicer* (chickpea milkvetch)- first recorded in 2000 on the west side of the Glenn Highway, approximately 300 m (984 ft) south of the bridge over the Eagle River, and in 2002 along Turnagain Arm. The Glenn Highway populations were revisited with this project (GLE329) and have increased from 0.5 to 1 ac; the status of the Turnagain Arm populations is not known but this species has not been re-reported since its initial detection.
- *Verbascum thapsus* (common mullein; 52) – represents a first record for AKEPIC, however two specimens are housed at the University of Fairbanks Herbarium (ALA); one was collected from Sitka in 2008; no location or collection date is given for the second specimen.
- *Hieracium piloselloides* (tall hawkweed) – represents a first record for Alaska; no specimens of this species are recorded in AKEPIC or housed at the University of Fairbanks Herbarium (ALA).
- *Sisymbrium altissimum* (tall tumblemustard) - first recorded in 2003 from the Big Lake–Mat-Su Valley area and again in 2007 from Haines. There have been no additional records since, suggesting low establishment and/or dispersal rates for this species in Alaska.

III. Control actions completed to date

Control of non-native species was not within the scope of this project. However, one small infestation of *Medicago sativa* ssp. *falcata* was hand-pulled from the northeast side of C Street where it crosses Chester Creek. The other non-native species detected at this location were not controlled.

Apart from this project, the Seeds of Success field crew that surveyed the New Seward Highway from the Beluga Point Rest Area (milepost 110) to Windy Trailhead (milepost 106.5) controlled two species: *Tragopogon dubius* was hand-pulled when found, and the single *Centaurea stoebe* plant found at Beluga Point was hand-pulled.

Discussion

A diversity and abundance of non-native plants are present within the Municipality, and new taxa are being introduced each year. Of the 64 non-native taxa documented in this survey, 11 are considered highly or extremely invasive and three species are on the Municipality's A-list, which connotes a high priority for eradication due to a combination of invasiveness and limited distribution. Directing management towards these highly invasive taxa represents the most efficient use of limited resources. Of the approximately ten new arrivals to the state documented from various surveys conducted in 2011 (Table 5), eight were reported from the Municipality, suggesting that Anchorage is indeed a major portal of introduction. These newly introduced species have not been ranked for invasiveness and are not currently tracked on the Municipality's prioritized lists but typically, only a subset of introduced and naturalized species has the potential to cause a high level of ecological or economic impact.

Table 5. Non-native plant species reported from Alaska in 2011 that were not previously documented in the state.

Scientific Name	Common Name	Location of First Report
Alopecurus arundinaceus	creeping meadow foxtail	Anchorage
Conium maculatum	poison hemlock	Anchorage
Fagopyrum esculentum	common buckwheat	Eagle River
Lamium amplexicaule	henbit deadnettle	Anchorage
Lepidium latifolium	broadleaved pepperweed	Anchorage
Linaria maroccana	Moroccan toadflax	Anchorage
Malva sylvestris	high mallow	Palmer
Erysimum cheiri	Aegean wallflower	Eagle River
Hieracium piloselloides	tall hawkweed	Anchorage
Vicia sativa ssp. *nigra*	garden vetch	Fairbanks

I. Management priorities

High-priority species

A-listed species

The following A-listed species are modestly to highly invasive plant species, which are thought to have a limited distribution within the Municipality. These species were detected at multiple locations during the course of this survey. Species-specific recommendations are given below; distribution maps are provided in Appendix VII.

- *Medicago sativa* ssp. *falcata* (yellow alfalfa; 64) - because this species can be moderately invasive and has a very limited distribution in Anchorage we recommend all seven populations for control. Sites CAN020.01, CAN020.02, and CST078.02 (Figures 6, 7, 8) occur close to Chugach State Park or in a riparian corridor; of all the *Medicago sativa* ssp. *falcata* sites, these represent the top priorities for control.

Figure 6. Location of *Medicago sativa* ssp. *falcata* at mailbox #8801 on Canyon Road (Plot CAN020.01; 61.10144, -149.71791)

Figure 7. Location of *Medicago sativa* ssp. *falcata* on the south side of Canyon Road, approximately 15 meters west of the intersection with View Heights Way (Plot CAN020.02; 61.10135, -149.71713)

Figure 8. Location of *Medicago sativa* ssp. *falcata* on the northeast side of Chester Creek and C Street (Plot CST078.02; 61.20360, -149.88733)

- *Thlaspi arvense* (field pennycress; 42) - this species is modestly invasive, and its distribution is currently restricted to six known populations within the Municipality. Largely in consideration of this species' limited distribution, the following sites are recommended for control: the two larger populations located on the Old Glenn Highway in Eagle River (OGH306.01) and the intersection of Dimond Boulevard and the New Seward Highway (DIM508.01), as well as the outlying population at the southeast corner of Driftwood Bay and Driftwood Bay Drive in Eagle River (DRI272; Figures 9, 10, 11).

Figure 9. Location of *Thlaspi arvense* on the east side of the Old Glenn Highway, 0.25 miles north of plot OGH306 (Plot OGH306.01; 61.38717, -149.48468)

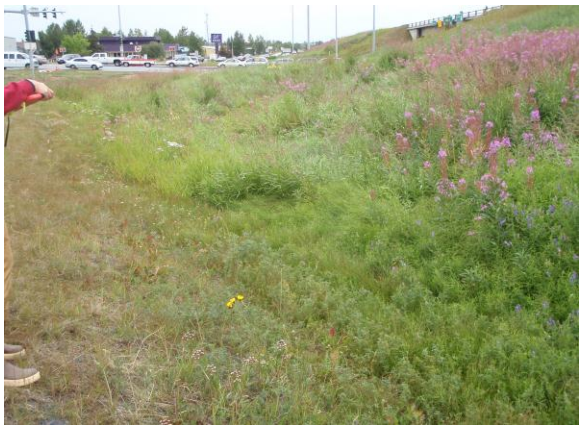

Figure 10. Location of *Thlaspi arvense* on the southwest side of the Dimond/New Seward Highway interchange, middle area of triangle (Plot DIM508.01; 61.14396, -149.85728)

Figure 11. Location of *Thlaspi arvense* on the southeast corner of Driftwood Bay and Driftwood Bay Drive (Plot DRI272; 61.31266, -149.53752)

- *Myosotis scorpioides* (European forget-me-not; 54) - based on our now more complete picture of this species' relatively widespread distribution, and on field observations of its low ecological impact, we recommend that this species be reclassified as a B-list species and populations not prioritized for control.

B-listed species

The B-listed species detected in this survey generally fall into two categories; those that are widespread and abundant across the Municipality and those that are less ubiquitous but may threaten certain habitats such as wetlands or riparian corridors. For the widespread B-listed species that often form semi-continuous infestations along roadsides, containment by mowing is recommended (see 'Mowing Plan' section). These species include:

- *Linaria vulgaris* (yellow toadflax; 69)
- *Vicia cracca* (bird vetch; 73)
- *Melilotus alba* (white sweetclover; 81)
- *Bromus inermis* ssp. *inermis* (smooth brome; 62)

For the less ubiquitous B-listed species that often form more discrete populations and may occur in or near sensitive areas, targeted control is recommended. These species include:

- *Cirsium arvense* (Canada thistle; 76)
- *Hieracium aurantiacum* (orange hawkweed; 79)
- *Melilotus alba* (white sweetclover; 81)
- *Phalaris arundinacea* (reed canary grass; 83)
- *Prunus virginiana* (choke cherry; 74)
- *Ranunculus acris* (tall buttercup; 54) and *R. repens* (creeping buttercup; 54)
- *Sonchus arvensis* including *S. arvensis* ssp*. uliginosus* (perennial sowthistle; 73)
- *Tanacetum vulgare* (common tansy; 60)

Although the distribution of these species is less widespread, control of all populations of these species would still require a major commitment of resources. For this reason we recommend that populations occurring in or near sensitive areas be prioritized for control. Population or species-specific recommendations for these species follow; distribution maps are provided in Appendix VII. Please note neither *Sonchus arvensis* nor *S. arvensis* ssp. *uliginosus*, were found in any sensitive areas and are therefore not addressed in this section.

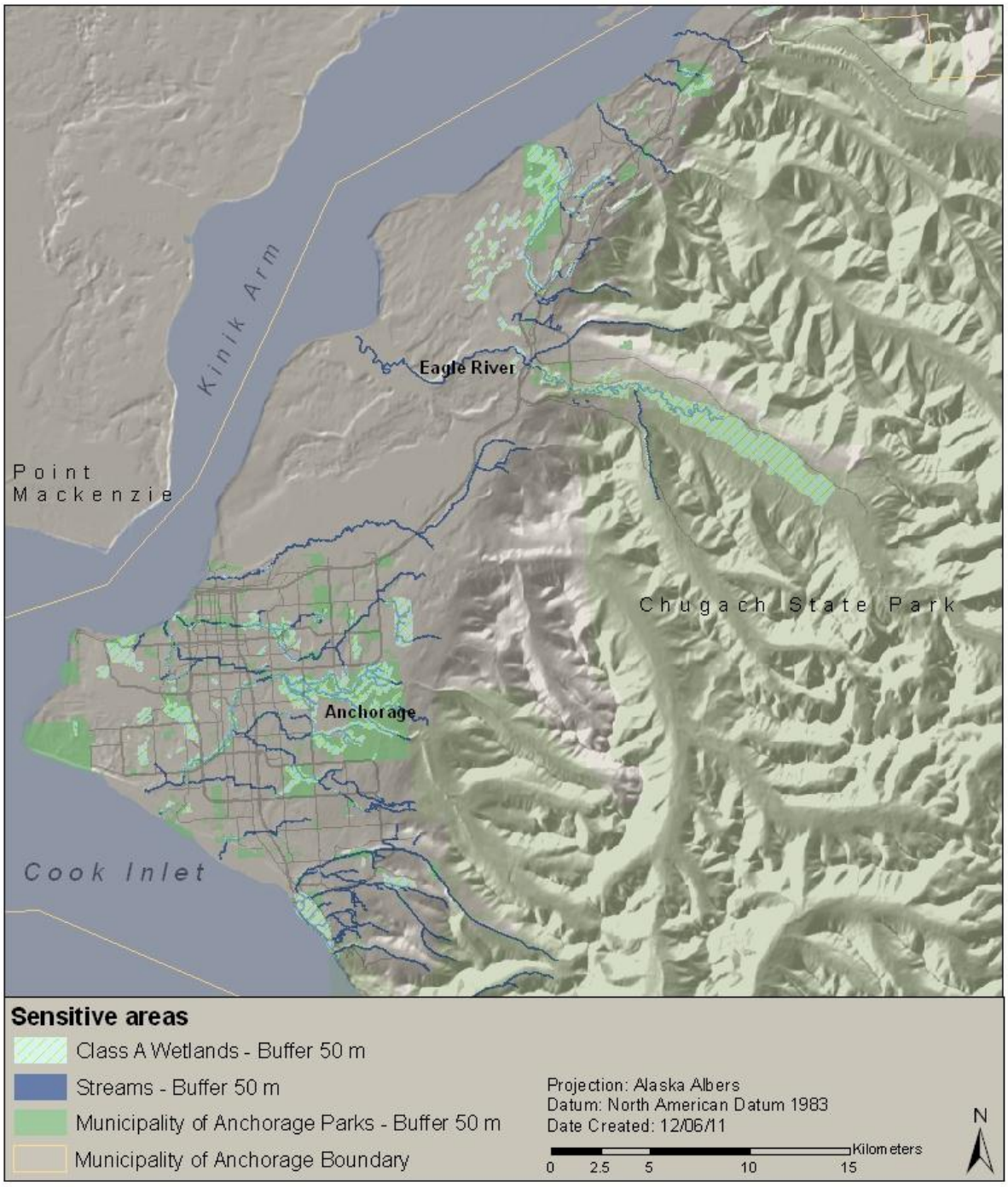

Figure 12. Distribution of sensitive areas within the Municipality of Anchorage, Alaska.

Cirsium arvense (Canada thistle; 76) – is a tenacious species whose eradication often requires persistent control efforts that combine cultural, mechanical, biological, and chemical methods (Jacobs et al. 2006). Only one of the nine populations of *Cirsium arvense* detected in this survey occurred in a sensitive area. This population is located along Northern Lights Boulevard (NLI067.02) in a landscaped area east of the Goose Lake Park sign and is comprised of 151-500 stems (Figure 13).

Figure 13. Location of *Cirsium arvense* east of the Goose Lake Park sign along Northern Lights Boulevard (Plot NLI067.02; 61.198230, -149.822430)

Hieracium aurantiacum (orange hawkweed; 79) – this species is one of the few non-native species that in Alaska has been observed establishing and persisting in areas of low disturbance and organic soils. There are multiple populations close to the State Park and National Forest boundaries (e.g. Potter Valley, L. Flagstad pers. comm.; Bird, Indian, Girdwood). A small population was found and pulled in 2009 in Chugach State Park (Glenn Alps area, on the trail to the Ballfield, 61.10201, -149.65739); the population could not be relocated in 2010. To reduce the potential for future introductions to these natural areas, six of the 18 *Hieracium aurantiacum* populations detected in this survey that occur close to Chugach State Park are recommended for control. These sites are listed in Table 6, their locations are shown in Figures 14-19, and a map of their distribution is shown as Figure 20.

Table 6. Locations of *Hieracium aurantiacum* populations recommended for control in the Municipality of Anchorage, Alaska.

Site Code	Location Information	Latitude	Longitude	Stem Count
ABB511.01	West side of Abbott/Hillside Drive, across the street from mailboxes #10001 and #10101	61.12923	-149.74466	6-25
DEA020.04	South side of DeArmoun Road, under power line in drainage ditch, west of Patrick Road	61.10145	-149.73541	6-25
ERL247	West side of Eagle River Loop Road, south of Eagle River Road	61.29558	-149.54561	6-25
ERR279.01	South side of Eagle River Road at mailbox #19411	61.31053	-149.52039	51-150
POT042	South side of Potter Valley Road, east of Osprey Circle	61.05367	-149.77765	6-25
RAB007	North side of Rabbit Creek Road, steep grade behind guard rail, extends into forested area	61.08347	-149.76691	51-150

Figure 14. Location of *Hieracium aurantiacum* on the west side of Abbott/Hillside Drive, across the street from mailboxes #10001 and #10101 (Plot ABB511.01; 61.12923, -149.74466)

Figure 15. Location of *Hieracium aurantiacum* on the south side of DeArmoun Road, under power line, in a drainage ditch, west of Patrick Road (Plot DEA020.04; 61.10145, -149.73541)

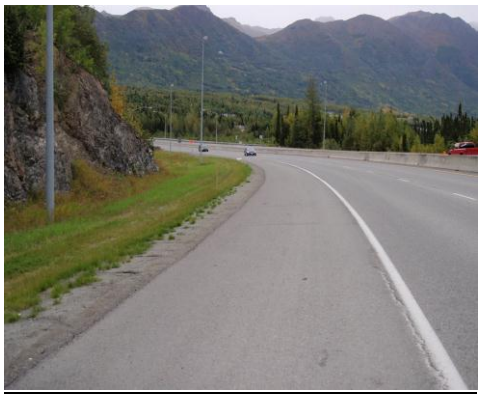

Figure 16. Location of Hieracium aurantiacum on West side of Eagle River Loop Road, south of Eagle River Road (Plot ERL247; 61.29558, -149.54561)

Figure 17. Location of *Hieracium aurantiacum* on South side of Eagle River Road at mailbox #19411 (Plot ERR 279.01; 61.31053, -149.52039)

Figure 18. Location of *Hieracium aurantiacum* on South side of Potter Valley Road, east of Osprey Circle (Plot POT042; 61.05367, -149.77765)

Figure 19. Location of *Hieracium aurantiacum* on north side of Rabbit Creek Road, steep grade behind guard rail (Plot RAB007; 61.08347, -149.76691)

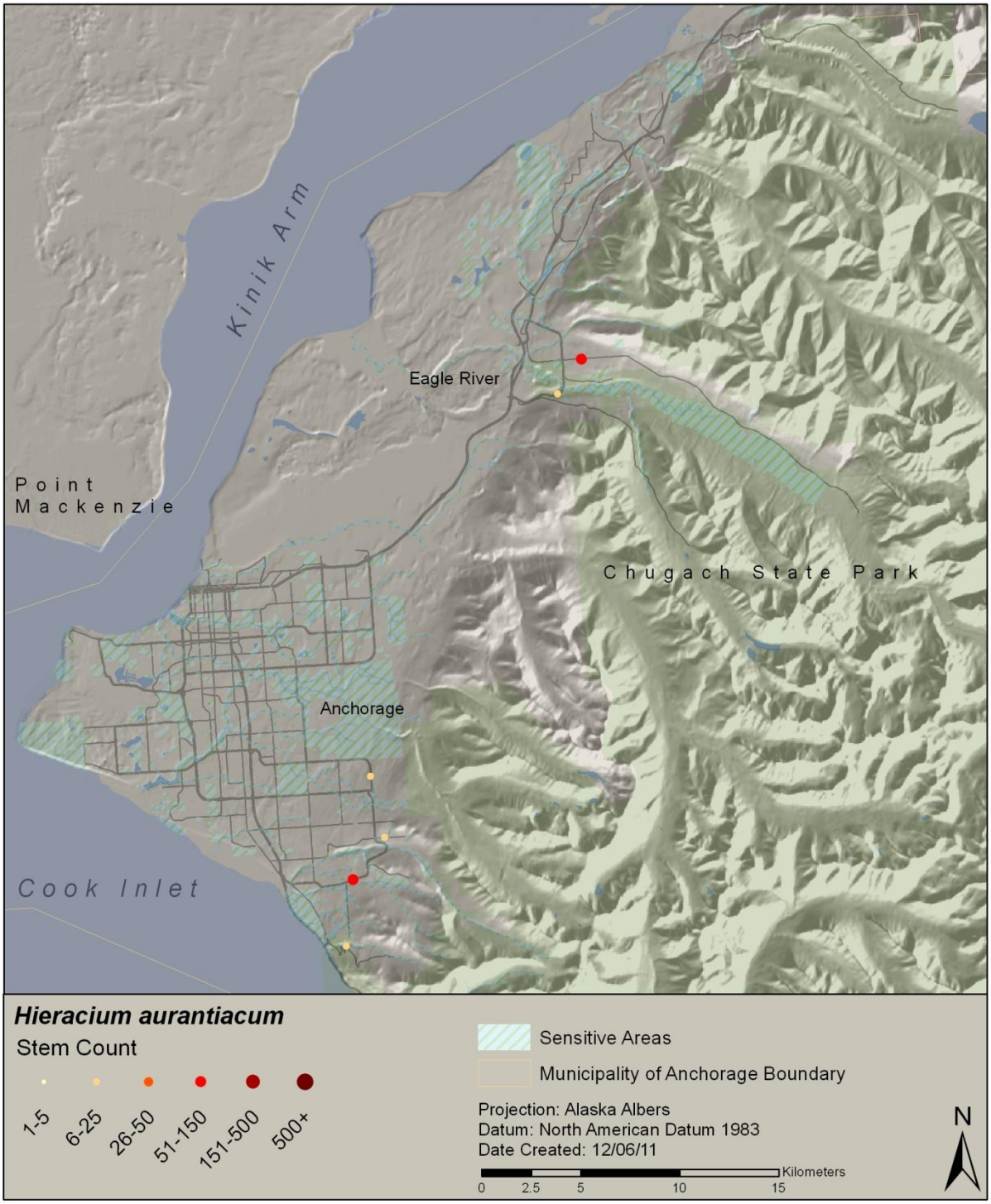

Figure 20. Locations of *Hieracium aurantiacum* populations recommended for control in the Municipality of Anchorage, Alaska.

Melilotus alba (white sweetclover; 81) – this species prefers disturbed, fine-grained mineral soils where it readily establishes and often proliferates to monoculture (Conn et al. 2008). The affinity of *Melilotus alba* for glacial-fed river bars, roadside dust shadows and gravel trails is of special concern as these features often act as dispersal corridors

(Cortés-Burns et al. 2008). Populations of *Melilotus alba* occurring within 50 m (164 ft) of a stream corridor should be prioritized for control. These locations are shown in Figure 23 and listed in Table 7. Although they did not satisfy the criteria for occurring in a sensitive area, there are two additional populations of *Melilotus alba* that are notable due to their proximity to stream and river corridors. A small population (6-25 stems) was found on the north side of Eagle River Road at a small creek crossing approximately one mile northwest of the Eagle River Nature Center (Figure 21) and a much larger population (more than 2,000 stems) occurs at the Glenn Highway bridge over the Eagle River (Figure 22).

Figure 21. Location of *Melilotus alba* at a small stream crossing on Eagle River Road (Plot ERR290; 61.24527, -149.28978)

Figure 22. Location of *Melilotus alba* at the Eagle River Bridge (Plots GLE328, 61.30232, -149.5858; GLE328.01, 61.31126, -149.57674; GLE328.03, 61.31161, -149.57755; GLE328.04, 61.30975, -149.58212).

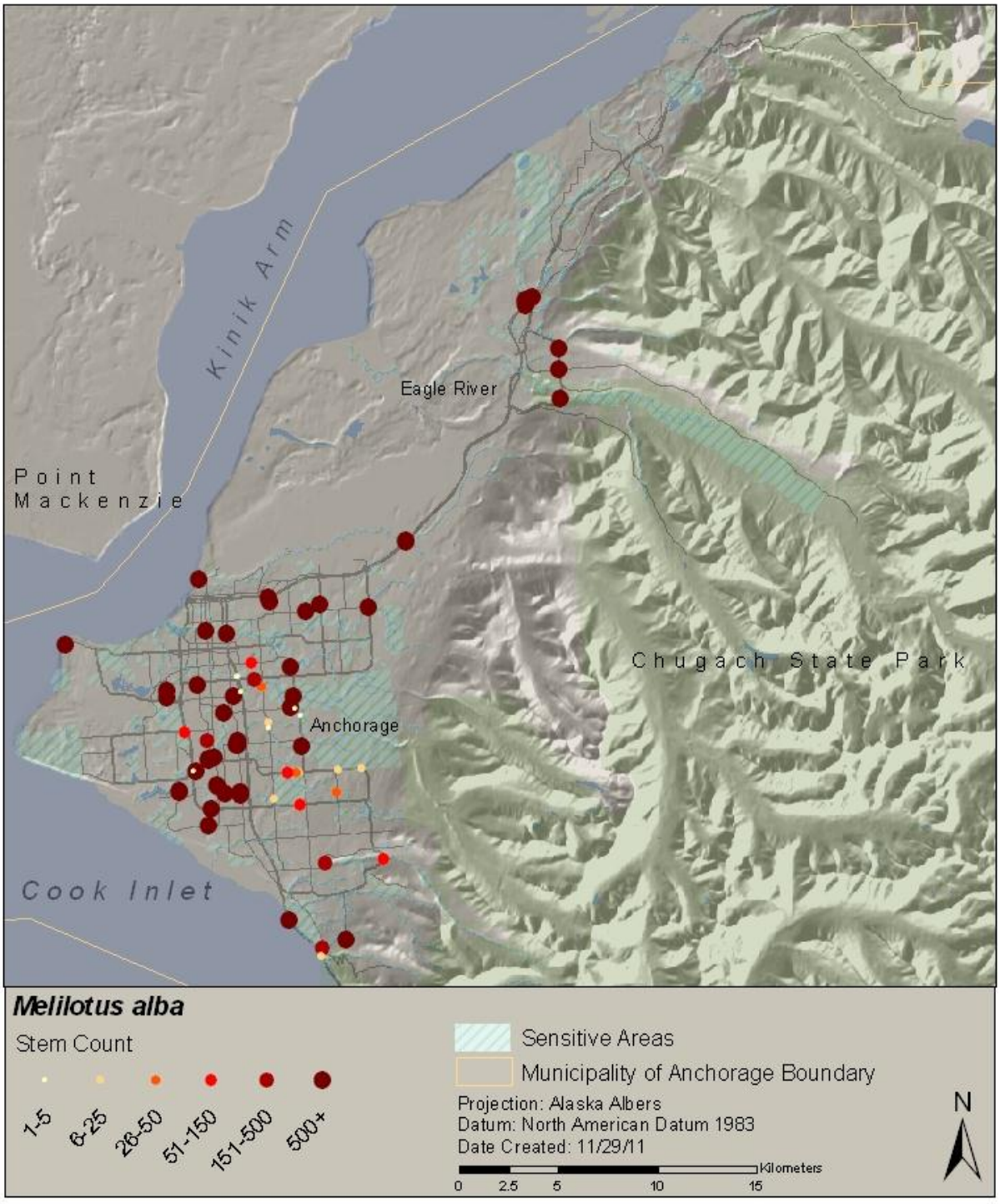

Figure 23. Locations of *Melilotus alba* populations recommended for control in the Municipality of Anchorage, Alaska.

Table 7. Locations of *Melilotus alba* populations recommended for control in the Municipality of Anchorage, Alaska.

Site Code	Location Information	Latitude	Longitude	Stem Count
1HA176	Northwest corner of 100th Ave and Old Seward Highway	61.130370	-149.864530	500+
76A169.01	North side of 76th Ave, west of Old Seward Highway	61.152050	-149.865780	500+
ARC598	East side of Arctic Boulevard	61.146500	-149.891890	500+
ARC598.01	West side of Arctic Boulevard	61.145950	-149.892440	500+
BIR622.04	west side of Birch Road, south of Milrob Road	61.127900	-149.774410	26-50
CST078.04	East side of C Street	61.203830	-149.887270	500+
CST085.01	East side of C Street	61.133800	-149.885280	500+
CST085.02	East side of C Street	61.133980	-149.886110	500+
DOW182.02	North side of west Dowling Road	61.166430	-149.875240	500+
EKL315	South side of Eklutna Lake Road	61.42667	-149.20503	500+
EKL325	North side of Eklutna Lake Road	61.44794	-149.3094	1-5
ELM535	East side of Elmore Road, north of 64th Ave	61.163240	-149.804280	1-5
ERL276	Southwest corner of Eagle River Loop Road and Kantishna Drive	61.320070	-149.539170	500+
ERR290	North side of Eagle River Road at creek crossing approximately 1 mile west of the Nature Center	61.24527	-149.28978	6-25
GLE228	Southeast side of Glenn Highway and Ship Creek	61.238140	-149.693710	500+
GLE228.01	Southeast side of Glenn Highway and Ship Creek	61.238640	-149.694120	500+
GLE304.02	West corner of northwestern triangle at the Glenn Highway and North Eagle River Access Road interchange	61.342770	-149.566670	500+
GLE304.03	North corner of southwestern triangle at Glenn Highway and North Eagle River Access Road interchange	61.342590	-149.567140	500+
GLE304.04	North corner of northeastern triangle at Glenn Highway and North Eagle River Access Road interchange	61.344380	-149.560350	500+
GLE304.05	Middle of southeastern triangle at Glenn Highway and North Eagle River Access Road interchange	61.340750	-149.567570	500+
GLE328.01	Northbound on west side of Glenn Highway and Eagle River	61.31126	-149.57674	500+
GLE328.03	Southbound on east side of Glenn Highway and Eagle River	61.31161	-149.57755	500+
GLE328.04	Southbound on west side of Glenn Highway and Eagle River	61.30975	-149.58212	500+
GOL036	East side of Golden View Drive	61.061110	-149.774110	500+
HIR258	North side of Hiland Road	61.27967	-149.48212	1-5
INT146.01	North side of International Airport Road at Campbell Creek	61.173900	-149.864560	500+
KNG175	Northwest corner of King Street and 100th Ave	61.130470	-149.879060	500+

Site Code	Location Information	Latitude	Longitude	Stem Count
LAK574.01	West side of Lake Otis Parkway and south of Homestead Court	61.177220	-149.838470	26-50
LAK575.03	Southeast portion of Lake Otis Parkway and creek crossing	61.160740	-149.833910	6-25
LAK583	East side of Lake Otis Parkway and north of Creekview Loop	61.158600	-149.833980	1-5
MUL109.01	East side of Muldoon Road and DeBarr Road at creek	61.209780	-149.733180	500+
NEW205	West side of New Seward Highway at Chester Creek	61.201900	-149.868420	500+
NEW206.07	Northwest interchange island at New Seward Highway and Tudor Road	61.182580	-149.861420	1-5
NEW206.08	West side of New Seward Highway, north of International Airport Road, at Campbell Creek crossing	61.175280	-149.859010	1-5
NEW216	East side of New Seward Highway, 0.5 miles south of intersection with Rabbit Creek Road	61.071360	-149.826400	500+
OLD040	West side of Old Seward Highway about 1,000 ft north of intersection with Potter Valley Road	61.058320	-149.797300	151-500
OLD613	Southeast corner of Old Seward Highway and 76th Street, at Little Campbell Creek South Fork	61.151790	-149.863890	500+
OLD613.01	Northeast corner of Old Seward Highway and 74th Street, at Little Campbell Creek North Fork	61.153650	-149.863850	500+
OLD613.02	East side of Old Seward Highway, south of 74th Street, in front of Henry's Services	61.153080	-149.863780	500+
OLD618.02	Southwest corner of Old Seward Highway and 76th Street, at Little Campbell Creek South Fork	61.151790	-149.864470	500+
OLD620	Southwest corner of Old Seward Highway and 100th Street	61.130150	-149.864260	500+
OLD620.01	West side of Old Seward Highway, south of 100th Avenue, empty lot north of Phil Haws Auto Outlet	61.129130	-149.864330	500+
RAB009.01	East side of Rabbit Creek Road, south side of creek crossing, behind guardrail	61.096510	-149.734010	26-50
RAB009.02	West side of Rabbit Creek Road, south side of creek crossing, behind guardrail	61.096660	-149.734270	51-150
TUD122.01	South side of Tudor Road, west of Lake Otis Parkway	61.180740	-149.844990	151-500
VIC089.01	East side of Victor Road, at Stonegate Park, north of Olympic Drive	61.132320	-149.921750	500+
VIC089.02	East side of Victor Road at Stonegate Park	61.132710	-149.921800	500+

Phalaris arundinacea (reed canary grass; 83) – this species is an aggressive invader of wet habitats. Once established, it alters ecosystem structure and function by forming dense mats which exclude native species, encourage silt deposition and retard natural erosion (Coops et al. 1996; Kätterer and Andren 1999). We recommend that populations of *Phalaris arundinacea* occurring within 50 m (164 ft) of a wetland or stream be prioritized for control. These locations are shown in Figure 24 and listed in Table 8.

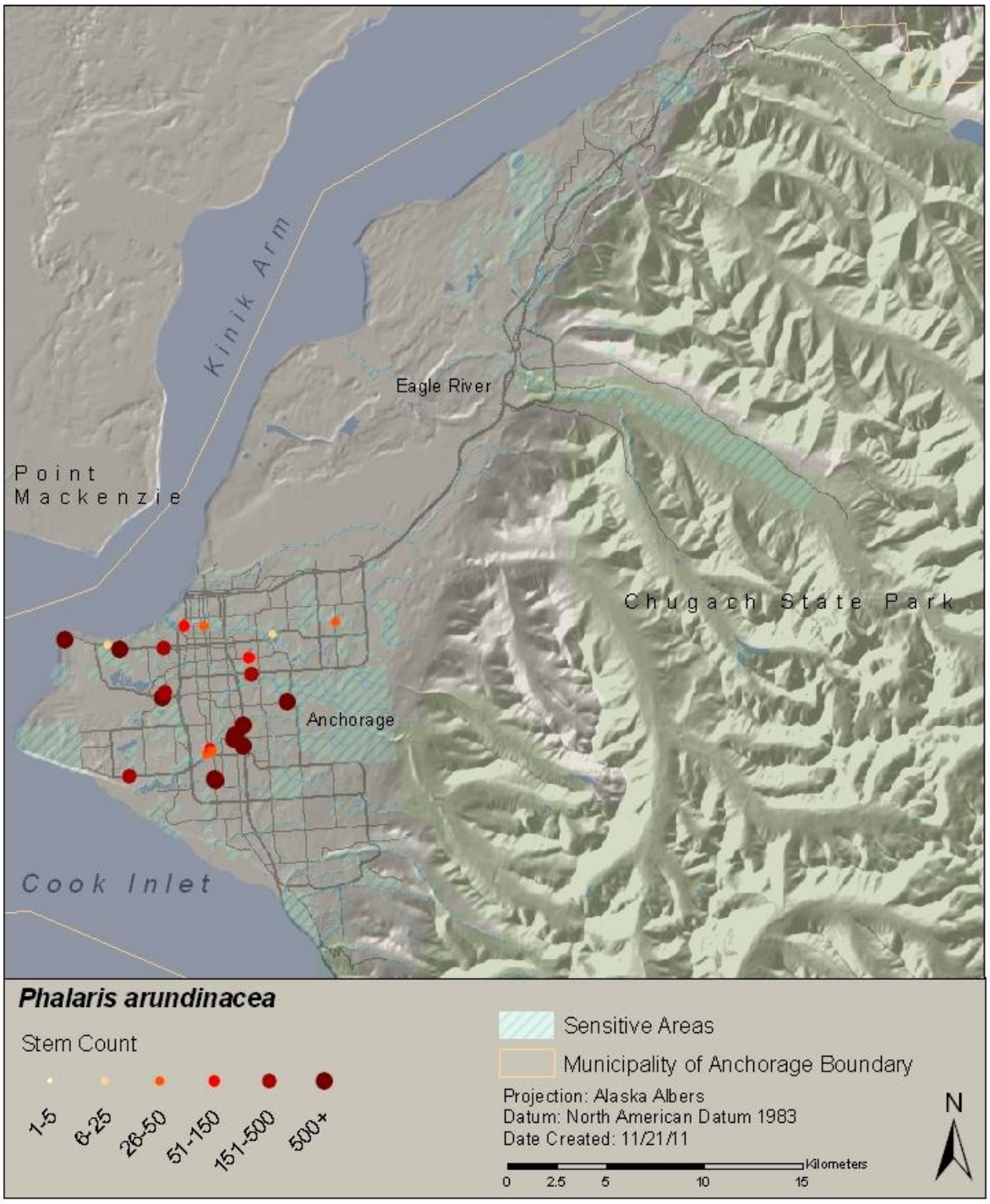

Figure 24. Locations of *Phalaris arundinacea* populations recommended for control in the Municipality of Anchorage, Alaska.

Table 8. Locations of *Phalaris arundinacea* populations recommended for control in the Municipality of Anchorage, Alaska.

Site Code	Location Information	Latitude	Longitude	Stem Count
36A193.01	South side of 36th Ave, west of Randolph Street	61.187950	-149.843490	26-50
36A193.03	South side of 36th Ave, David Green Park	61.187910	-149.846710	51-150
76A169.01	North side of 76th Ave, west of Old Seward Highway, Whisper Faith Kovach Park	61.152050	-149.865780	500+
ARC598.01	West side of Arctic Boulevard, north of Dimond Blvd, north side of Campbell Creek	61.145950	-149.892440	26-50
BEA104	East side of Beaver Place, north end of Cheney Lake	61.202180	-149.762390	26-50
CST078.02	East side of C Street, north of 19th Ave, north side of Chester Creek	61.203600	-149.887330	26-50
CST083.02	West side of C Street, north of Dimond Boulevard, at Campbell Creek	61.148050	-149.887630	51-150
CST083.03	Southwest of C Street and Campbell Creek, before concrete barrier	61.146740	-149.887510	26-50
CST085.01	East side of C Street at stream near top soil distributing area	61.133800	-149.885280	500+
CST085.02	West side of C Street at stream, south of East 95th Ave	61.133980	-149.886110	500+
DIM567	North side of Dimond, east of Emerald Street	61.137580	-149.967010	151-500
DOW185	South side of Dowling Road, west of Elmore on greenbelt	61.166910	-149.812870	500+
INT155.02	South side of International Airport Road, west of Northwood Drive	61.172790	-149.931230	500+
NEW208.04	West side of New Seward Highway, north of 76th Ave, at small creek crossing	61.157500	-149.856030	500+
NEW209.01	West side of New Seward Highway, north of Dimond Boulevard, at creek crossing	61.148140	-149.856840	500+
NLI050	North side of Northern Lights Boulevard, east of Lake Hood Drive	61.195300	-149.968410	500+
NLI050.01	North side of Northern Lights Boulevard, western edge of Earthquake Park, old landscaped area	61.197750	-149.980130	6-25
NLI052	Northern Lights Boulevard turns into Point Woronzof Road, west side of road	61.201380	-150.019580	500+
NLI056.01	South side of Northern Lights Boulevard, east of Forest Park Drive, at Fish Creek	61.195220	-149.925840	151-500
NLI067.02	South side of Northern Lights Boulevard, west of Arca Drive, landscaped area east of the Goose Lake Park sign	61.198230	-149.822430	6-25
NOD159.04	West side of Northwood Drive, north of International Airport Road	61.174640	-149.927900	151-500
OLD613	Southeast corner of Old Seward Highway and 76th Ave, at Little Campbell Creek South Fork	61.151790	-149.863890	500+
OLD613.01	Northeast corner of Old Seward Highway and 74th Ave, at Little Campbell Creek North Fork	61.153650	-149.863850	500+
OLD613.02	East side of Old Seward Highway, south of 74th Ave, in front of Henry's Services	61.153080	-149.863780	500+
OLD618.01	West side of Old Seward Highway, south of 74th Ave, at Little Campbell Creek North Fork	61.153250	-149.864360	500+

Site Code	Location Information	Latitude	Longitude	Stem Count
OLD618.02	Southwest corner of Old Seward Highway and 76th Ave, at Little Campbell Creek South Fork	61.151790	-149.864470	500+
SPE165.03	West side of Spenard Road, north of 19th Ave, at Chester Creek crossing	61.204050	-149.905430	51-150
TUD122.01	South side of Tudor Road, west of Lake Otis Parkway, at creek	61.180740	-149.844990	151-500

Prunus virginiana (choke cherry; 74) – this is an ornamental tree species, which has become naturalized along the greenbelts of Anchorage (Flagstad et al. 2010a). Because *Prunus virginiana* could eventually become as widespread as closely related *P. padus,* which is rapidly changing the composition and structure of riparian vegetation along Municipality creeks, *P. virginiana* populations occurring within 50 m (164 ft) of a stream corridor should be prioritized for control work. These populations are shown in Figure 25 and listed in Table 9. No populations of *Prunus padus* were detected within the riparian corridors surveyed, although the lack of flowers during the field work could have hindered positive identification of the species.

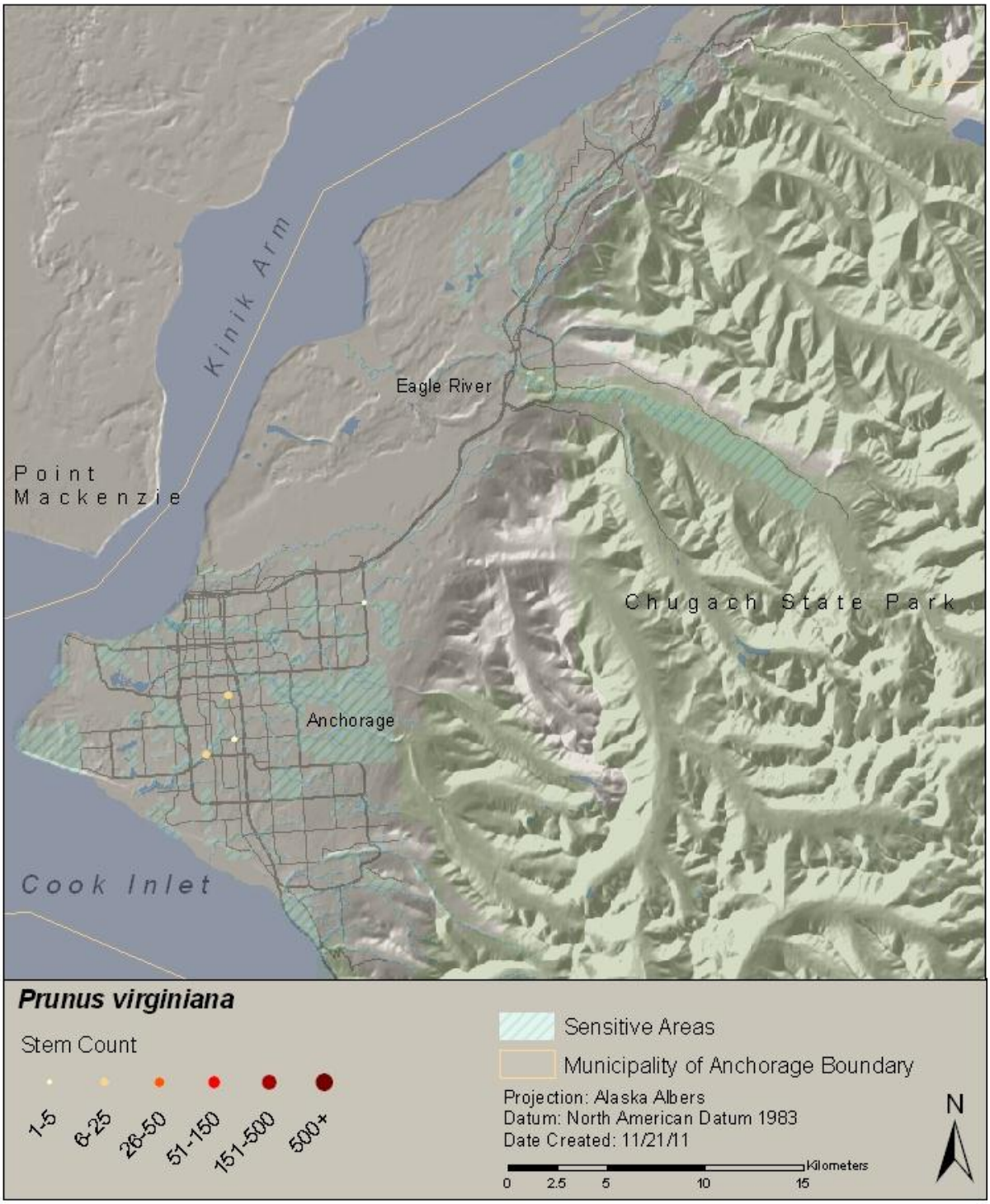

Figure 25. Locations of *Prunus virginiana* populations recommended for control in the Municipality of Anchorage, Alaska.

Table 9. Locations of *Prunus virginiana* populations recommended for control in the Municipality of Anchorage, Alaska.

Site Code	Location Information	Latitude	Longitude	Stem Count
76A169.01	North side of 76th Ave, west of Old Seward Highway, Whisper Faith Kovach Park	61.152050	-149.865780	1-5
ARC598.01	West side of Arctic Boulevard, north of Dimond Boulevard, north of Campbell Creek	61.145950	-149.892440	6-25
MUL109.01	East side of Muldoon Road and DeBarr Road, north side of creek	61.209780	-149.733180	1-5
OLD617.02	West of Old Seward Highway, south of Arctic Roadrunner, at Campbell Creek	61.172200	-149.868330	6-25
OLD618.02	Southwest corner of Old Seward Highway and 76th Ave, at Little Campbell Creek South Fork	61.151790	-149.864470	1-5

Ranunculus acris (tall buttercup; 54) and *R. repens* (creeping buttercup; 54) – these non-native buttercups have an affinity for wet habitats. Occurrences of these species within 50 m (164 ft) of a wetland or stream should be prioritized for control. Locations of *Ranunculus acris* are shown in Figure 26 and listed in Table 10; co-occurrence of *R. repens* is noted.

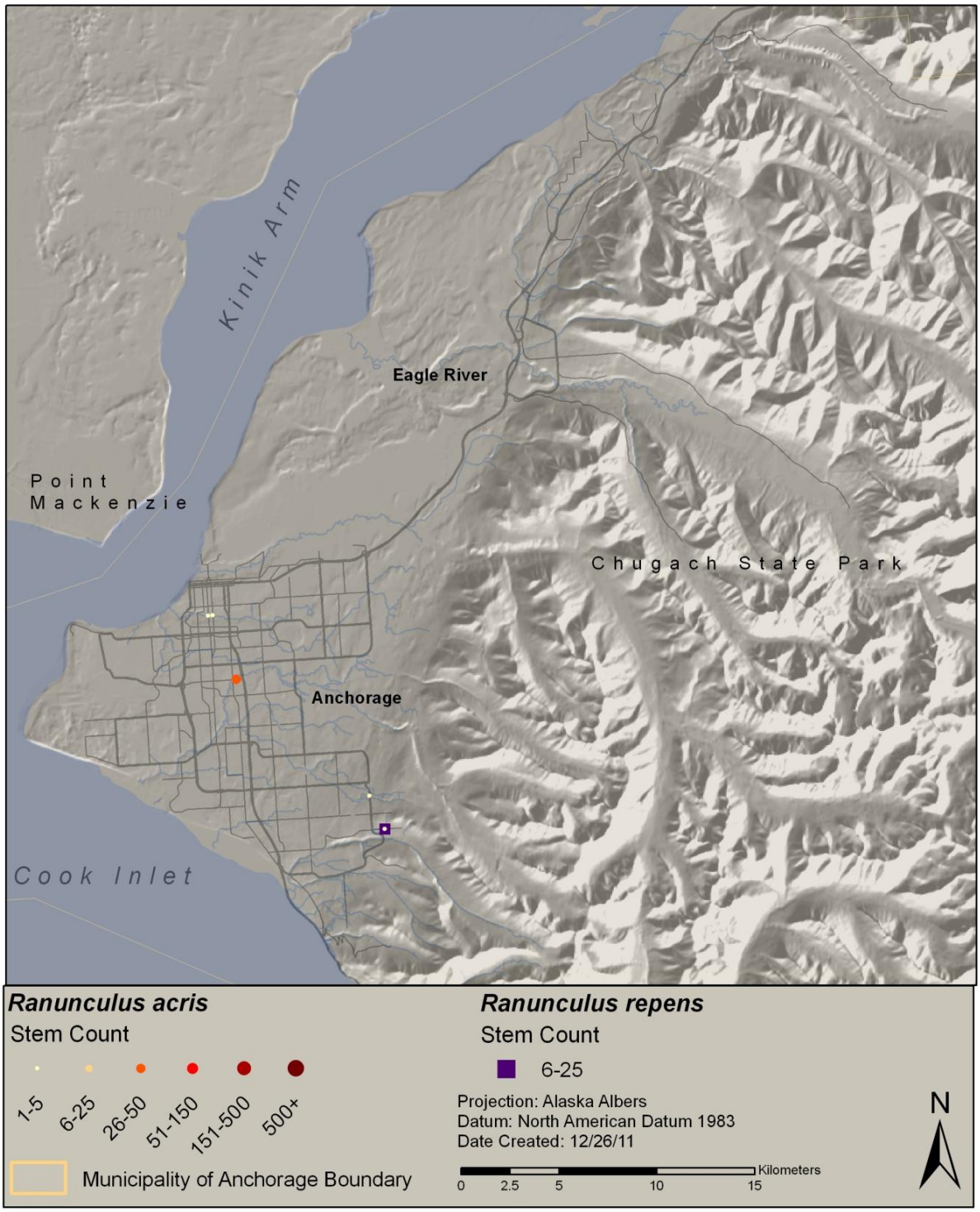

Figure 26. Locations of *Ranunculus acris* and *R. repens* populations recommended for control in the Municipality of Anchorage, Alaska.

Table 10. Locations of *Ranunculus acris* and *R. repens* populations recommended for control in the Municipality of Anchorage, Alaska.

Site Code	Location Information	Latitude	Longitude	Stem Count
AST080.03	Northeast side of Chester Creek and A Street	61.203530	-149.882920	1-5
CST078.01	East side of Chester Creek trail and C Street	61.203390	-149.887400	1-5
DEA020.03	Drainage ditch east of Patrick Rd on Upper DeArmoun Road, below pedestrian crossing sign**	61.101440	-149.732150	1-5
HIL001.02	West side of Hillside Drive, South of Alps Road and directly South of the creek running beneath the road	61.117000	-149.744670	1-5
INT146.02	Southeast side of Campbell Creek and International Airport Road, between Old and New Seward Highways	61.173740	-149.864230	26-50

***Ranunculus repens* also present at this location

Tanacetum vulgare (common tansy; 60) – once established, this species requires a high level of effort to eradicate due to its ability to reproduce from both seeds and rhizomes. For this reason, *Tanacetum vulgare* populations occurring within 50 m (164 ft) of any sensitive area are recommended for control. These populations are shown in Figure 27 and listed in Table 11.

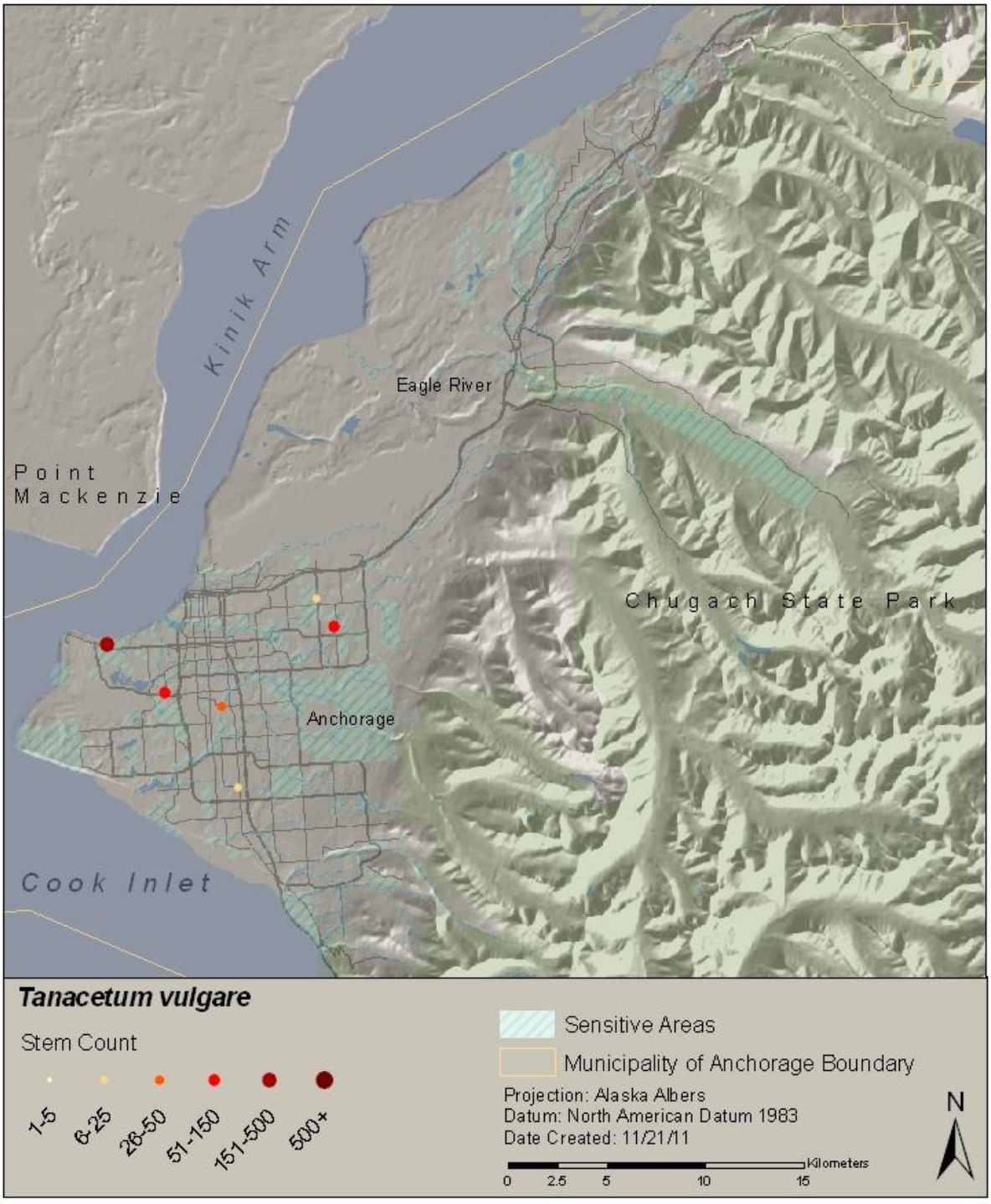

Figure 27. Locations of *Tanacetum vulgare* populations recommended for control in the Municipality of Anchorage, Alaska.

Table 11. Locations of *Tanacetum vulgare* populations recommended for control in the Municipality of Anchorage, Alaska.

Site Code	Location Information	Latitude	Longitude	Stem Count
BAX104.02	West side of Baxter Road and Prosperity Drive intersection	61.199340	-149.763200	51-150
BON132.02	West side of Boniface Parkway, north of DeBarr Road, Russian Jack Park	61.212260	-149.778720	6-25
DOW182.02	North side of Dowling Road, west of Austin Ave and the Campbell Creek crossing	61.166430	-149.875240	26-50
ERR279.01	South side of Eagle River Road at house #19411	61.31053	-149.52039	51-150
NLI050.01	North of Northern Lights Boulevard, west end of Earthquake Park, old landscaped area	61.197750	-149.980130	151-500
NOD159.03	West side of Northwood Drive, north of International Airport Road, in park	61.174050	-149.927980	51-150
OLD620.01	West side of Old Seward Highway, south of 100th Ave, empty lot north of Phil Haws Auto Outlet	61.129130	-149.864330	6-25

U-listed species

The following U-listed species that are of unknown invasiveness and priority were detected in the Municipality. Species-specific recommendations are given below; distribution maps are provided in Appendix VII.

- *Astragalus cicer* (cicer milkvetch; NR) – a semi-continuous population of this species spans several plots on the Glenn Highway in the vicinity of Eagle River (GLE234.01, .04, .05, GLE328.04 and GLE329; Figure 28). The potential invasiveness of this species is not well documented. While it appears not to have spread considerably since its introduction to the Municipality in 2000 or prior, populations are not declining naturally and eradication of this non-native species seems prudent. However, this species is of lesser concern than many of the more highly invasive species detected in this survey.

Figure 28. General location of *Astragalus cicer* along the Glenn Highway (Plots GLE234.01 (61.29356, -149.59096), GLE234.04 (61.29657, -149.58847), GLE234.05 (61.29774, -149.58952), GLE328.04 (61.30975, -149.58212) and GLE329 (61.30296, -149.58809)).

- *Berteroa incana* (hoary alyssum; NR) – this species was detected at one location in this survey (NLI060.01; Figure 29). *Berteroa incana* is expected to be moderately invasive and is recommended for control based on its limited distribution as well as its occurrence within a greenbelt.

Figure 29 Location of *Berteroa incana* at intersection of Northern Lights Boulevard and the greenbelt, west of Bragaw Street and bus stop 1313 (Plot NLI060.01; 61.19824, -149.82086)

- *Cerastium tomentosum* (snow in summer; NR) – the single population of this presumably weakly invasive species is suspected to have been planted and is unlikely to persist outside of cultivation. This species is not recommended for immediate control.
- *Chaenorhinum minus* (dwarf snapdragon; NR) – the potential invasiveness of this species is not well known, however the C Street population detected in this survey (CST073; Figure 30), represents one of only two documented locations (see also special notes section) in Alaska and as such should be prioritized for control.

Figure 30. Location of *Chaenorhinum minus* in a landscaped area in front of Billiard Palace (Plot CST073; 61.18906, -149.88681)

- *Coronilla varia* (crown vetch; 68) – this population (SPE165.02), spans Spenard Road along the Chester Creek Trail. It was first reported in 2006, and remains the only known population in the state. Control efforts have been ongoing since the initial detection of this species and should be continued.
- *Elymus sibiricus* (Siberian wildrye; 53) – although this species was only detected twice in this survey (EKL321.01, NLI060.01), this modestly invasive grass is relatively common statewide and is not recommended for immediate control.
- *Leontodon autumnalis* (fall dandelion; 51) – this modestly invasive aster is relatively common in the Municipality and statewide and is not recommended for immediate control.

- *Linaria pinifolia* (pineneedle toadflax; NR) – this species is very uncommon statewide. The population detected in this survey (OLD617.01; Figure 31), is one of only two known locations in the Municipality. It appears to have escaped a nearby landscaped area, but given that it occurs within a riparian corridor (Chester Creek) and has a very restricted distribution, control of this population is recommended.
- *Lotus corniculatus* (bird's foot trefoil; 65) – this species is uncommon both statewide and locally. With the addition of the two populations detected in this survey (POT043.01, RAS544.09; Figure 32) there are now only three known locations within the Municipality. This species is recommended for control based on its limited distribution.
- *Papaver croceum* (Icelandic poppy; 39) – although this survey only documented one population, this ornamental plant is widely planted in the Municipality and relatively common statewide. For these reasons, this species is not recommended for control.
- *Silene chalcedonica* (maltese cross; 42) – although this survey only documented one population, this species is often included in wildflower mixes and is relatively common in the Municipality (but less so on a statewide basis). This species is not recommended for control.
- *Sonchus asper* (spiny sowthistle; 46) – although this survey only documented one population, several populations of this species are documented along the Tony Knowles Coastal Trail and it is common in southeast Alaska. Due to its relatively widespread distribution, this species is not recommended for immediate control.

Figure 31. Location of *Linaria pinifolia* on the north side of the Old Seward Highway, by the Local Burgerman patio (Plot OLD617.01; 61.17248, -149.86836)

Figure 32. Location of *Lotus corniculatus* on the northeast side of the Minnesota/Raspberry interchange, west of the on ramp, middle area of triangle (Plot RAS544.09; 61.16037, -149.91263)

New arrivals to the State

Lepidium latifolium (broadleaved pepperweed; 71) represents the highest priority for control of all the species and populations detected in this survey. This species is able to reproduce by both seeds and root fragments and consequently is very difficult to eradicate once established. Control of the single population detected on the east side of the New Seward Highway at the Lore Road onramp (NEW219.01; Figure 33) as well as future survey of the surrounding area for additional plants is strongly recommended.

Figure 33. Location of *Lepidium latifolium* on the east side of the New Seward Highway at the Lore Road onramp (Plot NEW219.01; 61.1526, -149.85541)

The remaining three species that represent new introductions to the State; *Erysimum* cheiri (Aegean wallflower; NR), *Lamium amplexicaule* (henbit deadnettle; NR), and *Linaria maroccana* (Moroccan toadflax; NR), are ornamental species that have likely escaped from nearby gardens. Because it is likely that these species will be unable to persist outside of cultivation and there is a high probability of reintroduction to treated areas, these species are not high priorities for control; monitoring their behavior is instead recommended.

New arrivals to the Municipality

Medicago sativa ssp. *sativa* (alfalfa; 59) is a new introduction to the Municipality and as such, the three populations of this taxon are recommended for control. These populations are located at a stream on the west side of C Street (CST085.02; Figure 34), at a topsoil distribution center on the southeast corner of C Street and 92nd Avenue (CST095.01; Figure 35) and on the southwest side of the Minnesota Drive/Raspberry Road interchange in the vegetated triangle west of the onramp (RAS544.06; Figure 36). The ability of sister subspecies *Medicago sativa* ssp. *falcata* to invade semi-natural areas in combination with the currently limited distribution of *Medicago sativa* ssp. *sativa* across the state make it a priority for control.

Figure 34. Location of *Medicago sativa* ssp. *sativa* on the west side of C Street at a stream crossing (Plot CST085.02; 61.13398, -149.88611)

Figure 35. Location of *Medicago sativa* ssp. *sativa* on the southeast corner of C Street and 92nd Avenue, near topsoil distributor (Plot CST095.01; 61.13715, -149.88530)

Figure 36. Location of *Medicago sativa* ssp. *sativa* on the southwest side of the Minnesota Drive/Raspberry Road interchange, in the triangle west of the onramp (Plot RAS544.06; 61.15826. -149.91284)

Achillea filipendulina (fernleaf yarrow; NR) – although this species had not previously been recorded in the AKEPIC database, this species is thought to have been present in the Municipality for at least the last decade (M. Carlson pers. comm.). In the past ten years it apparently has not experienced any dramatic increases in range or abundance, and consequently control of *Achillea filipendulina* is not a high priority.

Clematis tangutica var. *tangutica* (golden virginsbower; NR) – this species was detected at one location along 100th Street below the Minnesota Drive overpass (Figure 37). *Clematis tangutica* var. *tangutica* is ornamental plant that has likely escaped cultivation. Once established, this species is known to be an aggressive invader of both urban and natural areas in Canada (Alberta Invasive Plant Council 2011). Due to its limited distribution in Alaska and its invasiveness in similar climates, *Clematis tangutica* var. *tangutica* is a high priority for control

Figure 37. The single location of *Clematis tangutica* var. *tangutica* detected in this survey (Plot MIN648.01; 61.13029, -149.90796).

Hordeum vulgare (common barley; 39) – this grass is weakly invasive and generally restricted to low-competition, open habitats (von Bothmer et al. 2007). In Alaska it is

commonly associated with straw (Conn et al. 2010). This species is not expected to persist outside of cultivation and is thus a low priority for control.

Nemophila menziesii (baby blue eyes; NR) – this species is an annual plant and a common component of wildflower seed mixes. It is not considered noxious anywhere in North America and has not demonstrated invasive behavior in Alaska. This species is not expected to persist outside of cultivation and should be a low priority for control.

Veronica spicata (spiked speedwell; NR) – this species is an ornamental with presumably low persistence outside of cultivation. *Veronica spicata* has been planted in the Municipality for decades and has only recently been reported as a weed. Because of the popularity of *Veronica spicata* as a garden plant, there is a high potential for reintroduction to treated areas. The potential for reintroduction in combination with the presumably low invasiveness of *Veronica spicata* make this species a low priority for control; monitoring the behavior of this species is instead recommended.

Non-listed species

Five species detected in this survey do not appear on any of the Municipalities prioritized lists. Species-specific recommendations follow:

Dactylis glomerata (orchardgrass; 53) – a single population of this species was recorded at the intersection of International Airport Road and Minnesota Drive (INT148.01; Figure 38) and has also been observed on Birch Road. Previously, the only location of *Dactylis glomerata* in the Municipality was known from the vicinity of Portage Lake. The record from this survey represents the first report of this grass within developed areas of the Municipality and as such, is recommended for control.

Figure 38. Location of *Dactylis glomerata* at the intersection of International Airport Road and Minnesota Drive (Plot INT148.01; 61.17329, -149.91997)

The remaining four non-listed species; *Achillea ptarmica* (sneezeweed; 46), *Centaurea montana* (perennial cornflower; 46), *Lamium album* (white deadnettle; 40) and *Leucanthemum maximum* (Shasta daisy; NR) are ornamentals that are not likely to pose a high level of ecological or economic impact, and because of their popularity as garden plants there is a high potential for reintroduction to treated areas. However, the *Leucanthemum maximum* population occurring at the intersection of the Glenn Highway and Muldoon Road (GLE226.05; 61.22806, -149.73389) could be controlled as a precautionary measure, in the case that this species proves to be as invasive as its sister species *L. vulgare* (oxeye daisy; 61).

High-priority locations

Outlier populations

Outlying populations of non-native plant species were defined for the purposes of this survey as large (more than 0.1 acre) populations separated by more than five miles from the closest population same species. The many sites that qualified as outlying populations and are listed as Appendix VI; outlying populations that are considered the highest priorities for control based on their invasiveness or location are shown in Figure 42 and listed in Table 12. Several of these high-priority outlying populations have been discussed in previous sections of the report:

- The outlying populations of the A-listed taxa, *Medicago sativa* ssp*. falcata* and *Thlaspi arvense,* have been recommended for control in the 'High-priority, A-listed species' section based on their high invasiveness and restricted distribution.
- The outlying populations of B-listed taxa, *Melilotus alba, Ranunculus repens, Sonchus arvensis* and *Sonchus arvensis* ssp*. uliginosus* have been recommended for control in the 'High-priority, B-listed species' section based on their occurrence in or near sensitive areas.
- The outlying populations of U-listed species, *Berteroa incana, Chaenorhinum minus, Coronilla varia, Linaria pinifolia, Lotus corniculatus* and *Sonchus asper*, have been recommended for control in the 'High-priority, U-listed species' section based on their very restricted distributions.

The only three outlying populations recommended for control that have not been discussed in conjunction with some other classification or control category are *Campanula rapunculoides, Linaria vulgaris* and *Tanacetum vulgare*.

- *Campanula rapunculoides* - a small (6-25 stems) outlying population was found on the northwest side of Eagle River Loop Road, south of the Eagle River Bridge (Figure 39). This site was previously noted because it also hosts *Hieracium aurantiacum*.
- *Linaria vulgaris* - a medium sized (51-150 stems) population was found on the north side of Eklutna Lake Road (Figure 40).
- *Tanacetum vulgare* - a medium sized population (51-150 stems) was found on Eagle River Road (Figure 42).

Figure 39. Location of outlying *Campanula rapunculoides* population on Eagle River Loop Road (Plot ERL247; 61.29558, -149.54561)

Figure 40. Location of outlying *Linaria vulgaris* population on Eklutna Lake Road (Plot EKL322; 61.44177, -149.23499)

Figure 41. Location of outlying *Tanacetum vulgare* population on Eagle River Road (Plot ERR279.01; 61.31053, -149.52039)

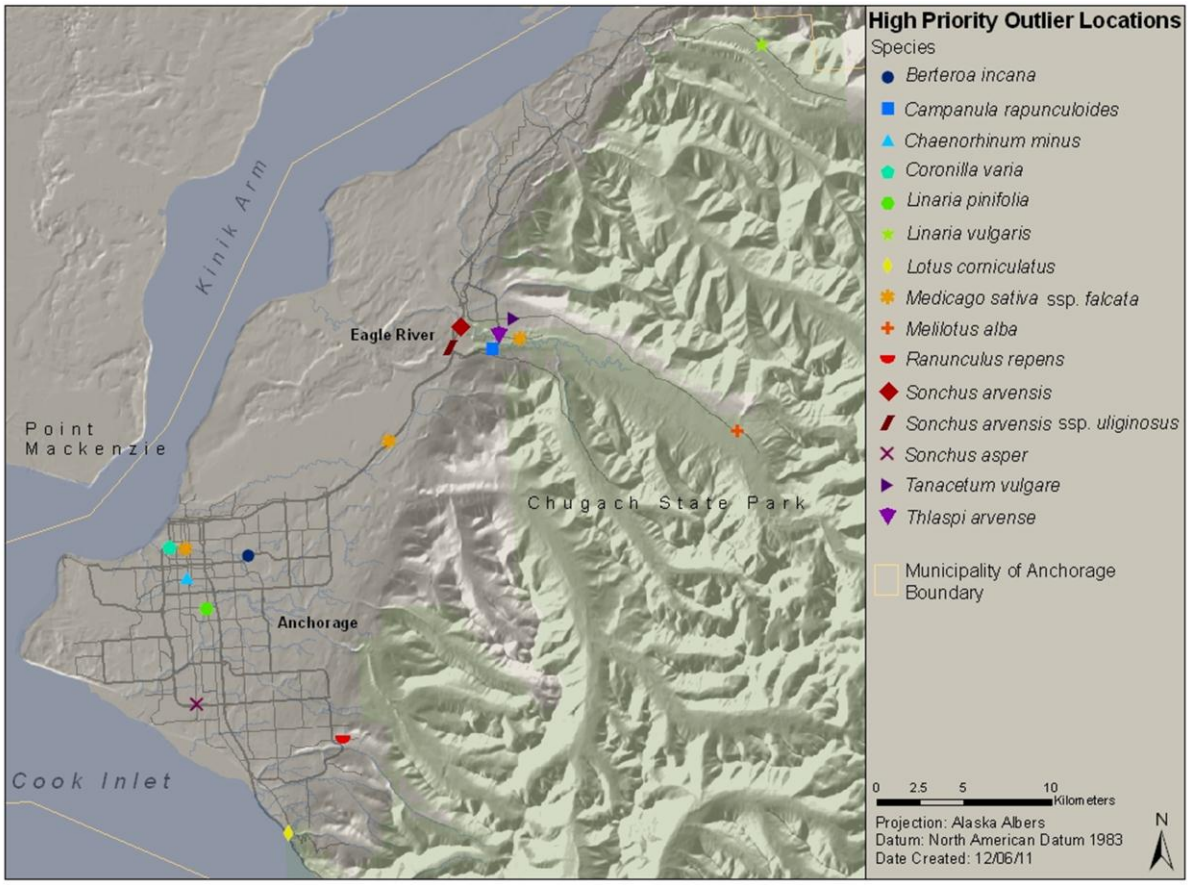

Figure 42. Locations of species that are high priorities for control in the Municipality of Anchorage, Alaska.

Table 12. Location and character of outlier populations representing high priorities for control in the Municipality of Anchorage, Alaska.

Scientific Name	Common Name	Invasiveness Rank	List	Site Code	Location Information	Latitude	Longitude	Stem Count
Berteroa incana	hoary false madwort	NR	U	NLI060.01	South side of Northern Lights Boulevard, west of Bragaw, near bus stop 1313, where trail connects road with greenbelt	61.19824	-149.82086	1-5
Campanula rapunculoides	creeping bellflower	64	B	ERL247	Northwest side of Eagle River Loop Road, south of the Eagle River	61.29558	-149.54561	6-25
Chaenorhinum minus	dwarf snapdragon	NR	U	CST073	West side of C Street, north of 36th Ave, landscaped area in front of the Billiard Palace	61.18906	-149.88681	1-5
Coronilla varia	crownvetch	68	U	SPE165.02	East side of Spenard Road, where it meets the Chester Creek Trail, just south of joining with Minnesota	61.20499	-149.90436	500+
Linaria pinifolia	pineneedle toadflax	NR	U	OLD617.01	Northwest corner of Old Seward Highway and Campbell Creek, near Local Burgerman patio	61.17248	-149.86836	1-5
Linaria vulgaris	yellow toadflax	69	B	EKL322	North side of Eklutna Lake Rd, about 4.3 miles northwest of Eklutna Lake	61.44117	-149.23499	51-150
Lotus corniculatus	birdsfoot trefoil	65	U	POT043.01	West side of Potter Valley Rd, about 400 ft east of junction with the Old Seward Highway	61.05544	-149.79562	500+
Medicago sativa ssp. *falcata*	yellow alfalfa	64	A	CST078.02	Northeast corner of C Street and Chester Creek, north of 19th Ave	61.2036	-149.88733	1-5
Medicago sativa ssp. *falcata*	yellow alfalfa	64	A	DRI272.01	South side of Driftwood Bay Drive, across from house #19701	61.30035	-149.51471	500+
Medicago sativa ssp. *falcata*	yellow alfalfa	64	A	GLE231.01	Southwest interchange island at the Glenn Highway and D Street	61.25208	-149.66209	51-150
Melilotus alba	white sweetclover	81	B	ERR290	North side of Eagle River Road at creek crossing, about 1 mile west of nature center	61.24527	-149.28978	6-25
Ranunculus repens	creeping buttercup	54	B	DEA020.03	North side of Upper DeArmoun Road, east of Patrick Road, drainage ditch below pedestrian crossing sign	61.10144	-149.73215	1-5
Sonchus arvensis	perennial sowthistle	73	B	GLE328.02	East side of northbound lane on the Glenn Highway, about 1,000 ft south of the Eagle River	61.30788	-149.57915	51-150

Scientific Name	Common Name	Invasiveness Rank	List	Site Code	Location Information	Latitude	Longitude	Stem Count
Sonchus arvensis ssp. *uliginosus*	moist sowthistle	73	B	GLE234.05	Northwest island at Glenn Highway and Eagle River Loop Road interchange	61.29774	-149.58952	51-150
Sonchus asper	spiny sowthistle	46	U	MIN647.01	Northeast corner of C Street and O'Malley Road interchange, between roundabout and sidewalk	61.12376	-149.88594	6-25
Tanacetum vulgare	common tansy	60	B	ERR279.01	South side of Eagle River Road at house #19411	61.31053	-149.52039	51-150
Thlaspi arvense	field pennycress	42	A	DRI272	Southeast corner of Driftwood Bay and Driftwood Bay Drive	61.30266	-149.53752	1-5

II. Mowing plan

Several B-listed species occur along roadways as semi-continuous populations; because the populations of these species are too large (more than 500 stems) for effective manual control, containment by mowing is recommended. The populations recommended for mowing are represented by the following taxa:

- *Vicia cracca* (bird vetch; 73) 215 infestations
- *Linaria vulgaris* (yellow toadflax; 69) 184 infestations
- *Bromus inermis* ssp. *inermis* (smooth brome; 62) 169 infestations
- *Melilotus alba* (white sweetclover; 81) 150 infestations
- *Phalaris arundinacea* (reed canarygrass; 83) 31 infestations
- *Tanacetum vulgare* (common tansy; 60) 1 infestation

Additional B-listed species such as *Leucanthemum vulgare* and *Hieracium aurantiacum*, and many C-listed species also occur as large populations, however but due to their reproductive ecology or widespread distribution, these species are not effectively controlled by mowing and for this reason are not explicitly addressed in this discussion.

In general, mowing should be timed to occur after flowering but before seed set. Mowing after flowering effectively injures plants at a time when resources are dedicated to the aboveground, reproductive structures, while mowing before seed set prevents the dispersal of mature seed. It should be stressed that mowing after seed maturation may not only be ineffective, but could result further spread of the species. The following information on flowering time, seed set and effective mowing strategies was derived from Alaskan studies or those conducted in similar climates; the phenology of these species is further detailed in their biographies presented in Appendix VII.

Bromus inermis* ssp. *inermis flowers in mid to late June and seed matures in August (Howard 1996, Sather 1987). If only one mowing is feasible, it should be timed to cut plants when the flowering head is still enclosed in the sheath (referred to as the boot stage) and plants are 46-61 cm (18 to 24 in) tall. If more resources are available, mowing should be repeated four times during the growing season. Cutting plants cut close to the ground (3.5 cm, 1.4 in) is recommended to cause greater injury (Sather 1987); however it is expected that this practice would also discourage the growth of native grasses.

Linaria vulgaris flowers from mid-June to September and seed matures in late summer (Epps 1971, Pratt 1989, Wilke and Irwin 2010). Mowing can prevent this species from setting seed, but also stimulates growth from rhizomes and lateral roots. Care should be taken to not to disturb soil, as new plants can establish from root fragments (GISD 2007).

Melilotus alba is a biennial plant that flowers in its second year from mid-June to October (AKEPIC 2005, Seefeldt 2007). Seeds mature from early August until first frost (Turkington et al. 1978). Seedlings emerge in March and April with a second flush in September and October (Turkington et al. 1978). Plants are most weakened when cut after the pre-bud stage and at a height of 15 cm (6 in), opposed to 30 cm (12 in).

Mowing in late August or early September can limit subsequent growth, overwintering ability and second year recruitment (Turkington et al. 1978).

Phalaris arundinacea flowers in midsummer and seed matures in mid-August (Great Lakes Region; GLIF&WC undated). This plant is strongly rhizomatous and only sometimes reproduces by seed; consequently, mowing will reduce aboveground biomass, but not reduce rhizome density (Slemmons 2007).

Tanacetum vulgare begins to flower in June and seed matures through the fall (Montana; Gucker 2009). Plants should be mowed in June before flower heads develop and again when half the flowers have bloomed to prevent late flower head development (Montana; Gucker 2009). Care should be taken to avoid disturbing soil as plants are able to regenerate from root fragments. Seeds can remain on plants for up to three years; although the viability of these seeds is unknown, it is best to avoid mowing old stands (Gucker 2009).

Vicia cracca flowers from approximately mid-June to mid-July, no information on seed set was found, however field experience indicates seed matures by late August. Mowing is recommended near the base of their stem before the end of flowering; most infestations will not tolerate more than three mowings (Nolen 2002). Mowing should be repeated annually for at least five years to deplete seed banks (YISC 2010).

Based on the phenology of these species, bi-monthly mowing beginning in mid-June and continuing until two weeks before the first frost – typically late September for the Anchorage area – could provide effective containment. Roads sections that are maintained in the summer by either the Alaska Department of Transportation or Public Facilities (ADOT&PF) or the Municipality of Anchorage (Figure 43) that are recommended for mowing are presented in the following in order of priority, summer maintenance responsibility and, for roads maintained by the Municipality, management area (i.e. north or south of Tudor Road). Mowing on both sides of the road, vegetated medians and islands, unless otherwise noted is assumed.

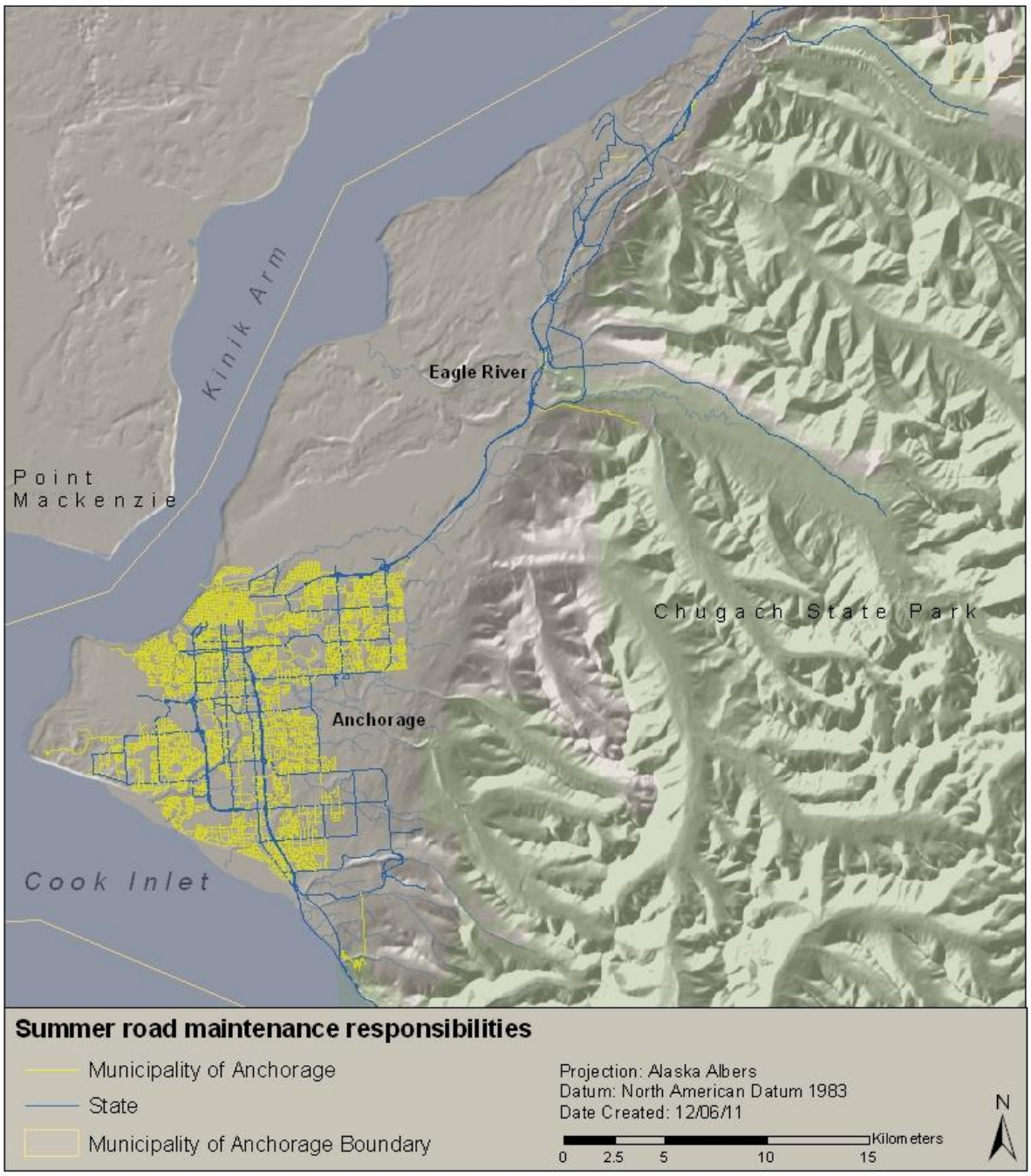

Figure 43. Summer road maintenance within the Municipality of Anchorage, Alaska.

Higher priority road sections

The following sections of road are major dispersal corridors and/or are adjacent to sensitive areas that support large (more than 500 stems), semi-continuous populations of B-listed plant species:

AKDOT&PF-maintained road sections:

Glenn Highway: from Reeve Boulevard to Eklutna Lake Road

New Seward Highway: from the downtown area to Potter Valley Road

Minnesota Drive: from Westchester Lagoon to O'Malley Road

C Street: entire length, including **A Street** where they branch

International Airport Road: from Minnesota Drive to the Ted Stevens International Airport

Birch Road: from Abbott Road to O'Malley Road

Municipality of Anchorage-maintained road sections, Northern Management area:

- Northwest corner of Mountain View Drive and Lane Street
  Vicinity of **Louis G. Mizelle Memorial Park**
  Species: *Vicia cracca*
- North side of Mountain View Drive
  Vicinity of **Davis Park,** population was also recorded on the south side of the road
  Species: *Linaria vulgaris*
- Northwest corner of Airport Heights Drive (DOT maintained – not previously recommended) and **Merrill Field Drive**
  Species: *Linaria vulgaris*
- South side of 15th Ave
  East of **Orca Park**
  Species: *Bromus inermis* ssp. *inermis, Linaria vulgaris, Vicia cracca*
- West 19th Ave and C Street (DOT maintained – previously recommended)
  Vicinity of **Chester Creek Greenbelt**
  Species: *Linaria vulgaris*, *Leucanthemum vulgare*
- West side of E Street in front of duplex numbered 1624/1626
  Across from **Valley of the Moon Park**
  Species: *Linaria vulgaris*
- Arctic Boulevard
  At underpass connecting **Valley of the Moon Park** and the **Chester Creek Greenbelt**
  Species: *Linaria vulgaris*
- Point Woronzof Drive
  From eastern boundary of **Earthquake Park**, west to end of Municipality maintenance
  Species: *Bromus inermis* ssp. *inermis, Linaria vulgaris, Phalaris arundinacea*
- Baxter Road and Beaver Place from 16th Ave to Northern Lights Boulevard

Vicinity of Cheney Lake Park and Campbell Creek Greenbelt
Species: *Linaria vulgaris, Vicia cracca*

- Northern Lights Boulevard from its intersection with Lake Otis Boulevard to its intersection with Muldoon Road
  Vicinity of **Tikishla Park, Chester Creek Greenbelt, Goose Lake Park, Foxhall Park, Arnold L. Muldoon Park and J.B. Gottstein Park**
  Species: *Bromus inermis* ssp. *inermis, Leucanthemum vulgare, Linaria vulgaris*, *Vicia cracca*
- 36th Ave from Lake Otis Boulevard to Denali Street
  Vicinity of **David Green Memorial** and **Jacobson Parks**
  Species: *Bromus inermis* ssp. *inermis, Leucanthemum vulgare, Linaria vulgaris, Vicia cracca*
- East side of Arctic Boulevard, between 36th and 40th Avenues
  Vicinity of **Springer Street Park**
  Species: *Linaria vulgaris*

Municipality of Anchorage-maintained road sections, Southern Management area:

- Northwood Drive from Spenard Road to International Airport Road
  Vicinity of **Northwood** and **Bentzen Lake Parks**
  Species: *Bromus inermis* ssp*. inermis, Melilotus alba, Linaria vulgaris, Vicia cracca*
- West side of Arctic Boulevard
  Vicinity of **Pop Carr Park**
  Species: *Bromus inermis* ssp*. inermis*
- Dowling Road between Lake Otis Boulevard and Elmore Road
  Vicinity of **Far North Bicentennial Park**
  Species: *Melilotus officinalis, Vicia cracca*
- Old Seward Highway between International Airport Road and Dowling Road
  Vicinity of **Campbell Creek Greenbelt** and Municipal Waste Transfer Station
  Species: *Bromus inermis* ssp*. inermis, Linaria vulgaris, Melilotus alba, Vicia cracca*
- **Arctic Boulevard** from International Airport Road to Raspberry Road
  Species: *Linaria vulgaris, Phalaris arundinacea, Vicia cracca* (Note: the *Phalaris arundinacea* population is adjacent to the **railroad tracks**)
- North side of Raspberry Road, East of Lowell Circle
  Approaching entrance to **Kincaid Park**
  Species: *Hieracium aurantiacum, Vicia cracca*
- Arctic Boulevard and **Campbell Creek Greenbelt**
  South of the pedestrian tunnel
  Species: *Bromus inermis* ssp. *inermis, Melilotus alba*
- Northeast corner of Old Seward Highway (DOT maintained – not previously recommended) and 74th Ave
  Vicinity of the **North Fork of Little Campbell Creek**
  Species: *Bromus inermis* ssp*. inermis, Linaria vulgaris, Melilotus alba, Phalaris arundinacea*

- North side of 76th Ave, east of 75th Court
  Vicinity of **Little Campbell Creek**
  Species: *Bromus inermis* ssp*. inermis, Linaria vulgaris, Melilotus alba, Phalaris arundinacea, Vicia cracca*
- Lore Road between New Seward Highway and Lake Otis Boulevard
  Vicinity of **Lore Park**
  Species: *Linaria vulgaris, Melilotus alba, Vicia cracca*
- **King Street** between Dimond Boulevard and 104th Ave
  Species: *Linaria vulgaris, Melilotus alba, Phalaris arundinacea, Vicia cracca*
- Southeast corner of C Street (DOT maintained – previously recommended) and 104th Ave
  Topsoil distribution site
  Species: *Bromus inermis* ssp. *inermis*, *Linaria vulgaris, Melilotus alba, Vicia cracca*
- Northwest corner of DeArmoun Road (DOT maintained – not previously recommended) and **Matthews Road**
  Species: *Melilotus alba, Tanacetum vulgare, Vicia cracca*
- **Elmore Road roundabout**
  At entrance to South High School and surrounding area
  Species: *Hieracium aurantiacum, Vicia cracca*
- Goldenview Drive
  North of **Moen Park** on banks of **Furrow Creek**
  Species: *Leucanthemum vulgare, Melilotus alba*

Lower priority road sections

The following sections of road also support large (more than 500 stems), semi-continuous populations of B-listed species, but are expected to be less significant dispersal corridors due to less traffic flow and are not adjacent to sensitive areas:

AKDOT&PF-maintained road sections:

Eagle River Loop Road: entire length

DeBarr Road: entire length

Boniface Parkway: along Russian Jack Park

Elmore Road: entire length

Abbott Road: entire length

O'Malley Road: entire length

Municipality of Anchorage-maintained road sections, Northern Management area:

- South side of Stewart Mountain/Highland Road near house number 8130
  Species: *Bromus inermis* ssp. *inermis*
- Southeast corner of Commercial Drive and Mountain View Drive
  Species: *Linaria vulgaris*
- West side of Turpin Road, north of its intersection with Donna Drive

In front of the Russian Orthodox Cathedral
Species: *Linaria vulgaris, Melilotus alba, Vicia cracca*

- Northeast corner of E Street and 10th Ave
  Species: *Linaria vulgaris*
- Northwest corner of I Street (DOT maintained – not previously recommended) and 12th Ave
  Species: *Linaria vulgaris*
- Northwest corner of DeBarr Road (DOT maintained – previously recommended) and Patterson Street
  Species: *Linaria vulgaris*
- Southwest corner of DeBarr Road (DOT maintained – previously recommended) and Edward Street
  Species: *Linaria vulgaris*
- Northwest corner of 15th and Ingra Street
  Species: *Linaria vulgaris, Melilotus alba*
- Northwest corner of Arctic Boulevard and 22nd Ave
  Species: *Bromus inermis* ssp. *inermis*
- Southeast corner of Fireweed Lane and Spenard Road
  Species: *Linaria vulgaris*
- Southeast corner of Fireweed Lane and LaTouche Street
  Landscaped area
  Species: *Vicia cracca*
- Northwest corner of Lake Otis Boulevard and Cornell Court
  Species: *Bromus inermis* ssp. *inermis*
- UAA Drive – entire length
  Species: *Leucanthemum vulgare, Linaria vulgaris*, *Lupinus polyphyllus, Vicia cracca*
- Providence Drive – entire length
  Species: *Bromus inermis* ssp*. inermis, Linaria vulgaris, Myosotis scorpioides*
- East side of Baxter Road at intersection with 41st Street
  Species: *Vicia cracca*
- Northwest side of Spenard Road between 36th Ave and Minnesota Drive
  Species: *Linaria vulgaris*

Municipality of Anchorage-maintained road sections, Southern Management area:

- Northwest corner of Wisconsin and Spenard Road
  Species: *Linaria vulgaris*
- Southwest corner of Tudor Road (DOT maintained – not previously recommended) and Cordova Street
  Species: *Linaria vulgaris*
- South side of Raspberry Road, East of Rovenna Street
  Species: *Linaria vulgaris, Vicia cracca*
- Northwest corner of Lore Road and Elmore Road (DOT maintained – recommended previously)
  Species: *Vicia cracca*

- North side of East 88th Ave, east of Seemie Street
  Species: *Bromus inermis* ssp. *inermis*, *Melilotus alba, Vicia cracca*
- Southwest corner of Old Seward Highway (DOT maintained – not previously recommended) and Merlin Loop
  Species: *Linaria vulgaris, Melilotus alba, Vicia cracca*
- Southeast corner of Old Seward Highway (DOT maintained – not previously recommended) and Abbott Road
  Species: *Linaria vulgaris, Melilotus alba, Vicia cracca*
- Northwest and southwest corners of Old Seward Highway (DOT maintained – not previously recommended) and 100th Ave
  Species: *Melilotus alba, Vicia cracca*
- West 100th Ave from Minnesota Drive to its transition to Pointe Resolution Drive
  Species: *Linaria vulgaris, Vicia cracca*
- Southeast corner of Victor Road (this section maintained by DOT – not previously recommended) and Minerva Way
  Species: *Bromus inermis* ssp. *inermis*, *Linaria vulgaris*
- West side of Victor Road, between the two arms of Maritime Loop
  Species: *Linaria vulgaris*
- C Street/Klatt Road from the intersection of C Street and O'Malley Road to the intersection of Klatt Road and Casey Cusack Loop
  Species: *Bromus inermis* ssp. *inermis*, *Linaria vulgaris, Leucanthemum vulgare, Melilotus alba, M. officinalis, Vicia cracca*
- Northeast corner of Jarvis Ave and Old Seward Highway (DOT maintained – not previously recommended)
  Species: *Vicia cracca*

Best management practices

Management practices that could be implemented by the Municipality's Parks and Recreation Department as well as the ADOT&PF to help minimize the introduction and dispersal of non-native plant species along Municipality roadsides are summarized in the following (BC MoT&I 2010):

Keep equipment clean: Avoid traveling through infested areas or mow the areas prior to use. Wash equipment after returning to the maintenance yard and inspect and clean vehicles before entering a weed-free area or before leaving an infested area.

Minimize roadside disturbance: Set mower blade height at least six inches above grade to minimize soil disturbance and damage to native grasses, which could promote establishment of non-native species.

Retain desirable vegetation: Seeding with native perennial grasses after any ground-disturbing activity encourages the growth of native species and provides competition for non-native species. Use of locally-produced native seed mixes will decrease the potential for seed contaminants.

Coordinate activities: If invasive plant populations will be treated with herbicides, establish an annual vegetation control schedule in collaboration with the pesticide

applicator and local weed groups. Do not mow or brush seven days before or after a foliar herbicide treatment.

Practice effective mowing and brushing: Begin mowing or brushing in weed-free areas and end in infested areas. Implement full-width mowing in areas where herbicides cannot be applied. When mowing near waterways, leave a buffer of a foot or two to prevent excessive plant material from entering the water body. Mowing should be avoided after seed set, especially near features that could act as dispersal corridors such as greenbelts and riparian corridors.

Ditch effectively: Soil disturbance can be minimized by conducting ditch work when the ground has thawed but plants have not yet set seed (June). Do not dump invasive plant contaminated ditch waste on established, desired vegetation; instead, dispose of waste at a designated disposal site. Where it is necessary to side-cast ditch waste, ensure that any waste deposited on established vegetation is spread evenly and reseeded.

Effectively manage source and waste materials: Use clean fill from weed-free sources. Dispose of invasive plant contaminated soil at a designated disposal site. Regularly inspect all material sources to ensure they are weed-free. Record and report invasive plant infested gravel pits and spoil piles.

Restore disturbed sites: Regrade disturbed soils and remove invasive plant-contaminated soil. Reseed with weed-free native seed that is quick to establish. Suggested native, ruderal species for mesic sites in southcentral Alaska include the grasses *Arctagrostis latifolia* (wideleaf polargrass), *Calamagrostis canadensis* (bluejoint), *Deschampsia beringensis* (Bering's tufted hairgrass), *D. cespitosa* (tufted hairgrass), *Elymus trachycaulus* (slender wheatgrass), *Festuca rubra* (red fescue), Poa alpina (alpine bluegrass) and the forbs *Artemisia tilesii* (Tilesius' wormwood) and *Chamerion angustifolium* (fireweed; Wright 2008). An appropriate fertilizer may be used on treated areas from which all viable propagules of non-native species have been removed.

III. Recommended revisions to the Municipality's prioritized list of weed species

The Municipality of Anchorage maintains a prioritized list of non-native plant species known to occur within the boundaries of the Municipality (Gary 2010). The survey presented in this report has added to our collective knowledge regarding the presence, aggressiveness and distribution of non-native plant species in the Municipality. In the context of this new information, we recommend that the following additions and changes be made to the Municipality's prioritized lists:

- Add to the A-list species new to the Municipality: *Lepidium latifolium* and *Medicago sativa* ssp. *sativa*.
- Add to the U-list species new to the state: *Erysimum cheiri*, *Lamium amplexicaule* and *Linaria maroccana* and species new to the Municipality: *Achillea filipendulina*, *Hordeum vulgare* and *Veronica spicata*.

- Move *Coronilla varia* from the U- to A-list; its potential invasiveness has been assessed, and it has a limited distribution. The single population detected in this study adds to the two populations previously known from the Municipality.
- Move *Lotus corniculatus* from the U- to A-list; it is moderately invasive and has a limited distribution in the Municipality and Alaska. To date, there are only three known locations of this species in Anchorage: two records from this study and one previous.
- Move *Leontodon autumnalis* from the U- to B-list; the distribution of this species is now better known. More than eight records from this survey plus two previous records make this modestly invasive species somewhat widespread, yet still at a manageable level within the Municipality.
- Remove *Silene latifolia* ssp. *alba* from the B list as The Flora of North America does not recognize any subspecies of *Silene latifolia*.
- Add the new and revised invasiveness ranks developed by Nawrocki et al. in 2011 to the current prioritized list of non-native plant species.

Revisions determined by the Municipality since the completion of this field survey:

- *Myosotis scorpioides* was moved from the A- to the B-list on the basis that it is more widespread that previously realized, with 27 infestations from this survey and more than eight populations are known around Girdwood (AKEPIC 2011, J. Heys pers. comm.).

IV. Future prevention and monitoring

Ultimately, the best approach to efficient weed management lies with the prevention of future introductions. Management practices should be implemented that focus on invasive plant identification, modes of introduction and dispersal, and control methods. Specific training in these areas for Municipality and ADOT&PF road crews and resource managers would facilitate interagency cooperation and encourage collaborative management.

It is also important that the Municipality continues to conduct inventory and monitoring work. This will increase the chances of detecting new, incipient infestations, enabling Municipality natural resource managers to respond to these populations before they become established. Future survey work should concentrate on portals of introduction, under surveyed dispersal nodes and corridors as well as sensitive habitats. Possible locations include:

- Port of Anchorage
- Glenn Highway and Seward Highway weigh stations
- Ted Stevens International Airport
- Lake Hood Seaplane Base
- Merrill Field General Aviation Airport
- Joint Base Elmendorf-Richardson
- Railways throughout Anchorage

Also recommended are the surveys of material source areas, material storage sites (both snow and soil), spoil piles, and aquatic habitats within the Municipality. Continued monitoring of known populations within the Municipality will allow managers to quantify any changes in the size and/or behavior of existing weed populations and evaluate the effectiveness of control treatments on specific infestations.

Given that the population of *Lepidium latifolium* is highly ranked and new to Alaska; its location – the Lore Road onramp to the New Seward Highway – should be controlled as soon as conditions allow. Nearby areas should be surveyed to determine the exact extent of the population. Control and future monitoring of this location is highly recommended.

Finally, the Municipality's ever increasing collaborations with local weed management groups and outreach to the public is commendable. Thanks to coordinated efforts such as these, the locations and dangers of newly introduced invasive species, such as the *Elodea nuttallii* populations recently found in Sand DeLong and Little Campbell Lakes, are identified and publicized before their size becomes unmanageable. Given that 74% of all AKEPIC records collected within the Municipality (including this survey) are associated with roadside habitats, we believe that increased collaboration with the ADOT&PF and Municipality road maintenance crews will be invaluable for future management of non-native species within the Municipality.

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Appendices

Appendix I: Prioritized lists of non-native plant species in the Municipality of Anchorage

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	Rank
Polygonum cuspidatum	Japanese knotweed	87
Polygonum x *bohemicum*	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 jacobea	tansy ragwort	63
Cirsium vulgare	bull thistle	61
Myosotis scorpioides	true forget-me-not	54
Hypericum perforatum	St. Johnswort	52
Tragopogon dubius	yellow salsify	50
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	Rank
Phalaris arundinacea	reed canarygrass	83
Melilotus alba	white sweetclover	81
Hieracium aurantiacum	orange hawkweed	79
Cirsium arvense	Canada thistle	76
Prunus padus	European bird cherry	74
Prunus virginiana	chokecherry	74
Sonchus arvensis	field sowthistle	73
Vicia cracca	bird vetch	73
Lupinus polyphyllus	bigleaf lupine	71
Linaria vulgaris	butter and eggs	69
Melilotus officinalis	yellow sweetclover	69
Campanula rapunculoides	rampion bellflower	64
Bromus inermis	smooth brome	62
Leucanthemum vulgare	oxeye daisy	61
Tanacetum vulgare	common tansy	60
Ranunculus repens	creeping buttercup	54
Ranunculus acris	tall buttercup	54
Hieracium umbellatum	narrowleaf hawkweed	51
Silene latifolia ssp. *alba*	bladder campion	42

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	Rank
Caragana arborescens	Siberian peashrub	74
Rosa rugosa	rugosa rose	72
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	narrowleaf hawksbeard	56
Phleum pratense	timothy	54
Trifolium pratense	red clover	53
Poa pratensis	Kentucky bluegrass	52
Alopecurus pratensis	meadow foxtail	52
Rumex acetosella	sheep sorrel	51
Galeopsis bifida	splitlip hempnettle	50
Galeopsis tetrahit	brittlestem hempnettle	50
Medicago lupulina	black medic	48
Rumex crispus	curled dock	48
Tripleurospermum perforatum	scentless false mayweed	48
Poa annua	annual bluegrass	46
Polygonum aviculare	knotweed	45
Plantago major	common plantain	44
Anthemis cotula	mayweed	41
Lolium perenne ssp. *perenne*	perennial rye grass	41
Lolium perenne ssp. *multiflorum*	Italian rye grass	41
Capsella bursa-pastoris	shepherd's purse	40
Poa compressa	Canada bluegrass	39
Chenopodium album	lambsquarters	37
Cerastium fontanum	mouse-ear chickweed	36
Senecio vulgaris	common groundsel	36
Viola tricolor	johnny jumpup	34
Matricaria discoidea	pineappleweed	32
Spergula arvensis	corn spurry	32
Lepidium densiflorum	common pepperweed	25
Stellaria media	common chickweed	42/54
Bromus hordeaceus	soft brome	NR
Erucastrum gallicum	common dogmustard	NR
Erysimum cheiranthoides	wormseed wallflower	NR
Papaver rhoeas	corn poppy	NR
Polygonum lapathifolium	willow weed	NR

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	Rank
Coronilla varia	crown vetch	68
Lotus corniculatus	bird's-foot treefoil	65
Elymus sibiricus	Siberian wildrye	53
Poa trivialis	rough bluegrass	52
Leontodon autumnalis	fall dandelion	51
Polygonum convolvulus	black bindweed	50
Rumex longifolius	garden dock	48
Brassica napus	rapeseed	47
Polygonum persicaria	spotted ladysthumb	47
Sonchus asper	spiny sowthistle	46
Sonchus oleraceus	common sowthistle	46
Amaranthus retroflexus	redroot pigweed	45
Hypochaeris radicata	hairy cat's ear	44
Euphrasia nemorosa	common eyebright	42
Silene dioica	red catchfly	42
Silene latifolia	bladder campion	42
Descurainia pinnata	western tansy mustard	41
Senecio sylvaticus	woodland ragwort	41
Cerastium glomeratum	sticky chickweed	36
Veronica serpyllifolia ssp. *serpyllifolia*	thymeleaf speedwell	36
Spergularia rubra	purple sand spurry	34
Astragalus cicer	chickpea milkvetch	NR
Berteroa incana	hoary alyssum	NR
Cerastium tomentosum	snow in summer	NR
Chaenorhinum minus	dwarf snapdragon	NR
Conyza canadensis	horseweed	NR
Erodium cicutarium	redstem stork's bill	NR
Linaria pinifolia	pineneedle toadflax	NR
Lychnis chalcedonica	maltesecross	42
Papaver nudicaule	Iceland poppy	39
Phalaris canariensis	annual canarygrass	NR
Raphanus sativus	cultivated radish	NR
Sorbaria sorbifolia	false spiraea	NR
Trifolium aureum	golden clover	NR
Veronica peregrina ssp. *peregrina*	neckweed	NR

Appendix II: Field data sheet

MUNI Roads Survey Data Sheet (2011)

**Survey Date: ____/____/2011 **Observers: _____ **Required Field
mm / dd / yyyy *Last Name, First Name Initial. (e.g.: Smith, J.; Williams, R.)*

Observers Affiliation: AKNHP

A. Site Information

**
Site Code: _____ -- ___ ___ ___ Photo ID's- _____
Visit Type: Reconnaissance
Study Type: Highest priority species
** Area Surveyed: _____ (acres)
(Note: 0.002 acre = 100 ft sq)
Site Vegetation Community Description (level IV Viereck et al. 1992): _____

Disturbance Type (see instructions below):_____

B. Location Information

** Latitude: _____ (Decimal Degrees, NAD83)

** Longitude: _____ (Decimal Degrees, NAD83)

Elevation: _____ (ft)
** Collection Method: GPS
** GPS precision: _____ (ft. [*AVERAGE!*] GPS Unit: _____

Notes (location):_____
_____
_____

C. Survey Information

** Plant Species Code *(see below)*	**Infested Area (acres) *(TOTAL Infest)*	**Canopy (%) Cover *(WITHIN plot)*	Stem Count *(TOTAL Infest)*	Collected

D. Notes (species):_____
_____
_____
_____
_____

Appendix III: Street name site code abbreviations

Street Name	Code	Street Name	Code	Street Name	Code
100th Ave.	1HA	Driftwood Bay Drive	DRI	New Seward Highway	NEW
15th Ave.	15A	E Street	EST	North Post Road	NOP
36th Ave.	36A	Eagle River Loop Road	ERL	Northern Lights Boulevard	NLI
3rd Ave.	3AV	Eagle River Road	ERR	Northwood Drive	NOD
4th Ave.	4AV	Eklutna Lake Road	EKL	Northwood Street	NWO
5th Ave.	5AV	Elmore Road	ELM	Ocean Dock Road	ODR
6th Ave.	6AV	Fireweed Lane	FIR	Oceanview Drive	OCE
76th Ave.	76A	Gambell Street	GAM	Old Glenn Highway	OGH
88th Ave.	88A	Glenn Highway	GLE	Old Seward Highway	OLD
A Street	AST	Golden View Drive	GOL	O'Malley Road	OMA
Abbott Road	ABB	Hiland Road	HIR	Postmark Drive	POS
Airport Heights Drive	AIR	Hillside Drive	HIL	Potter Valley Road	POT
Arctic Boulevard	ARC	Huffman Road	HUF	Providence Drive	PRO
Baxter Road	BAX	I Street	IST	Rabbit Creek Road	RAB
Beaver Place	BEA	Ingra Street	ING	Raspberry Road	RAS
Benson Boulevard	BEN	International Airport Road	INT	Reeve Boulevard	REE
Birch Road	BIR	Jewel Lake Road	JEW	Sand Lake Road	SAN
Boniface Parkway	BON	Jodphur Street	JOD	Southport Drive	SOU
Bragaw Street	BRA	John's Road	JOH	Spenard Road	SPE
Business Boulevard	BUS	Kincaid Road	KIN	Strawberry Road	STR
C Street	CST	King Street	KNG	Tudor Road	TUD
Canyon Road	CAN	L Street	LST	Turpin Street	TUR
Clark's Road	CLA	Lake Otis Parkway	LAK	UAA Drive	UAA
Commercial Drive	COM	LaTouche Road	LAT	Victor Road	VIC
DeArmoun Road	DEA	Lore Road	LOR	West Klatt Road	WKL
DeBarr Road	DEB	Minnesota Drive	MIN	West Potter Drive	WPO
Dimond Boulevard	DIM	Mountain View Drive	MOU	West and East Loop Road	EAS
Dowling Road	DOW	Muldoon Road	MUL	Wisconsin Road	WIS

Appendix IV: Voucher list

The following table lists species collected during the 2011 survey of Municipality of Anchorage roadsides that are now curated at the University of Alaska Anchorage Herbarium (UAAH). Herbarium specimens are located at the Alaska Natural Heritage Program and are available for loan on request.

Scientific Name	Common Name	List	Rank	Number of Specimens
Achillea filipendulina	fernleaf yarrow	NA	NA	1
Achillea ptarmica	sneezeweed	NA	46	2
Astragalus robbinsii ssp. *harringtonii*	Harold's milkvetch	Native	NA	2
Astragalus cicer	chickpea milkvetch	U	NA	1
Beckmannia syzigachne	slough grass	Native	NA	3
Berteroa incana	hoary alyssum	U	NA	1
Bromus inermis ssp. *inermis*	smooth brome	B	62	3
Bromus pumpellianus var. *pumpellianus*	Pumpelly's brome	Native	NA	1
Calamagrostis stricta ssp. *inexpansa*	northern reedgrass	Native	NA	1
Campanula rapunculoides	rampion bellflower	B	64	6
Cerastium tomentosum	snow in summer	U	NA	1
Chaenorhinum minus	dwarf snapdragon	U	NA	1
Cirsium arvense	Canada thistle	B	76	1
Clematis tangutica var. *tangutica*	golden virginsbower	NA	NA	4
Coronilla varia	crownvetch	U	68	1
Dactylis glomerata	orchard grass	NA	53	1
Descurainia sophioides	northern tansymustard	Native	NA	1
Elymus sibiricus	Siberian ryegrass	U	53	2
Galeopsis bifida	splitlip hempnettle	C	50	1
Galium boreale	northern bedstraw	Native	NA	2
Hedysarum alpinum	alpine sweetvetch	Native	NA	2
Hieracium aurantiacum	orange hawkweed	B	79	1
Hieracium umbellatum	narrowleaf hawkweed	B	51	3
Hordeum vulgare	common barley	NA	39	1
Impatiens noli-tangere	touch-me-not	Native	NA	1
Lamium album	white deadnettle	NA	40	1
Lamium amplexicaule	henbit deadnettle	NA	NA	1
Leontodon autumnalis	fall dandelion	U	51	3
Lepidium latifolium	broadleaved pepperweed	NA	71	1
Leucanthemum maximum	Shasta daisy	NA	NA	1
Leucanthemum vulgare	oxeye daisy	B	61	1
Leymus mollis	American dunegrass	Native	NA	1
Linaria maroccana	Moroccan toadflax	NA	NA	1
Linaria pinifolia	pineneedle toadflax	U	NA	1
Linaria vulgaris	yellow toadflax	B	69	1
Lotus corniculatus	bird's-foot trefoil	U	65	5
Lupinus polyphyllus	bigleaf lupine	B	71	1
Medicago lupulina	black medic	C	48	1
Medicago sativa ssp. *falcata*	yellow alfalfa	A	64	4
Medicago sativa ssp. *sativa*	alfalfa	NA	59	3
Melilotus alba	white sweetclover	B	81	1

Scientific Name	Common Name	List	Rank	Number of Specimens
Melilotus officinalis	yellow sweetclover	B	69	1
Mimulus guttatus	seep monkeyflower	Native	NA	1
Myosotis asiatica	Asian forget-me-not	Native	NA	1
Myosotis scorpioides	true forget-me-not	A	54	7
Myosotis sp.		NA	NA	1
Nemophila menziesii	baby blue-eyes	NA	NA	1
Papaver croceum	Iceland poppy	U	NA	1
Phalaris arundinacea	reed canarygrass	B	83	3
Potentilla fruticosa	shrubby cinquefoil	Native	NA	1
Potentilla pensylvanica	Pennsylvania cinquefoil	Native	NA	1
Ranunculus acris	tall buttercup	B	54	6
Ranunculus macounii	Macoun's buttercup	Native	NA	1
Ranunculus repens	creeping buttercup	B	54	2
Silene latifolia	bladder campion	B	42	8
Sonchus arvensis	field sowthistle	B	73	2
Sonchus arvensis ssp. *uliginosus*	moist sowthistle	B	73	1
Sonchus asper	spiny sowthistle	U	46	1
Tanacetum vulgare	common tansy	B	60	4
Thlaspi arvense	pennycress	A	42	1
Tripleurospermum inodorum	Scentless false mayweed	C	48	1
Veronica spicata	spiked speedwell	NA	NA	2
Vicia cracca	bird vetch	B	73	1

Appendix V: Species list

The following table lists all non-native plant species documented during the 2011 Municipality of Anchorage roadside survey. Municipality prioritized list rank and invasiveness rank are also given.

Scientific Name	Common Name	Family	List	Invasiveness Rank
Achillea filipendulina	fernleaf yarrow	Asteraceae	NA	NR
Achillea ptarmica	sneezeweed	Asteraceae	NA	46
Astragalus cicer	chickpea milkvetch	Fabaceae	U	NR
Berteroa incana	hoary alyssum	Brassicaceae	U	NR
Bromus inermis ssp. *inermis*	smooth brome	Poaceae	B	62
Campanula rapunculoides	rampion bellflower	Campanulaceae	B	64
Capsella bursa-pastoris	shepherd's purse	Brassicaceae	C	40
Caragana arborescens	Siberian peashrub	Fabaceae	C	74
Centaurea montana	perennial cornflower	Asteraceae	NA	46
Cerastium fontanum	mouse-ear chickweed	Caryophyllaceae	C	36
Cerastium tomentosum	snow in summer	Caryophyllaceae	U	NR
Chaenorhinum minus	dwarf snapdragon	Scrophulariaceae	U	NR
Chenopodium album	lambsquarters	Chenopodiaceae	C	37
Cirsium arvense	Canada thistle	Asteraceae	B	76
Clematis tangutica var. *tangutica*	golden virginsbower	Ranunculaceae	NA	NR
Coronilla varia	crown vetch	Fabaceae	U	68
Crepis tectorum	narrowleaf hawksbeard	Asteraceae	C	56
Dactylis glomerata	orchard grass	Poaceae	NA	53
Elymus sibiricus	Siberian wildrye	Poaceae	U	53
Erysimum cheiri	Aegean wallflower	Brassicaceae	NA	NR
Galeopsis bifida	splitlip hempnettle	Lamiaceae	C	50
Hieracium aurantiacum	orange hawkweed	Asteraceae	B	79
Hieracium umbellatum	narrowleaf hawkweed	Asteraceae	B	51
Hordeum vulgare	common barley	Poaceae	NA	39
Lamium album	white deadnettle	Lamiaceae	NA	40
Lamium amplexicaule	henbit deadnettle	Lamiaceae	NA	NR
Leontodon autumnalis	fall dandelion	Asteraceae	U	51
Lepidium latifolium	broadleaved pepperweed	Brassicaceae	NA	71
Leucanthemum maximum	Shasta daisy	Asteraceae	NA	NR
Leucanthemum vulgare	oxeye daisy	Asteraceae	B	61
Linaria maroccana	Moroccan toadflax	Scrophulariaceae	NA	NR
Linaria pinifolia	pineneedle toadflax	Scrophulariaceae	U	NR
Linaria vulgaris	yellow toadflax	Scrophulariaceae	B	69
Lotus corniculatus	bird’s-foot trefoil	Fabaceae	U	65
Lupinus polyphyllus	bigleaf lupine	Fabaceae	B	71
Matricaria discoidea	pineappleweed	Asteraceae	C	32
Medicago lupulina	black medic	Fabaceae	C	48
Medicago sativa ssp. *falcata*	yellow alfalfa	Fabaceae	A	64
Medicago sativa ssp. *sativa*	alfalfa	Fabaceae	NA	59
Melilotus alba	white sweetclover	Fabaceae	B	81

Scientific Name	Common Name	Family	List	Invasiveness Rank
Melilotus officinalis	yellow sweetclover	Fabaceae	B	69
Myosotis scorpioides	true forget-me-not	Boraginaceae	A	54
Nemophila menziesii	baby blue-eyes	Hydrophyllaceae	NA	NR
Papaver croceum	Iceland poppy	Papaveraceae	U	39
Phalaris arundinacea	reed canarygrass	Poaceae	B	83
Plantago major var. *major*	common plantain	Plantaginaceae	C	44
Polygonum aviculare	knotweed	Polygonaceae	C	45
Prunus padus	European bird cherry	Rosaceae	B	74
Prunus virginiana	chokecherry	Rosaceae	B	74
Ranunculus acris	tall buttercup	Ranunculaceae	B	54
Ranunculus repens	creeping buttercup	Ranunculaceae	B	54
Rumex crispus	curled dock	Polygonaceae	C	48
Silene chalcedonica	maltesecross	Caryophyllaceae	U	42
Silene latifolia	bladder campion	Caryophyllaceae	B	42
Sonchus arvensis ssp. *uliginosus*	perennial sowthistle	Asteraceae	B	73
Sonchus asper	spiny sowthistle	Asteraceae	U	46
Tanacetum vulgare	common tansy	Asteraceae	B	60
Thlaspi arvense	pennycress	Brassicaceae	A	42
Trifolium hybridum	alsike clover	Fabaceae	C	57
Trifolium pratense	red clover	Fabaceae	C	53
Tripleurospermum inodorum	scentless false mayweed	Asteraceae	C	48
Veronica spicata	spiked speedwell	Scrophulariaceae	NA	NR
Vicia cracca	bird vetch	Fabaceae	B	73

Appendix VI: Outlier populations

The following table lists populations of non-native plant species that are greater than 0.1 acre and are located more than five miles from the nearest population of the same species.

Scientific Name	Common Name	Invasiveness Rank	List	Site Code	Location Information	Latitude	Longitude	Stem Count
Achillea filipendulina	fernleaf yarrow	NR	NA	DIM505.09	Southeast corner of Abbott Road and Brayton Drive	61.14437	-149.85265	6-25
Achillea ptarmica	sneezeweed	46	NA	NLI050.02	Northern Lights Boulevard turns into Point Woronzof Road, north side of road, east of chain link fence	61.19811	-149.98735	6-25
Berteroa incana	hoary alyssum	NR	U	NLI060.01	South of Northern Lights Boulevard, west of Arca Drive, trail connects road to greenbelt by bus stop 1313	61.19824	-149.82086	1-5
Bromus inermis ssp. *inermis*	smooth brome	62	B	EKL321.01	East side of Eklutna Lake Road, about 3.7 miles north of lake access parking area	61.43554	-149.22464	151-500
Campanula rapunculoides	rampion bellflower	64	B	ERL247	West side of Eagle River Loop Road, south of Eagle River	61.29558	-149.54561	6-25
Centaurea montana	perennial cornflower	46	NA	ERR279.01	South side of Eagle River Road at house #19411	61.31053	-149.52039	51-150
Cerastium tomentosum	snow in summer	NA	U	CST085.01	Stream on east side of C Street, at top soil distributor, north of 100th Ave	61.1338	-149.88528	6-25

Scientific Name	Common Name	Invasiveness Rank	List	Site Code	Location Information	Latitude	Longitude	Stem Count
Chaenorhinum minus	dwarf snapdragon	NR	U	CST073	West of C Street, north of 36th Ave, landscaped area in front of Billiard Palace	61.18906	-149.88681	1-5
Clematis tangutica var. *tangutica*	golden virginsbower	NA	NA	MIN648.01	South side of 100th Street, between Minnesota overpasses, climbing on fence	61.13029	-149.90796	51-150
Coronilla varia	crown vetch	68	U	SPE165.02	East side of Spenard Road before it joins with Minnesota, at Chester Creek Trail	61.20499	-149.90436	500+
Dactylis glomerata	orchard grass	53	NA	INT148.01	Northwest highway interchange island at International Airport Road and Minnesota	61.17329	-149.91997	26-50
Elymus sibiricus	Siberian wildrye	53	U	EKL321.01	East side of Eklutna Lake Road, about 3.7 miles north of lake access parking area	61.43554	-149.22464	6-25
Elymus sibiricus	Siberian wildrye	53	U	NLI060.01	South of Northern Lights Boulevard, west of Arca Drive, trail connects road to greenbelt by bus stop 1313	61.19869	-149.81674	1-5
Hordeum vulgare	common barley	39	NA	OLD614.04	Southeast corner of Old Seward Highway and International Airport Road, landscaped area by the Peanut Farm parking lot	61.17328	-149.86787	1-5
Lamium album	white deadnettle	40	NA	DIM508.02	Southwest island of the Dimond and New Seward Highway interchange	61.14429	-149.85727	51-150

Scientific Name	Common Name	Invasiveness Rank	List	Site Code	Location Information	Latitude	Longitude	Stem Count
Lamium amplexicaule	henbit deadnettle	NA	NA	CST145	East side of C Street, landscaped strip at 1712 A Street building	61.20501	-149.8871	6-25
Lepidium latifolium	perennial pepperweed	71	NA	NEW219.01	East side of New Seward Highway at Lore Road onramp	61.1526	-149.85541	51-150
Leucanthemum maximum	Shasta daisy	NA	NA	GLE226.05	Northwest interchange island at Glenn Highway and Muldoon Road	61.22806	-149.73389	6-25
Leucanthemum vulgare	oxeye daisy	61	B	EKL322	East side of Eklutna Lake Road, about 5.5 miles from highway	61.44117	-149.23499	6-25
Linaria maroccana	Moroccan toadflax	NA	NA	OLD617.01	East side of Old Seward Highway, north side of Campbell Creek, near Local Burgerman patio	61.17248	-149.86836	1-5
Linaria pinifolia	pineneedle toadflax	NR	U	OLD617.01	East side of Old Seward Highway, north side of Campbell Creek, near Local Burgerman patio	61.17248	-149.86836	1-5
Linaria vulgaris	butter and eggs	69	B	EKL322	East side of Eklutna Lake Road, about 5.5 miles from highway	61.44117	-149.23499	51-150
Lotus corniculatus	bird's-foot trefoil	65	U	POT043.01	West side of Potter Valley Road, about 400 ft north of intersection with Old Seward Highway	61.05544	-149.79562	500+
Lotus corniculatus	bird's-foot trefoil	65	U	RAS544.09	Northeast corner of interchange at Minnesota and Raspberry Roads, middle of triangle	61.16037	-149.91263	500+

Scientific Name	Common Name	Invasiveness Rank	List	Site Code	Location Information	Latitude	Longitude	Stem Count
Medicago sativa ssp. *falcata*	yellow alfalfa	64	A	CST078.02	Northeast side of C Street and Chester Creek	61.2036	-149.88733	1-5
Medicago sativa ssp. *falcata*	yellow alfalfa	64	A	DRI272.01	South side of Driftwood Bay Drive, across from #19701	61.30035	-149.51471	500+
Medicago sativa ssp. *falcata*	yellow alfalfa	64	A	GLE231.01	Southwest island at Glenn Highway and D St interchange	61.25208	-149.66209	51-150
Melilotus alba	white sweetclover	81	B	ERR290	North side of Eagle River Road at creek crossing, about 1 mile west of nature center	61.24527	-149.28978	6-25
Nemophila menziesii	baby blue-eyes	NA	NA	NLI067.02	South side of Northern Lights Boulevard, landscaped area east of Goose Lake Park sign	61.19823	-149.82243	26-50
Papaver croceum	Iceland poppy	NA	U	36A193	Southeast corner of 36th Ave and Macinnes Street, in David Green Park	61.1879	-149.84911	6-25
Prunus virginiana	chokecherry	74	B	DRI273	Southeast side of Driftwood Bay Drive and Meadow Park Circle	61.30006	-149.51004	6-25
Ranunculus repens	creeping buttercup	54	B	DEA020.03	North side of Upper DeArmoun, east of Patrick Road, drainage ditch under pedestrian crossing sign	61.10144	-149.73215	1-5
Silene chalcedonica	maltesecross	42	U	GLE224.03	Northeast interchange island at Glenn Highway and Bragaw Road	61.22212	-149.80612	500+

Scientific Name	Common Name	Invasiveness Rank	List	Site Code	Location Information	Latitude	Longitude	Stem Count
Sonchus arvensis	field sowthistle	73	B	GLE328.02	East side of northbound lane of Glenn Highway, south of Eagle River	61.30788	-149.57915	51-150
Sonchus arvensis ssp. *uliginosus*	moist sowthistle	73	B	GLE234.05	Northwest interchange island at Glenn Highway and Eagle River Loop Road	61.29774	-149.58952	51-150
Sonchus asper	spiny sowthistle	46	U	MIN647.01	Northeast corner of C Street and O'Malley Road interchange, between roundabout and sidewalk	61.12376	-149.88594	6-25
Tanacetum vulgare	common tansy	60	B	ERR279.01	South side of Eagle River Road at house #19411	61.31053	-149.52039	51-150
Thlaspi arvense	pennycress	42	A	DRI272	Southeast corner of Driftwood Bay and Driftwood Bay Drive	61.30266	-149.53752	1-5
Thlaspi arvense	pennycress	42	A	OGH306.01	East side of Old Glenn Highway, about 150 ft north of Lutheran Church	61.38717	-149.48468	500+
Veronica spicata	spiked speedwell	NA	NA	NLI050.01	North side of Northern Lights Boulevard, west end of Earthquake Park, old landscaped area	61.19775	-149.98013	151-500
Veronica spicata	spiked speedwell	NA	NA	NLI060.01	South of Northern Lights Boulevard, west of Arca Drive, trail connects road to greenbelt by bus stop 1313	61.19824	-149.82086	1-5

Appendix VII: Species biographies

The following species biographies summarize the biology, ecological impacts, known distribution and potential control methods for the non-native species detected in this survey that merit management. Manual, mechanical, chemical, cultural or biological control methods are recommended based on the species' invasiveness, distribution, or outlier or sensitive area location. Chemical control is often an essential part of integrated vegetation management, but specific recommendations on the type, rate and timing of herbicide application are beyond the expertise of AKNHP. A certified pesticide applicator should be enlisted for treatment of the species and populations for which chemical treatment is the only effective option.

The descriptions included herein were developed with the intention that information for a single species (e.g., the target species for an organized weed pull) or subset of species could be removed, copied and brought into the field by weed management crews. The mechanical control recommendations presented are based on management practices shown to be effective in similar ecogeographic regions and on invasive species control research conducted in Alaska. Integrated vegetation management should consider all non-native plant species present at a location and their relative abundances. More detailed biographies can be found for ranked non-native species at the AKEPIC website (http://aknhp.uaa.alaska.edu/botany/akepic/non-native-plant-species-biographies/).

Astragalus cicer (chickpea milkvetch; NR; U-list)

Species Biography

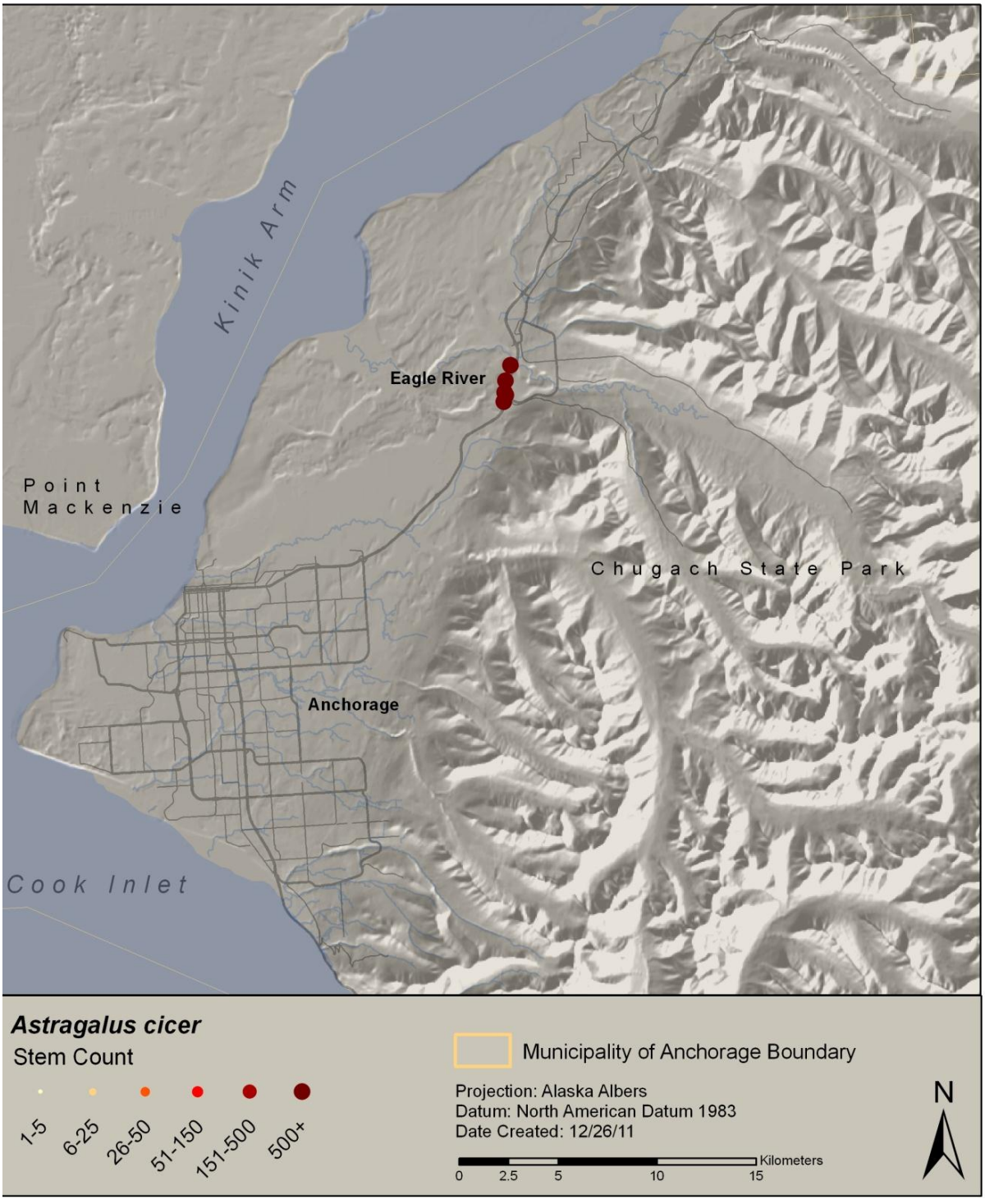
Astragalus cicer is native to open woods, forest margins, hedges, ditches and stream banks of Europe. It was introduced to the United States in the 1920s to undergo research regarding its suitability as a forage crop (Tilley et al. 2008) and today is widely cultivated for hay and as a forage crop. The plant can spread by seed but also vegetatively, producing a short taproot and creeping rhizomes that allow the plant to extend up to 120 cm (47 inches) in diameter (Government of Alberta 2011). Although *Astragalus cicer* is common in moist habitats in Europe, it has established in the in dry climates of the western United States. This species tolerates varied soil types, including clay, silt, loam, and coarse calcareous soils, but does best on moderately coarse substrates with a pH range of 6-8.1; it does not tolerate deep sand. Plants do well on disturbed sites, and are able to fix atmospheric nitrogen (Tilley et al. 2008).

***Astragalus cicer* flowers, leaves and seed pods**

Control Methods

Control and management recommendations are not presently available for this species.

Distribution



Distribution map of plots at which *Astragalus cicer* (chickpea milkvetch; NR; U-list) was recorded within the Municipality of Anchorage, Alaska.

Berteroa incana (hoary alyssum; NR; U-list)

Species Biography

Berteroa incana

Berteroa incana is native to east-central Europe and western Asia. It was first noted in North America in the late 1800s, and by the 1960s could be commonly found on rangelands, pastures, and in forage crops. This species was likely introduced to western states as a contaminant in alfalfa and clover seed, and likely continues to be transported long distances as a contaminant of lawn seed, forage, and hay. Seeds may also be dispersed by machinery, mowers, and contaminated gravel and soil; given the small size of seeds, it is possible they are also moved by wind and water (Jacobs and Mangold 2008). Currently, *B. incana* is considered a noxious weed in British Columbia, Minnesota and Washington, and it is included on the noxious seed list of Michigan (Invaders Database 2010).

This plant is naturally adapted to temperate climates and is resistant to summer drought. In North America it invades roads, trails, railroads, gravel, lake and stream banks, vacant lots, farmyards, lawns, hay meadows, and overgrazed rangeland and pastures. It does best on open, disturbed, dry sites, and thrives on gravel and sand with limited nutrients. It is commonly found on limestone and calcareous substrate, and less often in acidic soils (Jacobs and Mangold 2008).

Continuous production of flowers and fruits, along with tolerance to drought, allow *B. incana* to outcompete native plants and reduce biodiversity. It establishes a seed bank which can remain dormant yet viable for several years. Additionally, this plant attracts very few pollinating insects and consequently can cause a reduction in the richness of pollinator communities (Jacobs and Mangold 2008).

Control Methods

Control options include the following:

Manual: Hand pulling is a viable option for small or new infestations, scattered plants, or where individuals persist after treated with herbicide. Pulling is only effective if the root crown is removed, and repeat treatments will be needed as new plants will emerge from the seed bed (Jacobs and Mangold 2008).

Mechanical: Mowing is generally not effective and may instead contribute to seed distribution. However, repeated mowing to below six inches can potentially decrease seed production if used in combination with nutrient management and irrigation to selectively improve the health of desired plants. Soil amendments will decrease site suitability for *B. incana*, as it favors poor soils and dry locations (Jacobs and Mangold

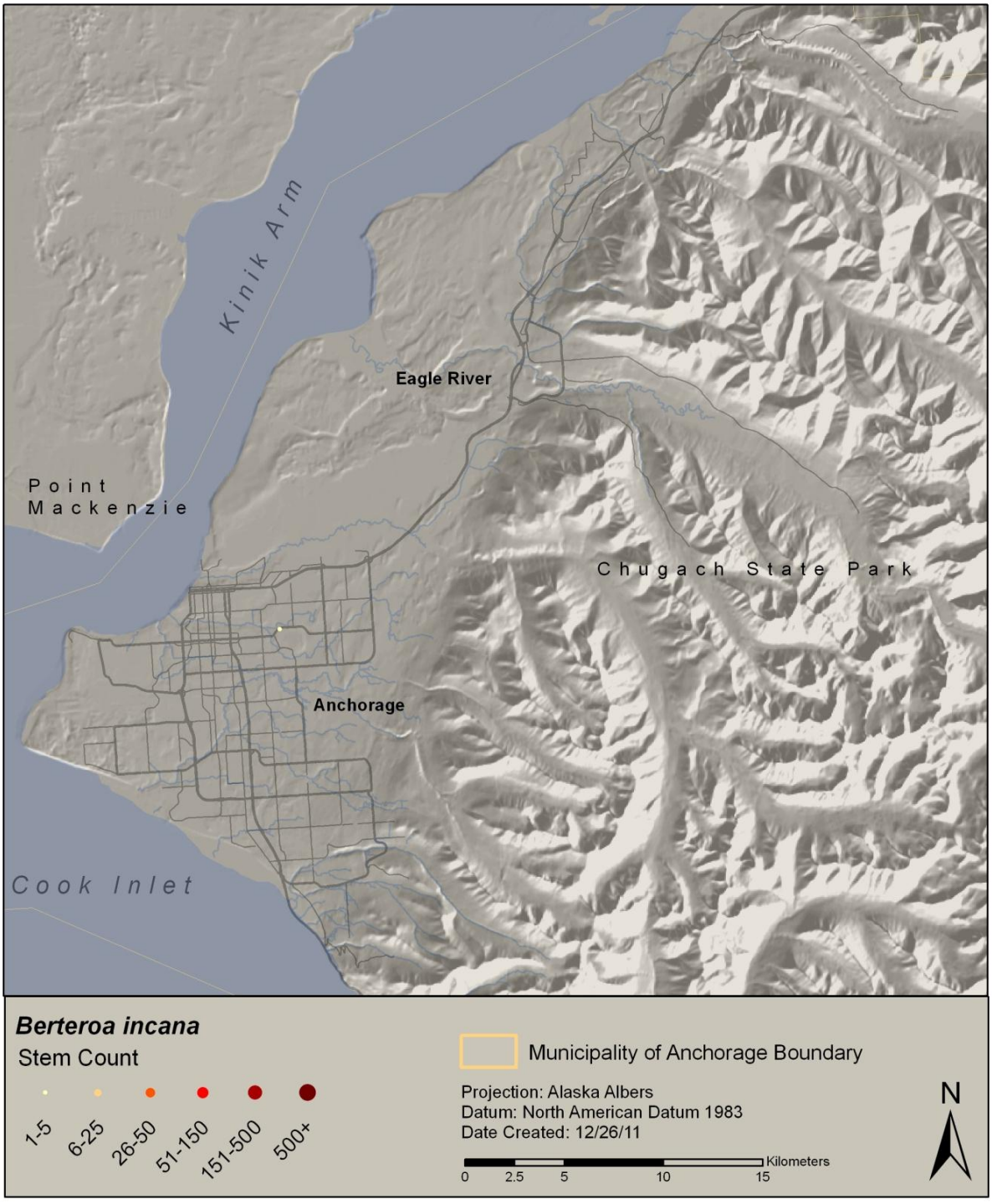
2008). Severing the tap root below the root crown with tilling is effective, but the associated soil disturbance will stimulate new plant growth from the seed bank. Tilling and subsequent herbicide application may be effective in decreasing the seed bank (Jacobs and Mangold 2008).

Chemical: Herbicides are most effective when applied in the spring, while plants are growing but before they produce seed. Repeat applications are needed as new shoots emerge from the seed bank (Jacobs and Mangold 2008).

Biological: There are no biological control methods known for this species. The effects of controlled grazing have not been fully studied, although it is known that overgrazing promotes *B. incana*, and it is toxic to horses if it constitutes more than 30% of their diet (Jacobs and Mangold 2008).

Revegetation is important in any invasive plant management plan, and any *B. incana* removal efforts should be followed with planting or seeding competitive perennial and native species.

Distribution



Distribution map of plots at which *Berteroa incana* (hoary alyssum; NR; U-list) was recorded within the Municipality of Anchorage, Alaska.

Bromus inermis ssp. *inermis* (smooth brome; 62; B-list)

Species Biography

Bromus inermis* ssp. *inermis

Bromus inermis ssp. *inermis* is an perennial grass that reproduces sexually by seeds and vegetatively by rhizomes. Seeds generally remain viable in the soil for 2-10 years (AKEPIC 2005). This species can establish in undisturbed or lightly disturbed, moist, loamy soils, is fire-tolerant, and winter-hardy, even in interior Alaska (AKEPIC 2005).

Bromus inermis ssp. *inermis* was imported into the United States in the late 1800s as a forage grass and for hay production. In Alaska, it has been widely planted for erosion control in roadside revegetation projects (AKEPIC 2005), and is also dispersed as a contaminant in top soil (Densmore et al. 2001).

In the contiguous United States, it colonizes degraded prairies, roadsides, ditches, and moist wooded areas (Minnesota DNR 2003). In Alaska it forms dense stands that exclude native species and consequently may inhibit natural successional processes (AKEPIC 2005, Cortés-Burns pers. obs.).

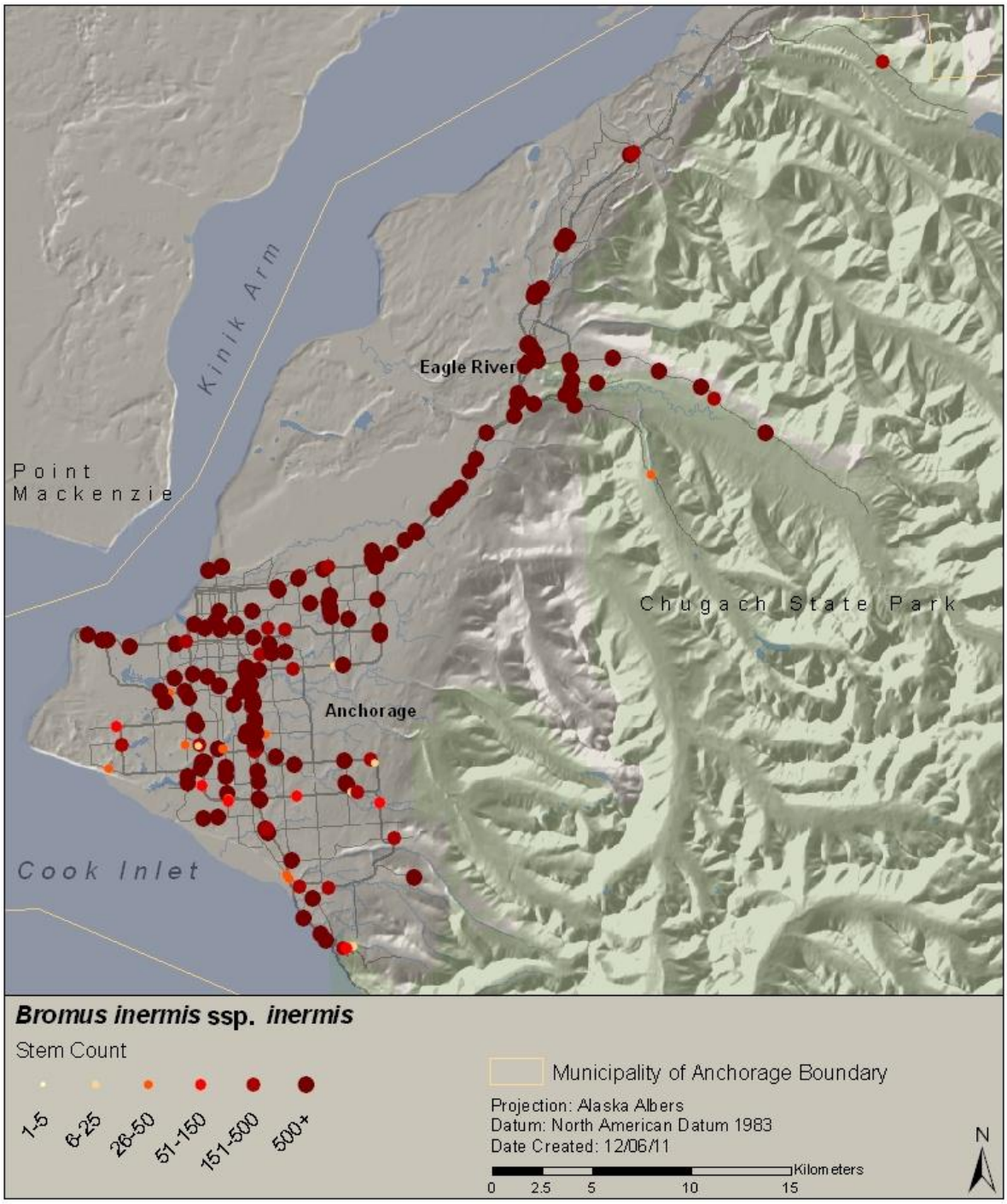
Control Methods

Bromus inermis ssp. *inermis* flowers in mid to late June and seed matures in August (Howard 1996, Sather 1987). If only one mowing is feasible, it should be timed to cut plants when the flowering head is still enclosed in the sheath (referred to as the boot stage) and plants are 46 to 61 cm (18 to 24 in) tall. Cutting at this stage will prevent the maturation of seed and will injure the plant when resources have been allocated to the aboveground portions of the plant and before tiller buds are fully developed. Evidence also shows that plants cut once in the boot stage are just as affected as plants cut three times later in the growing season; likely because removing apical meristems before tiller buds were fully developed slows recovery. If more resources are available, mowing should be repeated four times during the growing season, as repeat cutting will keep stored carbohydrate levels at lower than normal levels and increase mortality. Cutting plants cut close to the ground (3.5 cm, 1.4 in) is recommended to cause greater injury; however it is expected that this practice would also discourage the growth of native grasses. After cutting, the root mass remaining in the soil may produce an allelopathic substance that inhibits further development of remaining plant roots (Sather 1987).

Control recommendations for *Bromus inermis* ssp. *inermis* in Alaska are summarized in the following (Seefeldt 2007).

	Human-disturbed, naturally-disturbed, and unaltered sites
Small infestation (<50 stems)	• Hand-weed or cut before the inflorescence can be felt at the tip of the elongating stem • Repeat monthly during the growing season for up to 4 years
Large infestation (>50 stems)	• Cut or mow before the inflorescence can be felt at the tip of the elongating stem • Repeat monthly during the growing season for up to 4 years

Distribution



Distribution map of plots at which *Bromus inermis* ssp. *inermis* (smooth brome; 62; B-list) was recorded within the Municipality of Anchorage, Alaska.

Campanula rapunculoides (rampion bellflower; 64; B-list)

Species Biography

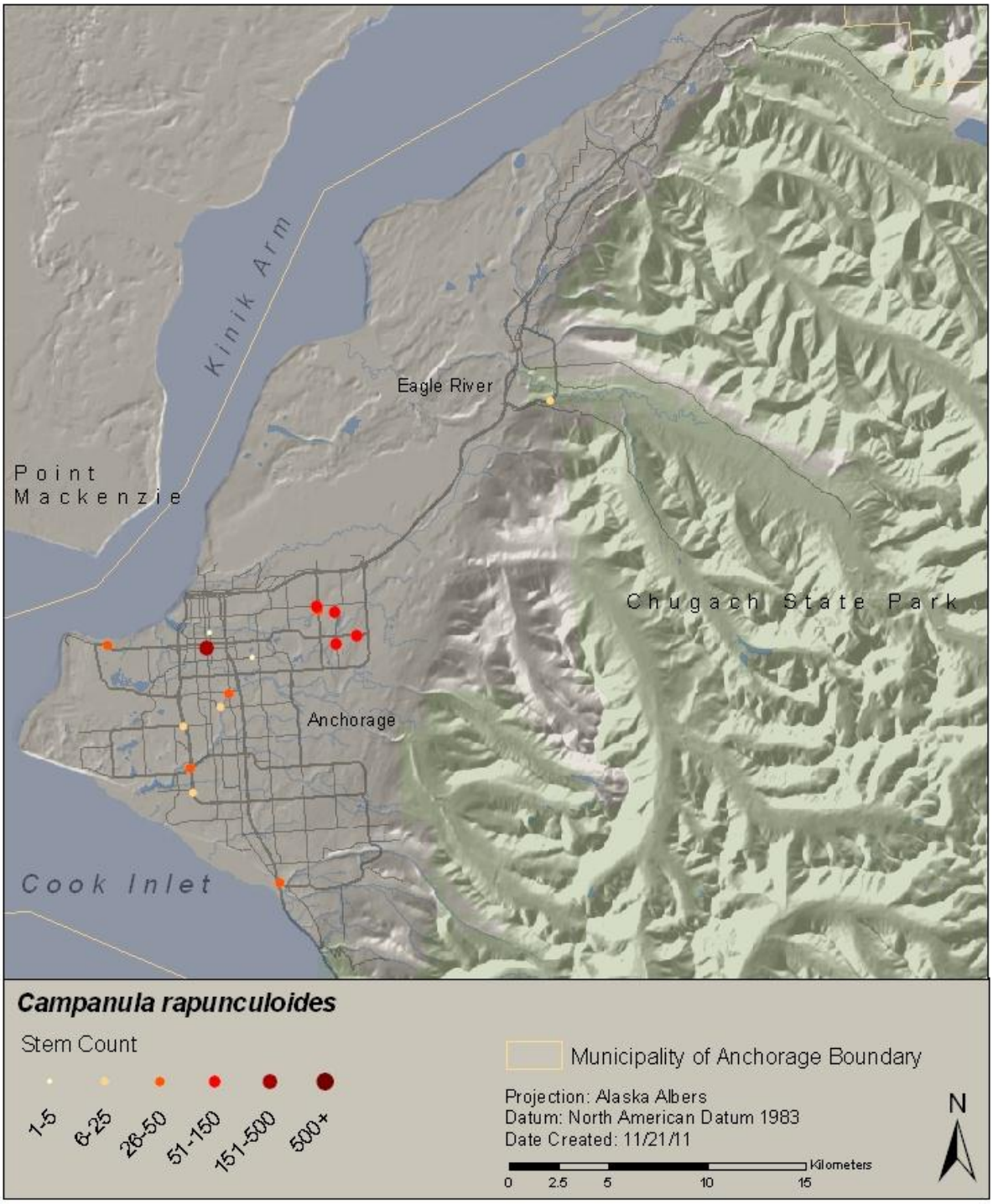
Campanula rapunculoides is native to Eurasia and was introduced into Alaska as an ornamental, mainly in wildflower seed mixes. As its common name suggests, this species reproduces sexually by seeds and vegetatively by rhizomes. Its impact on native ecosystems has yet to be determined, although it is likely to reduce soil moisture and nutrients (Royer and Dickinson 1999). This non-native species is of potentially high concern, as it appears to be invading forest edges, meadows, gardens and lawns, and disturbed areas and roadsides in Ontario and Newfoundland (Canadian Wildlife Federation, undated). In Alaska, it also escapes gardens and is common along roadsides, alleys, and trails in Anchorage, where it may reduce available habitat for native forbs.

Campanula rapunculoides

Control Methods

Small infestations of *Campanula rapunculoides* appear to respond well to digging. Care should be taken to remove all belowground parts, as plants are able to regenerate from rhizome fragments.

Distribution



Distribution map of plots at which *Campanula rapunculoides* (rampion bellflower; 64; B-list) was recorded within the Municipality of Anchorage, Alaska.

Chaenorhinum minus (dwarf snapdragon; 62; U-list)

Species Biography

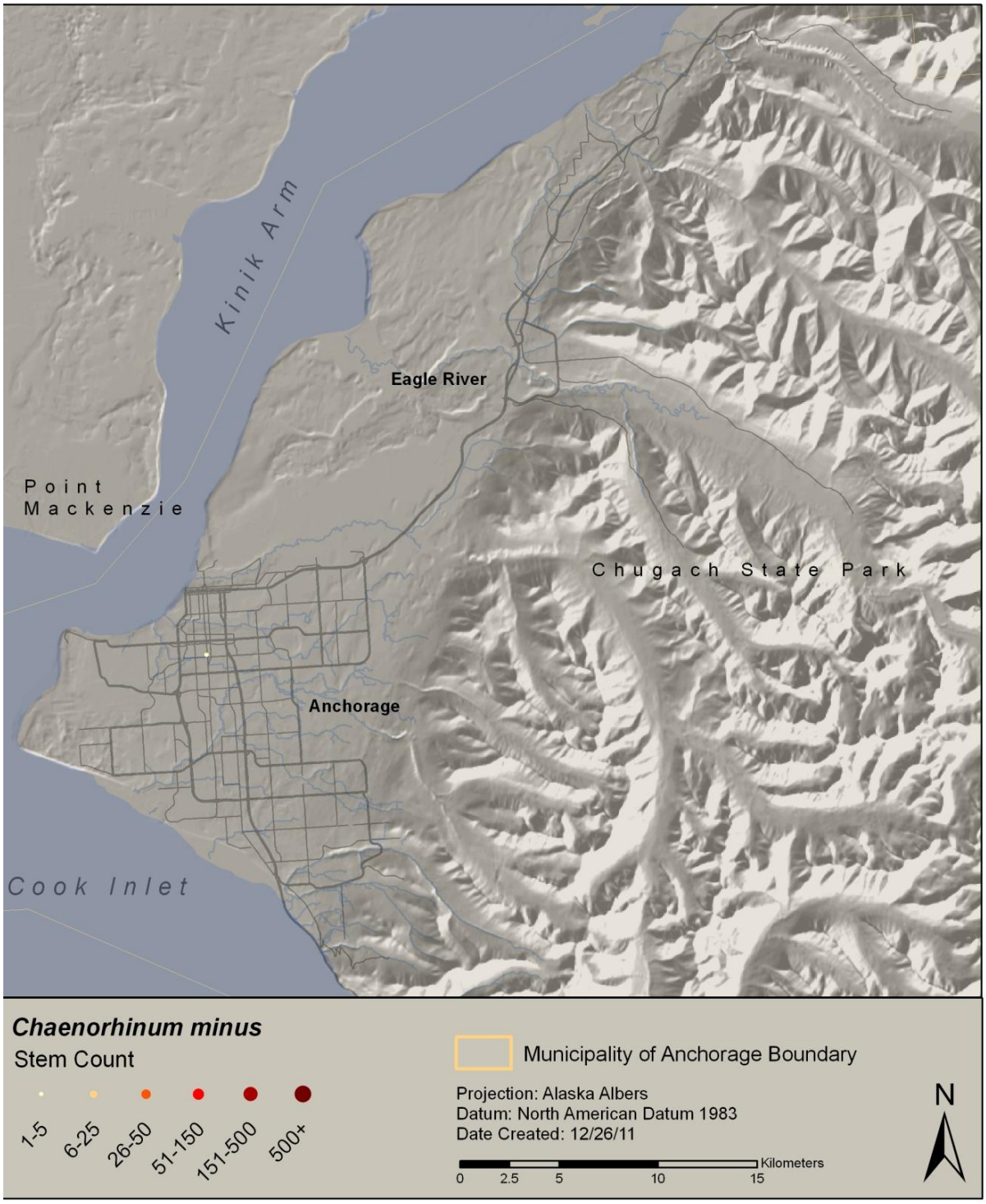
This plant is native to Asia and Europe (USDA 2011). In Washington State its seed is considered noxious. It grows in waste areas, along railroads and roadsides, disturbed soils, gravel, sand and gravel bars in streams (Weldy and Werier 2012).

Chaenorhinum minus © Louis-M. Landry

Control Methods

Control methods are not presently available for this species.

Distribution



Distribution map of plots at which *Chaenorhinum minus* (dwarf snapdragon; 62; U-list) was recorded within the Municipality of Anchorage, Alaska.

Cirsium arvense (Canada thistle; 76; B-list)

Species Biography

Cirsium arvense

Despite its common name, Canada thistle is native to Eurasia (Jacobs et al. 2006). This species was introduced to North America from Europe in the 1600s as a contaminant of grain seed, and within a century was listed as noxious by several eastern states. *Cirsium arvense* is a highly invasive perennial able to reproduce both sexually and vegetatively. Seeds can remain viable in the soil for up to 20 years and new plants are able to generate from the root system or root fragments (Graziano 2011, Minnesota DNR 2003).

This species displaces natural vegetation by competing for moisture, light, and nutrients; it releases allelopathic compounds that are toxic to other species, attracts pollinators away from native wildflowers, and is known to harbor other insect pest species (AKEPIC 2005, VDCR 2006). Higher concentrations of CO_2 increase growth rates and herbicide resistance of *Cirsium arvense*, potentially making future control in a changing climate more difficult (Ziska 2002, Ziska 2004).

In the contiguous United States, *Cirsium arvense* grows in most soils and prefers full sun. It is found in open disturbed areas such as roadsides, ditch banks and pastures but will also invade natural barrens, glades, savannas, meadows, sedge meadows, swamps, woodlands, shores and dunes. Once established, this species spreads quickly through horizontal root growth, which can elongate 5.5 m (18 ft) in one season, and produce new shoots every 7.5 to 15 cm (3 to 6 in; Minnesota DNR 2003, VDCR 2006). It has been declared a noxious weed in 35 states and is one of the most tenacious agricultural weeds in North America (USDA, NRCS 2011). In Canada, this species is known to flower mid-June to September. Plants have a longer blooming period in more northern locations, such as Alaska (Zouhar 2001).

Control Methods

Eradication of *Cirsium arvense* usually takes persistent control over several years. Spread primarily occurs through vegetative expansion and to a lesser extent by seed. Consequently, the most effective control actions will integrate multiple treatment methods to target both reproductive strategies of the plant and gradually exhaust root system reserves (Graziano 2011, Jacobs et al. 2006, Nuzzo 1997). Whenever possible seedlings that have not yet developed perennial root systems (less than three weeks old) should be targeted (Zouhar 2001). Mature plants should be treated at the early bud stage when carbohydrate reserves are at their lowest. Viable seeds can be produced even after the plant is cut, so if mowing occurs after some flowers have opened, then

plant debris will need to be removed from the treatment site (Nuzzo 1997, Zouhar 2001). For any treated area, laying sod or seeding with competitive native species that can provide dense cover early in the spring is recommended.

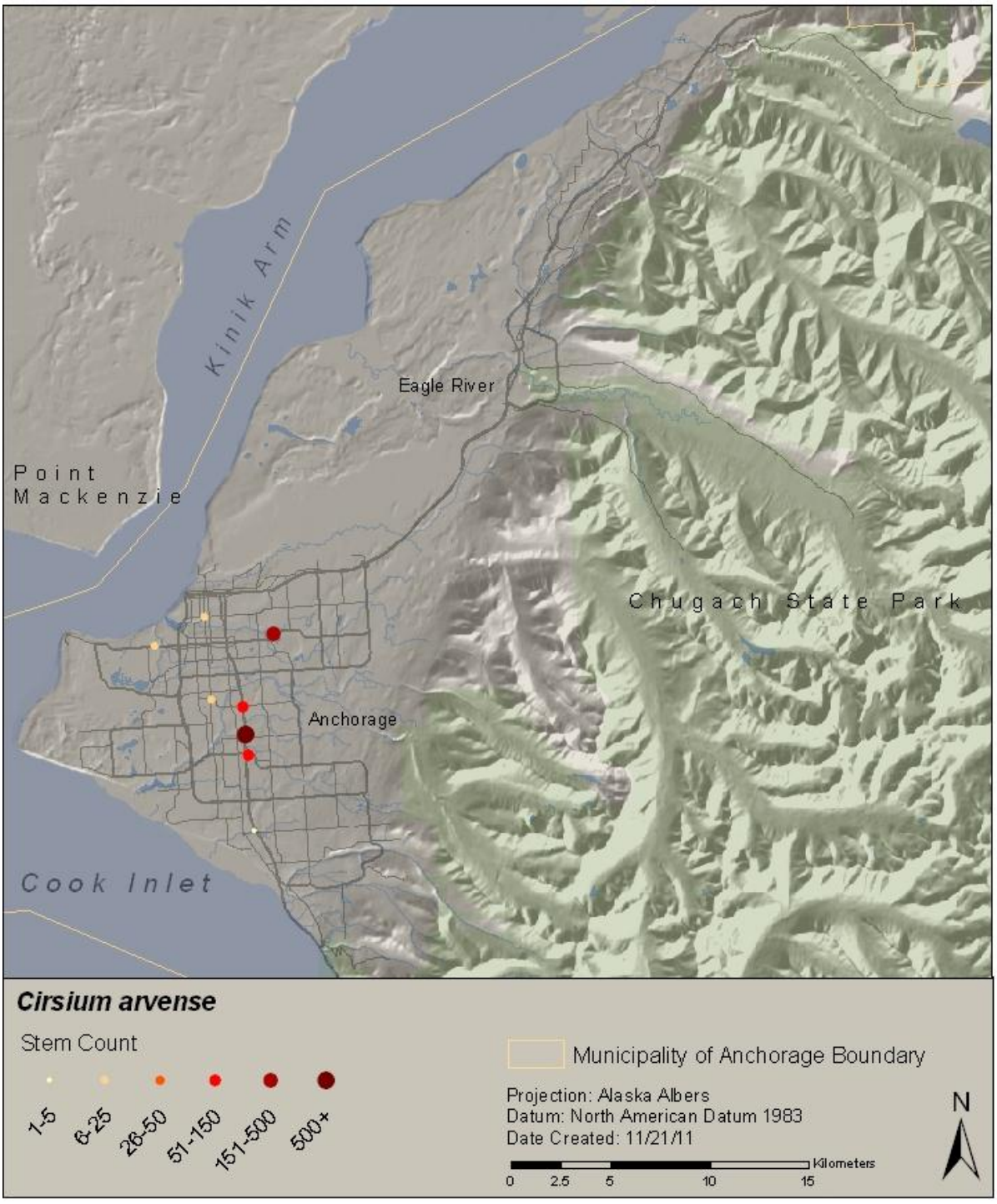
Manual: For small infestations, pulling, hand-cutting or mowing can be effective if repeated several times each season. In general, hand pulling alone will not be effective and should be combined with other treatments. Covering populations with a light-blocking yet water-permeable material may be effective. Fabric should extend several feet past the visible edge of the population, or herbicide should be applied around the edges. Note that tarping stream banks can destabilize soil by killing all vegetation (Graziano 2011). It typically takes two to three years of smothering to kill *Cirsium arvense* (Neil Diboll Prairie Nursery, undated).

Mechanical: Mowing can temporarily decrease aboveground biomass, and should be repeated monthly for up to four years to be maximally effective. If monthly mowing is not feasible, mowing three times a year, in June, August, and September can be effective. Mowing twice a year, in mid-June and again in September will contain and potentially weaken infestations (Nuzzo 1997). Alternatively, mowing in early spring when root reserves are lowest may result in the greatest reduction of the population. Mowing must be done when flower buds are just about to open as this will starve the root system and prevent seed set. In Minnesota, mowing around June 21 prevented re-growth during that year (Jacobs et al. 2006). For mowing to be practical, *Cirsium arvense* should be present at a high density or the surrounding vegetation should be grass species that will not be damaged by mowing (Graziano 2011). When mowing, blades should be set high enough to leave at least nine leaves per stem, or at least 20 cm (8 in) of bare stem tissue to avoid stimulating root growth (Nuzzo 1997).

Biological: Stem weevil, bud weevil and stem gall fly are commercially available for the biocontrol of *Cirsium arvense*. However, in North America biocontrol is largely ineffective because the life cycles of *Cirsium arvense* and biological control agents are not synchronized, causing damage to plants but not mortality. In Alaska, biological controls may affect native *Cirsium* species, so they are not appropriate in regions of southeast Alaska where native *C. edule* or *C. foliosum* exist (Graziano 2011). For biological control to be a viable option the plant infestation needs to be larger than 1 acre, uniform, dense, contiguous, and isolated from human disturbance that could cause unintentional transportation (Winston 2008). Grazing animals are impractical for control of *Cirsium arvense*.

Chemical: In southcentral Alaska, an application of a systemic herbicide in September is most effective, given that *Cirsium arvense* continues photosynthesizing after most native vegetation has senesced. Frost will increase the effectiveness of herbicides because cold temperatures promote translocation to the plants' roots. Chemical treatment is most effective when preceded by multiple mowings. Where mowing is not practical, it is preferable to instead apply herbicides in early spring and again in the fall (Graziano 2011).

Distribution



Distribution map of plots at which *Cirsium arvense* (Canada thistle; 76; B-list) was recorded within the Municipality of Anchorage, Alaska.

Clematis tangutica* var. *tangutica (golden virginsbower; NR; not listed)

Species Biography

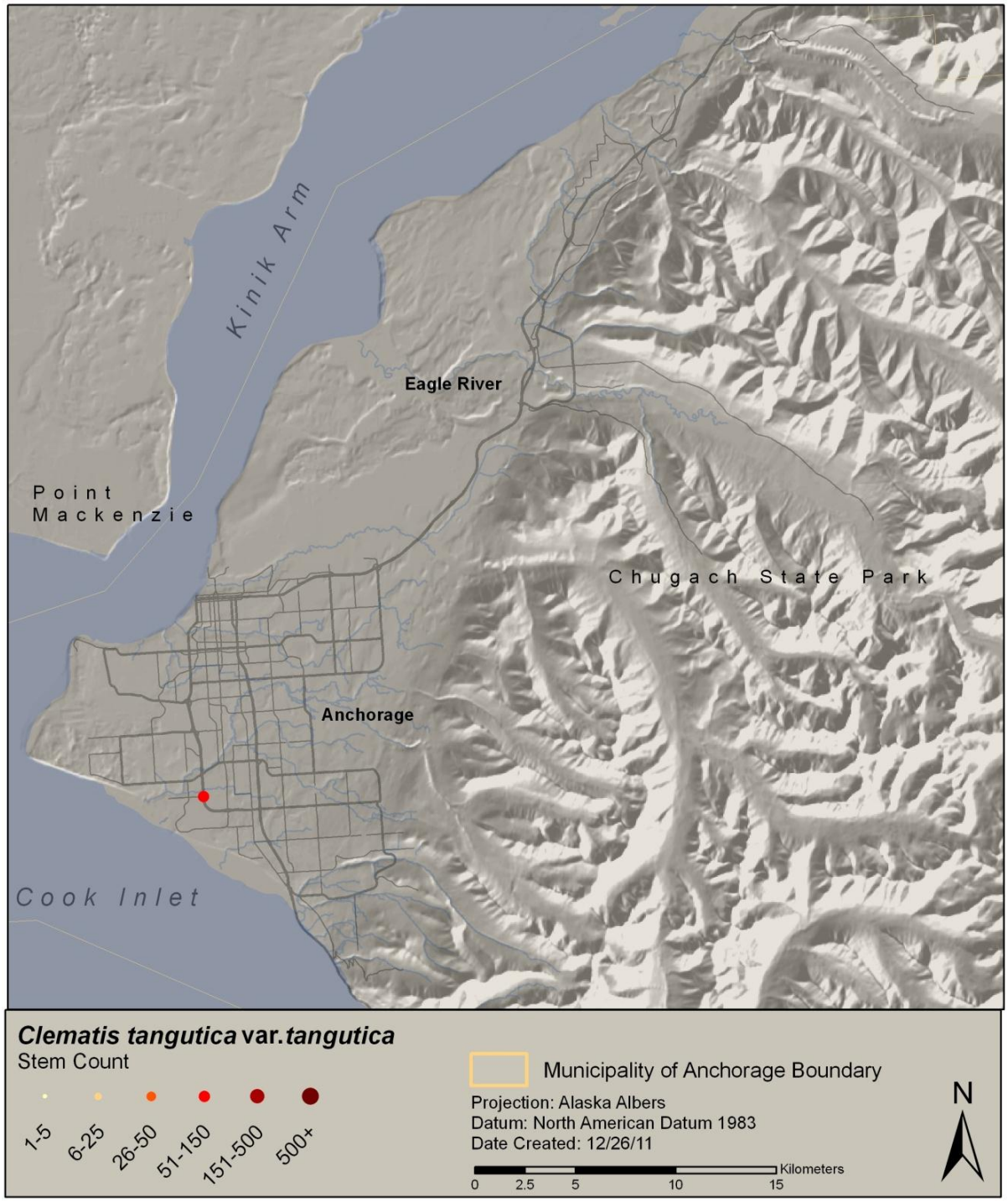
Clematis tangutica* var. *tangutica

Clematis tangutica var. *tangutica* is native to high mountains in Asia and is considered a noxious weed in parts of Canada. It reproduces vegetatively from stem pieces and also by seed. Seeds are attached to long, silky hairs that enable easy dispersal by wind or water. The plant produces a long tap root, climbs over trees and shrubs, and is very aggressive once established. Naturally adapted to high elevations (1300-5400 m; 4265-17,716 ft), this species thrives in steppe and montane zones in full sun, but also tolerates poor soils, drought, cold, and partial shading. It is found along roadsides and other disturbed sites, grassy areas, open woodland and thickets (AIPC 2011).

Control Methods

A combination of mechanical and chemical methods is likely most effective in the control of *Clematis tangutica* var. *tangutica*. Hand pulling should occur before seeds are produced, and repeat treatments are likely necessary to remove any resprouts. Plants can reproduce from stem parts, so plants should be carefully transported and disposed. Herbicides have been effective on young shoots and flowering plants but are ineffective on mature plants with woody stems. Depending on the type of herbicide selected, application should occur in early spring or late fall. The most effective method of control for mature plants is to pull the woody stems, and as much other material as possible, and follow up with either continued hand pulling or herbicide application to any regrowth. There are no known biological control methods for this species (AIPC 2011).

Distribution



Distribution map of plots at which *Clematis tangutica* var. *tangutica* (golden virginsbower; NR; not-listed) was recorded within the Municipality of Anchorage, Alaska.

Coronilla varia (crown vetch; 68; U-list)

Species Biography

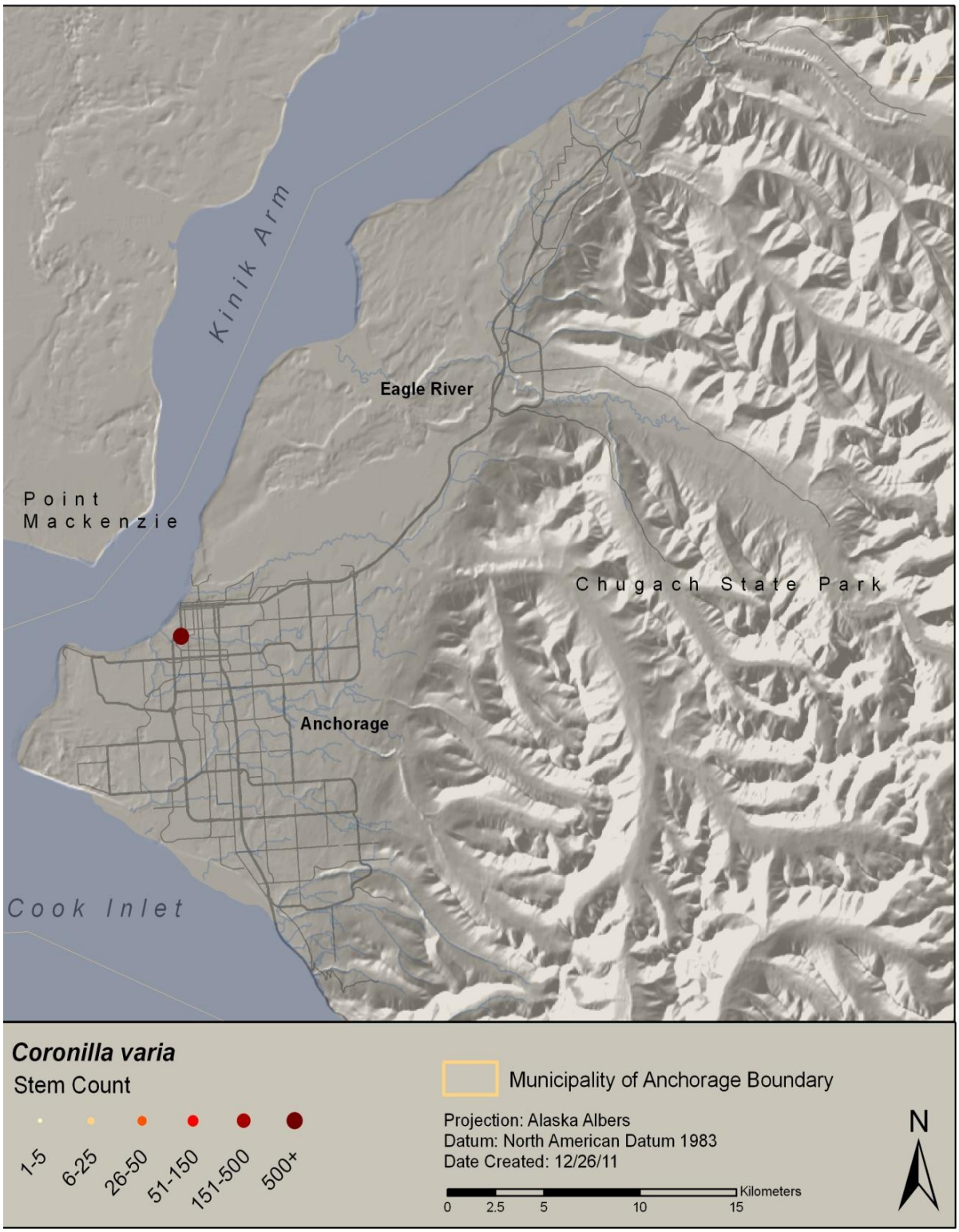
Coronilla varia

Coronilla varia is native to the Mediterranean region of Europe and southwest Asia and is now present in all states except North Dakota. (Landcare Research 2011, Tu 2003). *Coronilla varia* is a perennial plant that is able to reproduce sexually by seeds and vegetatively by rhizomes (Losure et al. 2009). Seed production is usually low (Gucker 2009), but the number of seeds produced per plant has not been quantified. Plants can regenerate from rhizome fragments and stem fragments that contain at least one node. *Coronilla varia* is intolerant of shade and can climb over shrubs to outshade underlying vegetation (Tu 2003). However, populations in Alaska have not been observed to climb (M. Rasy pers. comm.). As a member of the pea family, *Coronilla varia* is able to fix atmospheric nitrogen, which alters the natural nutrient status of the soil in favor of other native ruderal and non-native weedy species (AKEPIC 2005).

Control Methods

Herbicide application is the most effective method for control. However, tarping with light-blocking material or manual removal may eradicate small populations (Gucker 2009, Tu 2003). Mowing several times per growing season is thought to prevent the spread of *Coronilla varia*. Regardless of method, control measures will likely need to be repeated for several years. Controlled sites should be monitored, as plants can regenerate from rhizome fragments (Losure et al. 2009, Tu 2003).

Distribution



Distribution map of plots at which *Coronilla varia* (crown vetch; 68; U-list) was recorded within the Municipality of Anchorage, Alaska.

Dactylis glomerata (orchard grass; 53; not listed)

Species Biography

Dactylis glomerata is a strongly tufted, perennial grass. *Dactylis glomerata* reproduces sexually by seeds and vegetatively by tillering (Beddows 1957). Dense stands of *Dactylis glomerata* may suppress the growth of native shrubs (Anderson and Brooks 1975). Establishment of this species is usually associated with human disturbances (Williamson and Harrison 2002), but it is also known to invade undisturbed coastal prairie grasslands (Corbin et al. 2004). *Dactylis glomerata* is native to Europe. and has been listed as a noxious species in New Jersey and Virginia.

***Dactylis glomerata* against and alder leaf**

Control Methods

Mechanical methods do not effectively control *Dactylis glomerata*. Infestations can be controlled by numerous available herbicides (Rutledge and McLendon 1996).

Distribution

Distribution map of plots at which *Dactylis glomerata* (orchard grass; 53; not listed) was recorded within the Municipality of Anchorage, Alaska.

Hieracium aurantiacum (orange hawkweed; 79; B-list)

Species Biography

Native to the mountains of northern and central Europe, *Hieracium aurantiacum* was first introduced in North America in 1875 as a garden plant (North Dakota Department of Agriculture 2003). *Hieracium aurantiacum* is a very effective invader because it can reproduce sexually by seed and vegetatively by both stolons and rhizomes. In Alaska, *Hieracium aurantiacum* flowers from mid-July to October. Seeds are able to germinate immediately after being shed from the parent plant and remain viable for up to seven years (Stone 2010). Additionally, new plants emerge every year from rhizomes and stolons, and a single plant can produce four to eight stolons annually.

Hieracium aurantiacum

Using these various reproductive strategies, this species is able to colonize an area and quickly form large, dense mats of basal rosettes that exclude native vegetation (North Dakota Department of Agriculture 2003). It is commonly observed invading clear cuts, meadows, forest openings, and roadsides. *Hieracium aurantiacum* also impacts ecological processes by releasing allelopathic compounds and by reducing soil moisture and nutrient availability (AKEPIC 2005). In Alaska, this is one of the few non-native plant species that is able to establish in organic soils and at high elevations (L. Flagstad pers. comm.). In the contiguous United States this highly aggressive plant has been listed as noxious by a number of states including Idaho, Minnesota, Colorado, Oregon, Washington, and Montana (USDA, NRCS 2009).

Control Methods

This species is particularly difficult to remove, because disturbance to populations can increase plant growth from fragmented rhizomes, stolons, and roots

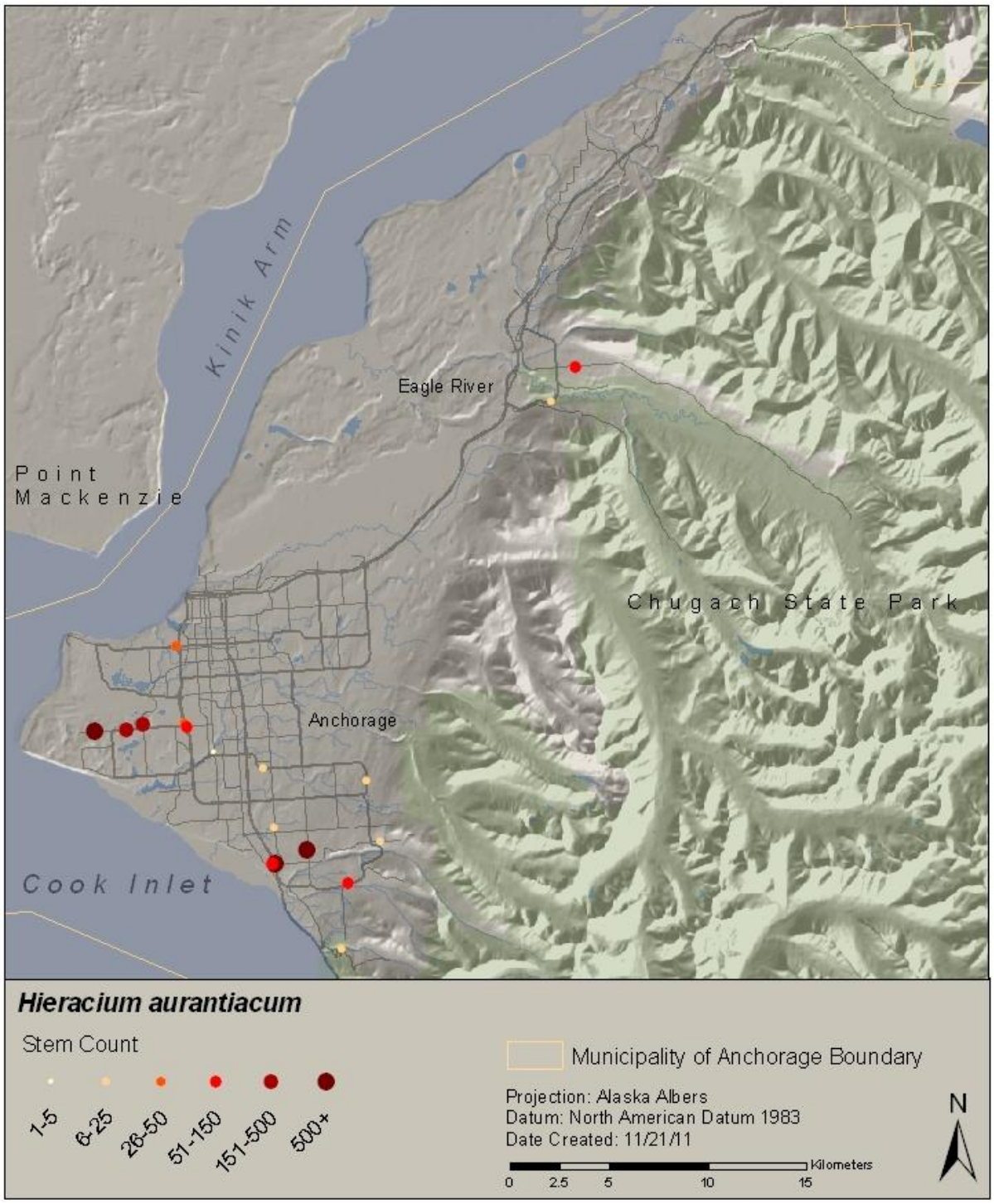
Control trials conducted by Seefeldt and Carr (2007) in Talkeetna, Alaska indicate that hand pulling is not an effective method to control this species, mainly because of the difficulty of removing all underground parts. However, attempts at manual control may still be preferable to no control efforts at all. When hand pulling, plants should be removed early in the growing season while they are still in the rosette stage. If plants are found in flower, the inflorescence should be cut, bagged, and incinerated, as hawkweeds can form viable seeds after they are cut or removed from the soil (King County Noxious Weed Control Program 2005).

Mowing can potentially limit or prevent seed production, but will not remove rosettes. Additionally, mowing may promote vegetative spread and flowering (Stone 2010, Van Vleet 2009).

One method of control that has met with some success is annual tillage used in conjunction with herbicide applications (Stone 2010). Several herbicides are effective for controlling this species, and in the absence of tillage, it is recommended that herbicide be applied to basal rosettes (Van Vleet 2009).

Most seed is produced and vegetative reproduction occurs on the edge of populations, opposed to dense infestation centers. For this reason, control efforts should target edges and outliers as much as the primary mass of an infestation (Stone 2010).Regardless of control method, treated sites should be revisited throughout the summer to control resprouts and should be monitored at least seven years to ensure exhaustion of the seed bank.

Distribution



Distribution map of plots at which *Hieracium aurantiacum* (orange hawkweed; 79; B-list) was recorded within the Municipality of Anchorage, Alaska.

Lepidium latifolium (broadleaved pepperweed; 71; not listed)

Species Biography

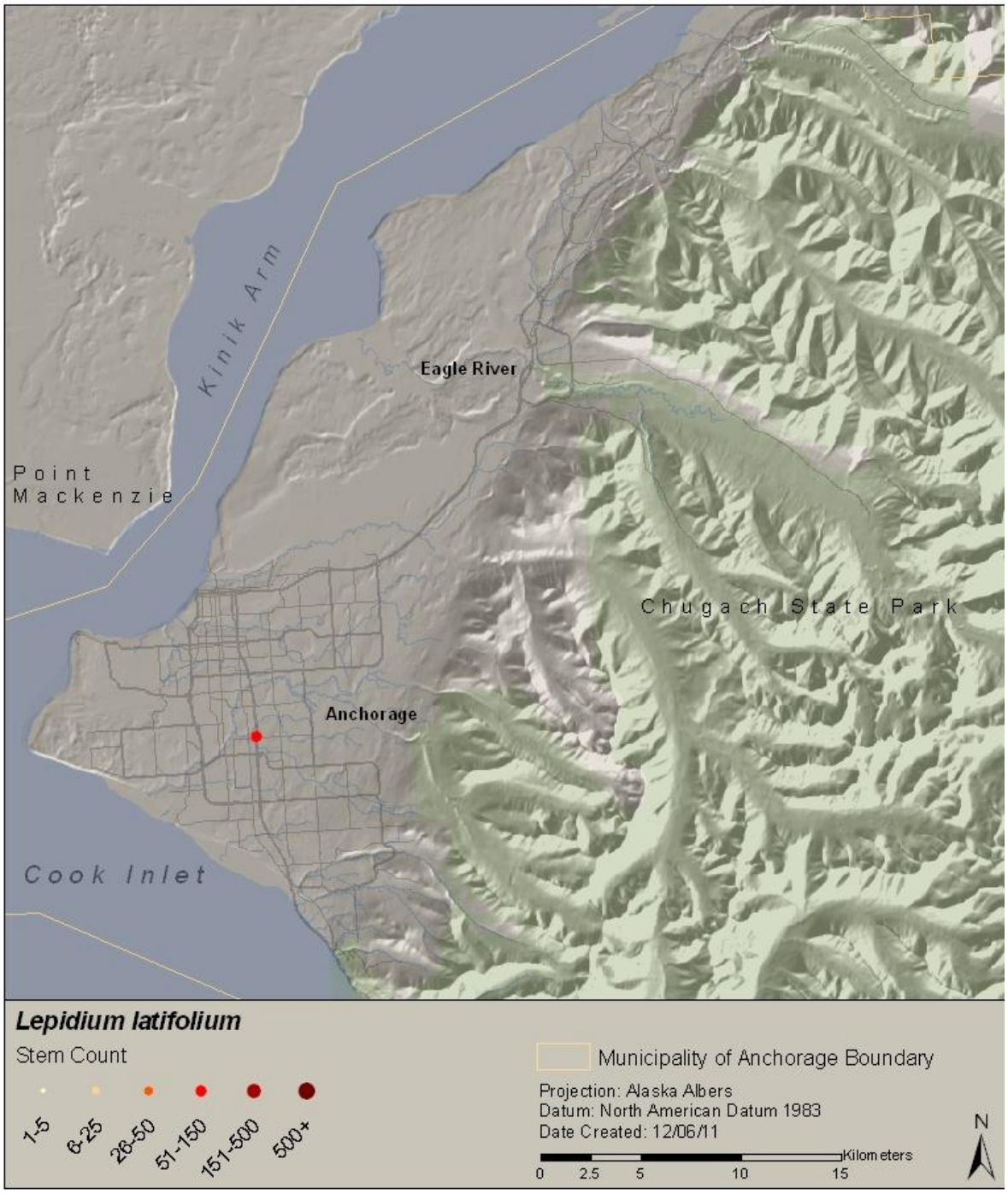
Lepidium latifolium is native to southeastern Europe and southwestern Asia. *Lepidium latifolium* reproduces sexually by seeds and vegetatively from intact root systems or fragments. Each plant is capable of producing thousands of seeds per year (Howald 2000, Renz 2000). *Lepidium latifolium* creates large, monospecific stands that displace native plants and animals (Corliss 1993, Renz 2000). Stands of this species increase the salt content of surrounding soil, which favors halophytes and eliminates other species. *Lepidium latifolium* is a noxious weed in Alaska, British Columbia, California, Colorado, Hawaii, Idaho, Indiana, Montana, Nevada, New Mexico, Oregon, South Dakota, Utah, Washington, and Wyoming (USDA, NRCS 2009).

Lepidium latifolium (photo by Mel Harte)

Control Methods

Once established, *Lepidium latifolium* can be very difficult to remove. Mechanical methods are unlikely to control *Lepidium latifolium* because new plants quickly regenerate from root fragments. Chemical methods have been used successfully. No biological control agents have been introduced to control *Lepidium latifolium*, because there are several important cultivated crops in the Brassicaceae family as well as several threatened and endangered, native *Lepidium* species in the United States. Old stems and litter take several years to degrade. It may be necessary to remove the litter to allow the germination and establishment of desirable native plant species. If soil salinities are dramatically increased by *Lepidium latifolium*, an intensive soil remediation program may be necessary before native species can reestablish. Controlled areas must be monitored as this species can regenerate from dormant root fragments (Howald 2000, Renz 2000).

Distribution



Distribution map of plots at which *Lepidium latifolium* (broadleaved pepperweed; 71; not listed) was recorded within the Municipality of Anchorage, Alaska.

Leucanthemum vulgare (oxeye daisy; 61; B-list)

L. maximum (Shasta daisy; NR; not listed)

These two *Leucanthemum* species share similar biological and ecological attributes. We describe the species separately but combine the discussion of their management.

Species Biographies

Leucanthemum vulgare is native to Europe (Polunin 1969) and was likely introduced to North America as an ornamental early in the twentieth century (Alvarez 2000). This visually appealing plant was brought into Alaska as a garden plant, and is often sold commercially in wildflower seed mixes. Unfortunately, *Leucanthemum vulgare* easily escapes cultivation and has invaded fields, roadsides, and disturbed areas, where it forms dense colonies that reduce the diversity and abundance of native species (AKEPIC 2005).

This short-lived perennial flowers in its second year and reproduces vegetatively by rhizomes and sexually by seed (Griswold 1985). Seeds can remain viable for up to 60 years, developing large seed banks (Chippindale and Milton 1934). Although seeds have no special adaptations for dispersal; water, human and animal traffic, and earth-moving machinery can carry seeds into new areas (Alvarez 2000).

Leucanthemum vulgare **flower and spoon-shaped leaves**

Leucanthemum maximum **showing lance-shaped leaves. Photo from zauberstaud.de**

Leucanthemum vulgare can grow in a wide range of environmental conditions and flourishes in nutrient poor soils. This species is also a host for several viral diseases affecting crops, including the yellow dwarf virus of potatoes (Parsons 1992). *Leucanthemum maximum* cultivars number in the dozens and may persist from abandoned plantings or escape cultivation (DiTomasso and Healy 2007, Strother 2006). *Leucanthemum vulgare*

can be differentiated from *L. maximum* by the length and shape of its leaves; *L. vulgare* has spoon-shaped leaves that are less than 10 cm long, whereas *L. maximum* has lance-shaped leaves up to 20 cm long.

Control Methods

Leucanthemum vulgare and *L. maximum* are especially difficult to control or eradicate due to the long viability of their seed, their capacity to form large seed banks, and their ability to resprout from rhizomes. A combination of hand removal and mulching has provided successful control of *Leucanthemum vulgare* (Alvarez 2000).

Manual: Hand-pull small infestations (less than 0.25 acres) taking care to remove all rhizomes as plants can regenerate from fragments (Bossard et al. 2000). Plants should be pulled before they produce seed; root systems tend to be shallow (Heutte et al. undated, Van Vleet 2009).

Mulching: Heavy mulching has been found to be the most successful non-chemical method for the removal of larger infestations. Mature and immature plants can be killed through the application of thick, compacted mulch (Alvarez 2000). If live plants are found under the straw, or light is able to reach the soil, then another layer of mulch should be applied before flowering. Hand pulling is recommended along edges that are difficult to mulch (Alvarez 2000).

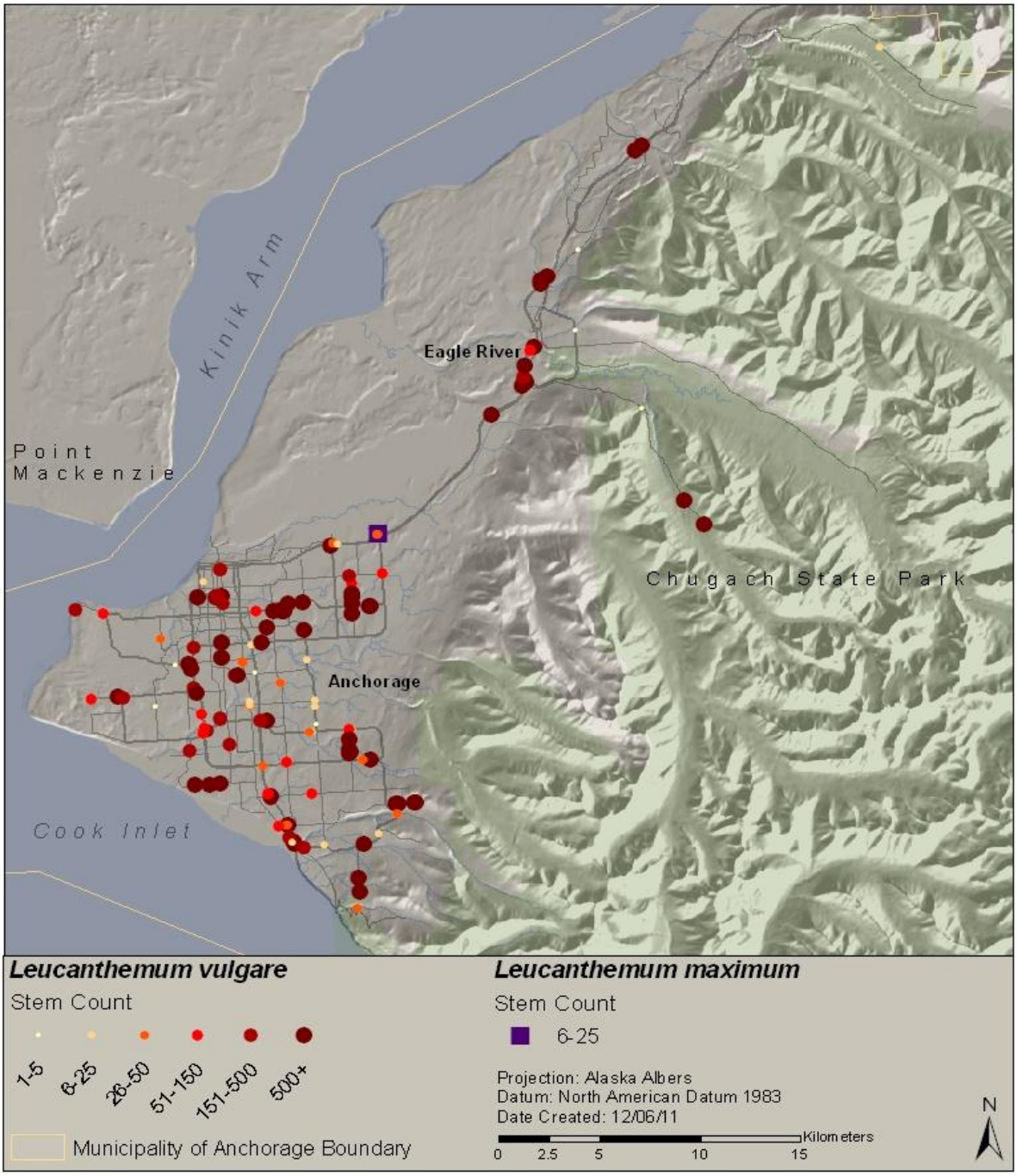
Mowing: Mowing is not recommended. Although mowing can prevent the production of seed, it also stimulates shoot production and establishment (Van Vleet 2009).

Chemical: Herbicides should be applied before flowering. Applying nitrogen fertilizer can be equally as effective as applying herbicide (Van Vleet 2009).

Control recommendations for *Leucanthemum vulgare* in Alaska are summarized in the following (Seefeldt 2007):

	Human-disturbed sites	**Naturally-disturbed and unaltered sites**
Small or large infestations	• Start control one month after snow melts. • Count plants. Cut or bag flowering heads, dig out plants and rosettes removing as much of the roots as possible. • Scout area for new plants. • Revisit once a month. • Alternatively, spot spray plants with an appropriate herbicide. • Visit the site each year and repeat herbicide application or hand weed • Monitor for up to 5 years	• Start control one month after snow melts • Count plants. Cut or bag flowering heads, dig out plants and rosettes removing as much of the roots as possible. • Scout area for new plants • Revisit once a month. • Encourage growth of native species by fertilizing or seeding with perennial native grasses • Monitor for up to 5 years

Distribution



Distribution map of plots at which *Leucanthemum vulgare* (oxeye daisy; 61; B-list) and *L. maximum* (Shasta daisy; NR; not listed) were recorded within the Municipality of Anchorage, Alaska.

Linaria pinifolia (pineneedle toadflax; NR; U-list)

Species Biography

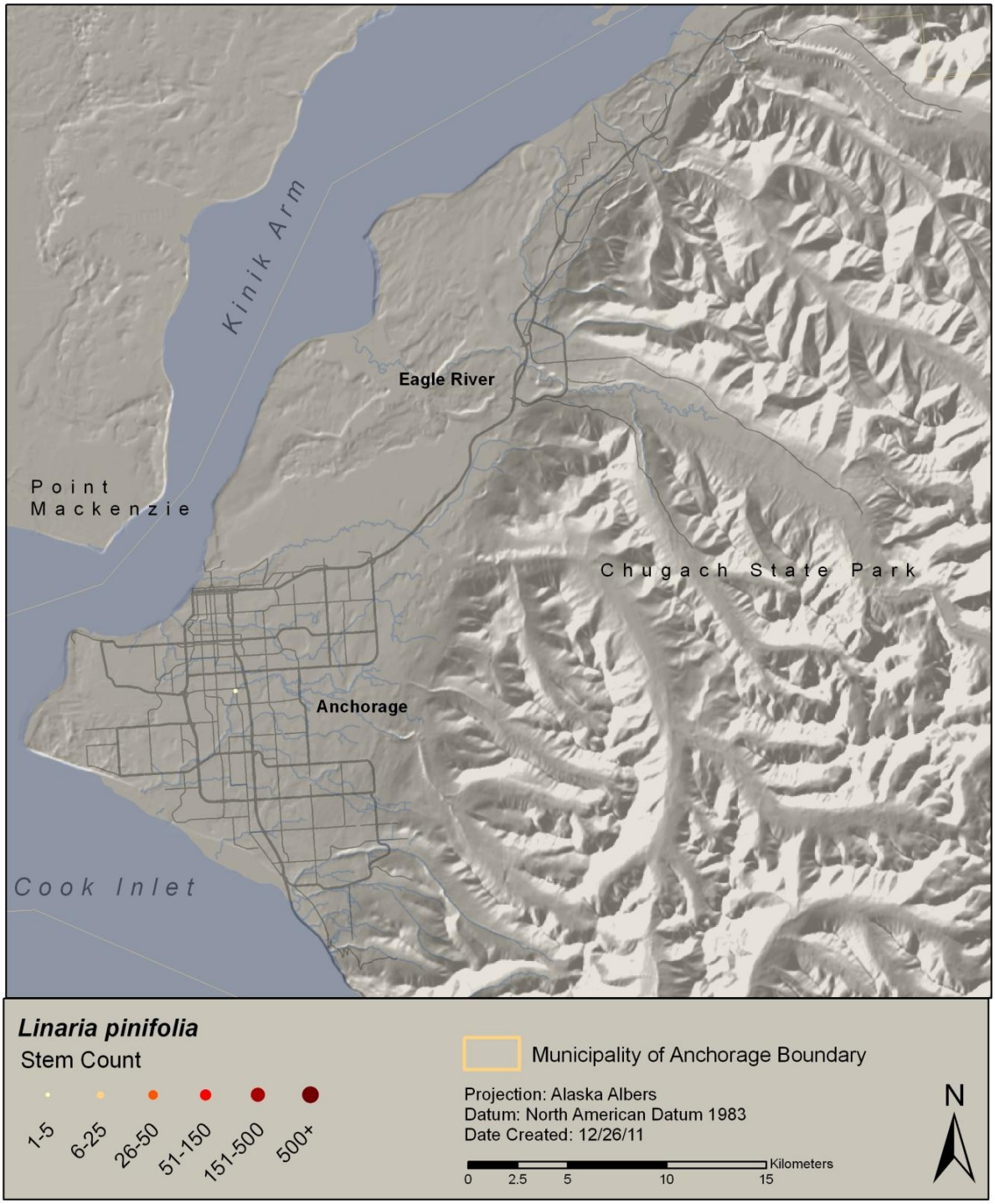
This annual forb is native to Africa and in North America is an occasional garden escapee. Life history traits are not well documented, but it does not appear to be particularly aggressive outside of its natural range.

Linaria pinifolia © Louis-M. Landry

Control Methods

Control methods are not presently available for this species.

Distribution



Distribution map of plots at which *Linaria pinifolia* (pineneedle toadflax; NR; U-list) was recorded within the Municipality of Anchorage, Alaska.

Linaria vulgaris (butter and eggs; 61; B-list)

Species Biography

Linaria vulgaris is a short-lived perennial native to the steppes of southeastern Europe and southwestern Asia (Jacobs and Sing 2006). It was introduced in North America as an ornamental in the mid-1600s (Holdorf, undated) and was likely sold in Alaska as a garden plant. This species is an aggressive invader due to its high seed production and tenacious vegetative reproduction from rhizomes and root fragments. Seeds remain viable for 8-10 years. Once established in an area, it quickly spreads, forming large colonies that displace native vegetation. Plants contain poisonous glycosides that can be toxic to livestock. It is commonly found in disturbed areas but has also colonized alpine meadows in some of the contiguous United Sates. This species is a designated noxious weed in Idaho, Montana, Nevada, New Mexico, Oregon, South Dakota, Washington, and Wyoming (USDA, NRCS 2009).

Linaria vulgaris

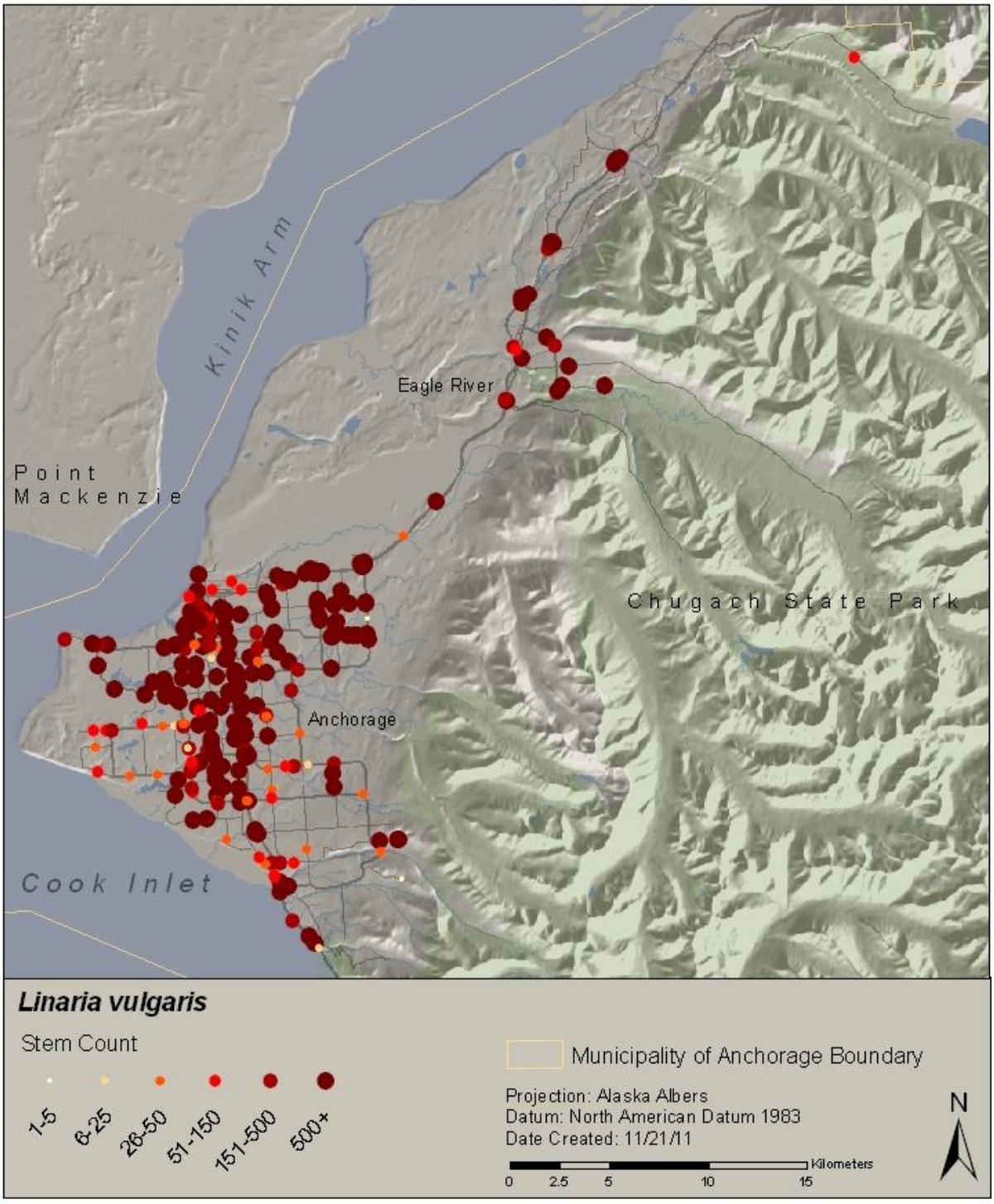
Control Methods

Linaria vulgaris flowers for three to six weeks from mid-June to September (Epps 1971, Wilke and Irwin 2010). Seeds are produced in the late summer and can be dispersed throughout the fall and winter. Mowing after flowering but before seed set can contain infestations, but will also stimulate growth from rhizomes and lateral roots. Herbicides can also provide effective control. When treating sites, care should be taken not to disturb soil, as new plants can establish from root fragments. Treated areas should be revegetated with perennial grasses, which may be able to outcompete *Linaria vulgaris* (GISD 2007).

Control recommendations for *Linaria vulgaris* in Alaska are summarized in the following (Seefeldt 2007):

	Human and naturally-disturbed sites
Small or large infestations	• Start control one month after snow melts • Count and dig up plants collecting as much of the rhizome as possible; scout area for new plants • Revisit once a month • Encourage growth of native species by fertilizing or seeding with native, perennial grasses • Alternatively, spray plants with herbicide before flower initiation and revisit monthly • Visit the site each year and repeat herbicide application or hand weed

Distribution



Distribution map of plots at which *Linaria vulgaris* (butter and eggs; 69; B-list) was recorded within the Municipality of Anchorage, Alaska.

Lotus corniculatus (bird's-foot trefoil; 65; U-list)

Species Biography

Lotus corniculatus

Lotus corniculatus is native to Eurasia and North Africa (DiTomaso and Healy 2007, Jones and Turkington 1986). This short-lived perennial plant grows for two to four years. It forms a deep taproot; secondary roots spread laterally and can produce new shoots. It also reproduces sexually by seed (DiTomaso and Healy 2007, Jones and Turkington 1986). This species can form dense mats (Turkington and Franko 1980) that outshade surrounding vegetation (Winter and Yalch 1996) and likely increase the density of vegetation in disturbed areas. As a member of the pea family, it is able to fix atmospheric nitrogen, which alters the natural nutrient status of the soil in favor of other non-native and native weedy species (AKEPIC 2005). *Lotus corniculatus* has not been declared noxious by any state.

This species' flowering period is indeterminate, with flowering occurring over an extended period from June through September. Seed set occurs throughout the summer. Seeds are released one to two weeks after ripening, when pods turn from green to brown (Dzyubenko and Dzyubenko 2009).

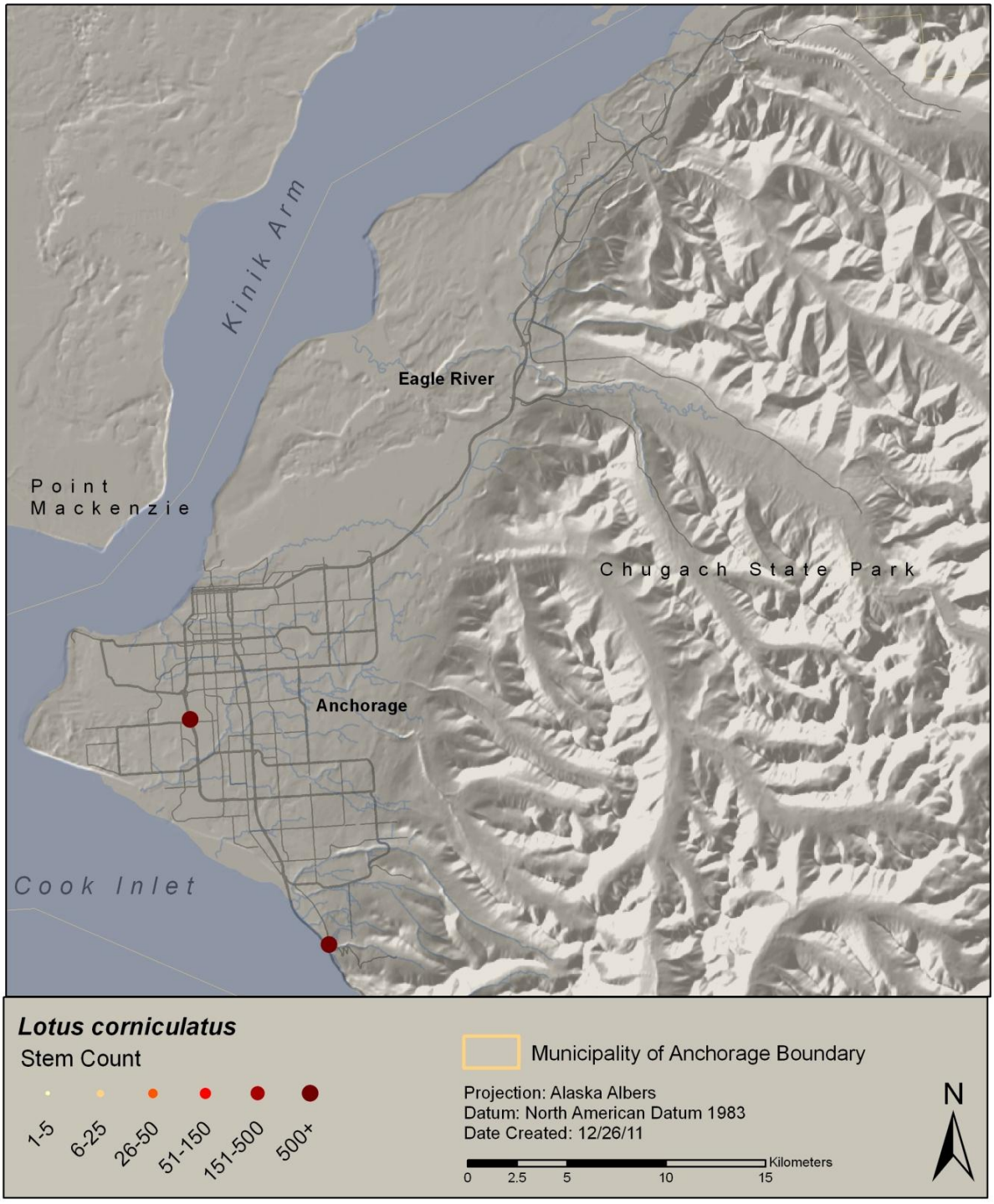
Control Methods

Hand pulling or digging small populations appears to be effective, as plants that were removed by digging in 2006 along the Dalton Highway were not found again in 2007 (Cortés-Burns et al. 2008). Removing plants manually can be difficult because of the stout roots. Digging of larger populations may need to be repeated for several years to provide effective control (DeVelice pers. comm.). Some varieties have developed herbicide resistance (Turkington and Franko 1980).

Control recommendations for *Lotus corniculatus* in Alaska are summarized in the following (Seefeldt 2007):

	Human and naturally-disturbed sites
small infestations	• Visit early in the growing season. • Count the plants and hand weed to remove as much of the roots as possible. • Revisit once a month. • Scout the area for new plants. • Encourage growth of native plants by fertilizing or seeding with native grasses.

Distribution



Distribution map of plots at which *Lotus corniculatus* (bird's-foot trefoil; 65; U-list) was recorded within the Municipality of Anchorage, Alaska.

Medicago sativa* ssp. *falcata (yellow alfalfa; 64; A-list)

Medicago sativa* ssp. *sativa (alfalfa; 59; not listed)

These two *Medicago sativa* subspecies share similar biological and ecological attributes. We describe the species separately but combine the discussion of their management.

Species Biography

Native to Southwestern Asia, *Medicago* species have been widely cultivated in North America for erosion control, habitat restoration and as a nectar source for honey bees (McLean et al. 1981, Royer and Dickinson 1999). The utility of these species has likely contributed to their spread. These taprooted, long-lived perennials can persist for up to 10 years (Bagavathiannan et al. 2010). They reproduce primarily by seed, with the average number of seeds produced by a single plant documented at 5,320 (Bagavathiannan and Van Acker 2009, Stevens 1932). Seeds can remain viable in the soil for 20 years (Lewis 2006). It also spreads vegetatively, particularly when cut. *Medicago* shoots are indeterminate, continually producing reproductive and vegetative parts (Bagavathiannan and Van Acker 2009). As a member of the pea family, it is able to fix atmospheric nitrogen, which alters the natural nutrient status of the soil in favor of other non-native and weedy native species (AKEPIC 2005). Plants are generally associated with disturbed ground and may also persist after cultivation on ranch lands. In Alaska, these subspecies are not well-adapted for cultivation (J. Conn pers. comm., Hitchcock and Cronquist 1973, Hultén 1968, Royer and Dickenson 1999). They have not been declared noxious in any state.

***Medicago sativa* ssp. *falcata* flowers (left) and sickle-shaped pods (right)** © Thomas Schoepke

***Medicago sativa* ssp. *sativa* flowers and spirally-coiled seed pods** (http://www.tropicalforages.info)

The two subspecies of *Medicago sativa* can be easily distinguished. *M. sativa* ssp. falcata has yellow flowers and sickle-shaped pods, whereas *M. sativa* ssp. *sativa* has purple flowers and spirally-coiled pods

Control Methods

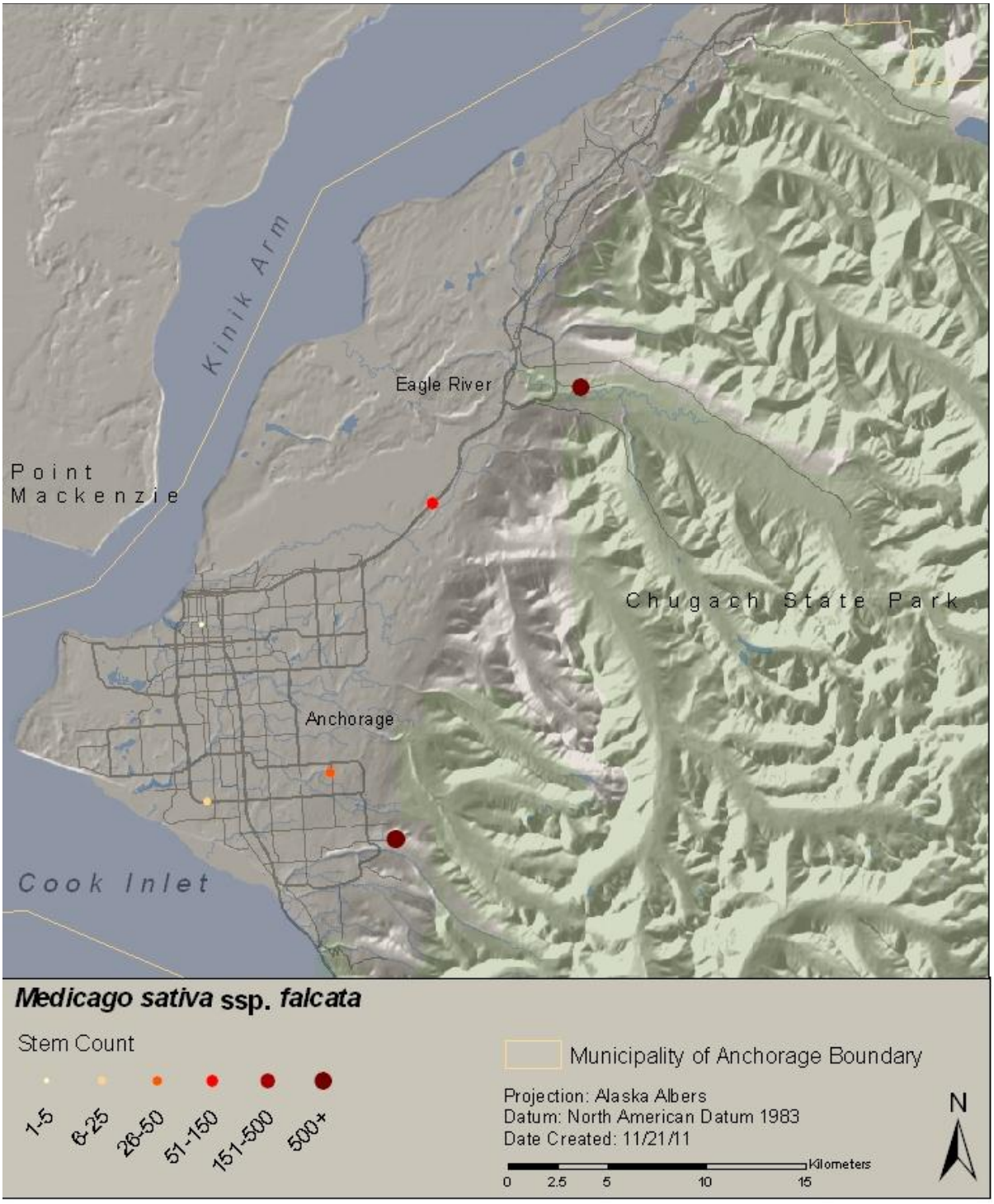
Control measures are not well-developed because of the value of *Medicago* species as agricultural crops. However, it is known that they are susceptible to herbicides (Bowes 1982, Cogliastro et al. 1990), and that hand pulling prior to seed set can be effective (AKEPIC 2005).

Unfortunately, plants re-grow quickly after mowing, because cutting axillary stems results in re-growth instead of mortality. *Medicago sativa* often re-establishes faster than potential competitors, and growth from mature plants is faster than new seedling recruitment. In cold climates the crown, which enables perennation and regrowth, develops partly below the surface of soil, making it difficult to remove (Bagavathiannan and Van Acker 2009).

Control recommendations for *Medicago sativa* ssp. *sativa* – which presumably apply to *Medicago sativa* ssp. *falcata* – in Alaska have been developed and are summarized in the following (Seefeldt 2007):

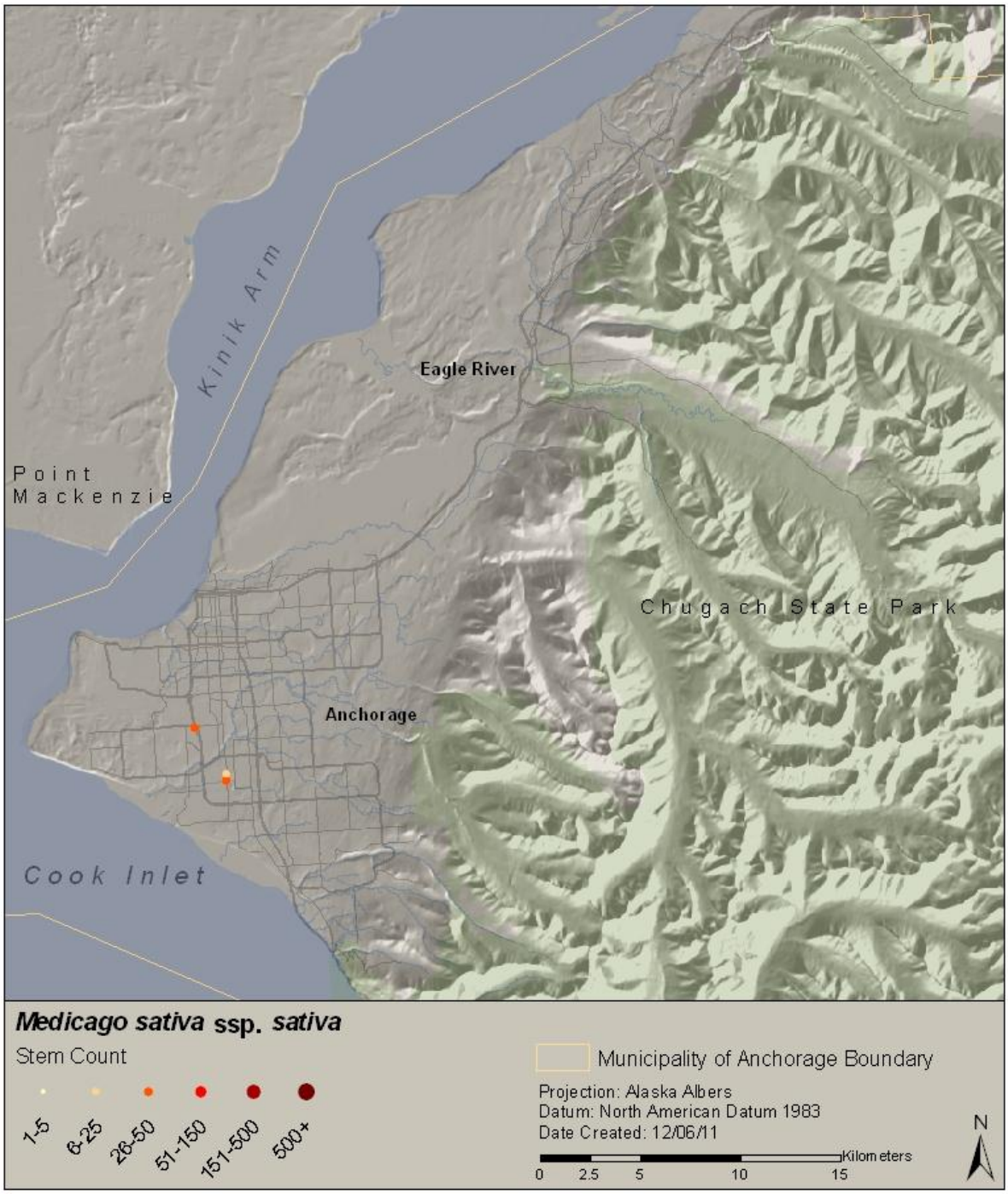
	Human- or naturally-disturbed and unaltered sites
Small populations (<50 stems)	• Hand pull and remove the entire plant. • Scout area for new plants. • Revisit as necessary.
Large populations (>50 stems)	• There are herbicides that will kill these plants, but off-target impacts make them problematic for control. • Scout area for new plants. • Seed treated area with native grasses to provide competition. • Revisit sites annually.

Distribution



Distribution map of plots at which *Medicago sativa* ssp. *falcata* (yellow alfalfa; 64; A-list) was recorded within the Municipality of Anchorage, Alaska.

Distribution



Distribution map of plots at which *Medicago sativa* ssp. *sativa* (alfalfa; 59; not listed) was recorded within the Municipality of Anchorage, Alaska.

Melilotus alba[4] (white sweetclover; 81; B-list)

Species Biography

***Melilotus alba* flowers and leaves**

Melilotus alba is a biennial forb that is present in all 50 states and most of Canada. It was introduced to Alaska in 1913 as a potential forage crop and subsequently escaped cultivation (Conn et al. 2008). Although it only reproduces by seed, each plant is capable of producing up to 350,000 seeds, which can remain viable in the soil for over 20 years (AKEPIC 2005). Invasion of naturally- and human-disturbed areas characterized by fine mineral material and alkaline soils (e.g. graded roadsides, road-side dust shadows, and glacial river gravel bars; Conn et al. 2008). The affinity of *Melilotus alba* for these environments is of special concern as they often form corridors along which the species' seeds can migrate. As a member of the pea family, *Melilotus alba* is able to fix atmospheric nitrogen which alters the soil nutrient status in favor of itself and other weed species. However, this species' ability to fix nitrogen is reduced in acidic soils (Seefeldt 2007). This species contains the fragrant chemical compound coumarin, which is toxic to animals. It is also allelopathic (USDA 2002). This species is listed as noxious in the Canadian province of Quebec.

***Melilotus alba* colonizing burned areas on the Dalton Highway in 2007. Photo**

Control Methods

Melilotus alba is notoriously difficult to eradicate due to the volume and longevity of seed produced (Rutledge and McLendon 1996). As a biennial, *Melilotus alba* flowers in its second year from mid-June to October (AKEPIC 2005, Seefeldt 2007). Seeds mature from early August until first frost (Turkington et al. 1978). Seedlings emerge in March and April with a second flush in September and October (Turkington et al. 1978).

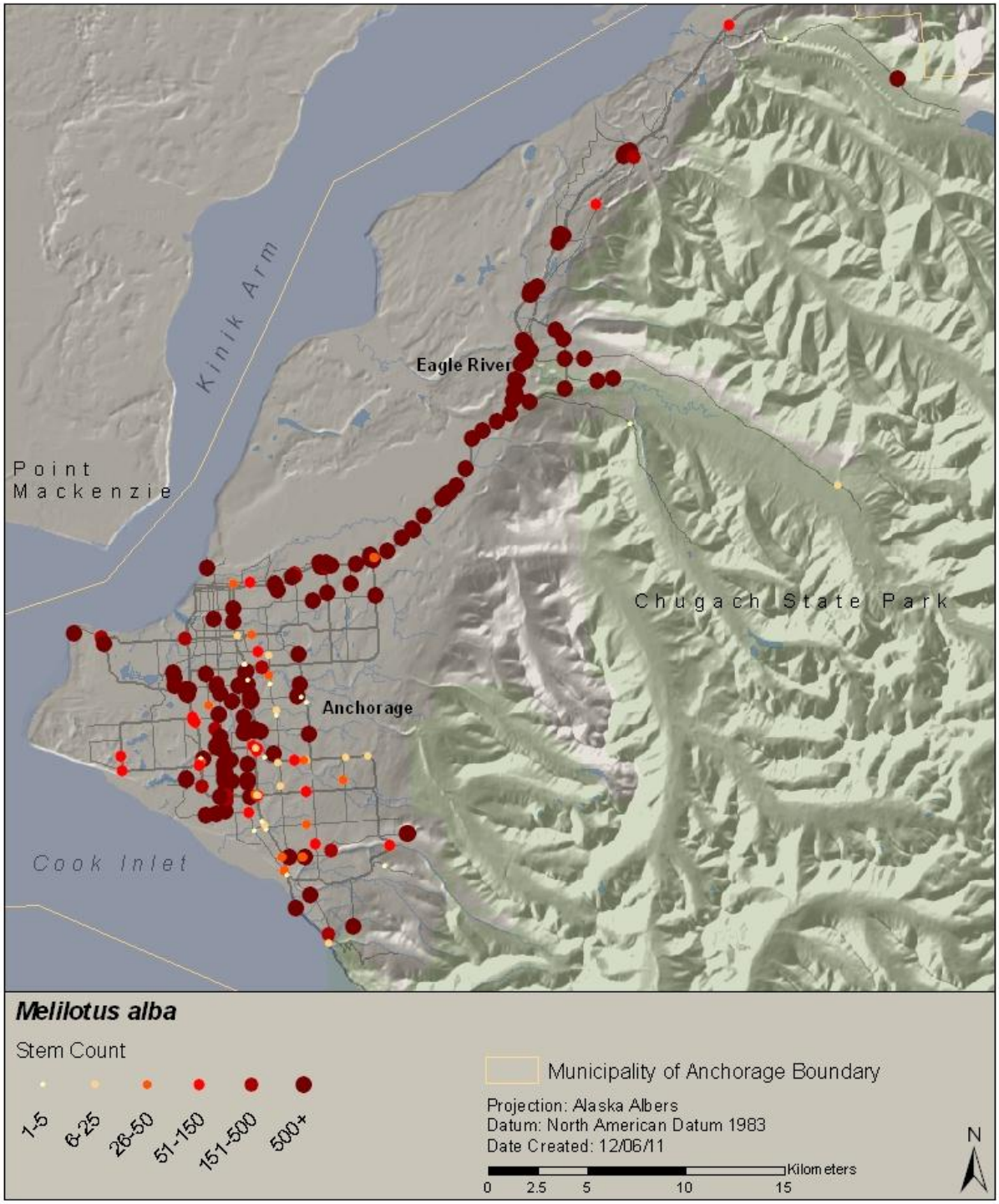
[4] Note on taxonomy: The accepted name is *Melilotus albus*, which includes *M. alba* and *M. officinalis*. The two species are recorded separately here because *M. alba* appears to be more invasive in Alaska, especially within riparian zones.

Small populations are best controlled by hand-pulling as cutting will stimulate flowering and seed set. The soil disturbance associated with hand pulling will also stimulate growth, so follow-up visits to treated sites will be important to control regrowth (Seefeldt 2007). If mowing is selected for treatment, as may be the case for large populations where herbicide application is not feasible, cutting should occur after the pre-bud stage but before seed set when plants are at an approximate height of 15 cm (6 in), opposed to 30 cm (12 in). Mowing in late August or early September can limit subsequent growth, overwintering ability and second year recruitment (Turkington et al. 1978). Regardless of control method, Infestations should be revisited for many years to ensure that the seed bank is depleted (Densmore et al. 2001). Reseeding with native perennials can greatly reduce or eliminate *Melilotus* regrowth after treatment (Turkington et al. 1978).

Control recommendations for *Melilotus alba* in Alaska is summarized in the following (Seefeldt 2007):

	Human- or naturally-disturbed and unaltered sites
Small populations (<50 stems)	• Visit sites well before flower initiation (mid-June). • Estimate population size and density. • Hand pull and remove the entire plant when soil is moist and before flowering (June). • Revisit every 2 weeks. • Conduct additional hand-pulling in the fall.
Large populations (>50 stems)	• Visit sites well before flower initiation (mid-June). • Estimate population size and density. • Spray infestation and a 50 ft buffer with an appropriate herbicide. • Monitor annually and retreat if seedlings are found.

Distribution



Distribution map of plots at which *Melilotus alba* (white sweetclover; 81; B-list) was recorded within the Municipality of Anchorage, Alaska.

Phalaris arundinacea (reed canarygrass; 83; B-list)

Species Biography

Phalaris arundinacea

In the United States *Phalaris arundinacea* was first documented in agricultural trials in the 1830s, and it has since been planted throughout the country for forage and erosion control.

Notably, this species is apparently native to some areas of North America. A few wild populations predate the introduction of the European non-native genotypes, but these populations did not appear to be aggressive (Merigliano and Lesica 1998). In Alaska, Hultén (1968) identified a few populations of ostensibly native *Phalaris arundinacea* around hot springs of the interior. However, in recent years a more aggressive form of this species has established in disturbed sites in interior (as far north as Wiseman), south-central, and southeast Alaska.

This grass can reproduce sexually by seed and vegetatively by rhizomes or rhizome fragments (AKEPIC 2005). Roots and rhizomes form shallow (less than 30 cm [12 in] deep) yet dense networks. Vegetative spread by tillers can take place shortly after seedlings become established, when plants are only 3 cm (1 in) tall (Slemmons 2007). A very high annual seed yield (Baltensperger and Kalton 1958; Østrem 1988), period of seed dormancy (Landgraff and Junttila 1979, Vose 1962), and rates of viability (GLIF&WC undated) result in the formation of seed banks, which make populations difficult to eradicate even after removal of the above and below ground parts of mature plants. It is an aggressive invader of wet habitats. Once established, it quickly forms dense monotypic stands (Coops et al. 1996; Kätterer and Andren 1999). In wetlands, the density of such stands encourages silt deposition and slows down natural erosion, consequently changing the structure and function of the ecosystem. This species is listed noxious in Washington State.

Control Methods

Phalaris arundinacea flowers in midsummer and seed matures in mid-August (Great Lakes Region; GLIF&WC undated). Control should be initiated once the grass has achieved some growth in the late spring. Treatment at this time will reduce or eliminate seed development, and starve the plant of its rhizome reserves when they are already being depleted. Sites with diverse vegetation at the onset of management tend to respond more positively to treatments than monotypic stands (Apfelbaum and Sams 1987). Plants reestablish quickly from seeds after a population is treated, so it may be

necessary to retreat the site later in the growing season and annually for four or five years until the seed bank is depleted (Apfelbaum and Sams 1987). Fertilizer should not be used on treatments sites, as it will likely support further growth of *Phalaris* (Slemmons 2007).

Mechanical control methods may be feasible but are labor intensive and require a long-term investment of resources. Experiments conducted on the Kenai Peninsula show that mowing and herbicide application are equally effective in managing *Phalaris* in the first year. Herbicide application is the most cost-effective means of control, and pre-mowing facilitates the application of herbicide. This approach is practical on large infestations and on wet or uneven ground. However, there may be legal constraints to using herbicides (e.g., it is prohibited on floodplains), and herbicides do not kill seeds, so follow up treatments are necessary (Spellman, unpublished data). *Phalaris arundinacea* is strongly rhizomatous and only sometimes reproduces by seed; consequently, mowing will reduce aboveground biomass, but not reduce rhizome density (Slemmons 2007).

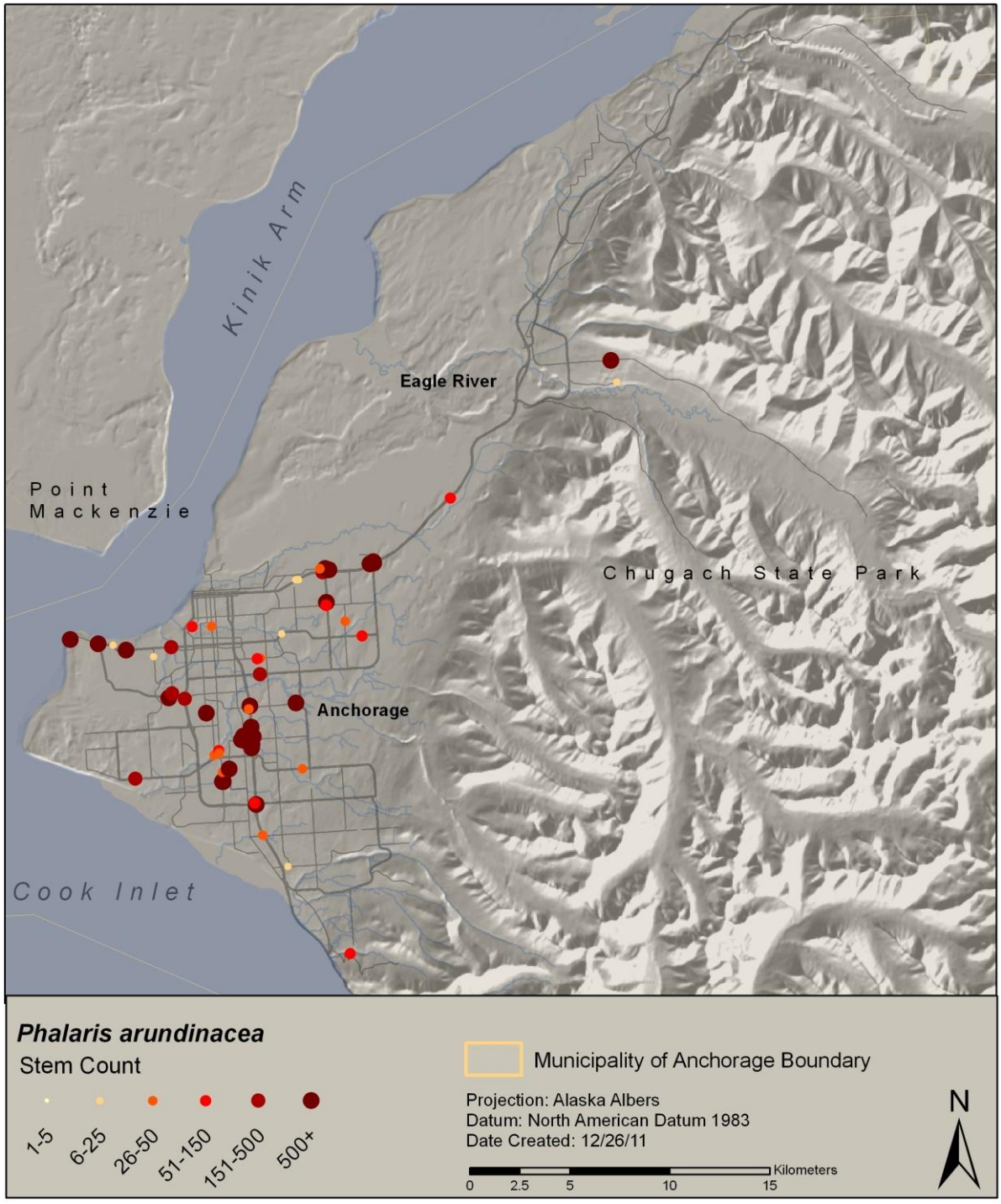
Tarping may be an effective method of control, and is easiest to implement on flat sites of moderate size. Trials show that tarping is more effective than mowing or herbicide application in the first year, but the rate of regrowth in subsequent years is not yet known. Tarping is also the most labor-intensive management approach (Spellman, unpublished data). Mowing infestations makes the infestation of tarps easier (Slemmons 2007).

No biological agents for the control of *Phalaris arundinacea* that are appropriate for use in natural areas are known.

Control methods for *Phalaris arundinacea* in Alaska are summarized in the following (Seefeldt 2007):

	Human-disturbed, naturally-disturbed, and unaltered sites
Small infestation (<50 stems)	• Handweed or cut before the inflorescence can be felt at the tip of the elongating stem • Repeat monthly during the growing season for up to 4 years
Large infestation (>50 stems)	• Cut or mow before the inflorescence can be felt at the tip of the elongating stem • Repeat monthly during the growing season for up to 4 years

Distribution



Distribution map of plots at which *Phalaris arundinacea* (reed canarygrass; 83; B-list) was recorded within the Municipality of Anchorage, Alaska.

Prunus virginiana (chokecherry; 74; B-list)

Species Biography

Prunus virginiana

Prunus virginiana can reproduce from seed as well as regenerate vegetatively from root crowns and lateral roots (Johnson 2000). A single tree can produce 600 to 3,000 seeds (Parciak 2002). In Anchorage, seeds of *Prunus virginiana*'s sister species, *P. padus*, were minimally viable after three years (Flagstad et al. 2010b). *Prunus virginiana* was introduced to Alaska as an alternative to its sister species *P. padus*, but it has also escaped cultivation and become naturalized along the city's greenbelts (although to a lesser extent than *P. padus*). This species is potentially as invasive as *Prunus padus,* which has impacted the structure and composition of the vegetation along several Anchorage creeks, in some sections forming stands with few or no native species in the canopy or understory.

There are two traits that help distinguish *Prunus virginiana* from *P. padus*:

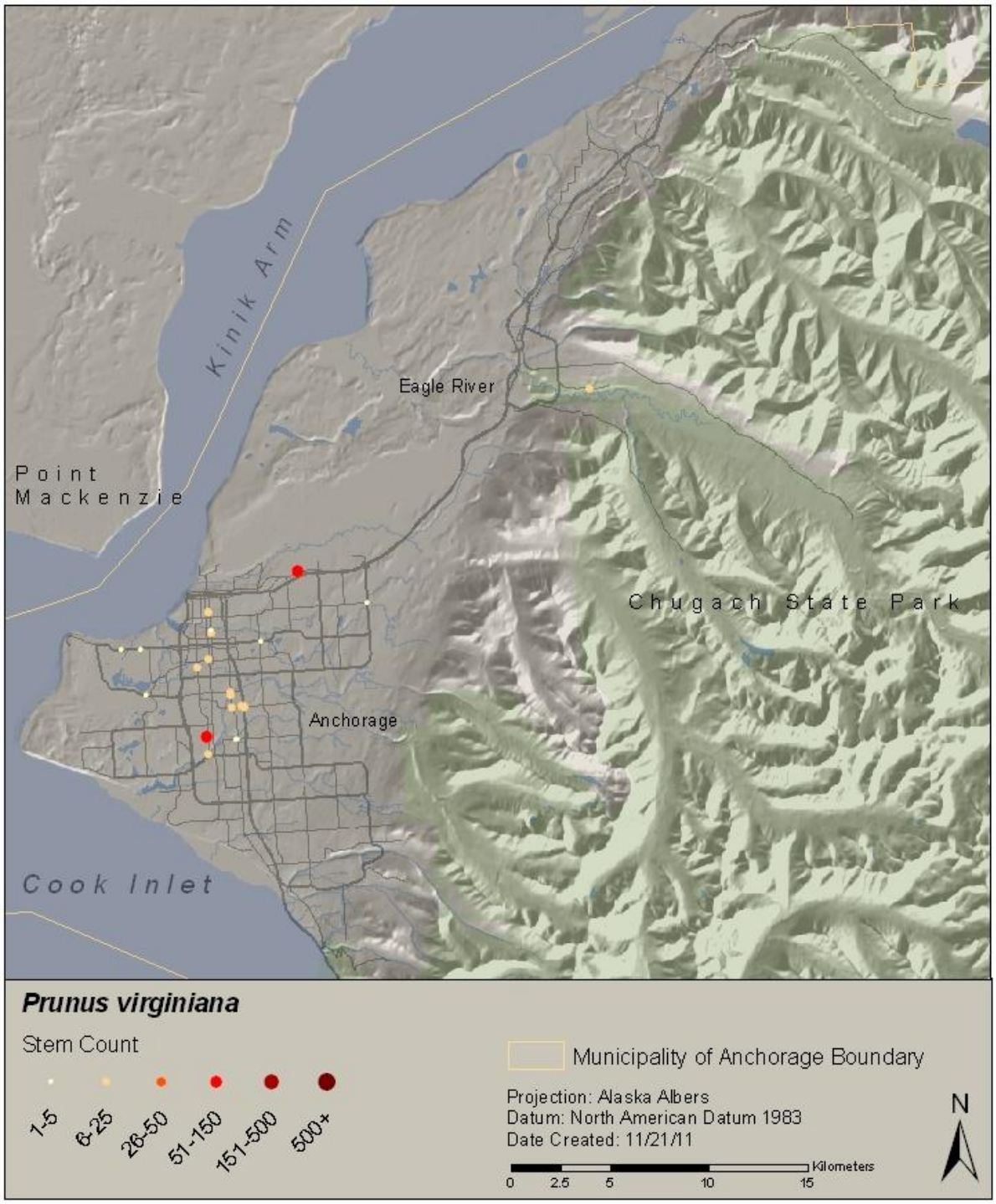
- In early spring (May) when these species are in flower, the hypanthium of *Prunus virginiana* is hairless whereas the hypanthium of *Prunus padus* is pubescent.
- Later in the summer, the foliage of *Prunus virginiana* turns dark red, whereas the leaves of *Prunus padus* remain green throughout the growing season.

Control Methods

Considering the apparent self-thinning in stands of the sister species, *Prunus padus*, and their inability to build long-term seed banks, control efforts should concentrate on the removal of mature (fruit producing) trees (Flagstad et al. 2010a).

Prunus virginiana seedlings and young saplings can be controlled by digging plants out. Mature plants are difficult to control without the use of herbicides; plants under 3 m (10 ft) tall are susceptible to foliar applications, whereas herbicide should be applied to the basal 30 cm (1 ft) of bark, exposed roots and/or cut stumps for larger trees (Mulligan and Munro 1981).

Distribution



Distribution map of plots at which *Prunus virginiana* (chokecherry; 74; B-list) was recorded within the Municipality of Anchorage, Alaska.

Ranunculus acris (tall buttercup; 54; B-list)

R. repens (creeping buttercup; 54; B-list)

These two *Ranunculus* species share similar biological and ecological attributes. We describe the species separately but combine the discussion of their management.

Species Biographies

Ranunculus acris is native to, and widely distributed throughout Europe. This biennial to short-lived perennial reproduces by seed only and grows in grassland, woodland, and occasionally sand dune communities. It has been listed noxious in Minnesota, Montana, and the Canadian province of Quebec. *Ranunculus acris* can be distinguished from *R. repens* by its upright growth habit and its 5- to 7-parted leaves.

Ranunculus repens is native to Europe. This species grows in disturbed areas, gardens, croplands, grasslands, woodlands, and semi-aquatic communities, such as swamps, pond margins, rivers, and ditches (Harper 1957, Lovett-Doust et al. 1990). *Ranunculus repens* has been prohibited in Massachusetts and is listed as noxious in the Canadian province of Quebec. *Ranunculus repens* can reproduce sexually by seeds and vegetatively from stolons and rhizomes (Harper 1957). *Ranunculus repens* can be distinguished from *R. acris* by its trailing growth habit, stems that root at the nodes and 3-parted leaves.

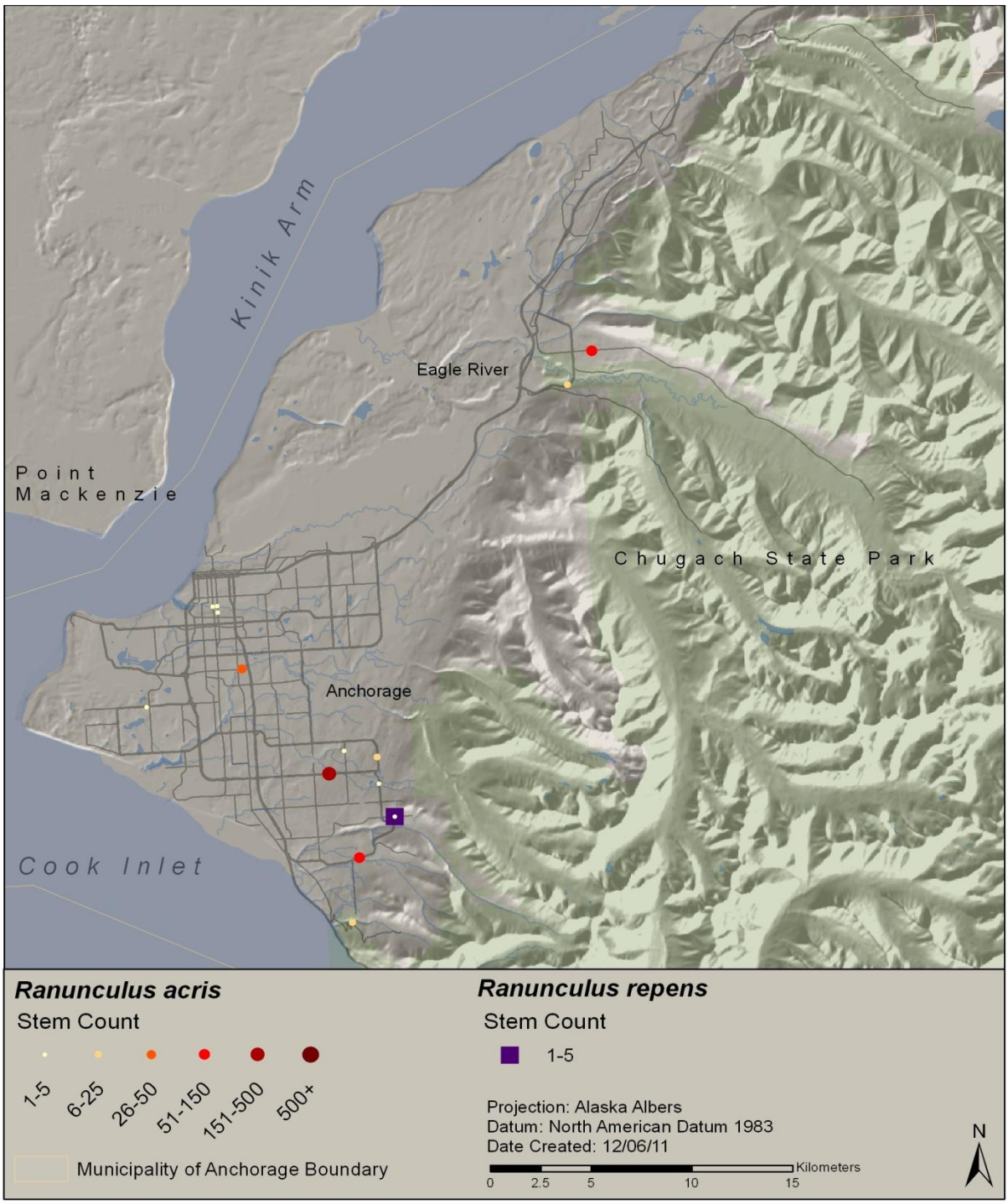
Ranunculus acris **flowers, seed heads and 5-parted leaf**

The 3-parted leaves of ***Ranunculus repens***

Control Methods

Herbicides are generally recommended for the control of buttercups. Manual removal may weaken a population, but plants can regenerate from parts of the caudex and stolon if the entire plant is not removed. Plowing provides ideal conditions for the germination of seeds and is not recommended as a management technique (Harper 1957, Lovett-Doust et al. 1990).

Distribution



Distribution map of plots at which *Ranunculus acris* (tall buttercup; 54; B-list) and *Ranunculus repens* (creeping buttercup; 54; B-list) were recorded within the Municipality of Anchorage, Alaska.

Sonchus arvensis* ssp. *uliginosus (moist sowthistle; 73; B-list)

Species Biography

Sonchus arvensis* ssp. *uliginosus

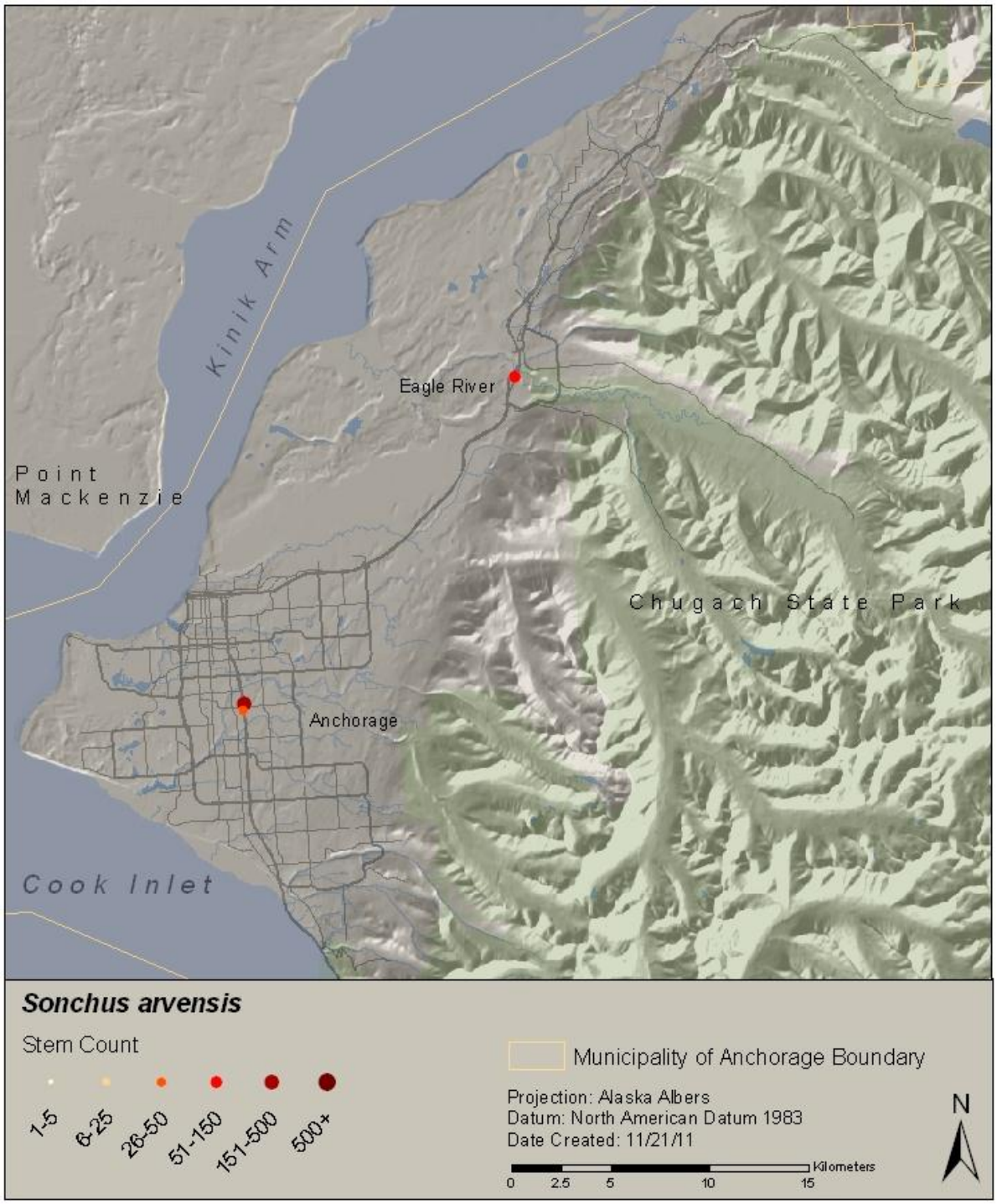
Sonchus arvensis ssp. *uliginosus* is native to Europe, western Asia, and Iceland. It commonly grows in gardens, cultivated areas, roadsides, and fertile waste areas (Rutledge and McLendon 1996, Whitson et al. 2000). It can also grow on disturbed sites in prairies, woods, meadows, lawns, stream banks, and lake shores (Butterfield et al. 1996, Gubanov et al. 1995, Noxious Weed Control Board 2003).

Sonchus arvensis ssp. *uliginosus* is a perennial plant that can reproduce sexually by seeds and vegetatively from rhizomes. Each plant can produce 4,000 to 13,000 seeds, which can remain dormant in the soil for up to six years (Royer and Dickinson 1999). Its extensive root system can grow up to 3 m (10 ft) deep. At high densities, *Sonchus arvensis* ssp. *uliginosus* drastically reduces water resources and possibly decreases the plant species richness of communities (Butterfield et al. 1996).

Control Methods

Biological, chemical, and mechanical control methods have been effective in the control of *Sonchus arvensis* ssp. *uliginosus*. Mechanical treatments must be repeated several times per growing season for several years to reduce seed production and root reserves. *Sonchus arvensis* ssp. *uliginosus* is relatively resistant to many common broadleaf herbicides (Butterfield et al. 1996, Rutledge and McLendon 1996).

Distribution



Distribution map of plots at which *Sonchus arvensis* ssp. *uliginosus* (moist sowthistle; 73; B-list) was recorded within the Municipality of Anchorage, Alaska.

Tanacetum vulgare (common tansy; 60; B-list)

Species Biography

Tanacetum vulgare

Tanacetum vulgare is native to Siberia and parts of Europe (Gucker 2009, NatureGate 2011). It was introduced to North America from Europe in the 17th century as an ornamental and medicinal plant (Gucker 2009, Whitson et al. 2000) and commonly escapes cultivation along the Pacific Coast (Watson 2006). *Tanacetum vulgare* reproduces sexually by seeds and vegetatively from long rhizomes (Gucker 2009, Luneva 2006). Each plant is capable of producing over 50,000 seeds. However, seed banks seem to be short-lived, and seeds may be viable for as little as one season (Gucker 2009).

This species is unpalatable and poisonous when consumed in large quantities. Dense populations of *Tanacetum vulgare* displace native plant species and restrict the flow of water when growing along stream banks (Gucker 2009). *Tanacetum vulgare* colonizes disturbed areas, including forest understories. In Alaska, most infestations are associated with anthropogenically disturbed areas.

Control Methods

In Montana, *Tanacetum vulgare* begins to flower in June and seed matures through the fall. On dry sites, plants may senesce as early as August; however on moist sites, leaves can remain green until October or November. Flowers hold seed and remain intact through the fall. Some stems emerge from rhizomes in November, although most stems appear in the spring, later than most perennial grasses (Gucker 2009).

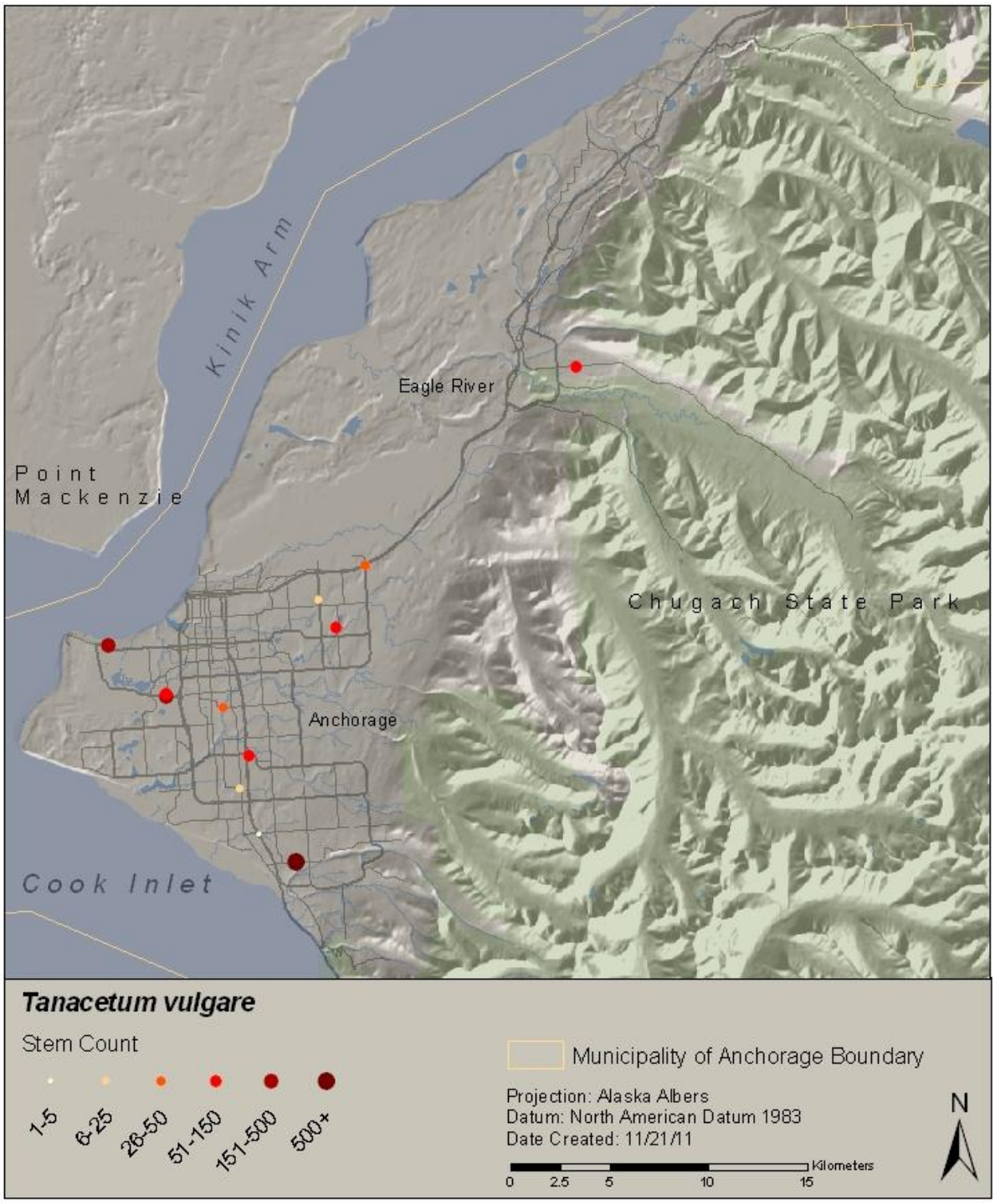
Small populations of *Tanacetum vulgare* can be removed by hand pulling or digging as long as all belowground portions of the plant are removed. If mowing is the selected control method, plants should be cut in June before flower heads develop and again when half the flowers have bloomed to prevent late flower head development. Mowing multiple times per year before seed set can contain populations (Montana; Gucker 2009). Seeds can remain on plants for up to three years; although the viability of these seeds is unknown, it is best to avoid mowing old stands (Gucker 2009).

Regardless of treatment method, gloves should be worn when handling plants, as this species can cause dermatitis. Care should be taken to avoid disturbing soil as plants are able to regenerate from root fragments. Plants should be bagged and incinerated to avoid regeneration and unintentional dispersal (Gucker 2009, King County 2010).

Control methods for *Tanacetum vulgare* in Alaska are summarized in the following (Seefeldt 2007):

	Human-disturbed, naturally-disturbed, and unaltered sites
small or large infestations	• Visit sites in mid-summer after plants have bolted • Count and dig up plants, collecting as much of the rhizome as possible. • Scout the area for new plants. • Alternatively, spot spray plants with an appropriate herbicide at the bud to bloom stage. • Revisit the site annually when plants are in the bud to bloom stage, and repeat herbicide application or hand weed after counting the plant stems.

Distribution



Distribution map of plots at which *Tanacetum vulgare* (common tansy; 60; B-list) was recorded within the Municipality of Anchorage, Alaska.

Thlaspi arvense (pennycress; 42; A-list)

Species Biography

Thlaspi arvense is an annual plant native to Eurasia. This species only reproduces by seed yet is self-compatible (able to be fertilized by its own pollen). On average, each plant produces 7,000 seeds but is capable of producing as many as 20,000 seeds (Best and McIntyre 1975, NAPPO 2003, Royer and Dickinson 1999). Most seeds germinate within nine years of being buried in soil, but a small portion of seeds can remain viable for as long as 20 years (Best and McIntyre 1975). *Thlaspi arvense* requires sparsely vegetated soil in disturbed areas or cultivated lands to germinate (Holm et al. 1997, NAPPO 2003). Infestations recorded in Alaska are associated with disturbances (AKEPIC 2010).

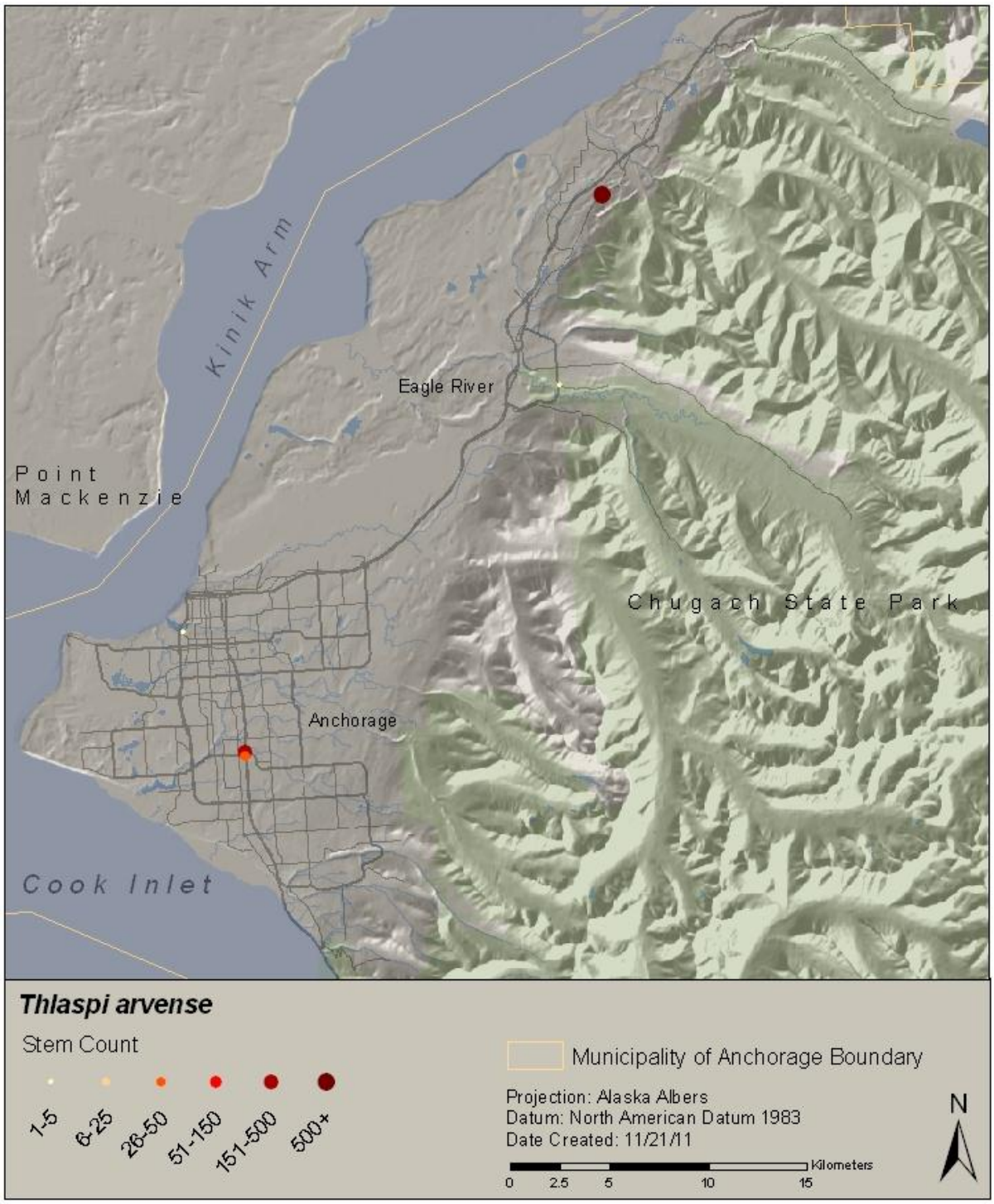
Thlaspi arvense

In Saskatchewan, Canada, most seeds germinate from mid-April to mid-May, and flower in 30 to 50 days, producing mature seed by early July. The majority of seed is shed in the following weeks and can germinate immediately under the right conditions. A lesser number of plants emerge in the fall, which overwinter as rosettes, and flower early the subsequent growing season. Some germination occurs sporadically throughout the summer (Best and McIntyre 1975).

Control Methods

Thlaspi arvense can be controlled by hand pulling before seed production, however this treatment must continue until the seed bank is exhausted (DiTomaso and Healy 2007). In some areas control may not be necessary as *Thlaspi arvense* will naturally be replaced by native species in the absence of further disturbance (Best and McIntyre 1975).

Distribution



Distribution map of plots at which *Thlaspi arvense* (pennycress; 42; A-list) was recorded within the Municipality of Anchorage, Alaska.

Vicia cracca (bird vetch; 73; B-list)

Species Biography

Vicia cracca is a perennial climbing plant that can reduce light availability and eventually smother underlying vegetation. As a member of the pea family, *Vicia cracca* is able to fix atmospheric nitrogen, increasing the nutrient content of soil and facilitating the establishment of native and non-native weed species. *Vicia cracca* can spread vegetatively by rhizomes and regenerate from rhizome fragments; it also produces large amounts of seed, which can remain viable for up to five years in the soil. *Vicia cracca* does not resprout after cutting (AKEPIC 2005).

Vicia cracca

Control Methods

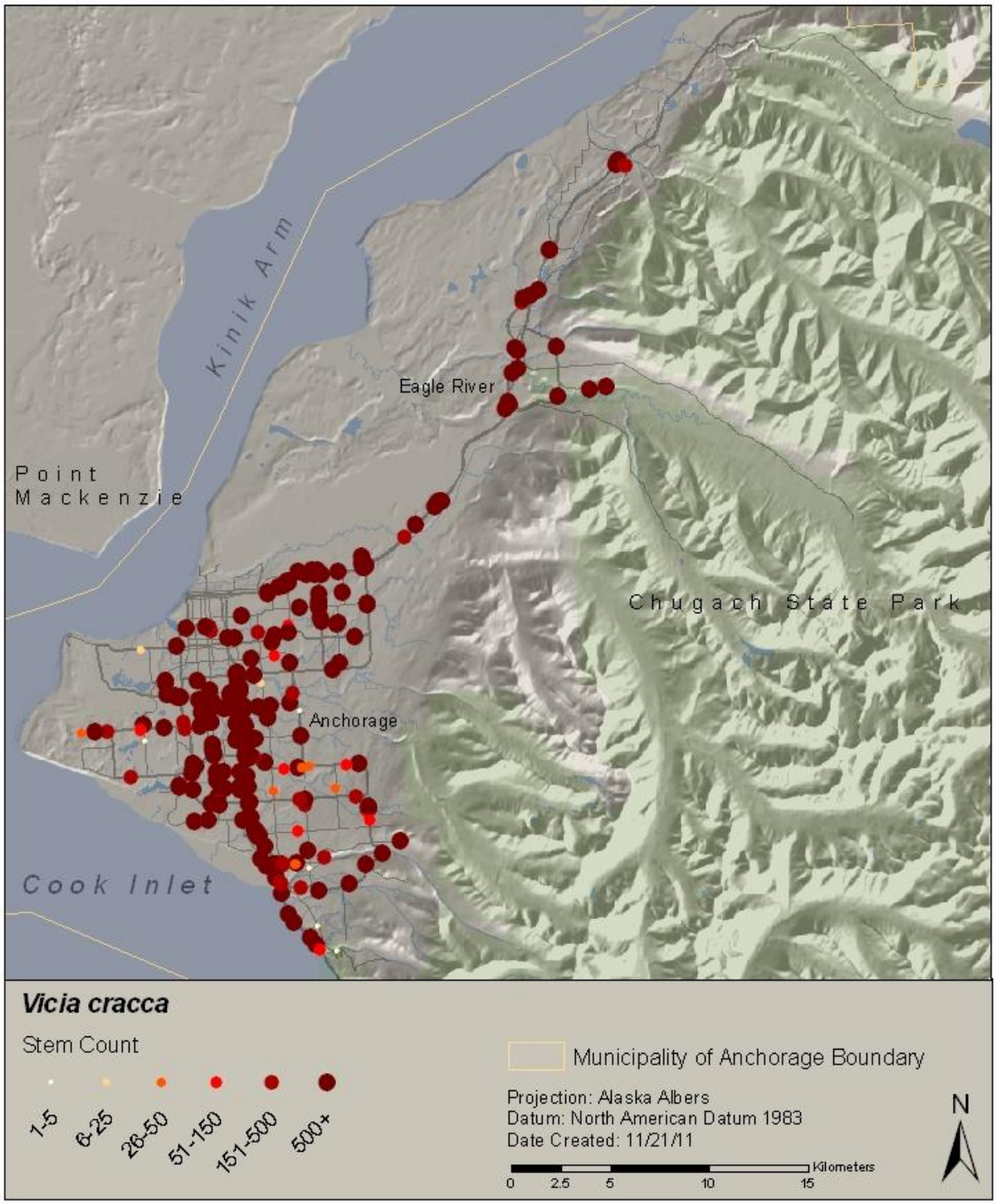
Vicia cracca flowers from approximately mid-June to mid-July, no information on seed set was found, however field experience indicates seed matures by late August.

Small populations can be hand-pulled, with care taken to remove all belowground parts, as *Vicia cracca* is able to reproduce from rhizome fragments. Mechanical control of this species is effective, as plants cannot resprout after cutting and do not tolerate repeated cutting. Plants should be cut near the base of their stem. Mowing should be timed to occur before the end of flowering and if possible, should be repeated every six weeks throughout the growing season (Nolen 2002). If only one mowing per season is feasible, then treatment should be repeated annually for at least five years to deplete the seed bank (YISC 2010).

Control methods for *Vicia cracca* in Alaska are summarized in the following (Seefeldt 2007):

	Human-disturbed, naturally-disturbed, and unaltered sites
small or large infestations	• Visit sites before flower initiation (early to late July). • Estimate the density and size of infestation, then mow at the base of the plant or hand-pull. • Revisit every six weeks during the growing season and repeat treatment as needed • Scout the area for new plants. • After five years of treatment, when the seed bank should be depleted of seeds, plants should be sprayed with an appropriate herbicide while they are actively growing and before flowering.

Distribution



Distribution map of plots at which *Vicia cracca* (bird vetch; 73; B-list) was recorded within the Municipality of Anchorage, Alaska.