BLM-BAER Final Report
Invasive Plant Species Monitoring and Control: Areas Impacted by 2004 and 2005 Fires in Interior Alaska

A survey of Alaska BLM lands along the Dalton, Steese, and Taylor Highways

Melilotus alba plants spreading into a burn off the Dalton Highway

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ABSTRACT

In 2006 we completed invasive plants species surveys for three major Interior Alaska highways (Steese, Dalton, and Taylor) that were affected by the 2004 and 2005 fires. Particular emphasis was directed to roadsides and adjacent Bureau of Land Management lands. Non-native plant establishment was greatest and most widespread along the Dalton Highway, with aggressively invasive species occurring throughout the area surveyed. Infestations along the Steese corridor were fewer and more localized, while the Taylor Highway was the least infested. Most non-native populations were restricted to anthropogenically disturbed sites, including road construction and revegetation activities, parking lots, campgrounds, and Alaska Department of Transportation stations. While these sources of disturbance are more important in current patterns of invasive species establishment, invasive species were also spreading in recently burned (but otherwise undisturbed) areas. Three infestations were recorded spreading from the roadside into fire-disturbed areas during 2006 and 2007, *Crepis tectorum*, *Hieracium umbellatum*, and *Melilotus alba*, all three on the Dalton. Additionally, one infestation (*Caragana arborescens*) was invading undisturbed, native plant communities along the Steese Highway. Although some of the controls conducted on infestations in 2006 appeared to have been effective during our revisit work in 2007, we do not consider that a single growing season is enough time to determine whether a species' seed bank has been depleted or not. The two species that seemed to respond best (but not always, and only for very small population sizes) to hand pulling were the highly invasive *Crepis tectorum* and *Melilotus alba*. Finally, increases in propagule pressure, the volume of traffic along these roads, and the (climate-change driven) frequency of lightning-induced fires is likely to result in an increase in the number of invasive species populations that move off the human footprint into native ecosystems in the future.

We provide specific recommendations for the removal or containment of the infestations. Overall, invasive species eradication and containment work must prioritize (1) infestations of species that have already been detected spreading into fire-disturbed sites and undisturbed, native communities, and (2) populations of highly aggressive species located within close proximity to a forest clearing, a burned site, or a waterway, giving precedence to those sites with high propagule pressure. This effort must be followed up with monitoring, especially for species with seeds that can remain viable for many years and for species that can resprout from underground parts. In addition, we advise agencies involved in the maintenance and construction of Alaska's transportation networks to develop measures when conducting roadwork that could help minimize the spread of non-native species (for instance, grading early rather than late in the season, periodically cleaning the machinery and tools used for road work activities, or only using weed-free certified seeding mixes in revegetation work). Finally, we suggest that activities promoting public awareness on invasive plants and the danger they pose to Alaska's native ecosystems be organized or supported in the towns and communities located along each of the three highways surveyed.

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INTRODUCTION

Background

The establishment, growth, and persistence of non-native plant species pose a serious threat to native ecosystems. Even though not all non-native species cause significant economic or ecological harm, those species that are *invasive* are well known to alter community composition, successional pathways, nutrient cycling, hydrology, and fire regimes, as well as reduce or eliminate threatened and endangered native species populations (U.S. Congress 1993, Busch 1995, Myers 1997, Brooks 1999, Stein *et al.* 2000).

While invasive plants constitute a major problem in the Lower 48 states (*cf*. Randall 1996), Alaska has been considered relatively immune to their deleterious impacts. In the past five years, however, this perception has changed (Shephard 2004, Carlson and Shephard 2007). More and more non-native species and populations are being recorded and, disturbingly, a number of species have moved off of the anthropogenic footprint and have overrun natural areas, clearly damaging the area's ecology (Carlson 2006, Conn *et al*. in press). Even so, invasive plants in this state are still mainly restricted to the regions of greatest anthropogenic disturbance. Consequently, land managers in Alaska have the unique opportunity to be proactive in managing exotic and invasive plants.

Invasive plants are often opportunistic species that thrive under the types of conditions created by disturbances: increased light and nutrient availability, reduced interspecific competition, and increased bare soil (Rejmánek 1989, Harrod and Reichard 2001). Forest and grassland fires are a well known disturbance and have accelerated non-native plant establishment in the Lower 48, through both increase in availability of disturbed habitat and due to inadvertent dispersal during firefighting activities (Hobbs and Huenneke 1992, Brooks 2001, Harrod and Reichard 2001). Forest fires also create a complex matrix of disturbance and natural, undisturbed plant communities that may offer a transitional foothold habitat for non-native plants to invade more intact habitats. Thus, the 2004 and 2005 fires that burned over ten million acres in Alaska provide a dangerous opportunity for the expansion of established invasive plants and invasion of new invasive plant species into the state's wildlands.

BLM-AKNHP Assistance Agreement

Severe fires throughout Alaska's interior region in 2004 and 2005 may have facilitated the expansion of non-native plants into previously undisturbed, natural communities in Alaska. The potential for invasive plants to move into burned lands is greatest near pre-existing populations and high use areas such as roads, trails, campgrounds, cabins, landing zones, or firefighting activity sites. As part of the Burned Area Emergency Rehabilitation and Stabilization plan for Alaska's 2004 fires, the BLM received funding to investigate fire related sites that may subsequently have introduced invasive plants, and entered into an assistance agreement with the Alaska Natural Heritage Program (AKNHP), University of Alaska, to assess the (potential) expansion of invasive plants from high use areas into adjacent BLM interior Alaska lands that were affected by the 2004 and 2005 fires.

Under this agreement, during the 2006 field season, the AKNHP was responsible for surveying BLM land along the Dalton, Steese, and Taylor Highways, with emphasis on areas affected by the following 2004 and 2005 fires:

1. Steese Highway (Fairbanks northeast to Circle):
   - 2004 fires: Bolgen Creek, Boundary
2. Dalton Highway (Fairbanks north to Wiseman):
   - 2004 fires: Fort Hamlin Hills, Dall City, Evansville
   - 2005 fires: Ray river, North Bonanza, Chapman Creek
3. Taylor Highway (Tetlin Junction northeast to Eagle):
   - 2004 fires: Porcupine, Chicken, Wall Street, King Creek, Deer Creek
   - 2005 fires: Boundary Creek

During the 2007 season, the AKNHP agreed to revisit all 2006 control and photo-monitoring plots, as well as record any new priority non-native species populations that had not been detected in 2006.

The aim of these surveys was to identify the locations, species, and extent of establishment of invasive plant populations. The information collected has been used to prioritize infestation areas for invasive plant management and eradication work. It has also guided efforts to detect currently invasive plant-free areas that are at high risk of being invaded from surrounding, non-native plant sources based on parameters such as type and frequency of disturbance in the invasive plant-free site, proximity to the source location, and aggressiveness of the species. In addition, the AKNHP has entered the data collected into the Alaska Exotic Plant Clearinghouse (AKEPIC), the statewide invasive plant database, thus making it available to local, regional, state, and federal agencies and private individuals involved in invasive species issues. Lastly, the results from this work, together with those of other Alaska federal and state agencies that received BAER funds, will provide greater insight into the relationship between fires and the spread of non-native plants in interior Alaska lands.

LOGISTICS, SAMPLING PROTOCOLS, AND DATA ANALYSIS

Pre-fieldwork: logistics

The AKNHP adapted the sampling protocol developed by the Alaska Exotic Plants Mapping Program (AKNHP 2006(a), see http://akweeds.uaa.alaska.edu/) to fit the goals of the current project. The AKNHP Program Botanist and BLM Vegetation Specialist (Matthew Carlson and Jeanne Standley, respectively) put together a list of priority invasive plants (Appendix D.I.a.) based on the invasiveness values given by the state's "Weed Ranking Project" (AKNHP 2006(b), see http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm), whereby non-native species ranked 50 and above were considered priority species. Exceptions were made for species that are already too widespread and for which efficient eradication is no longer a realistic option (e.g.: *Stellaria media*, *Taraxacum officinale* ssp. *officinale*, and *Poa pratensis* ssp. *pratensis*), and for species whose taxonomic or nativity status is unclear. An example of the latter would be foxtail barley (*Hordeum jubatum*), as it is currently thought that there may be native and non-native genotypes of this species in Alaska, but these cannot be distinguished phenotypically. In addition, it is possible that hybridization between the two genotypes may have taken place, further blurring the distinction between these two (potential) species. Finally, Trimble GPS units were programmed with data dictionaries that are compatible with BLM's data format.

Fieldwork methodology

In 2006, field work was carried out during July and August 2006 by three AKNHP crews, consisting of two surveyors each.

Two types of surveys were conducted for each highway:

1. following AKEPIC data protocols, which includes all non-native plants
2. using BLM data protocols, which collects information on potential invasive plant source areas and on high priority species infestations located in and near burned lands along the highways

For the AKEPIC-based inventories, plots were read at five mile intervals at right-of-way sites along the highways, regardless of the presence/absence of invasive species at a given site (Fig. 1). Plot data were recorded using Garmin GPS units and paper datasheets, and included information on the locality, disturbance type and age, infestation size, non-native species' names and aggressiveness, associated habitat, and control measures taken, if any (see Appendix D.II for a blank copy of the datasheets used). The AKEPIC-based inventories were conducted prior to the BLM-based protocols to inform the surveyors of the scope and general patterns of non-native plants.

In the second phase, inventories were made both at sites that constituted potential sources of invasive plant dispersal into BLM burned areas, and at burned areas that were infested by one or more of the invasive plant species defined as "priority" (Appendix D.I.a., Fig. 2). Surveys were also carried out in roadside areas that appeared to harbor new non-native species, to have high degrees of infestation, or to be particularly sensitive locations (for example, the confluence of highways and rivers). Last, approximately one mile of the side roads or trails that originate from this road system and provide access to burned BLM managed lands were also monitored if it was considered that there was a moderate to high risk of invasion and establishment by invasive plants.

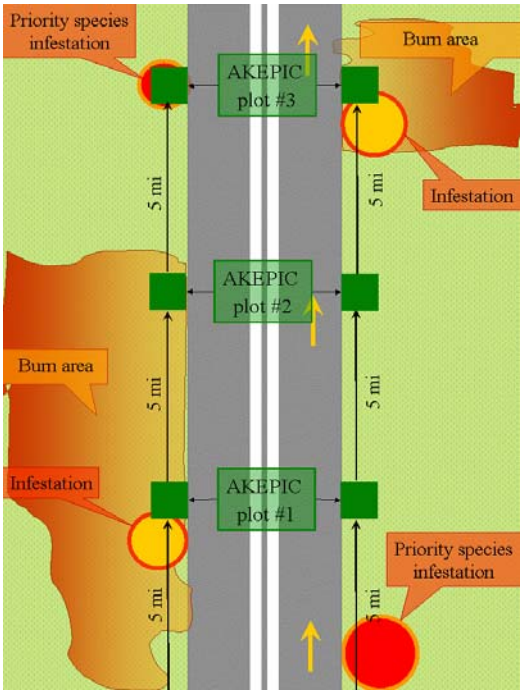


Figure 1. AKEPIC-based plots were read on the outbound trip.

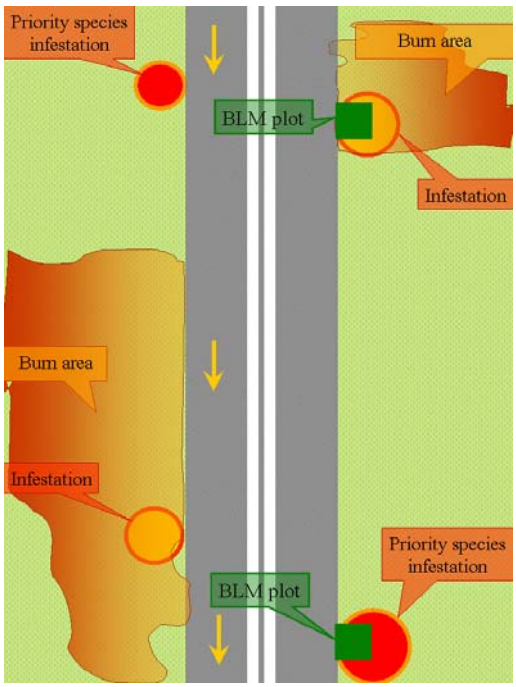


Figure 2. BLM-BAER methodology plots were erected on the way back.

Surveyors used Trimble GPS units that had been programmed and provided by BLM. At each plot the following information was recorded: vegetation type, percent canopy cover, disturbance type and age, non-native species' names and aggressiveness, stem count and acres infested, phenological stage of each species (flowering, fruiting, seed set), voucher specimen collected (yes/no), photo taken (yes/no), and, when pertinent, information on photo-monitoring points established and on control actions taken.

Photo-monitoring points were set up either in sites that seemed especially susceptible to invasion and would provide an early warning on likely infestations, or in sites that had invasive species and were in or near BLM burned land. To help assess treatment effectiveness over time, photographs of the photo-monitoring points were taken and a compass reading from the photographer to the point was taken. To facilitate relocation of each site, aluminum tags with the

highway name, site number and date were nailed to the nearest hard surface (e.g. a standing or fallen tree). The GPS reading and the description of point and tag location were recorded.

Control of high priority invasive plants was carried out on some small infestations (less than 1000 plants) by hand pulling. Individuals removed were immediately bagged and taken to disposal sites to minimize the risk of dispersal following this action. At sites in which control measures were taken, additional plot information was recorded, including the number of acres treated and the number hours spent controlling the population. Photographs of the site were taken before and after invasive plant control. Both invasive plant infestations that are recommended for control and those where control work had been done were marked with flagging tape, and the plant code, date, and surveyors' initials were written on the flagging tape with a permanent marker.

For both AKEPIC-based and BLM-BAER-based inventories, invasive plant species were identified by their scientific name or species code as recorded in USDA-NRCS (2008) PLANTS database (http://plants.usda.gov).

In 2007 we revisited the control and photo-monitoring points established along the Taylor, Steese, and Dalton Highways during the 2006 season, and also recorded all new infestations. Data was collected following the BLM-BAER methodology, and herbarium specimens were made for all priority invasive species not collected and mounted in 2006.

Post-fieldwork

Upon completion of both the 2006 and the 2007 field season, all data collected on the Trimble and Garmin GPS units were transferred to a computer database. Data recorded for all plots and for the photo-monitoring sites, including photographs, were transferred into a database and can now be accessed as a GIS product. These data will also be uploaded into the BLM database and the statewide Alaska Exotic Plant Information Clearinghouse (AKEPIC) database after they have been proofread and corrected to ensure accuracy.

All plant specimens collected have been determined by AKNHP botanists. Voucher specimens were collected for the reference herbarium at BLM, and duplicates will be deposited at the UAA and UAF herbaria. These species include non-native plant species, unknown species that are possibly non-native, and species commonly used for roadside revegetation. A total of 70 specimens, with two vouchers for each priority species encountered, will be mounted, labeled, and given to the BLM. When relevant and possible, duplicates of voucher specimens will be deposited at the University of Alaska Anchorage herbarium.

RESULTS

During July and August 2006, three AKNHP crews conducted non-native plant surveys along the Steese, Dalton, and Taylor Highways using primarily AKEPIC methodology. However, those areas that constituted major potential vectors for invasive plant dispersal into burned BLM managed lands were additionally inventoried following BLM-BAER data collection protocols. In July 2007, we revisited the 2006 control and photo-monitoring sites, repeated control work in those cases where the 2006 pull had not been completely effective, and recorded a number of new infestations, this time using only BLM-BAER datasheets.

Below we present a detailed account of the findings and observations made during the two field seasons. For each highway, we identify areas that constitute invasive species 'hotspots', we list all the non-native plant species found in the burned areas surveyed, and provide information on which infestations appeared to have been eliminated following 2006 control work (even if in most cases a single growing season is not enough time to determine control-effectiveness) and which ones we recommend be prioritized for future monitoring, management, and/or eradication work.

Steese Highway 2006 Inventory Results

Overview

Fieldwork was carried out along the Steese Highway right-of-ways, from its intersection with the Elliott Highway to the town of Circle, between July 17th and August 2nd 2006. Exhaustive surveys were conducted along the roadside areas affected by the 2004 Boundary and Bolgen Creek fires. Secondary roads and trails branching off the highway were inventoried for up to one mile or until no more invasive species were found.

A total of 41 AKEPIC-based plots were inventoried along the highway and the Circle Hot Springs Road, in an effort that covered over 150 miles of highway and more than 50 acres of disturbed land, including right-of-ways, trails and fire access roads. These surveys included 11 gravel pits and rock quarries, 20 parking lots and nearby trailheads, three (3) BLM managed campgrounds, and more than 50 highway-creek crossings. More than 100 additional infestations were detected and recorded within the Bolgen Creek and Boundary fire perimeters, and two photo-monitoring plots were created and read in each of these following the BLM-BAER protocol.

In all, 33 non-native plant species, representing nine (9) families, were noted (Table 1). The most frequently recorded species were *Bromus inermis* ssp. *inermis, Matricaria discoidea, Plantago major*, and *Taraxacum officinale* ssp. *officinale*. Some species, such as *Leucanthemum vulgare* (oxeye daisy) and *Trifolium repens* (white clover) were only found outside the (Boundary and Bolgen) burned areas. (Maps showing the sites at which *Bromus inermis* ssp. *inermis*, *Melilotus alba*, *Trifolium hybridum*, *T. pratense*, and *Vicia cracca* were observed are provided in Appendix A.I).

Table 1. List of non-native plant species encountered along the Steese Highway in 2006.

Family Name	Scientific Name	Common Name	Invasiveness Rank	Bolgen Creek Fire	Boundary Fire
Poaceae	*Bromus inermis* ssp. *inermis*	smooth brome	62	X	X
Brassicaceae	*Capsella bursa-pastoris*	shepherd's purse	40		X
Fabaceae	*Caragana arborescens*	Siberian peashrub	66		X
Chenopodiaceae	*Chenopodium album*	lambs quarters	35	X	
Polemoniaceae	*Collomia linearis*	narrowleaf mountaintrumpet	not ranked		X
Asteraceae	*Crepis tectorum*	narrowleaf hawksbeard	54		X
Poaceae	*Elymus repens*	quackgrass	59		
Poaceae	*Elymus sibiricus*	Siberian wildrye	not ranked		X
Brassicaceae	*Erysimum cheiranthoides*	wallflower mustard	not ranked		
Asteraceae	*Hieracium umbellatum*	narrowleaf hawkweed	51		X
Poaceae	*Hordeum jubatum*	foxtail barley	63	X	X
Brassicaceae	*Lepidium densiflorum*	common pepperweed	25		
Asteraceae	*Leucanthemum vulgare*	oxeye daisy	61		
Poaceae	*Lolium perenne* ssp. *perenne*	Italian ryegrass	41		
Asteraceae	*Matricaria discoidea*	pineapple weed	33	X	X
Fabaceae	*Melilotus alba*	white sweetclover	80	X	X
Fabaceae	*Melilotus officinalis*	yellow sweetclover	65		X
Poaceae	*Phleum pratense*	timothy	56		X
Plantaginaceae	*Plantago major*	common plantain	44	X	X
Poaceae	*Poa annua*	annual bluegrass	46		X
Poaceae	*Poa pratensis* ssp. *irrigata*	spreading bluegrass	52		X
Poaceae	*Poa pratensis* ssp. *pratensis*	Kentucky bluegrass	52	X	X
Poaceae	*Poa trivialis*	rough bluegrass	52		
Polygonaceae	*Polygonum aviculare*	prostrate knotweed	45		X
Polygonaceae	*Polygonum convolvulus*	black bindweed	50		X
Polygonaceae	*Rumex longifolius*	dooryard dock	48	X	
Caryophyllaceae	*Stellaria media*	chickweed	42		
Asteraceae	*Taraxacum officinale* ssp. *officinale*	common dandelion	58		X
Fabaceae	*Trifolium hybridum*	alsike clover	57		X
Fabaceae	*Trifolium pratense*	red clover	53		
Fabaceae	*Trifolium repens*	white clover	59		X
Fabaceae	*Vicia cracca*	bird vetch	73		X
Violaceae	*Viola tricolor*	pansy violet	not ranked		X

2006 burned area survey results

Boundary Burn (04)

A total of 23 non-native plants were detected in the 2004 Boundary Fire section of the highway (Table 1). *Bromus inermis* ssp. *inermis*, *Caragana arborescens*, *Melilotus alba*, and *Vicia cracca* were the most aggressively invasive species found. The latter two were also the most frequently recorded, but their distribution was restricted to road fill importation sites and gravel pits. *Caragana arborescens*, on the other hand, was observed growing in natural, undisturbed habitats.

A medium sized infestation of *Bromus inermis* ssp. *inermis* (smooth brome) was detected at Site #146 (N 65.17831°, W 147.275504°, Mile 38, near the Kokomo Creek crossing, *ca.*5 miles before the Upper Chatanika River State Campground). This species had probably been seeded here as a result of roadside revegetation work. We suggest this small infestation be prioritized for control.

Scattered patches of *Vicia cracca* (bird vetch), *Trifolium hybridum* (alsike clover), and *T. repens* (white clover) were recorded along the highway between Miles 38 and 52: some near the Upper Chatanika River Recreation Site, one at the Boston Creek-Steese Highway crossing, and multiple ones around the pond located at the end of a gravel road that branches off the highway at Mile 52 (Site #131). These species were generally growing together, at the same sites, and were not encountered in any other areas of the highway, nor were they found spreading into undisturbed sites. Their clumped but infrequent occurrence suggests that there is a common seed source for these species, which could be linked to the fact that road work was being carried out in this section of the highway. We recommend that control efforts be carried out soon on these incipient, disjunct infestations (especially on the bird vetch ones), as it will be harder and more expensive to eliminate them once they become fully established and start to spread. (See Appendix A.I for maps of the sites at which these species were observed).

At the intersection of the Boston Creek with the highway we recorded infestations of *Bromus inermis* ssp. *inermis* and *Caragana arborescens*, as well as the *Vicia cracca* and *Trifolium hybridum* populations mentioned above. All these species were growing on the north side of the road, right next to the creek, and close to a burned hillside. We therefore strongly recommend that this crossing be targeted for weed eradication and monitoring work. In addition, any areas in which gravel has recently been added could be monitored for new infestations, as many of the gravel pits surveyed along this highway were contaminated with *Melilotus alba* and *B. inermis* ssp. *inermis*.

Boundary Burn photo-monitoring points

One photo-monitoring point was set up to facilitate the management and eradication of a *Caragana arborescens* (Siberian peashrub) stand at the Boston Creek-highway intersection, Site #139 (N 65.225124°, W 147.127824°). It is possible that this species was planted around the rest-area and parking lot, and has since spread beyond the roadside fill area. A large number of seedlings and young plants were growing in the adjacent, undisturbed, mixed spruce-birch forest. Furthermore, mature plants had abundant numbers of fruits, so that additional seedlings and opportunities for seed dispersal are likely. We advicse that this site be given precendence for future control and long-term monitoring work (see Appendix A.III, Table III.1 for a list of priority infestations selected for eradication in the Boundary Burn section of the highway, and recommended control methods).

Figure 3. Photo-monitoring point at Site #142, Mile 38, marking a *Melilotus alba* infestation within the Boundary Burn section.

A second photo-monitoring plot was erected at Site #142 (N 65.1874°, W 147.254121°, Mile 38; Fig. 3), to mark a *Melilotus alba* (white sweetclover) infestation. This site had first and second year plants growing on a pile of coarse material extracted from a mine or excavation pit on the south side of the road, and is adjacent to the burn. If this population were extirpated soon it would prevent the formation of a seed bank in the excavated area. Furthermore, if the contaminated, mined materials have been transported to other parts of the highway, we suggest that these be monitored for incipient white sweetclover infestations.

Bolgen Creek Burn (04)

Eight non-native species were recorded in the section of the highway affected by the Bolgen Creek fire, with *Melilotus alba*, *Vicia cracca*, and *Bromus inermis* ssp. *inermis* being the most aggressively invasive ones. All infestations were restricted to anthropogenically disturbed sites (See Appendix A.I for maps of the sites at which these species were observed).

Figure 4. Monospecific smooth brome stand at a former clear cut by the Albert Creek crossing.

Bromus inermis ssp. *inermis* was likely used in past roadside revegetation work throughout the length of the Steese Highway, which could explain why it was the most frequently recorded species in this burn (see Appendix A.I for a map of smooth brome infestation sites). Although most infestations were small and restricted to the roadside, there was one particularly large, pure stand of smooth brome that covered over one acre of land at the Albert Creek crossing (Site #7, N 65.591208°, W 144.703986°, mile marker 131, just north of Central; Fig. 4). This site was probably cleared when the highway was built, and has since been colonized by this grass (no other non-native or native species were observed here). We recommend that control methods be implemented here to, at a minimum, suppress seed production, and if possible, eradicate the population (see Appendix A.III, Table III.1 for a list of priority infestations selected for eradication in the Boundary Burn section of the highway, and recommended control methods).

Bolgen Creek Burn photo-monitoring points

Two photo-monitoring plots were established in this burn. One was set up at Site #6 (N 65.673749°, W 144.408275°, Mile 143; Fig. 5), in an area that had been recently bulldozed and used for firefighting activities. The resulting high percentage of bare, unvegetated, and disturbed soil made it a likely target for non-native plant colonization, which could then spread into the adjacent burned land. At the time of the survey, however, there were no non-natives at this location.

Figure 5. Photo-monitoring point at Site #6, in the Bolgen Creek Burn area. This site had been used to load firefighting equipment.

A second monitoring plot was established at Site #8 (N 65.590152°, W 144.724637°) at mile marker 131, just east of Central, where there was a small (approximately 0.2 acres), isolated infestation of *Melilotus alba* (white sweetclover) growing on the right of way, adjacent to burned land (Fig. 6). We strongly recommend that control work be carried out here immediately, before a large seed bank forms and the population becomes fully established.

Figure 6. Infestation of white sweetclover in the Bolgen Creek Burn boundary (photo-monitoring point coincides with Mile 131 of the highway).

2006 unburned area survey results

Noteworthy infestations were also recorded outside the burned sections of the highway for the following invasive species:

1. *Melilotus alba* (white sweetclover). In addition to the small burned area populations this species was found outside the burns, including the following sites:

   1.a. Mile marker 90 (Site #4): this population was growing on a gravel pit on the north side of the road. Survey tape was placed around a couple of the plants. The AKNHP crew pulled many of the larger stems to reduce seed production, but still, numerous seedlings and vegetative plants remain.

   1.b. Site #156 (N 65.13694°, W 147.455534°): another large infestation was recorded at a gravel extraction pit along the Watershed Road, on the way to the Poker Flats Watershed Research Station, near mile marker 33 (Fig. 7). It is likely that the contaminated gravel extracted here has been transported to other areas, thus promoting the spread and establishment of this highly invasive species across the region. See Appendix A.III, Table III.1 for control methods that could be used to contain or reduce this infestation.

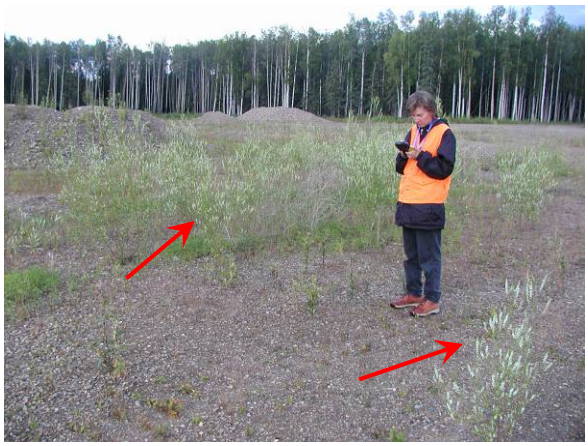


Figure 7. Gravel extraction pit on Watershed Road infested with white sweetclover.

1.c. Sites #9 (N 65.573063°, W 144.802503°), at the BLM bunkhouse in Central, and #10 (N 65.273827°, W 146.646509°), at the BLM maintained Cripple Creek Campground: the two populations detected here were also growing on gravel material. The two gravel piles, which are most likely contaminated with white sweetclover seeds, are being used for trail and campground maintenance work. Some removal work was done at each site, but we advise that both be revisited (new individuals should be pulled prior to seed set to avoid the formation of a large seedbank).

2. *Bromus inermis* ssp. *inermis* (smooth brome): Two large, monospecific stands of approximately 1000 to 10000 stems each were recorded outside the burns at Site #1 (N 65.572929°N, W 144.801884°), on the formerly cleared banks of Crooked Creek, by the BLM bunkhouse. These infestations constitute two potential dispersal foci from which this species could spread into the surrounding areas, including the Bolgen Burn, which is only ¼ mile down the creek. Consequently, we recommend that these two patches be targeted for eradication (see Appendix III, Table III.3 for a list of priority infestations selected for eradication in and near the Bolgen Burn section of the highway, and recommended control methods). The abundance of smooth brome on this highway is probably linked with its use in roadside revegetation projects. We suggest that future control work focuses on containing the current roadside infestations, with emphasis on those occurring between Miles 38 and 39.

3. *Leucanthemum vulgare* (oxeye daisy): A relatively large population of approximately 1000 to 10000 individuals was observed on the right-of-way 5.5 miles northeast of Fox, next to a driveway and gate to private property (Fig. 8). This ornamental plant was probably first planted here by the private land owner. The majority of the population (60%) consisted of seedlings and of young, first year plants. However, mature flowering individuals were also observed. This infestation could be extirpated using a combination of physical (cutting and bagging inforrescences, and digging up the

Figure 8. Oxeye daisies on the right-of-way 5.5 miles northeast of Fox.

plants) and chemical (spot spraying) techniques. Doing so would prevent it from spreading further up and down the highway, which otherwise has relatively few occurrences of this species.

4. *Trifolium pratense* (red clover): A small (less than 200 individuals) population of red clover was discovered just outside Circle, at Mile 161. This species is used for forage in the Matanuska-Susitna region, where it has escaped from cultivation and established along roadsides and in disturbed sites. However, it is still infrequent in Interior Alaska, and must therefore be controlled through hand-pulling, including underground parts.

5. *Hieracium umbellatum* (narrowleaf hawkweed): An infestation of less than 1000 stems was recorded at the entrance to the Pedro Creek parking across from the Felice Pedroni Memorial. Pedro Creek is a very popular recreational site for tourists and local residents, and this invasive species was likely brought here unintentionally by visitors. Controling and reducing this infestation through herbicide application and seeding with native grasses will prevent the species from spreading and establishing along the Pedro Creek.

It must be noted that much of the recent roadside revegetation work carried out at the junction of the Steese and Elliot Highways was done using a seed mix of native, perennial *Poa alpina* (alpine bluegrass) and non-native, annual *Lolium perenne* ssp. *multiflorum* (Italian ryegrass). This is not of special concern to us because native alpine bluegrass can outcompete Italian ryegrass within a couple growing seasons. Finally, even though the non-natives found at this junction at the time of the survey were not aggressive (e.g. *Chenopodium album*, *Lolium perenne* ssp. *multiflorum*), we recommend that BLM and/or Department of Transportation (DOT) crews monitor this area carefully for the next two to three years, to ensure that it does not get colonized by aggressively invasive species.

2006 Eradication work

Control work along the Steese Highway included hand pulling isolated individuals of *Crepis tectorum*, *Elymus sibiricus*, *Melilotus alba*, *Polygonum convolvulus*, and *Trifolium hybridum*. Several patches of *Vicia cracca* were also dug up or pulled. In all, 29 control actions were taken on more than nine acres (see Appendix A.II.a. for a table and Appendix A.II.b. for a map of the sites along the Steese Highway where control work was done in 2006). Most of the plants extirpated were adult individuals, in either the flowering or seed setting stage (i.e., not seedlings). Once pulled, the plants were bagged and removed from the infestation site, and then taken to the BLM field office for disposal.

Steese Highway 2007 Revisit Results

Overview

On July 18th and 19th 2007 we traveled the Steese Highway from its intersection with the Elliot Highway to the outskirts of the town of Circle. We revisited 28 of the 29 sites that had been controlled in 2006 (Table 2). Of these, 20 were distributed along the Boundary Creek Burn section, and nine were in unburned portions of the highway, including one in the town of Central, which was almost surrounded by the Bolgen Creek fire but was not actually burned in it. In addition, we pulled 23 new, small, isolated infestations (all in the Boundary Creek Burn area), for which we only collected the following data: species name, number of stems pulled, control effort (in hours), and locality information (latitude, longitude) (Table 3). We were also able to relocate the four (4) photo-monitoring plots that had been erected in 2006.

Seven non-native species, representing four families, were recorded as part of this revisit work. *Melilotus alba*, *Vicia cracca*, *Caragana arborescens*, and *Elymus sibiricus* were the most aggressively invasive species found (Table 2). As in 2006, the first 30-35 miles of the Steese, which were largely unaffected by the 2004-2005 fires, constitute the most heavily infested section of the highway.

Table 2. List and distribution of non-native plant species infestations *revisited* in 2007 on the Steese Highway.

Family Name	Scientific Name	Common Name	Invasiveness Rank	Bolgen Cr Burn	Boundary Burn	Other
Fabaceae	*Caragana arborescens*	Siberian pea-shrub	66		X	
Asteraceae	*Crepis tectorum*	narrowleaf hawksbeard	54		X	
Poaceae	*Elymus sibiricus*	Siberian wildrye	59		X	
Fabaceae	*Melilotus alba*	white sweetclover	80	X	X	X
Polygonaceae	*Polygonum convolvulus*	black bindweed	50		X	X
Fabaceae	*Trifolium hybridum*	alsike clover	57			X
Fabaceae	*Vicia cracca*	bird vetch	73		X	

Table 3. List and distribution of *new* non-native plant species infestations found (and extirpated) in 2007 along the Steese Highway.

Species name	Stem count	Control action	Garmin GPS wpt ID	Lat	Lon
Melilotus alba	1	Manual pull	3	65.2804	-146.5776
Trifolium hybridum	1	Manual pull	4	65.2628	-146.7549
Melilotus alba	1	Manual pull	4	65.2628	-146.7549
Trifolium hybridum	1	Manual pull	5	65.2604	-146.7695
Melilotus alba	1	Manual pull	5	65.2604	-146.7695
Melilotus alba	1	Manual pull	6	65.2567	-146.7843
Melilotus alba	1	Manual pull	7	65.2552	-146.7882
Melilotus alba	1	Manual pull	8	65.2553	-146.7881
Melilotus alba	1	Manual pull	9	65.2483	-146.8007
Melilotus alba	2	Manual pull	10	65.2383	-146.8349
Melilotus alba	3	Manual pull	11	65.2367	-146.8492
Melilotus alba	5	Manual pull	12	65.2365	-146.8506
Melilotus alba	3	Manual pull	13	65.2358	-146.8575
Melilotus alba	25	Manual pull	14	65.2355	-146.8601
Melilotus alba	15	Manual pull	15	65.2350	-146.8637
Melilotus alba	40	Manual pull	16	65.2329	-146.8872
Melilotus alba	25	Manual pull	17	65.2305	-146.9074
Melilotus alba	40	Manual pull	18	65.2297	-146.9175
Melilotus alba	2	Manual pull	19	65.2296	-146.9197
Melilotus alba	40	Manual pull	20	65.2298	-146.9231
Melilotus alba	36	Manual pull	21	65.2205	-146.9732
Melilotus alba	10	Manual pull	22	65.2200	-147.0244
Melilotus alba	75	Manual pull	23	65.2210	-147.0348
Melilotus alba	100	Manual pull	24	65.2215	-147.0862
Melilotus alba	30	Manual pull	25	65.2222	-147.0893

2007 burned area survey results

Boundary Burn (04)

All 20 infestations that were controlled in 2006 in this section of the highway were revisited in 2007 (Table 4, for a map of sites controlled in 2007 see Appendix A.II.c), and 23 new and very small infestations (mainly of *Melilotus alba*) were also pulled (Table 3, Appendix A.II.c).

No new plants were found at any of the six *Crepis tectorum* infestation sites that had been controlled in 2006, which had all consisted of small (1-5 individuals), highly localized infestations (Table 4, Appendix A.II.c). This could imply that manual pulling can be effective for some non-native species if it is done while the populations are very small, and before a big seed bank develops.

Table 4. List of 2006 control plots located in the Boundary Creek Burn that were *revisited* in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Melilotus alba	743 (155)	65.1519	-147.3671	n/a	E side 500 ft N of turnout for gravel pit and pond, in Boundary burn	0	No
Vicia cracca	744 (154)	65.1541	-147.3584	n/a	NW side, middle of slough, possibly not in correct location	0	No
Vicia cracca	745 (approx. 500 m from 153)	65.1589	-147.3329	35	SE side, burn extends to road, may not be in correct location	0	No
Melilotus alba	746 (145)	65.1847	-147.2641	n/a	gravel parking with lake to the N, NW side	6-25	Yes
Vicia cracca	747 (31)	65.1846	-147.2633	n/a	NW side, gravel parking with lake to N, S corner, behind fire ring	26-50	Yes, but possibly a seed bank has already formed
Vicia cracca	750 (141)	65.2255	-147.1259	43	fill pile at W end of pullout, at end of guardrail	0	No
Vicia cracca	751 (131)	65.2163	-146.9821	n/a	side road to S, on bank at E end of pond	6-25	Yes
Vicia cracca	752 (132)	65.2157	-146.9835	n/a	side road to S of Steese, on bank at S side of pond	0	No
Vicia cracca	753 (130)	65.2169	-146.9826	n/a	side road on S of Steese, on bank N of pond, near parking area	0	No

Table 4. List of 2006 control plots located in the Boundary Creek Burn that were *revisited* in 2007 (contd.').

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Crepis tectorum	754 (26)	65.2410	-146.8237	52	side road to N of Steese, fill pile 100 ft down on E	0	No
Crepis tectorum	755 (20-22, 25)	65.2589	-146.7762	55	on long hill between creek and side road to N, on N side close to bottom of hill	0	No
Crepis tectorum	756 (20-22, 25)	65.2582	-146.7778	55	on long hill between creek and side road to N, on S side, midway up hill	0	No
Crepis tectorum	757 (20-22, 25)	65.2580	-146.7793	55	on long hill between creek and side road to N, on N side, near top of hill	0	No
Elymus sibiricus	758 (23)	65.2581	-146.7790	55	on long hill between creek and side road to N, on N side, near top of hill, by yellow marker	151-500 (510150 in '06)	Only controlled area between bridge and side road
Crepis tectorum	759 (19)	65.2681	-146.7212	56	100 ft NE of Davidson ditch pullout, S side of road	0	No
Polygonum convolvulus	760 (16)	65.2719	-146.7087	57	pullout on S side, towards W end	0	No
Elymus sibiricus	761 (14)	65.2720	-146.7082	56	pullout on S side, middle of vegetated median	26-50 (1-5 in '06)	Yes
Melilotus alba	762 (11)	65.2737	-146.6464	n/a	Cripple Creek campground, river access, fill pile	0	No
Crepis tectorum	763 (12)	65.2770	-146.6571	59	seeded road cut, N side, W of Cripple Creek campground	0	No

Of the seven *Vicia cracca* (bird vetch) patches pulled in 2006, five appeared to be clean in 2007 (Table 4, Appendix A.II.c). However, despite the 2006 hand pulling efforts, *V. cracca* was still found growing at Site #747-2007 (#31-2006), in a gravel parking lot off the highway. We pulled all the new adult individuals found in 2007, but recommend that this site is revisited for another two to three years to check (and pull) any seedlings that may arise from the seed bank (Fig. 9). Site #751-2007 (#131-2006, Table 4, Fig. 10), at the east end of a pond off the highway, had more *V. cracca* plants in 2007 (6-25 stems) than in 2006 (1-5 stems), despite 2006 control work, which indicates that a seed bank may have started to form, as bird vetch only reproduces from seed and does not resprout after cutting.

Figure 9. A *Vicia cracca* infestation located in a gravel parking lot off the highway was controlled in 2006 but had grown back again in 2007 (Site #747-2007). Although we pulled it again, it is likely that the plants will grow back because we were unable to fully remove the root system, and it is likely that a small seed bank may have started to form.

Figure 10. *Vicia cracca* individuals had also grown back at Site #131-2007 (they were dug out again) on the grassy slopes surrounding a pond by the highway.

Similarly, of the three *Melilotus alba* infestations controlled in 2006, those that were very small and isolated (Sites #743 and #762, with stem counts of 1-5 in 2006) had no new individuals in 2007 (Table 4). In contrast, the *M. alba* patch growing at Site #746-2007, in a gravel pullout near a swampy lake, was only slightly smaller than it had been in 2006 before it was controlled (20 stems instead of 20-50 stems) (Fig. 11, Table 4).

The two *Elymus sibiricus* sites controlled in 2006 continued to be infested with this species in 2007 (Table 4, Appendix A.II.c), and in both cases population size had increased. We did not pull any individuals growing in the roadside gravel along the hill (Site #758-2007, #23-2006, Fig. 12) because it would have taken up too much time. We did, however, pull all the flowering individuals we found at Site #761-2007 (#14-2006, Fig. 13) at a roadside pullout. However, the plants will most likely grow again next year, as some plants had already gone to seed. Because of the way in which this grass was only found in sections of the roadside that appeared to have been recently paved and revegetated (Figs. 12, 13), we propose that this species may have been introduced as a contaminant in the seeding mix used by road maintenance crews.

Figure 11. Some of the bigger *Melilotus alba* patches that had been pulled in 2006 had to be controlled again in 2007, as is the case for the infestation at Site #746-2007, located in the same gravel parking lot as the *Vicia cracca* plants in Figure 7.

Figure 12. *Elymus sibiricus* is growing interspersed with other grasses in imported gravel along a recently revegetated section of the Highway, at Site #758-2007 (not pulled).

Figure 13. *Elymus sibiricus* population at Site #761-2007 (flowering individuals were pulled, but it is highly unlikely that we effectively removed the population as some plants had already gone to seed).

The pullout by the Boston Creek crossing continues to be a highly problematic area in this burn. We revisited the photo-monitoring plot established there in 2006 (Site #749-2007, Fig. 14, see below for a more detailed account) and recorded a very large (1000+) population of *Caragana arborescens*, together with small clumps of *Trifolium hybridum* and a few stems of *Crepis tectorum*, which we pulled. The one species we did not find here in 2007 that had been recorded in 2006 was *Vicia cracca* (Site #150-2007). As this pullout is at the intersection of the highway with a river crossing (thus facilitating dispersal downstream into native vegetation) and is surrounded by burned white spruce forests, we strongly recommend that the infestations recorded be extirpated, and the site be monitored for three to five years to eradicate any new invasive plant species' seedlings that might emerge following control work.

Figure 14. This large stand of *Caragana arborescens* could eventually spread into the surrounding burned forest via Boston Creek.

Boundary Burn photo-monitoring points

We revisited both Boundary Burn photo-monitoring plots (Table 5). Site #748-2007 (#142-2006, Fig. 15) marks a large (1000-10000 individuals) *Melilotus alba* infestation, which was growing on imported gravel at a pullout ("Robert Fox" property) with numerous other *M. alba*, *Bromus inermis* ssp. *inermis* and *Lepidium densiflorum* populations. As in so many other instances of roadside areas that have weed infested gravels, propagules could quickly disperse from this area into the surrounding, native vegetation. We recommend monitoring this site to check that the *M. alba* population

doesn't start spreading uphill into undisturbed vegetation, and if possible, treating it to contain and/or reduce its extent (see Appendix III, Table III.1 for a schematic description of the control methods recommended for this infestation).

Figure 15. This gravel filled pullout was infested with many non-native plant species. The *Melilotus alba* infestation photographed here was very big, and probably has a well established seed bank (Boundary Burn photo-monitoring point, Site #748-2007).

The second photo-monitoring plot (Site #749-2007, #139-20006, Figs. 16 and 17) is at the Boston Creek crossing, just before mile marker 44, and was set up to help manage a dense stand of *Caragana arborescens*. This population had rapidly increased in size in the span of a year, going from *ca.* 25 individuals in 2006 to 1000+ in 2007. Furthermore, because this infestation extends from the road pullout to the creek, it could spread downstream into the nearby burned, mixed, white spruce forest. In addition, three other aggressively invasive species were recorded here both in 2006 and 2007: *Crepis tectorum* (all stems pulled in 2007), *Bromus inermis* ssp. *inermis*, and *Trifolium hybridum* (in 2006 surveyors had also observed *Vicia cracca* in this area, but none were found in 2007). We strongly recommend that this area is highly prioritized in any future monitoring and eradication efforts.

Figure 16. A dense *Caragana arborescens* stand extends from the Boston Creek–highway crossing to a pullout at Site #748-2007. This infestation should be prioritized for eradication work, as the population has already increased dramatically in size over the span of one year, and it could easily spread along the creek banks into the burn.

Figure 17. Another view of the *Caragana arborescens* infestation, looking from the pullout towards Boston Creek (Site #748-2007).

Table 5. 2006 photo-monitoring plots located in the Boundary Creek Burn that were revisited in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Control action
Melilotus alba	748 (142)	65.1873	-147.2541	n/a	gravel pull through on E side, older fill pile to NE, tag 1 on aspen to W, tag 2 on dead spruce	No
Caragana arborescens	749 (139)	65.2251	-147.1280	43	Boston Creek crossing, before MP 44, NW side, 50 ft NE of culvert, parallel to guardrail for approximately 100 ft	No

Bolgen Creek Burn (04)

Like in 2006, we did not detect any infestations moving off the human footprint into undisturbed areas. The only control plots we revisited in this area were in the town of Central, which is close to the burn perimeter, not inside it. These and other unburned area plots are discussed in the "2007 unburned area results" section of this report.

Bolgen Creek Burn photo-monitoring points

We revisited the two photo-monitoring plots that had been set up in 2006 (Table 6). One of these plots (Site #767-2007, #1-2006) had been established because it had a high percentage of bare, unvegetated, and disturbed soil that was adjacent to the road and to the burn. As in 2006, we found no invasive species here in 2007, and therefore recommend that it is given less importance than photo-monitoring site #766-2007 (below) and those established within the Boundary Creek Burn perimeter (photo-monitoring sites #748 and #749), which all deserve immediate attention.

The second plot (Site #766-2007, #8-2006, Fig. 18) marks a large infestation (1000-10000 stems) of *Melilotus alba* that was growing on the right of way, adjacent to burned land. There was no significant change in population size from 2006. We recommend that this population is controlled before it expands into the surrounding burn, especially as this more northerly section of the Steese Highway is still largely weed-free.

Figure 18. Large *Melilotus alba* infestation in the Bolgen Creek Burn boundary, just north of Central (Site #766-2007).

Table 6. 2006 photo-monitoring plots located in the Bolgen Creek Burn that were revisited in 2007.

Species name	Site code	Lat	Lon	Mile marker	Location notes
Melilotus alba	766 (8)	65.5901	-144.7255	130	photo monitoring plot STS 8, S side, 0.1 mi W of red house, adj. to pond, did not find tag, replaced
None	767 (6)	65.6738	-144.4082	143	S side, small pullout just W of MP 143, tagged tree fallen, replaced with tag on N side of rd

2007 unburned area revisit results

Nine control plots were revisited in 2007, seven of which were concentrated in the first 25 miles of the Steese Highway (Sites #736-742-2007), while the remaining two (Sites #764-2007 and #765-2007) were located close to the North Fork bridge (near mile marker 95) and in Central, respectively (Table 7, for maps of some of the key infestations controlled in 2007 see Appendix A.II.c).

Table 7. List of plots read in the unburned sections of the highway in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Melilotus alba	736 (181)	64.9673	-147.5866	12	NW side, between gravel lot and driveway with orange mailbox	0	No
Melilotus alba	737 (172)	65.0026	-147.5202	16	NW side, adjacent to tailings pile	0	No
Melilotus alba	738 (171)	65.0307	-147.4731	18	NW side, downhill from curve sign	0	No
Crepis tectorum	739 (170)	65.0412	-147.4172	n/a	Fish Creek road pullout across from Fairbanks Creek road	0	No
Trifolium hybridum	740 (162)	65.0466	-147.4369	21	Cleary Summit, SE corner of intersection, near mailboxes	100	Yes, but there are many more small infestations left nearby
Melilotus alba	741 (158)	65.0791	-147.4340	24	E side, 100 ft N of road sign	0	No
Melilotus alba	742 (156)	65.1366	-147.4535	n/a	Watershed road gravel pit to W	10000+	Yes
Melilotus alba	764 (4)	65.4026	-145.7436	93	gravel pit on N side of road, 500 ft W of North Fork Twelvemile Creek bridge	400	Yes, but only eliminated two out of three clumps.
Melilotus alba	765 (9)	65.5729	-144.8028	n/a	BLM bunkhouse yard, W from side door at yard-forest boundary	0	No (none found)

The majority of these plots, which had small populations of either *Melilotus alba* (Sites #736-2007, #737-2007, #738-2007, and #741-2007) or *Crepis tectorum* (Site #738-2007) in 2006, were weed-free in 2007. This suggests that hand-pulling small, isolated populations of these two species can provide an effective way to their control and/or eradication.

The *Melilotus alba* (white sweetclover) infestation at a gravel extraction pit along the Watershed Road (Site #742-2007, #156-2006, Fig. 19), consisted of 1000-10000 stems in 2006, and was estimated to be slightly larger in 2007 (10000+ stems). We pulled plants for 30 minutes, but found we had only removed a minuscule portion of the population. Given that the contaminated gravel is being used in construction and maintenance

Figure 19. Watershed Road *Melilotus alba* infestation (Site #742-2007). Hand pulling efforts will probably be ineffective given the size of the population (10000+ stems) and the existence of an equally large seed bank.

projects, if this infestation is not treated and eventually elimintated it is very likely the white sweetclover propagules will be dispersed to and start growing in other sections of the road. Hand pulling at this site would not only be costly, but also ineffective, as a large seed bank has most likely developed by now. We therefore suggest spot spraying the populations with herbicides (Appendix A.III, Table III.1).

Another species controlled in this first section of the highway was *Trifolium hybridum*, at the Cleary Summit intersection (Site #740-2007). Although we pulled about 100 stems of one clump, we were unable to dig out underground parts. It is therefore likely that it will resprout (from adventitious stem buds) in the coming seasons, and/or that the propagules from nearby clumps will recolonize the disturbed patch of ground.

Site #764-2007 (Figs. 20 a, b), which marks a *Melilotus alba* infested gravel pit at mile marker 93, near the North Fork bridge, was partially pulled by AKNHP crews in 2006 (they pulled the largest stems to reduce seed production). Despite this effort, the population had doubled in size by the next year. In 2007, we extirpated two of a three clumps growing there (we could not pull the remaining one because we could not fit any more plants into our vehicle). Extirpation of the third clump is highly recommended, and will help keep this infestation restricted to the pullout.

Figure 20(a). *Melilotus alba* population at mile marker 93, near the North Fork bridge. This population should be treated and extirpated so that propagules do not spread either naturally, or by transporting this contaminated gravel to new sections of the road (Site #764-2007).

Figure 20(b). We pulled two of the three clumps of *M. alba* growing at this location over a one hour period. We suggest that this site be revisited for additional control and eradication work.

We also checked the *Melilotus alba* infestation site that had been recorded at the BLM bunkhouse in Central in 2006 (Site #765). No *M. alba* plants were found there in 2007, although there was a large (500+ stems) population of *Leucanthemum vulgare*.

Other non-native species populations observed outside the burned areas during our surveys were *Bromus inermis* ssp. *inermis* (large infestations by the banks of Crooked Creek in Central), *Trifolium pratense* (a medium sized population growing at Mile 161 near Circle), *Leucanthemum vulgare* (a large population north of Fox, and a medium one by the BLM bunkhouse in Central), and *Hieracium umbellatum* (two medium to large populations, one at the entrance to the Pedro Creek parking, and another at a pullout shortly before getting to Cleary Summit). Given that the land around Central and Circle is still largely weed-free, we recommend that the *Bromus inermis* ssp. *inermis* and *Trifolium pratense* populations found in these areas be targeted for extirpation

(see Appendix A.III, Table III.3 and II.4 for more information on these sites and control recommendations).

Steese Highway problematic areas

Despite there being non-native plants throughout the length of the highway, the following two areas constitute definite invasive species 'hotspots':

1. Fox to Davidson Ditch: The section of the highway from Fox to Mile 60 had the greatest diversity of non-native species. This is likely due to the large volume of traffic in this area, and to the many road construction projects that were taking place here (Fig. 21). The area comprised between Mile 52 and Mile 60 was particularly rich in invasive species: a number of species found here, such as *Crepis tectorum*, *Elymus sibiricus*, *Phleum pratense*, *Polygonum convolvulus*, and *Viola tricolor*, were not seen anywhere else on the Steese Highway. These plants may have been introduced with top soil, seed mix or contaminated construction equipment, given that some parts of this portion of the highway were under construction and others had just recently been built and revegetated. Another hotspot of invasive species in the Davidson Ditch area is the Boston Creek crossing (Site #749-2007), where populations of *Caragana arborescens* (1000+ stems), *Crepis tectorum* (all stems pulled in 2007), *Bromus inermis* ssp. *inermis*, and *Trifolium hybridum* were recorded (there were also some *Vicia cracca* plants observed here in 2006, but not in 2007). We strongly recommend that this area highly prioritized for any future monitoring and eradication efforts (see below).

Figure 21. Discrete infestation of white sweetclover in the Boundary Burn area. This photo illustrates the very strong correlation that exists between road construction work (with the consequent use of contaminated materials) and non-native plant infestations.

2. The area around the junction of the Elliot and Steese Highways.

In addition, the populations found in/around the towns of Central and Circle constitute relative hotspots for the more northern portion of the highway, as this is otherwise a largely weed-free section of Highway.

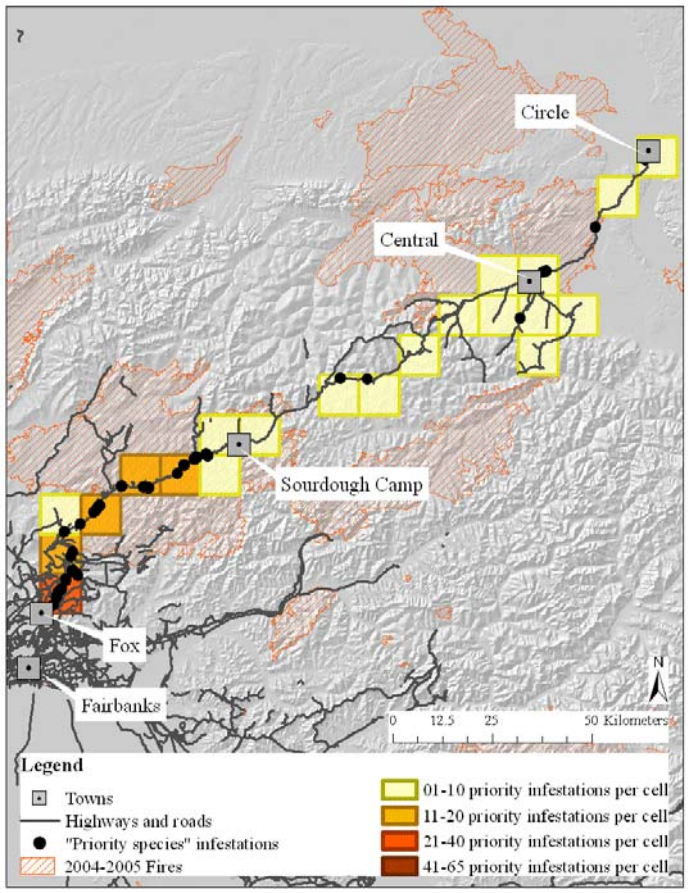


Figure 22. Infestation density along the Steese Highway. We divided the highway into 10km^2 cells, then totaled the number of priority species infestations per cell. Moderate to high infestation densities (with 10-20 priority infestations in a 10km2 area) were found between Fox and Sourdough Camp, along Davidson Ditch. High densities, with 20-40 priority infestations per cell, were recorded at the junction of the Elliot and Steese Highways.

Priority infestations for control work

We provide lists of priority sites for control and eradication work for the Steese Highway in Appendix A.III, and a map showing the distribution of these sites in Appendix IV. These lists include brief schematic information on the types of treatments that we suggest be used to reduce or eliminate the selected infestations. However, for a more detailed description of the mechanical and chemical treatments that can be used for each priority species, please see the 'Control methods for 2006 and 2007 priority infestations' section of this report.

In general, we suggest that sites that are contaminated with aggressively invasive species and have the potential to act as major dispersal foci (for instance, populations that are within close proximity to creek crossings and burned areas, or infestations growing on gravel extraction pits) be targeted first.

Most of the sites that we selected for priority control work were located in the Davidson Ditch area (Appendix A.III, Table III.1). Within this section, we recommend that the Boston Creek crossing roadside populations of *Crepis tectorum*, *Bromus inermis* ssp. *inermis*, *Caragana arborescens*, and *Trifolium hybridum* be eliminated and then monitored to detect any new plants resprouting or arising from a seed-bank. The creek connects these infestations with the surrounding burned hills, thus providing a potential dispersal corridor for these weeds to spread into the fire-disturbed habitats.

We also selected two large *Melilotus alba* populations in the Boundary Burn that we propose be contained, and if possible, over time, eliminated. One was growing at a gravel extraction pit along the Watershed Road, near mile marker 33, and we propose that it be extirpated soon, because the contaminated gravel extracted is probably being transported to other areas, thus facilitating the spread and establishment of this highly invasive species throughout the region. The second large infestation, marked by a photo-monitoring point, was recorded on a pile of coarse material extracted from a mine or excavation pit, at a pullout on the south side of the road ("Robert Fox" property). We suggest this population be extirpated to prevent the formation of a seed bank in the excavated area and the spread of this species into the adjacent native, burned vegetation.

There were also numerous small and isolated *Melilotus alba* roadside populations in the first 60 miles of the highway which would be worth pulling, especially given that our field observations indicate that handpulling small (1-5 individuals) infestations of *M. alba and Crepis tectorum* can be an efficient way of extirpating these populations (the average amount of time spent recording, pulling, and bagging these small infestations was 3-5 minutes, and most of the small populations pulled in 2006 were weed-free in 2007) (Appendix A.III, Table III.1).

Scattered patches of *Vicia cracca* (bird vetch), which is highly aggressive, *T. repens* (white clover), which is still infrequent in Interior Alaska, and *Elymus sibiricus*, were also recorded along the Davidson Ditch section of the highway (Appendix A.III, Table III.1). We recommend that work be carried out soon on these incipient, disjunct infestations as it will be harder and more expensive to eliminate them once they become fully established and start to spread.

Although *Bromus inermis* ssp. *inermis* (smooth brome) was frequently recorded in the Davidson Ditch area, we suggest focusing on eradicating two relatively isolated populations observed near Kokomo Creek (shortly before the Upper Chatanika River State Campground, Sites #146 and #152), given that they were still small, and by eradicating them soon one could effectively prevent their spread along the roadside (Appendix A.III, Table III.1). Another smooth brome infestation that we would prioritize for control work was located at the Albert Creek crossing just north of Central (Site #7, Appendix A.III, Table III.3). This site was probably cleared when the highway was built, and has since been colonized by this grass (no other non-native or native species were observed here). We recommend that mechanical or chemical control methods are implemented here to, at a minimum, suppress seed production, and if possible, eradicate the population.

Finally, among the few infestations recorded north of Central we highlight the small (approximately 0.2 acres), isolated *Melilotus alba* population growing at mile marker 131, along the right of way and adjacent to burned land Appendix A.III, Table III.3. We strongly recommend that control work be carried out here immediately, before a large seed bank forms and the population becomes fully established.

Steese Highway summary of findings

All priority invasive species detected along the Steese Highway in the 2006 and 2007 surveys must be targeted for eradication (see Appendix A.III for a list of infestations recommended for control). Most of the invasive species formed small, scattered infestations, and can therefore still be successfully extirpated. For more widespread invasives, such as smooth brome, we propose focusing on containing the existing infestations and preventing new ones from arising.

Non-native species were largely restricted to anthropogenically disturbed sites. However, the highly invasive *Caragana arborescens* (Siberian peashrub) was found spreading into undisturbed, native communities at the Boston Creek crossing (Boundary Burn), and appeared to have rapidly grown in size between one year and the next. We strongly advise that this infestation be eradicated as soon as possible. Unlike the Dalton Highway, no non-natives were observed growing on fire-disturbed sites along the Steese. Nonetheless, burned areas remain highly vulnerable to invasion and should be monitored accordingly.

Two invasive species 'hotspots' were identified: the junction of the Elliot and Steese Highways, and the section of highway extending from Fox to Davidson Ditch. The presence of infestations along the highway was strongly correlated with road building and roadside revegetation activities, with the importation of contaminated gravel and other construction materials, and with parking lots, trailheads, campgrounds, and boat launch sites. Consequently, all these sites must be inventoried and monitored for early detection of new non-native plant establishment.

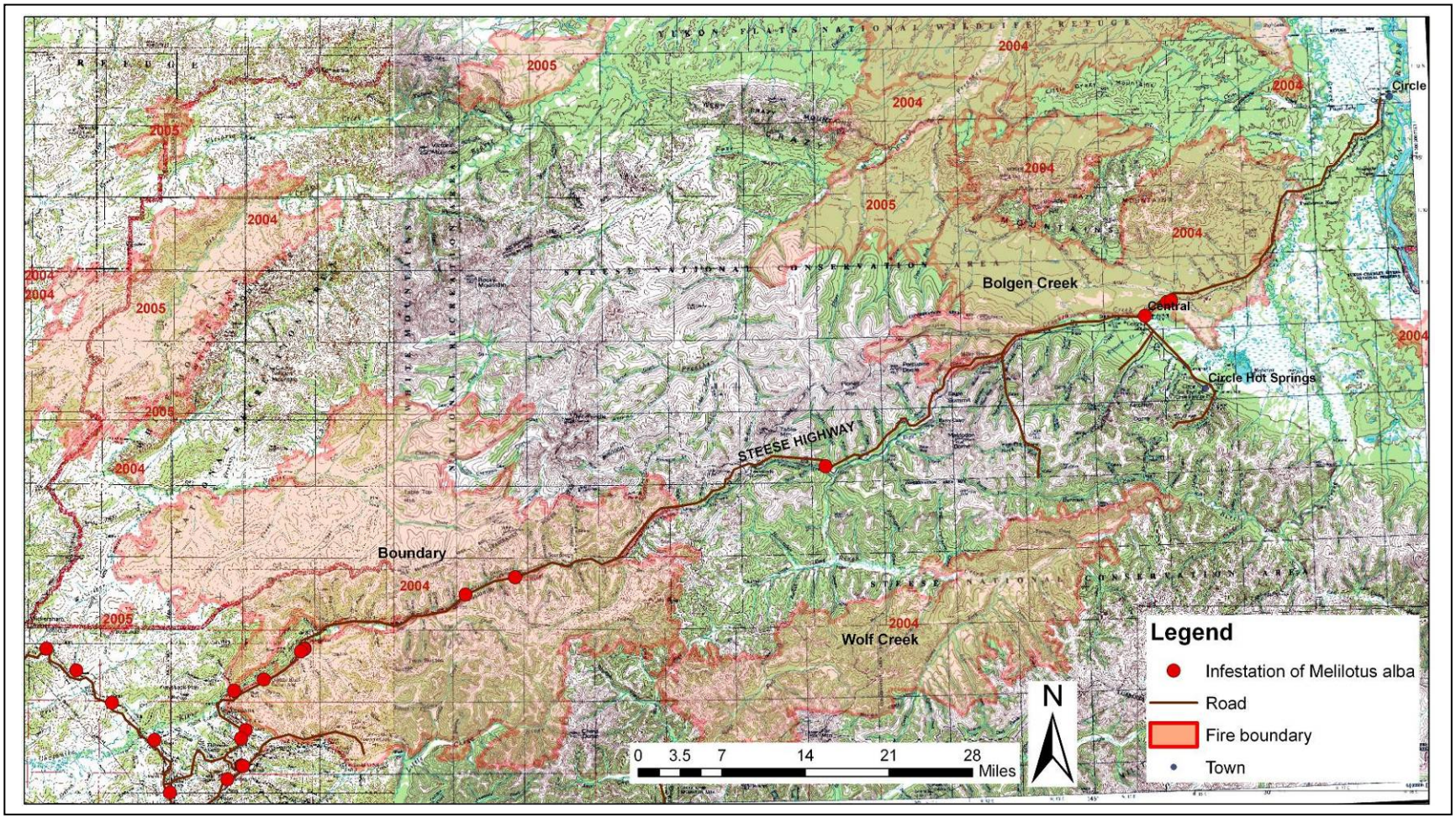
Many of the sites controlled in 2006 and revisited in 2007 were weed-free (see Table 4 for a list of sites controlled in 2006 and revisited in 2007). Most of the populations extirpated in 2006 had been very small (1-50 stems) and one could therefore conclude that if infestations are pulled completely (leaving no underground parts for those species that can reproduce vegetatively) at a very early stage, before a seed bank has formed, they can be effectively eliminated using only hand-pull methods. However, one must interpret these observations with caution, as it could also be that some seeds that did not germinate in 2007 could still germinate in the next growing season, as most of the highly invasive species recorded in Interior Alaska (*Melilotus alba*, *Vicia cracca*, *Caragana arborescens*, *Crepis tectorum*, etc.) produce seeds that can remain viable in the soil for many years. Based on the type and size of each infestation seen during 2006 and 2007, and their proximity to waterways and burns, we selected those that we considered should be prioritized for eradication and those that should be monitored for changes in their behavior (invasiveness) over the coming five years (see Appendix A.III for brief recommendations on what control methods could be used for each selected infestation). –

Finally, plant collections were made for the reference herbarium at BLM. All non-native species encountered were collected, together with unknown species that could potentially be non-native, and with species commonly used in roadside revegetation work. The list of voucher specimens collected along the Steese Highway includes: *Crepis tectorum*, *Caragana arborescens*, *Elymus sibiricus*, *Hieracium umbellatum*, *Leucanthemum vulgare*, *Polygonum convolvulus*, *Phleum pratense*, and *Vicia cracca*.

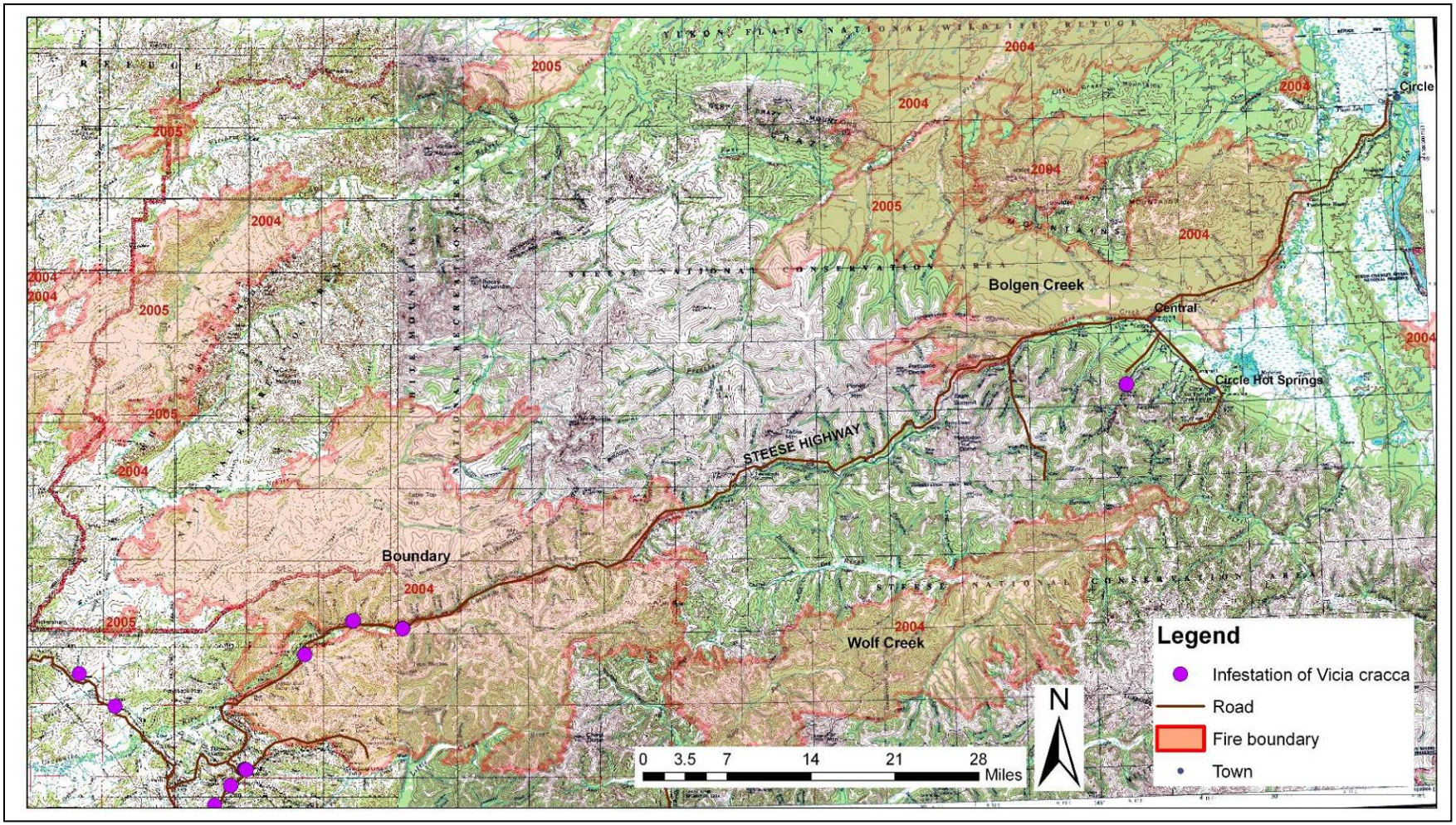
Steese Highway Appendices – Set 'A'.

Appendix A.I. Infestation maps for key species recorded along the Steese Highway.

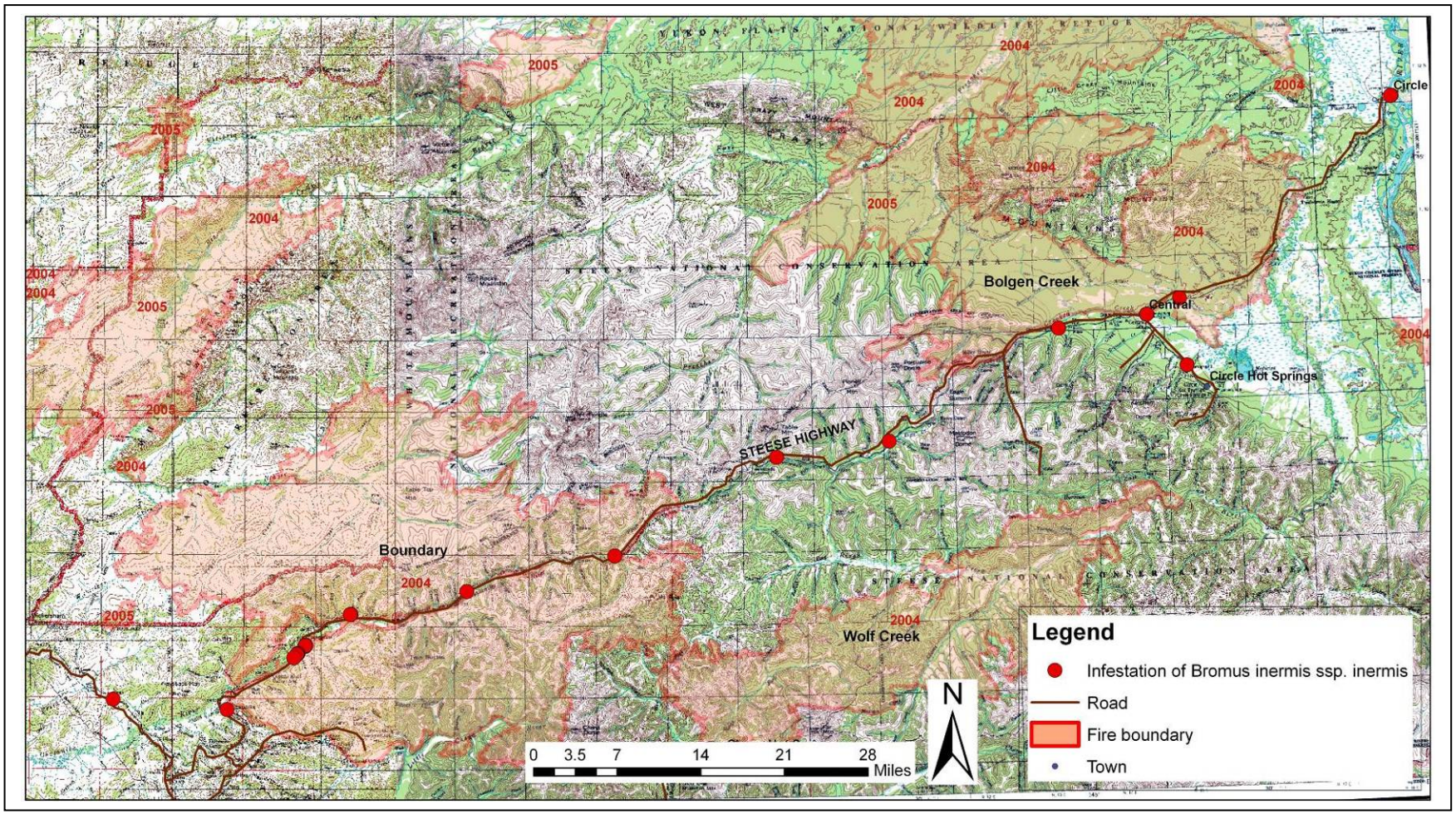
2006 infestations of white sweetclover (Melilotus alba) *along the Steese Highway.*



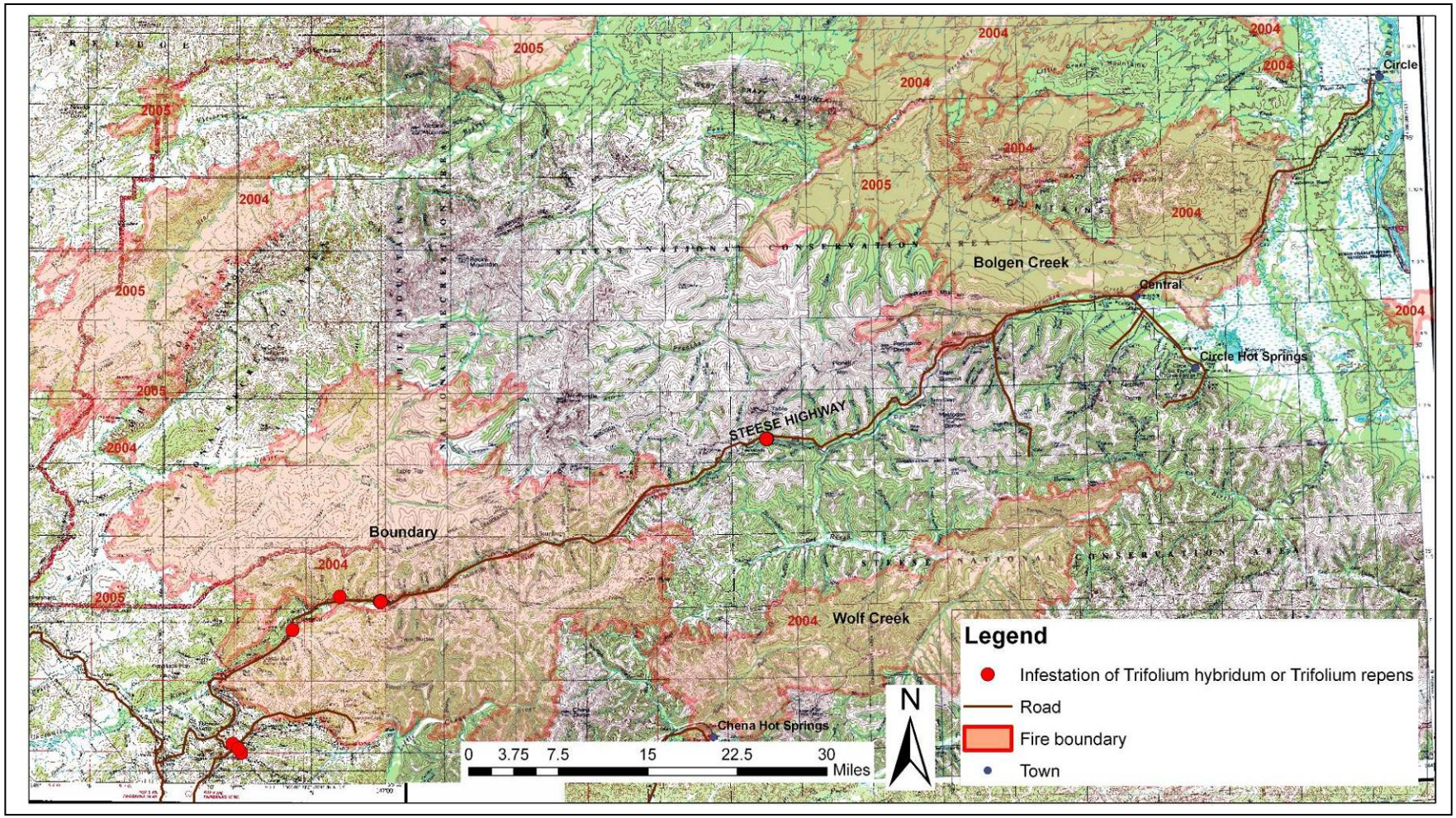
2006 infestations of bird vetch (Vicia cracca) *along the Steese Highway*



2006 infestations of smooth brome (Bromus inermis *ssp.* inermis) *along the Steese Highway.*



2006 infestations of white (Trifolium repens) *and alsike clover* (T. hybridum) *along the Steese Highway.*



Appendix A.II.a. Records of 2006 control work on small infestations along the Steese Highway corridor.

Species name	Site code	Mile marker	Latitude	Longitude	Location notes	Stem count	Aggressiveness	Phenology	Control action
Crepis tectorum	1	162	65.825430	-144.060886	Circle, Yukon river, boat ramp	1-5	Very Low	Flowering	Manual pull
Crepis tectorum	12	60	65.277200	-146.656447	west of mm 60	1-5	Very Low	Seed Set	Manual pull
Crepis tectorum	19	58	65.268956	-146.720079		1-5		Flowering	Manual pull
Crepis tectorum	20	57	65.257662	-146.780524	west of creek and gravel pit	1-5	Very Low	Flowering	Manual pull
Crepis tectorum	21	55	65.257593	-146.780878	west of creek and gravel pit	1-5	Very Low	Flowering	Manual pull
Crepis tectorum	22	55	65.257593	-146.780878	west of creek and gravel pit - across hwy from 21 closer to bridge	1-5	Very Low	Flowering	Manual pull
Crepis tectorum	26	56	65.240404	-146.822833	corner of side road, north of highway	1-5	Very Low	Seed Set	Manual pull
Crepis tectorum	170		65.041150	-147.416899	Fish Creek, road pull-out, across from Fairbanks Creek Road	1-5	Very Low	Flowering	Manual pull
Elymus sibiricus	14	58	65.272447	-146.706801	across from road pullout	1-5	Very Low	Flowering	Manual pull
Elymus sibiricus	23	55	65.257593	-146.780878	west of creek and gravel pit	51-150	Very Low	Seed Set	Manual pull

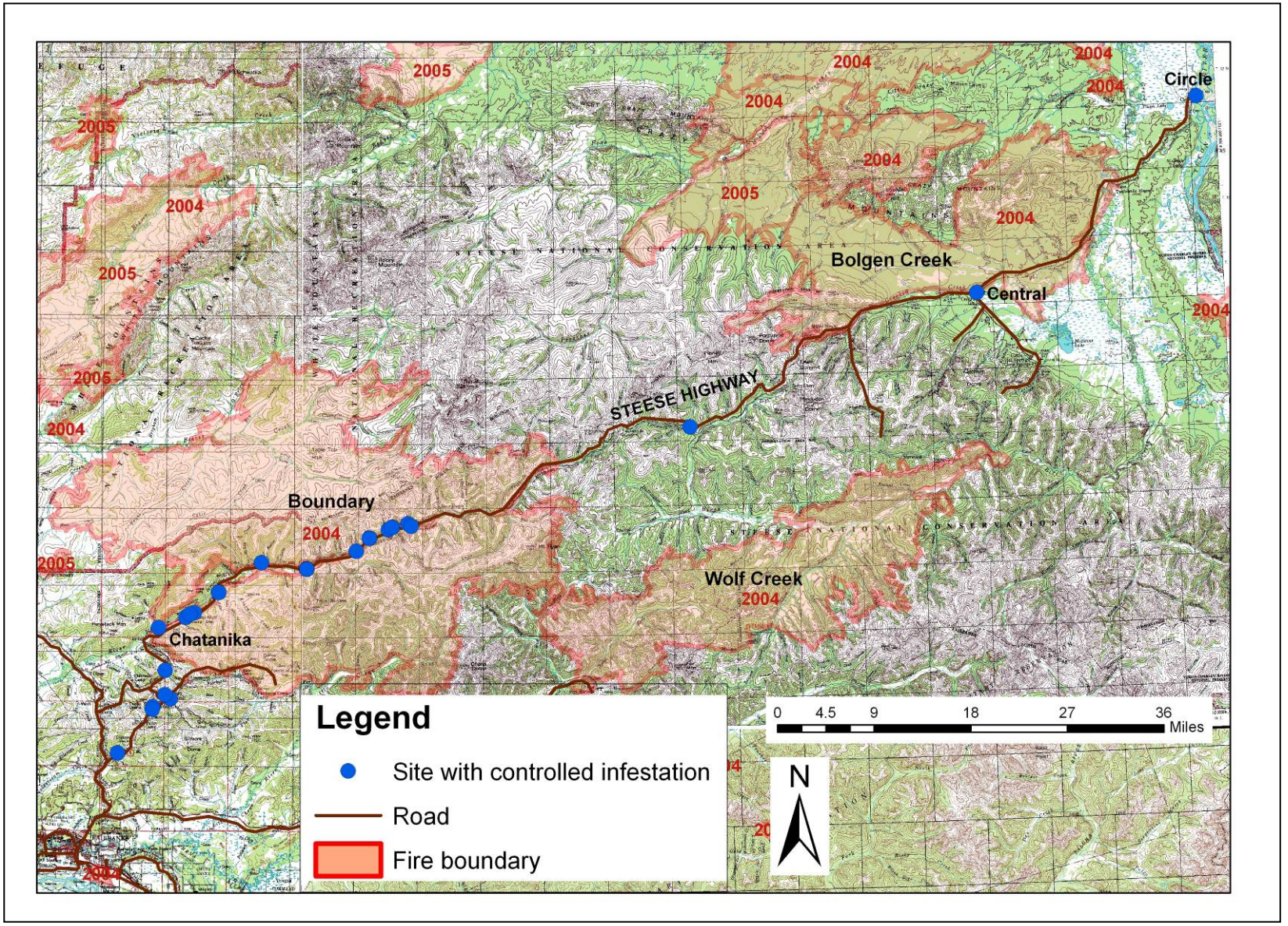
Appendix A.II.a. (contd'.). Records of 2006 control work on small infestations along the Steese Highway corridor.

Species name	Site code	Mile marker	Latitude	Longitude	Location notes	Stem count	Aggressiveness	Phenology	Control action
Melilotus alba	9	130	65.573063	-144.802502	BLM Bunkhouse property	6-25		Flowering	Manual pull
Melilotus alba	4	83	65.402585	-145.743364	gravel pit on N side of road, 500 ft W of North Fork Twelvemile Creek bridge	6-25	Medium	Bud	Manual pull
Melilotus alba	11	60	65.273748	-146.646490	Cripple Creek campground river access/fill pile	1-5	Very Low	Seedling	Manual pull
Melilotus alba	145	38	65.184639	-147.264004	lake parking just north of Kokomo Creek	26-50		Flowering	Manual pull
Melilotus alba	155	33	65.150870	-147.369514	roadside	1-5	Very Low	Flowering	Manual pull
Melilotus alba	156	33	65.136940	-147.455534	gravel pit	1000-10000		Seed Set	Manual pull
Melilotus alba	158	25	65.079497	-147.434055		1-5		Flowering	Manual dig
Melilotus alba	171	10	65.030317	-147.472619		1-5		Flowering	Manual pull
Melilotus alba	172		65.003504	-147.518344	3200 Steese	1-5		Flowering	Manual pull
Melilotus alba	181		64.967756	-147.583962		6-25		Flowering	Manual pull

Appendix A.II.a. (contd'.). Records of 2006 control work on small infestations along the Steese Highway corridor.

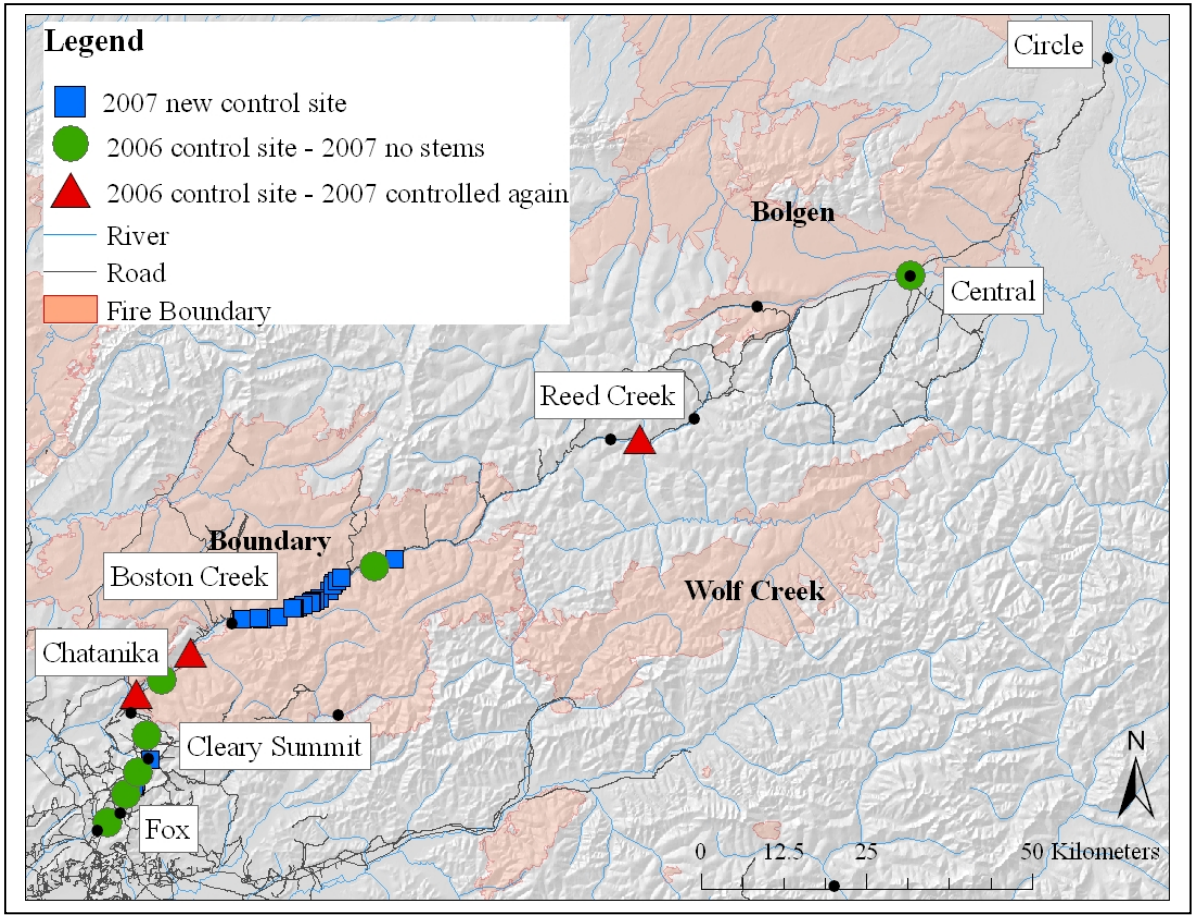
Species name	Site code	Mile marker	Latitude	Longitude	Location notes	Stem count	Aggressiveness	Phenology	Control action
Polygonum convolvulus	16	58	65.271916	-146.710207	Burnt. road pullout on south side of road. Adjacent to burn.	1-5	Very Low	Seed Set	Manual pull
Trifolium hybridum	162		65.046888	-147.433828	Cleary Summit Road, near intersection	1-5	Very Low	Flowering	Manual pull
Vicia cracca	31	38	65.184639	-147.263995	gravel pit, parking	51-150	Medium	Flowering	Manual pull
Vicia cracca	130	52	65.216567	-146.983380	little pond at end of side road	6-25	Very Low	Flowering	Manual pull
Vicia cracca	131	52	65.216537	-146.982205	far side of pond next to 132	1-5	Very Low	Flowering	Manual dig
Vicia cracca	132	52	65.215967	-146.982689	far side of pond next to 132	6-25	Very Low	Flowering	Manual dig
Vicia cracca	141	44	65.225078	-147.127225	north side of road. Between pullout and stream. Burn on hillside behind sampling site	6-25	Low	Flowering	Manual dig
Vicia cracca	153		65.157263	-147.341628		6-25	Low	Flowering	Manual pull
Vicia cracca	154	34	65.155383	-147.356988	gravel pit, south side of road	6-25	Low	Flowering	Manual dig

Appendix A.II.b. Map of sites along the Steese Highway where control work was done in 2006.

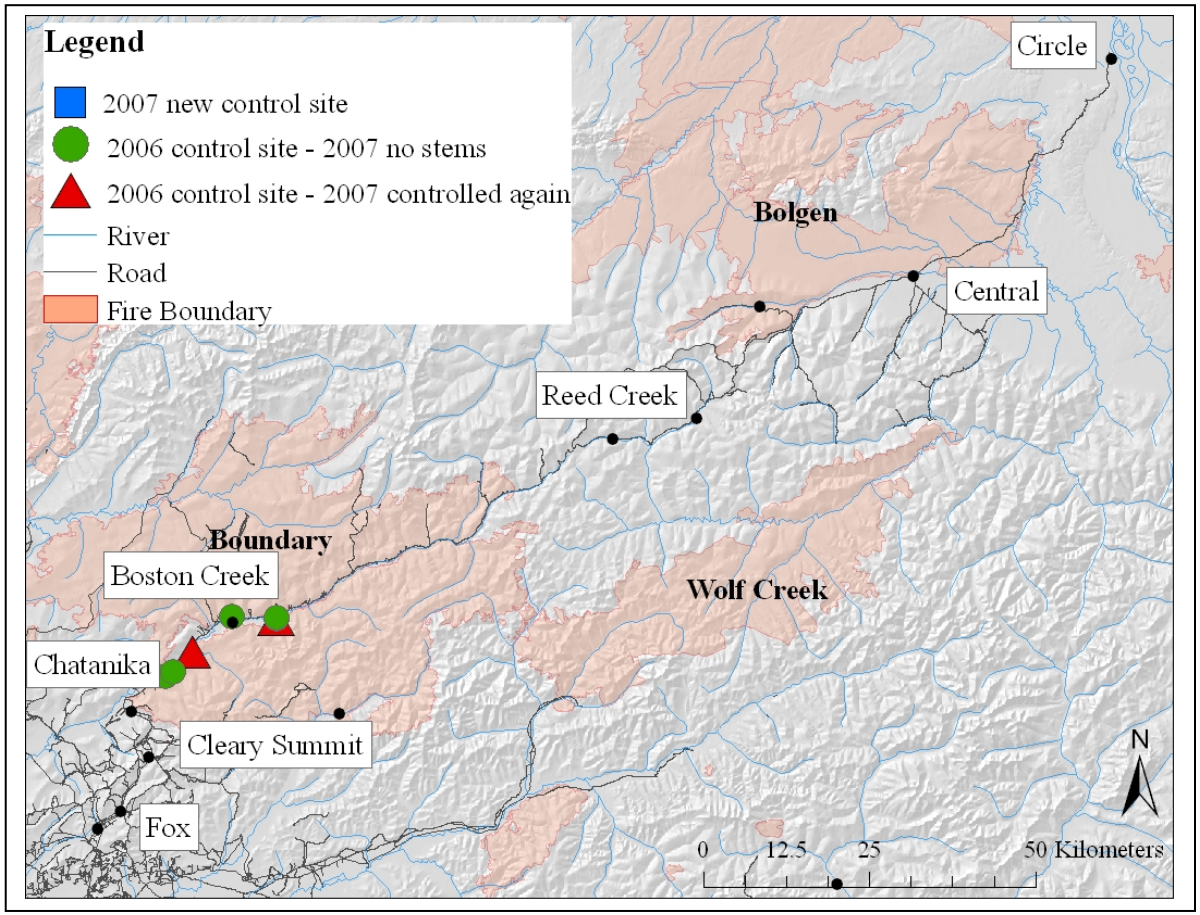


Appendix A.II.c. Maps of sites along the Steese Highway targeted for control work in 2007.

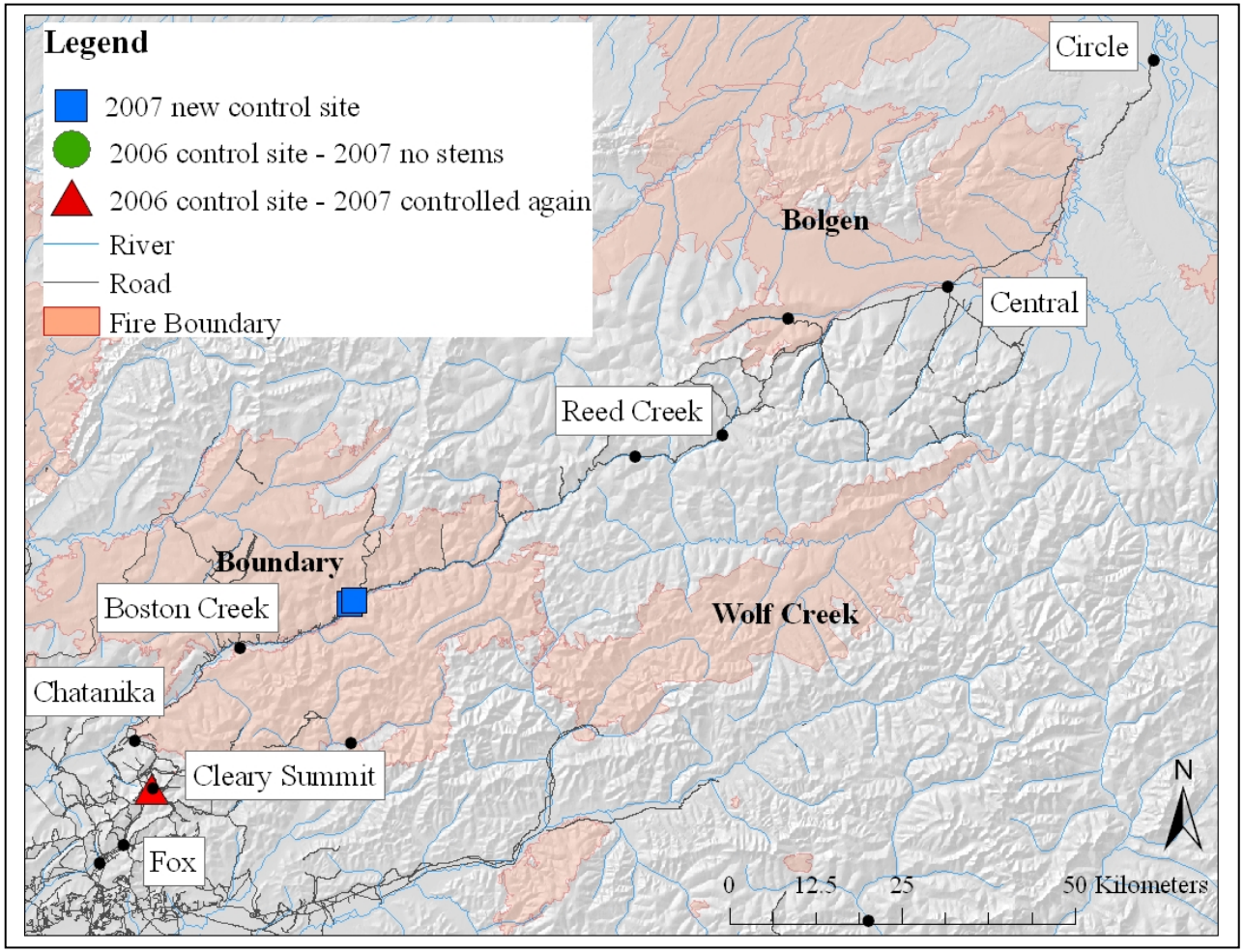
Melilotus alba *2006 control sites and 2007 new sites that were targeted for control in 2007.*



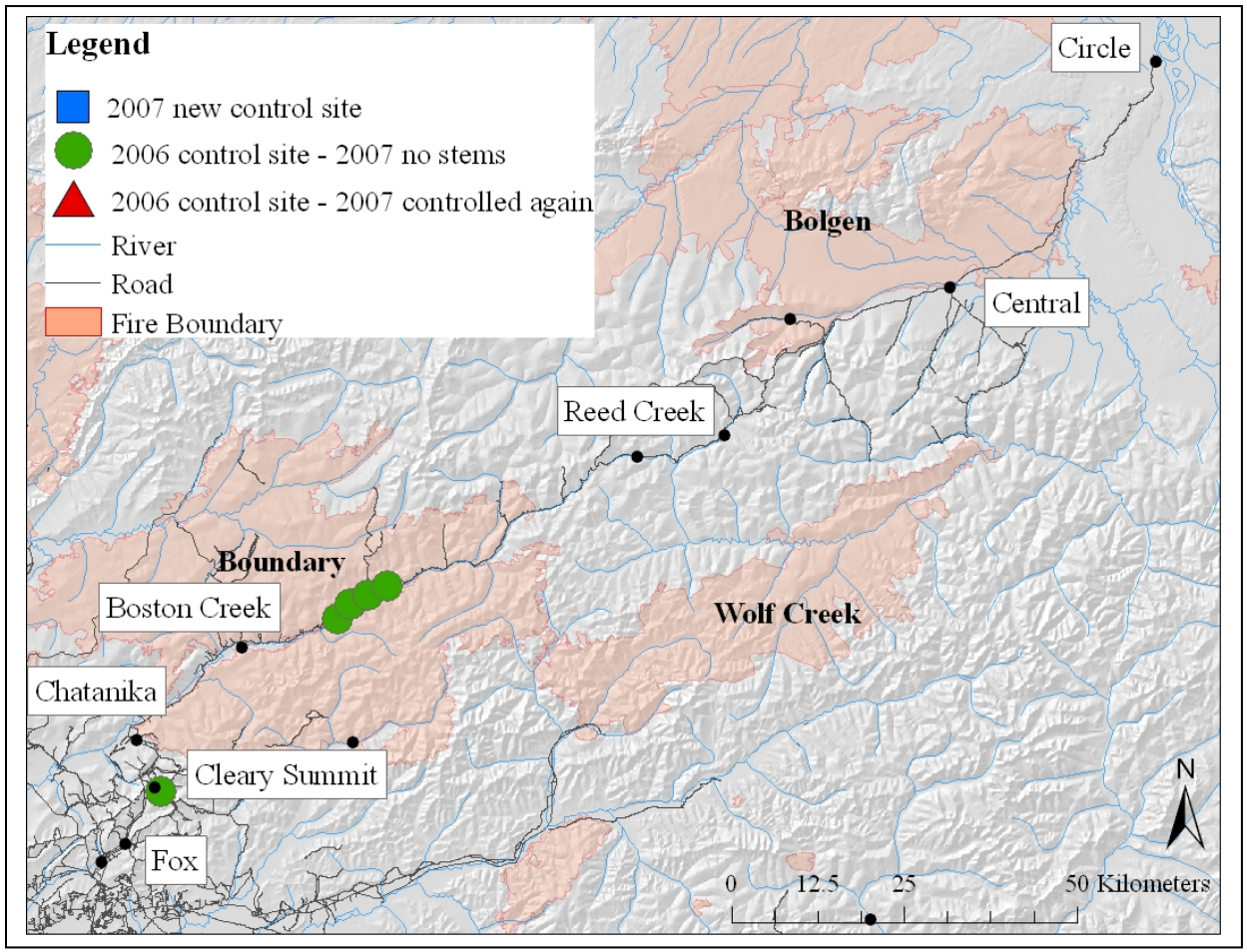
Vicia cracca *2006 control sites that were targeted for control in 2007.*



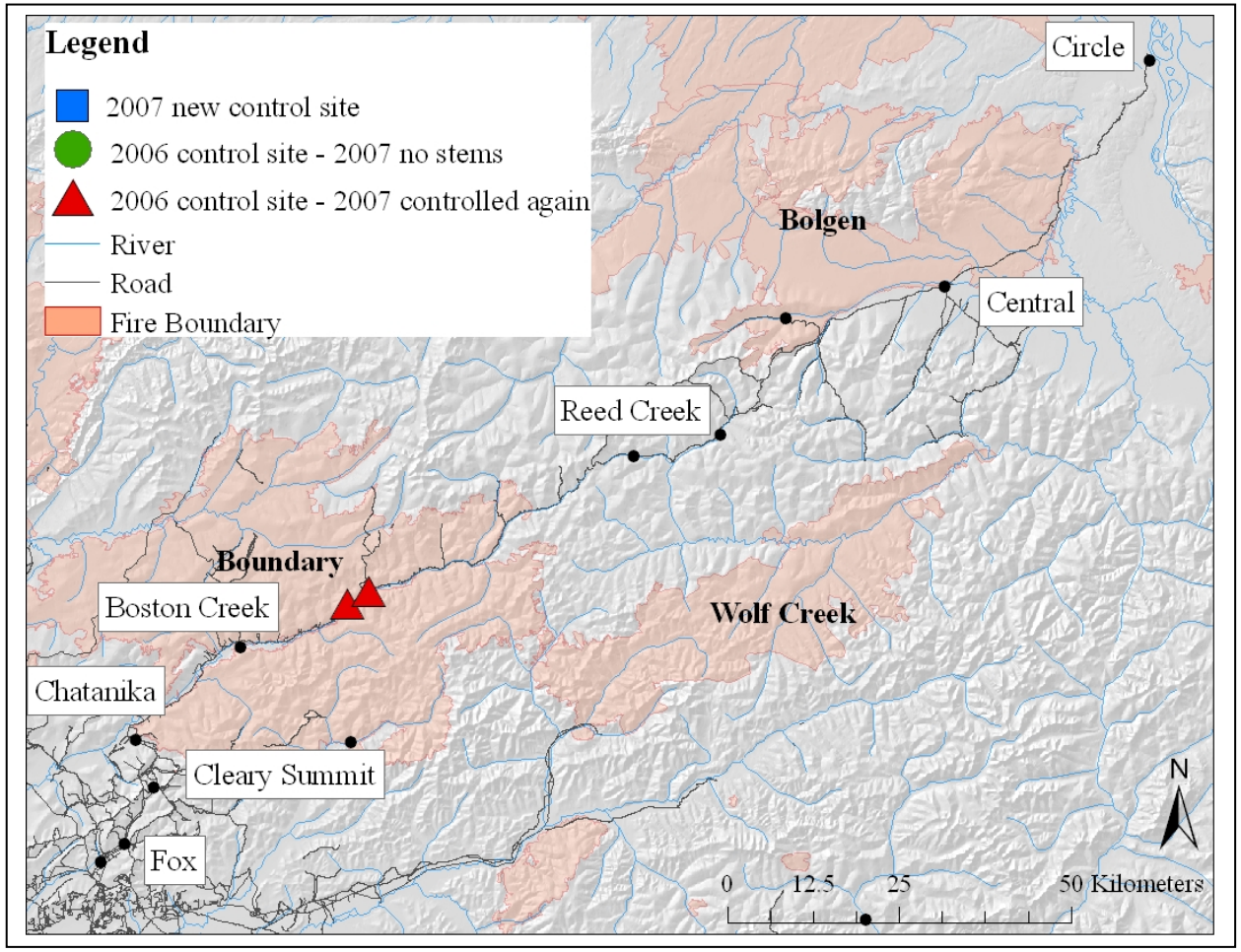
Trifolium hybridum *2006 control sites and 2007 new sites that were targeted for control in 2007.*



Crepis tectorum *2006 control sites that were targeted for control in 2007.*



Elymus sibiricus *2006 control sites that were targeted for control in 2007.*



Appendix A.III. Problematic infestations along the Steese Highway recommended for control and monitoring.

Table III.1. Location of problematic infestations recommended for control and monitoring work in (and south of) the Boundary Burn.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Est. stem count	Control action 06/07	Recommended methods of control
Leucanthemum vulgare	(174)	64.991544	-147.533088	right-of-way 5.5 mi NE Fox, next to a driveway and gate to private property	(1000-10000)	None	– Cut or bag flowering heads one month after snow melt – Dig out plants and rosettes – Spot-spray w/ herbicide 'diflufenzopyr' – Revisit and treat monthly during the growing season – Monitor for up to 5 years
Hieracium umbellatum	(173)	65.008214	-147.501301	Opposite the Felice Pedroni Memorial; at the parking lot on the east side of the road	(500-1000)	None	– Spray infestation + 50 ft radius with Telar seedlings (control before onset of flowering) – Optional: seed with native grasses – Monitor annually
Melilotus alba	742 (156)	65.1369	-147.4555	mi 33, Watershed road near Poker Creek	'06: 1000-10000 '07: 10000+	Hand pulling (only some clumps) in '06 and '07	– Spray infestation + 50 ft radius – Monitor annually
Bromus inermis ssp. *inermis*	(152)	65.1729	-147.2872	east of Kokomo Cr	151-500	None	– Cut or mow (monoculture) before the inflorescences appear – Repeat monthly during the growing season for up to 4 years

(list of sites continues - next page)

Table III.1. Location of problematic infestations recommended for control and monitoring work in (and south of) the Boundary Burn (contd'.).

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Est. stem count	Control action 06/07	Recommended methods of control
Bromus inermis ssp. *inermis*	(146-151)	65.1776	-147.2777	mi 38, before Upper Chatanika River campground, nr. Kokomo Cr	26-50	None	– Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years
Melilotus alba	746 (145)	65.1846	-147.2640	Pullout by swampy lake, *ca.* 1-3 miles south of Upper Chatanika River campground, just north of Kokomo Creek	6-25	Yes, pulled both years	– Spray infestation + 50 ft radius – Monitor annually
Vicia cracca	747 (31, 144)	65.1846	-147.2640	Pullout by swampy lake, *ca.* 1-3 miles south of Upper Chatanika River campground	26-50	one pulled in 2006, the other not pulled in 2006; pulled in 2007	– Hand pull or mow before flowering – Revisit and re-treat 1x every 6 wks until the winter – Monitor and re-treat for 5 years – After 5 years, apply herbicide on remaining plants
Trifolium hybridum	(143)	65.1848	-147.2632	Pullout by lake, just south of Upper Chatanika River campground	1-5	None	– Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs

(list of sites continues - next page)

Table III. 1. Location of problematic infestations recommended for control and monitoring work in (and south of) the Boundary Burn (contd'.).

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Est. stem count	Control action 06/07	Recommended methods of control
Melilotus alba	748 (27, 142)	65.1872	-147.2547	after Upper Chatanika R. campground	1000-10000	None	– Spray infestation + 50 ft radius with adequate herbicide – Monitor annually
Caragana arborescens	749 (139)	65.2251	-147.1278	mi 43, Boston Cr crossing	'06: 6-25 '07: 500-1000	None	– Hand pulling, cutting, digging – Stamp injection – Monitor for 2-3 years
Trifolium hybridum	(140)	65.2251	-147.1278	mi 43, Boston Cr crossing	151-500	None	– Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Bromus inermis ssp. inermis	(137)	65.2254	-147.1251	mi 43, Boston Cr crossing	6-25	None	– Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years
Trifolium repens Trifolium hybridum	(133-135)	65.2193	-147.0109	mi 51, between Boston Cr and Moose Cr, near culvert- off road, by pond	51-150	None	– Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Vicia cracca	751-753 (130-132)	65.2166	-146.9834	mi 52, between Boston Cr and Moose Cr, little pond at end of side road	6-25	Pulled in 2006, and only found 1 stem in 2007 which we pulled	– Hand pull or mow before flowering – Revisit and re-treat 1x every 6 wks until the winter – Monitor and re-treat for 5 years – After 5 years, apply herbicide on remaining plants
Elymus sibiricus	761 (14, 17)	65.2690	-146.7203	Davidson Ditch, mi 58, after Ptarmigan Cr, across from road pullout, before Cripple Cr	1-5	'06: yes, no '07: yes	– Repeated hand pulls – (seed with native grass) – Monitor for +/- 4 years

Table III.2. Location of problematic infestations recommended for control and monitoring work between the Boundary and Bolgen Burns.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Est. stem count	Control action 06/07	Recommended methods of control
Bromus inermis ssp. *inermis*	(7)	65.4116	-145.8890	mi 82, west side of Reed Cr, access road	1-5	No	– Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years
Melilotus alba	764 (4)	65.4026	-145.7434	mi 83, gravel pit 500 ft W of North Fork bridge	’06: 6-25 ’07: 151-500	Yes, pulled both years	– Spray infestation + 50 ft radius – Monitor annually

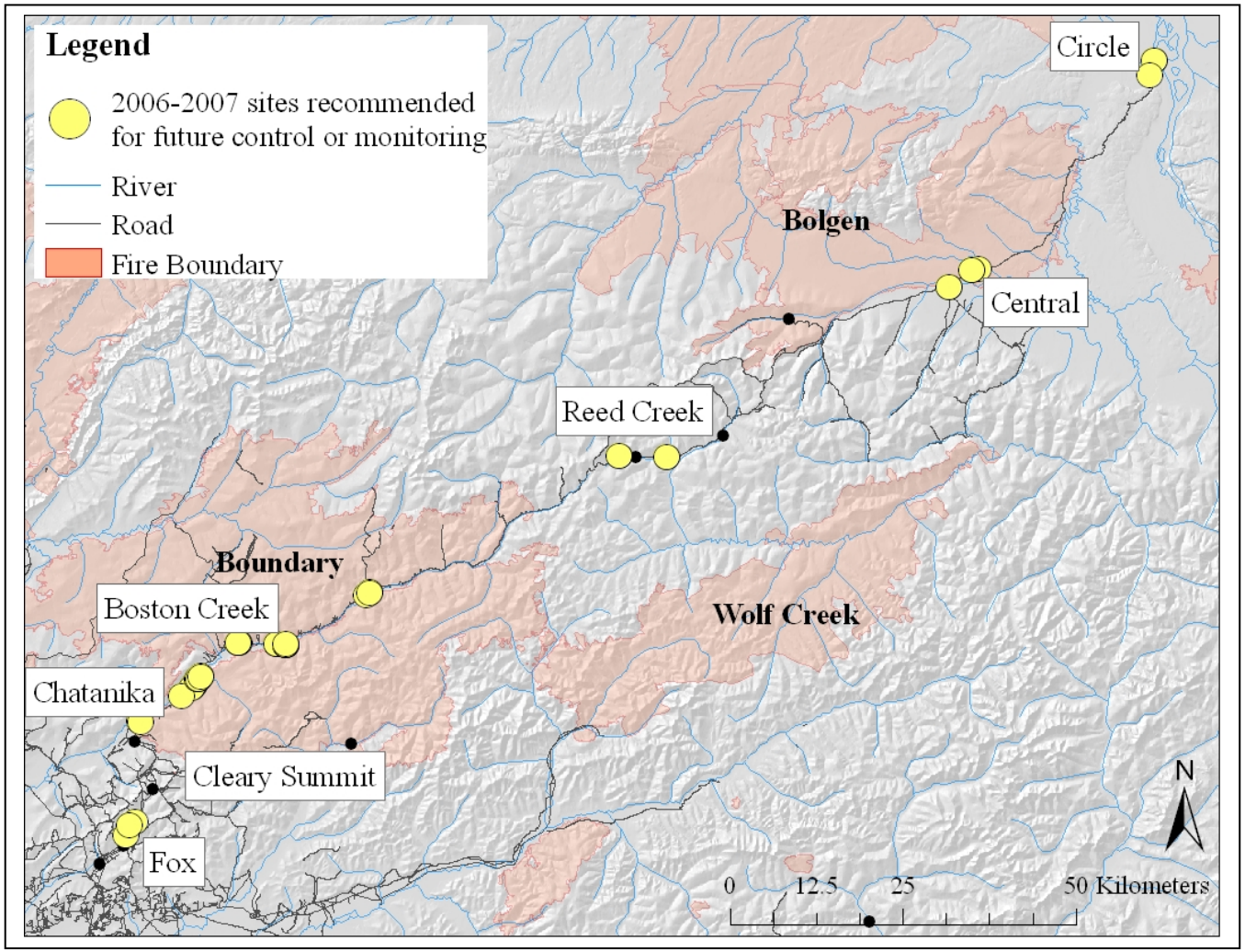
Table III.3. Location of problematic infestations recommended for control and monitoring work in/around the Bolgen Burn.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Est. stem count	Control action 06/07	Recommended methods of control
Bromus inermis ssp. *inermis*	1	65.5729	4.8020	mi 130, BLM bunkhouse nr. Crooked Cr	1000-10000	No	– Mow (monoculture) before the inflorescences appear – Repeat monthly during the growing season for up to 4 years
Bromus inermis ssp. *inermis*	7	65.5912	-144.7040	mi 131, Albert Cr crossing pullout	26-50	No	– Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years
Melilotus alba	766 (8)	65.5902	-144.7246	mi 131, along roadside East of Central, 0.1 mi W of red house	1000-10000	No	– Modify road maintenance regime – Spray infestation + 50 ft radius – Monitor annually

Table III.4. Location of problematic infestations recommended for control and monitoring work in and near Circle.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Est. stem count	Control action 06/07	Recommended methods of control
Trifolium pratense	5	65.8078	-144.0837	mi 161, along road, outside of Circle	51-150	No	– Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Crepis tectorum	1	65.8254	-144.0609	mi 162, Circle, Yukon river boat ramp	1-5	Yes	– Hand pull, incl. underground parts – Bag and remove plants – Monitor for 3+ years

Appendix A.IV. Map of problematic infestations along the Steese Highway recommended for control and monitoring.



Dalton Highway 2006 Inventory Results

Overview

Fieldwork along the Dalton Highway was conducted from July 22nd through July 27th 2006. Monitoring efforts extended from one mile south of the Yukon River-Dalton Highway crossing to the town of Coldfoot, and covered a total of five fires: Fort Hamlin Hills (2004), Ray River (2005), Dall City (2004), North Bonanza (2005), and Chapman Creek (2005). The 2004 Evansville Burn was excluded from the surveys because there was no road access to it. Secondary roads and trails were also surveyed for up to one mile or until no more invasive species were found. Additional sites included trailheads, fire access roads, and pipeline access roads.

A total of 24 non-native species belonging to seven families were recorded in the approximately 120 miles of highway and roughly 214 acres of roadside and adjacent lands inventoried (Table 8). Surveyors read 20 AKEPIC-based plots, which included nine plots on pipeline maintenance access pullouts and three at rest stops and picnic areas, and 451 BLM-BAER plots, which were erected whenever priority invasive species were found on or near BLM land, including right-of-ways, trailheads, fire access roads, and pipeline access roads. Nine permanent photo-monitoring plots were established, two in each of the burned areas (Fort Hamlin Hills, Dall City, 2005 North Bonanza, and Chapman Creek), except for the Ray River Burn, where we only set up one plot because the portion of the highway affected by this fire is very short (see Appendix B.III for a map of sites at which photo-monitoring points were established).

Table 8. List of non-native plant species encountered along the Dalton Highway in 2006.

Family Name	Scientific Name	Common Name	Invasiveness Rank
Poaceae	*Alopecurus pratensis*	meadow-foxtail	not ranked
Poaceae	*Bromus inermis* ssp. *inermis*	smooth brome	62
Brassicaceae	*Capsella bursa-pastoris*	shepherd's purse	40
Chenopodiaceae	*Chenopodium album*	lambs quarters	35
Asteraceae	*Crepis tectorum*	narrowleaf hawksbeard	54
Brassicaceae	*Descurainia sophia*	flaxweed tansymustard	41
Asteraceae	*Hieracium umbellatum*	narrowleaf hawkweed	51
Poaceae	*Hordeum jubatum*	foxtail barley	63
Brassicaceae	*Lepidium densiflorum*	common pepperweed	25
Asteraceae	*Leucanthemum vulgare*	oxeye daisy	61
Fabaceae	*Lotus corniculatus*	birdsfoot trefoil	not ranked
Asteraceae	*Matricaria discoidea*	pineapple weed	33
Fabaceae	*Medicago sativa* ssp. *sativa*	alfalfa	59
Fabaceae	*Melilotus alba*	white sweetclover	80
Fabaceae	*Melilotus officinalis*	yellow sweetclover	65
Plantaginaceae	*Plantago major*	common plantain	44
Poaceae	*Poa pratensis* ssp. *irrigata*	spreading bluegrass	52
Poaceae	*Poa pratensis* ssp. *pratensis*	Kentucky bluegrass	52
Polygonaceae	*Polygonum aviculare*	prostrate knotweed	45
Asteraceae	*Taraxacum officinale* ssp. *officinale*	common dandelion	58
Fabaceae	*Trifolium hybridum*	alsike clover	57
Fabaceae	*Trifolium pratense*	red clover	53
Fabaceae	*Trifolium repens*	white clover	59
Fabaceae	*Vicia cracca*	bird vetch	73

2006 burned area survey results

Fort Hamlin Hills Burn (04)

The Fort Hamlin Hills Burn is the most southerly burn along the Dalton Highway. The following five non-native species were found in this section: *Crepis tectorum*, *Bromus inermis* ssp. *inermis*, *Melilotus alba*, *Trifolium hybridum*, and *Vicia cracca*. Of these, the most invasive species were *Melilotus alba* (ranked at 80 points out of 100) and *Vicia cracca* (invasiveness rank of 73 points). The latter was also the most frequently recorded together with *Crepis tectorum* (54 points). (See Appendix B.I for maps of the sites at which these species were recorded in 2006 along the Dalton Highway).

Trifolium hybridum (57 points) was widespread locally and was recorded at Sites #447 (N 65.912291°, W 149.794946°) and #448 (N 65.911066°, W 149.790749°). We recommend

that these sites be prioritized for eradication. (Appendix I shows all *T. hybridum* infestations observed on the Dalton Highway).

No invasive species were expanding from anthropogenically disturbed sites into burned areas.

Fort Hamlin Hills Burn photo-monitoring points

One photo-monitoring point was established at Site #144 (N 65.933015°, W 149.852656°), marking a population of *Vicia cracca* on the right-of-way (Fig. 23). The second one was set up at Site #150 (N 65.906983°, W 149.779104°), which was infested with *Melilotus alba* (Fig. 24).

Figure 23. Photo-monitoring point marking a *Vicia cracca* infestation on a right-of-way (Site #144, Fort Hamlin Hills Burn, Dalton Highway).

Figure 24. This *Melilotus alba* infestation covers approximately one acre of roadside and is adjacent to the Fort Hamlin Hills Burn. A photo-monitoring point was established here (Site #150).

Ray River Burn (05)

Seven non-native species were recorded in the Ray River Burn section: *Crepis tectorum*, *Bromus inermis* ssp. *inermis*, *Melilotus alba*, *Trifolium hybridum*, *T. pratense*, *Hieracium umbellatum*, and *Vicia cracca* (see Appendix B.I for maps of the sites at which these species were recorded in 2006 along the Dalton Highway). The most aggressively invasive species were *Melilotus alba* (80 points, Fig. 25) and *Vicia cracca* (73 points), while *Bromus inermis* ssp. *inermis* (62 points) and *Trifolium hybridum* (57 points) were the most frequently recorded.

Figure 25. Photo-monitoring point marking a *Melilotus alba* infestation on a gravel pullout adjacent to the Ray River Burn (Site #129).

Figure 26. *Trifolium pratense* (red clover) at Site #136 along the Dalton Highway.

A population of *T. pratense* (53 points) was recorded at Site #136 (N 65.937828°, W 149.867187°) on a side road leading to a BLM camp and DOT station, approximately 0.25 meters east of the highway, less than one mile away from the Fort Hamlin Fire boundary, and a quarter mile from the Ray Fire perimeter. We recommend that control actions are carried out before it disperses and establishes in the neighboring burned areas (Fig. 26).

No invasive species were recorded extending into the burned areas.

Ray River Burns photo-monitoring points

A single photo-monitoring point was set up at Site #129 (N 65.97571°, W -149.99953°), approximately 10.5 miles north of the Yukon River, at a gravel pullout adjacent to a burned spruce forest, where there was a *Melilotus alba* infestation.

Dall City Burn (04)

Fifteen non-native species were observed in this portion of the Dalton Highway: *Alopecurus pratensis, Crepis tectorum, Bromus inermis* ssp. *inermis, Melilotus alba, M. officinalis, Trifolium hybridum, T. pratense, Hieracium umbellatum, Lepidium densiflorum, Lotus corniculatus, Medicago sativa* ssp. *sativa, Plantago major, Polygonum aviculare, Taraxacum officinale* ssp. *officinale*, and *Vicia cracca*. As in the preceding two fires, the most invasive species were *M. alba* and *V. cracca*, and the most common ones were *B. inermis* ssp. *inermis* and *T. hybridum*, as well as *M. alba*. These last three species were broadly distributed, and we therefore recommend that control efforts focus on containing the existing populations and preventing their further expansion.

Three notable findings in the Dall City Burn were:

1. Individual plants of *Lotus corniculatus* (birdsfoot trefoil) were recorded at two locations: Site #94 (N 66.267175°, W 150.345131°), and Site #89 (N 66.279834°, W 150.360537°; Fig. 27). (See Appendix B.I for a distribution map). All plants found during this survey were dug out. However, we strongly recommend that these two sites be revisited and monitored for early detection and elimination of any new plants (see 2007 section for revisit results).

   Figure 27. Flowering *Lotus corniculatus* plant along the roadside, within the Dall City Fire perimeter (Site #94).

   In the Lower 48 and Canada this plant develops thick mats on disturbed ground and prevents colonization of native species (Cal-IPC 2003, Czarapata 2005). It has been widely planted for erosion control along roadsides and as livestock forage, which is problematic because birdsfoot trefoil easily escapes cultivation colonizing roadsides, fields, pastures and forests (Turkington and Franko 1980). Fires have been found to increase seed germination and promote seedling establishment (Czarapata 2005), which makes the 2004 and 2005 burn areas particularly susceptible to invasion by this species.

2. A single population of *Medicago sativa* ssp. *sativa* (alfalfa) was found at Site #90 (N 66.273931°, W 150.35138°). We recommend that it be extirpated. This species is known from the agricultural regions of South-central Alaska, where it has escaped cultivation. However, it is extremely infrequent in Interior Alaska, with only two other known records, both from the Fairbanks Experimental Station (see Appendix B.I for a map showing the distribution of alfalfa along the Dalton Highway).

3. An isolated occurrence of *Vicia cracca* (bird vetch) was observed at Site #101 (N 66.215723°, W 150.25254°). We recommend it be extirpated before it disperses and establishes in other areas (see Appendix B.I for a map showing the distribution of bird vetch along the Dalton Highway).

Dall City Burn photo-monitoring points

The two following photo-monitoring points were established in this burn:

1. Site #95 (N 66.260409°, W 50.331254°), where approximately five acres of roadside land were infested with *Trifolium hybridum* and *Melilotus alba* (Fig. 28). The *Trifolium hybridum* population was dense and very well established along the right-of-way, but was not extending into the forest. However, this species delays the establishment of native species on the roadside, making it susceptible to invasion by other non-natives. The infestation was so dense that it would be virtually impossible to eradicate it completely from the site. However, control work could be carried out here to prevent it from expanding any further.

2. Site #86 (N 66.305984°, W 150.400036°) marks a *Melilotus alba* infestation (Fig. 29). The population was restricted to the right-of-way and adjacent to a black spruce forest that burned in the 2004 Dall City Fire. Up to 50 stems of *Melilotus alba* were counted, some setting seed while others were still in flower.

Figure 28. Dall City Fire photo-monitoring plot with *Trifolium hybridum* and *Melilotus alba*.

Figure 29. Photo-monitoring point marking a *Melilotus alba* (white sweetclover) infestation next to a black spruce forest burned in the Dall City Fire (Site #86).

North Bonanza Burn (05)

Nine non-native species were observed in the 2005 North Bonanza Burn area: *Bromus inermis* ssp. *inermis, Crepis tectorum, Hieracium umbellatum, Melilotus alba, M. officinalis, Trifolium hybridum, T. pratense, Trifolium repens,* and *Vicia cracca*. The most invasive species were *Melilotus alba* (white sweetclover) and *Vicia cracca* (bird vetch). White sweetclover was also one of the most frequently recorded species, together with *Crepis tectorum* and *Trifolium hybridum*.

A total of 17 *Trifolium hybridum* infestations were observed scattered throughout the northern two thirds of this burned section of the highway. We suggest that these populations be contained, and that control work be conducted from the periphery of the infestation inwards.

Figure 30. *Vicia cracca* patch adjacent to black spruce forest burned by the 2005 Bonanza Creek Fire (Site #69, photo-monitoring point).

Other invasive species recorded in this burn section include:

1. *Trifolium repens*, which was locally very abundant at Sites #222 (N 66.75052°, W 150.677°) and #229 (N 66.729236°, W 150.667°).

2. *Vicia cracca*, forming a single, isolated, small population at Site #69 (N 66.706811°, W 150.67568°; Fig. 30). We advise that this infestation be prioritized for future monitoring and control work.

3. *Hieracium umbellatum*, with large numbers of individuals extending into the burned areas (Fig. 31), was recorded at the following sites:
   - Site #63 (N 66.731326°, W 150.667192°)
   - Site #67 (N 66.718057°, W 150.670958°)
   - Site #230 (N 66.727754°, W 150.667311°)
   - Site #231 (N 66.718288°, W 150.666955°)

4. *Crepis tectorum*, observed at Site #54 (N 66.822731°, W 150.662952°) on the Jim River D.O.T Station Road, was likely introduced in the area as a contaminant in fill importation material, which was covered by it at the time of the 2006 survey. Furthermore, several individuals at different phenological stages (some flowering, some setting seed) of this medium to large sized infestation (up to 500 stems) had started to spread into the adjacent fire-disturbed, black spruce forest (Fig. 32). Control (hand-pulling before seed set or by applying herbicides) and monitoring work are recommended for this infestation.

It is important to highlight that *Crepis tectorum* (Site #54) and *Hieracium umbellatum* (Sites #63, #67, #230, and #231) were the only species in this section of the highway that had moved off the human footprint and expanded into the fire-disturbed forest (in 2007 *Melilotus alba* plants were also found growing among muskeg plants off the roadside in the North Bonanza Burn). Their aggressively invasive behavior merits that they be prioritized for eradication work (See Appendix B.I for maps of the sites at which these two species were recorded on the Dalton Highway, and Appendix B.IV, Table IV.4 for a brief description of control recommendations).

Figure 31. *Hieracium umbellatum* (narrowleaf hawkweed) extending into burned black spruce forest. North Bonanza Creek Burn.

Figure 32. Flowering and seed-setting individuals of *Crepis tectorum* are invading the fire-disturbed black spruce forest by the Jim River DOT station road (Site #54, photo-monitoring point, North Bonanza Burn).

Lastly, an additional population of *Hieracium umbellatum* was recorded approximately two miles south of the North Bonanza Fire perimeter which, if treated with herbicides, could prevent its expansion along the right-of-way (see Appendix B.IV for a list of infestations on the Dalton Highway requiring future control work).

North Bonanza Burn photo-monitoring points

Two photo-monitoring points were set up: one at Site #69 (N 66.706811°, W 150.67568°) to mark the above described single, isolated, small population of *Vicia cracca* (see previous section, Fig. 30), and the other at Site #54 (N 66.822731°, W 150.662952°) to monitor a *Crepis tectorum* roadside infestation (see previous section, Fig. 32).

Chapman Creek Burn (05)

A total of nine non-native species were found along the intersection of the 2005 Chapman Creek Burn with the Dalton Highway: *Alopecurus pratensis*, *Crepis tectorum*, *Bromus inermis* ssp. *inermis*, *Lepidium densiflorum*, *Matricaria discoidea*, *Melilotus alba*, *Plantago*

major, *Taraxacum officinale* ssp. *officinale*, and *Vicia cracca* (Figs. 33 and 34). As is the case for all the other burned areas along this highway, *Melilotus alba* and *Vicia cracca* were the most aggressively invasive species recorded. *Melilotus alba* was also the most frequently recorded species. Control work is needed at Site #18 (N 67.055936°, W 150.350407°), which was infested with *Vicia cracca*, and at Site #37 (N 66.97558°, W 150.338362°), *ca.* 2.5 miles south of this fire's boundary, where *Trifolium hybridum* was observed.

Chapman Creek Burn photo-monitoring points

One point was established at Site #13 (N 67.157043°, W -150.357703°), where there was a *Bromus inermis* ssp. *inermis* infestation adjacent to the burn (Fig. 33). The second point is at Site #23 (N 67.042832°, W -150.313559°), and marks a *Melilotus alba* infestation (Fig. 34). We recommend that both populations be monitored in the future.

Figure 33. Chapman Creek Burn photo-monitoring point marking a *Bromus inermis* ssp. *inermis* infestation (Site #13).

Figure 34. *Melilotus alba* infestation at the second photo-monitoring point in the Chapman Creek Burn (Site #23).

2006 unburned area survey results

Melilotus alba infestations were observed throughout most of the Dalton Highway, in burned and unburned areas, until Coldfoot. In addition, *Crepis tectorum*, *Poa pratensis* ssp. *irrigata*, *Trifolium hybridum*, *Vicia cracca*, and *Leucanthemum vulgare* were recorded at a number of unburned sites. (See Appendix B.I for distribution maps of these species inside and out of the 2004 and 2005 burned areas).

2006 eradication work

For a list of sites at which control work was conducted in 2006 please see Appendix B.II.

Dalton Highway 2007 Revisit Results

Overview

On July 8th and 9th 2007 we surveyed the Dalton Highway, from its intersection with the Elliot Highway to Coldfoot.

We revisited 20 of the 28 control plots set up in 2006 (Table 9), and all the 2006 photo-monitoring plots. Ten of the 28 infestations controlled in 2006 were controlled again in 2007, while another 10 were weed free in the second year. However, our ability to determine whether we were or were not at the exact site of a 2006 plot was often hampered by the accumulation of 2006 and 2007 GPS accuracy errors and the quasi-continuous nature of the distribution of non-native species along this highway. Thus, although we were unable to precisely relocate the remaining eight 2006 control plots, we did set up a number of new plots within 100 meters of some of them (Table 9, see Appendix B.II.b for a map of some of the key infestations targeted for control in 2007).

As in 2006, control work was mainly concentrated in three areas: along the section of the Highway affected by the Dall City Burn, just before the North Bonanza Burn, and in the last 50 kilometers before Coldfoot (in and around the Chapman Creek Burn perimeter).

The most invasive species found in 2007 were *Melilotus alba*, *Vicia cracca*, and *Bromus inermis* ssp. *inermis*. In particular, we recorded a highly aggressive infestation of *Melilotus alba* that had spread from the highway's right-of-way into the adjacent, undisturbed shrub understory of a burned black spruce forest in the Jim River DOT station area (Site #342-2007, North Bonanza Burn). Similarly, a *Vicia cracca* population that was recorded in 2006 in the Fort Hamlin Hills Burn had started to colonize the surrounding burned, barren organic/humus soils in 2007. We suggest that both populations be prioritized for eradication work.

Table 9. List and distribution of non-native plant species infestations *revisited* in 2007 on the Dalton Highway.

Family Name	Scientific Name	Common Name	Invasiveness Rank	Fort Hamlin Hills	Ray River	Dall City	North Bonanza Cr	Chapman Cr
Poaceae	*Alopecurus pratensis*	meadow foxtail	not ranked					X
Poaceae	*Bromus inermis* ssp. *inermis*	smooth brome	62	X	X		X	X
Asteraceae	*Crepis tectorum*	narrowleaf hawksbeard	54	X	X		X	X
Asteraceae	*Hieracium umbellatum*	narrowleaf hawksweed	51				X	
Asteraceae	*Leucanthemum vulgare*	oxeye daisy	61	Only found near Coldfoot				
Fabaceae	*Lotus corniculatus*	birdsfoot trefoil	not ranked			X		
Fabaceae	*Medicago sativa* ssp. *sativa*	alfalfa	59			X		
Fabaceae	*Melilotus alba*	white sweetclover	80	X	X	X	X	X
Poaceae	*Poa pratensis* ssp. *irrigata*	spreading bluegrass	52					
Fabaceae	*Trifolium hybridum*	alsike clover	57		X	X		
Fabaceae	*Vicia cracca*	bird vetch	73	X				

2007 burned area survey results

Fort Hamlin Hills Burns (04)

No control work was done in this burn, neither in 2006 nor in 2007.

Fort Hamlin Hills Burn photo-monitoring points

Two photo-monitoring points were established in this burn in 2006, and were relocated in 2007 (Table 10).

Table 10. 2006 photo-monitoring plots located in the Fort Hamlin Hills Burn that were revisited in 2007.

Scientific name	Site code 2007 (2006)	Disturbance type	Est. Stem count	Lat	Lon
Melilotus alba (2006 record)	202.0 (150)	Fill Importation	10000+	65.9070	-149.7789
Crepis tectorum (new record)	202.1 (~150)	Fill Importation	6-25	65.9070	-149.7789
Vicia cracca, (2006 record)	207.1 (144)	Forest Fire	151-500	65.9330	-149.8527
Melilotus alba (new record)	207.2 (~144)	Forest Fire	500-1000	65.9330	-149.8527
Bromus inermis ssp. *inermis* (new record)	207.3 (~144)	Forest Fire	51-150	65.9330	-149.8527

Site #144 (#207.1-2007, Fig. 35) marks a fire disturbed site infested with *Vicia cracca*. The population was estimated at 1000-10000 individuals in 2006, while 2007 the stem count given was 151-500. This decrease is noteworthy as no control work was done in 2006, and there were no indications that the roadside vegetation had recently been cleared in the 2007 survey. However, despite the apparent decrease in size, plants from this population had started to colonize burned, barren organic/humus soils in 2007, and we therefore recommend that they be eradicated as soon as possible. In addition, two new non-native species

Figure 35. This *Vicia cracca* population had started to colonize adjacent, burned soils in 2007 (Site #144-2006). The site was also infected with two new invasive species that were not there in 2006: *Melilotus alba* and *Bromus inermis* ssp. *inermis*.

were recorded here in the second field season: a large population of *Melilotus alba* (Site #207.2-2007) and a medium sized one of *Bromus inermis* ssp. *inermis* (Site #207.3-2007). (See Appendix B.IV, Table IV.1 for more information on the infestations found at this site, and recommended control methods for each one).

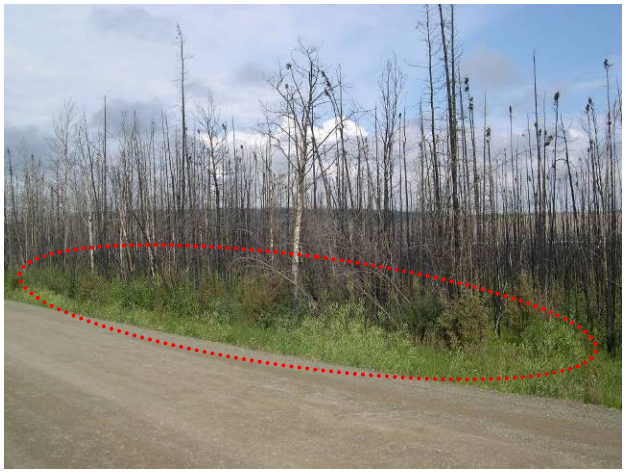


Figure 36. This *Melilotus alba* infestation at photo-monitoring point #150-2006 (#202-2007) had expanded in size since the 2006 field season.

We also relocated Site #150 (Site #202-2007, Fig. 36), where there was a *Melilotus alba* infestation growing on imported land fill. The population appeared to have grown since 2006, expanding from 1000-10000 stems to 10000+ stems. We also observed a new but small infestation of *Crepis tectorum* here which could be extirpated to prevent it from invading the adjacent burned forest (Site #202.1-2007).

Ray River Burn (05)

No control work was done in this burn, neither in 2006 nor in 2007.

Ray River Burn photo-monitoring points

We revisited the *Melilotus alba* infestation located at photo-monitoring point #211-2007, on a gravel pullout adjacent to a burned spruce forest (Fig. 37, Table 11). It did not appear to have increased in size nor cover (1-5% cover, 1000-10000 individuals) from one year to the next. We also checked two large populations of *Trifolium hybridum* and *Bromus inermis* ssp. *inermis* which had already been recorded in 2006 at this site, and found that both had

Figure 37. *Melilotus alba* infestation growing at photo-monitoring point #129-2006 (#211-2007).

increased in size from the first field season to the next: stem count for the *T. hybridum* population changed from small (6-25) to large (500-1000), and estimated cover of *Bromus inermis* ssp. *inermis* went from low (1-5%) to moderate (6-25%).

Table 11. 2006 photo-monitoring plots located in the Ray River Burn that were revisited in 2007.

Scientific name	Site code 2007 (2006)	Disturbance type	Est. Stem count	Lat	Lon
Melilotus alba (2006 record)	211.1 (129)	Fill Importation	1000-10000	65.9757	-149.9996
Trifolium hybridum	211.2 (~129)	Fill Importation	500-1000	65.9757	-149.9996
Bromus inermis ssp. *inermis*	211.3 (~129)	Fill Importation	1000-10000	65.9757	-149.9996

Dall City Burn (04)

Figure 38. The two *Lotus corniculatus* infestations that were found and pulled in the Dall City Burn section in 2006 were not found in 2007.

Three non-native plant populations were controlled in this area in 2006: two *Lotus corniculatus* ones (Sites #225 and #227-2007, Fig. 38), and one *Medicago sativa* ssp. *sativa* one (Site #228-2007). None of these species were found here in 2007. However, we did record two new species at Site #225-2007: *Melilotus alba* and *Trifolium hybridum*, neither of which were controlled.

We also pulled part of a new infestation of *Melilotus alba* that was continuous from Sites #229-2007 to #231-2007 (6-25 stems were extirpated at Site #229-2007, but plants at Sites #230-2007 and #231-2007 were left untreated) (Fig. 39). Finally, we were unable to check Site #101-2006, where an isolated occurrence of *Vicia cracca* growing on importation fill had been found. We recommend that this site be relocated and that any *V. cracca* found there be extirpated during the next growing season, before it spreads further along the roadside or into the burn.

Figure 39. Some sections of the *Melilotus alba* infestation that extended from Site #229-2007 to Site #231-2007 were pulled, bagged, and removed.

Table 12. List of 2006 control plots located in the Dall City Burn that were revisited in 2007 (also includes new 2007 records).

Scientific name	Site code 2007 (2006)	Est. Stem count	2007 Control action	Control time (mins)	Lat	Lon
Lotus corniculatus (2006 record)	225.1 (94)	0	No	0	66.2672	-150.3451
Melilotus alba (new record)	225.2 (94)	6-25	No	0	66.2672	-150.3451
Trifolium hybridum (new record)	225.3 (94)	500-1000	No	0	66.2672	-150.3451
Lotus corniculatus (2006 record)	227 (89)	0	No	0	66.2798	-150.3605
Medicago sativa ssp. *sativa* (2006 record)	228 (90)	0	No	0	66.2740	-150.3516
Melilotus alba (new record)	229-231	6-25	Manual pull	30	66.3060	-150.4000

Dall City Burn photo-monitoring points

The large infestations of *Trifolium hybridum* and *Melilotus alba* marked by photo-monitoring point #95-2006 (Site #224-2007) in 2006 were relocated in 2007. Estimated stem counts were the same in both years (Fig. 40, Table 13).

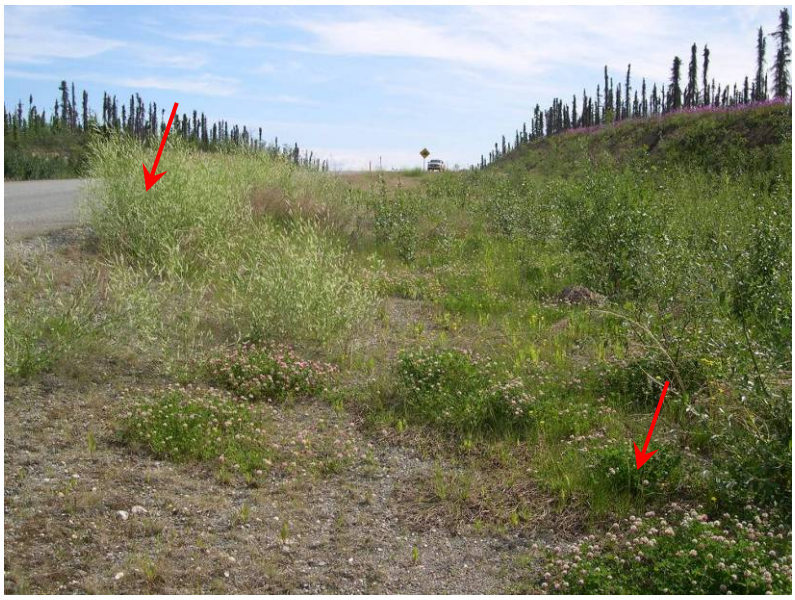


Figure 40. *Melilotus alba* and *Trifolium hybridum* populations found at Site #86-2006 were still present in 2007.

Photo-monitoring point #229-2007 had 26-50 stems of *Melilotus alba* growing on imported fill in 2006 (Site #86-2006). In 2007 the population, which was slightly smaller (6-25 stems), was pulled again (Table 13).

Table 13. 2006 photo-monitoring plots located in the Dall City Burn that were revisited in 2007.

Scientific name	Site code 2007 (2006)	Disturbance type	Est. Stem count	Control action	Lat	Lon
Trifolium hybridum	224 (95)	Fill Importation	10000+	No	66.2603	-150.3313
Melilotus alba	229 (86)	Fill Importation	6-25	Manual pull, 30 mins	66.3060	-150.3999

North Bonanza Burn (05)

No control work was done on infestations in this burn, neither in 2006 nor in 2007. However, we did observe that the following two invasive species populations were spreading into burned areas:

1. At Site #230-2006 (#256-2007) we relocated one of four *Hieracium umbellatum* populations found in this area in 2006 (see Fig. 31 in the previous section) We advise that this population, which was recruiting 30 meters into the neighboring burned forest, be prioritized for future control (herbicide application, see Control Methods for 2006 and 2007 Priority Infestations section) and monitoring work.

2. At Site #342-2007, just south of Pump Station 5, a population of 26-50 *Melilotus alba* plants consisting of seedlings and flowering individuals had started to invade the adjacent burned, open, black spruce forest, and was growing among native muskeg plants (Figs. 41 and 42). We strongly recommend that this population, which was part of a larger infestation that extended up and down the road from this point, be extirpated following the guidelines provided in Appendix B.IV, Table IV.4.

Figure 41. In 2007, the *Melilotus alba* population observed at Site #342 had invaded the nearby burned, black spruce forest and was growing among native muskeg plants.

Figure 42. A close-up of a *Melilotus alba* flowering individual growing in burned muskeg at Site #342.

North Bonanza Burn photo-monitoring points

In 2006, we established a photo-monitoring point at Site #69 (Site #254-2007) to mark a small (6-25 stems), isolated infestation of *Vicia cracca*. Although we relocated the plot, the only priority invasive species found there in 2007 was *Melilotus alba* (Fig. 43, Table 14).

A second photo-monitoring point was set up at Site #261-2007, by the Jim Creek DOT station, where an infestation of *Crepis tectorum* had been observed (Fig. 44). No marked increase in the size of this population occurred between 2006 and 2007 (estimated stem count was 151-500 both times, Table 14).

Table 14. 2006 photo-monitoring plots located in the North Bonanza Burn that were revisited in 2007.

Scientific name	Site code 2007 (2006)	Disturbance type	Est. Stem count	Lat	Lon
Melilotus alba (*Vicia cracca* in 2006)	254 (69)	Fill Importation	6-25	66.7067	-150.6753
Crepis tectorum	261 (54)	Forest Fire	151-500	66.8227	-150.6628

Figure 43. 2006 photo-monitoring plot #69 was set up to mark a *Vicia cracca* infestation. However, when we revisited it in 2007 the only non-native species recorded here was *Melilotus alba*.

Figure 44. The *Crepis tectorum* infestation that was invading a burned, black spruce forest in 2006 forest, located at photo-monitoring plot #54, was still there in 2007 (inset shows close up of plants at this site).

Chapman Creek Burn (05)

We revisited all nine 2006 control plots, and carried out control work on an additional five (Table 15).

Table 15. List of 2006 control plots located in the Chapman Creek Burn that were revisited in 2007 (also includes new 2007 control plots).

Scientific name	Site code 2007 (2006)	Est. Stem count	2007 Control action	Control time (mins)	Lat	Lon
Melilotus alba	271.1 (32)	0	No	0	67.0116	-150.2837
Melilotus alba	272 (~32)	51-150	Manual pull	6	67.0120	-150.2845
Melilotus alba	274 (27)	0	No	0	67.0193	-150.2882
Crepis tectorum	275 (26)	51-150	Manual pull	21	67.0347	-150.3044
Melilotus alba	277 (23)	0	No	0	67.0428	-150.3135
Melilotus alba	279 (21)	0	No	0	67.0518	-150.3272
Melilotus alba	281	151-500	Manual pull	21	67.0528	-150.3295
Melilotus alba	282 (16)	1-5	Manual pull	12	67.0616	-150.3441
Melilotus alba	284 (~15)	6-25	Manual pull	12	67.0730	-150.3500
Melilotus alba	285 (15)	0	No	0	67.0726	-150.3504
Melilotus alba	323 (~15)	51-150	No	0	67.0723	-150.3502
Bromus inermis ssp. *inermis*	286.1 (14)	0	No	0	67.0823	-150.3525
Alopecurus pratensis	286.2 (~14)	26-50	Manual pull	21	67.0823	-150.3525
Crepis tectorum	286.3 (~14)	6-25	Manual pull	6	67.0823	-150.3525
Melilotus alba	295.2	6-25	Manual pull	6	67.1570	-150.3579
Melilotus alba	296 (12)	0	No	0	67.1583	-150.3554

Sites #274-2007, #277-2007, #279-2007, #285-2007, and #296-2007, which had been controlled for *Melilotus alba* in 2006, were weed free in 2007. However, two infestations of *M. alba* were detected approximately 30-50 meters from Site #285-2007, one consisted of 22 stems and was extirpated (Site #284-2007), while the other one was larger (51-150 stems) and was not pulled (Site #323-2007). We did not find any new *Melilotus alba* individuals at the 2006 control Site #32 (#271.1-2007) either, but did record a new, medium sized *M. alba* infestation less than 50 meters away from it, at Site #272-2007, which we pulled. Because of the close proximity of these new infestations to the old ones we do not consider these two areas to be weed free.

The two 2006 controls that were clearly unsuccessful were: (1) a small population of *Crepis tectorum* which had been hand pulled at Site #26 (#275-2007) and had doubled in size by 2007, and (2) a very small population of *Melilotus alba* (Site #16-2006, #282-2007), which we pulled again in 2007. We also extirpated two new *Melilotus alba* populations at Sites #281-2007 (Fig. 45) and #295.2-2007.

The small population of *Bromus inermis* ssp. *inermis* that was pulled in 2006 had not grown back either (Site #286.1-2007), but new and small infestations of *Alopecurus pratensis, Lepidium densiflorum, Plantago major, Crepis tectorum, Taraxacum officinale* ssp. *officinale* (Site #286.2) and *Crepis tectorum* (Site #286.3-2007) appeared in its place.

Figure 45. This new *Melilotus alba* infestation found in 2007 in the Chapman Creek Burn section of the Dalton Highway was also pulled (Site #281-2007).

We did not check the two sites that were recommended for control work (but were not controlled) in 2006. These were Sites #18-2006, which was infested with *Vicia cracca,* and #37-2006, *ca.* 2.5 miles south of the burn, where *Trifolium hybridum* had been recorded. We suggest that these two plots be revisited during future inventory or control projects, and if found, that they be treated tbefore they expand any further along the roadside or into the burn.

Finally, we propose that Site #327-2007, which had a small (1-5 stems) *Melilotus alba* infestation, should be given high priority for future control work because it was growing near the South Fork of the Koyukuk River (it was not pulled in 2007).

Chapman Creek Burn photo-monitoring points

Figure 46. The *Bromus inermis* ssp. *inermis* infestation at photo-monitoring point #13 (#295-2007) remained the same in size and cover from 2006 to 2007.

The *Bromus inermis* ssp. *inermis* population that was tagged in 2006 was relocated in 2007 (Site #13, #295.1-2007, Table 16, Fig. 46). No marked change in the population's cover or size was observed.

The second photo-monitoring point had been set up to track a small (1-5 stems) *Melilotus alba* infestation. When we revisited this site in 2007, no individuals were found

in the area (Site #23, #277-2007, Table 16).

Table 16. 2006 photo-monitoring plots located in the Chapman Creek Burn_that were revisited in 2007.

Scientific name	Site code 2007 (2006)	Disturbance type	Est. Stem count	Lat	Lon
Melilotus alba	277 (23)	Fill Importation	0	67.0428	-150.3135
Bromus inermis ssp. *inermis*	295.1 (13)	Fill Importation	151-500	67.1569	-150.3579

2007 unburned area survey results

In 2007 we revisited eight *Melilotus alba* (white sweetclover) infestations that had been controlled in 2006 and were located in unburned sections of the highway (Table 17). Hand-pulling appeared to be effective in at least half of these sites (#265-2007, #269-2007, south of the Chapman Creek Burn perimeter, and #300-2007, #309-2007, north of the latter), which were all weed free. In contrast, eradication efforts at Sites #301 and #308, north of Chapman Creek Burn, were unsuccessful, and additional control work was required in 2007. Finally, even though no *M. alba* plants were seen at Sites #298-2007 and #245-2007, we did record and remove plants at Sites #299-2007 and #243.1-2007, which were *ca.* 20 and 100 meters away, respectively.

We also controlled five (5) new non-native plant infestations, all in the vicinity of Coldfoot (Table 17). At Site #310-2007 we pulled a medium sized population (95 stems) of *Leucanthemum vulgare* that was growing along the edge of a roadside pullout. This is the same site from which, in 2006, we had removed a few (1-5) stems of *Melilotus alba* (Site #4-2006), but none were found in 2007. At Site #313-2007 we pulled a single stem of *Melilotus alba* and extirpated part of a much larger (500-1000 stems) infestation of *Leucanthemum vulgare* that had also been partially pulled in 2006 (Site #2-2006) and that was growing on imported fill with high quartz content. These two species were also growing at Site #314-2007, from which they were removed. A list of sites from this section of the highway that AKNHP would select for future control work is provided in Appendix B.IV, Table IV.6.

Table 17. List of 2006 control plots located in unburned areas that were revisited in 2007 (also includes new 2007 control plots).

Scientific name	Site code 2007 (2006)	Est. Stem count	2007 Control action	Control time (mins)	Lat	Lon
Melilotus alba (2006 record)	243.1 (75)	6-25	Manual pull	15	66.5385	-150.7939
Melilotus alba (2006 record)	245 (75)	0	No	0	66.5385	-150.7939
Melilotus alba (2006 record)	265 (40)	1-5	No	0	66.9530	-150.4046
Melilotus alba (2006 record)	269 (36)	0	No	0	66.9758	-150.3372
Melilotus alba (2006 record)	298 (10)	0	No	0	67.1833	-150.2981
Melilotus alba (2006 record)	299 (10)	26-50	Manual pull	6	67.1840	-150.2968
Melilotus alba (2006 record)	300 (9)	0	No	0	67.1866	-150.2912
Melilotus alba (2006 record)	301 (8)	51-150	Manual pull	21	67.1887	-150.2872
Melilotus alba (2006 record)	308 (5)	1-5	Manual pull	12	67.2243	-150.2317
Melilotus alba (2006 record)	309 (4)	0	No	0	67.2251	-150.2285
Leucanthemum vulgare **(new record)**	310	51-150	Manual pull	21	67.2256	-150.2272
Leucanthemum vulgare **(new record)**	313.1	500-1000	(partial) Manual pull	21	67.2311	-150.2208
Melilotus alba **(new record)**	313.2	1-5	Manual pull	6	67.2311	-150.2208
Leucanthemum vulgare **(new record)**	314.1	51-150	Manual pull	21	67.2346	-150.2190
Melilotus alba **(new record)**	314.2	1-5	Manual pull	6	67.2346	-150.2190

Dalton Highway problematic areas

Even though aggressively invasive *Melilotus alba* and *Vicia cracca* were recorded throughout the Dalton Highway, they were especially abundant within the Fort Hamlin Hills, Ray River, and Dall City Fire perimeters (Fig. 47; see Appendix B.I for maps of the sites at which these two species were recorded). By far the most problematic section of the highway is the one corresponding to the North Bonanza Burn (see Appendix B.IV. Table IV.4 for a list of sites selected for control work), where populations of *Crepis tectorum*, *Hieracium umbellatum*, and *Melilotus alba* were detected spreading off the roadside and into the burns, and where there were five *M. alba* infestations located within 100 meters of a creek or stream (a potential dispersal route for this species to colonize off-road, undisturbed, natural habitats). Given the aggressive behavior of these three species, we propose that these North Bonanza populations be targeted for eradication.

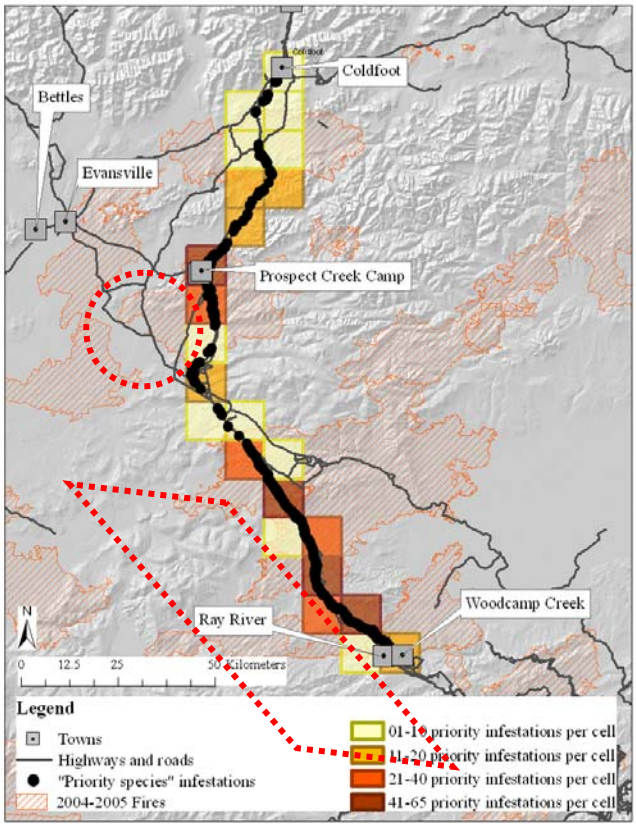


Figure 47. Infestation density along the Dalton Highway. We divided the highway into 10km^2 cells, then totaled the number of priority species infestations per cell. This is the only highway of the three surveyed with sections that had over 50 priority infestations in a 10km^2 area. Very high densities (with over 40 infestations per 10km^2 cell) of priority infestations were recorded in and north of the Ray River-Fort Hamlin Hills Burns, and around Prospect Creek Camp, in the North Bonanza Burn. These two areas are highlighted in red.

Priority infestations for control work

We provide lists of sites that we recommend be prioritized for control and eradication work for the Dalton Highway in Appendix B.IV, and a map showing the distribution of these sites in Appendix B.V. These lists include brief schematic information on the type of treatments that could be used to reduce or eliminate the selected infestations. However, for a more detailed description of the mechanical and chemical treatments that can be used for each priority species, please see the 'Control methods for 2006 and 2007 priority infestations' section of this report.

In general, we recommend that priority be given to: (1) aggressively invasive species' populations that are moving off the human footprint into native vegetation or burned areas, (2) *Melilotus alba* populations located close to a creek or river crossing (to prevent their spread along the river bed into low-use human areas and undisturbed, natural habitats), and (3) incipient infestations caused by aggressively invasive species that are by and large still uncommon in Interior Alaska north of Fairbanks. In this section we identify some of the most important sites in each burned area we consider should be given precendence for eradication, control, or monitoring work based on the above criteria (see Appendix B.IV for a complete list of the sites selected for future control work in each section of the Dalton Highway).

Among the Fort Hamlin Hills Burn infestations, the one that we suggest be given top priority for eradication work is the *Vicia cracca* population that was growing just south of the creek crossing by the Five Mile Landing Strip, and that had started to invade burned, barren soils in 2007 (Site #207.1-2007) (Appendix B.IV, Table IV.1). In addition, we also recommend eliminating a small and isolated *Crepis tectorum* infestation recorded in 2007 *ca.* 3miles north of the Yukon River crossing (Site #202.1). This species has proven to be one of the most aggressively invasive ones (together with *Hieracium umbellatum* and *Melilotus alba*) in other portions of the Dalton, but at this point it could still be efficiently eliminated by repeated cycles of hand-pulling or small applications of herbicide.

There were also three large (500+ stems) *Melilotus alba* infestations in the Fort Hamlin Hills Burn that were located within 100 meters of a river or a creek and that we would therefore select for control (containing or reducing the populations) and monitoring work (Sites #201.1, #202, and #207.2, Appendix B.IV, Table IV.1). Three major factors contribute to *Melilotus alba*'s high degree of invasiveness: (1) its ability to establish along river bars, (2) its increased germination rates following a fire, and (3) its ability to quickly colonize open and disturbed sites. This species, whose seeds can be dispersed by water (Eckardt 1987, Rutledge and McLendon 1996), and has the potential to alter river sedimentation rates (Shephard, pers. comm.), has already effectively spread and become established along a number of interior, south-central, and south-east Alaska river bars. Furthermore, *M. alba* is a fire-adapted plant (fire scarifies its seeds, and stimulates germination) and can quickly colonize forest clearings and fire-disturbed sites, as we have observed in other sections of the Dalton Highway (see Site #342, North Bonanza Burn). Given the proximity of Sites #201.1, #202, and #207.2 to both burned areas and river crossings, it is important that their infestations be controlled and monitored to facilitate the early detection of changes in these populations' behavior (aggressiveness) and size.

The Ray River Burn area is a comparatively low priority section of the highway, as no non-native plants were seen moving into native vegetation or growing close to the intersection with a river. Still, we do recommend that the large infestations of *Melilotus alba*, *Bromus inermis* ssp. *inermis*, and *Trifolium hybridum* observed on a gravel pullout at Site #211-2007 be monitored for future possible changes in their size and their aggressiveness.

In addition, we recommend that any red and white clover infestations found along the Dalton, such as the *Trifolium pratense* population found by the Ray River Burn at Site #136-2006, be pulled (see Appendix B.IV, Table IV.2 for more information on this infestation). Although *Trifolium pratense* (red clover) and *T. repens* (white clover) appeared to exhibit a less aggressive behavior along the Dalton Highway than their relatives *Melilotus alba*, *Vicia cracca*, and *T. hybridum*, they are still relatively uncommon in this part of the state, and we therefore advise that they be eliminated when possible to prevent them from spreading north of Fairbanks.

A total of six populations were selected for control work within the Dall City Burn section (see Appendix B.IV, Table IV.3 for a list of these sites and guidelines for their extirpation). Among these, we highlight the small infestations of *Melilotus alba* growing at Sites #224 and #225-2007 that were near and at the West Fork of the Dall River crossing. If the latter are not completely elimintated in future control efforts, it is possible that this species will start to spread downstream into undisturbed, native habitats.

This burn is also where discrete infestations of *Medicago sativa* ssp. *sativa* and *Lotus corniculatus* were detected and pulled in 2006 (Sites #225, #227, and #228-2007). Although none were found when the sites were revisited in 2007, we strongly recommend that these sites be checked for another two to three years to ensure that the infestations were definitively extirpated (Appendix B.IV, Table IV.3).

Lastly within this burn, there was a small (26-50 stems) *Vicia cracca* population that was observed in 2006 growing on imported fill near the West Fork of the Dall River crossing. This highly aggressive species is very difficult to extirpate once it becomes fully established, and is relatively uncommon north of Fairbanks. We therefore propose that it be controlled within the next couple growing seasons, before a large seed bank develops (Appendix B.IV, Table IV.3).

The North Bonanza Burn is the section of the highway with the greatest number of problematic infestations. A total of five areas that were within 100 meters of a creek or a river were infested with *Melilotus alba* (Sites #212 and #257-2006, and #251, #252, #255-257-2007), and at Site #342-2007 this species was starting to invade the barren soils of a burned, black spruce forest adjacent to the road. Similarly, four medium to large sized populations of *Hieracium umbellatum* and one of *Crepis tectorum* were recorded moving off the roadside areas and into the surrounding burned black spruce forest. We strongly advise that all eleven sites be treated during the next growing season, with the intention of stopping the advance of these species into native vegetation (Appendix B.IV, Table IV.4).

In the Chapman Creek Burn we suggest controling the *Crepis tectorum* and *Melilotus alba* infestations detected and pulled during the 2007 fieldseason (see Table 15 in the previous

section), with emphasis on the 1-5 stems of *M. alba* found at Site #327-2007 (Appendix B.IV, Table IV.5), because of its proximity to the South Fork of the Koyukuk River crossing. Site #18-2006, which was infested with *Vicia cracca* in 2006 and is *ca*. 5 kilometers north of the South Fork of the Koyukuk crossing, should be revisited and, if necessary, controled.

Finally, although no highly invasive populations were detected in the unburned section of highway extending from the Chapman Burn to the town of Coldfoot, we do recommend that all *Leucanthemum vulgare* populations be contained or extirpated, and that the *Melilotus alba* infestation by Rosie Creek (#304-2007) be removed (using mechanical methods such as hand-pulling before flowering occurs) to prevent it spreading along the creek banks into off-road habitats (Appendix B.IV, Table IV.6).

Dalton Highway summary of findings

The most aggressively invasive species recorded in the Dalton Highway surveys were *Melilotus alba* (80 points), *Vicia cracca* (73 points), *Melilotus officinalis* (65 points), *Bromus inermis* ssp. *inermis* (62 points), and *Leucanthemum vulgare* (61 points). (See Appendix I for Dalton Highway distribution maps for some of these species).

Melilotus alba and *Bromus inermis* ssp. *inermis*, which were observed throughout the length of the highway, were particularly abundant within the Fort Hamlin Hills, Ray River, and Dall City Fire perimeters. *Crepis tectorum* and *Trifolium hybridum* were also widespread along the Dalton Highway right-of-ways. Given the broad distribution of these four species, we recommend that efforts focus on containing the current infestations by (a) extirpating any small patches or isolated occurrences of these plants, and (b) controlling and reducing larger populations.

Prompt eradication work is recommended for sites infected with large populations of aggressive non-native species and that are adjacent to a burned area. Even though preliminary field observations have not recorded many instances of invasive plants moving into burns, Villano's (2008) experimental work shows that there is a high potential for invasion by non-native species into black spruce burn areas. Furthermore, Villano's (2008) work suggests that susceptibility to invasion in boreal ecosystems increases over time, especially in sites of low to medium burn severity. This endorses our recommendation to not only control 'high risk' invasive plant populations over the next growing season, but also implement long-term monitoring plans that will facilitate the early detection and rapid elimination of any new non-native plants that may subsequently germinate or resprout in the treated sites. In addition, in the case of white sweetclover, we also advise that any populations found within 500 feet from a waterway (river or creek crossing) be extirpated quickly, to prevent this species from spreading downstream, given that this species has already spread along river bars into natural habitats in other parts of the state, and that it has the potential to alter soil nutrient status and river sedimentation rates (Shephard, pers. comm.).

In three instances, individuals of *Crepis tectorum* (narrowleaf hawksbeard), *Hieracium umbellatum* (narrowleaf hawksweed), and *Melilotus alba* (white sweetclover) were found

growing in burned areas adjacent to the highway, all occurring in the North Bonanza Creek Fire section of the highway. In addition, various *M. alba* populations were found growing close to waterways. Given that these three species are highly aggressive and that *M. alba* is able to invade natural habitats by spreading along river bars, we recommend that these three burned-area infestations be prioritized for control work.

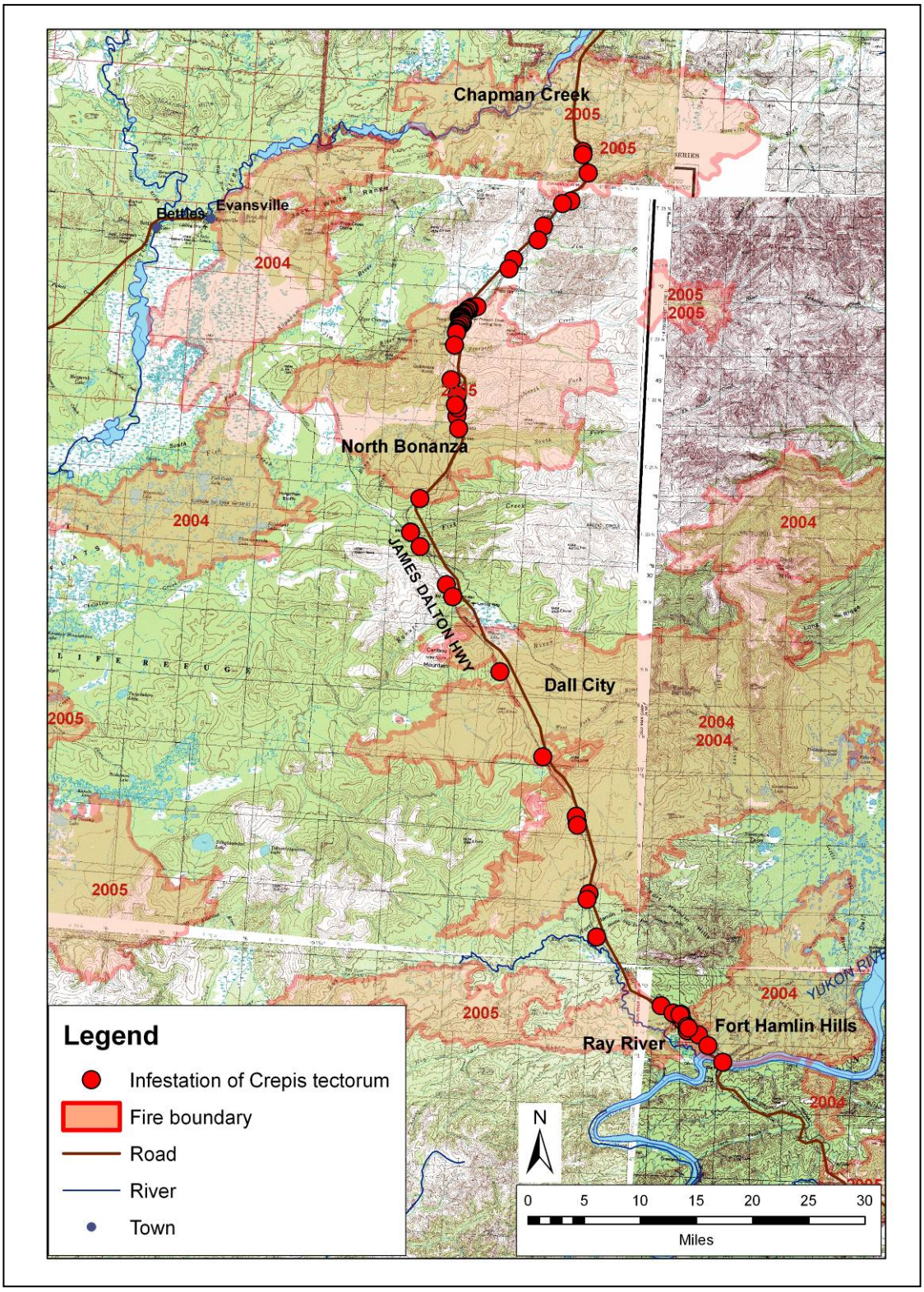
The Dalton Highway was the only road system of the three surveyed in which aggressive species had clearly moved off anthropogenically altered soils into adjacent burned, black spruce forest soils. In addition to site-specific factors that might be facilitating the colonization of these burned sites, it is possible that there are regional differences between the area around the Dalton Highway and those surrounding the Steese and Taylor roads that make the Dalton burns more prone to invasion. The greater levels of traffic, road maintenance and human disturbance, the overall higher propagule pressure, and the lower levels of vascular and non-vasuclar native plant biomass and cover could all be contributing to making the burned areas around the Dalton Highway more predisposed to invasion by non-native plants than burns near the Steese and Taylor roads (Villano 2008). Another regional difference worth taking into consideration is that the mineral soil pH of the Dalton is higher than that of the Steese and Taylor (Villano 2008), and acidic soils can reduce non-native plant establishment (for some species). For instance, invasive legumes like *Melilotus alba* and *Vicia cracca* are nitrogen-fixers, and nodulation (the symbiotic relationship whereby legumes can fix atmospheric nitrogen) is negatively affected by low soil pH (Cregan 1981). Therefore, non-native legumes are more likely to fare better in the more basic soils of the Dalton Highway than in those near the Steese and Dalton. There are other abiotic factors (e.g. temperature, precipitation, snow quantity and timing, carbon dioxide levels, among others) that may also be driving the Dalton Highway's greater susceptibility to being invaded by non-native plants, but these have yet to be researched.

Finally, plant collections of all the non-native species that were encountered were made for the reference herbarium at BLM. We also collected unknown species that could potentially be non-native, as well as species commonly used for roadside revegetation. The list of voucher specimens collected along the Dalton Highway includes: *Crepis tectorum, Hieracium umbellatum, Leucanthemum vulgare, Lotus corniculatus*, *Medicago sativa* ssp. *sativa*, *Melilotus alba, M. officinalis, Trifolium repens,* and *Vicia cracca*.

Dalton Highway Appendices – Set 'B'.

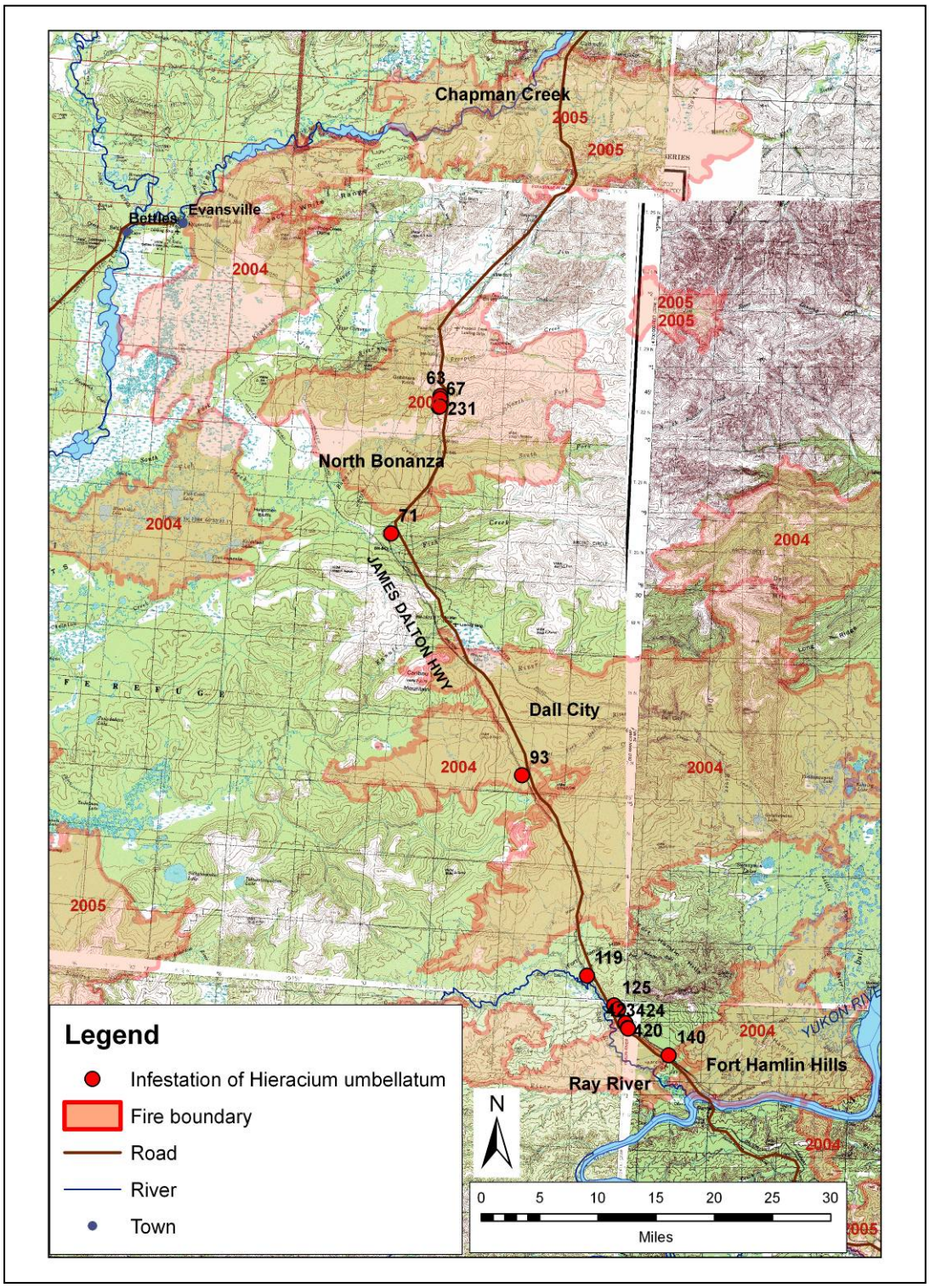
Apendix B. I. Infestation maps for key species recorded along the Dalton Highway.

2006 infestations of narrowleaf hawksbeard (Crepis tectorum) *along the Dalton Highway.*

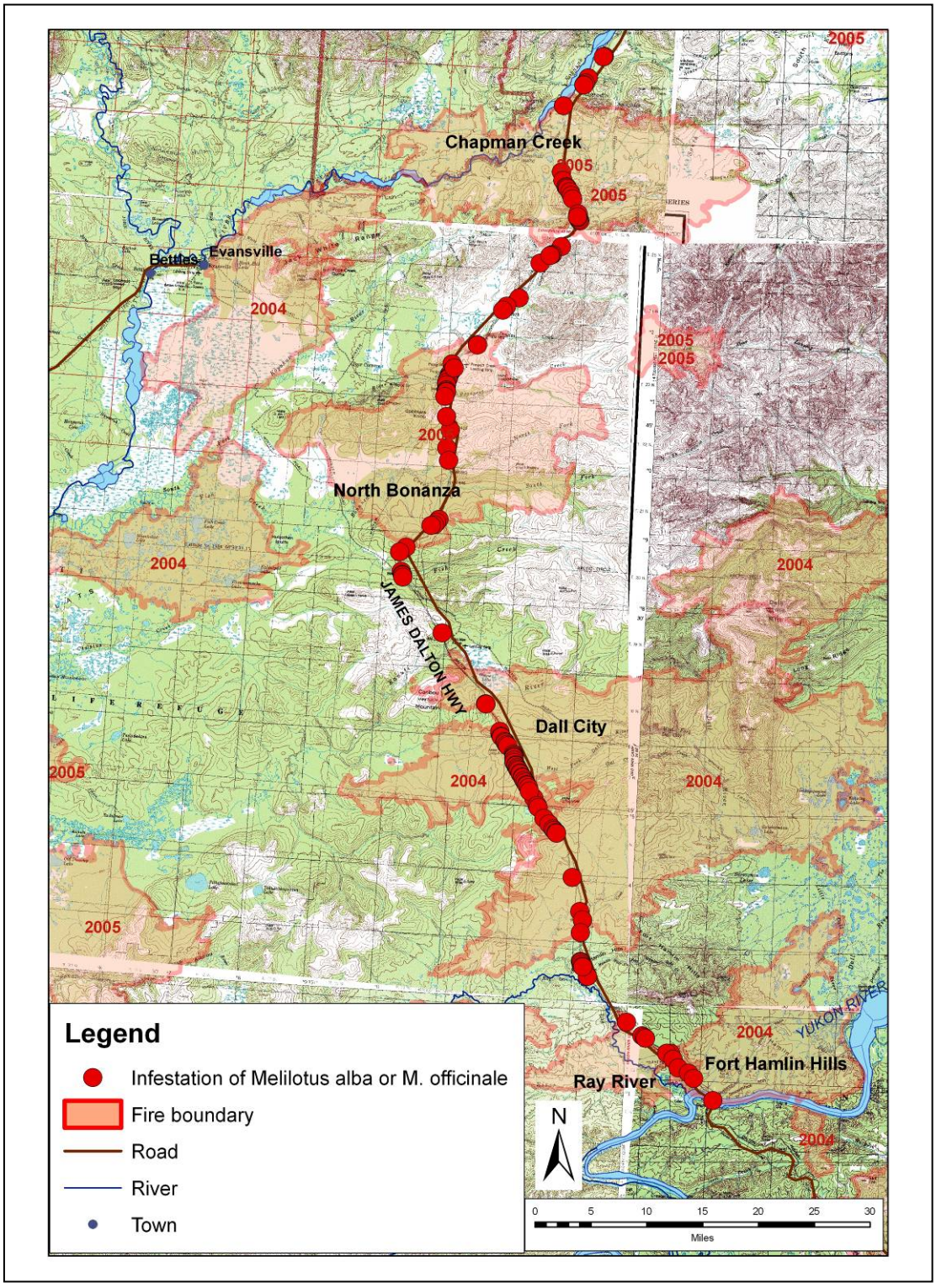


2006 infestations of narrowleaf hawkweed (Hieracium umbellatum)

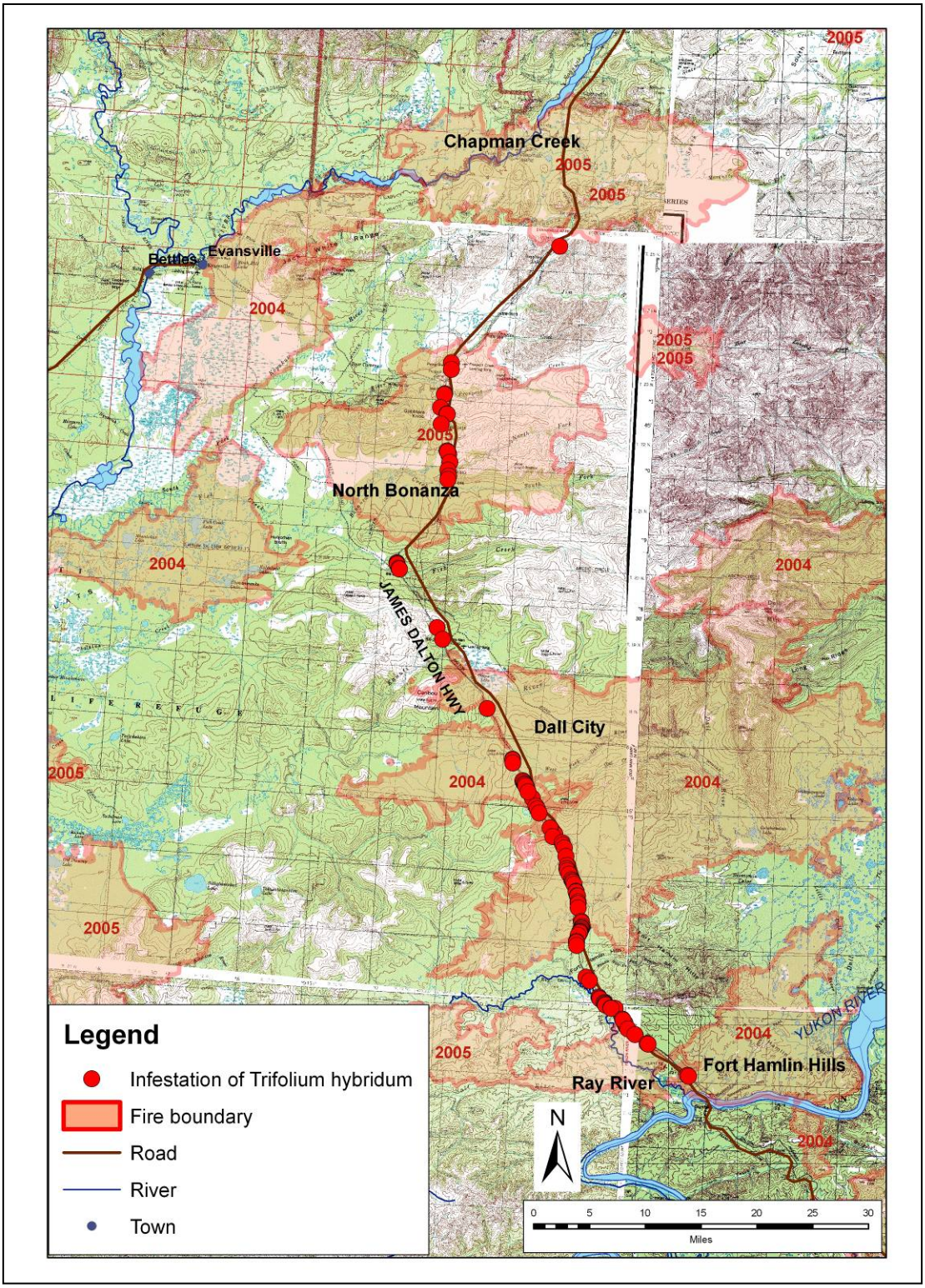
along the Dalton Highway



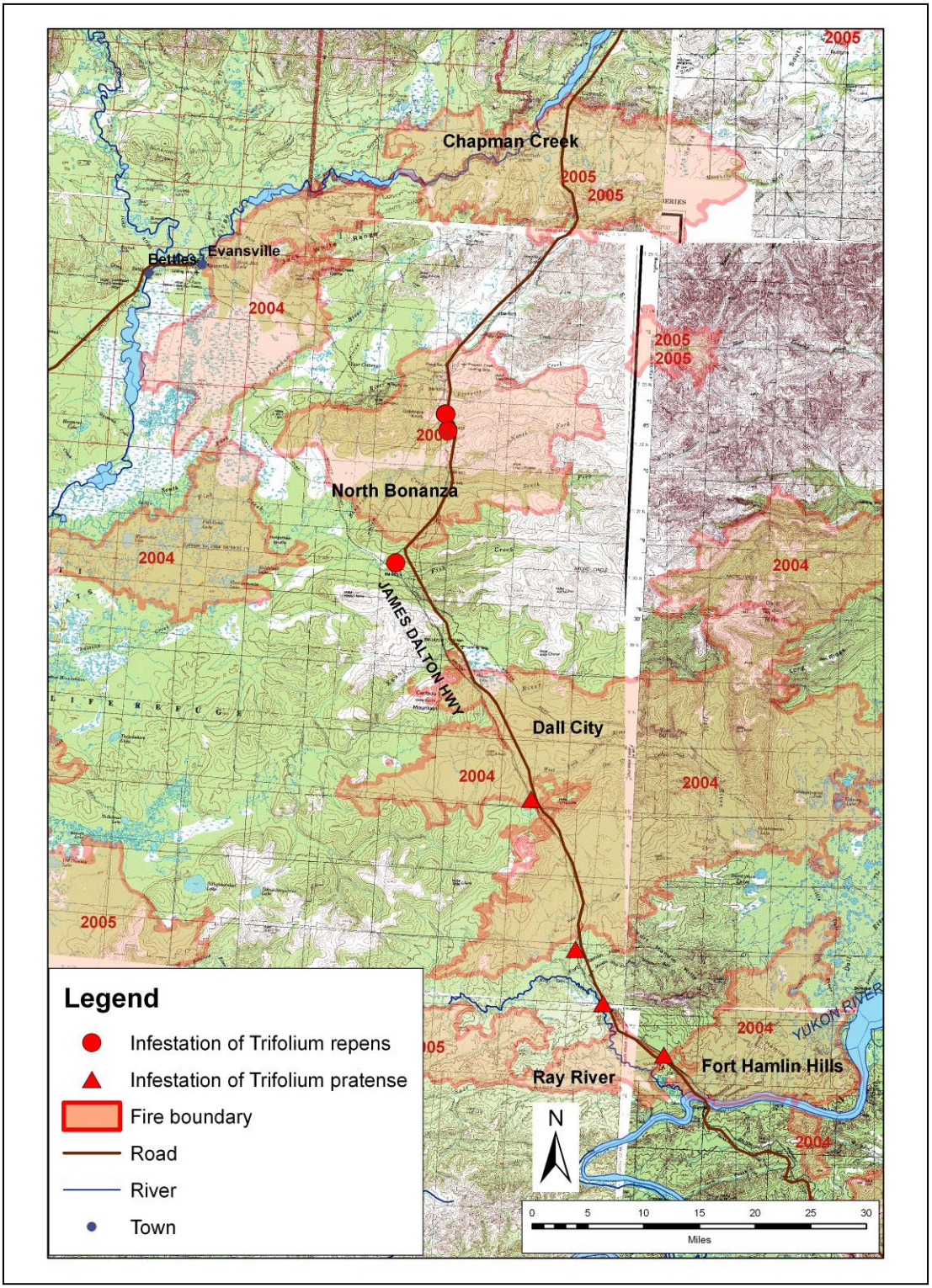
2006 infestations of white sweetclover (Melilotus alba) *along the Dalton Highway.*



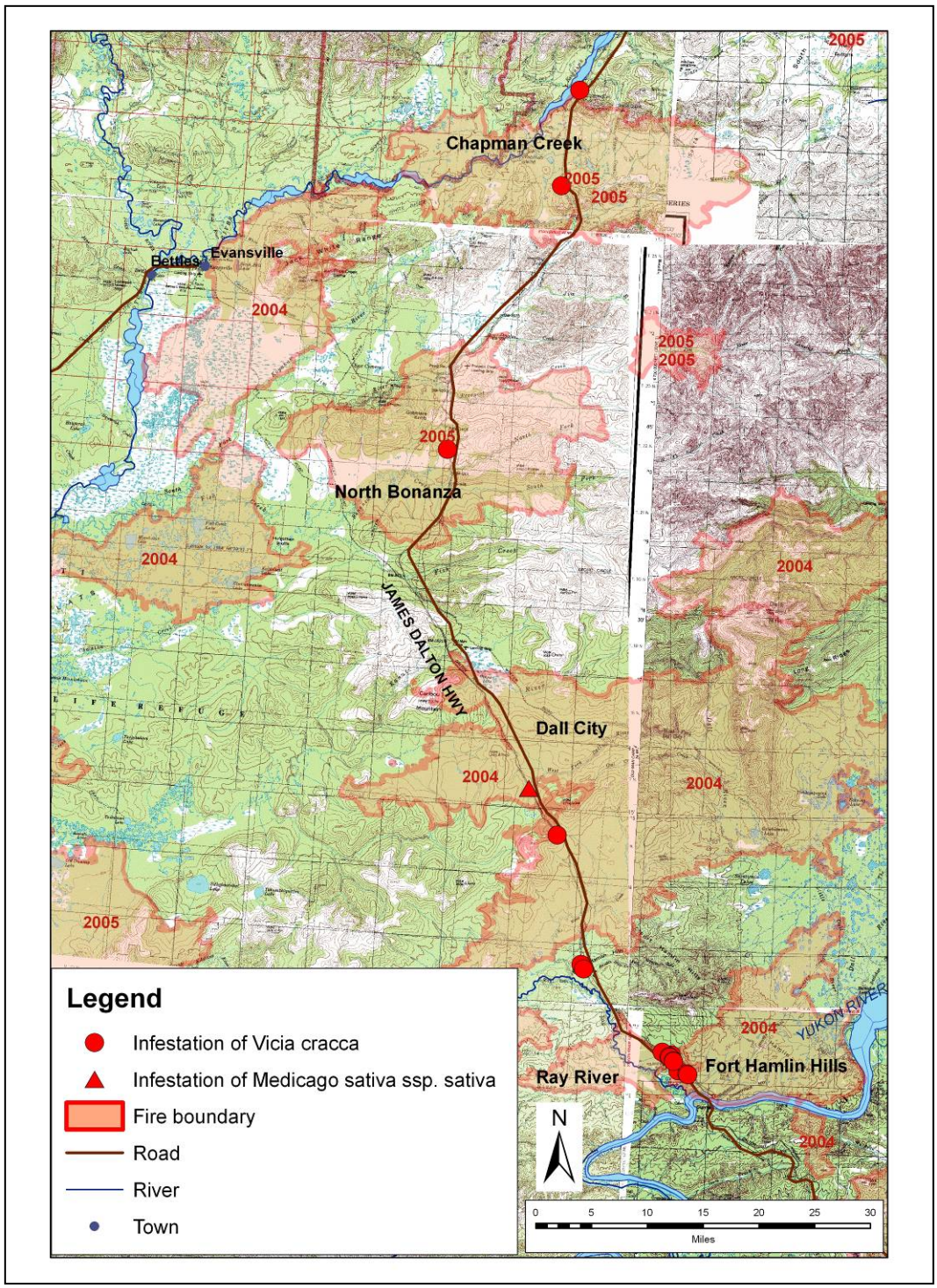
2006 infestations of alsike clover (Trifolium hybridum) *along the Dalton Highway.*



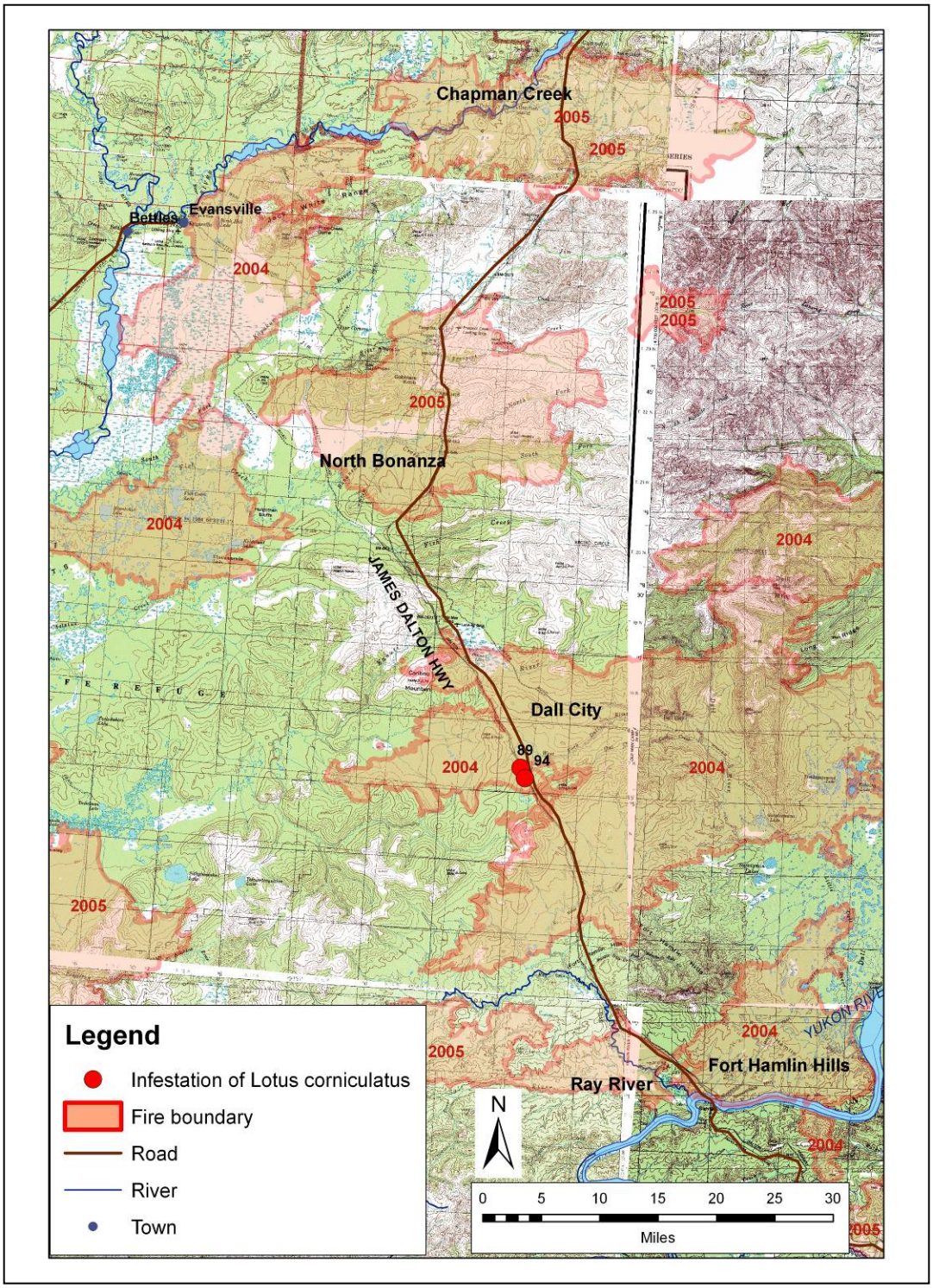
2006 infestations of white and red clover (Trifolium repens *and* T. pratense) *along the Dalton Highway.*



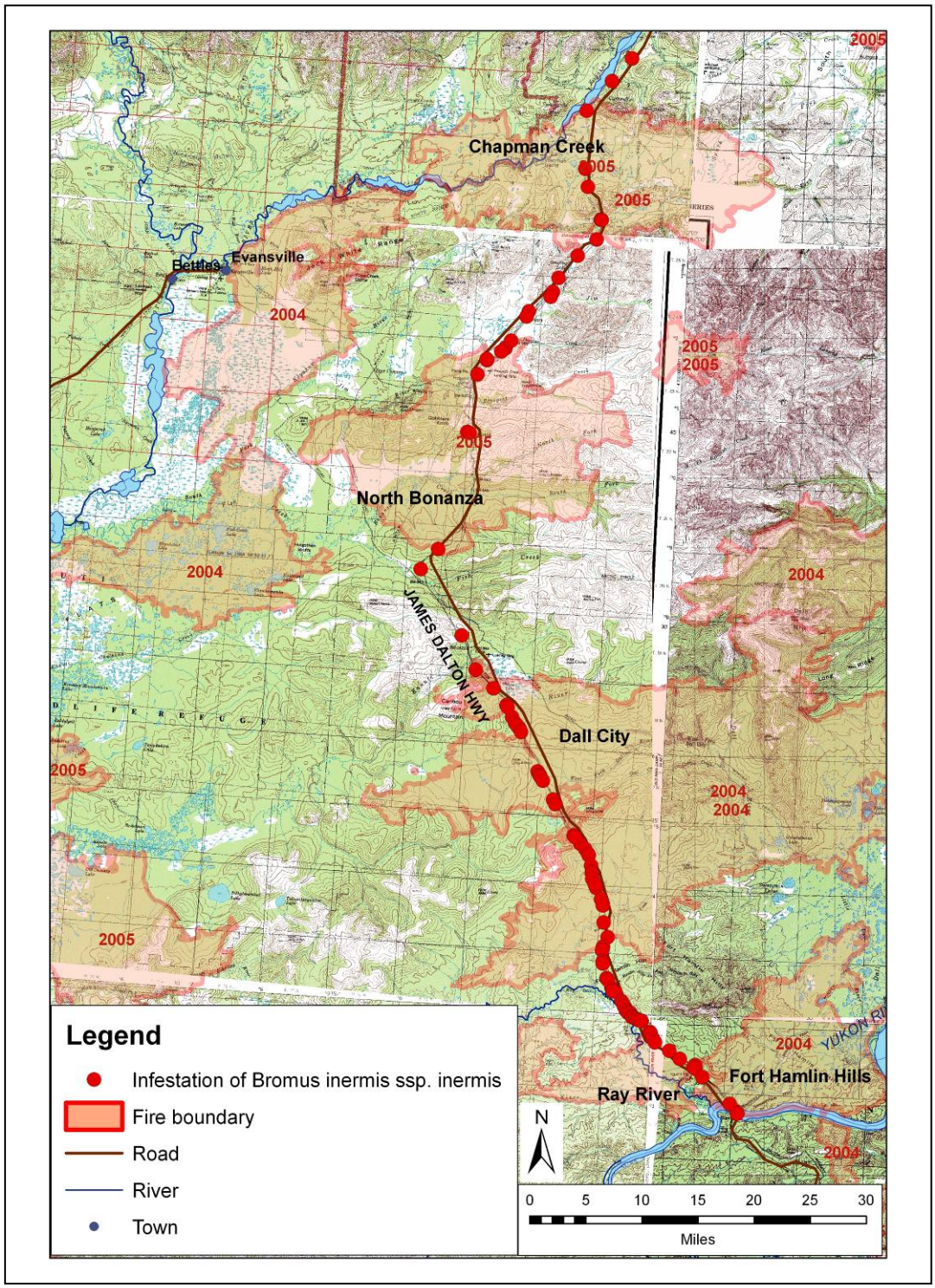
2006 infestations of alfalfa (Medicago sativa *ssp.* sativa) *and bird vetch* (Vicia cracca) *along the Dalton Highway.*



2006 infestations of birdsfoot trefoil (Lotus corniculatus) *along the Dalton Highway.*



2006 infestations of smooth brome (Bromus inermis *ssp*. inermis) *along the Dalton Highway.*



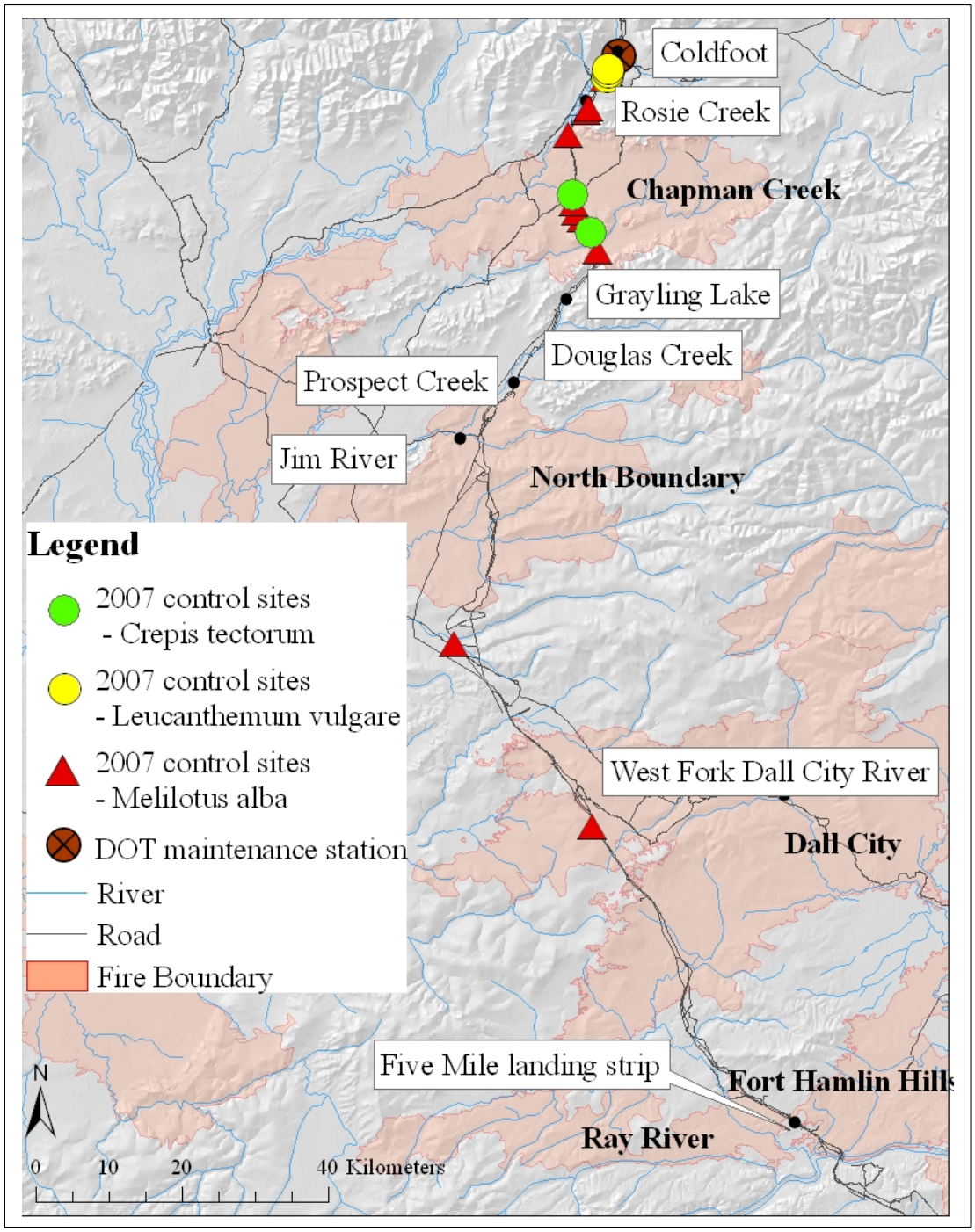
Appendix B.II.a. Records of 2006 control work on infestations from the Dalton Highway.

Species name	Site code	Latitude	Longitude	% cover	Stem count	Aggressiveness	Phenology	Control action	Control hours
Leucanthemum vulgare	1	67.2400121170	-150.216419222	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Leucanthemum vulgare	2	67.2310997895	-150.220803276	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	4	67.2251184243	-150.228563287	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	5	67.2242681491	-150.231801348	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	8	67.1890963918	-150.286609301	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	9	67.1866376186	-150.291537766	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	12	67.1583201383	-150.355349311	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Bromus inermis ssp. *inermis*	14	67.0822813496	-150.352538068	Trace (<1%)	6-25	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	15	67.0725998566	-150.350303112	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	16	67.0616883360	-150.344115290	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	21	67.0516106020	-150.326998515	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	23	67.0428315304	-150.313559114	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins

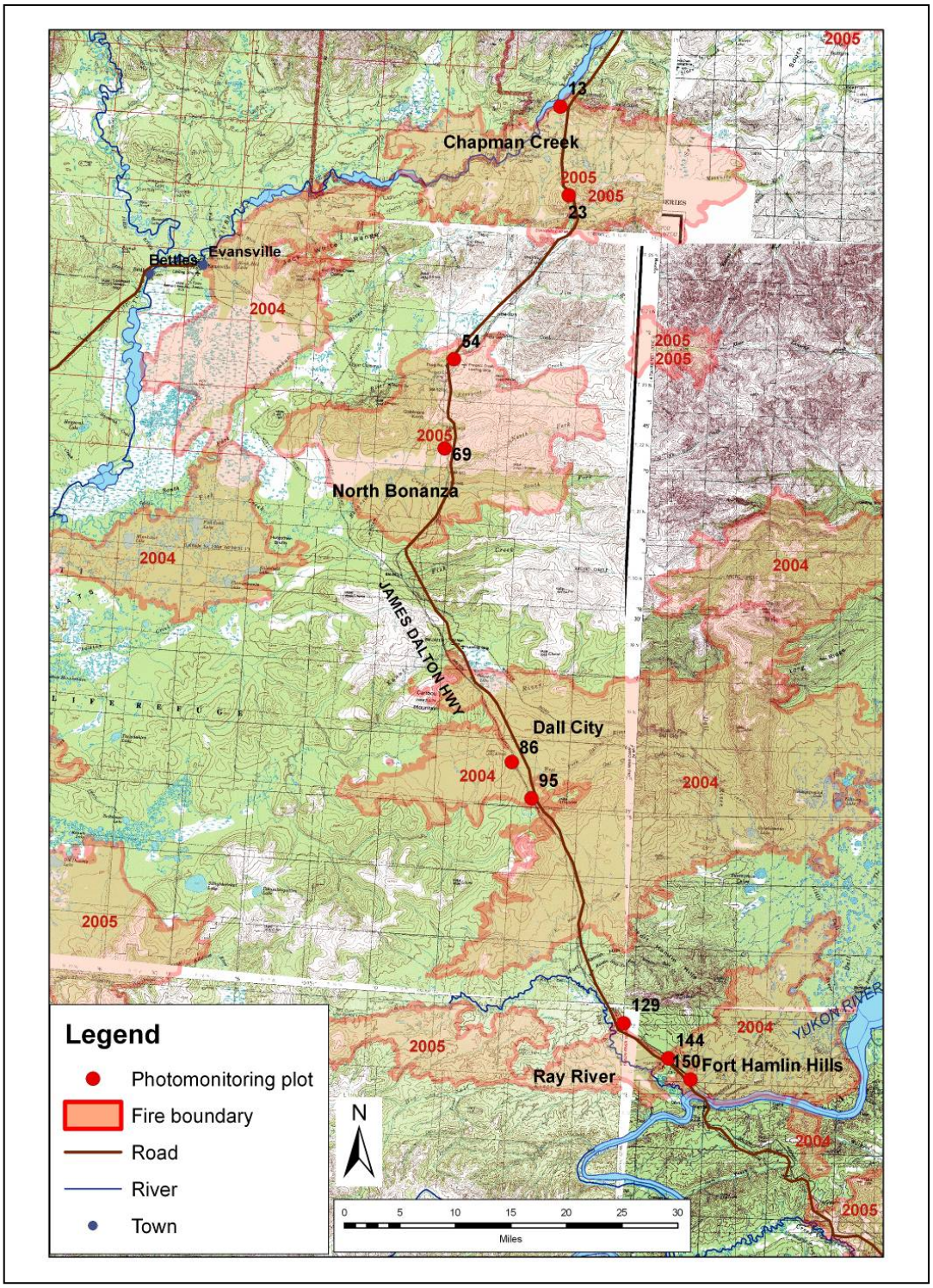
Appendix B.II.a. (contd'.). Records of 2006 control work on infestations along the Dalton Highway.

Species name	Site code	Latitude	Longitude	% cover	Stem count	Aggressiveness	Phenology	Control action	Control hours
Crepis tectorum	26	67.0346649059	-150.304426782	Trace (<1%)	6-25	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	27	67.0192987270	-150.288231989	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	32	67.0116313736	-150.283813548	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	36	66.9758978383	-150.337144999	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	40	66.9529508039	-150.404589178	Trace (<1%)	1-5	Very low	Flowering	Manual pull	5-10 mins
Melilotus alba	75	66.5384043401	-150.793859815	Trace (<1%)	1-5	--	Flowering	Manual pull	5-10 mins
Lotus corniculatus	89	66.2798344870	-150.3605373170	Trace (<1%)	1-5	--	Flowering	Manual pull	5-10 mins
Medicago sativa ssp. *sativa*	90	66.2739313246	-150.351380465	Trace (<1%)	1-5	--	Flowering	Manual pull	5-10 mins
Lotus corniculatus	94	66.2671752682	-150.345131322	Trace (<1%)	6-25	--	Flowering	Manual pull	5-10 mins

Appendix B.II.b. Map of sites along the Dalton Highway targeted for control in 2007.



Appendix B.III. Map of 2006 photo-monitoring points along the Dalton Highway.



Appendix B.IV. Problematic infestations along the Dalton Highway recommended for control and monitoring.

Table IV.1. Location of problematic infestations recommended for control and monitoring work in the Fort Hamlin Hills Burn.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Melilotus alba	201.1 (151)	65.8798	-149.7141	Yukon River BLM Information Center	Fill Importation	500-1000 (10000+)	Reduce and contain: – Modify road maintenance regime (from late summer to spring) – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall (patches > 500ft from river – spray infestation with herbicides – Monitor annually
Melilotus alba (2006 record)	202.0 (150)	65.9070	-149.7789	3mi N Yukon River crossing, 0.25mi N of unnamed creek crossing	Fill Importation	10000+	Reduce: – Modify road maintenance regime (from late summer to spring) – Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) – Monitor annually
Crepis tectorum (new record)	202.1 (~150)	65.9070	-149.7789	3mi N Yukon River crossing, 0.25mi N of unnamed creek crossing	Fill Importation	6-25	– Extirpate: – Hand pull, including underground parts if possible – Bag and remove plants – Monitor for 1 year – if unsuccessful, start herbicide application

(list continues – next page)

Table IV.1. Location of problematic infestations recommended for control and monitoring work in the Fort Hamlin Hills Burn. (cntd.').

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Trifolium hybridum	(448)	65.9110	-149.7907	c. 5 km N YK River crossing, *ca.* 1.3 km N unnamed creek crossing	Fill Importation	n/a	– Extirpate: – Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Trifolium hybridum	(447)	65.9122	-149.7949	c. 5 km N YK River crossing, *ca.* 1.3 km N unnamed creek crossing	Fill Importation	n/a	– Extirpate: – Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Vicia cracca, (2006 record)	207.1 (144)	65.9330	-149.8527	100 m S creek crossing by Five Mile landing strip, invading burned, barren soils	Forest Fire	151-500 (1000-10000)	– Extirpate: – Hand pull above and below- ground parts or mow before flowering (before July) – Revisit and re-treat 1x every 6 wks until the winter – Monitor for 5 years. If plants persist, cost/benefit analysis of applying herbicide (clopyralid) on remaining plants before flowering
Melilotus alba (new record)	207.2 (~144)	65.9330	-149.8527	100 m S creek crossing by Five Mile landing strip	Forest Fire	500-1000	– Reduce: – Modify road maintenance regime (from late summer to spring) – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall – Monitor annually
Bromus inermis ssp. *inermis* (new record)	207.3 (~144)	65.9330	-149.8527	100 m S creek crossing by Five Mile landing strip	Forest Fire	51-150	– Reduce: – Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years

Table IV.2. Location of problematic infestations recommended for control and monitoring work in the Ray River Burn.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Trifolium pratense	(136)	65.9378	-149.8671	Rd to Mile 7 BLM camp and DOT station, N creek crossing by Five Mile landing strip	Fill Importation	(6-25)	Relocate and, if found, extirpate: – Hand pulling (include below ground parts) before seed set – Monitor site and surrounding area for 4-5 yrs
Melilotus alba (2006 record)	211.1 (129)	65.9757	-149.9996	Gravel pullout, halfway b/w BLM camp and DOT station and Fort Hamlin Hills Cr	Fill Importation	1000-10000	Reduce and monitor for changes in size/invasiveness: – Modify road maintenance regime (from late summer to spring) – Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) – Monitor annually
Trifolium hybridum	211.2 (~129)	65.9757	-149.9996	Gravel pullout, halfway b/w BLM camp and DOT station and Fort Hamlin Hills Cr	Fill Importation	500-1000	Reduce and monitor for changes in size/invasiveness: – Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Bromus inermis ssp. *inermis*	211.3 (~129)	65.9757	-149.9996	Gravel pullout, halfway b/w BLM camp and DOT station and Fort Hamlin Hills Cr	Fill Importation	1000-10000	Reduce and monitor for changes in size/invasiveness: – Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years

Table IV.3. Location of problematic infestations recommended for control and monitoring work in the Dall City Burn.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Vicia cracca	(101)	66.2157	-150.2525	Across from pipeline pullout	Fill Importation	(26-50)	Relocate and, if found, extirpate: –Hand pull above and below- ground parts or mow before flowering (before July) –Revisit and re-treat 1x every 6 wks until the winter –Monitor and re-treat for 5 years –Monitor for 5 years. If plants persist, apply herbicide (clopyralid) on remaining plants before flowering
Trifolium hybridum	224 (95)	66.2603	-150.3313	0.75 km S of West Fork Dall River crossing	Fill Importation	10000+	Reduce: –Hand pulling (include below ground parts) +/- mowing to ground level before seed set –Optional: seed with native grasses –Monitor site and surrounding area for 4-5 yrs
Melilotus alba	224 (95)	66.2603	-150.3313	0.75 km S of West Fork Dall River crossing	Fill Importation	10000+	Reduce: –Modify road maintenance regime (from late summer to spring) –Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) –Monitor annually
Lotus corniculatus (2006 record)	225.1 (94)	66.2672	-150.3451	West Fork Dall River crossing	Fill Importation	0 (6-25)	Monitor for new occurrences. If found, extirpate: –Digging (remove all root fragments) before seed set –Monitor site and surrounding area for 4-5 yrs
Melilotus alba (new record)	225.2 (94)	66.2672	-150.3451	West Fork Dall River crossing	Fill Importation	6-25	Extirpate: –Modify road maintenance regime (from late summer to spring) –Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall –Monitor annually

(list continues – next page)

Table IV.3. Location of problematic infestations recommended for control and monitoring work in the Dall City Burn (cntd.').

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Trifolium hybridum (new record)	225.3 (94)	66.2672	-150.3451	West Fork Dall River crossing	Fill Importation	500-1000	Reduce: –Hand pulling (include below ground parts) +/- mowing to ground level before seed set –Optional: seed with native grasses –Monitor site and surrounding area for 4-5 yrs
Lotus corniculatus (2006 record)	227 (89)	66.2798	-150.3605	1.5 km N of West Fork Dall River crossing	Fill Importation	0 (1)	Monitor for new occurrences. If found, extirpate: –Digging (remove all root fragments) before seed set –Monitor site and surrounding area for 4-5 yrs
Medicago sativa ssp. *sativa* (2006 record)	228 (90)	66.2740	-150.3516	0.5 km N of West Fork Dall River crossing	Fill Importation	0 (1)	Monitor for new occurrences. If found, extirpate: –Hand pulling (include below ground parts) before seed set –Optional: seed with native grasses –Monitor site and surrounding area for 4-5 yrs
Melilotus alba	229-231 (86, 282-285, 288, 291)	66.3060	-150.4000	4-6.5 km N of West Fork Dall River crossing	Fill Importation	26-50 at any given site	Extirpate: –Modify road maintenance regime (from late summer to spring) –Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) –Monitor annually

Table IV.4. Location of problematic infestations recommended for control and monitoring work in the North Bonanza Burn.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Melilotus alba	(257)	66.5438	-150.7986	Fish Cr, just S of North Bonanza Burn	Fill Importation	n/a	Relocate and, if found, extirpate: –Modify road maintenance regime (from late summer to spring) –Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall –Monitor annually
Melilotus alba	251	66.6249	-150.6819	Near one of the Bonanza Cr tributary creek crossings	Fill Importation	51-150	Extirpate: –Modify road maintenance regime to kill seedlings and reduce spread (from late summer to spring) –Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) –Monitor annually
Melilotus alba	252	66.6785	-150.6637	Near one of the Bonanza Cr tributary creek crossings	Fill Importation	6-25	Extirpate: –Modify road maintenance regime (from late summer to spring) –Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) –Monitor annually
Melilotus alba	255-257	66.7099	-150.6737	>1 km from one of the Bonanza Cr tributary creek crossings	Fill Importation	6-25	Extirpate: –Modify road maintenance regime (from late summer to spring) –Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) –Monitor annually

(list continues – next page)

Table IV.4. Location of problematic infestations recommended for control and monitoring work in the North Bonanza Burn (cntd.').

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Melilotus alba (*Vicia cracca* '06)	254 (69)	66.7067	-150.6753	On blind curve north of North Bonanza Fire	Fill Importation	6-25 (no *V. cracca* in 2007)	Extirpate: –Modify road maintenance regime (from late summer to spring) –Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) –Monitor annually
Hieracium umbellatum	(67)	66.7180	-150.6709	Gravel pit, invading burned area	Fill Importation	(1000-10000)	Reduce: –Spray infestation + 50 ft radius with Telar seedlings (control before onset of flowering) –Optional: seed with native grasses –Monitor annually
Hieracium umbellatum	(231)	66.7182	-150.6669	3.5mi N of North Fork Bonanza Cr, invading burned area	Fill Importation	n/a	Reduce: –Spray infestation + 50 ft radius with Telar seedlings (control before onset of flowering) –Optional: seed with native grasses –Monitor annually
Hieracium umbellatum	256 (230)	66.7281	-150.6672	4mi N of North Fork Bonanza Cr, invading burned area	Forest Fire	500-1000	Reduce: –Spray infestation + 50 ft radius with Telar seedlings (control before onset of flowering) –Optional: seed with native grasses –Monitor annually
Hieracium umbellatum	(63)	66.7313	-150.6671	On long downhill, invading burned area	Fill Importation	(500-1000)	Reduce: –Spray infestation + 50 ft radius with Telar seedlings (control before onset of flowering) –Optional: seed with native grasses –Monitor annually

(list continues – next page)

Table IV.4. Location of problematic infestations recommended for control and monitoring work in the North Bonanza Burn (cntd.').

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Melilotus alba	260	66.7821	-150.6887	Continuous to Pump Station 5 - adjacent to burn	Fill Importation	10000+	Contain and monitor for changes in size/invasiveness: Modify road maintenance regime (late summer to spring) – Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) – Monitor annually
Melilotus alba	(212)	66.7884	-150.6884	nr Prospect Cr	Fill Importation	n/a	If possible, extirpate: – Modify road maintenance regime – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall – Monitor annually
Melilotus alba	342	66.7936	-150.6865	just south of Pump Station 5 on west side of road, invading burned forest	Forest Fire	26-50	Extirpate: – Spray infestation + 20 ft radius with Telar – Monitor annually
Crepis tectorum	261 (54)	66.8227	-150.6629	Jim River DOT station, invading burned area	Forest Fire/Fill Importation	151-500 (151-500)	Extirpate: – Herbicide application – Monitor annually for 3+ years – (off road plants: hand pull, including underground parts if possible, and, monitor for 1 year – if unsuccessful, consider herbicide application)
Melilotus alba	262	66.8327	-150.6202	3.5km N Pump Station 5, close to Dougals Cr	Fill Importation	26-50	Extirpate: – Modify road maintenance regime (late summer to spring) – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall – Monitor annually
Melilotus alba	338	66.8338	-150.6152	3.5km N Pump Station 5, close to Dougals Cr	Fill Importation	1-5	Extirpate (same as for Site #262, see previous)

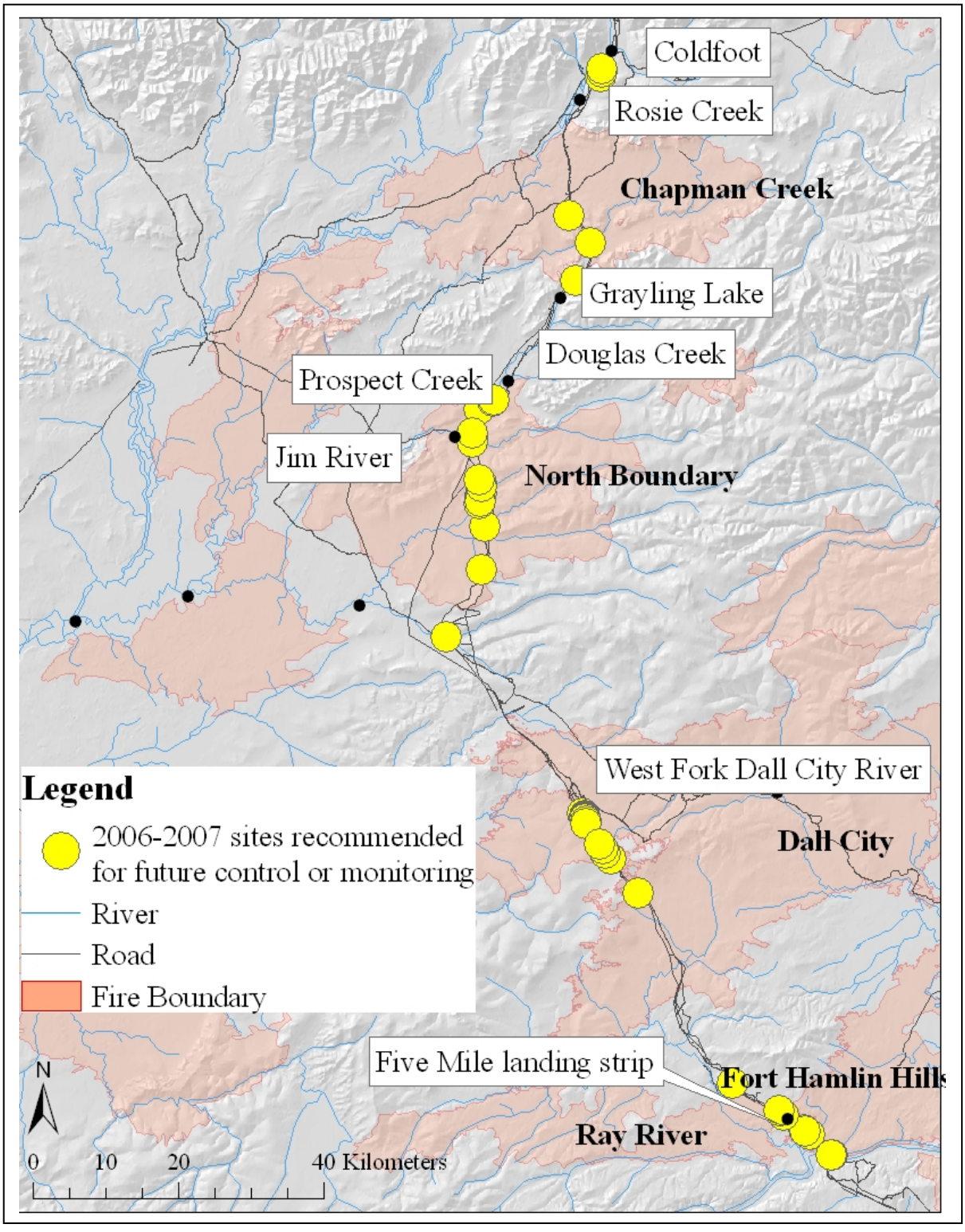
Table IV.5. Location of problematic infestations recommended for control and monitoring work in the Chapman Creek Burn.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Melilotus alba	327	67.0204	-150.2871	Nr S Fork Koyukuk	Fill importation	1-5	Extirpate: – Modify road maintenance regime (from late summer to spring) – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall – Monitor annually
Trifolium hybridum	(37)	66.9756	-150.3384	3 km N Grayling Lake	Fill importation	(6-25)	Extirpate: – Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Vicia cracca	(18)	67.0558	-150.3505	rd across from pipeline access	Fill importation	(26-50)	Extirpate: – Hand pull above and below- ground parts or mow before flowering (before July) – Revisit and re-treat 1x every 6 wks until the winter – Monitor and re-treat for 5 years – Monitor for 5 years. If plants persist, apply herbicide (clopyralid) on remaining plants before flowering

Table IV.6. Location of problematic infestations recommended for control and monitoring work in the unburned areas between Chapman Creek Burn and Coldfoot.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Disturbance type	Est. stem count 2007 (2006)	Recommended methods of control
Melilotus alba	304 (7)	67.1958	-150.2778	Rosie Creek crossing	Fill importation	51-150 (500-1000)	Extirpate: – Modify road maintenance regime (from late summer to spring) – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall – Monitor annually
Leucanthemum vulgare (new record)	310	67.2256	-150.2272	Southerly edge of pullout	Fill importation	0 (after '07 pull)	Monitor for new occurrences. If found, extirpate: – Cut or bag flowering heads one month after snow melt – Dig out plants and rosettes – Spot-spray w/ herbicide 'diflufenzopyr' – Revisit and treat monthly during the growing season – Monitor for up to 5 years
Leucanthemum vulgare (new record)	313.1	67.2311	-150.2208	Near culvert on W side of road	Fill importation	500-1000	Reduce and monitor: – Cut or bag flowering heads one month after snow melt – Dig out plants and rosettes – Spot-spray w/ herbicide 'diflufenzopyr' – Revisit and treat monthly during the growing season – Monitor for up to 5 years
Leucanthemum vulgare (new record)	314.1	67.2346	-150.2190	Near culvert on W side of road	Fill importation	0 (after '07 pull)	Monitor for new occurrences. If found, extirpate: – Cut or bag flowering heads one month after snow melt – Dig out plants and rosettes – Spot-spray w/ herbicide 'diflufenzopyr' – Revisit and treat monthly during the growing season – Monitor for up to 5 years

Appendix B.V. Map of problematic infestations along the Dalton Highway recommended for control and monitoring.



Taylor Highway 2006 Inventory Results

Overview

Fieldwork along the Taylor Highway, from Tetlin Junction to Eagle, was conducted from July 11th through July 16th 2006.

Six burned areas were monitored along the way, corresponding to the intersection of the highway with the 2004 Porcupine, Chicken, Wall Street, King Creek, and Deer Creek Fires, as well as the 2005 Boundary Creek Fire. Plots were read on right-of-ways, while secondary roads, winter trails, and ATV trails were inventoried for up to one mile or until no invasive species were present. Potential invasive plant dispersal foci, such as the DOT maintenance station and the junction of the Taylor and the Alaska Highways, were also targeted.

In all, 160 miles of highway were covered, and 102 plots were read. Of these, 33 used the AKEPIC protocol, while the rest (69) followed BLM-BAER methodology, and were established only when priority invasive plant infestations were detected. Six of these plots were set up as photo-monitoring points.

Excluding species whose nativity status remains questionable (*Erysimum cheiranthoides, Hordeum jubatum,* and *Potentilla norvegica,*), a total of 25 non-native species were recorded (Table 18). The most common ones were: *Bromus inermis* ssp. *inermis, Plantago major, Taraxacum officinale* ssp. *officinale,* and *Trifolium hybridum.*

Most of the invasives documented near the burns rank low to very low in terms of their invasiveness, with the exception of *Vicia cracca* (bird vetch), which was seen (slightly) invading the undisturbed shrub understory adjacent to the highway's right-of-way (see Appendix C.I for a map of the sites at which bird vetch populations were observed). Lastly, although non-natives were not found on the winter trails, they were relatively common and extended farther along upland ATV trails.

Table 18. List of non-native plant species encountered along the Taylor Highway in 2006.

Family Name	Scientific Name	Common Name	Invasive-ness Rank	Porcu-pine	Chicken	Wall Street	King Cr	Boundary Cr
Caryophyllaceae	*Agrostemma githago*	corncockle	not ranked		X			
Poaceae	*Bromus inermis* ssp. *inermis*	smooth brome	62	X	X			
Chenopodiaceae	*Chenopodium album*	lambs quarters	35		X			
Polemoniaceae	*Collomia linearis*	narrowleaf mountain trumpet	not ranked					
Asteraceae	*Crepis tectorum*	narrowleaf hawksbeard	54	X			X	
Brassicaceae	*Descurainia sophia*	flaxweed tansymustard	41					
Poaceae	*Hordeum jubatum*	foxtail barley	63	X	X	X	X	X
Boraginaceae	*Lappula squarrosa*	bristly sheepburr	44					
Brassicaceae	*Lepidium densiflorum*	common pepperweed	25				X	
Linaceae	*Linum perenne*	blue flax	not ranked					
Asteraceae	*Matricaria discoidea*	pineapple weed	32	X	X		X	X
Fabaceae	*Medicago sativa* ssp. *falcata*	yellow alfalfa	64					
Fabaceae	*Melilotus alba*	white sweetclover	80					
Fabaceae	*Melilotus officinalis*	yellow sweetclover	65					

Table 18. List of non-native plant species encountered along the Taylor Highway in 2006 (contd.')

Family Name	Scientific Name	Common Name	Invasive-ness Rank	Porcu-pine	Chicken	Wall Street	King Cr	Boundary Cr
Papaveraceae	*Papaver nudicaule*	Icelandic poppy	not ranked			X		
Plantaginaceae	*Plantago major*	common plantain	44	X	X		X	X
Poaceae	*Poa pratensis* ssp. *pratensis*	Kentucky bluegrass	52					
Polygonaceae	*Polygonum aviculare*	prostrate knotweed	45	X	X			X
Rosaceae	*Potentilla norvegica*	Norwegian cinquefoil	not ranked				X	
Polygonaceae	*Rumex acetosella*	sheep sorrel	51					
Polygonaceae	*Rumex crispus*	curly dock	48					
Caryophyllaceae	*Stellaria media*	chickweed	42					
Asteraceae	*Taraxacum officinale* ssp. *officinale*	common dandelion	58	X		X	X	
Fabaceae	*Trifolium hybridum*	alsike clover	57		X		X	
Fabaceae	*Vicia cracca*	bird vetch	73			X		

2006 burned area survey results

Porcupine Burn (04)

Seven non-native species were found inside the boundaries of the Porcupine Burn. These were *Bromus inermis* ssp. *inermis*, *Crepis tectorum*, *Hordeum jubatum*, *Matricaria discoidea*, *Polygonum aviculare*, *Plantago major*, and *Taraxacum officinale* ssp. *officinale*. The first two, which rank at 62 and 54 points of invasiveness respectively, were the most problematic species in this area.

Bromus inermis ssp. *inermis* was found at three locations in the northern portion of the burn: Site TAY06-0006 (N 63.59794°, W 142.34946°), Site TAY06-0007 (N 63.64768°, W 142.2888°), and Site #13 (N 63.631731°, W 142.313992°). A population of *Crepis tectorum* infestation was also located in this area, at Site #12 (N 63.631412°, W 142.314083°) (see Appendix C.I for maps of the sites at which *Bromus inermis* ssp. *inermis* and *Crepis tectorum* were recorded).

Porcupine Burn photo-monitoring points

No photo-monitoring plots were established in this area.

Chicken Burn (04)

Agrostemma githago, Bromus inermis ssp. *inermis, Chenopodium album, Hordeum jubatum, Matricaria discoidea, Plantago major, Polygonum aviculare,* and *Trifolium hybridum* were recorded in this burn, with *Bromus inermis* ssp. *inermis* (62 points out of 100) and *Trifolium hybridum* (57 points) being the most aggressively invasive, as well as the most frequently observed.

Chicken Burn photo-monitoring points

Two photo-monitoring points were erected in the Chicken Fire perimeter.
1. Site #23 (N 64.04641°, W 142.054339°) marks a smooth brome (*Bromus inermis* ssp. *inermis*) and alsike clover (*Trifolium hybridum*) infestation (Fig. 48).

2. Site #6 (N 63.865919°, W 142.228878°), was set up to monitor an alsike clover (*Trifolium hybridum*) population that was invading native grass adjacent to a burned, black spruce bog (Fig. 49).

Figure 48. This Chicken Burn photo-monitoring point was established at a site infested by *Bromus inermis* ssp. *inermis* and *Trifolium hybridum* (Site #23).

Figure 49. *Trifolium hybridum* was invading native vegetation adjacent to a burned, black spruce bog at this photo-monitoring point (Site #6, Chicken Burn).

Wall Street Burn (04)

Two populations of *Vicia cracca* and one of *Papaver nudicaule* were identified in the Wall Street Burn. The larger of the two *V. cracca* infestations (up to 5000 stems) was located at Site #3 (N 64.0503°, W 141.785981°), growing behind the fence of the South Fork DOT Station (Fig. 50). The other infestation was one mile west of this point, at Site #1 (N 64.056813°, W 141.809232°). Because bird vetch was only found at these two locations and nowhere else along the highway (see Appendix C.I for a map of the two sites where *V. cracca* was recorded), we advise that both populations be eliminated completely (see Appendix C.III.b. for more details on these two sites and guidelines for control work). Furthermore, we suggest that the equipment stored in the DOT station be periodically cleaned, especially after it has been used in areas where highly invasive species have been recorded, to minimize the risk of spreading invasive propagules from contaminated to weed-free sections of the highway.

Figure 50. These two photos were taken at the DOT South Fork Station, which has a large infestation of bird vetch (*Vicia cracca*) (Site #3, Wall Street Burn). Both the DOT population and the one located less than a mile west from here should be targeted for eradication.

Wall Street Burn photo-monitoring points

Both photo-monitoring points established in the Wall Street Burn were free of invasive plants. One was located on the west side of the highway at Site #8 (N 64.086225°, W 141.665243°), in a native forb-graminoid roadside community (Fig. 51). The second one was at Site #6 (N 64.08569°, W 141.648632°), and was dominated by native willows, alder, and grasses (Fig. 52).

Figure 51. Native forb-graminoid roadside vegetation (Site #8, Wall Street Burn).

Figure 52. Weed-free photo-monitoring plot at Site #6, Wall Street Burn.

King Creek Burn (04)

One population of each of the following species was observed along the King Creek Burn area: *Crepis tectorum, Matricaria discoidea, Plantago major*, and *Trifolium hybridum* (see Appendix C.I for a map of the sites where alsike clover was recorded).

King Creek Burn photo-monitoring points

A single photo-monitoring point was set up at Site #12 (N 64.370089°, W 141.413751°), in an early seral herbaceous roadside vegetative community. Species recorded here included *Potentilla norvegica* (no longer being tracked as a non-native in AKEPIC), *Hordeum jubatum* (whose non-nativity is questionable), and *Taraxacum officinale* ssp. *officinale* (extremely widespread in Alaska, and thus not worth prioritizing for control anymore) (Fig. 53).

Boundary Creek Burn (05)

A single population of *Matricaria discoidea* was all that was recorded from this burn.

Boundary Creek Burn photo-monitoring points

A photo-monitoring point was established at Site #8 (N 64.58596°, W 141.27352°), marking a native, early seal herbaceous roadside community (Fig. 54).

Figure 53. King Creek photo-monitoring point. Roadside vegetation here included *Potentilla norvegica*, *Hordeum jubatum*, and *Taraxacum officinale* ssp. *officinale*. These species should not be prioritized for control.

Figure 54. Weed-free Boundary Creek Fire photo-monitoring point.

Deer Creek Burn (04)

The Deer Creek Burn was not surveyed because it was off the road network. However, the AKNHP crew did inventory the very beginning of the 70-Mile Trail leading to this burn until no invasives species were found (less than one mile, Fig. 55). Very few non-natives were recorded here, and most of these (e.g. *Erysimum cheiranthoides*, *Hordeum jubatum*, and *Plantago major*) were not aggressive, with the exception of a small (ca. 100 stems) population of smooth

Figure 55. Wetland on the 70-Mile Trail leading to the Deer Creek Burn, west of Eagle.

brome (*Bromus inermis* ssp. *inermis*) at the beginning of the trail (Site #1, N 64.792036°, W 141.236519°).

Deer Creek Burn photo-monitoring points

Because the area was not surveyed, no photo-monitoring points were set up.

2006 unburned area survey results

Non-native plants found outside of the fire perimeters include: *Collomia linearis, Descurainia sophia, Lappula squarrosa, Linum perenne, Medicago sativa* ssp. *falcata, Melilotus alba, Melilotus officinalis, Poa pratensis* ssp. *pratensis, Rumex acetosella, Rumex crispus,* and *Stellaria media.*

Infestations of *Bromus inermis* ssp. *inermis*, *Chenopodium album*, *Crepis tectorum*, *Lappula squarrosa*, *Lepidium densiflorum*, *Medicago sativa* ssp. *falcata*, *Melilotus alba*, *Melilotus officinalis*, *Polygonum aviculare*, and *Trifolium hybridum* were found in the (unburned) area around Tetlin Junction. *Melilotus alba*, which was both the most frequently and most invasive species recorded in the first three miles of the highway, was observed in the following areas:

1. Sites #25 and #26 (N 63.344889°, W 142.601039°): these two adjacent infestations of up to 200 and 700 individuals, respectively, all in the seedling stage, were located at Mile 2.5 of the highway. Site #26 was marked with yellow flagging tied to a willow tree (Fig. 56).

Figure 56. *Melilotus alba* infestation at Site #26 (left). The willow tree that was next to the infestation was tagged with yellow flagging tape (right).

2. Site #27 (N 63.328065°, W 142.59663°): a mixed population of flowering individuals and first year seedlings, totaling some 700 individuals, was observed at mile 1.1 of the highway, and hand pulled. We recommend that this site be revisited to check for new seedlings that may emerge from the seedbank.

3. Site #28 (N 63.328467°, W 142.596738°): a second population, consisting mainly of seedlings, was also observed at mile 1.1, near a parking sign. Although the bigger plants were hand pulled, smaller seedlings remained.

4. Site #29 (N 63.311692°, W 142.602427°): The infestations recorded here, at the junction of the Alaska and Taylor Highways, were dispersing northwards into the Taylor.

Bromus inermis ssp. *inermis*, *Crepis tectorum*, *Medicago sativa* ssp. *falcata*, *Melilotus officinalis*, and *Trifolium hybridum* were also documented at the junction of the Taylor and Alaska Highways (i.e. Site #29), but unlike *Melilotus alba*, they had not yet expanded northwards. Annual monitoring and pulling efforts are recommended for all the above mentioned sites.

2006 eradication work

A total of four infestations were controlled along the Taylor Highway: two *Melilotus alba* populations were hand-pulled at Sites #25 (N 63.344946°, W 142.601168°) and #27; about 0.1 acres of *Polygonum aviculare* were pulled from Site #24 (N 63.403103°, W 142.470529°), in the Porcupine Burn, and roughly 1000 flowering stems of *Vicia cracca* were pulled at Site #1, about 6.5 miles north of Chicken. (Even though all adult *V. cracca* individuals were removed, there were still some seedlings left that we adivise should be dug out during the 2008 growing season together with any new plants that may germinate from the seed bank). (See Appendix C.II for a list of the sites where control work was conducted, and Appendix C.III.b for a more control recommendations)

Taylor Highway 2007 Revisit Results

Overview

Of the 35 BLM-BAER plots that were read, thirteen were located in areas affected by the 2004 Porcupine, Chicken, Wall Street, and King Creek Fires, as well as the 2005 Boundary Creek Fire. Control work was carried out at 17 sites, and all six photo-monitoring plots erected in 2006 were relocated and re-photographed. In addition, we collected information on infestations observed in the town of Eagle.

A total of eleven non-native species were recorded, representing seven families (Table 19). Two of these had not been recorded in 2006: *Tripleurospermum perforata* (Asteraceae) and *Caragana*

arborescens (Fabaceae). The most invasive species were *Melilotus alba* (80 points), *Vicia cracca* (73 points), and *Bromus inermis* ssp. *inermis* (62 points) (the populations of *Melilotus officinalis* and *Medicago sativa* ssp. *falcata* were not found in 2007). As in 2006, *Vicia cracca* (bird vetch) was the seen slightly invading the undisturbed shrub understory adjacent to the highway's right-of-way (Site # 1-2006). *Trifolium hybridum*, on the other hand, which had also started to move off human altered sites into the Chicken burn in 2006, was recorded as restricted to imported fill on the roadside at the same site in 2007 (Site #6-2006)

Table 19. List and distribution of non-native plant species infestations *revisited* in 2007 on the Taylor Highway.

Family Name	Scientific Name	Common Name	Invasive-ness Rank	Porcu-pine	Chicken	Wall Street	King Cr	Boun-dary Cr
Poaceae	*Bromus inermis* ssp. *inermis*	smooth brome	62	X	X			
Polemoniaceae	*Collomia linearis*	narrowleaf mountain trumpet	not ranked	X				
Asteraceae	*Crepis tectorum*	narrowleaf hawksbeard	54	X	X			
Poaceae	*Elymus repens*	quackgrass	59	X		X		
Boraginaceae	*Lappula squarrosa*	bristly sheepburr	44					
Fabaceae	*Melilotus alba*	white sweetclover	80	X				
Papaveraceae	*Papaver nudicaule*	Icelandic poppy	not ranked			X		
Fabaceae	*Trifolium hybridum*	Alsike clover	57	X	X			
Asteraceae	*Tripleurosper mum perforata*	scentless false-mayweed	48	X				
Fabaceae	*Vicia cracca*	bird vetch	73			X		

2007 burned area survey results

Porcupine Burn (04)

Much of the road traversing the Porcupine Burn was undergoing or had recently undergone construction and revegetation work at the time of the 2007 surveys (Fig. 57). This could explain why we found a number of non-native plant infestations here in 2007 that had not been

Figure 57. This photograph shows a stretch of the road that was being worked on at the time of the 2007 survey, and along which we counted numerous *Crepis tectorum* individuals (Site #720-2007).

observed in 2006. In all, twelve new populations were recorded, of which the following eight were controlled: *Melilotus alba* (Site #713), *Crepis tectorum* (Sites #714 and #722), *Bromus inermis* (Site #715), *Collomia linearis* (Site #716), *Tripleurospermum perforata* (Sites #717 and #721), and *Trifolium hybridum* (Site #724) (Table 20, for maps of some of the key infestations targeted for control in 2007 see Appendix C.II.b).

The only Porcupine Burn plot that was controlled in 2006 consisted of a small infestation of *Polygonum aviculare* that was located on a trail branching off a pullout at mile marker 10.3 (Site #725-2007, #24-2006). In 2007 we revisited this area but did not find any non-native species. Lastly, we did not look for the 2006 *Crepis tectorum* and *Bromus inermis* ssp. *inermis* infestations because they were neither controlled in 2006 nor were they located at photo-monitoring locations.

Table 20. List of sites inventoried and/or controlled in the Porcupine Burn section in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Melilotus alba	713	63.3525	-142.6063	3.5	E side 500 ft S of Porcupine burn	151-500	yes
Crepis tectorum	714	63.3533	-142.6066	3.6	W side 100 ft S of Porcupine burn	6-25	yes
Bromus inermis ssp. *inermis*	715	63.3659	-142.5842	4.0	pullout on E side	6-25	yes
Collomia linearis	716	63.3659	-142.5834	4.0	pullout on E side, E of small fill pile	500-1000	yes
Tripleurospermum perforatum	717	63.3682	-142.5794	4.2	W side, adjacent to Porcupine burn	1-5	yes
Crepis tectorum	718	63.3682	-142.5794	4.2	W side adjacent to Porcupine burn	151-500	no
Elymus repens	719	63.3682	-142.5794	4.2	W side adjacent to Porcupine burn	26-50	no
Crepis tectorum	720	63.3796	-142.5469	6.0	E and W sides before pullout at MP 6	151-500	no
Tripleurospermum perforatum	721	63.3789	-142.5487	6.0	W side	1-5	yes
Crepis tectorum	722	63.3807	-142.5456	6.5	W side adjacent to low severity area of Porcupine burn	6-25	yes
Bromus inermis ssp. *inermis*	723	63.3807	-142.5456	6.5	W side adjacent to low severity Porcupine burn	26-50	no
Trifolium hybridum	724	63.3808	-142.5456	6.5	W side adjacent to low severity burn	1-5	yes
Polygonum aviculare	725 (24)	63.4045	-142.4740	10.3	down trail from pullout on E side	0	no

Porcupine Burn photo-monitoring points

No photo-monitoring plots were established in this area in 2006.

Chicken Burn (04)

The only control work carried out in this burn was at Site #727-2007, which was not recorded in 2006, and where we extirpated a small population of *Crepis tectorum* (Table 21, for maps of some of the key infestations targeted for control in 2007 see Appendix C.II.b). As in 2006, *Bromus inermis* ssp. *inermis* and *Trifolium hybridum* were the most frequently observed species in this section of the road and vicinity.

Table 21. List of sites inventoried and/or controlled in the Chicken Burn section in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Crepis tectorum	727	63.7958	-142.2182	43.0	E side, 100 ft S of Chicken burn	6-25	yes

Chicken Burn photo-monitoring points

We revisited the two photo-monitoring points erected in 2006 (Table 22). At mile marker 48 we relocated the *Trifolium hybridum* infestation and corresponding tags (Site #728-2007, #6-2006, Fig. XX). Contrary to our 2006 observations, we do not consider that the *T. hybridum* patch was invading native vegetation in 2007. We pulled about 90% of the population, trying when possible to dig out the root system, and the number of stems this year was lower than in 2006 (51-150 vs. 500-1000 stems).

Figure 58. *Trifolium hybridum* continues to grow at this photo-monitoring point (Site #728-2007, #6-2006). We dug up about 90 pecent of the infestation in 2007.

The second photo monitoring point was at mile marker 65 (Site #729-2007, #23-2006), and marked an infestation of *Bromus inermis* ssp. *inermis* that extends almost continuously from the previous point to the town of Chicken. Unlike the 2006

survey results, low invasiveness levels (spreading into native vegetation) were recorded for both these populations in 2007.

Table 22. 2006 photo-monitoring plots located in the Chicken Burn that were revisited in 2007.

Species name	**Site code 2007 (2006)**	**Lat**	**Lon**	**Mile marker**	**Location notes**	**Est. stem count**	**Control action**
Trifolium hybridum	728 (6-7)	63.8658	-142.2289	48.0	W side, photo monitoring point TAY 6, Chicken burn	51-150	yes
Bromus inermis ssp. *inermis*	729 (23)	64.0464	-142.0544	65.0	on S shoulder of hill, W side, 2 tags visible from road	10000+	no

Wall Street Burn (04)

In 2006, AKNHP crews hand pulled most of the approximately 1000 stems of *Vicia cracca* that were spreading from the roadside into native vegetation at mile marker 85 (Site #730-2007, #1-2006). In 2007 we repeated control work and pulled *ca.* 300 stems (of an estimated total of 150-500 stems), which suggests that hand-pulling in 2006 did help control (but not eliminate) the population (Table 23, for maps of some of the key infestations targeted for control in 2007 see Appendix C.II.b). We also re-photographed the larger (up to 5000 stems) infestation located at Site #3-2006 growing along the fence of the South Fork DOT station. Any control efforts carried out in this section of the highway should aim to reduce or eliminate both populations. Furthermore, the stations and the equipment stored in it should be periodically cleaned to minimize the spread of invasive species.

In addition to the *Papaver nudicaule* population detected in 2006 (Site #732, mile marker 93.5) we saw various additional, small populations of this species scattered between mile markers 109 and 112, all growing on disturbed, moist soil. None of these infestations were controlled as they are not considered highly aggressive nor high priority.

Table 23. List of sites inventoried and/or controlled in the Wall Street Burn section in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Vicia cracca	730 (1)	64.0568	-141.8092	85	TAY 1 control plot, E side	151-500	yes
Papaver nudicaule	732	64.0814	-141.6440	93.5	300 ft S of Wall Street burn, recently graded	51-150	No

Figure 59. *Vicia cracca* continued to grow at Mile marker 85, close to the South Fork DOT Station (Site #730-2007, #1-2006). However, hand pulling all adult inviduals in 2006 did appear to have helped control, and even reduce, this population, which was estimated at 1000 stems in 2006, and 500 stems in 2007.

Wall Street Burn photo-monitoring points

Like in 2006, the Wall Street burn photo-monitoring points at Sites #735 (Site #8-2006) had no invasive plant species. However, we re-determined the grass growing along the road at Site #731 (#6-2006) as *Elymus repens*, which was probably sowed here following road construction work (Table 24). *Hordeum jubatum* was also recorded at Site #735, but because its non-nativity is questionable and it is common, at low densities, throughout most of the highway, we do not consider this population as a cause for concern.

Figure 60. *Elymus repens* growing along the roadside at photo-monitoring plot #735-2007, in the Wall Street Burn.

Table 24. 2006 photo-monitoring plots located in the Wall Street Burn that were revisited in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Location notes	Est. stem count	Control action
Elymus repens	731 (6)	64.0856	-141.6484	Wall Street photo monitoring plot TVB071506	500-1000	no
None	735 (8)	64.0861	-141.6655	W side, both tags visible on birch trees, no target spp observed	0	no

King Creek Burn (04)

No infestations were controlled in this section of the highway in 2006. Consequently, no revisit work was required here in 2007, except for the photo-monitoring points.

King Creek Burn photo-monitoring points

As in 2006, no priority invasive species were recorded at the King Creek photo-monitoring plot in 2007 (Site #734-2007, #12-2006, Table 25). The same non-native species that were recorded here in 2006 were observed again in 2007: *Hordeum jubatum*, whose non-nativity is questionable, *Potentilla norvegica*, and *Taraxacum officinale* ssp. *officinale*.

Table 25. 2006 photo-monitoring plots located in the King Creek Burn that were revisited in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
None	734 (12)	64.3700	-141.4136	118.0	E side, King Creek burn, no target spp detected	0	no

Boundary Creek Burn (05)

Boundary Creek Burn photo-monitoring points

We revisited the single photo-monitoring point established in 2006 (Site #733-2007, #8-2006), and replaced both tags. No non-native species were recorded (Table 26).

Table 26. 2006 photo-monitoring plots located in the Boundary Creek Burn that were revisited in 2007.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
None	733 (8b)	64.5853	-141.2741	140.0	photo point #8, couldn't find tags, replaced both, recreated point	0	no

Deer Creek Burn (04)

We hiked three miles into the Deer Creek burn following the Tractor trail, and did not find any non-native species along the way (waypoint 03, N 64.8034º, W 141.3007º. (We were unable to relocate the *Bromus inermis* ssp. *inermis* infestation recorded here in 2006).

2007 unburned area survey results

Teltin Junction and the first three miles of the highway north of it continue to be an invasive species 'hotspot' (Fig. 61, Table 27). In 2006 a number of non-native species were recorded at the junction, with only *Melilotus alba* extending *north* of it. In contrast, in 2007 we found semi-continuous populations of *Bromus inermis* ssp. *inermis* and *Crepis tectorum*, in addition to those of *M. alba*, throughout this three mile section of road, as well as some discrete and patchy infestations of *Elymus repens*, *Collomia linearis*, *Lappula squarrosa*, and *Trifolium hybridum*. Because this part of the highway appears to have undergone recent road work, the most likely explanation for the rapid increase in number and size of non-native plant species infestations along it is that the recently imported gravel was contaminated with non-native plant propagules. We recommend that this area be prioritized for control and monitoring work (see below).

Table 27. List of plots read in the three first and heavily infested miles of the Taylor Highway.

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Melilotus alba	701 (29)	63.3116	-142.6020	0.0	Tetlin junction	10000+	no
Crepis tectorum	702	63.3116	-142.6020	0.0	Tetlin junction	51-150	yes
Elymus repens	703	63.3116	-142.6021	0.0	Tetlin junction	26-50	no
Bromus inermis ssp. *inermis*	704	63.3116	-142.6023	0.0	Tetlin junction	51-150	no
Trifolium hybridum	705	63.3116	-142.6026	0.0	Tetlin junction	26-50	no
Collomia linearis	705b	63.3116	-142.6026	0.0	Tetlin junction	26-50	no

Table 27. List of plots read in the three first and heavily infested miles of the Taylor Highway (cntd.').

Species name	Site code 2007 (2006)	Lat	Lon	Mile marker	Location notes	Est. stem count	Control action
Crepis tectorum	706	63.3176	-142.6004	0.2	E side	1-5	Yes, pulled 100%
Melilotus alba	707	63.3421	-142.5952	2.0	E side, S of parking sign, graded and seeded within last 2-3 yrs	0	No
Crepis tectorum	708	63.3417	-142.5947	2.0	W side	51-150	Yes, pulled 50%
Collomia linearis	708b	63.3417	-142.5947	2.0	W side	26-50	no
Crepis tectorum	709	63.3459	-142.6026	3.0	pullout on W side	1-5	Yes, pulled 100%
Elymus repens	710	63.3455	-142.6023	3.0	pile of fill and embankments	151-500	no
Melilotus alba	711 (25, 26)	63.3448	-142.6011	3.0	W side between 7 percent grade sign and pullout	151-500	Yes, pulled 100%
Lappula squarrosa	712	63.3459	-142.6027	3.0	W side of pullout	6-25	Yes, pulled 100%
Bromus inermis ssp. *inermis*	726	63.7719	-142.2364	42.0	E side	151-500	no

The invasive populations found at the junction of the Tetlin and Alaska Highways in 2007 were large. We only pulled two small to medium sized *Crepis tectorum* clumps which were located at Sites #702 (50-150 stems) and #706 (1-5 stems), respectively. We decided not to extirpate the rest because it would have been very time consuming. However, we did control the following four (of a total of seven) infestations detected in the first three miles *north* of the junction (Table 27, for maps of some of the key infestations targeted for control in 2007 see Appendix C.II.b):

Figure 61. The area around and just north of Tetlin Junction constitutes the most heavily infested section of the Taylor Highway (Sites #701-705b-2007).

1. *Melilotus alba*: a population of approximately 700 invididuals was found at mile marker 2.5 of the Taylor Highway in 2006 (Sites #25 and #26). All adult individuals were pulled that season, but seedlings were left untouched. In 2007 we relocated the plot (Site #711) and counted a total of 450 stems, including adults and seedlings. The entire population was hand-pulled, but as there were likely some root fragments and seeds left in the soil, we recommend this plot we revisited

and controlled for at least another five years (Fig. 62, see Appendix C.III.a for recommended control methods).

2. *Crepis tectorum*: Infestations were recorded at Sites #706 (51-150 stems) and #709 (1-5 stems). We pulled about 50 percent of the population at the first site, and all individuals at the second site.
3. *Lappula squarrosa*: 6-25 stems counted at Site #712, all of which were pulled.
4. *Collomia linearis:* Sites #702 and #708, 50 percent of both of which we removed.

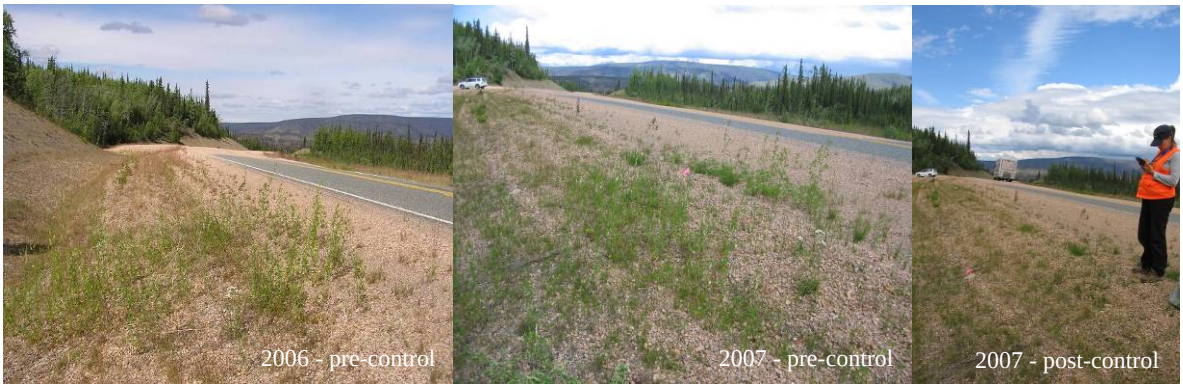


Figure 62. Most adult and some seedling *Melilotus alba* plants found in 2006 at Site #26 were pulled (left). That first year the population size was estimated at 700 stems. When we revisited the site in 2007 (Site #711) we counted a total of 450 stems, all of which we pulled (right). However, it is very likely that some root fragments and seeds remain in the soil, and that some new individuals will sprout or grow back in the coming years.

After mile marker ten (10) the occurrence of invasive species became increasingly restricted to areas of recent anthropogenic disturbance. *Bromus inermis* ssp. *inermis* was very common in the Chicken Burn area (Figs. 63, 64), and grew semi-continuously from mile marker 42 (Site #726), just south of the burn, to the town of Chicken, restricted to imported gravel along the roadsides. This species often formed pure stands, appeared to be restricted to the right-of-ways, and was most likely introduced in contaminated gravel.

Figure 63. *Bromus inermis* ssp. *inermis* population growing on imported fill just south of the Chicken Burn section of the highway.

Figure 64. Photo monitoring point at mile marker 65 (Site #729-2007, #23-2006), marking a *Bromus inermis* ssp. *inermis* infestation that extends almost continuously from this site to the town of Chicken.

Finally, in the town of Eagle, dense *Caragana arborescens* stands had been planted as hedges around a few yards, and a big patch of *Leucanthemum vulgare* was growing in the middle of a garden (waypoint 02, N 64.7873º, W 141.1989º, Figs. 65-66). While we were in town, we noticed that National Park Service – Alaska Regional Office biologists visited Eagle to give talks on invasive plant species for the local community. We strongly encourage this approach, but focusing on non-native plants that occur in/around Eagle (rather than top statewide invasives, which are not always found in this part of Interior Alaska), to raise awareness among locals about the non-native species that are found in their area, and the threats that these species pose to the health and function of their surrounding natural ecosystems.

Fig. 65. A dense stand of *Caragana arborescens* growing in a yard in the town of Eagle.

Fig. 66. *Caragana arborescens* in fruit marking the perimeter of the yard in the forefront, and a patch of *Leucanthemum vulgare* growing in the background (Eagle, AK).

Taylor Highway problematic areas

The largest numbers of non-native species were concentrated in and near the Alaska-Taylor Highway junction (Fig. 37). Non-native species recorded in the first three miles of the Taylor Highway in 2006 included: *Bromus inermis* ssp. *inermis*, *Chenopodium album*, *Crepis tectorum*, *Lappula squarrosa*, *Lepidium densiflorum*, *Medicago sativa* ssp. *falcata*, *Melilotus alba*, *Melilotus officinalis*, *Polygonum aviculare*, and *Trifolium hybridum*. In 2007 we recorded two more non-native species in this section of the highway: *Elymus repens* and *Collomia linearis* (see Table 27, above).

Other problematic areas were the Chicken Burn section of the highway (*Bromus inermis* ssp. *inermis* and *Trifolium hybridum*), the South Fork DOT station and vicinity (*Vicia cracca* infestations), and the town of Eagle (*Caragana arborescens* and *Leucanthemum vulgare*).

Priority infestations for control work

We provide lists of sites that we would select for control and eradication work for both the Tetlin Junction area and the rest of the Taylor Highway in Appendix .C.III.a. and Appendix C.III.b., respectively, and a map showing the distribution of these sites in Appendix C.IV. These lists include schematic information on the type of treatments that could be used to reduce or eliminate the selected infestations. However, for a more detailed description of the mechanical and chemical treatments that can be used for each priority species, please see the 'Control methods for 2006 and 2007 priority infestations' section of this report.

We strongly recommend that the first three to four miles north of Teltin Junction be monitored for new or spreading weed populations, and that those that have already been detected be controlled over the coming years, giving higher priority to those furthest away from the Junction itself, as the latter is likely to remain an invasive species hotspot because it intersects with the Alaska Highway, which is a major route for the introduction (by connecting Alaska with Canada and the Lower 48) and dispersal (high traffic volume) of invasive species.

In particular, we recommend that all populations of *Bromus inermis* ssp. *inermis*, *Melilotus alba* (Sites #25 and #26-2006, #28-2006), and *Crepis tectorum* (Sites #708 and #709) recorded after Tetlin Junction and before the Porcupine Burn be controlled and/or extirpated (Appendix C.III.b). Although *Lappula squarrosa* is not as highly invasive as the above three species, we suggest that Site #712-2007, where we found and pulled 6-25 stems in the second field season, be revisited to check for new individuals.

From the start of the Porcupine Burn of the highway to the town of Chicken, we recommend that control work focuses first on eliminating the small sized (6-200 stems) populations of *Bromus inermis* ssp. *inermis* (Sites #715, #723, #726-2007, and #35-2006). For larger populations (>250 stems) the goal might be to control rather than eliminate them, working from the outside in (Sites #13, #9, #23, #30-2006, and #729-2007) (see Appendix C.III.b for guidelines on how to control and reduce these infestations).

All infestations of *Crepis tectorum* recorded between mile marker 3.5 and the town of Chicken were small and discrete and could therefore be cost-effectively extirpated through repeated cycles of hand-pulling early in the season (Sites #714, #718, #720, #722, and #12-2006), without having to use chemicals. The same would apply to the two small *Tripleurospermum perforata* infestations growing on imported fill in the Porcupine Burn: digging these plants up at the beginning of each season, before they set seed, and revisiting the sites throughout the growing season and for a number of years to check for new individuals, will probably suffice to eradicate these two occurrences.

We suggest that the small to medium sized *Melilotus alba* population (c. 200 stems) that we pulled in 2007 at Site #713 be monitored over the coming five years, and any new also be monitored, and if over time some start to spread into native, undisturbed vegetation, then they should be evaluated for possible control work (Appendix C.III.b).

In addition, we advise that the *Vicia cracca* infestation located just south of the South Fork of the Jim River DOT station, at Site #730 (#1 and #2-2006) be targeted for extirpation (Appendix C.III.b.). Unfortunately, new infestations will probably continue to come up until the extensive weed population at the DOT station is reduced or eliminated (Site #3-2006).

In the northernmost section of the highway, we suggest that the *Bromus inermis* ssp. *inermis* population detected in 2006 at Site #1-2006, at the start of the 70-mile Trail (Appendix C.III.b.), be targeted for eradication. Finally, we encourage BLM and NPS to organize events in Eagle that will help educate residents on the possible risks linked with the introduction and spread of invasive species in their region of the state, which is still largely weed-free, and that might discourage people from planting horticultural plants like *Caragana arborescens* in their yards in the future.

Taylor Highway summary of findings

The Taylor Highway is not yet as affected by invasive plant species as the Steese and Dalton corridors are. There were fewer instances of aggressively invasive species, and none were observed moving off of high-use areas into undisturbed native or burned habitats. Furthermore, most of the priority species were concentrated in the first three miles of the highway, close to the junction of the Taylor and Alaska Highways. This area constitutes the main gateway for the future introduction and spread of invasive plants into the rest of the Taylor Highway.

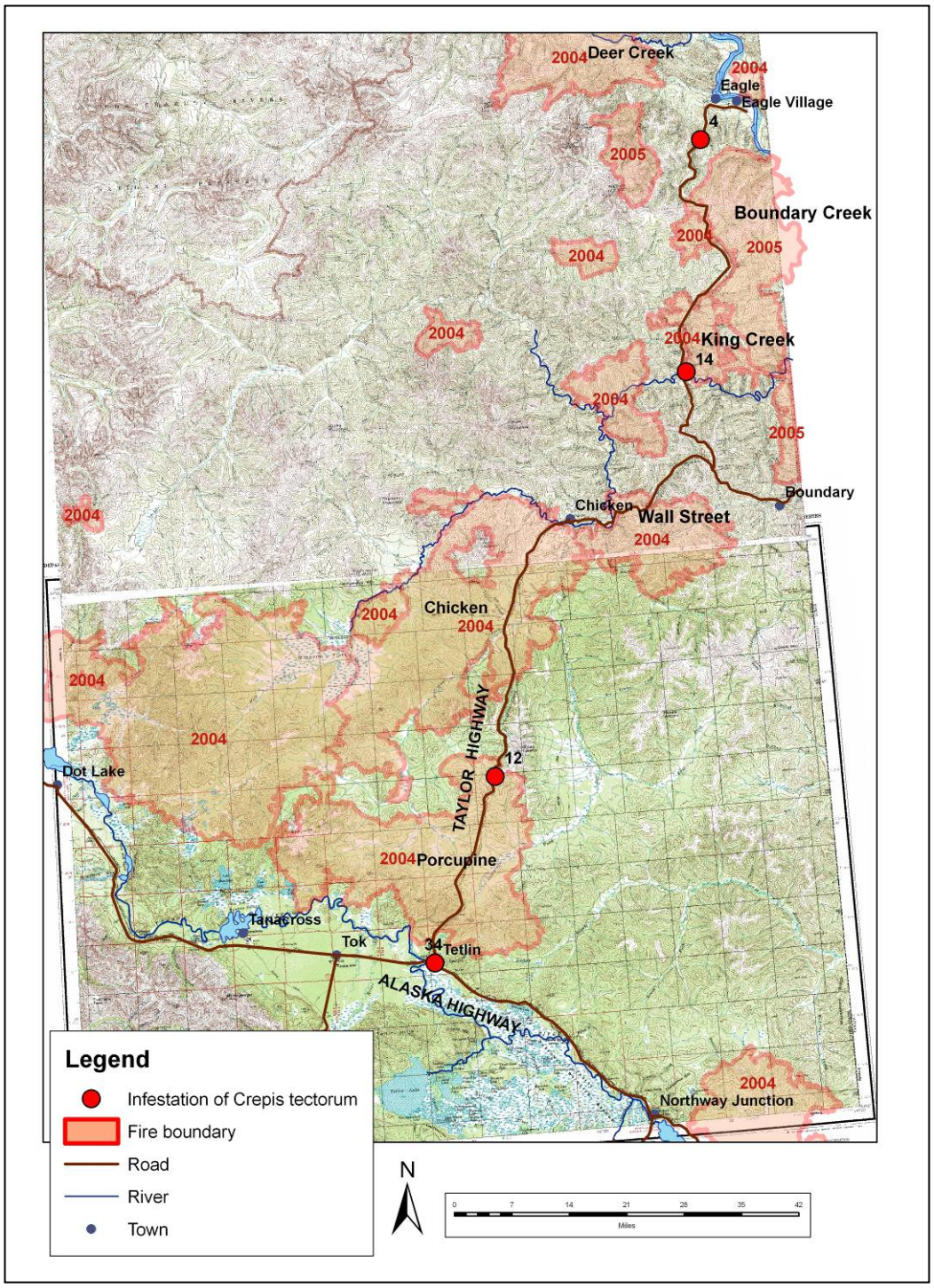
Given that the majority of priority species found along the Taylor Highway formed small and isolated infestations, they can still be targeted for complete eradication (see Appendix C.II for a list of infestations that were controlled in 2006, and Appendix C.III.b for a list of infestations requiring future control and monitoring work). The two exceptions to this would be *Bromus inermis* ssp. *inermis*, which was common throughout the highway, especially in and around Chicken, and the *Vicia cracca* infestation at the South Fork DOT station. In these two cases, we suggest that containing the infestations and avoiding their further expansion would be the most realistic short-term goals.

Lastly, as indicated in the previous section, we propose that activities like invasive plants workshops and weed pulls be held in the towns of Eagle and Chicken. These would help inform local residents on the threats associated with some of the most aggressively invasive species found in their area, and could help foster a greater sense of land stewardship among the people of these two communities.

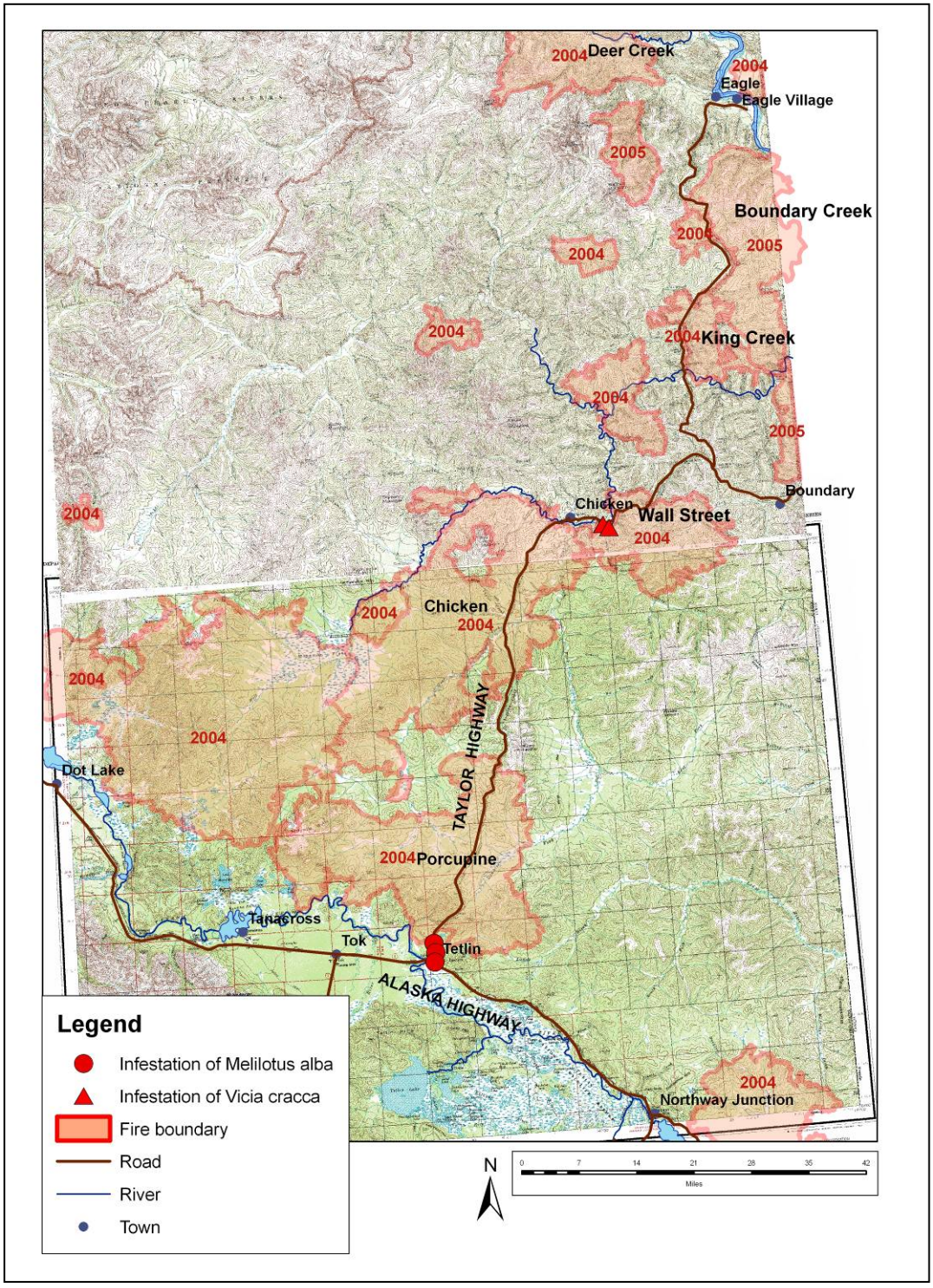
Taylor Highway Appendices – Set 'C'.

Appendix C.I. Infestation maps for key species recorded along the Taylor Highway.

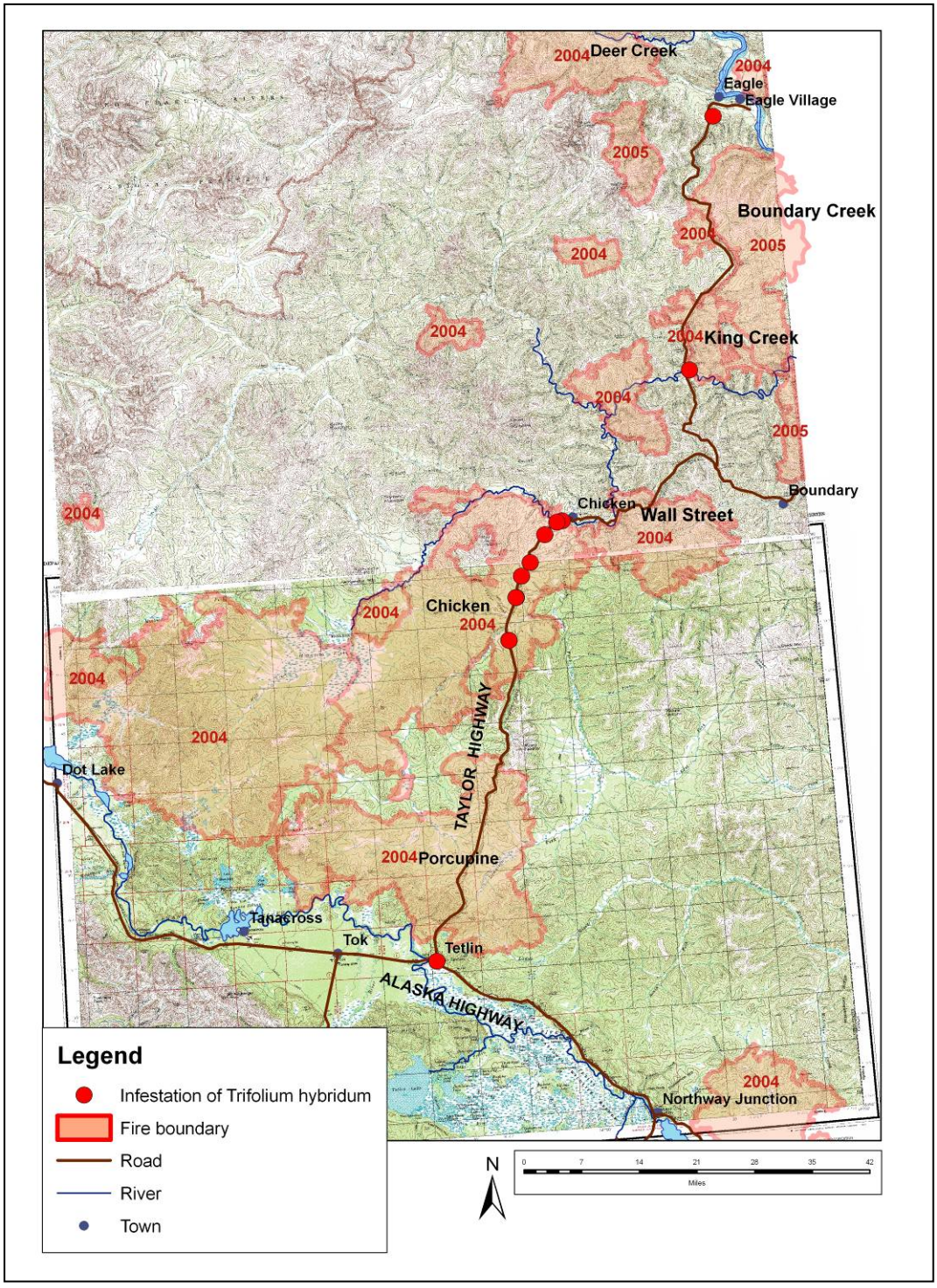
2006 infestations of narrowleaf hawksbeard (Crepis tectorum) *along the Taylor Highway.*



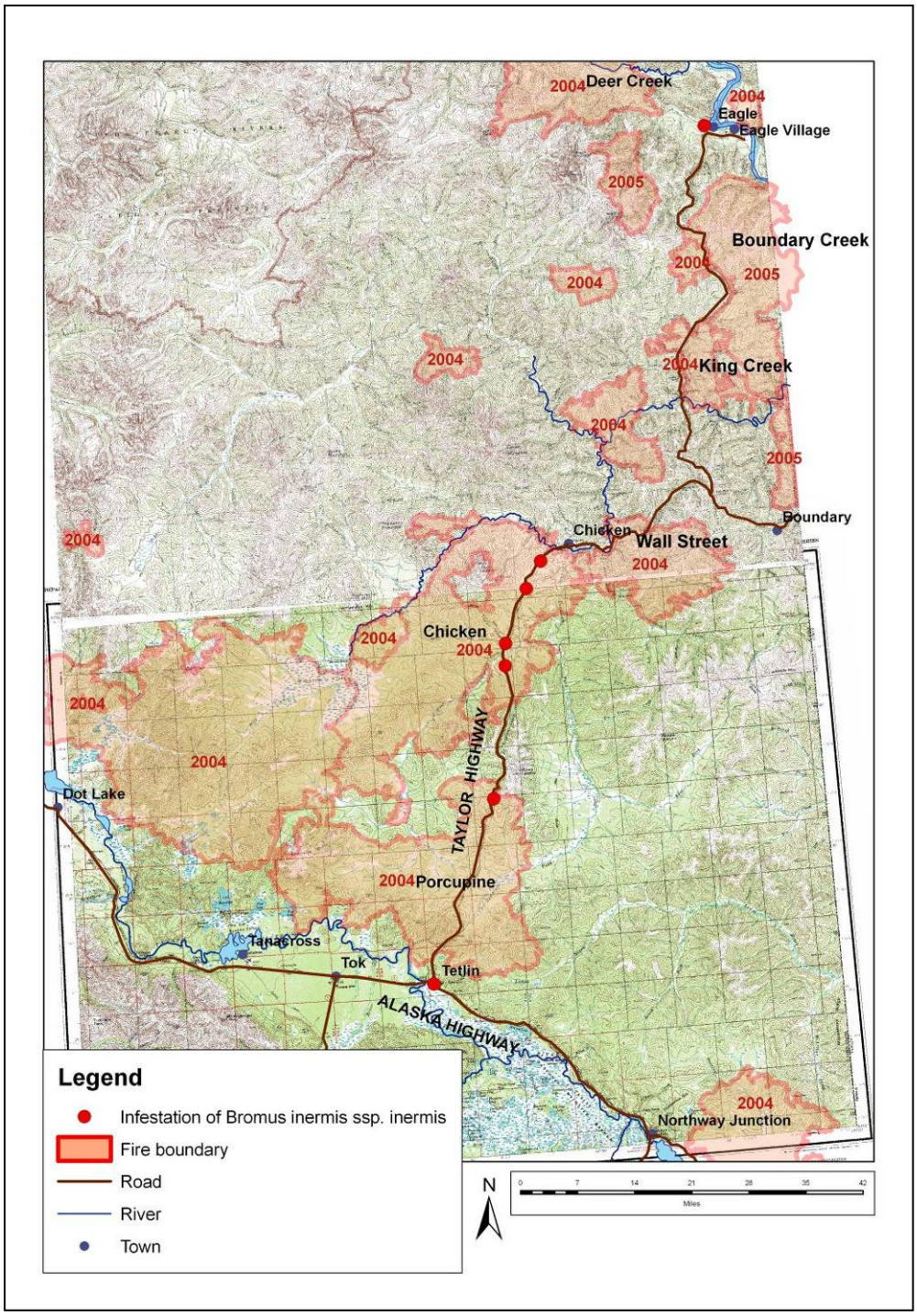
2006 infestations of white sweetclover (Melilotus alba) *and bird vetch* (Vicia cracca) *along the Taylor Highway.*



2006 infestations of alsike clover (Trifolium hybridum) *along the Taylor Highway.*



2006 i*nfestations of smooth brome* (Bromus inermis *ssp*. inermis) *along the Taylor Highway*.

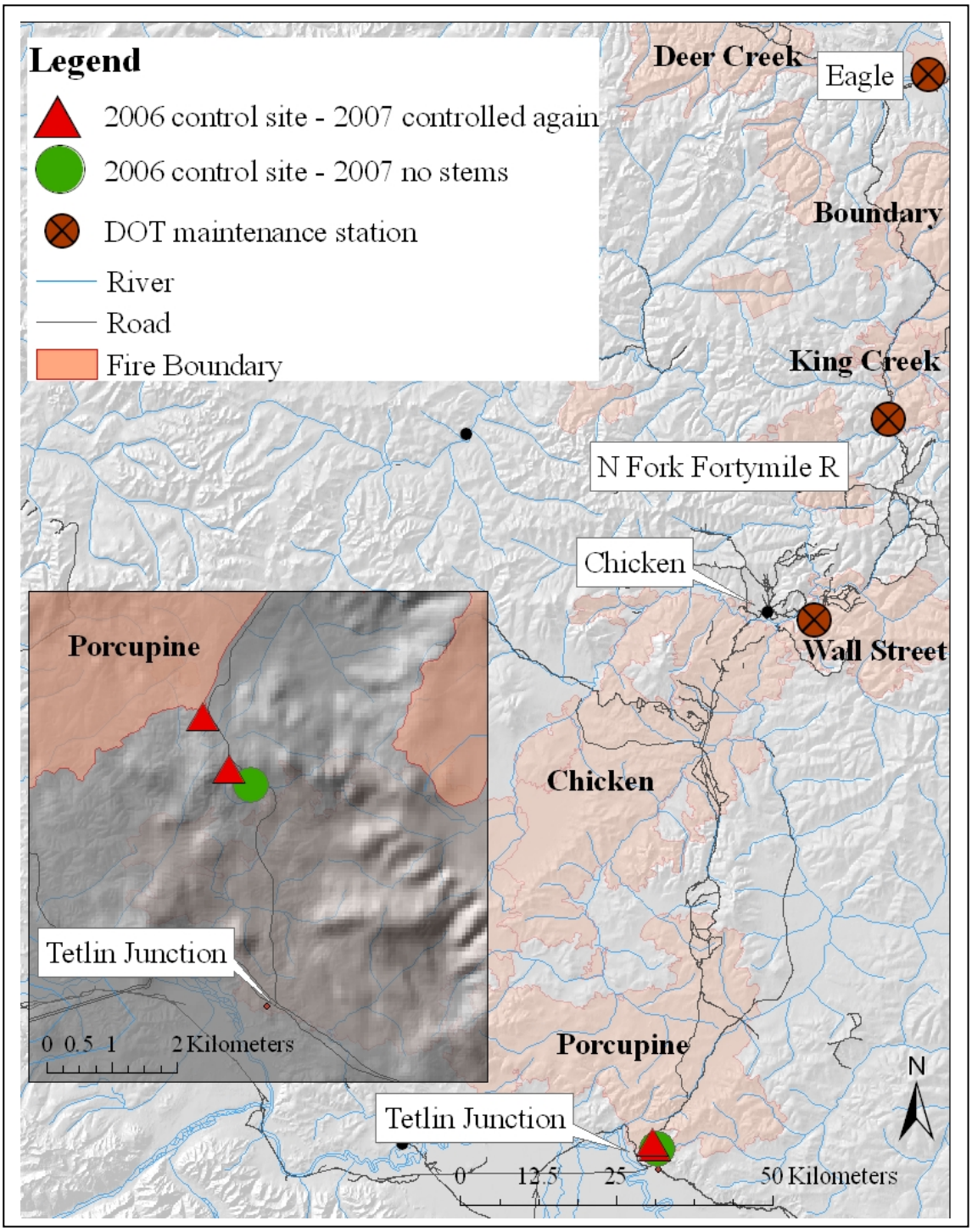


Appendix C.II.a. Records of 2006 control work on small infestations along the Taylor Highway.

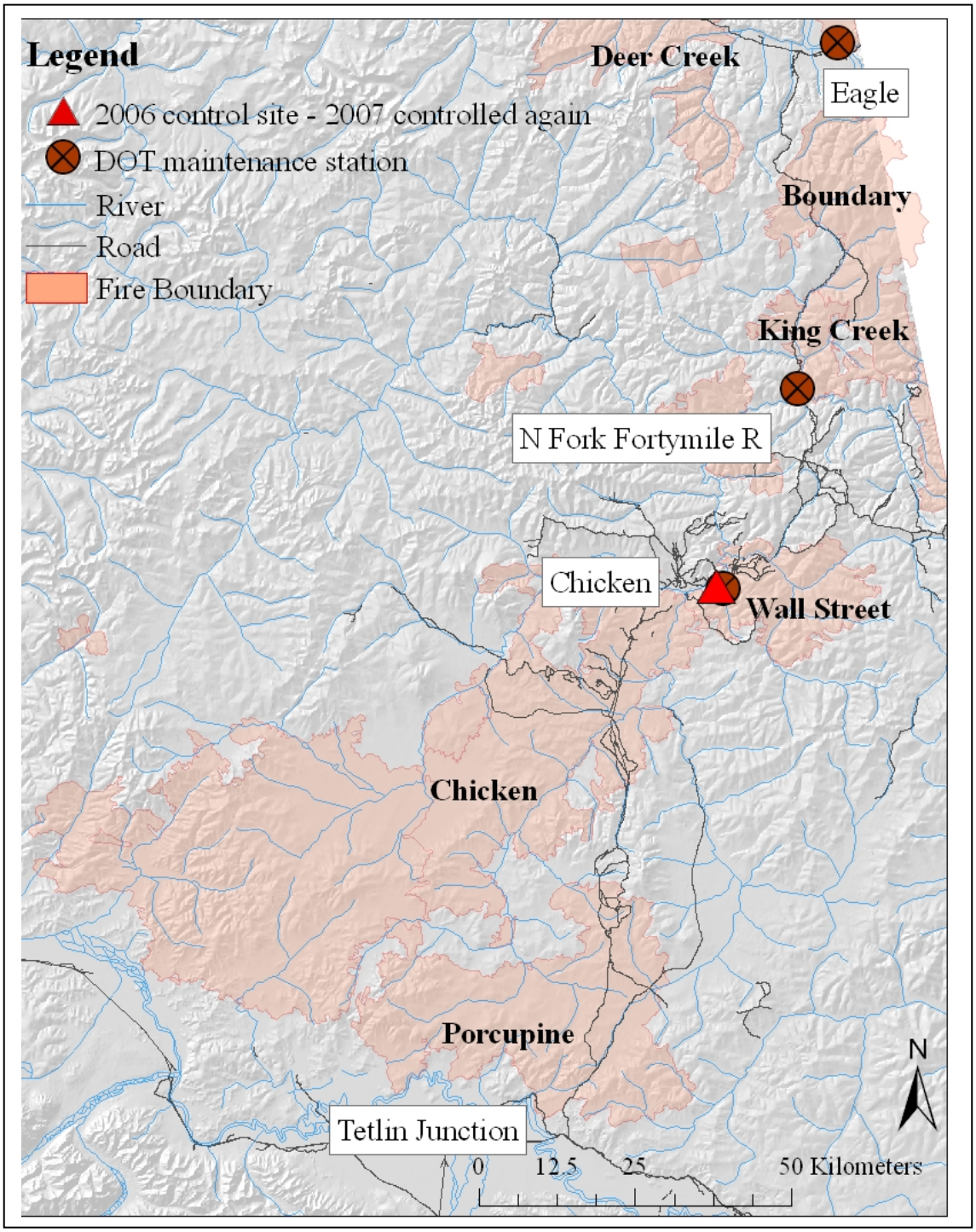
Species name	Site code	Latitude	Longitude	Location notes	Stem count	Aggressiveness	Phenology	Control action	Control hours
Vicia cracca	1	64.056813	-141.809232	6.5 miles N of Chicken burn	1000	Medium	Flowering	Manual pull	1
Polygonum aviculare	24	63.403102	-142.470528	trail; Porcupine burn	25	Very Low	Seedling	Manual pull	0.25
Melilotus alba	25	63.344945	-142.601168	mp 2.5	200	Very Low	Flowering	Manual pull	1
Melilotus alba	27	63.328065	-142.596629	mp 1.1, near parking sign	700	Very Low	Flowering	Manual pull	1

Appendix C.II.b. Maps of sites along the Taylor Highway targeted for control in 2007.

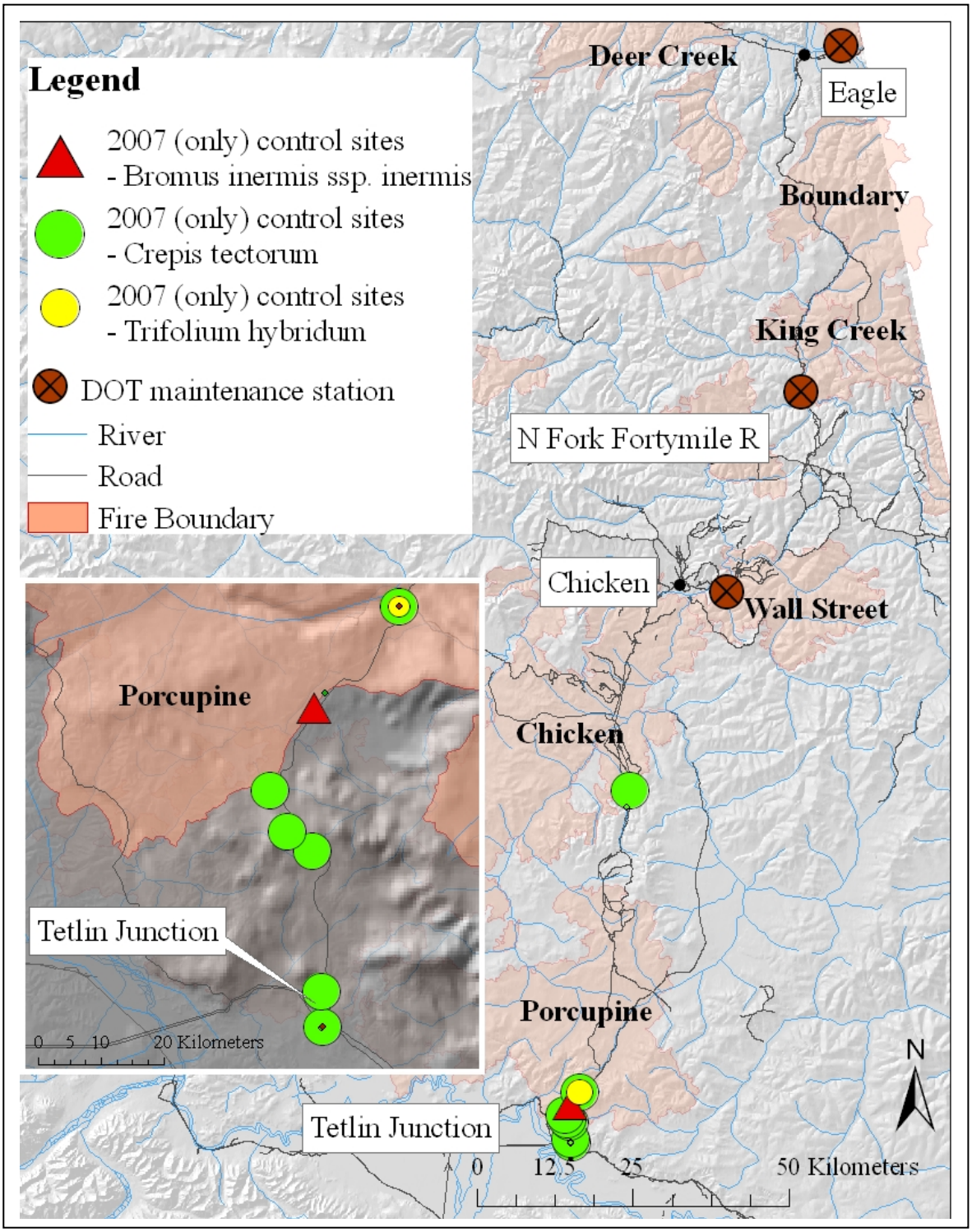
Melilotus alba *2006 control sites that were targeted for control in 2007.*



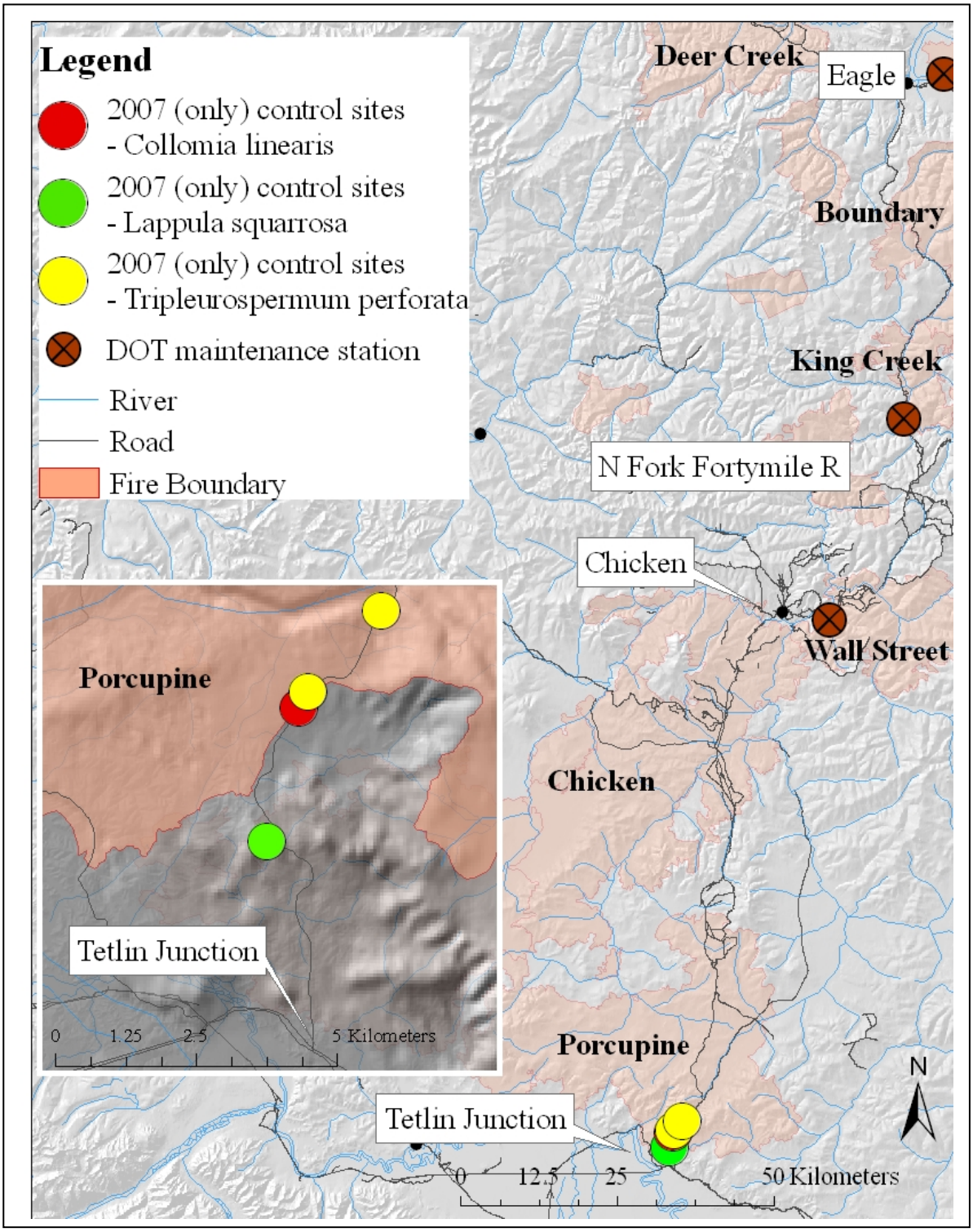
Vicia cracca *2006 control sites that were controlled in 2007.*



Bromus inermis *ssp*. inermis, Crepis tectorum, *and* Trifolium hybridum *new sites that were controlled in 2007 (none were controlled in 2006).*



Tripleurospermum perforata, Collomia linearis, *and* Lappula squarrosa *new sites that were controlled in 2007 (none were controlled in 2006).*



Appendix C.III.a. Problematic infestations at Tetlin Junction recommended for control and monitoring.

Species name	Site code 2007 (2006)	Lat	Lon	Est. stem count	Control actions '07/'06	Recommended methods of control
Melilotus alba	• 701 (29a)	63.3117	-142.6020	10000+ (3000)	None	– Modify road maintenance regime to kill seedlings and reduce spread (from late summer to spring) – Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) – Monitor annually
Crepis tectorum	• 702 (34a)	63.3117	-142.6020	51-150 (500)	Partially pulled (none in 06)	– Herbicide application – Monitor annually for 3+ years
Bromus inermis ssp. *inermis*	• 704 (31)	63.3117	-142.6024	51-150 (1000)	None	– Cut or mow (especially if it is a monoculture) before the inflorescences appear – Repeat monthly during the growing season for up to 4 years
Trifolium hybridum	• 705 (40)	63.3116	-142.6027	26-50 (100)	None	– Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Melilotus officinalis	• (35a)	63.3117	-142.6023	(55)	None	– Modify road maintenance regime to kill seedlings and reduce spread (from late summer to spring) – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall – Monitor annually
Medicago sativa ssp. *falcata*	• (30a)	63.3117	-142.6024	(500)	None	– Hand pulling (include below ground parts) before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs

Appendix C.III.b. Problematic infestations along the Taylor Highway recommended for control and monitoring.

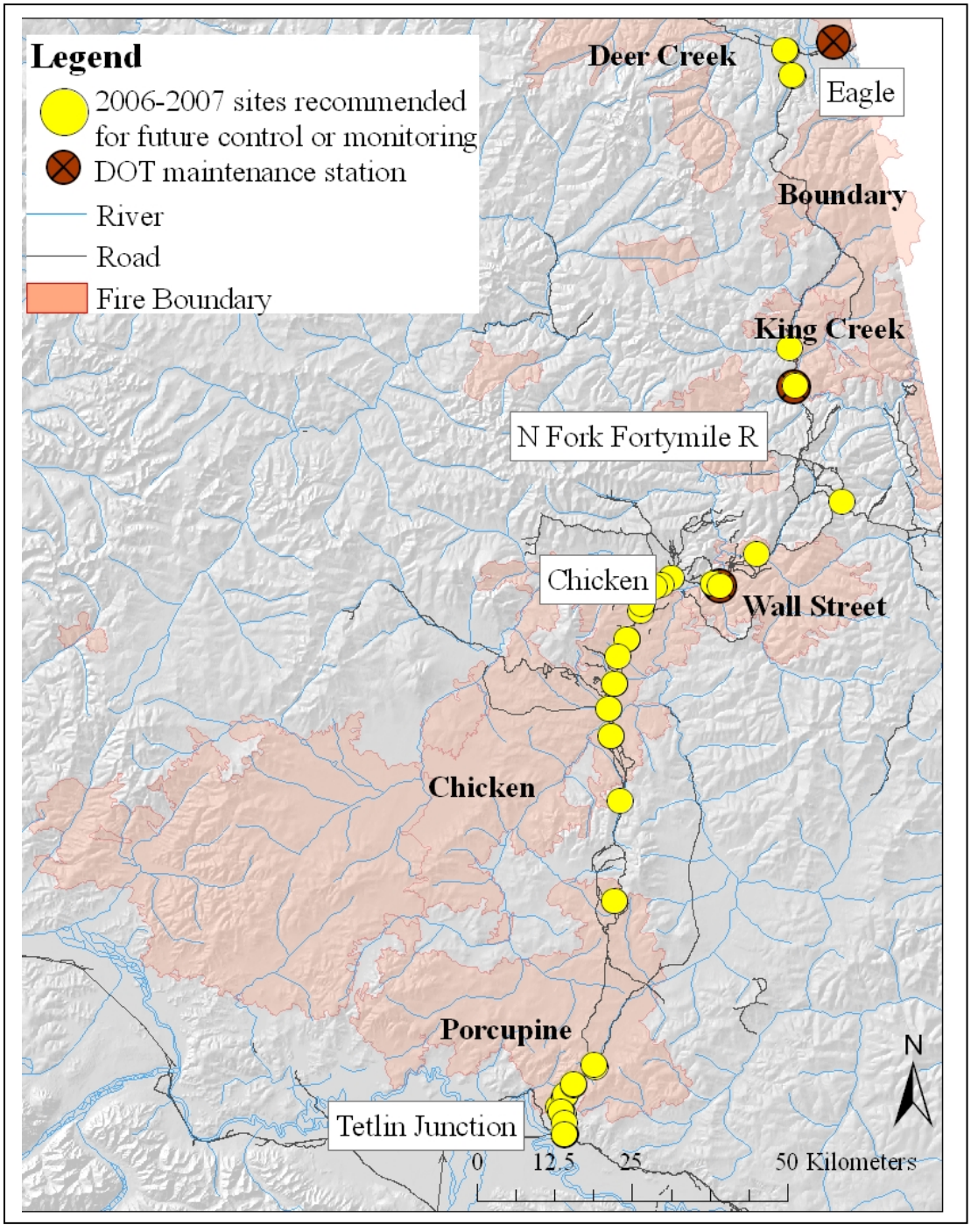
Species name	Site code 2007 (2006)	Burn	Location notes	Est. stem count	Recommended methods of control
Melilotus alba	– 711 (=25, 26)	Outside of burn, S Porcupine	– MM 3	– 450 (200-700), pulled '06, '07	– Modify road maintenance regime – Spray infestation + 50 ft radius – Monitor annually
Melilotus alba	– (28)	Outside of burn, S Porcupine	– MM 1.1	– (700)	– Modify road maintenance regime – Spray infestation + 50 ft radius – Monitor annually
Crepis tectorum	– 708	S of Porcupine Burn	– MM 2	– 51-150, pulled	– Herbicide application – Monitor annually for 3+ years
Crepis tectorum	– 709	S of Porcupine Burn	– W side of pullout, MM 3	– 1, pulled	– Hand pull, incl. underground parts, bag and remove plants – Monitor annually for 3yrs – if unsuccessful, start herbicide application
Lappula squarrosa	– 712	S of Porcupine Burn	– W side of pullout, MM 3	– 8, pulled	– Hand pulling, revisit annually for 2yrs
Melilotus alba	– 713	Porcupine	– MM 3.5, 500 ft S of Porcupine	– 200, pulled	– Modify road maintenance regime – Spray infestation + 50 ft radius – Monitor annually
Crepis tectorum	– 714 – 722 – (12)	Porcupine	– MM 3.6 – MM 6.5 – 2-3 km before end of Porcupine Burn, S Mt Fairplay	– 10, pulled – 10, pulled – (50)	– Hand pull, incl. underground parts, bag and remove plants – Monitor annually for 3yrs – if unsuccessful, start herbicide application
Crepis tectorum	– 718 – 720	Porcupine	– MM 4.2 – MM 6	– 250 – 250	– Herbicide application – Monitor annually for 3+ years
Bromus inermis ssp. *inermis*	– 715 – 723	Porcupine	– MM4 – MM 6.5	– 20, pulled – 26-50	– Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years
Bromus inermis ssp. *inermis*	– (13)	Porcupine	– 2-3 km before end of Porcupine Burn, S Mount Fairplay	– (1000)	– Cut or mow (monoculture) before the inflorescences appear – Repeat monthly during the growing season for up to 4 years

(list continues beow –next page)

Appendix C.III.b. Problematic infestations along the Taylor Highway recommended for control and monitoring (cntd.').

Species name	Site code 2007 (2006)	Burn	Location notes	Est. stem count	Recommended methods of control
Bromus inermis ssp. *inermis*	– 726	Outside of burn	– MM 42, just south of Chicken Burn	– 151-500	– Cut or mow (monoculture) before the inflorescences appear – Repeat monthly during the growing season for up to 4 years
Bromus inermis ssp. *inermis*	– (9) – (23) – 729 b)	Chicken Burn	– S West Fork xssing – S Mosquito Fork xssing – MM 65	– (5000) – (5000) – 10000 (3000)	– Cut or mow (monoculture) before the inflorescences appear – Repeat monthly during the growing season for up to 4 years
Bromus inermis ssp. *inermis*	– (35b)	Chicken Burn	– Taylor Creek crossing	– (6-25)	– Hand weed and cut before the inflorescences appear – Repeat monthly during the growing season for up to 4 years
Trifolium hybridum	– (15), (22) – (24), (29b), (32), (33), (34b) – (6), (7)	Chicken	– 2, 3 km S Chicken town – N Taylor Cr xssing – 2-3 km S West Fork xssing	– Mostly b/w 250-1000	– Hand pulling (include below ground parts) +/- mowing to ground level before seed set – Optional: seed with native grasses – Monitor site and surrounding area for 4-5 yrs
Vicia cracca	– 730 (1-2)	Wall Street	– 6.5mi N Chicken	– 300 (1000, pulled '06, '07)	– Hand pull or mow before flowering – Revisit and re-treat 1x every 6 wks until the winter – Monitor and re-treat for 5 years – After 5 years, apply herbicide on remaining plants
Vicia cracca	– (3, DOT S. Fork Station)	Wall Street	– South Fork DOT station	– (5000)	– As above (assess applying Clopyralid before 5yrs?)
Trifolium hybridum	– (13)	King Creek	– King Cr Burn: O'Brien station, N of Fortymile R and S of Buck Creek crossings	– 300	– Same as previous *T. hybridum*
Trifolium hybridum	– (1)	N Boundary Burn	– 4 km S Eagle, Bluff Creek xssing (unburned)	– 5000	– Same as previous *T. hybridum*
Bromus inermis ssp. *inermis*	– (1)	Outskirts of Deer Creek	– Near 70 Mile trailhead	– (100)	– Hand weed and cut before the inflorescence appears – Repeat monthly during the growing season for up to 4 years

Appendix C.IV. Map of problematic infestations along the Taylor Highway recommended for control and monitoring.



CONTROL METHODS FOR 2006 AND 2007 PRIORITY INFESTATIONS

In this section we outline the mechanical and chemical methods that could be used on the non-native plant populations selected for control work along the Steese, Dalton, and Taylor Highways (see Appendix A.III, Appendix B.IV, and Appendix C.III, for their respective lists of priority infestations). Most of the recommendations made in this work are based on the management practices that Dr. Seefeldt (Agricultural Research Station, US Department of Agriculture, Fairbanks, AK) has been developing for the BLM-Alaska based on Dalton Highway infestations, as well as on species descriptions provided by AKNHP botanists.

Trifolium pratense (red clover, 53 points†) and *Trifolium repens* (white clover, 59 points†)

† Invasiveness rank (out of 100 points)

White clover reproduces by seeds and creeping stems (rhizomes) that root at the nodes. Once white clover becomes established on bare ground, it can expand into naturally disturbed areas. It is known to invade canopy gaps in native vegetation, as well as to colonize river gravel bars (Coladonato 1993). Red clover, on the other hand, reproduces mainly by seed (Densmore *et al*. 2001), and often forms very dense stands, thus delaying colonization by native plants.

Like alsike clover, red and white clovers increase soil nitrogen levels by fixing atmospheric nitrogen (USDA-NRCS 2008), and by altering edaphic conditions these species may have the ability to delay the establishment of native species (Rutledge and McLendon 1996). However, as noted in the previous section (*T. hybridum*), clovers are especially sensitive to low pH soils because the formation of nitrogen-fixing nodules is negatively affected by the mineral deficiencies associated with acid soils. This could partially explain why the alsike, red, and white clover infestations recorded were restricted to areas of human disturbance.

To prevent white and red clover from spreading into native vegetation, it is recommended that infestations be controlled by digging all individuals out, including underground parts to avoid resprouting, and that they subsequently be monitored for new individuals coming up from the seed bank. In the case of white clovers, it is especially critical that the extirpated plant fragments be bagged and removed from the site, as stem fragments can produce new, viable individuals (Seefeldt, pers. comm).

Trifolium repens *Trifolium pratense*	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Hand pulling (include below ground parts) before seed set	
Large infestation	• Monitor site and surrounding area for 4-5 yrs	

Trifolium hybridum (alsike clover, 57 points[†])

[†] Invasiveness rank (out of 100 points)

This species, as many members of the Fabaceae plant family (pea family), has nitrogen-fixing abilities (USDA-NRCS 2008) and can therefore alter ecosystem processes by affecting the chemical composition of the soils it colonizes. It is also an effective colonizer of unvegetated ground, and appears to delay natural succession by native plants (Rutledge and McLendon 1996). However, nodulation (the symbiotic relationship whereby legumes can fix atmospheric nitrogen) is frequently negatively affected by one or more of the deficiencies or toxicities commonly associated with acid soils (Cregan 1981). The low pH in much of Interior Alaska's soils, and the high sensitivity of clovers (*Trifolium* spp.) to acid soil conditions (Cregan 1981) may help explain why all infestations recorded were limited to areas of human disturbance, and were not observed spreading into (burned or unburned) native vegetation.

Alsike clover infestations found along the highways can be eliminated by digging the plants up in their entirety (including below ground parts) or by cutting at ground level to prevent regeneration from adventitious buds (Seefeldt, pers. comm.). Because this species primarily reproduces by seed, all control work must be done at the beginning of the flowering period, to prevent seed set. In addition, we recommend that the area within 25 yards of each infestation, as well as any anthropogenically disturbed sites within 200 yards of these, be scouted for new plants (Seefeldt, pers. comm.). Because *T. hybridum* seed can remain viable in the soil for up to 20 years, it is advised that this combination of digging/cutting and monitoring work be repeated for at least four to five years, to detect and extirpate any new individuals arising from the seed bank. Furthermore, the eradication of populations growing on predominantly unvegetated soils could be accelerated if the area is seeded with native grasses (e.g. *Poa alpina*, *Festuca rubra*), which will provide adequate competition to reduce the density of this species (Seefeldt, pers. comm.).

There are herbicides that kill alsike clover, but given the risk of off-target impacts, mechanical methods should still be considered (Seefeldt, pers. comm.), especially given that most of the infestations found were small and were restricted to anthropogenically altered sites.

Trifolium bybridum	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Hand pulling (include below ground parts) +/- mowing to ground level before seed set • Optional: seed with native grasses • Monitor site and surrounding area for 4-5 yrs	
Large infestation		

Medicago sativa ssp. *sativa* (alfalfa, 59 points†) and *Medicago sativa* ssp. *falcata* (yellow alfalfa, 64 points†)

† Invasiveness rank (out of 100 points)

Only two infestations of alfalfa (*Medicago* spp.) were recorded in our surveys, one along the Dalton Highway (*M. sativa* ssp. *sativa*, which was pulled) and the other at Tetlin Junction (*M. sativa* ssp. *falcata*, or yellow alfalfa). Both were only found in 2006 and were restricted to anthropogenically altered areas.

We recommend that these infestation sites be revisited to check for new seedlings that may come up from the seedbank. Any new individuals found must be pulled in their entirety, including underground parts to avoid resprouting (Rosenstock and Stevens 1989). Furthermore, the area within 25 yards and any anthropogenically disturbed sites within 200 yards of the controlled infestation should be scouted for new plants (Seefeldt, pers. comm.). Control and revisit work should be repeated for four to five years, to extirpate any additional individuals arising from the seedbank. Like with alsike clover, seeding with native grasses (e.g. *Poa alpina*, *Festuca rubra*) can provide adequate competition to reduce the density of this species (Seefeldt, pers. comm.).

Medicago sativa	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Hand pulling (include below ground parts) before seed set • Optional: seed with native grasses • Monitor site and surrounding area for 4-5 yrs	
Large infestation		

Lotus corniculatus (birdsfoot trefoil, unranked†)

† Invasiveness rank (out of 100 points)

Birdsfoot trefoil is a nitrogen-fixing plant and can therefore alter the chemistry of the soils it colonizes. Furthermore, it forms dense mats which choke out and shade native vegetation (MNDNR 2006). This species can reproduce by seeds, but primarily spreads vegetatively by horizontal above- (stolons) and below- (rhizomes) ground modified stems (OSU undated). Because the flowering period is indefinite, seeds are produced throughout the growing season, and ungerminated seeds can build up seed banks (Jones and Turkington 1986).

The two small, isolated occurrences of this species were recorded along the Dalton Highway in 2006 and dug up, and were not found again in 2007. However, given the potential invasiveness of this species, we do recommend that these sites be revisited and scouted for new plants. If new plants are found they must be dug out making sure to remove all root fragments (USDA Forest Service 2006), and before the first flowers of the season set seed to prevent the establishment of a seed bank.

Larger infestations (of which there were none in 2006 and 2007) could be eliminated by mowing them more than once every three weeks down to a height of less than two inches (OSU undated)

for several years. However, given that this species is able to resprout from root crowns, and that mowing is non-selective and would also delay the establishment of native plants (USDA Forest Service 2006), the best option is to eradicate this species manually while infestations are still small.

Lotus corniculatus	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Digging (remove all root fragments) before seed set • Monitor site and surrounding area for 4-5 yrs	
Large infestation	• Digging (remove all root fragments) before seed set • Less recommended: mowing 1x every 3 weeks • Monitor site and surrounding area for 4-5 yrs.	• Digging (remove all root fragments) before seed set • Monitor site and surrounding area for 4-5 yrs

Caragana arborescens (siberian peashrub, 66 points†)

† Invasiveness rank (out of 100 points)

The single Siberian peashrub infestation found was located in the Boundary Burn section of the Steese Highway, at the Boston Creek crossing on. We strongly advise that this infestation be prioritized for complete extirpation, which can be done using a combination of mechanical (hand pulling, cutting, digging) and chemical (stamp injection) methods (prior to using any herbicides, one will have to make sure that there will be no side-effects of applying chemicals at this site which is adjacent to a burn and a stream). Post-control monitoring work is also recommended, to eliminate any new individuals that may come up from the seedbank.

Caragana arborescens	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Hand pulling, cutting, digging • Stamp injection • Monitor for 2-3 years	• Hand pulling, cutting, digging • Monitor for 2-3 years
Large infestation		

Vicia cracca (bird vetch, 73 points†)

† Invasiveness rank (out of 100 points)

Bird vetch was locally abundant in all three areas inventoried. It is an ecologically damaging species that can form dense mats covering cover short (<3ft tall) native vegetation, can climb over shrubs such as alder and willow, and can alter native ecosystem processes because it is a nitrogen-fixer and can therefore change the natural nutrient status. Complete eradication of all populations recorded, as well as additional monitoring work, is a priority.

It is recommended that sites be visited before flower initiation (early to late July), and that plants be mown near the base of their stem or hand-pulled (Seefeldt, pers. comm.). When time and size permits, removal work must include above and below ground parts, since *V. cracca* is able to reproduce vegetatively from rhizome fragments, as well as from seed. The site should be

revisited every six weeks and the treatment repeated until the end of the growing season. The area within at least a 50 yard radius and any disturbed areas within a half mile should be scouted for new plants (Seefeldt, pers. comm.). Bird vetch seeds can remain viable in a seed bank for up to five years, so any infestations should be treated and monitored for at least that amount of time, to guarantee the depletion of the seed bank (Seefeldt, pers. comm.; Nolen 2002).

If plants still remain after the five years of mechanical control, they can be sprayed while they are actively growing and before flowering with one pint/acre of clopyralid (Transline) with an approved adjuvant (0.25% v/v) to kill the adult plants. This would probably not be appropriate in the case of the large *V. cracca* infestations (500-1000+ stems) reported from a section of the Steese Highway that runs through a residential subdivision (just east of the junction of the Steese and Elliott Highways), as we expect that herbicide application might be met with opposition from local residents (Seefeldt, pers. comm.).

Vicia cracca	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small or large infestation	• Hand pull above and below- ground parts or mow before flowering (before July) • Revisit and re-treat 1x every 6 wks until the winter • Monitor and re-treat for 5 years • Monitor for 5 years. If plants persist, apply herbicide (clopyralid) on remaining plants before flowering	• Hand pull above and below- ground parts or mow before flowering (before July) • Revisit and re-treat 1x every 6 wks until the winter • Monitor for 5 years. If plants persist, cost/benefit analysis of applying herbicide (clopyralid) on remaining plants before flowering

Melilotus alba (white sweetclover, 80 points†)

† Invasiveness rank (out of 100 points)

This species is notoriously difficult to eradicate because its seeds remain viable in the soil for many years and it is able to quickly spread along roadsides, river banks, and fire-disturbed areas. Infestations along the Taylor, Dalton, and Steese Highways were strongly correlated with the presence of gravel materials used in road and trail construction.

Because of the potential for these plant species to spread (seeds), fix nitrogen (altering natural nutrient status), form dense stands, and invade and dominate alluvium along glacial streams and rivers, large populations should be contained or reduced, while populations within 500 feet of a creek or river crossing (to prevent spread downstream) and isolated, small populations should be one of the highest priorities for management (Seefeldt, pers. comm.).

All sites must be treated well before flowering occurs (mid-June on), and in all cases long-term control programs will be needed to guarantee the seed bank is depleted (Densmore *et al*. 2001), given that white sweetclover seeds can remain viable in the soil for up to 81 years (Rutledge and McLendon 1996).

Small populations growing on altered ground, infestations growing within 500 feet of a waterway, and plants that have invaded native vegetation are best extirpated mechanically by hand-pulling, roots and root crown included. Control work must always be carried out as soon as

possible, when the soil is still moist but before flowering (June), to prevent the formation of a large seed bank (Seefeldt, pers. comm.). Pulling is also recommended in the fall (Cole 1991). Nonteheless, hand pulling can disturb the soil, which may result in another flush of plants, so after pulling an infestation the site should be revisited every other week (Seefeldt, pers. comm.). (Cut white sweetclover plants regenerate and flower quickly, so cutting is not recommended).

A more effective method for reducing or eliminating medium to large populations growing on human-altered soils that are not close to a waterway is using herbicides, which provide almost complete control of sweetclover growing plants. If herbicides are applied, the area within 50 feet of the patch along the right-of-way should also be treated to prevent any seedling success of dispersed seeds. The following guidelines for herbicide application were developed by Seefeldt (pers. comm.) and could be applied to the infestations selected for chemical control work along each of the three (Dalton, Steese, Taylor) highways:

- Wetland areas: spot spray with Imzapyr (Habitat) and Roundup (Rodeo)
- Rights-of-way: Chlorsulfuron (Telar), Imazapyr (Arsenal), 2,4-D, Dicamba (Banvel), Metsufuron-methy (Escort), and Sulfometuron-methy (Oust)
- Alaska-specific: plants have been found to be very sensitive to Telar (2 oz per acre with 0.25% non-ionic surfactant). It controls seedlings for several years because it is actively taken up by the roots, as do several of the above herbicides (Habitat, Arsenal, and Oust).

For those populations that have moved off the human footprint into naturally disturbed sites but that are still close to the anthropogenically altered area, and are not close to a waterway, spraying with a soil active herbicide such as Telar to kill seedlings is suggested (Seefeldt, pers. comm.). An area 20 feet around the infestation should also be sprayed to control isolated individuals or any newly germinating seeds. Controled sites should be revisited every year before plants go to seed and retreated if seedlings are found. (Seefeldt, pers. comm.).

Grading of the roadway after the plants set seed will spread seeds up and down the highway and should be prevented, while grading in the spring or early summer before seed set is an excellent method for killing seedlings and second year plants (Seefeldt, pers. comm.).

Melilotus alba	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Modify road maintenance regime to kill seedlings and reduce spread (from late summer to spring) • Small populations and infestations near waterways: – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall. • Medium to large populations that are not close to waterways: – Spray infestation + 50 ft radius with selected chemical (different herbicides for different types of habitat/location) • Monitor annually	• Infestations growing near waterways or >150ft from human altered sites: – Hand pull, roots included, when soil is moist and before flowering (June). Pulls can also be done in the Fall. • Infestations growing on naturally disturbed sites, <150ft from human altered sites, and not near waterways: – Spray infestation + 20 ft radius with Telar • Monitor annually
Large infestation		

Elymus sibiricus (siberian wildrye, unranked†) and *Polygonum convolvulus* (black bindweed, 50 points†)

† Invasiveness rank (out of 100 points)

Only two populations of *Elymus sibiricus* and one of *Polygonum convolvulus* were recorded. All three were found in the Boundary Fire section of the Steese highway, and the black bindweed site was weed-free by 2007. The Siberian wildrye populations need to be controlled to prevent their further expansion and, if possible, reduce their current size. Given that *E. sibiricus* plants were growing interspersed among other native and non-native grasses and forbs, the most effective way of controlling this still uncommon weed on the Steese Highway would be by hand pulling individual plants before seed set. Similarly, any new *Polygonum convolvulus* plants that may be found can be eliminated by hand pulling.

Elymus sibiricus *Polygonum convolvulus*	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small or large infestation	• Repeated hand pulls	

Bromus inermis ssp. *inermis* (smooth brome, 62 points†)

† Invasiveness rank (out of 100 points)

This is one of the more problematic and widespread invasive species in Alaska. It has been widely used for roadside revegetation projects, and now persists in Interior Alaska. Therefore, we recommend that control work focus primarily on containing the current large roadside infestations, and preventing them from expanding any further. The goal would be to prevent plants from going to seed by mowing, cutting, and hand weeding the plants before the inflorescence can be felt at the top of the elongating stem. A controlled site should be revisited and retreated (if needed) monthly throughout the growing season (Seefeldt, pers. comm.). Because smooth brome often forms pure stands, repeated cuttings are possibly the most effective means of control. In particular, mowing an infested patch monthly during the growing season over a four-year period can greatly reduce smooth brome persistence (Marten and Hovin 1980). The very small, isolated infestations can be targeted for eradication using similar methods: repeated cycles of hand pulling and mowing before seed-set.

Bromus inermis ssp. *inermis*	**Human-disturbed, naturally-disturbed, and unaltered sites**
Small infestation	• Hand weed and cut before the inflorescence appears • Repeat monthly during the growing season for up to 4 years
Large infestation	• Cut or mow (especially if it is a monoculture) before the inflorescences appear • Repeat monthly during the growing season for up to 4 years

Hieracium umbellatum (narrowleaf hawkweed, 51 points†)

† Invasiveness rank (out of 100 points)

Narrowleaf hawkweed is a highly aggressive species whose seeds can disperse over long distances, that has a competitive ability against many native species, and has been observed growing in burned soils in black spruce forests up to 100 feet off the Dalton Highway. Because of the ease of applying chemical control methods that kill this species, narrowleaf hawkweed infestations can be efficiently contained, reduced, and monitored.

There are various reasons why the use of chemical treatments on well established populations is warranted. First, herbicides can successfully extirpate these infestations without disturbing the soil in which they grow, thus minimizing the chances of post-disturbance, vigorous plant reestablishment. Also, because the current populations are generally small, they can be eliminated with equally small amounts of chemicals, thus minimizing the negative side-effects of the chemicals on the surrounding, native communities. Previous work shows that using selective herbicides, followed by re-seeding with perennial grass and nitrogen fertilizer application, will hamper hawkweed reestablishment for three years (Prather and Robins 2005). Additionally, spot treatment is recommended to minimize effect of the chemicals used on the surrounding native plants and wildlife. The following mechanical and chemical control management practices were developed by Seefeldt (pers. comm.):

- Control work should be carried out when rosettes are starting to grow but before flowering (mid-late June)
- Manual pulling is not recommended as this is a rosette forming plant and is therefore hard to dig out. In addition, hand pulling disturbes the soil, and often results in a flush of seedlings (however, this could be somewhat minimized by seeding the soil with native grasses).
- Herbicide recommendations: spray the infested area as well as the area within 50 feet from it with Telar (chlorsulfuron) at 2 oz per acre with a 0.25% of a non-ionic surfactant, using a boom sprayer. The herbicide should control seedlings for several years.
- Revisit controlled sites in the early summer, annually

Hieracium umbellatum	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Spray infestation + 50 ft radius with Telar seedlings (control before onset of flowering) • Optional: seed with native grasses • Monitor annually	• In highly sensitive areas (>150ft into native vegetation): – Hand pull, including basal rosette and roots (control before onset of flowering) – Optional: seed with native grasses – Revisit frequently within the same growing season to pull new seedlings – Monitor annually • In less sensitive areas (<150ft from human altered area) – Spot spray infestation with Telar (control before onset of flowering) – Optional: seed with native grasses – Monitor annually
Large infestation		

Crepis tectorum (narrowleaf hawksbeard, 54 points†)

† Invasiveness rank (out of 100 points)

Narrowleaf hawksbeard infestations were found along all three highways. However, in the Dalton Highway some of the infestations had started to move off the right-of-ways and imported fill sites into the adjacent burned forest (e.g. Site #54-2006, on the Jim River DOT Station road).

There were a number of cases in which small (1-25) *Crepis tectorum* infested sites that had been controlled (hand-pulled) in 2006 appeared to be 'clean' in 2007. Despite this, Seefeldt (pers. comm.) suggests that *C. tectorum* be controlled using chemical methods, as hand pulling can be inefficient because seedlings are hard to find and do not pull up easily.

Crepis tectorum infestations growing on non-human altered soils (e.g. the Jim River DOT Station infestation) as well as all small (1-50 stems) infestations can be removed by repeated cycles of hand-pulling. As plants can resprout easily from the stump, the goal is to pull up as much of the plant as possible, and to do so before seed set. All plants must be bagged and removed from the site.

If the infestations persist, or for larger populations growing on altered ground, herbicide application (glyphosate) is recommended. The infestation area, plus a 50 foot buffer around it on altered ground, should be treated with metsulfuron-methyl (Ally) at 1 oz per acre. Glyphosate will kill most of the broadleaf vegetation that it is sprayed on, but grasses will not be harmed. Revisiting the sites annually will be necessary to confirm that no new plants have established. The area within at least a 200 yard radius and any disturbed areas within a half mile should be scouted for new plants (Seefeldt, pers. comm.).

Crepis tectorum	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small infestation	• Hand pull, including underground parts if possible • Bag and remove plants • Monitor for 1 year – if unsuccessful, start herbicide application	• Hand pull, including underground parts if possible • Bag and remove plants • Monitor for 3+ years
Large infestation	• Herbicide application • Monitor annually for 3+ years	

Leucanthemum vulgare (oxeye daisy, 61 points†)

† Invasiveness rank (out of 100 points)

Small to medium sized infestations of *Leucanthemum vulgare* were found in the last two to three miles south of Coldfoot on the Dalton Highway. A relatively large population of approximately 1000 to 10000 individuals was observed on the Steese Highway right-of-way 5.5 miles northeast of Fox, next to a driveway and gate to private property, and was probably first planted here by the private land owner. A third, medium sized oxeye daisy population was recorded during the 2007 Taylor Highway survey, with 500+ stems growing in the front yard of the BLM bunkhouse in Central.

Due to the potential to spread (wind dispersed seeds), displace native perennial species, out compete many native plants, and develop seed banks with seeds remaining viable for up to 60 years (Chippindale and Milton 1934), we suggest that these infestations be targeted for control work.

Infestations growing in anthropogenically disturbed sites can be eradicated, or at least controlled, through a combination of mechanical and chemical control methods. The infestations should be visited once a month starting one month after snow melts, and flowering heads must be bagged or cut to reduce seed production (Seefeldt, pers. comm.). Flowering plants and rosettes should then carefully dug up to collect as much of the roots as possible. Each controlled site should be revisited once a month, and the area within at least a 200 yard radius and any disturbed areas within a mile should be scouted for new plants. Additionally, any of the following herbicides can be used to spot spray plants, following label directions (Seefeldt, pers. comm.): Clopyralid (Transline); Imazapyr (Arsenal); metsulfuron methyl (Escort); or triclopyr (Redeem). These herbicides are toxic to many native forbs and shrubs. In our ecosystem, metsulfuron methyl and Imazapyr should kill oxeye daisy adult plants and any seedlings the following year. With all four herbicides, care should be taken to prevent drift. Herbicides should not be applied to infestations growing close to riparian areas or to natural or manmade bodies of water. The (mechanically and/or chemically) treated sites should be revisited each year for at least 5 years, and controlled again if necessary (Seefeldt, pers. comm.).

If any oxeye daisy populations are detected growing in burned or unburned soils that have not been used or modified by human activities, only the mechanical control and eradication methods outlined above should be used. In addition, native plant species at the site can be encouraged to grow (fertilization), and perennial native grasses (e.g. *Festuca rubra*, *Poa alpina)* can be seeded to suppress the growth of this non-native species.

Leucanthemum vulgare	**Human-disturbed site (e.g. land fill, roadside revegetation)**	**Naturally-disturbed (e.g. burn) and unaltered sites**
Small or large infestation	• Cut or bag flowering heads one month after snow melt • Dig out plants and rosettes • Spot-spray w/ herbicide 'diflufenzopyr' • Revisit and treat monthly during the growing season • Monitor for up to 5 years	• Cut or bag flowering heads one month after snow melt • Dig out plants and rosettes • Revisit and treat monthly during the growing season • Optional: fertilize spots where native plants are growing in the area or seed with native grasses (outcompete invasive seedlings) • Optional: if population persists, apply herbicide 'diflufenzopyr' • Monitor for up to 5 years

SUMMARY OF FINDINGS AND CONCLUSIONS FOR THE 2006 – 2007 SURVEYS

Native communities are susceptible to invasion by non-native plants that grow along roadsides and right-of-ways. This susceptibility is ostensibly greater in areas where the soil and vegetation have been disturbed. In 2006, three AKNHP crews carried out non-native plant surveys along the Steese, Dalton, and Taylor Highways, using AKEPIC and BLM-BAER based sampling methodologies, and paying special attention to roadside BLM lands that were affected by the 2004 and 2005 fires. In 2007, we revisited all 2006 photo-monitoring plots and most of the sites at which control work had been conducted the previous year.

In all, over 500 acres of Interior Alaska roadside areas were surveyed, and more than 800 infestations were recorded, most of which (75 percent) were captured with the BLM-BAER plots.

An analysis of the total number of priority, non-native species infestations recorded shows that the number of infestations observed in the Dalton Highway was more than four times that of the Steese Highway, and more than seven times that of the Taylor Highway (Fig. 67). In contrast, both the diversity (which we define here as the total number of priority, non-native species per highway) and the average size of infestation remained comparable from one highway to the next (Fig. 68, Table 28).

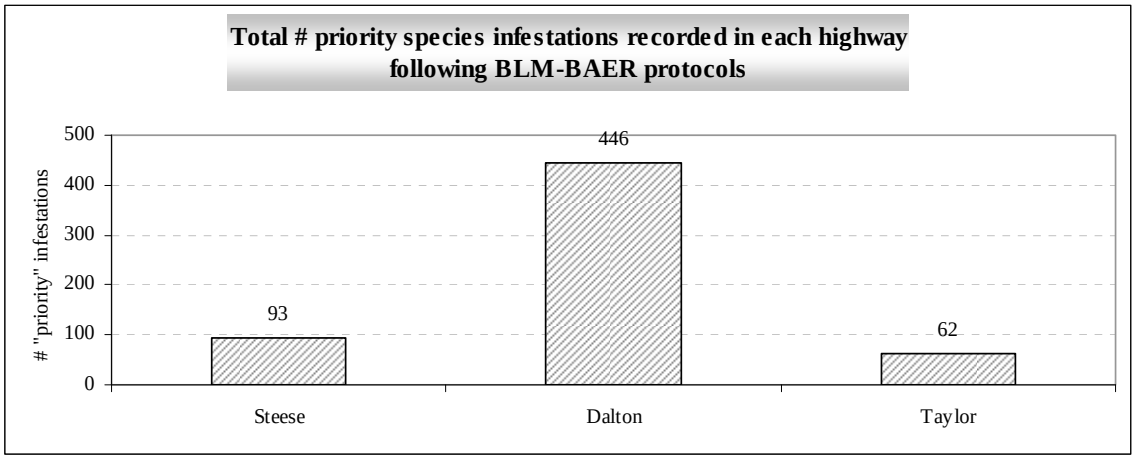


Figure 67. Total number of priority non-native species populations recorded in 2006 on the Steese, Dalton, and Taylor Highways (i.e. priority species "richness").

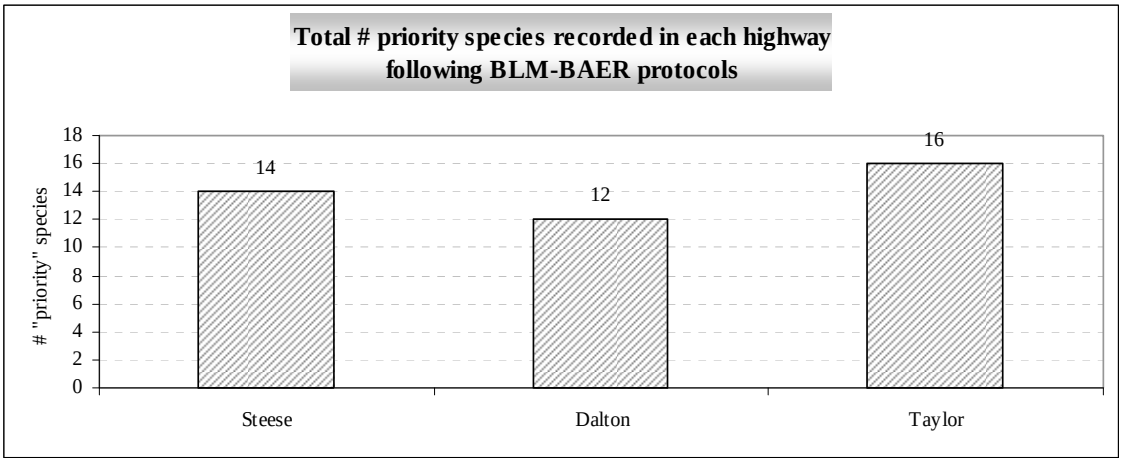


Figure 68. Total number of priority non-native species recorded in 2006 on the Steese, Dalton, and Taylor Highways (i.e. priority species "diversity").

Table 28. Total number of acres infested with priority non-native species and average size of a priority species infestation for the Steese, Dalton, and Taylor Highways (based on 2006 data).

Highway name	Total acreage infested	Average size of infestation
Steese	66	0.5
Dalton	166	0.4
Taylor	21	0.4

Thus, of the three highways surveyed, the Dalton was the most heavily infested, with populations of the highly aggressive *Melilotus alba*, *Bromus inermis* ssp. *inermis*, *Crepis tectorum*, and *Trifolium hybridum* occurring throughout the highway. Given the widespread distribution of these four species, complete eradication will be very resource-demanding and will require an integrated pest-management strategy. We recommend that initial efforts focus on containing the current infestations by (a) extirpating any small patches or isolated occurrences of these plants, and (b) controlling and/or reducing larger populations, and that they be implemented within the next one to two growing seasons.

In contrast, most of the infestations recorded along the Steese Highway were smaller and more localized, and could therefore still be targeted for extirpation (however, control work on the few, broadly distributed species, such as *Bromus inermis* ssp. *inermis*, should probably aim to contain, rather than eliminate, the current populations to prevent their further expansion).

There were even fewer instances of aggressively invasive species along the Taylor Highway, and none had yet dispersed from high-use areas into native burned or unburned vegetation.

In addition, the findings from the 2006 and 2007 surveys allowed us to identify the following invasive species 'hotspots' for each road system:

1. Dalton Highway: the area in and north of the Ray River-Fort Hamlin Hills Burns, extending into the Dall City Fire section, had very high densities of priority species, with over 40 populations per 10 km^2 cell (aggressively invasive *Melilotus alba* and *Vicia cracca* were especially abundant throughout this section of the road). A major invasive plant species 'hotspot' was the stretch of highway affected by the North Bonanza Burn, where we recorded populations of *Crepis tectorum*, *Hieracium umbellatum*, and *Melilotus alba* that had moved off the roadside areas into the burns, and where there were various *M. alba* infestations growing within 100 meters of a creek or stream.

2. Steese Highway: The stretch of highway between Fox and Sourdough Camp, along Davidson Ditch, had moderate to high priority species densities, with 10-20 populations per 10 km^2 cell. Many of the species found throughout the Davidson Ditch, such as *Crepis tectorum*, *Elymus sibiricus*, *Phleum pratense*, *Polygonum convolvulus*, and *Viola tricolor*, were not seen anywhere else on the Steese Highway. The Boston Creek crossing, in particular, was infested with a number of aggressively invasive species, including a very large population of *Caragana arborescens* that had started to move off human-altered soils into native vegetation. High densities, with 20-40 priority infestations per 10 km^2 cell, were also recorded at the junction of the Elliot and Steese Highways.

3. Taylor Highway: The majority of priority species infestations were concentrated in the first three miles of the highway from Tetlin Junction. Other problematic areas include the Chicken Burn section of the highway (with numerous *Bromus inermis* ssp. *inermis* and *Trifolium hybridum* populations), the South Fork DOT station and vicinity (infested with *Vicia cracca*, among other species), and the town of Eagle (where *Caragana arborescens* and *Leucanthemum vulgare* had been planted in people's yards).

We propose that there is a strong correlation between infestations and the following activities and places: (1) road building and roadside revegetation activities, especially with the importation of contaminated gravel and other construction materials (for instance, in the Steese Highway the presence of *Melilotus alba* tended to coincide with areas where new gravel had been laid); (2) parking lots, campgrounds, and other anthropogenically disturbed sites (these sites were often infested by *Bromus inermis* ssp. *inermis*); (3) DOT stations (e.g. the DOT station in the Taylor Highway is a major source of *Vicia cracca* propagules). Similar patterns of *Melilotus alba* invasions radiating from contaminated gravel fill were observed on other BLM-managed lands in Alaska (Carlson *et al.* 2006). Consequently, we advise that these activities and sites be inventoried and monitored to guarantee the early detection and extirpation of new non-native establishment.

In general, most non-native populations were restricted to anthropogenically-disturbed, high-use areas. The one instance of a non-native species extending into completely undisturbed, native vegetation was that of *Caragana arborescens* (Siberian peashrub), recorded at the Boston Creek crossing in the Steese Highway. Originally planted in interior Alaska because it is winter hardy, this species is now one of the most aggressive invaders of mixed forests in the Matanuska-Susitna area (Lapina and Carlson 2005), and is known to invade and modify the structure and community composition of European boreal forests. We therefore recommend that the Siberian peashrub infestation be prioritized for control and eradication work.

Equally critical was the detection of three populations, one of *Crepis tectorum*, one of *Hieracium umbellatum*, and one of *Melilotus alba*, spreading from the roadside into fire-disturbed sites in the North Bonanza Burn section of the Dalton Highway. In fact, the Dalton Highway was the only road system of the three surveyed in which aggressive species had clearly moved off anthropogenically altered soils into adjacent burned, black spruce forest soils (similar studies have also documented the spread of *Vicia cracca* (Seefeldt, pers. comm.) and other *Melilotus alba* populations (Villano, pers. comm.) into burned areas off the Dalton). In addition to site-specific factors that might be facilitating the colonization of these burned sites, there may be regional differences between the Dalton Highway and the Steese and Taylor roads that make the Dalton burned soils that are adjacent to the road more prone to invasion. In particular, it has been proposed that the Dalton's greater levels of traffic, road maintenance and human disturbance, overall higher propagule pressure, and lower levels of vascular and non-vasuclar native plant cover could all be contributing to making this highway's burned areas more predisposed to invasion by non-native plants than those near the Steese and Taylor roads (Villano 2008). Another possible determinant of invasibility is that the mineral soil pH of the Dalton is higher than that of the Steese and Taylor roads (Villano 2008). Higher pH values can facilitate the establishment of at least some invasive plants, including nitrogen-fixing legumes such as *Melilotus alba* and *Vicia cracca*, given that nodulation is negatively affected by low soil pH (Cregan 1981). Lastly, other abiotic factors (e.g. temperature, precipitation, snow quantity and timing, carbon dioxide levels, among others) may also be contributing to the greater susceptibility of the Dalton Highway to colonization by non-native plants, but they have yet to be researched.

The overall trend whereby most non-native plant populations were restricted to high human-use areas must be interpreted with caution. With time, it is likely that we will see a greater number of invasive species populations spreading into native ecosystems due to the sheer increase in propagule pressure and in the volume of traffic along these roads. Burned black spruce forests may become especially susceptible to invasion, as experimental studies indicate that soil conditions in this ecosystem become more favorable to invasive plant establishment over time, especially in sites of low to medium burn severity (Villano 2008). Global climate changes, which among other things could lead to an increase in the frequency and intensity of fire regimes in boreal forests, are also expected to favor the advance and establishment of non-native species, to the detriment of native plant communities. In order to curb this trend, we not only recommend that control and management actions be taken on the current infestations, but strongly urge that the agencies involved in the maintenance of these road systems (primarily DOT) develop measures to guarantee that the road construction and revegetation work they carry out minimizes, rather than facilitates, the spread of non-natives around the state. These actions could mimic those taken by BLM firefighting crews, and could involve using uncontaminated gravel, cleaning machinery before transporting it to a new place, and most important of all, trying to keep their stations as invasive plant-free as possible.

The specific sites that we selected for possible future control or monitoring work are described or listed in the previous sections of this report. However, in general, we consider that priority should be given to:

1. Infestations that are already spreading into burned or unburned native communities (*Caragana arborescens* in the Steese Highway, and C*repis tectorum, Hieracium umbellatum,* and *Melilotus alba* in the Dalton Highway).

2. Large populations of highly aggressive species, especially if they are close to a naturally disturbed site.

3. *Melilotus alba* populations found within 500 feet of a waterway (river or creek crossing), given that this species is able to spread downstream along river bars into natural habitats, and has the potential to alter soil nutrient status and river sedimentation rates (Shephard, pers. comm.).

It is important that the removal or containment of infestations also be accompanied by adaptive monitoring work, especially for those species with seeds that can remain viable for many years (e.g., *Melilotus alba*) and for species that can resprout vegetatively (e.g., *Trifolium repens*).

Furthermore, it must be noted that the 2005 burned sections were only surveyed systematically when they were still in their first growing season, and it is likely that a number of new non-native species will become established during the next growing seasons. We therefore strongly recommend that these areas be inventoried again, in their entirety, during the 2008 field season.

Finally, in addition to the future monitoring and control work recommended here, we suggest that activities promoting public awareness on invasive plants and the danger they pose to Alaska's native ecosystems be organized and encouraged. These could include, for instance, public presentations on weeds, the distribution of invasive plant field identification guides, and invasive plant-pulling events.

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APPENDICES – SET 'D'

Appendix D.I.a. BLM-AKNHP list of priority invasive species.

Scientific name	Common Name	Invasiveness Score (22 May 2006)
Polygonum cuspidatum Sieb. & Zucc.	Japanese knotweed	87
Centaurea biebersteinii DC	Spotted knapweed	86
Euphorbia esula L.	Leafy spurge	84
Lythrum salicaria L. & *L. virgatum* L.	Purple loosestrife, European wand loosestrife	84
Phalaris arundinacea L.	Reed canary grass	83
Impatiens glandulifera Royle	Ornamental jewelweed	82
† *Heracleum mantegazzianum* Sommier & Levier	Giant hogweed	81
Melilotus alba Medikus	White sweetclover	80
* *Nymphaea odorata* ssp. *odorata* Ait.	American white waterlily	80
Hieracium aurantiacum L. & *H. caespitosum* Dumort.	Orange hawkweed, meadow hawkweed	79
Bromus tectorum L.	Cheatgrass	78
* *Rubus discolor* Weihe & Nees	Himalayan blackberry	77
Cirsium arvense (L.) Scop.	Canada thistle	76
Prunus padus L.	European bird cherry	74
Vicia cracca L.	Bird vetch	73
Lepidium latifolium	Broad-leaved pepperweed	72
* *Alliaria petiolata* (Bieb.) Cavara & Grande	Garlic mustard	70
* *Cytisus scoparius* (L.) Link	Scotchbroom	69
Linaria vulgaris Miller	Butter and eggs	69
Caragana arborescens Lam.	Siberian peashrub	66
Lonicera tatarica L.	Bush honeysuckle	66
Melilotus officinalis (L.) Lam	Yellow sweetclover	65
Campanula rapunculoides L.	Creeping bellflower	64
Medicago sativa ssp. falcata (L.) Arcang.	Yellow alfalfa	64
Senecio jacobaea L.	Ragwort	63
Bromus inermis ssp. *inermis* Leyss.	Smooth brome	62
Carduus nutans, C. acanthoides, C. pycnocephalus, C. tenuiflorus	Nodding/spiny/Italian/winged plumeless thistle	61
Cirsium vulgare (Savi) Ten.	Bull thistle	61
Leucanthemum vulgare Lam.	Oxeye daisy	61
Sonchus arvensis ssp. *uliginosus* (Bieb.) Nyman	Field sowthistle	61
Hordeum murinum ssp. leporinum	Lepor barley	60

Appendix D.I.a. (contd'.). BLM-AKNHP list of priority invasive species.

Scientific name	**Common Name**	**Invasiveness Score** (22 May 2006)
Elymus repens (L.) Gould	Quackgrass	59
Medicago sativa ssp. *sativa* L.	Alfalfa	59
Sorbus aucuparia L.	European mountain ash	59
Trifolium repens L.	White clover	59
Convolvulus arvensis L.	Creeping jenny or morning glory	58
Gypsophila paniculata L.	Baby's breath	57
Tanacetum vulgare L.	Common tansy	57
Trifolium hybridum L.	Alsike clover	57
Phleum pratense L.	Timothy grass	56
Linaria dalmatica L.	Dalmatian toadlfax	55
Crepis tectorum L.	Narrowleaf hawksbeard	54
* *Ranunculus repens* L. & R. acris L.	Creeping buttercup, meadow buttercup	54
Dactylis glomerata L.	Orchard grass	53
Trifolium pratense L.	Red clover	53
Vicia villosa Roth	Hairy vetch	53
*† *Zostera japonica* Aschers. & Graebn.	Dwarf eelgrass	53
* *Hypericum perforatum* L.	St John's wort	52
Verbascum thapsus L.	Big taper	52
Digitalis purpurea L.	Purple foxglove	51
Polygonum convolvulus L.	Black bindweed	51
Rumex acetosella L.	Common sheep sorrel	51
Hieracium umbellatum L.	Narrowleaf hawkweed	51
Tragopogon dubius L.	Common salsify	50

Plant species rejected from consideration due to abundance and broad distribution	**Common Name**	**Invasiveness Score** (22 May 2006)
Hordeum jubatum L.	Foxtail barley	63
† *Stellaria media* (L.) Vill.	Chickweed	57
Taraxacum officinale ssp. *officinale* G.H. Weber ex Wiggers	Common dandelion	58
Poa pratensis ssp. *pratensis* L., *P. pratensis* ssp. *irrigata* (Lindm.) Lindb. F.	Kentucky and spreading bluegrass	52

* Species unlikely to be encountered in Interior Alaska

† Invasiveness rank largely based on potential impacts to maritime breeding bird colonies

Appendix D.I.b. List of priority invasive species recorded.

Family	Scientific Name	Common Name	Invasiveness Rank	Highway
Fabaceae	*Melilotus alba*	white sweetclover	80	Dalton, Steese, Taylor
Fabaceae	*Vicia cracca*	bird vetch	73	Dalton, Steese, Taylor
Fabaceae	*Caragana arborescens*	Siberian peashrub	66	Steese, (Eagle)
Fabaceae	*Melilotus officinalis*	yellow sweetclover	65	Dalton, Steese, Taylor
Fabaceae	*Medicago sativa* ssp. *falcata*	yellow alfalfa	64	Taylor
Poaceae	*Hordeum jubatum*	foxtail barley	63	Dalton, Steese, Taylor
Poaceae	*Bromus inermis* ssp. *inermis*	smooth brome	62	Dalton, Steese, Taylor
Asteraceae	*Leucanthemum vulgare*	oxeye daisy	61	Dalton, Steese, (Eagle)
Fabaceae	*Medicago sativa* ssp. *sativa*	alfalfa	59	Dalton
Fabaceae	*Trifolium repens*	white clover	59	Dalton, Steese
Poaceae	*Elymus repens*	quackgrass	59	Steese
Asteraceae	*Taraxacum officinale* ssp. *officinale*	common dandelion	58	Dalton, Steese, Taylor
Fabaceae	*Trifolium hybridum*	alsike clover	57	Dalton, Steese, Taylor
Poaceae	*Phleum pratense*	timothy	56	Steese
Asteraceae	*Crepis tectorum*	narrowleaf hawksbeard	54	Dalton, Steese, Taylor
Fabaceae	*Trifolium pratense*	red clover	53	Dalton, Steese
Poaceae	*Poa pratensis* ssp. *irrigata*	spreading bluegrass	52	Dalton, Steese
Poaceae	*Poa pratensis* ssp. *pratensis*	Kentucky bluegrass	52	Dalton, Steese, Taylor
Poaceae	*Poa trivialis*	rough bluegrass	52	Steese
Polygonaceae	*Rumex acetosella*	sheep sorrel	51	Taylor
Asteraceae	*Hieracium umbellatum*	narrowleaf hawkweed	51	Dalton, Steese
Polygonaceae	*Polygonum convolvulus*	black bindweed	50	Steese
Polygonaceae	*Rumex longifolius*	dooryard dock	48	Steese
Polygonaceae	*Rumex crispus*	curly dock	48	Taylor
Poaceae	*Poa annua*	annual bluegrass	46	Steese
Poaceae	*Alopecurus pratensis*	meadow-foxtail	not ranked	Dalton
Fabaceae	*Lotus corniculatus*	birdsfoot trefoil	not ranked	Dalton
Caryophyllaceae	*Agrostemma githago*	corncockle	not ranked	Taylor
Polemoniaceae	*Collomia linearis*	narrowleaf mountaintrumpet	not ranked	Taylor
Linaceae	*Linum perenne*	blue flax	not ranked	Taylor
Papaveraceae	*Papaver nudicaule*	Icelandic poppy	not ranked	Taylor
Rosaceae	*Potentilla norvegica*	Norwegian cinquefoil	not ranked	Taylor

Appendix D.II. Blank copy of the datasheet used for the AKEPIC-based inventories.

AKEPIC Mapping Project Inventory Field Data Sheet: Year 2006

*****Survey Date ____/____/____ *Observers:
mm / dd /yyyy

Observers Affiliation: BLM NPS UAF USFS USGS CES **AKNHP** ARS PSWCD other

Site information

Site Code: _____ Visit Type: Recon Is this a Revisit: No
Area Surveyed _____acres
Note: 1/10 acre=37ft radius, ½ acre=83 ft radius, 1acre=118ft radius
Site Vegetation Community Description: (Vierek Code) _____
Disturbance Type: _____
Estimated Age of Disturbance: _____years

B. Location information

*****Latitude: _____ *Longitude:_____ Elevation: _____m
****Note: Datum is NAD 27 and Coordinate Format is decimal degrees (60.123456°)****
*****Collection Method (circle and complete details)
GPS precision _____ft (0-5, 0-30, 0-100, 0-1000, 1000+)
15 min Topographic Map source _____scale _____date_____
quad name _____quad number_____
Notes (location):

C. Survey information

	Exotic Plant Species Code	*Infested Area (acres)	*Canopy Cover (%)	Stem Count	Collection Location	Control Action	Aggressiveness
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							