Exotic Plant Management in Glacier Bay National Park and Preserve
Gustavus, Alaska
Summer 2006 Field Season Report

Figure 1 – The bigleaf lupine (*Lupinus polyphyllus*) grows throughout Glacier Bay National Preserve at Dry Bay in open and shaded habitats.

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TABLE OF CONTENTS

Abstract

For the third consecutive year, intensive inventory work was performed at Glacier Bay National Park and Preserve (GLBA) to document the distribution and abundance of non-native plant species. Within the 444 ha (1096 acres) of the park and adjoining lands that were inventoried in 2006, six new species were documented. In addition, two other species that were collected in the past were relocated for the first time in the past three years, bringing the total count of non-native plant species observed to 48. The most widespread species is common dandelion (*Taraxacum officinale* ssp. *officinale*), which has invaded coastal meadows and anthropogenically-disturbed areas parkwide. The Bartlett Cove developed area hosts the highest diversity of non-native species present in the park. In the backcountry of Glacier Bay proper, shepherd's purse (*Capsella bursa-pastoris*), mouse-ear chickweed (*Cerastium fontanum*), oxeye daisy (*Leucanthemum vulgare*), reed canarygrass (*Phalaris arundinaceae*), red raspberry (*Rubus idaeus*), perennial sowthistle (*Sonchus arvensis*), chickweed (*Stellaria media*), and common dandelion (*Taraxacum officinale* ssp. *officinale*) have been detected. Dry Bay's (Glacier Bay National Preserve) greatest threat is bigleaf lupine (*Lupinus polyphyllus*), which is successfully outcompeting other species in both open meadows and shaded understory areas. Control efforts in Dry Bay have focused on oxeye daisy control. Within Gustavus, several aggressive invasive exotic species such as Canada thistle (*Cirsium arvense*), orange hawkweed (*Hieracium aurantiacum*), and yellow toadflax (*Linaria vulgaris*), are present and may spread to areas within the park. Throughout the season, control efforts removed approximately 1450 kg (3200 lb) of non-native plants. In subsequent years, monitoring should aim to determine the rate of spread of species already present and whether new species are colonizing. Control efforts should continue with work focusing on removing small, disjunct infestations and those in areas less disturbed by human activity such as the backcountry.

Introduction

Since 2001, baseline surveys for non-native plant species have been carried out on National Park Service (NPS) lands in Alaska. These surveys serve as the first source of data to be used in formulating long-term monitoring and control plans for exotic plant species in Alaska's NPS units. Exotic plant species are a concern to resource managers because they threaten the genetic integrity of native flora through hybridization (D'Antonio et. al 2001), can outcompete resident plant species for limited resources, and can change the structure and function of ecosystems through alterations of geochemical and geophysical processes (Ruesnik et. al 1995, Gordon 1998). Already, 1.1 million ha (2.6 million acres) or over 3% of the 34 million ha (83 million acres) managed by the NPS nationwide are infested with nonnative plant and animal species (Drees 2004). Conservative estimates of the economic costs of biotic invasions are $137 billion in the United States annually (Pimental et al. 2004).

In Alaska, NPS lands have thus far avoided invasion by many pernicious exotic species found in the lower 48 states (Westbrooks 1998). Several factors have contributed to this immunity. The first is climate. Circumboreal flora are adapted to a wide range of climatic conditions that exotic plants typically cannot tolerate. In addition, many parklands in Alaska have remained relatively free of anthropogenic disturbances such as livestock grazing, wildfire suppression, and altered

hydrological regimes that encourage the introduction of exotic species. Consequently, the remote wilderness parks in Alaska still retain all of their major floral and faunal ecosystem components (Densmore et. al 2001). Despite these protective factors, the threat of exotic plant invasion is increasing due to factors including global warming, increases in construction-related disturbance, and tourism. Throughout Alaska, over 170 non-native plant species have been documented, accounting for approximately 10% of the flora (Carlson et al. 2005). Fortunately, the NPS in Alaska has the opportunity to stay ahead of exotic plant introductions before they become a serious problem, but research and active management must begin now (Spencer 2001).

GLBA is unique among Alaska NPS units with respect to exotic plants for several reasons. Two factors make it vulnerable to invasion: 1) GLBA protects a large land area in the most temperate region of the state, and 2) the terrestrial landscape is undergoing transformation across a mosaic of successional stages through the ongoing colonization of areas recently exposed by glacial retreat. On the other hand, there are very limited avenues for the introduction of exotic plants to the park. Only the immediate frontcountry of GLBA is accessible by vehicles (which must be barged in), and most visitors never step ashore in the rest of the park. So far, there are relatively few introduced species present in Gustavus or the park, but the threat of exotic plant introduction is aided by the influx of summer visitors, the escape of planted cultivars from Gustavus, and ongoing maintenance activities that disturb the soil and facilitate the establishment of exotic species. Fortunately, GLBA has fared well in its isolation and has a real opportunity to avoid the problems other parks are experiencing, but park managers must remain vigilant.

Exotic plant surveys in GLBA during the 2006 field season were conducted to provide information on the distribution, abundance, and species composition of exotic plants in three general areas: Bartlett Cove, Dry Bay, and backcountry Glacier Bay. In addition to making comparisons to survey work from 2004 (Heys and McKee 2004) and 2005 (Rapp 2005), new areas of the park were examined to broaden the knowledge of the invasive plants within the park. Exotic plant control activities focused on the most aggressive species, disjunct populations, and populations with the greatest threat of spreading into less infested areas. Education and outreach activities targeted park staff, park visitors, Gustavus residents, and Gustavus students to make them more aware of the threats non-native species pose to the native ecosystem. Information gathered in 2006 will be used to help prioritize areas in the park and state for long-term monitoring and control.

Methods and Materials

Fieldwork at GLBA occurred from May through September 2006 following the protocol written by the Alaska Region Exotic Plant Management Team (EPMT) (Heys and Rapp 2006). For most of the summer, the field crew was Whitney Rapp (NPS) and Christina Gladmon (Alaska Conservation Foundation Intern). An Americorps Tribal Civilian Community Corps (TCCC) assisted in May and other volunteers helped throughout the summer. Areas inventoried included parts of Bartlett Cove; many of the established ORV trails in Dry Bay; and selected areas of the Glacier Bay backcountry, including parts of the West Arm, Hugh Miller Inlet, Scidmore Bay, the eastern side of the middle bay, and Excursion Inlet. Effort was focused on areas most likely affected by human activity or susceptible to colonization by non-native species based on

topography. Digital photos were taken opportunistically while on site. Where feasible and strategic, infestations were opportunistically controlled through hand-pulling.

Table 1 - Fields used in GPS data dictionary and GIS shapefile for invasive plant surveys, summer 2006.

Location_Name	Location ID (bartlett_cove, beardslees, dry_bay, east_arm, glacier_bay_other, gustavus, main bay, or west_arm)
Disturbance_Type	Disturbance Type (coastal, stream, river, glacier, fill importation, trampling, wind throw, slide, animal, material extraction, ORV disturbance, mowing, wildfire, logging, mining, grazing, plowing, brush cutting, herbicide, wind, thermal, volcano, abandoned homesite, or other). Because most of Alaska's exotic plants grow only on disturbed sites, we are tracking what disturbance types are being invaded by what species in NPS units.
Site_Description	Description of location.
Buffer_Distance_M	Buffer distance (in meters) to convert points and lines to polygons
Taxon	This is the dominant exotic plant species of a particular infestation. All species that have been reported from Alaska NPS units are on this list. "Other" is used for species not previously recorded with a description in the Remarks field. If the mapped area is free of exotic plants, "None" is used.
Phenology	Phenology of dominant exotic species (rosette, no_flower, full_flower, in_seed, stand_dead, or none)
%_Cover	Cover class percentage of dominant exotic species (0, 1, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100)
Stem_Count	The stem count of the dominant exotic species. A blank field indicates the number of plants was not counted.
Action	"Inventory" is the first documentation of a particular infestation, whereas "Monitor" is a follow-up visit to a previously inventoried site from this year or previous years. "Treatment" is the first control effort for a particular infestation and "Retreatment" applies to any subsequent control efforts in either the same or successive years. "Manual" involves pulling or digging. "Mechanical" involves actions like mowing, weed-whacking, chain-sawing, etc. "Chemical" involves the use of herbicides.
CntrlEffrt	Projected/actual control effort (low <1 hour, medium 1-8 hours, high >8 hours for one person)
Is_Exhaustive	"Yes" if all the exotic plants encountered were recorded. "No" if only a subset of species are recorded.
Comments	Any additional remarks.
Park_Unit	Associated park (GLBA)
Is_Inside_Park	"Yes" if the area mapped is located on park land. "No" if it lies outside of the park boundary or on inholdings.
Recorder_Name	Recorder (WSR = Whitney Rapp; CEG=Christina Gladmon)
Team_Name	AKEPMT = Alaska Exotic Plant Management Team
2Taxon, 3Taxon… 2Phenology, 3Phenology… 2%_Cover, 3%_Cover… 2StemCount, 3StemCount… 2Action, 3Action… 2Control_Effort, 3Control_Effort…	Additional fields for 9 other exotic taxa for each unique site including fields for Phenology, Percent Cover, Stem Count, Action, and Control Effort.
Spatial Accuracy Fields	Range of attributes to describe spatial information and precision
Date/Time	When the record was collected.
Acres	GIS-calculated acreage of each area

For the third year, Trimble GeoXT GPS units were used for all data collection during inventory and control events. Equipped with the Alaska EPMT standardized data dictionary (Table 1), the GeoXT can achieve submeter accuracy and ensure data integrity. Areas with and without non-native species were inventoried at a resolution to allow interannual comparisons of plant distributions. The data dictionary provides sufficient detail for describing the size, diversity, and severity of exotic plant infestations and for population of two distinct databases: APCAM (Alien Plant Control and Monitoring – a nationwide NPS database for exotic plant data) and AKEPIC (Alaska Exotic Plant Information Clearinghouse - a collaborative, interagency, web-based database for tracking Alaskan weeds).

The data collected using the GPS were differentially corrected using the closest base station (Gustavus, AK) and edited in GPS Pathfinder Office (Trimble, version 3.10). The corrected files were then exported as shapefiles for use in ArcGIS (ESRI, version 9.1). The permanent dataset is a multi-year, multi-park geodatabase maintained by the Alaska Region EPMT.

Results and Discussion

During the 2006 field season, approximately 444 ha (1096 acres) were surveyed with the focus of the effort on areas frequented by people both currently and historically, the coastline, areas previously not surveyed, and revisiting areas with previous control work. Survey work during 2006 added significantly greater resolution to data on distribution and abundance of the known non-native species.

Inventory work in 2006 resulted in the documentation of six new non-native species within and near GLBA (Appendix A). The newly identified and located species include bishop's goutweed (*Aegopodium podagraria*), common burdock (*Arctium minus*), Canada thistle (*Cirsium arvense*), mint (*Mentha* sp.), prostrate knotweed (*Polygonum aviculare*), and rugosa rose (*Rosa rugosa*). An additional two species, annual bluegrass (*Poa annua*) and Kentucky bluegrass (*Poa pratensis*) that had previously been documented in or near the park with herbarium specimens but had not been found during previous non-native plant surveys were located in 2006. This brings the total count of non-native plant species within the park and preserve to 33. An additional 15 non-native species have been documented in Gustavus, which brings the regional total exotic species count to 48. Non-native species previously identified within GLBA that were not relocated in 2006 include meadow foxtail (*Alopecurus pratensis*), yellow toadflax (*Linaria vulgaris*), maltesecross (*Lychnis chalcedonica*), white sweetclover (*Melilotus alba*), fowl bluegrass (*Poa palustris*), curly dock (*Rumex crispus*), and alsike clover (*Trifolium hybridum*). Yarrow (*Achillea millefolium*) was removed from the exotic plant list in 2006 since there is no way to differentiate native and exotic varieties based on morphological or genetic differences (Trock pers. comm. 2005).

Appendix B shows the locations of many of the non-native species observed during 2004-2006. The shapefile generated from the field inventory may be used in GIS to access additional information, including the assessment of invasive plant densities and the estimated control effort needed for eradication.

Manual control efforts of non-native species were focused primarily in Bartlett Cove, Dry Bay, Strawberry Island, and in areas with small infestations of less common species. Treatment of common dandelions occurred early in the season during May and June primarily around the Visitor Information Station (VIS) and along the road near the park boundary with immense assistance provided by the AmeriCorps Tribal Civilian Community Corps (TCCC). Attempts to control perennial sowthistle on Strawberry Island were made in May and August. Oxeye daisies were removed in all located sites within Bartlett Cove, at Reid Inlet, and at some sites in Dry Bay. All known populations of reed canarygrass (*Phalaris arundinacea*) were controlled in Bartlett Cove. All the comfrey plants found growing near the Bartlett Cove depot were removed in May and again in August. Effort was spent trying to control the only known population of tall buttercup. During July through September, common timothy (*Phleum pratense*) and orchardgrass (*Dactylis glomerata*) were removed from roadside locations in much of Bartlett Cove. All located red clover (*Trifolium pratense*) were removed again this summer. Opportunistically throughout the summer, other species, including plantain, white clover, and mouse-ear chickweed, were removed. Throughout the field season, approximately 1450 kg (3200 lb) of non-native plants were removed.

Species Summaries

With the identification of six new non-native species within and near GLBA this year, the urgency of continued monitoring and control to protect the native plant community became more compelling. In terms of distribution, *Taraxacum officinale* ssp. *officinale* has the most widespread distribution throughout the park. In Dry Bay, the species of greatest concern is *Lupinus polyphyllus* based on its current extent and ability to displace native species. Following many recent construction-related disturbance events, a number of invasive species have become well established in Bartlett Cove and will challenge management in the future.

Bishop's Goutweed - *Aegopodium podagraria*

The variegated form of goutweed has been widely planted in Gustavus as a groundcover. In a number of locations, this species has spread beyond the bounds of the maintained landscape and is displacing native vegetation. At this point, it is not known to be growing in the park. The species appears to spread vegetatively, so it is unlikely that seeds will be transported to the park to begin a new population.

Wild Chives - *Allium schoenoprasum*

An *Allium* species that keys out to be wild chives (*A. schoenoprasum*) was found growing in several places in Dry Bay. In addition, residents of Dry Bay have intentionally planted this and cultivated chives near their cabins. In 2006, the species was collected for positive identification. This species is listed as non-native by some sources (ITIS.usda.gov, Plants.usda.gov) and a native circumboreal species by other sources (Hultén 1968, Hitchcock and Cronquist 1973,

Welsh 1974, Cody 2000, Klinkenberg 2004,). Further work is needed to verify the taxonomy and nativity of this species to determine whether it should be a species of management concern.

Meadow Foxtail - *Alopecurus pratensis*

Meadow foxtail was collected from Bartlett Cove in 1961 and archived in the GLBA herbarium. Subsequent identification has not occurred, but this may be a result of insufficient grass identification skills. Future work should seek to relocate this species to determine if it is still present.

Common Burdock - *Arctium minus*

A single flowering specimen of common burdock was found growing at the margin of the seasonal housing parking lot this summer. This is one of the first records of this species from Alaska. Since the species is a biennial, it is likely to have been growing in the location for the past two years. Monitoring of this area should occur again next year. In addition, all other margins of the gravel roads should be checked since the gravel, which originated in British Columbia, may have been the source of the seed.

Smooth Brome - *Bromus inermis*

Smooth brome is growing densely along roadsides in Gustavus, as well as on the GLBA park property in Gustavus near the school. This species has not yet been located within Bartlett Cove or elsewhere in the park. This species should be searched for in future inventories since suitable habitat is available in Bartlett Cove and elsewhere, and it is a known invader of wetland habitats in the lower 48 states.

Shepherd's Purse - *Capsella bursa-pastoris*

Common in disturbed areas of Gustavus including near the airport, shepherd's purse has been found growing in the depot area of Bartlett Cove. The largest plants were found growing on a pile of soil near the shooting range, which may indicate the source of the introduction. Smaller plants were found growing near an excavated hole and near the chain link fence that secures the depot. Plants were opportunistically removed in 2006.

Additionally in 2006, shepherd's purse was found growing on Lone Island, a wildlife protection area closed to human use. An herbarium specimen of this species had been collected from the island in 1971 by Greg Streveler, a Gustavus resident, excellent natural historian, and former GLBA employee. How or when the species was initially introduced to the island is unknown. Exotic species such as chickweed around seabird colonies have proven more resistant to control (Lapina and Carlson 2006). Controlling this species on the island in 2006 would have exceeded the time allowed by the two-hour access waiver. The Alaska Natural Heritage Program has

ranked many non-native species (scale of 1-100 with a higher number indicating a greater threat) based on the species' observed ability to invade native communities and subsequent difficulty in their removal. Since shepherd's purse is not considered a high-risk species (40, Appendix A), the management of this species on this active bird nesting island should only occur only after August, if at all.

Figure 2 – *Cerastium fontanum* growing thickly near the Visitor Information Station (VIS) in Bartlett Cove.

Mouse-ear Chickweed - *Cerastium fontanum*

Mouse-ear chickweed is common in Bartlett Cove and Gustavus growing along roadsides and in disturbed areas. In addition, it has been observed in Bartlett Cove well beyond disturbed areas in the area south of the park road near the boundary. The species is also present in numerous locations in Dry Bay. Aside from dandelions, this is the species most frequently observed in the backcountry. Populations of mouse-ear chickweed have been found on Young Island in the Beardslee Islands, in Reid Inlet, in North Sandy Cove, and in multiple locations in Excursion Inlet. Efforts to control the Reid Inlet population occurred in 2006. Other areas were controlled opportunistically. Hand-pulling the species is challenging since it has a weak stem and frequently breaks near ground level. In addition, it very effectively integrates with native vegetation making selective removal challenging. Despite its wide distribution and ability to invade low disturbance areas in Glacier Bay, mouse-ear chickweed has a relatively low ranking (39, Appendix A), which suggests that it should not be a high-priority species for control.

Canada Thistle - *Cirsium arvense*

Canada thistle is an aggressive (ranking 76, Appendix A) exotic species that has been in Gustavus since at least 1970 when it was collected by Greg Streveler near the Gustavus Inn. Over 35 years later, the Gustavus Inn is still working to control the species using herbicides. At least two other populations are known to exist in Gustavus, including a large area near Toshua and Heather Parker's residence that has invaded both cleared and open forest understory habitats. The Parkers are also using herbicides to attempt to control the species. It is critical that this species be prevented from invading NPS lands.

Orchardgrass - *Dactylis glomerata*

Orchardgrass has been found growing scattered along the roads in Bartlett Cove and in Gustavus. Since it is growing in relatively low (controllable) densities, it has been the focus of control efforts in 2005 and 2006. The best time for control activities is late-July to late-August.

Quackgrass - *Elymus repens*

A single, small population of this grass is growing on and around a soil pile at the Bartlett Cove depot. In the 1990s Koren Bosworth documented this species to be growing near the Glacier Bay Lodge; however, it has since not been observed in that area. Efforts in 2007 should focus on the removal of the species.

Orange Hawkweed - *Hieracium aurantiacum*

Orange hawkweed has not yet been located within GLBA; however, it was included in multiple arrangements by Gustavus residents at the 4th of July contest, which suggests it is growing several places within Gustavus. Jamie Ogilvy, Gustavus resident and NPS employee, intentionally planted it at her house off of Church Road. She indicated the species was slow to establish and overall not very competitive; however, this species has proven to be very successful in other areas of Alaska. The flower bed along the road at Jamie's house where it was growing was dug in the fall of 2006, which will hopefully have killed many of the plants. The property has since been sold to new NPS employee Todd Bruno and his family. In 2007, educational materials regarding this species should be given to this family. Another larger population of orange hawkweed is known to be growing in Gustavus according to Jamie Ogilvey, but its specific location is unknown. Throughout the summer of 2006, orange hawkweed posters were displayed throughout the park and Gustavus to educate people about the concerns this species poses.

Figure 3 – An orange hawkweed outreach poster created by Christina Gladmon that was displayed throughout Gustavus and GLBA during the summer of 2006.

Foxtail Barley - *Hordeum jubatum*

Although considered native by most (Pojar and MacKinnon 1994, ITIS.usda.gov), foxtail barley can become very weedy in some areas. Although it has been detected in several areas within the park including Dry Bay, Strawberry Island, South Sandy Cove, Bartlett Cove, and Excursion

Inlet, it does not appear to be an invasive threat since its density is relatively low and it is mixed with diverse native species. Continued monitoring of the species is warranted.

Hairy Cat's Ear - *Hypochaeris radicata*

A single specimen of hairy cat's ear was removed from the Bartlett River trailhead in 2005. In 2006, a large population of the species was found growing in Gustavus throughout the softball field behind the post office, in the meadow between the post office and the school, and in the playground area of the school. Although outside of the park's work area, this species should be the focus of Gustavus community weed control efforts. The species is best targeted in late-July to early-August.

White Deadnettle - *Lamium album*

In 2005 and 2006, all observed specimens of white deadnettle were removed from near the Glacier Bay Lodge. Based on the plant's variegated foliage and its close proximity to the Lodge, it is likely that this was an escaped ornamental species. The Glacier Bay Lodge Landscape Management Plan includes an objective to "prevent proliferation of exotic plant species." As part of that, they are to 1) avoid using fill from outside the park, 2) plant non-native species in planter boxes only after consultation with NPS, and 3) discourage exotics in disturbed areas using mechanical and/or chemical methods. To date, the Glacier Bay Lodge has not been proactive in removing exotic species. Although the use of chemical control at the lodge is a provision, Marilyn Trump of the GLBA Concession Division is not aware of any instances where they have been used. In future years, the EPMT team should be consulted regarding the suggested non-native species to be planted and only native plants or non-invasive exotic species should be used. White deadnettle should be monitored for in early summer 2007 since it is anticipated that it can be eradicated from the park.

Oxeye Daisy - *Leucanthemum vulgare*

Oxeye daisies have proven very successful at growing in the vicinity of GLBA. As a result, this species was targeted for removal again in 2006. All known populations were removed in

Figure 4 – Near the Bartlett Cove water storage tanks is an area with abundant oxeye daisy seedlings carpeting the ground.

Bartlett Cove. Most often a single plant is located, indicating that it is likely the first year of establishment. In other areas, multiple plants grow, indicating that the species has been present and reproducing for multiple years. Finding seedlings is challenging since they are small and inconspicuous.

A single population of daisies growing in a dryas (*Dryas drummondii*) mat at a popular camping area in Reid Inlet was controlled for the second year in June 2006. Repeated attempts to revisit the site in late summer were unsuccessful. This population should be monitored and re-treated in mid-summer 2007 as a critical priority.

Figure 25 – An exotic dandelion flower head showing the characteristic reflexed involucral bra

Dry Bay has the most severe daisy problems of any area of GLBA. Several populations of daisies in Dry Bay were controlled again in 2006, including near the fish plant (Fig. 6 and 7), near the rafter outhouse, at the Moody residence, at the Swanson residence, and at the end of the runway near Johnny's East River Lodge. Controlling daisies at the fish plant and at Moody's residence was facilitated by mowing activities that had occurred prior to the daisies flowering. Although the mowing did not kill the plants, it reduced the number of flowering plants for the season, which made managing the species easier in 2006. Mowing in other areas, however, has encouraged the vegetative reproduction of this species to the degree that control becomes impossible without herbicides. After the EPMT departure, Jim Capra, Dry Bay Ranger, found and removed only five additional

Figure 6 and 7– The lefthand image shows Whitney Rapp near the seafood processing building in Dry Bay. In the righthand image, Christina Gladmon shows off the same area after the oxeye daisies were removed.

flowering daisies near the fish plant, which indicated the effectiveness of the 2006 control efforts. At the Hazen residence, all the daisy flower heads were removed; however, due to the number of plants and time constraints, the remainder of the plants were left intact. Several new populations of daisies were found and controlled in 2006, indicating that the species is likely spreading. One new infestation near the rafter outhouse is a result of moving seed-contaminated soil from near the fish plant to the outhouse area for construction. In the future, best management practices should be followed for construction in Dry Bay to prevent the spread of exotic plants. In general, areas surrounding flowering daisy populations have abundant seedlings, which are often cryptic due to their low-growing rosette of leaves. Consequently, all areas where daisies were controlled in 2005 and 2006 should be monitored and re-treated in 2007 and subsequent years. At least three days for two people should be budgeted for oxeye daisy control in Dry Bay for 2007.

Oxeye daisies are very prevalent in Gustavus, and landowners are very fond of the showy flowers and low maintenance plants. Daisy populations are likely spreading along the dirt roads in Gustavus by the graders that level the roads. Outreach efforts should continue to educate Gustavus residents about the risk posed by the species to the native flora. In 2006, oxeye daisy signs were displayed throughout much of the summer to raise awareness. Shasta daisies, which are also non-native but less invasive, may provide a suitable alternative, but seed and plant labeling do not always correctly distinguish between the two species. Additionally, the native arctic daisy (*Dendranthema arcticum*) was transplanted to two gardens in Gustavus in 2005 to see how it performs in cultivation. It over-wintered and successfully flowered in 2006 at one residence, demonstrating that it has the potential to be a suitable landscape alternative.

Yellow Toadflax - *Linaria vulgaris*

Yellow toadflax, also called butter and eggs, is common in some areas of Gustavus, but fortunately, it has not yet been detected in GLBA. Annual monitoring for this species should continue, and outreach efforts should emphasize that this plant is very difficult to eradicate once established.

Perennial Ryegrass - *Lolium perenne* ssp. *perenne/multiflorum*

Both *Lolium perenne* ssp. *perenne* and *L perenne* ssp..*multiflorum* (perennial ryegrass) have been identified growing along the roadsides in Bartlett Cove. Both subspecies were seeded as part of the revegetation process after the road paving that occurred in 2002. Although these plants were intended to be short-lived, their recurrence after multiple years suggests that they may be reseeding. In 2006, perennial ryegrass was most abundant along the roadside between the VIS and the first pullout beyond the depot. Continued monitoring of these species is necessary.

Figure 8 – Open areas of Dry Bay, particularly near the Alsek River, have abundant big leaf lupines that displace nearly all other native vegetation.

Figure 9 – In addition to invading open meadows, *Lupinus polyphyllus* appears to spread vegetatively in the shaded understory of Dry Bay's forests.

Bigleaf Lupine - *Lupinus polyphyllus*

Bigleaf lupine is native to the Pacific Northwest, but most authorities consider the species introduced to Alaska (Hultén 1968). Alternatively, the plants may be Russell hybrid lupines, which are ornamental crosses between *L. arboreus* and *L. polyphyllus*. In addition to the visual differences between the bigleaf and native nootka lupine, the bigleaf lupine is very fragrant.

In Gustavus, a pink-flowered cultivar is commonly planted and spreading, but it has not yet been observed in Bartlett Cove. In Dry Bay, the more common purple-flowered form is very widespread, particularly near the Alsek River. Occasional white and bicolored flowering plants are also present. The species occupies both open meadow and shaded understory habitats in very dense colonies that are excluding native species. It appears that plants are spreading both vegetatively and by seed. The summer of 2006 was a more prolific year for lupine flowering compared to 2005. Most of the areas occupied by bigleaf lupine are relatively free from human disturbance such that a strong link between their distribution and humans is not obvious. In contrast, much of the habitat occupied by bigleaf lupines is naturally disturbed and undergoing successional processes. This unfortunately leaves most of Dry Bay vulnerable to invasion. At this point, the species is not present on the successionally younger dunes and more open areas. However, it does appear to have been transported to areas such as the Rohloff cabin where it

might not have dispersed naturally. Dry Bay cabin permits should restrict planting and moving plant species to and within the Preserve.

It is difficult to know when the species was introduced to Dry Bay. Although it was absent from the GLBA herbarium, Greg Dudgeon, a former ranger in Dry Bay, can remember the species as being prevalent as early as 1990. Pat Pellett, a resident of the Forest Service (USFS) portion of Dry Bay, remembers the bigleaf lupines when he first started coming to the area in the late 1960s to early 1970s. Lisa Robbins, who spends time on both sides of the Alsek River, indicated that the species is prevalent on the west side of the Alsek as well as near the Akwe River. She speculated that the species spread with the Yakutat and Southern Railroad (1903- mid-1960s) that brought fish from the Situk River to Yakutat. From photos on the USFS website (http://www.fs.fed.us/r10/tongass/forest_facts/resources/heritage/ysrailroad.shtml), it appears the lupines are present near the Situk River. Nevertheless, this is still 65 km (40 miles) from the Alsek River and Dry Bay.

Since *L. polyphyllus* is growing in the same habitats with the native *L. nootkatensis*, it is possible that the two are hybridizing. Plants with intermediate morphological characteristics were observed in 2005. Teresa Sholars, lupine author of the *Flora of North America* and professor at College of the Redwoods, will be looking at lupine specimens from Dry Bay during the winter of 2007 to determine which species or cultivar they are.

Maltesecross - *Lychnis chalcedonica*

Maltesecross is an escaped ornamental species that was observed in Gustavus during the 2004 inventory. Although it was not relocated during 2005 or 2006 surveys, it was included in several of the 4th of July flower arrangements from Gustavus residents. Other related flowers, including bladder campion, are known to be growing in Gustavus. Future inventories should continue to look for these species.

Pineapple Weed - *Matricaria discoidea*

Pineapple weed is found in continuously disturbed areas, including near the depot and in parking areas in Bartlett Cove, on ORV trails in Dry Bay, and in Gustavus. The species has not been observed spreading into nearby less disturbed habitats or displacing native species. Therefore, although it is non-native, it is not of high management concern (33, Appendix A).

White Sweetclover - *Melilotus alba*

An herbarium specimen of white sweetclover was collected near the Gustavus airport in 1970. According to Greg Streveler (pers. comm. 2006) the area where the species was growing was paved during airport improvements, and the species has not been seen since then. This species is very invasive along roads and rivers in Alaska. It is growing in Haines and Skagway, so it is

possible for seeds to be transported with people, gear, or planes to Gustavus. Continued monitoring is necessary.

Mint - *Mentha* sp.

A small area of mint was found growing behind the fitness/e-cache building in 2006. All plants were removed. Monitoring in 2007 should occur to ensure that the plant does not return. It is possible that the mint is persisting from when the area was used for housing.

Forget-me-not - *Myosotis scorpioides* and *M. alpestris* ssp. *asiatica*

Taxonomy and nativity of the forget-me-not genus is unsettled. *Myosotis scorpioides*, often listed as *M. palustris*, is definitely present in Bartlett Cove and Gustavus and is a European introduction. Work performed at the ALA herbarium in Fairbanks, AK and subsequent communication with Carolyn Parker of the ALA, has revealed that the Alaska state flower, *M. alpestris* ssp. *asiatica*, has few records from Southeast Alaska. Consequently, it may be native to this range and rare, or introduced through cultivation (Parker 2006 pers. comm.). Some botanists split these species further (such as *M. sylvatica*), but the distinguishing characteristics are not definitive and lead to significant doubt when classifying species (Parker 2006 pers. comm.). Subsequent inventory efforts should collect forget-me-not specimens to determine what species are present.

Most likely based on plant/seed availability and the ignorance of the difference among species and nativity, the European species has been planted widely, including in planter boxes at the Glacier Bay Lodge in 2005. They have escaped cultivation around the Glacier Bay Lodge, near where the NPS trailers were in the Admin area, and in Gustavus. Plants are thriving in moist areas, including drainage ditches. Efforts should be made to remove all *M. scorpioides* plants in Bartlett Cove in June 2007 before seed is set. In addition, Glacier Bay Lodge should be encouraged to plant native species and not to sell Alaska wildflower mixes, which often include invasive species.

If *M. alpestris* ssp. *asiatica* is located, the population should be monitored to determine if it is spreading. Any information about the population's origin should also be gathered to better determine whether the species is native or introduced.

Figure 10 – A variegated cultivar of *Phalaris arundinacea* grows along the foundation of Andy Varni's home in Dry Bay, which also has a high concentration of other exotic species.

Reed Canarygrass - *Phalaris arundinacea*

Reed canarygrass is definitely native to Europe, although some people believe the species may have a circumboreal distribution. The species has a long agricultural record, including cultivation for forage as early as 1749 in Sweden. In the US, the first agronomic trials probably began in the 1830s when New England farmers began experimenting with crosses to increase palatability to livestock. With subsequent breeding for vigorous growth and drought tolerance, super-strains of canarygrass were developed that have become problematic as they have escaped. In addition to agricultural uses, reed canarygrass has often been used for erosion control due to its tolerance of wet areas and its ability to spread rapidly (Lyons 2006). Since there is some question regarding the species nativity, management of the species become questionable. Populations growing south of the Alaska Range are generally associated with anthropogenic disturbance and are most likely introduced or introgressed genotypes (Lapina and Carlson 2006). Since reed canarygrass is most frequently associated with human disturbances, it is most likely a result of human introduction.

Reed canarygrass is the highest ranked species (83, Appendix A) currently present in GLBA due to its threat to the native ecosystems. This grass forms dense monospecific stands that displace all other species, provides poor habitat for wildlife, and affects soil hydrology. All known stands of this grass within Bartlett Cove were removed for the second consecutive year in 2006. Although a substantial 285 kg (629 lbs.) of plant material were removed, this does represent a 60% decrease in mass from last year. Since none of the populations treated in 2005 had completely disappeared in 2006, regrowth is likely to continue over subsequent years. Consequently, these areas will need to be re-treated annually. In addition, new populations are likely to be found.

In 2006, several small populations of reed canarygrass were found in the backcountry, including near the former fox farm on Strawberry Island and at two locations in Excursion Inlet. No control work was performed on these populations in 2006, but control efforts should occur in 2007 and future years.

Figure 11 – Reed canarygrass is abundant in Gustavus as this meadow demonstrates. Education and outreach efforts in the community should raise awareness of the concerns this species poses.

Within Gustavus, reed canarygrass has affected a significant area, although most residents are unaware of the situation since grasses are often overlooked (Fig. 11). Although the species is best known for adversely affecting riparian habitat, reed canarygrass seems very successful in colonizing any modestly open habitat in Gustavus - probably due to the consistently wet soils.

A stand of a variegated cultivar of reed canarygrass was planted beside Andy Varni's home in Dry Bay (Fig. 10). This stand is bounded by the home and a walkway and does not appear to be spreading as vigorously as the non-variegated forms.

Common Timothy - *Phleum pratense*

Common timothy is abundant throughout Gustavus and common in Bartlett Cove. It was likely brought in as hay or grown for grazing animals. In Bartlett Cove, it is prevalent along the recently disturbed roadsides. During the late summer 2006, most of the plants growing along the road from the VIS to just beyond the first pull-out after the depot and again near the boundary were removed. Time did not permit the removal of additional plants. Although there are reports of the species in the backcountry, all specimens observed in 2005 and 2006 appeared to be the native *Phleum alpinium*.

Plants with intermediate morphological characteristics were observed in both Bartlett Cove and the backcountry. Although no information on hybridization was found, it may be possible for these species to hybridize. An effort should be made in 2007 to collect plants showing the full range of morphological characteristics since it is uncommon in Alaska to have both species growing together (Batten and Parker pers. comm. 2006).

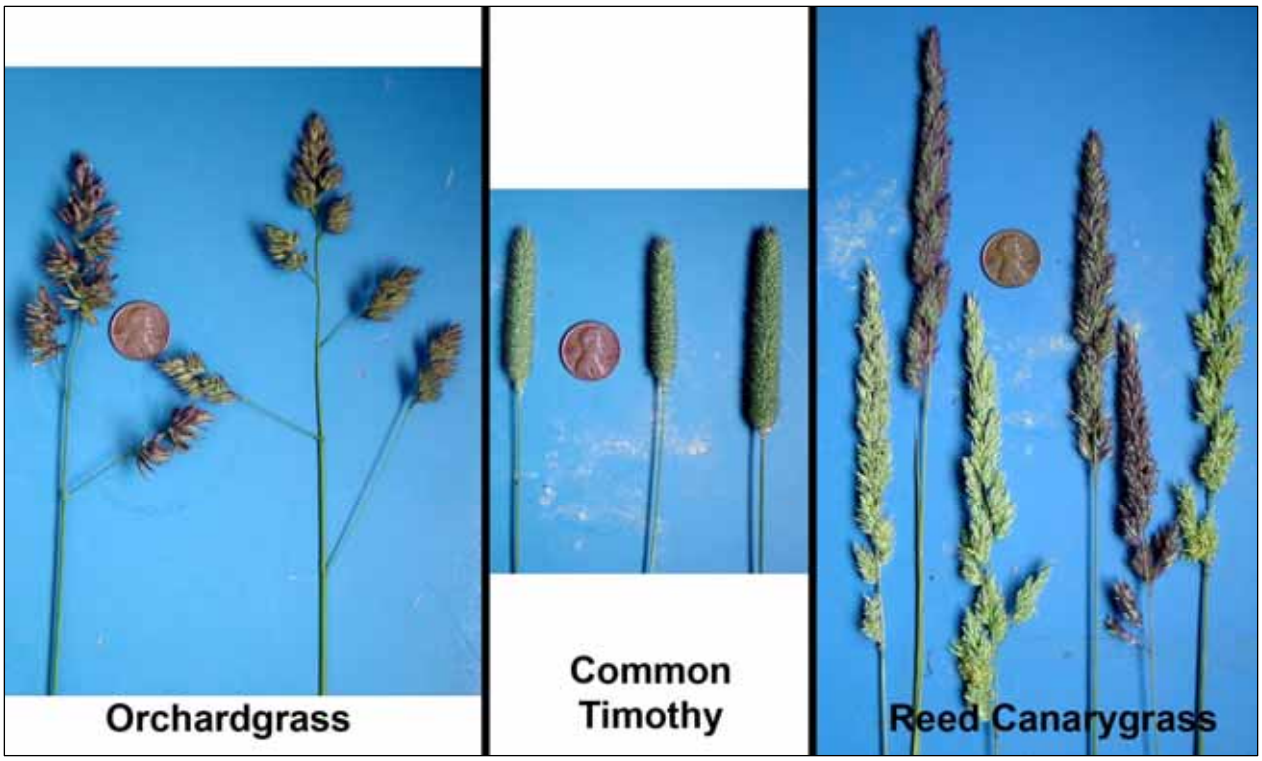

Figure 12 – Inflorescences of the three most common exotic grasses in Bartlett Cove: orchardgrass, common timothy, and reed canarygrass.

Common Plantain - *Plantago major*

Common plantain grows in recently disturbed locations in Bartlett Cove and Dry Bay such as along roads, in parking areas, and along trails. Although prevalent, it does not appear to be spreading outward into less disturbed areas or displacing native species. This species has not been recorded in the backcountry. As a result, this species' presence should continue to be monitored and plants should be controlled as time permits. Plantain should not be made a top management priority.

Annual Bluegrass - *Poa annua*

Annual bluegrass is a commonly-seeded grass for turf. It is common in Gustavus and present in Bartlett Cove. Specimens of a *Poa* thought to be *Poa annua* were collected from Lone Island and sent to the regional office for positive identification. Due to the difficulty of definitively identifying *Poa* species, management of this species may be challenging.

Fowl Bluegrass - *Poa palustris*

A single herbarium specimen of fowl bluegrass was collected from Drake Island. Unfortunately, the herbarium sheet was lost at some point in time. Additional training in grass identification and more survey effort are needed to relocate this species. It is likely that other non-native *Poa* species are also present within the park.

Kentucky Bluegrass - *Poa pratensis*

Kentucky bluegrass, another commonly seeded lawn grass, was found growing in Bartlett Cove and Gustavus in 2006. Due to low confidence in discerning this species from native bluegrass species, control and inventory efforts will continue to be hindered.

Prostrate Knotweed - *Polygonum aviculare*

Prostrate knotweed is a newly documented species for the area in 2006. It was observed to be growing in Gustavus in the abandoned driveway on Tom and Sal McLaughlin's property. Although locally abundant, its distribution appears to be restricted to the most disturbed areas.

Tall Buttercup - *Ranunculus acris*

Figure 13 – Christina Gladmon amongst the tall buttercup plants growing between the main and fuel docks in Bartlett Cove.

Tall buttercup is growing in a dense stand between the Bartlett Cove fuel and public use docks near the former location of the kayak racks (Fig. 13). The plants were dug out in 2005, but they were already dropping seed. In 2006, efforts to remove the plants were made, but concerns about contact with cow parsnip prevented effective removal of the species. In future years, it may be warranted to cut the leaves of cow parsnip in areas being treated to minimize exposure to the phototoxic chemical compounds. Although this would cause greater disturbance and possibly enhance growth of exotic species due to increased available light, it would protect the health of those controlling buttercup. Another concern regarding tall buttercup treatment is that it is difficult to distinguish the seedlings of *R. acris* from the native *R. uncinatus* and other buttercup species. For these reasons, this site will need to be resurveyed and treated before early July 2007.

Creeping Buttercup - *Ranunculus repens*

Figure 14 – Creeping buttercup carpets the vegetative understory along the old road near the kayak concession buildings.

Cooper (1939) collected creeping buttercup in a beach meadow near Bartlett Cove in 1935. Today this species is abundant in a few locations within Bartlett Cove including the Bauer/Young (GBQ 03) and Seraphin (GBQ 09A) residences, near the kayak concessionaire buildings (Fig. 14), and near the depot. In addition, very small populations beginning to colonize the road edges were observed and controlled this summer. Like *R. acris*, it is difficult to distinguish seedlings of *R. repens* from native buttercups. Control of this species is challenging due to the rooting at each node and its ability to integrate into mowed lawns. The species is most easily identified in mid-summer when the flowers are blooming. Since this species has proven very invasive in other areas of Southeast Alaska such as Sitka National Historical Park (Rapp 2006), investing the resources in trying to control the relatively small populations of this species early is warranted. Like *R. acris*, this species commonly grows beneath cow parsnip, so control efforts need to avoid contact with cow parsnip.

Rhubarb - *Rheum rhabarbarum*

Although not invasive, rhubarb is persistent in Alaska. For this reason, locations of rhubarb, particularly in Dry Bay, are being recorded for future management if cabins are abandoned. For example, the abandoned cabin at the end of the Bear Island Trail has rhubarb that should be removed.

Rugosa rose and other roses - *Rosa rugosa* and *Rosa* sp.

The rugosa rose, locally referred to as the Sitka rose, is a native of China, Japan, and Korea that has been well documented to escape cultivation and effectively naturalize. The origin of the "Sitka" rose likely dates back to the establishment in Sitka of the Alaska Agricultural Experimental Station and its first superintendent Charles Georgeson who introduced the species between 1903-1921 and later sent it to other areas of Alaska for cultivation (Holloway 2006). Rugosa rose is naturalizing in the meadow near the Gustavus dock and near many homes in Gustavus. To date, it has not been observed within GLBA.

The only native rose to the region is the nootka rose (*Rosa nutkana*), which is not frequently seen. Although many in Gustavus think they are planting nootka roses, often other rose species or cultivars are being planted that have an invasive habit. One of these non-native horticultural roses grows on the GLBA Gustavus property near the Gustavus School. Along the margins of Parker Road, roses are spreading widely.

Red Raspberry - *Rubus idaeus*

Although red raspberries are native to Alaska, the range map in Hultén (1968) does not show the species to be present in the coastal areas of Southeast Alaska. In addition, there are no collected specimens from this area in either the GLBA or the University of Alaska herbaria. All of the *R. ideaus* populations found to date within GLBA can be associated with current or historic human use, so it is probable that the plants were introduced for cultivation. Due to the uncertainty of nativity, this species will be treated as native until management decides otherwise.

Sheep Sorrel - *Rumex acetosella*

Sheep sorrel is known to be growing in three locations in GLBA: behind the depot building, near the Seraphin residence (GBQ 03), and between the fuel and public use docks. Due to the limited size of these populations, efforts should be made to control them in 2007. At the Gustavus dock, there is considerable invasion of the meadow areas by sheep sorrel, which demonstrates what can and likely will happen if this species is not controlled within the park.

Curly Dock - *Rumex crispus*

Curly dock, not to be confused with the native western dock (*R. occidentalis*), has not yet been observed in GLBA; however, it is present in Gustavus such as in the Sharman's vegetable garden. Monitoring for this species in the future is needed.

Perennial Sowthistle - *Sonchus arvensis*

Perennial sowthistle is well established in approximately 2.5 acres of the supratidal meadow near the former fox farm on Strawberry Island. It is likely that the species was introduced while the fox farm was in operation, which was before the late 1930s. Two populations separated by a wet meadow are growing in the herbaceous areas between the forest and the shoreline. The larger population appears bound by physical conditions of hydric soils, the intertidal zone, and the shaded forest margin that prevent continued vegetative expansion. The smaller, more eastern population appears to have room for continued vegetative expansion northeastward. In addition, this species could spread by seed to start new populations elsewhere.

In 2006, two control events occurred to try removing plants. The first event on May 26, 2006 involving 10 people, including the TCCC crew, yielded a disheartening 6 kg (14 lbs.) of plant material from a relatively small area. Once the plants got larger, a second control effort was held August 18, 2006 with another 10 people (Fig. 15). Although this second trip yielded 86 kg (190 lbs.), relatively little progress was made compared to the full extent of the infestation. Based on 2006 effort and acreage controlled, it is estimated that to manually clear the areas of perennial sowthistle could require a crew of 70 people working 8 hours a day for a week. To further compound the issue, hand-pulling is effective at removing above-ground biomass, but very little of the rhizomes are removed, which suggests the plants are likely to regrow.

Figure 15 – Interpretive Ranger Linda Lieberman volunteering to help remove perennial sowthistle on Strawberry Island. Her achievements are obvious when you compare the left and right sides of the image.

A population of *S. arvensis* has also established along the roadside across from the Gustavus Inn in Gustavus. In 2005, it appeared to be restricted to the south side of the road. In 2006, it was present on both sides of the road. The Gustavus Inn treated the plants with Spectracide Brush Killer herbicide (2,4-D principal ingredient) as they were beginning to flower in August 2006, which caused browning of the plants. These populations should be examined in 2007 to determine if this was a successful treatment. According to Gustavus resident Carole Baker, another population of perennial sowthistle grows along the banks of the Salmon River in the vicinity of City Hall.

Other areas of Southeast Alaska, including Juneau and Hyder, are showing that perennial sowthistle is very effective at forming dense infestations in coastal meadows, which suggests that GLBA should make the control of this species a high management priority. It is also known that the species is best controlled with herbicides. Depending on the outcome of the current Invasive Plant Management Plan Environmental Assessment that is considering the use of herbicides, the GLBA population of perennial sowthistle should be considered for herbicide treatment. If

approval to use herbicides is not provided, it is suggested that alternative treatments, including covering the coastal meadows with thick black plastic sheeting for at least a year, be attempted. This would kill most or all plants non-selectively. Once the sheeting is removed, the entire area would need to be revegetated with native seeds and/or plants.

European Mountain-ash - *Sorbus aucuparia*

European mountain-ash trees have been planted by landowners around Gustavus. The prolific production of red berries, which are consumed by birds and then redistributed, have resulted in mountain-ash trees germinating in new locations within Gustavus. Although it is possible that *S. aucuparia* may hybridize with the native *S. sitchensis*, the mountain-ashes observed in Gustavus display the characteristics of the non-native species, in particular the distinctive whitish hairs on new growth compared to reddish hairs of the native species (Table 2).

To date, the non-native mountain-ash has been observed only in Gustavus, including on the GLBA property near the school. Since this species has become problematic in other Southeast Alaskan communities such as Sitka (Rapp 2006) continued monitoring and education efforts are recommended. In addition, the use of the native Sitka mountain-ash in landscape settings (instead of *S. aucuparia*) should be encouraged.

Table 2 – Comparison of traits of native and non-native mountain-ash species (Klinkenberg 2004, Hultén 1968). The trait that most easily separates the species is the color of the hairs on the new growth.

	European Mountain-ash ***Sorbus aucuparia*** **(non-native)**	**Sitka Mountain-ash** ***Sorbus sitchensis*** **(native)**
Height	Small tree, 5-15 m	Medium to tall shrub, 1-4 m
Trunk/Stem	Primarily single stem, grayish, branched	Multi-stem, grayish-red, sparingly branched
Winter buds/ young growth	Grayish soft-hairy	Somewhat rusty-hairy
Leaves	11 to 15 (17) leaflets, sharp pointed at the tip, mostly smooth, saw-toothed almost to the base	7 to 11 leaflets, rounded to blunt at the tip, sometimes rusty-hairy below, coarsely saw-toothed for not more than ¾ their length
Flowers	Flat-topped; branches white-hairy; calyces hairy	Half-rounded; branches rusty-hairy; calyces mostly smooth
Fruits	Globe-shaped; not glaucous	Globe-shaped to ellipsoid; glaucous
Habitat	Cultivated, and escaped	Woods, up into subalpine region

Figure 16 – A native Sitka mountain ash seedling was found growing on Drake Island. Compared to the exotic species, it has fewer leaflets and reddish hairs on new growth.

Figure 17 – The European mountain-ash has distinctive white hairs on new growth and more leaflets that aid in distinguishing it from the native species.

Chickweed – *Stellaria media*

Chickweed is a weedy species of disturbed areas such as vegetable gardens in Gustavus. Additionally, it has been found growing on the GLBA property in Gustavus near the school, at the Seraphin residence (GBQ 09A) in Bartlett Cove, and on Lone Island in the backcountry of GLBA. The abundance of chickweed found on Lone Island in 2006 was quite surprising and may be a reflection of the constant disturbance and ample fertilization by nesting birds. Chickweed has shown an affiliation for seabird colonies in other regions and is considered a greater ecological concern in these habitats (Lapina and Carlson 2006). Given the time constraints (two hours) of the waiver to access this island by foot in 2006, it was impossible to control the species. Although controlling exotic species in the backcountry is generally a high priority, the importance of this island for nesting birds indicates that control efforts should not occur before September, if at all.

Figure 18 – Chickweed was found growing on Lone Island, in addition to more disturbed areas in Bartlett Cove and Gustavus.

There are native *Stellaria* species that are prevalent in coastal meadows in some areas of the park. Compared to the exotic species, they are generally more diminutive and the lower leaves are attached to the stem or on short stalks. In contrast, the exotic species has lower leaves on long stalks.

Figure 19 – Comfrey plants develop substantial root systems that require digging to effectively remove.

Common Comfrey - *Symphytum officinale*

Common comfrey has been planted for its ornamental and herbal properties in Dry Bay, at the Bartlett Cove depot, and on the GLBA property in Gustavus. The Dry Bay population at the Robbins house is still within the bounds where it was planted, but both of the other populations have spread by seed to form new populations. All plants in Bartlett Cove were removed during two control event in 2006, but the depot area should be resurveyed in 2007 to identify any overlooked plants. The plants in Gustavus on GLBA property should also be removed since the original plantings have been abandoned. Lisa Robbins, a Dry Bay cabin permit holder, has been informed of comfrey's habit of spreading and advised to keep the plants contained to the planted area.

Figure 20 – Due to glacial rebound, extensive coastal meadows are being created in Glacier Bay as the land rises following glacial unloading. These meadows are widely invaded by *Taraxacum officinale* ssp. *officinale*.

Common Tansy - *Tanacetum vulgare*

Tansy is another species often planted as an easy-care ornamental; however, it has the ability to reproduce and invade natural areas. To date it has only been observed in Gustavus including along Mountain View Highway, near the abandoned buildings preceding the airport where Dan Foley operated a fish processing plant, and on the corner of Dock Road and Church Road. Future inventory work should

determine whether the species is spreading into the park.

Common Dandelion - *Taraxacum officinale* ssp. *officinale*

In 1935 William S. Cooper collected *Taraxacum officinale* from only one study site, the Bartlett Cove area (Cooper 1939). Today it is common to find dandelions in open, non-wetland areas in the herbaceous area above the intertidal throughout most of Glacier Bay proper. Although their distribution is still patchy near the glaciers, they have the ability to establish in very young soils previously colonized only by native, early-successional species.

Figure 21 – The TCCC crew worked hard to reduce the dandelion infestation along the road edges in Bartlett Cove. Their efforts prevented countless seeds from blowing into the moose flats area.

Exotic dandelions are present in Dry Bay, but their densities are much lower than in Glacier Bay proper. In addition, native *Taraxacum ceratophorum* is well-distributed in Dry Bay. The realization of the presence of the native species occurred late in the 2006 trip. Consequently, it is possible that inventory efforts in 2005 and 2006 falsely inventoried areas with exotic dandelions. As a result, inventory efforts in 2007 should carefully inventory Dry Bay for where each species is growing. This will also be valuable since other areas have shown that *T. officinale* ssp. *officinale* is capable of hybridizing with native species and completely displacing them.

Figure 22 – The TCCC crew with over 200 lb. of exotic plants dug in an afternoon blocking rush hour traffic on the park road.

Survey work in Dundas Bay in 2005 resulted in finding no invasive species, including dandelions. Observations made by Sean and Janet Neilson, Gustavus residents and GLBA employee, in Lituya Bay in May 2005 indicate that dandelions are scattered throughout the bay. In areas of lower dandelion densities, it would be most valuable to survey during May and early June when the plants are in full bloom and more easily

Figure 23 – Once the dandelions went to seed, the *Dandi-Vac 2006* was used to vacuum seeds. Rowan Sharman and Kiana Young operated suction hoses attached to a wet-dry vac and generator in the truck bed. To be successful, the seeds had to be relatively dry. Future models should look to make the suction hoses lighter weight.

observed. Arresting the spread of this species will be extremely labor- and time-intensive because of its widespread distribution and its ability to disperse seeds long distances by wind and animals. For example, South Marble Island in the middle of Glacier Bay proper glows yellow from dandelion flowers in early spring despite the fact that this island is not visited by humans and is 2.6 km (1.6 miles) from the next closest island.

Native *Taraxacum* species have been identified within the park, so future monitoring should be careful to distinguish the variations. The native species are smaller, often grow in undisturbed areas and alpine meadows, and their involucral bracts have a different form. The invasive species' lower involucral bracts are long, smooth, bright green and curl downward away from the flower. In contrast, the native species' involucral bracts may be dark colored, widely triangular, clasping the

Figure 24 – Dandelions have proven successful in colonizing post-glacial areas with *Dryas* as this image taken on the Scidmore Glacier outwash shows.

Figure 25 – An exotic dandelion flower head showing the characteristic reflexed involucral bracts.

flower, or have horns (bumps on the tips). The native and exotic species have hybridized in other areas. Influences of *T. officinale* ssp. *officinale* on postglacial plant successional processes in Glacier Bay could be substantial and may warrant establishing long-term monitoring plots to assist in understanding the effects.

Alsike Clover - *Trifolium hybridum*

Although frequently observed in other areas of Alaska, alsike clover is not prevalent in Gustavus, and it is uncertain whether it has ever been observed in GLBA due to possible confusion with red clover. Continued monitoring should occur for this species.

Red Clover - *Trifolium pratense*

Red clover has a patchy distribution throughout Bartlett Cove and Gustavus. The plants are easily removed, so all known plants in Bartlett Cove were controlled in 2005 and 2006. However, since plants continue to reappear in the same areas, it is uncertain whether plants are sprouting from a seed bank or if pulling/digging the plant is ineffective in killing it. In Dry Bay a single red clover specimen was found in the garden of Brad Swanson in 2005 (Fig. 26). Due to sentimental reasons, Brad wanted to keep his plant, which he has had for multiple years. He promises to remove any new plants if they appear and is aware that he will receive all the blame for the invasion of this species in Dry Bay if his plant spreads. The plant was not flowering during the 2006 visit, but it was still persisting. In 2007, all plants in Bartlett Cove should be removed, and Brad Swanson's Dry Bay garden should be revisited.

Figure 26 – The only known clover in Dry Bay is growing in Brad Swanson's garden.

White Clover - *Trifolium repens*

Since the recent paving (2001-2002), revegetation (through 2004), and erosion control (through 2005) work on the Park Road, white clover has become well established along the length of the disturbed area. White clover is

Figure 27 – White clover with interspersed dandelions forms a dense mat that becomes very difficult to remove since it forms roots at the branch nodes.

particularly difficult to remove since it roots at each node. As a result, the entire mat needs to be pulled up with a hoe or cultivator, creating significant soil disturbance and disruption of all neighboring plants, which in turn promotes the establishment of yet more invasives. The distribution of white clover may be too large in Bartlett Cove to control at this point manually. Fortunately, the species has not yet been located in the backcountry or Dry Bay. Efforts should be made to prevent the introduction of the species to these areas.

Figure 28 – Wheat hybrid grass was seeded on the slopes near the new maintenance facility to stabilize the soil.

Common Wheat - *Triticum aestivum*

Wheat hybrids are growing along most of the roadways in Bartlett Cove from seed used during the revegetation/erosion control process after the road was paved. Both Regreen (a sterile wheat x wheatgrass hybrid) and Pioneer/Quickguard Sterile Triticale (a sterile wheat x rye hybrid) were hydroseeded multiple times over several years (2002-2005). Some of the seeds have proven fertile since viable seed was produced in 2004 and 2005. Many of these seeds germinated while still in the seed head in September to October in both years and may be perpetuating the species. In early spring 2006, germination was observed along the road in the vicinity of seasonal housing. Fortunately, subsequent late frosts appear to have killed many of the plants. Although there are still occasional plants persisting, the density of the species has declined significantly since 2005. The only area that still has abundant wheat is on the slopes near maintenance (Fig. 28), which were seeded in 2005. At this time, it looks like this species will continue to naturally decline in abundance.

Outreach/Education

Several outreach/education programs were conducted in the park and the community during 2006. In April, I gave a slide program to the interpretive division during their training. In May, I spent the afternoon with the Gustavus elementary school students giving a slide show and then walking around the schoolyard looking for exotic species. When the TCCC crew arrived, I oriented them to Glacier Bay and showed them the native and non-native plants of the area. On July 4th, the second annual invasive, exotic flower arranging contest (Fig. 29) was held. In addition to sponsoring the contest, Christina Gladmon and I displayed a poster, answered questions, and gave out information (Fig. 30). In early August, Dan Schultz (KLGO) came for a

Figure 29 – An entry in this year's 4th of July Invasive, Exotic Flower Arranging Contest.

training session with myself and Greg Streveler to help with plant identification. In late August, I gave an evening slide presentation at the Glacier Bay Lodge. Finally, in October, I presented a poster at the Committee for Noxious and Invasive Plant Management (CNIPM) conference in Anchorage.

As part of community outreach efforts, I assisted with exotic plant identification on the Gustavus properties of Janet and Joe Lassiter, Heather and Toshua Parker, and Sal and Tom McLaughlin. For the Parkers, I followed up by sending them information on Canada thistle control. I also discussed exotic plant prevention best management practices with Bob Christensen, Environmental Compliance Monitor for the Falls Creek Hydro-electric Project, and Greg Streveler during the Falls Creek road construction.

All GLBA employees received informative emails periodically throughout the summer updating them on the program's progress and species of concern. In addition to posters announcing the 4th of July contest, posters were hung in the park and the community for much of the summer making people aware of the concerns of orange hawkweed and oxeye daisy.

A 2007 priority should be to provide training for the interpretive rangers who interact with the visitors and for maintenance employees that will be working in the field. The 4th of July festivities are an excellent opportunity to reach many Gustavus residents. Work with Gustavus school children, including control events, should be prioritized when school is in session. Finding ways to attract more volunteers to help with control efforts, collect native plant seeds, or otherwise assist the program is also important. New "species of concern" posters for 2007 should include perennial sowthistle and Canada thistle.

Figure 30 – The information table set up in the Gustavus City Park at the 4th of July celebration.

Other Thoughts

Although GLBA and Gustavus are geographically isolated, they are not immune to invasion by non-native species. To date, 48 non-native species have been identified within GLBA and Gustavus, but many more species in nearby communities have not yet been observed, including aggressive species like Japanese knotweed (*Polygonum cuspidatum*). Resources, including time, money, equipment, and personnel, to continue to inventory and control invasive species must be made available consistently for the long-term. Without these resources, the challenges of maintaining the unique assemblage of native species and preserve the vast wilderness in its natural condition will be monumental.

GLBA needs to ensure that all future anthropogenic disturbances be mitigated in the most ecological manner, including pre-construction removal and storage of native vegetation for replanting, collection of local native seeds, restoration, and subsequent control of non-native species. A nursery area and seed bank should be created to facilitate revegetation areas. Christina Gladmon began a seed bank and seed collection protocol.

In addition to the species documented in this report, there are several additional cultivated vegetable and flower species including chives, asparagus, irises, Shasta daisies, and lettuce growing near the homes in Dry Bay and on the Gustavus property owned by GLBA. None of these species currently displays invasive tendencies, but a long-term plan should be in place to remove these plants if the residences become abandoned.

Partnerships focusing on exotic plants should be established with neighboring land managers, including the U.S. Forest Service, City of Gustavus, State of Alaska, and The Nature Conservancy. In addition, relationships should be strengthened with groups such as the Boy Scouts, Girl Scouts, and the Gustavus School from whom control events may be able to recruit volunteers.

Other Non-Plant Exotic Species

Although no inventory efforts have been made to document other exotic taxa, some incidental observations and conversations have identified some non-native animals. In addition to sightings throughout Southeast Alaska, an Atlantic salmon was observed in the upper Doame River of Dry Bay (Capra pers. comm. 2006). Sitka black-tailed deer, which are native to Southeast Alaska but not prevalent in GLBA, were transported to Willoughby Island around the 1920s and have persisted. In 2006, tracks of Sitka black-tailed deer were seen by Ranger Jim Capra on the beach in Dry Bay near the Grand Plateau Glacier outwash (Capra pers. comm.. 2006). The Dry Bay deer are likely from those introduced to the Yakutat area (Merriam et al. 2003). At least one, but more likely two, species of slugs has been introduced to Gustavus and Glacier Bay (Streveler pers. comm.. 2006). An effort to key out slugs should be conducted. European starlings are occasionally observed in Gustavus (Drumheller pers. comm. 2006). Other exotic bird species not yet observed but with expanding ranges include rock pigeons and Eurasian collared doves. North American native bird species with expanding ranges, which now include Gustavus, include brown-headed cowbirds and barred owls (Drumheller pers. comm. 2006). Ants range

from being locally abundant to absent in different areas, and it is unknown what species are present and whether they are native. A similar pattern is present with earthworms. There are likely other exotic invertebrates and pathogens present, but no monitoring effort is occurring.

Within Alaska, there is growing concern about exotic marine species invading. Species already present along the west coast of North America but not yet in Alaska include green crab (*Carcinus maenas*), Chinese mitten crab (*Eriocheir sinensis*), smooth cordgrass (*Spartina alterniflora*), and exotic tunicate species. Glacier Bay's dynamic and productive marine ecosystem could be at risk to invasions. Monitoring programs should begin to ensure early detection of invasion. Greg Ruiz, of the Smithsonian Environmental Research Center, has been coordinating national monitoring programs that GLBA may be able to use.

Recommended Plans for 2007 Field Season

Prevention and proactive removal will save time and money in the future with regard to invasive plant issues. Well-trained personnel are essential for monitoring and control efforts. In addition, park projects should use best management practices to avoid introducing or spreading exotic plants. Educational programs for park staff, Gustavus residents, and visitors will further develop awareness for the issue. This heightened consciousness will improve recruitment of volunteers for control events.

Priority Species for Treatment in 2007:

common burdock
shepherd's purse
mouse-ear chickweed in backcountry
Canada thistle
orchardgrass
quackgrass
orange hawkweed
hairy cat's ear
white deadnettle
oxeye daisy
forget-me-not
reed canarygrass
common timothy
tall buttercup
creeping buttercup
sheep sorrel
perennial sowthistle
comfrey
white clover
red clover

April

- Provide educational program to interpretive rangers during their training.
- Plan for the 2007 field season, including ensuring adequate field assistance will be available.

May

- Provide educational program to maintenance employees working outside and interested community members.
- Survey for common dandelions when they are in peak bloom. Recruit volunteer crews to remove plants from most frequented areas near the Lodge and VIS.
- Encourage Glacier Bay Lodge to plant native species and/or review plant choices.
- Plan and deliver a program for the Gustavus School before the school year ends.
- Provide educational programs for park staff, community members, and visitors.
- Collect specimens absent from herbarium.

June

- Continue inventorying and controlling all non-native species.
- Continue inventorying park to determine distribution of non-native species.
- Remove *Myosotis scorpioides* plants near lodge.
- Provide educational programs for park staff, community members, and visitors.
- Collect specimens absent from herbarium.
- Ongoing data processing.

July

- Continue inventorying and controlling all non-native species.
- Sponsor 4th of July contest at Gustavus celebration.
- Re-treat tall buttercup near outer dock before middle of the month.
- Re-treat reed canarygrass throughout Bartlett Cove.
- Control creeping buttercup throughout Bartlett Cove.
- Re-treat and locate new populations of oxeye daisy.
- Go to Dry Bay before the middle of the month for inventory and control work. Focus on controlling oxeye daisy, monitoring bigleaf lupine, and re-inventorying for native and exotic *Taraxacum*. Allocate at least 3 days for 2 people for daisy control.
- Provide educational programs for park staff, community members, and visitors.
- Collect specimens absent from herbarium.
- Ongoing data processing.

August

- Control timothy and orchardgrass, particularly along the road.
- Continue inventorying and controlling all non-native species.
- Provide educational programs for park staff, community members, and visitors.
- Collect specimens absent from herbarium.
- Ongoing data processing.

September

- Continue inventorying and controlling all species.
- Provide educational programs for park staff, community members, and visitors.
- Collect specimens absent from herbarium.
- Ongoing data processing.

October - November

- Complete data processing and write reports.
- Plan for 2007.

Acknowledgements

Susan Boudreau and Lewis Sharman are always available to assist and guide me at Glacier Bay. At the regional level, Jeff Heys provides immense programmatic and other assistance. For funding my position, I would like to thank the Alaska Region Exotic Plant Management Team. Christina Gladmon, ACF intern, was an invaluable assistant in the field and in the office this summer. The GLBA maintenance division has loaned tools, and in particular, Dean Waguespack has incinerated over 1.5 tons of invasive plants, which are not particularly combustible. My deepest appreciation goes to all the volunteers who assisted inventorying, controlling plants, driving a vessel, pointing me to plants I need to check out, and otherwise, including the entire TCCC crew, Julie da Silva, David Deyette, Linda Lieberman, Gus Martinez, Sol Martinez, Kelly Nemeth, Jamie Ogilvy, Melissa Senac, Maya Seraphin, Lewis Sharman, Rowan Sharman, Gregg Shirley, Justin Smith, Greg Streveler, Dan Van Leeuwen, Phoebe Vanselow, and Kiana Young. Without these volunteers and other support, I would have accomplished very little this summer.

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Appendices

Appendix A – List of known invasive plants within or near GLBA

Common Name	Scientific Name	When Observed[a]	Region Observed				AK Weeds Ranking[b]
			Bartlett Cove	Back-country	Dry Bay	Gustavus	
bishop's goutweed	*Aegopodium podagraria*	4				X	not ranked
wild chives	*Allium schoenoprasum* **	3, 4			X		not ranked
meadow foxtail	*Alopecurus pratensis*	1	X				not ranked
common burdock	*Arctium minus*	4	X				not ranked
smooth brome	*Bromus inermis*	1, 2, 3, 4				X	62
shepherd's purse	*Capsella bursa-pastoris*	1, 3, 4	X	X		X	40
mouse-ear chickweed	*Cerastium fontanum*	1, 2, 3, 4	X	X	X	X	39
Canada thistle	*Cirsium arvense*	4				X	76
orchardgrass	*Dactylis glomerata*	3, 4	X			X	53
quackgrass	*Elymus repens*	3, 4	X				59
orange hawkweed	*Hieracium aurantiacum*	3, 4				X	79
foxtail barley	*Hordeum jubatum* **	1, 3, 4	X	X		X	63
hairy cat's ear	*Hypochaeris radicata*	3, 4	X			X	not ranked
white deadnettle	*Lamium album*	3, 4	X				not ranked
oxeye daisy	*Leucanthemum vulgare*	2, 3, 4	X	X	X	X	61
yellow toadflax	*Linaria vulgaris*	1				X	69
perennial ryegrass	*Lolium perenne* ssp. *perenne/multiflorum*	1, 2, 3, 4	X				41
bigleaf lupine	*Lupinus polyphyllus* **	2, 3, 4			X	X	55
maltesecross	*Lychnis chalcedonica*	2				X	not ranked
pineapple weed	*Matricaria discoidea*	1, 3, 4	X		X	X	33
white sweetclover	*Melilotus alba*	1				X	80
mint	*Mentha* sp.	4	X				not ranked
forget-me-not	*Myosotis scorpioides* & *M. alpestris* ssp. *asiatica* **	1, 3, 4	X			X	not ranked
reed canarygrass	*Phalaris arundinacea*	1, 2, 3, 4	X	X	X	X	83

Common Name	Scientific Name	When Observed[a]	Region Observed				AK Weeds Ranking[b]
			Bartlett Cove	Back-country	Dry Bay	Gustavus	
common timothy	*Phleum pratense*	1, 2, 3, 4	X		X	X	56
common plantain	*Plantago major*	2, 3, 4	X		X	X	44
annual bluegrass	*Poa annua*	4	X	X		X	46
fowl bluegrass	*Poa palustris*	1					not ranked
Kentucky bluegrass	*Poa pratensis*	4	X			X	52
prostrate knotweed	*Polygonum aviculare*	4				X	45
tall buttercup	*Ranunculus acris*	3, 4	X			X	54
creeping buttercup	*Ranunculus repens*	3, 4	X		X	X	54
rhubarb	*Rheum rhabarbarum*	3, 4	X		X	X	not ranked
rugosa rosa	*Rosa rugosa*	4				X	not ranked
unidentified rose	*Rosa* sp.	3, 4				X	not ranked
red raspberry	*Rubus idaeus* **	1, 3, 4	X	X	X	X	not ranked
sheep sorrel	*Rumex acetosella*	1, 3, 4	X			X	51
curly dock	*Rumex crispus*	3				X	48
perennial sowthistle	*Sonchus arvensis*	3, 4		X		X	61
European mountain-ash	*Sorbus aucuparia*	3, 4				X	59
chickweed	*Stellaria media*	1, 3, 4	X	X		X	42/54
common comfrey	*Symphytum officinale*	3, 4	X		X	X	not ranked
common tansy	*Tanacetum vulgare*	2, 3, 4				X	57
common dandelion	*Taraxacum officinale* ssp. *officinale*	1, 2, 3, 4	X	X	X	X	58
alsike clover	*Trifolium hybridum*	3				X	57
red clover	*Trifolium pratense*	1, 2, 3, 4	X		X	X	53
white clover	*Trifolium repens*	1, 2, 3, 4	X			X	59
common wheat	*Triticum aestivum*	2, 3, 4	X				not ranked

[a] - 1 = Herbarium specimen; 2 = 2004 Exotic Plant Inventory; 3 = 2005 Exotic Plant Inventory; 4 = 2006 Exotic Plant Inventory

[b] - Ranking according to threat to native ecosystems in Alaska from low (0) to high (100) (http://akweeds.uaa.alaska.edu/akweeds_ranking_geo.htm) accessed 11/21/2006. For *Stellaria media* , the first number corresponds to disturbed sites and the second to sea bird colonies.

** - Species nativity in question for this location

Appendix B – 2004-2006 location maps of selected invasive plants in GLBA

Bishop's Goutweed *(Aegopodium podagraria)* Distribution
Wild Chive (*Allium schoenoprasum*) Distribution
Common Burdock (*Arctium minus*) Distribution
Smooth Brome (*Bromus inermis*) Distribution
Shepherd's Purse (*Capsella bursa-pastoris*) Distribution
Mouse-ear Chickweed (*Cerastium fontanum*) Distribution
Canada Thistle (*Cirsium arvense*) Distribution
Orchard Grass (*Dactylis glomerata*) Distribution
Quackgrass (*Elymus repens*) Distribution
Hairy Cat's Ear (*Hypochaeris radicata*) Distribution
White Deadnettle (*Lamium album*) Distribution
Oxeye Daisy (*Leucanthemum vulgare*) Distribution
Perennial Ryegrass (*Lolium perenne*) Distribution
Bigleaf Lupine (*Lupinus polyphyllus*) Distribution
Maltesecross (*Lychnis chalcedonica*) Distribution
Pineapple Weed (*Matricaria discoidea*) Distribution
Mint (*Mentha* sp.) Distribution
Forget-me-not (*Myosotis* spp.) Distribution
Reed Canarygrass (*Phalaris arundinacea*) Distribution
Common Timothy (*Phleum pratense*) Distribution
Common Plantain (*Plantago major*) Distribution
Annual Bluegrass (*Poa annua*) Distribution
Kentucky Bluegrass (*Poa pratensis*) Distribution
Tall Buttercup (*Ranunculus acris*) Distribution
Creeping Buttercup (*Ranunculus repens*) Distribution
Rhubarb (*Rheum rhabarbarum*) Distribution
Rugosa Rose (*Rosa rugosa*) Distribution
Red Raspberry (*Rubus idaeus*) Distribution
Rumex acetosella (*Sheep Sorrel*) Distribution
Perennial Sowthistle (*Sonchus arvensis*) Distribution
European Mountain-ash (*Sorbus aucuparia*) Distribution
Chickweed (*Stellaria media*) Distribution
Common Comfrey (*Symphytum officinale*) Distribution
Common Tansy (*Tanacetum vulgare*) Distribution
Common Dandelion (*Taraxacum officinale* ssp. *officinale*) Distribution
Red Clover (*Trifolium pratense*) Distribution
White Clover (*Trifolium repens*) Distribution
Common Wheat (*Triticum aestivum*) Distribution
Areas of No Exotic Plants

Bishop's Goutweed - *Aegopodium podagraria*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

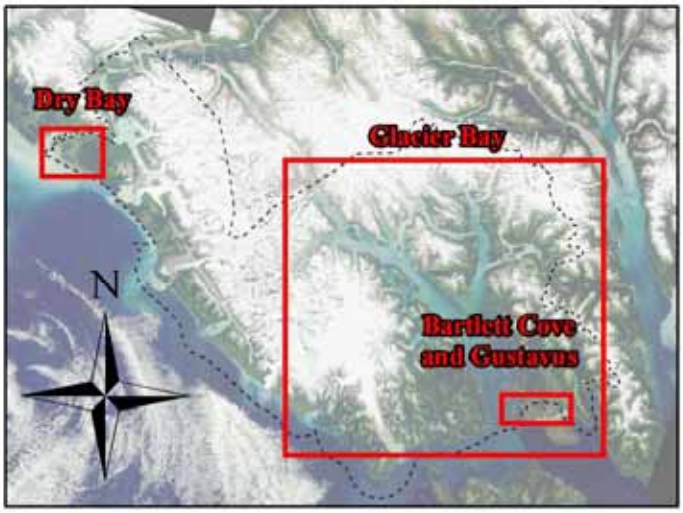
Present in 2005 Survey Area

Present in 2004 Survey Area

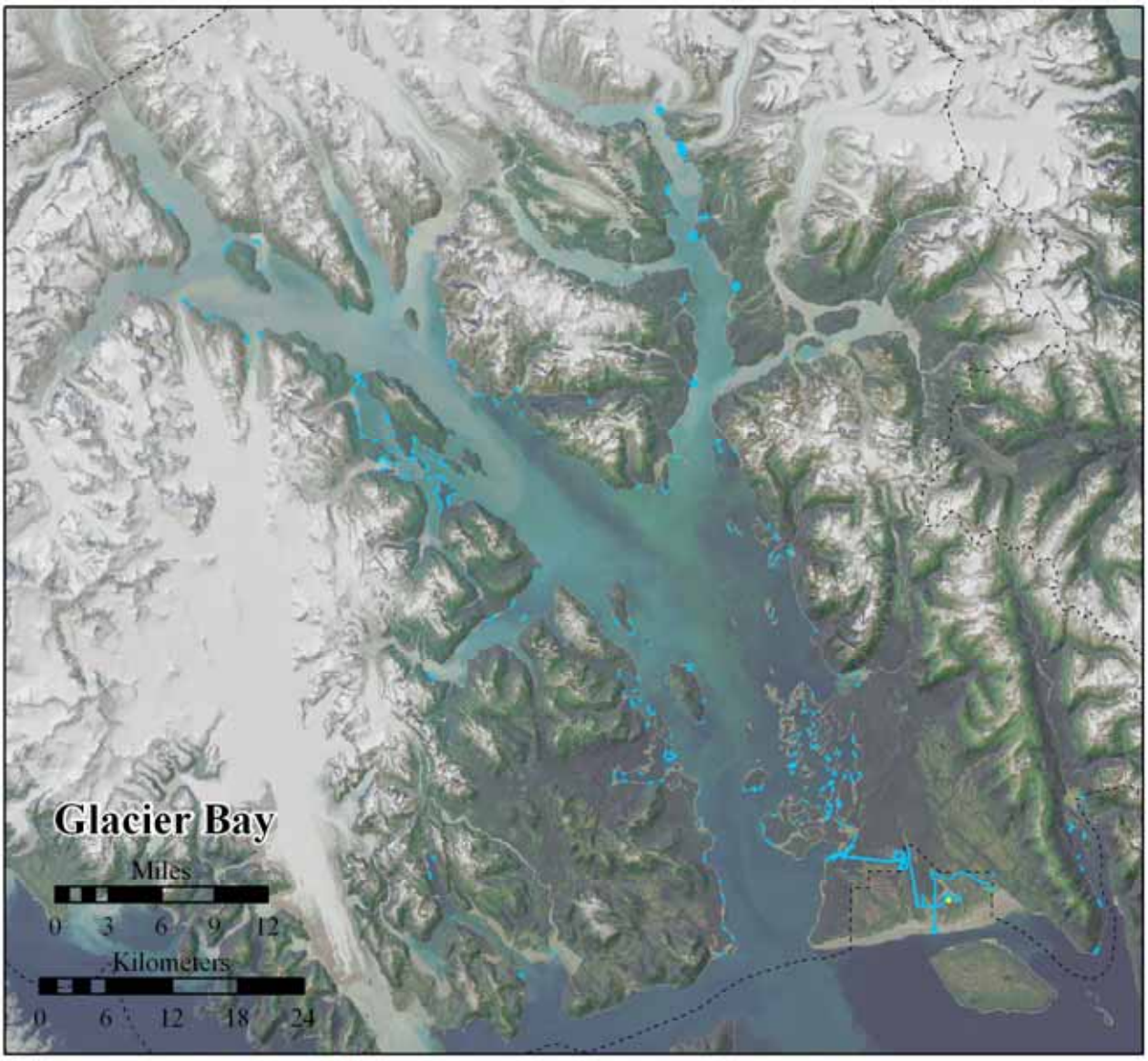
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Bishop's Goutweed - *Aegopodium podagraria*



Wild Chive - *Allium schoenoprasum*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

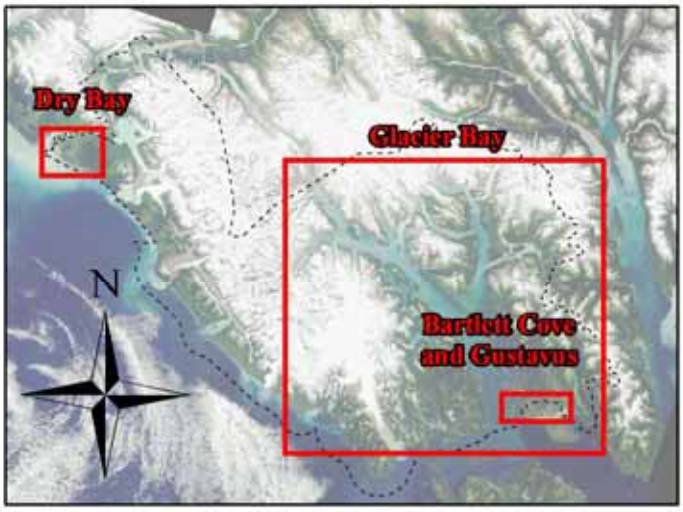
Present in 2005 Survey Area

Present in 2004 Survey Area

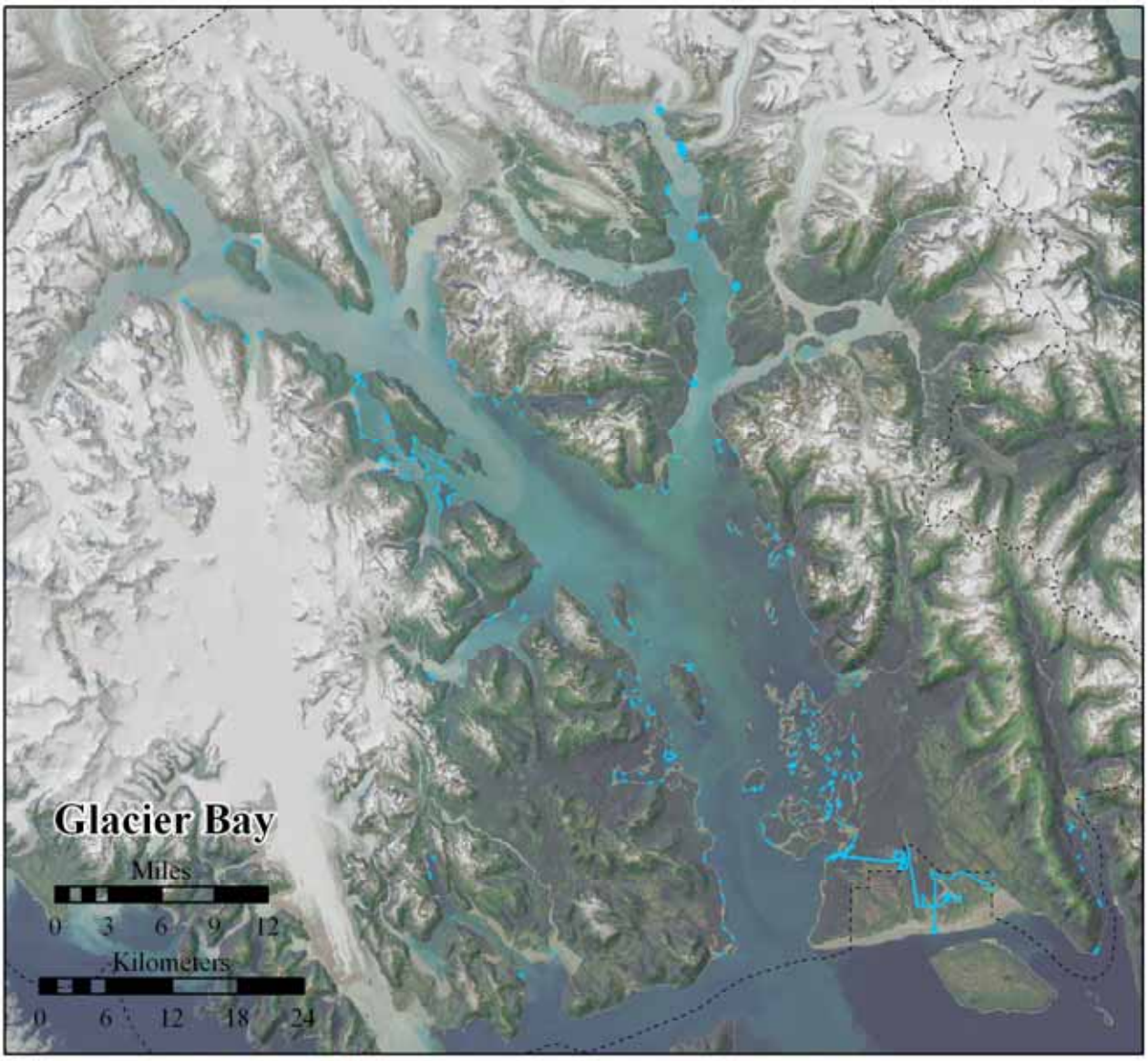
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Wild Chive - *Allium schoenoprasum*



Common Burdock - *Arctium minus*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

Present in 2005 Survey Area

Present in 2004 Survey Area

Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
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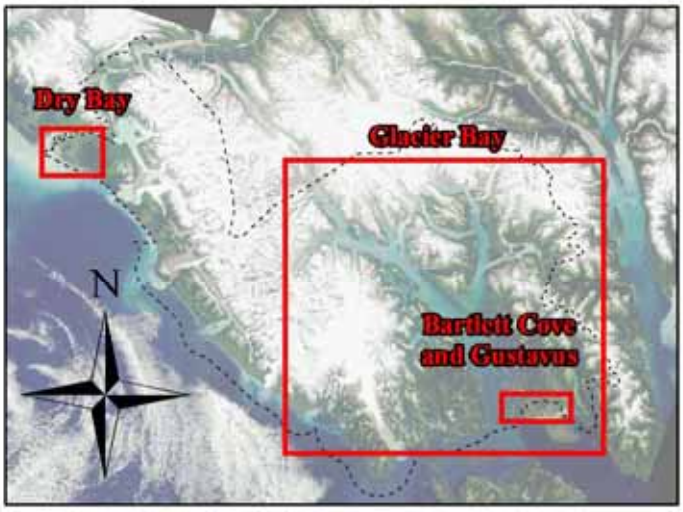
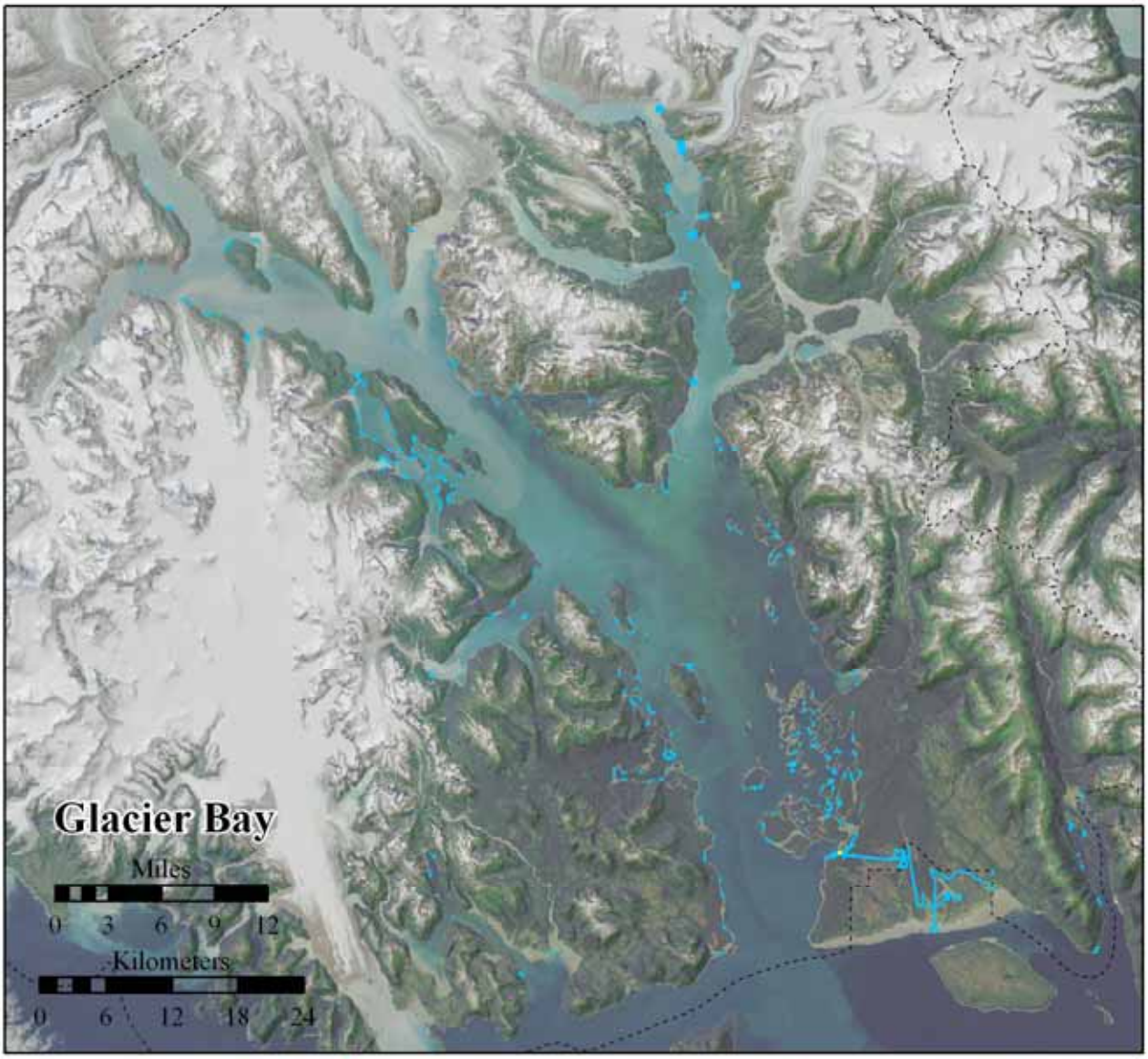
Created: November 2006



Common Burdock - *Arctium minus*



Smooth Brome - *Bromus inermis*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

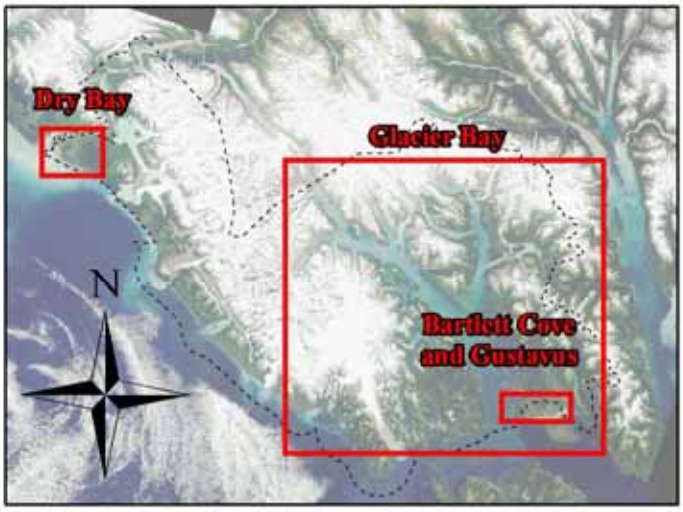
Present in 2005 Survey Area

Present in 2004 Survey Area

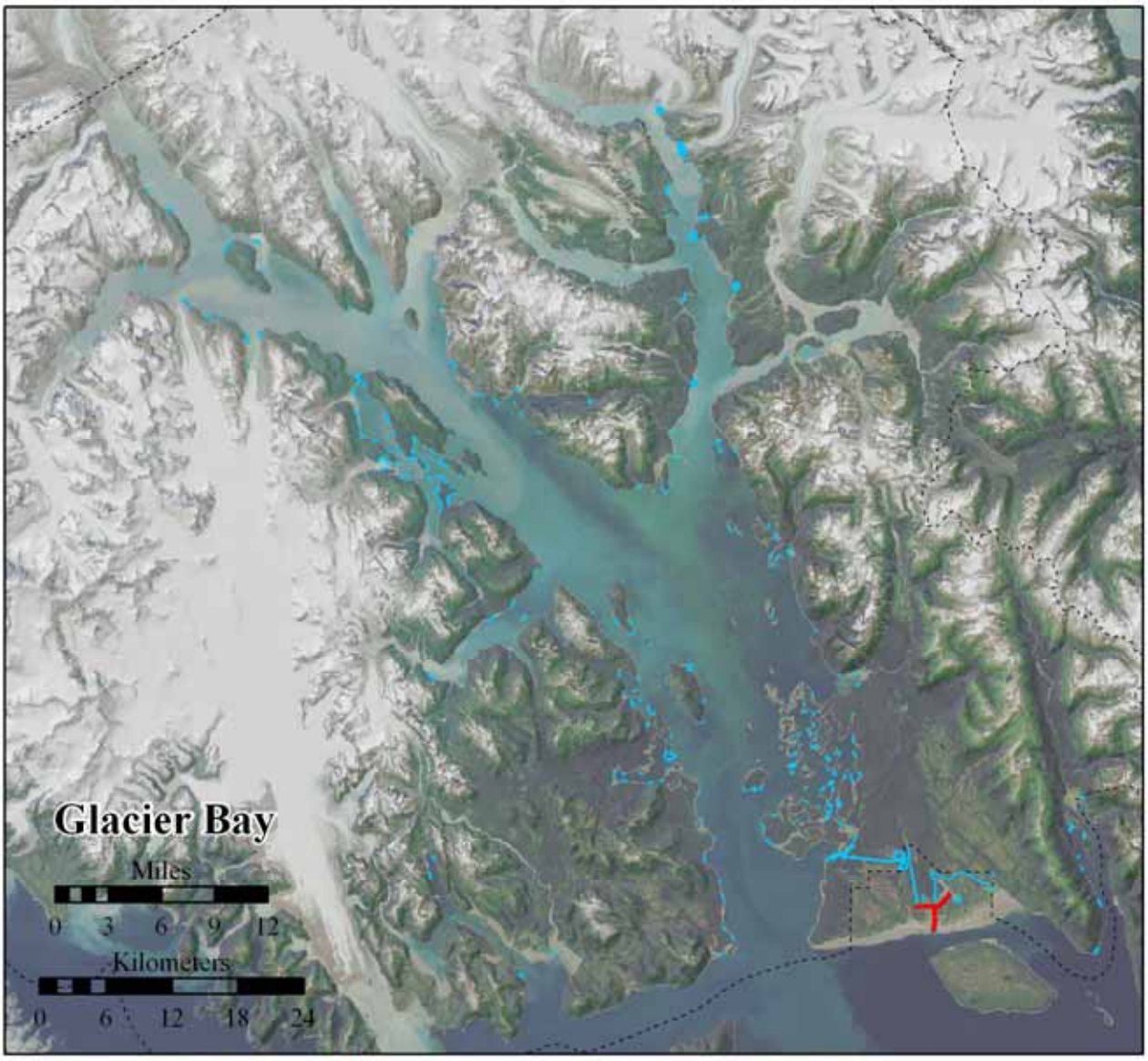
Absent in 2004-2006 Surveys

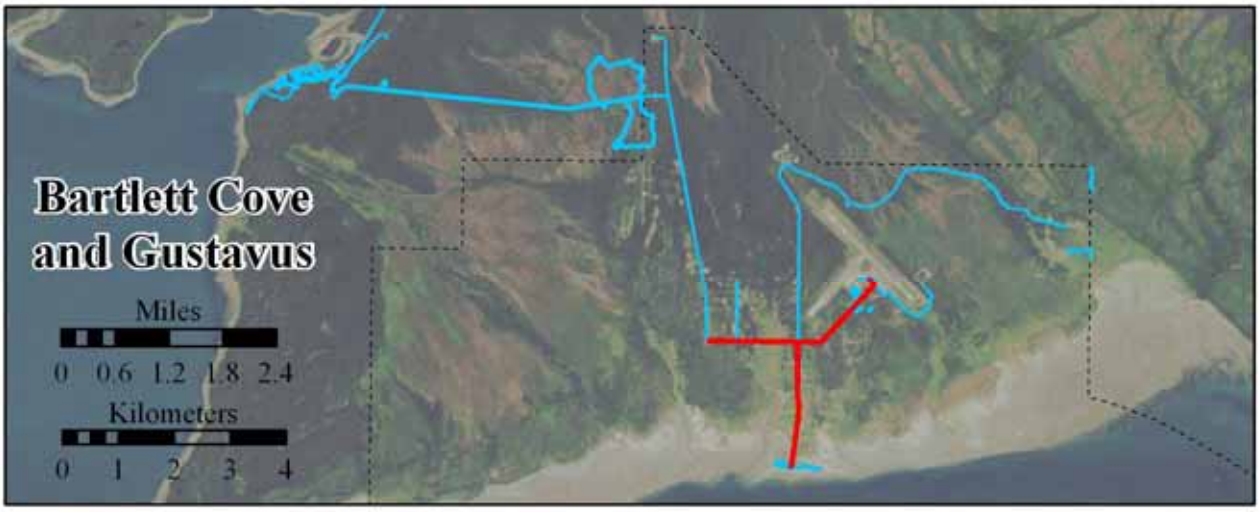
GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Smooth Brome - *Bromus inermis*





Shepherd's Purse - *Capsella bursa-pastoris*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

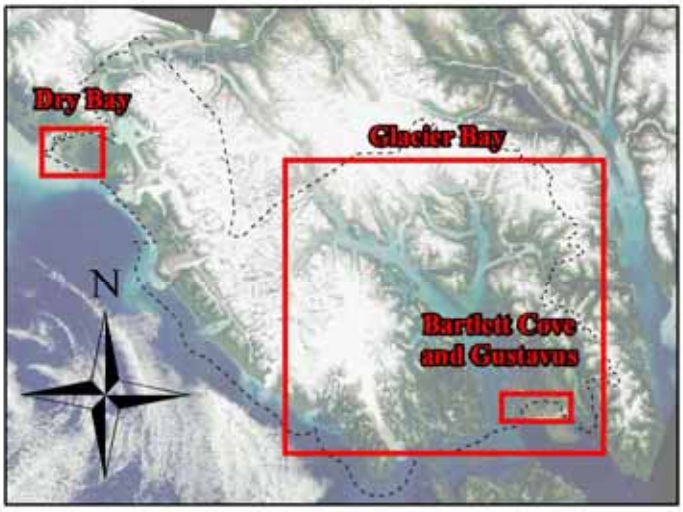
Present in 2005 Survey Area

Present in 2004 Survey Area

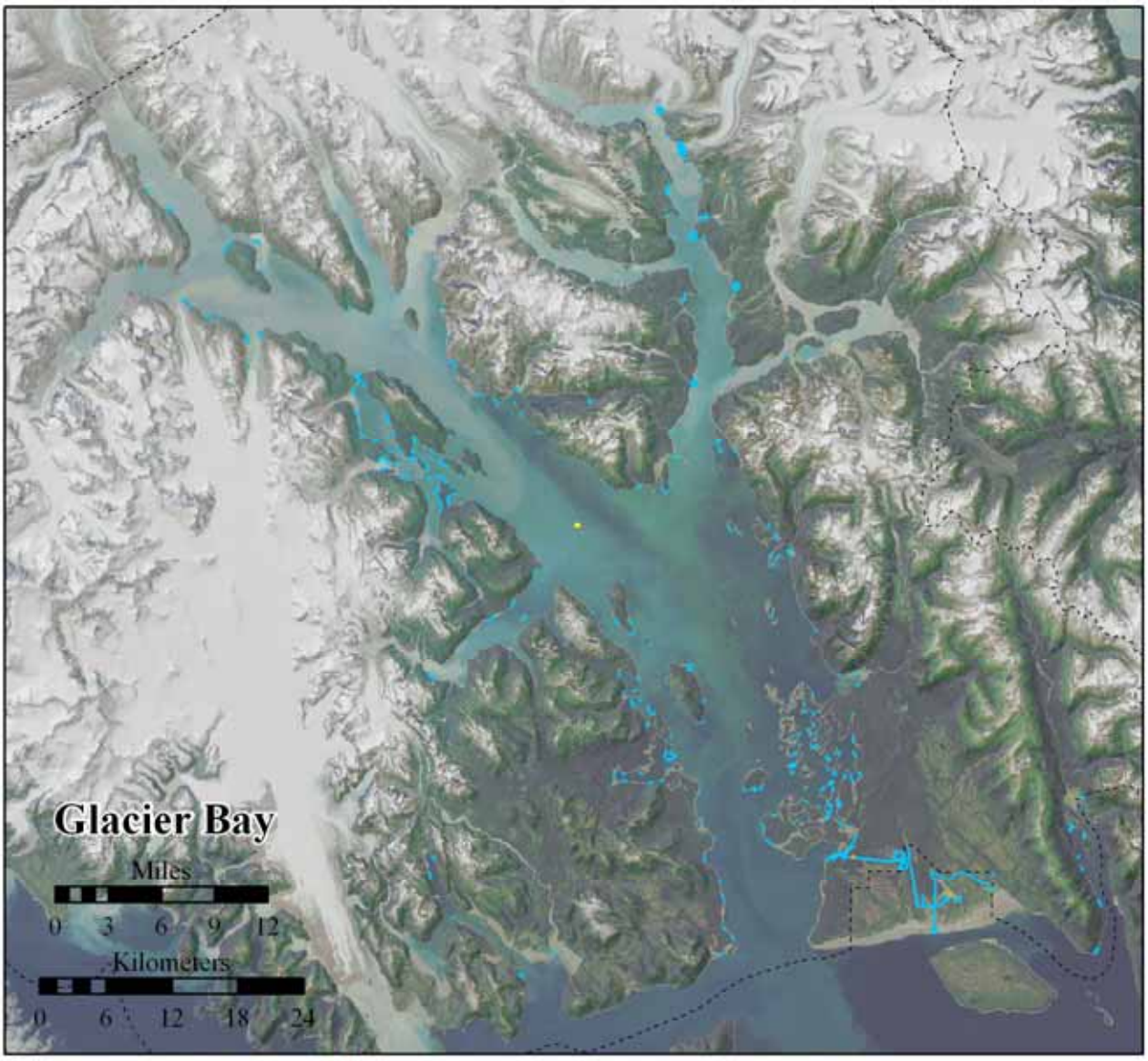
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006

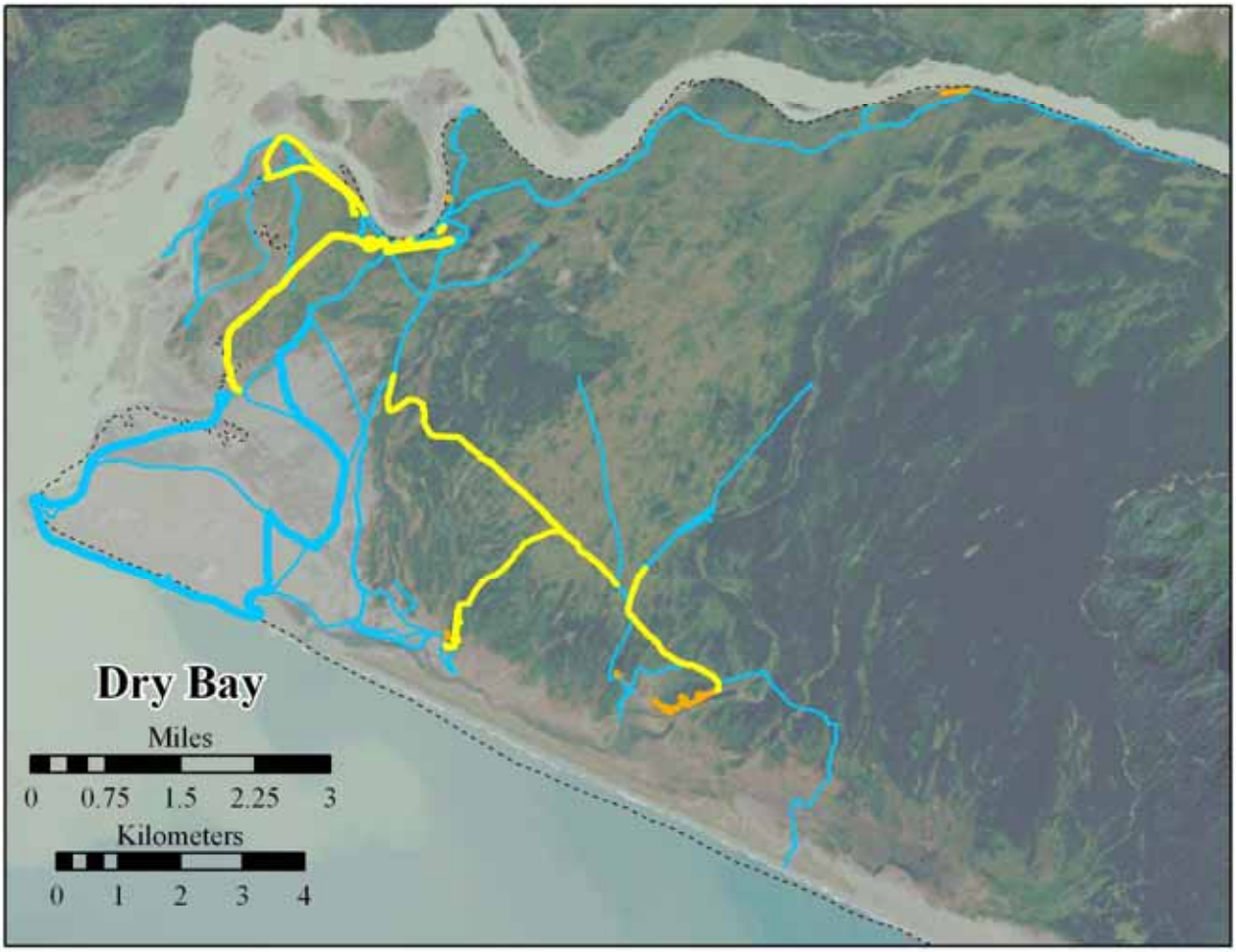


Shepherd's Purse - *Capsella bursa-pastoris*



Mouse-ear Chickweed - *Cerastium fontanum*

in Glacier Bay National Park and Preserve



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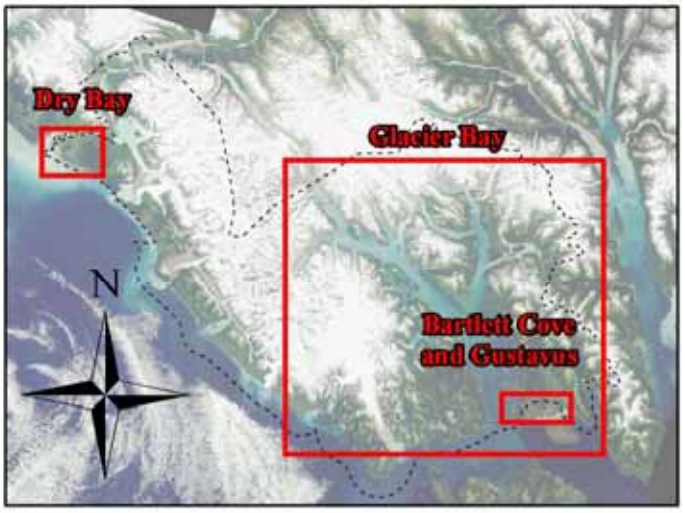
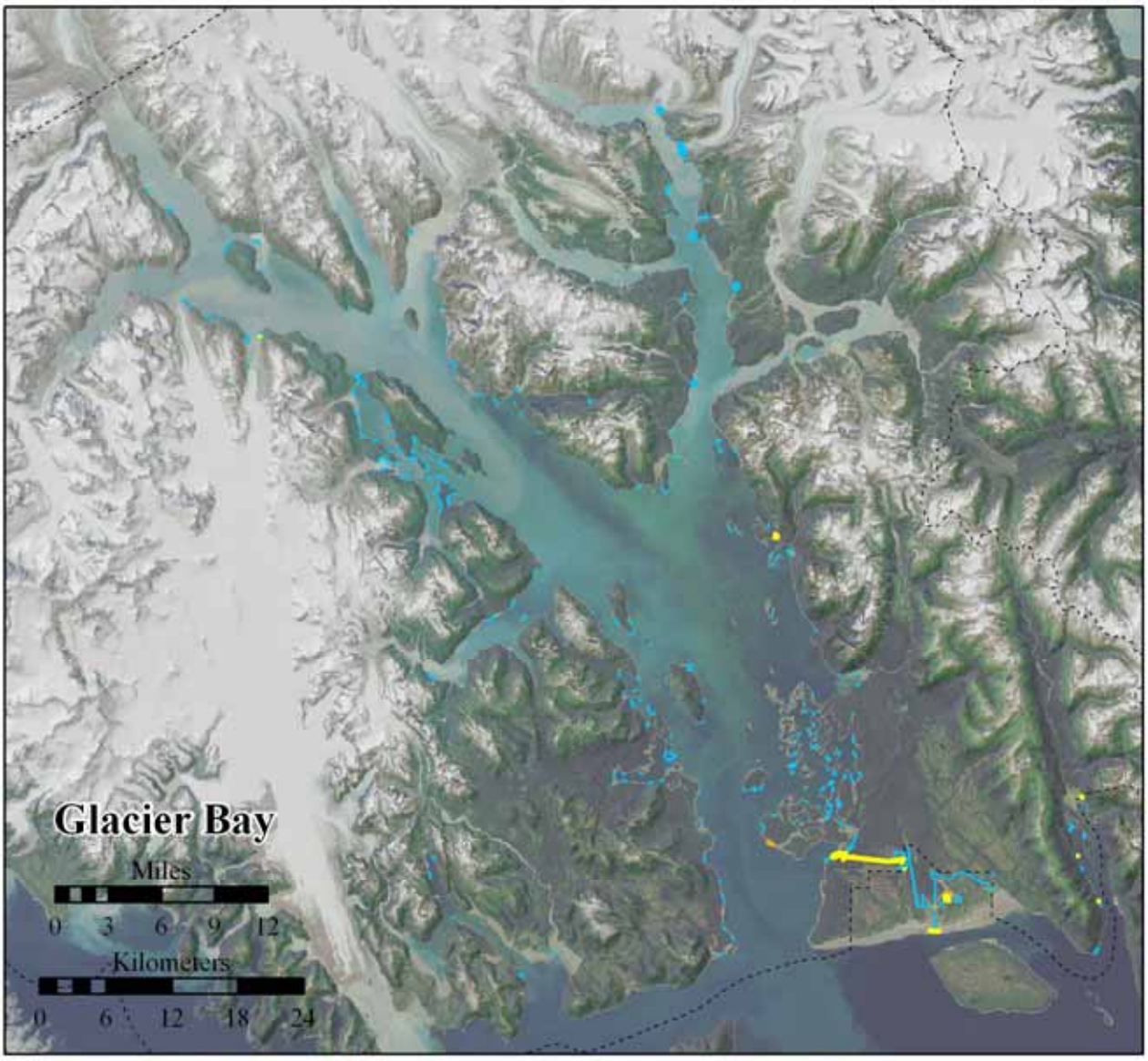
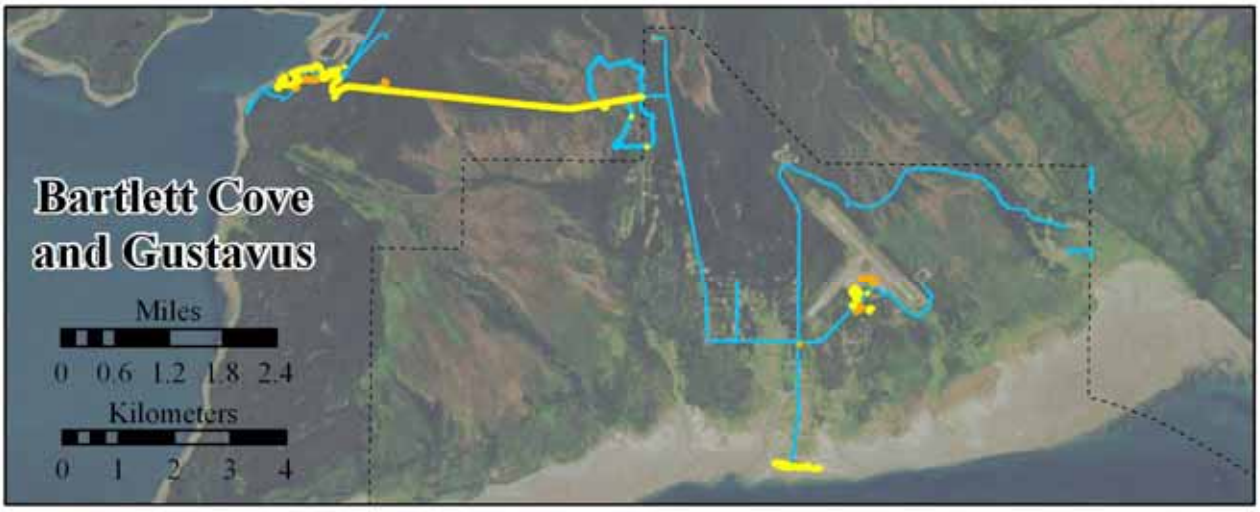


Mouse-ear Chickweed - *Cerastium fontanum*





Canada Thistle - *Cirsium arvense*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

Present in 2005 Survey Area

Present in 2004 Survey Area

Absent in 2004-2006 Surveys

GLBA Boundary

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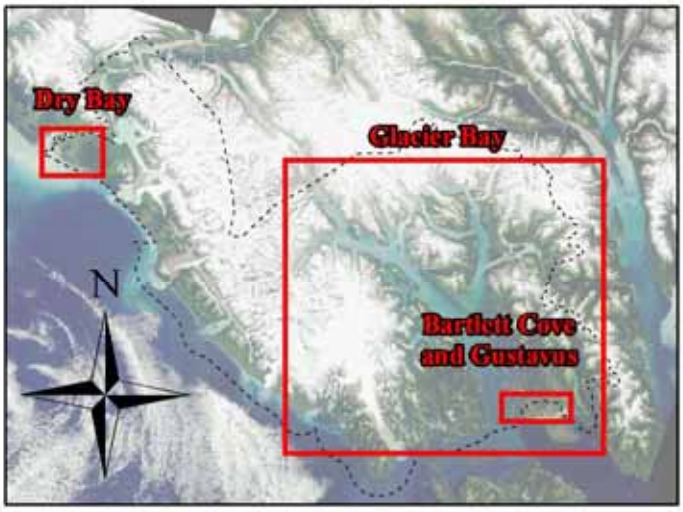
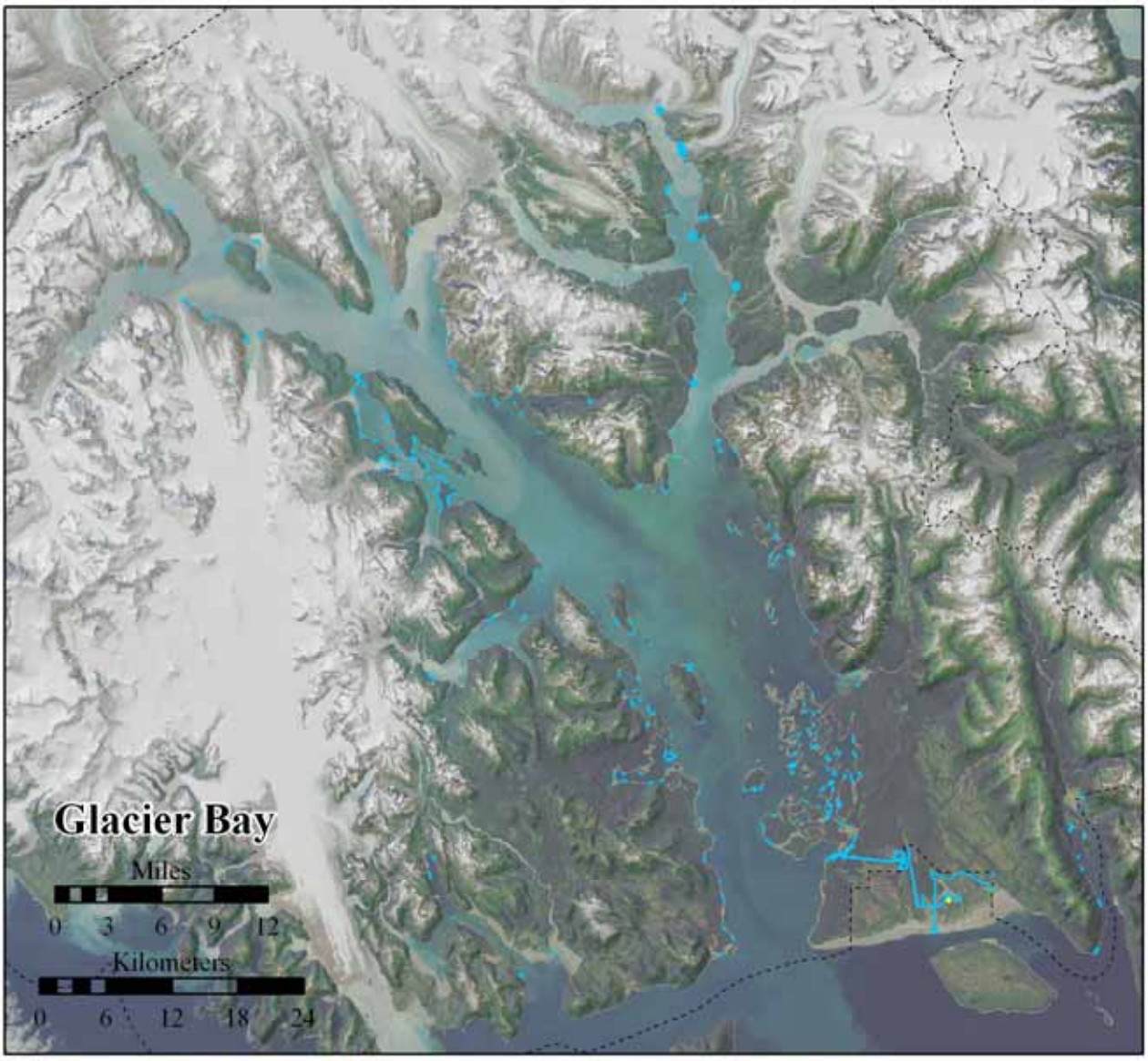


Canada Thistle - *Cirsium arvense*



Orchard Grass - *Dactylis glomerata*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

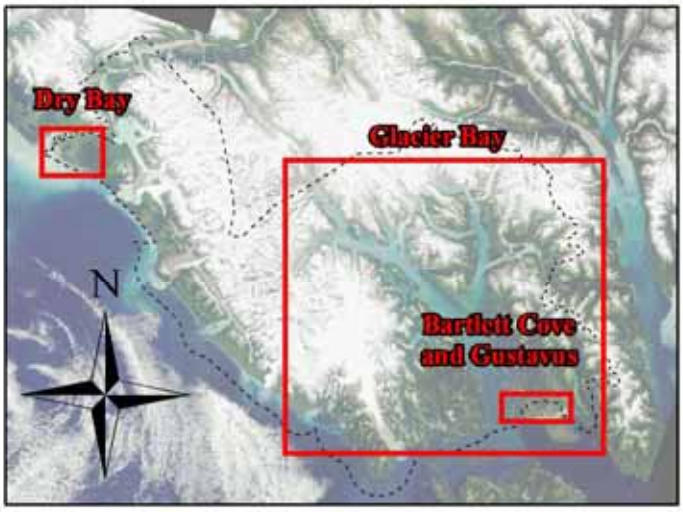
Present in 2005 Survey Area

Present in 2004 Survey Area

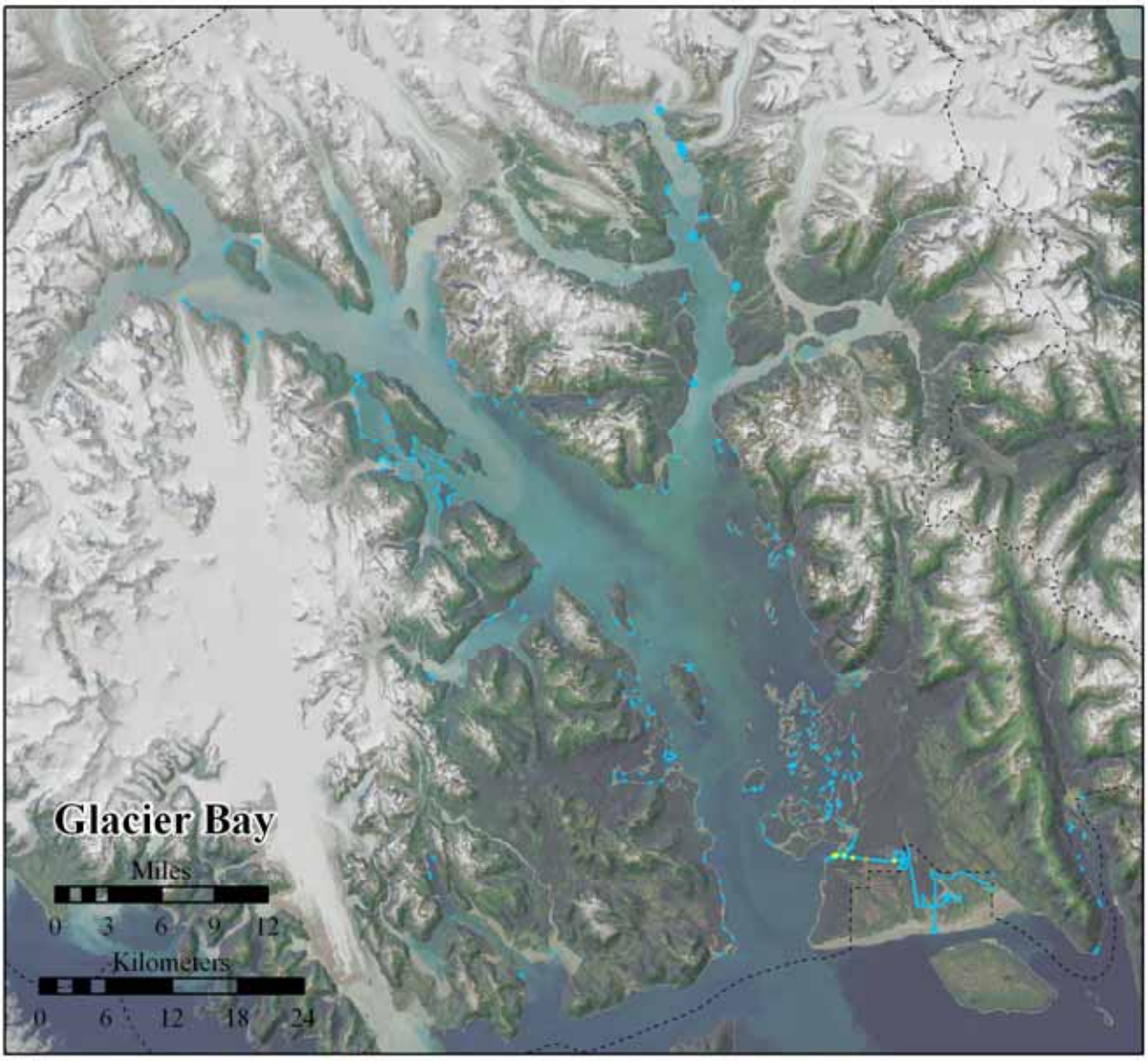
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Orchard Grass - *Dactylis glomerata*



Quackgrass - *Elymus repens*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

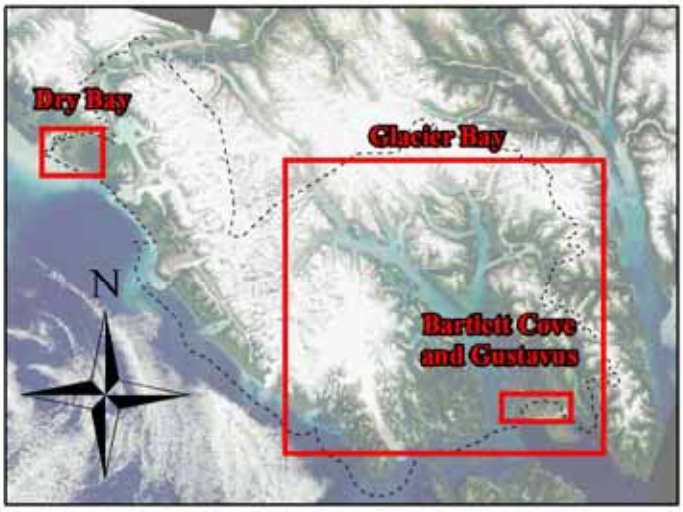
Present in 2005 Survey Area

Present in 2004 Survey Area

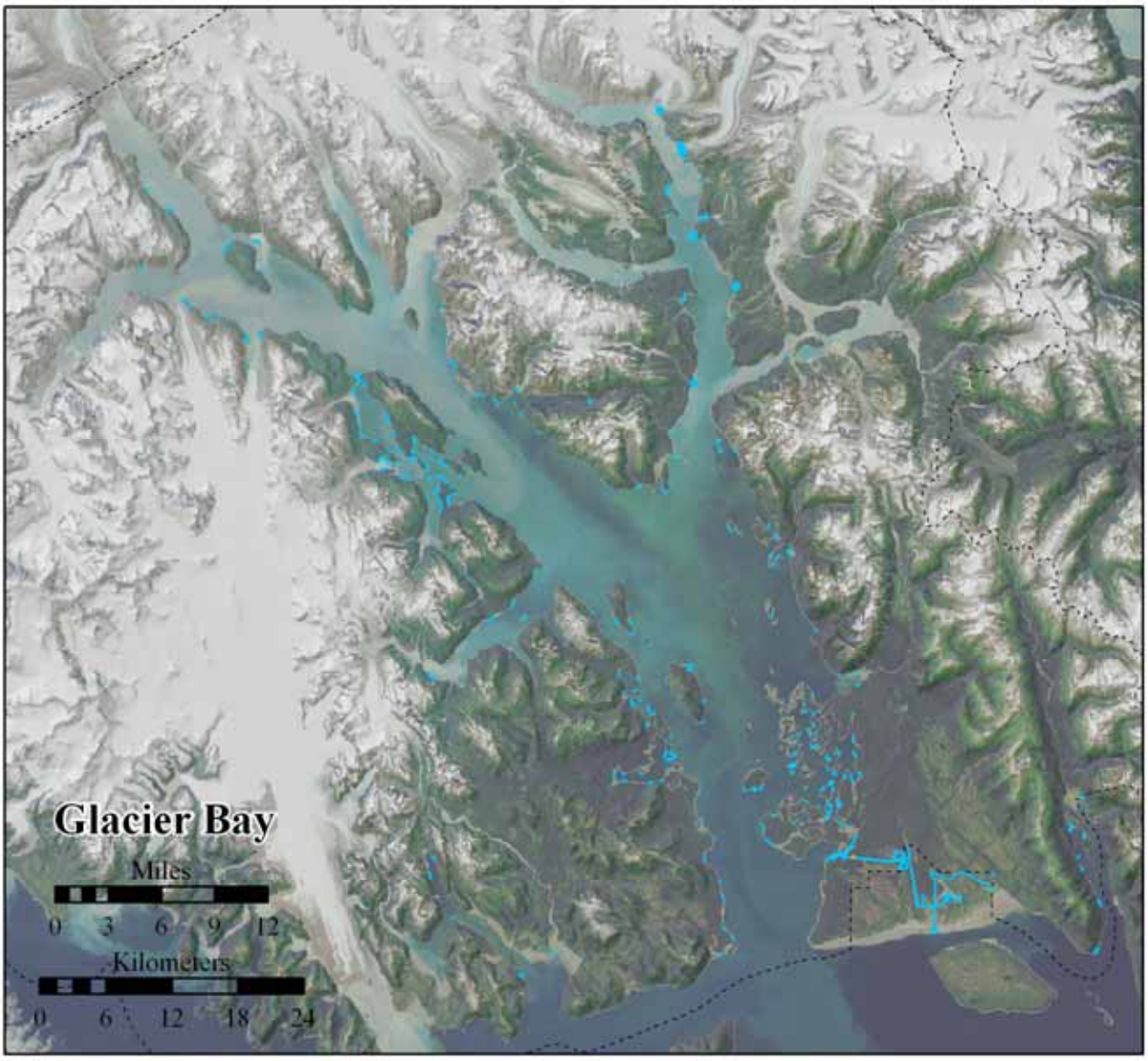
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Quackgrass - *Elymus repens*



Hairy Cat's Ear - *Hypochaeris radicata*

in Glacier Bay National Park and Preserve

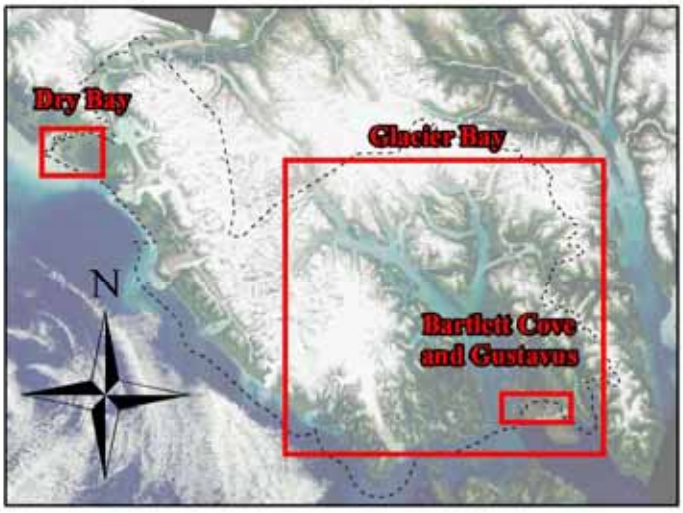
Present in 2006 Survey Area

Present in 2005 Survey Area

Present in 2004 Survey Area

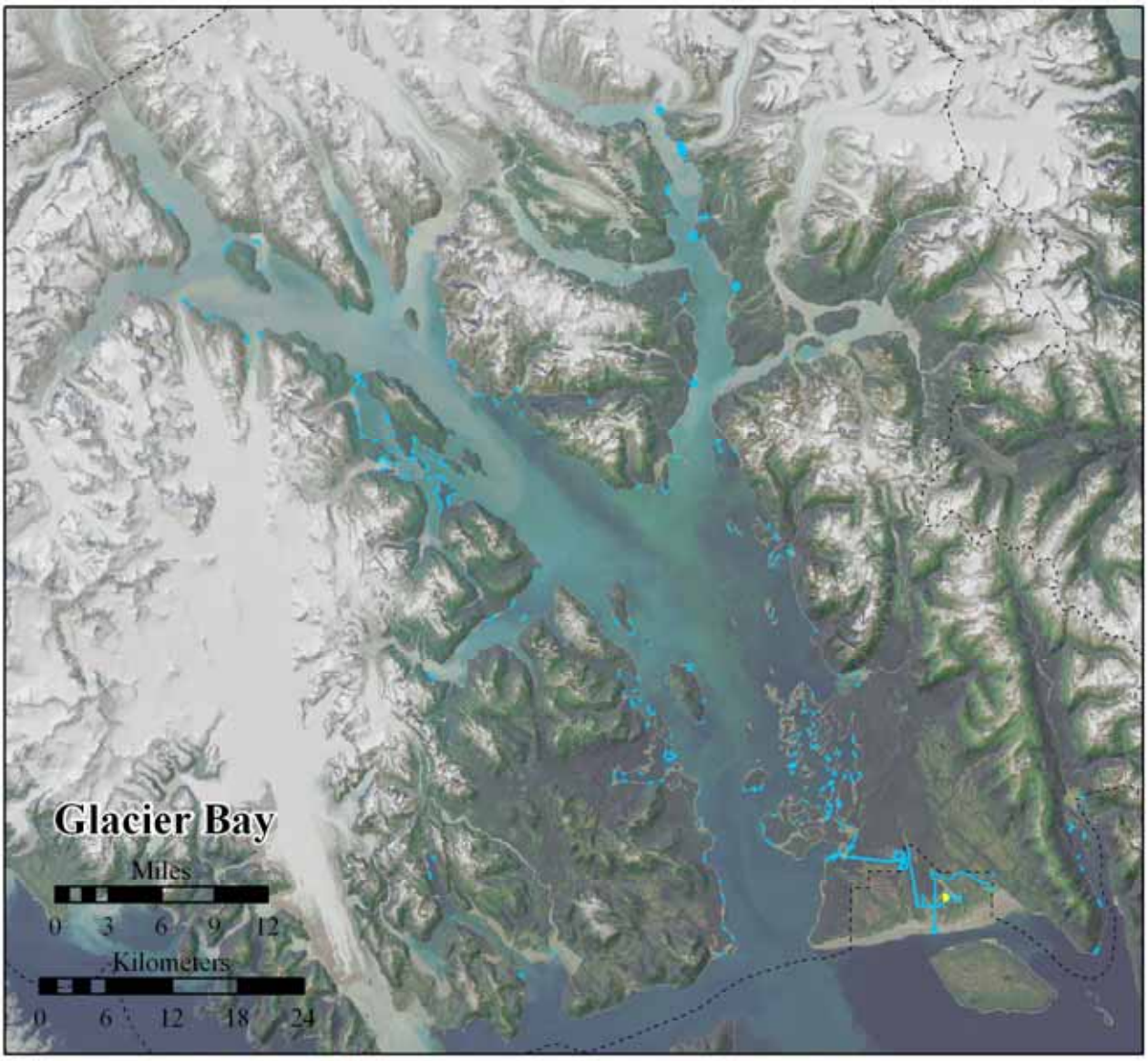
Absent in 2004-2006 Surveys

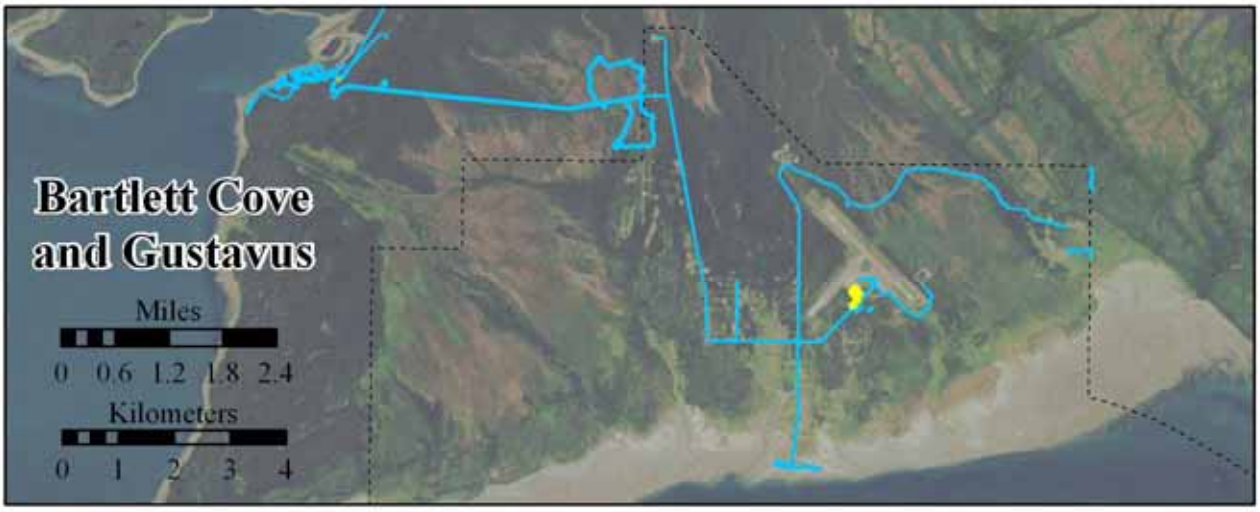
GLBA Boundary



Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006

Hairy Cat's Ear - *Hypochaeris radicata*





White Deadnettle - *Lamium album*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

Present in 2005 Survey Area

Present in 2004 Survey Area

Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
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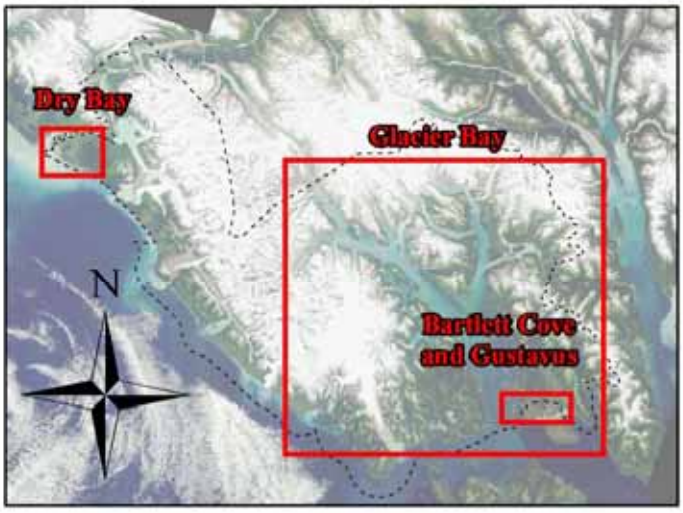
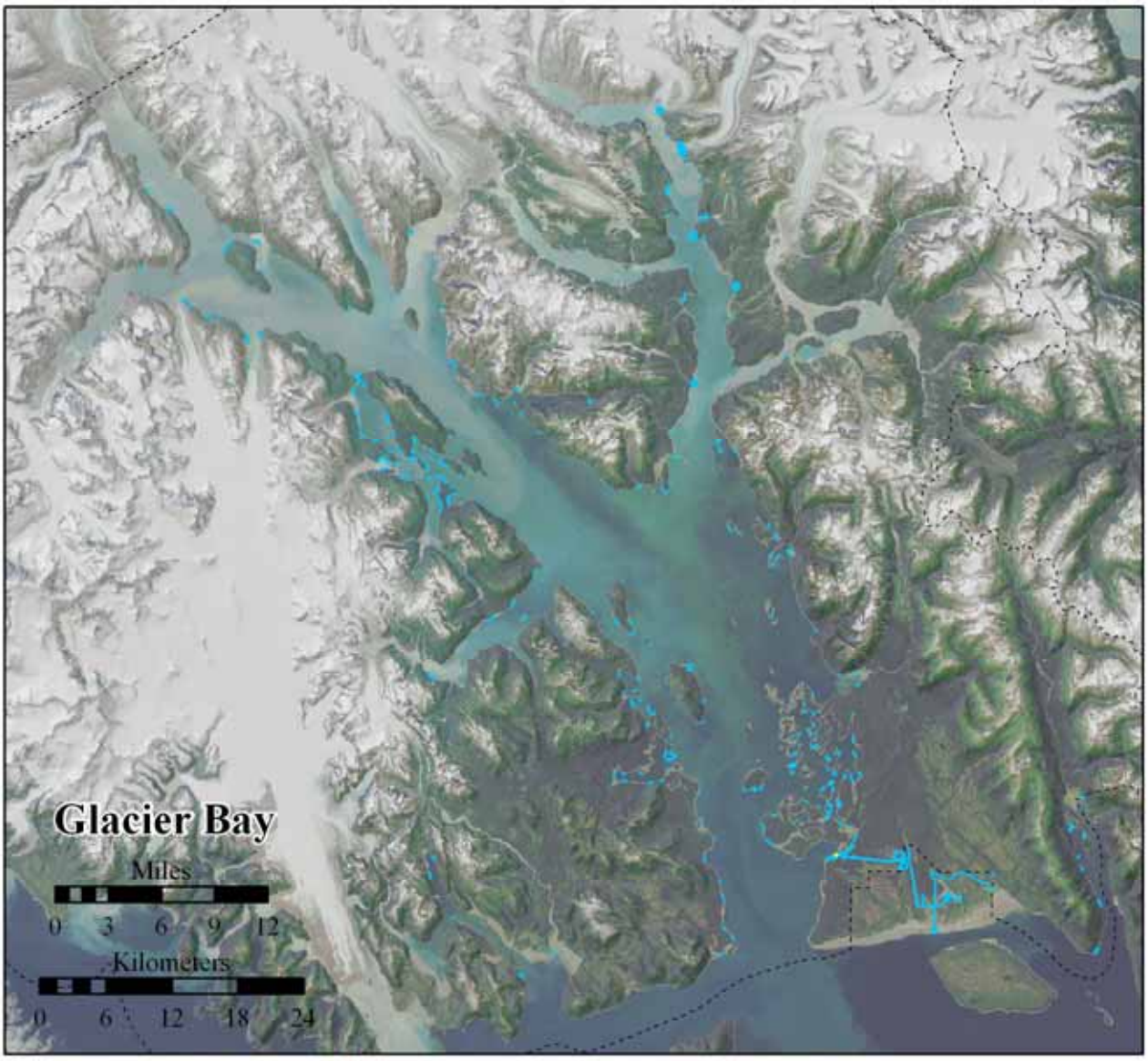
Created: November 2006



White Deadnettle - *Lamium album*



Ox-eye Daisy - *Leucanthemum vulgare*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

Present in 2005 Survey Area

Present in 2004 Survey Area

Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
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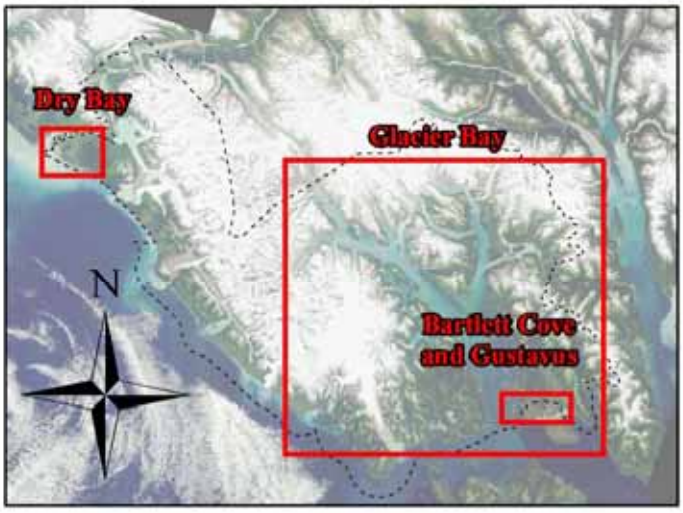
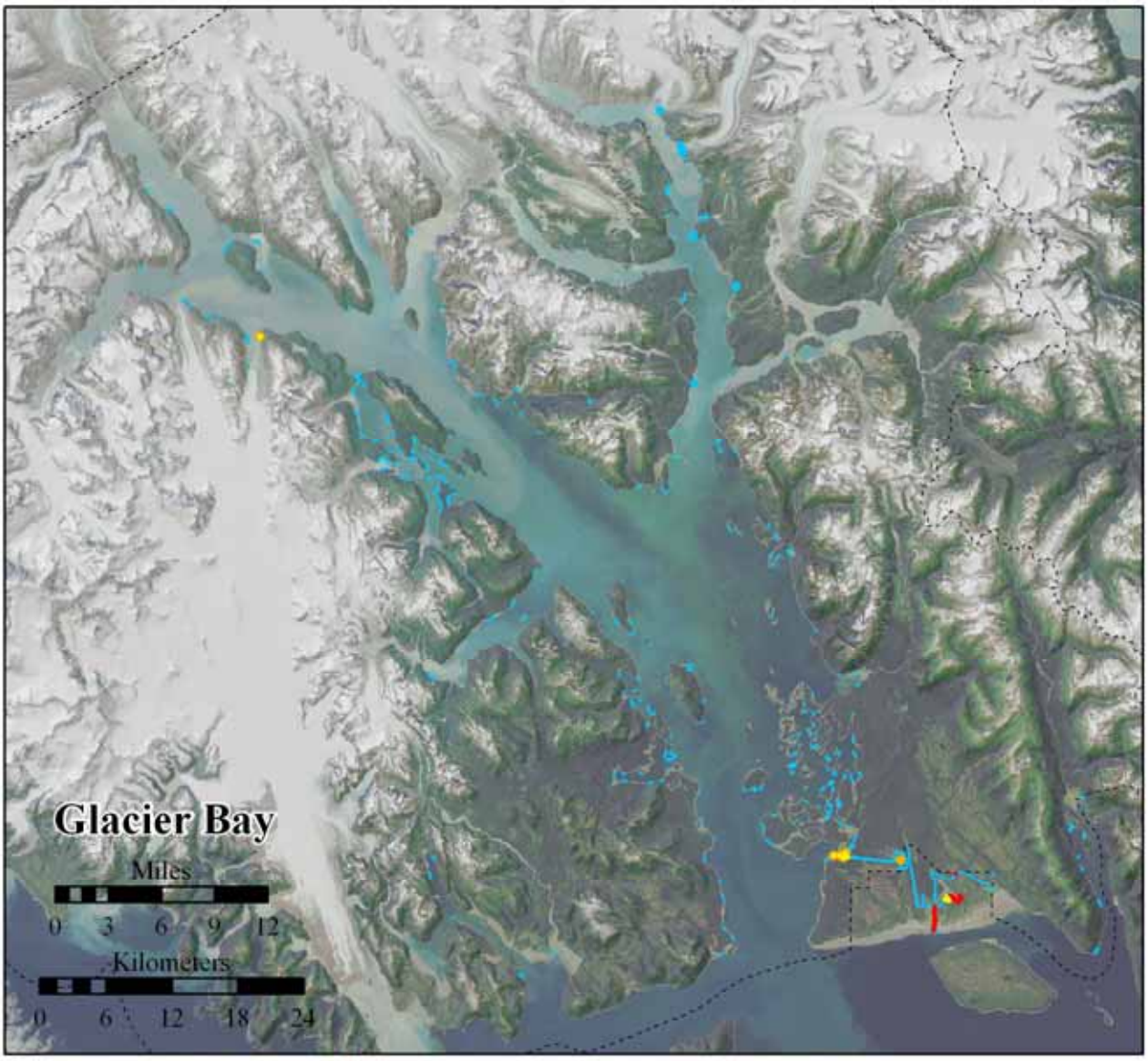
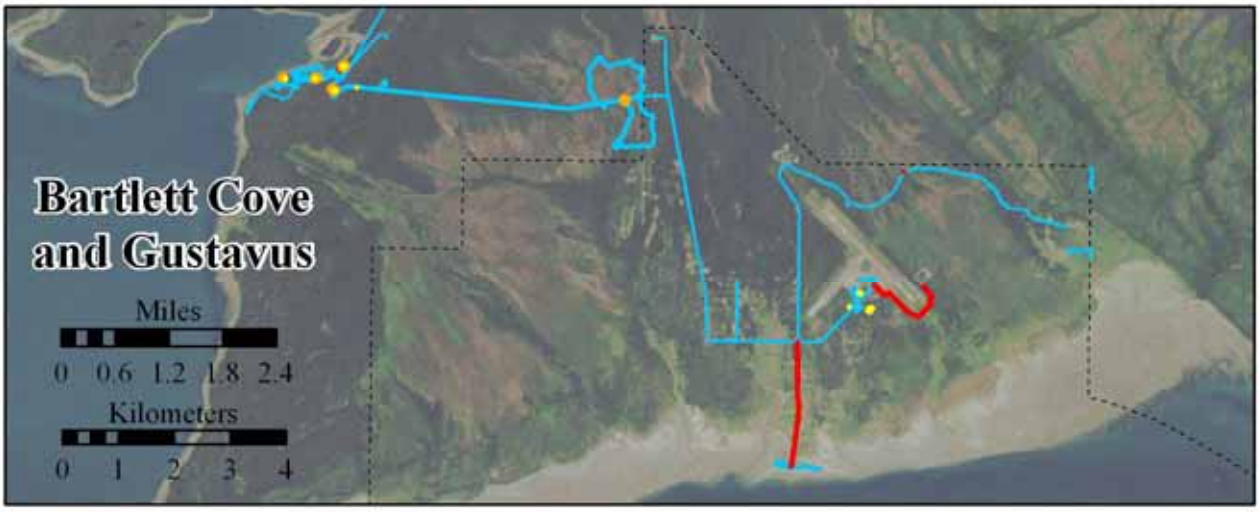


Ox-eye Daisy - *Leucanthemum vulgare*





Perennial Ryegrass - *Lolium perenne*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

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Present in 2004 Survey Area

Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
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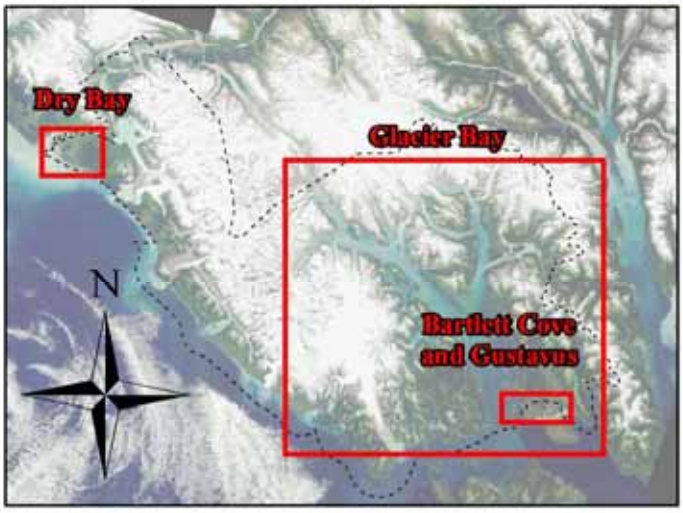
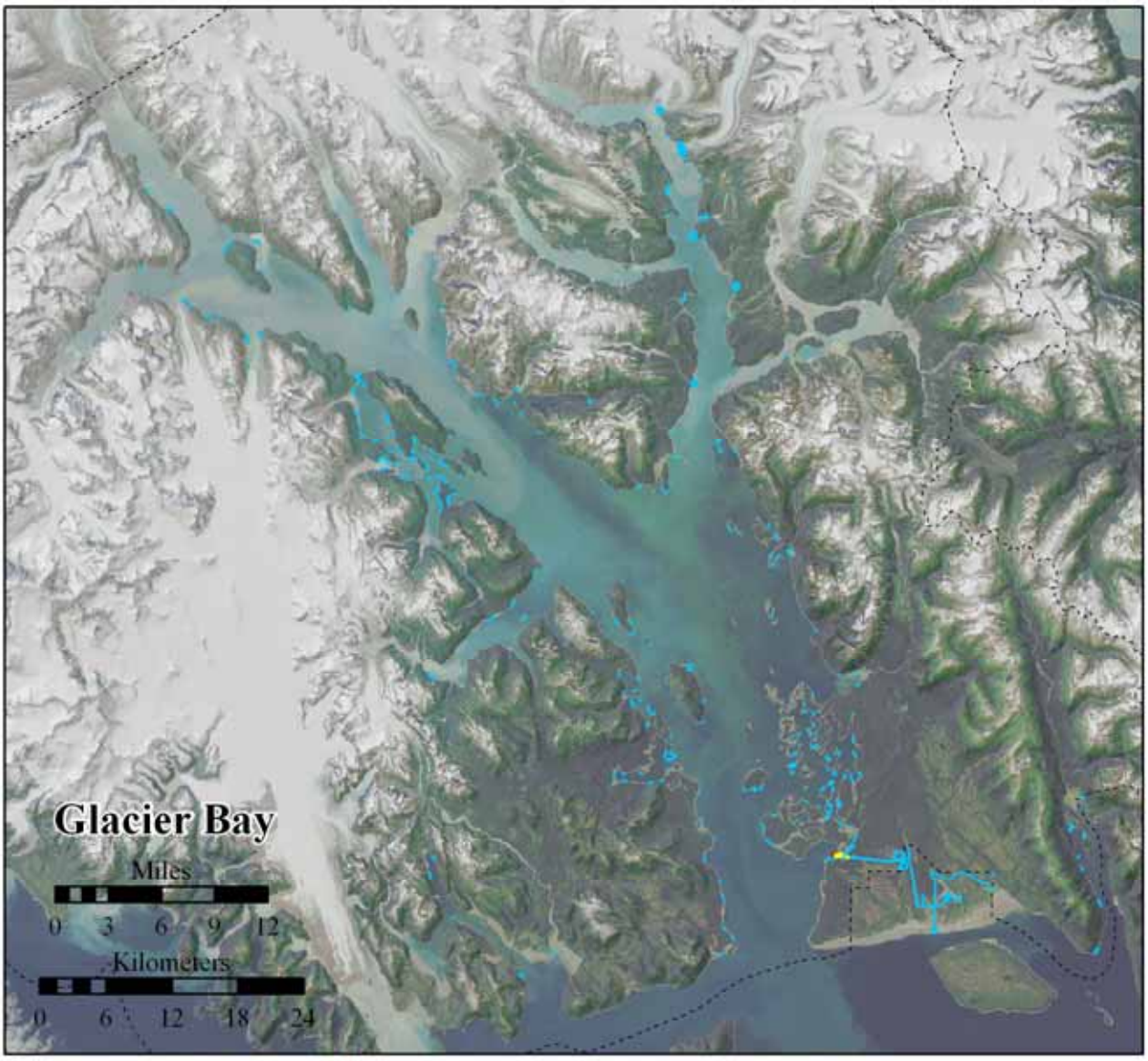
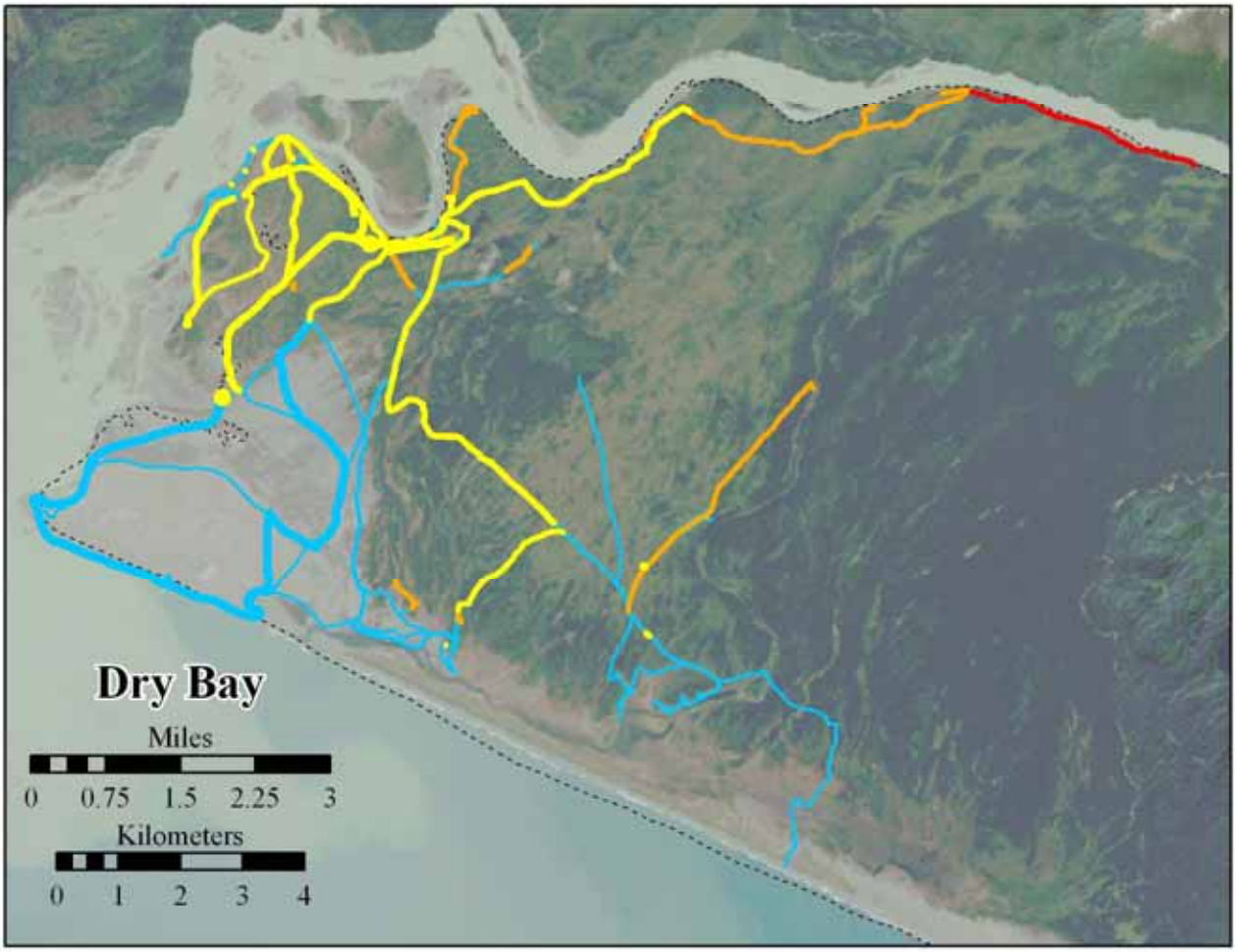


Perennial Ryegrass - *Lolium perenne*



Bigleaf Lupine - *Lupinus polyphyllus*

in Glacier Bay National Park and Preserve



Present in 2006 Survey Area

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GLBA Boundary

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Exotic Plant Management Team
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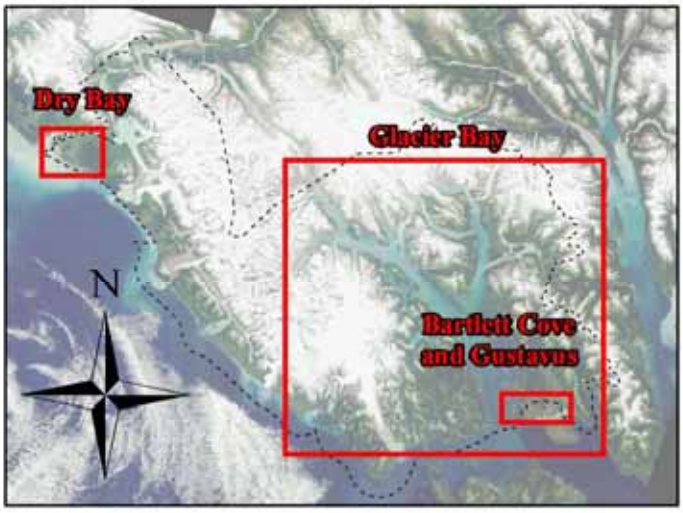
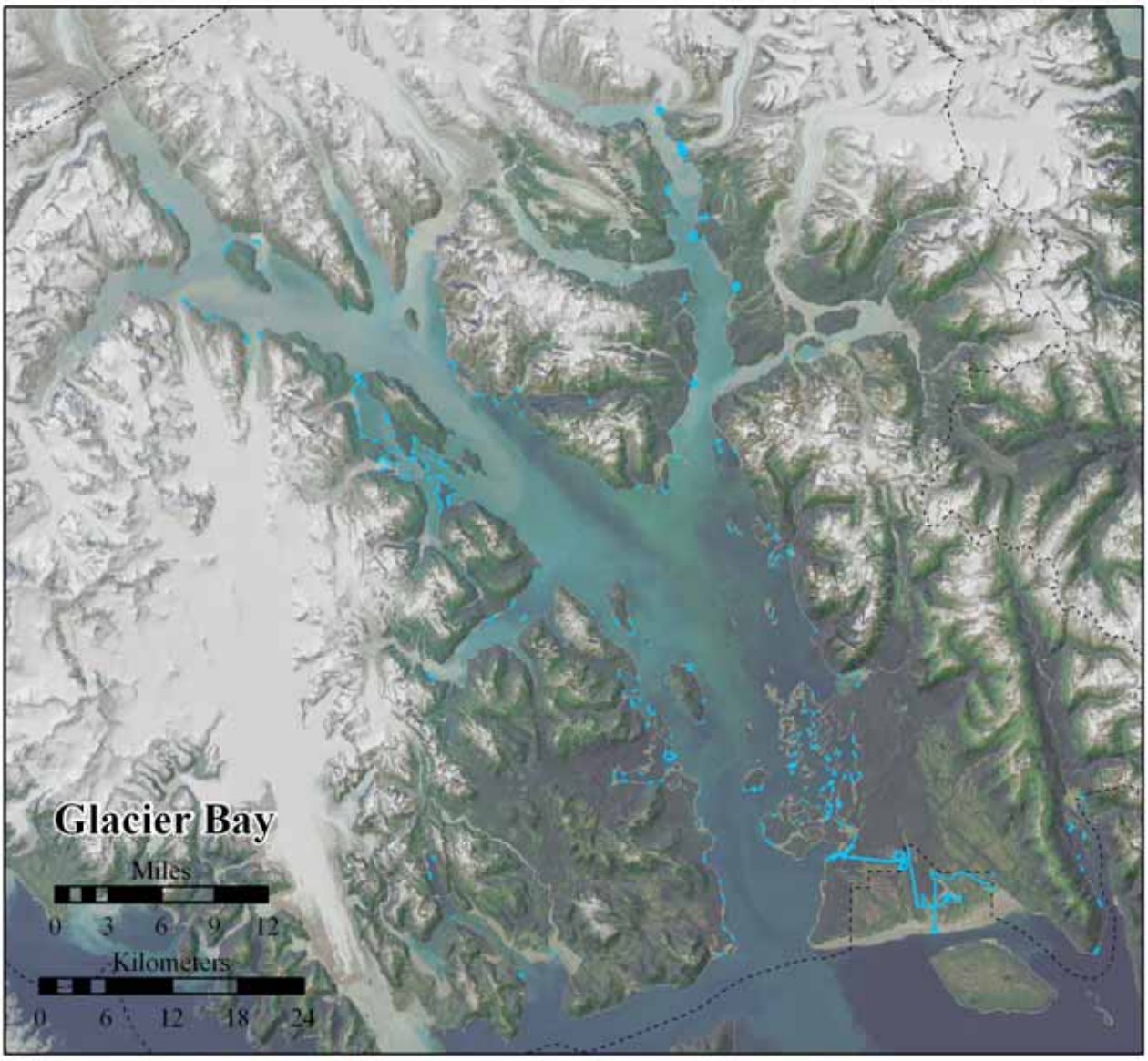


Bigleaf Lupine - *Lupinus polyphyllus*



Maltesecross - *Lychnis chalcedonica*

in Glacier Bay National Park and Preserve

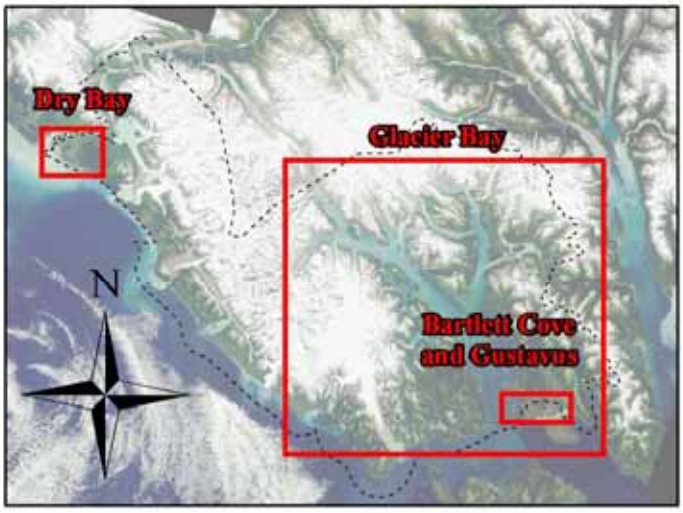
Present in 2006 Survey Area

Present in 2005 Survey Area

Present in 2004 Survey Area

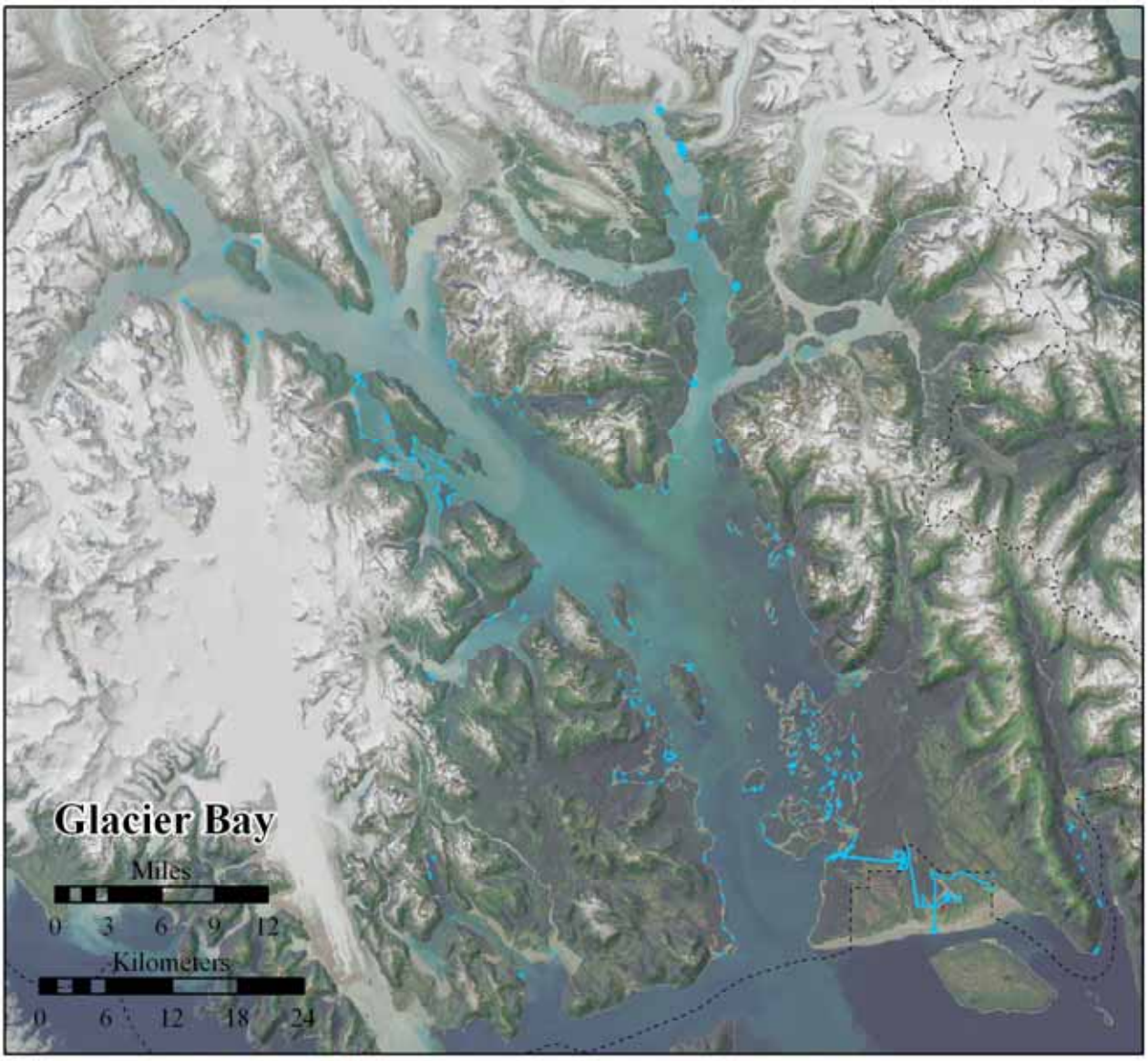
Absent in 2004-2006 Surveys

GLBA Boundary



Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006

Maltesecross - *Lychnis chalcedonica*



Pineapple Weed - *Matricaria discoidea*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

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GLBA Boundary

Alaska Region
Exotic Plant Management Team
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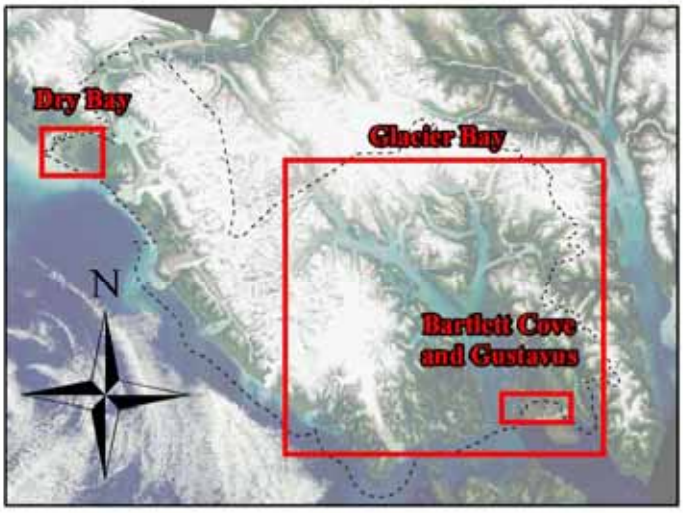
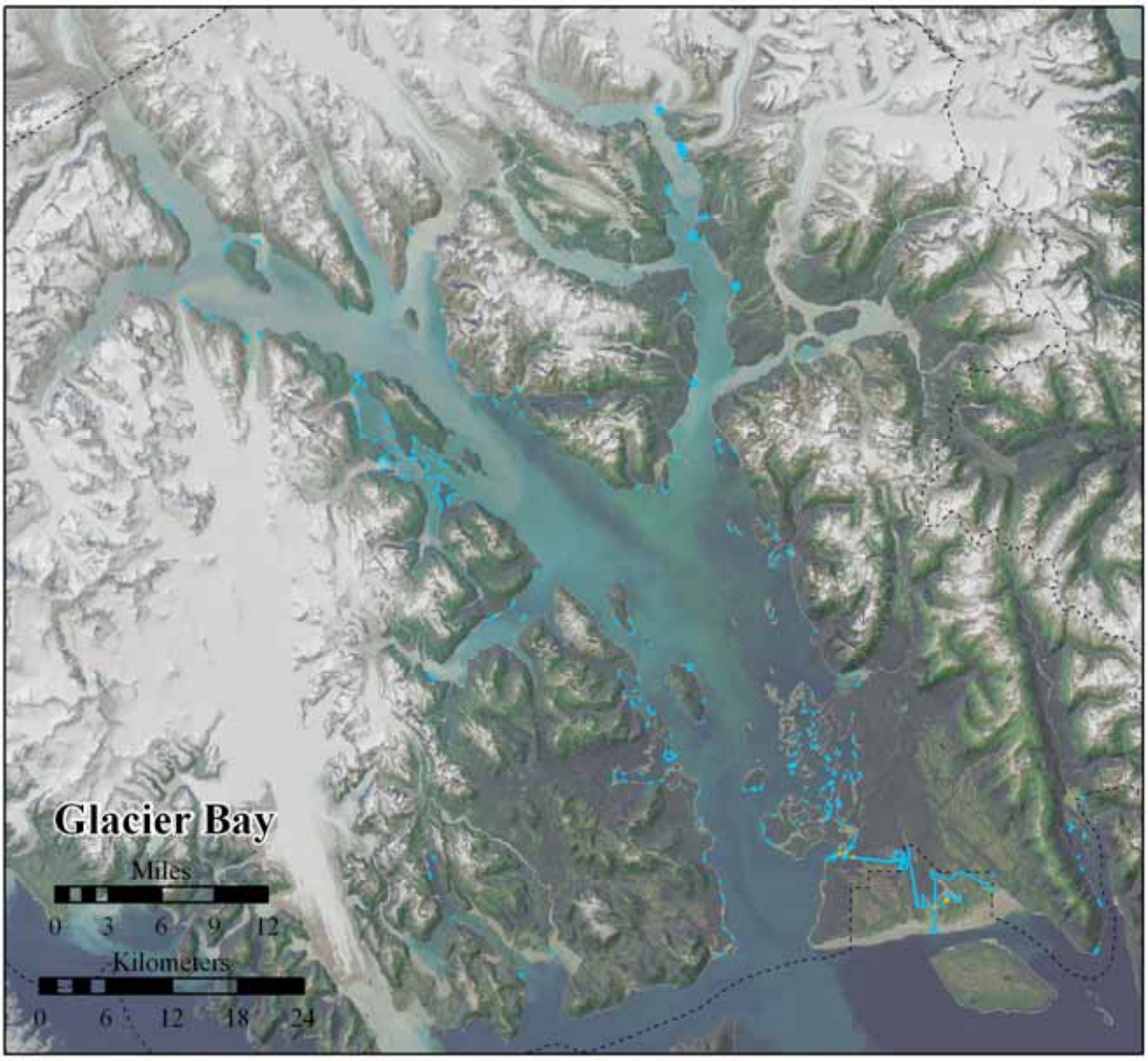


Pineapple Weed - *Matricaria discoidea*



Mint - *Mentha* sp.

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

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GLBA Boundary

Alaska Region
Exotic Plant Management Team
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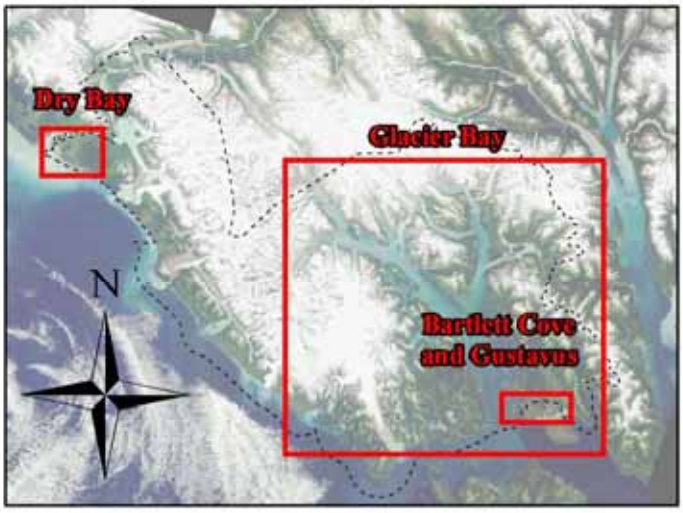
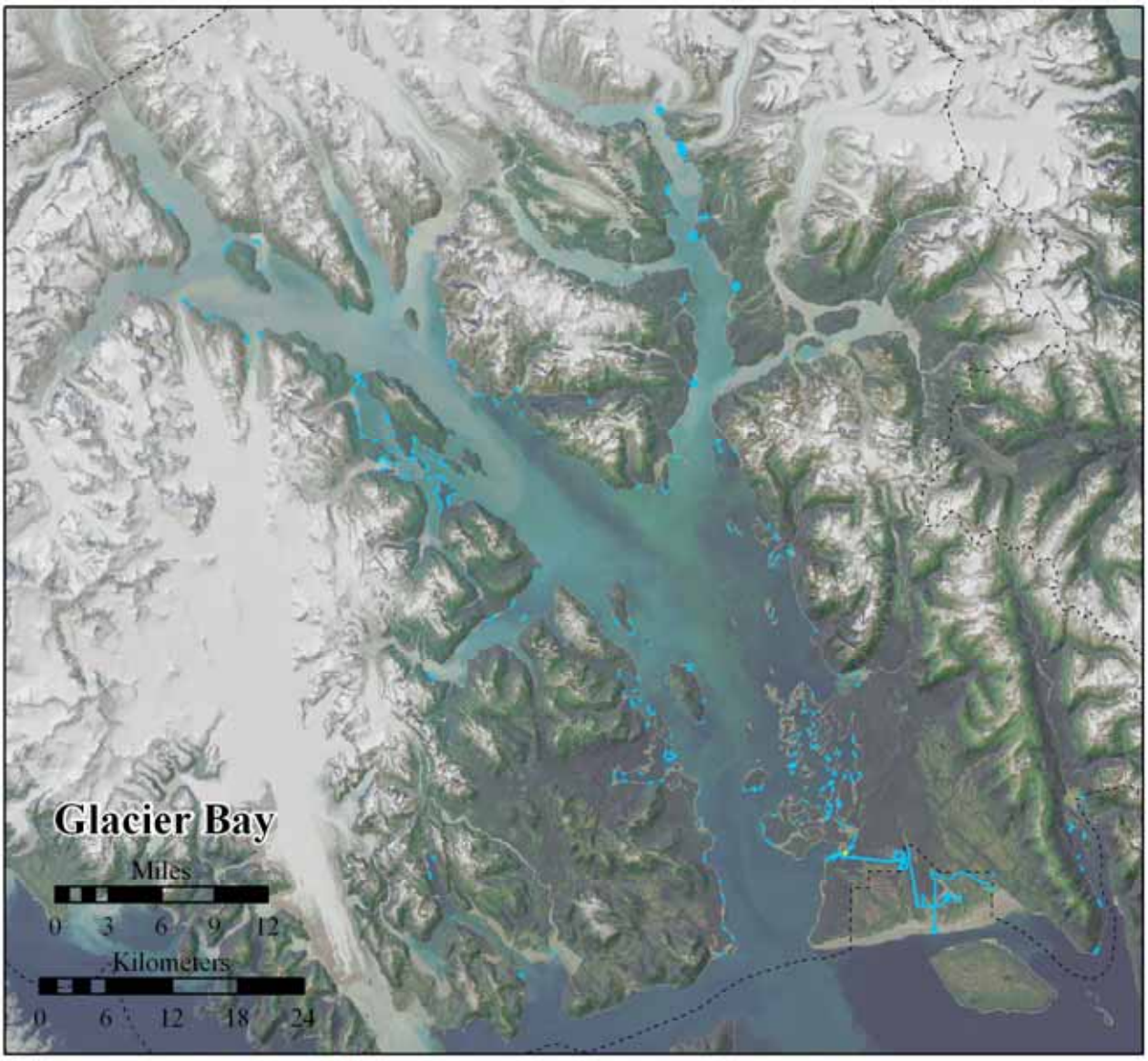


Mint - *Mentha* sp.



Forget-me-not - *Myosotis* spp.

in Glacier Bay National Park and Preserve

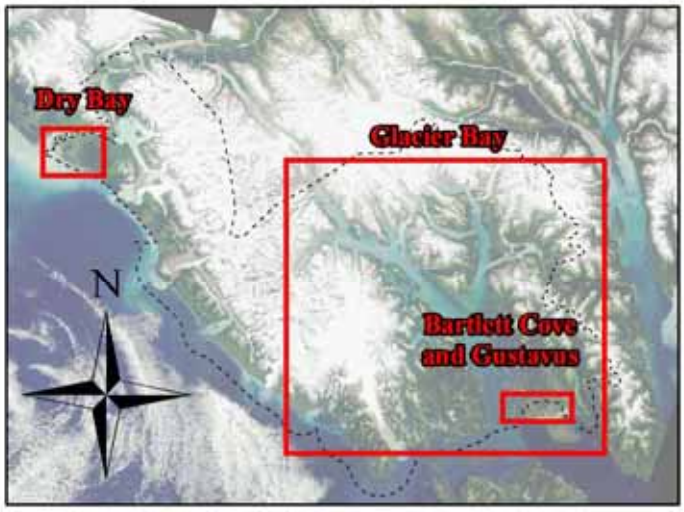
Present in 2006 Survey Area

Present in 2005 Survey Area

Present in 2004 Survey Area

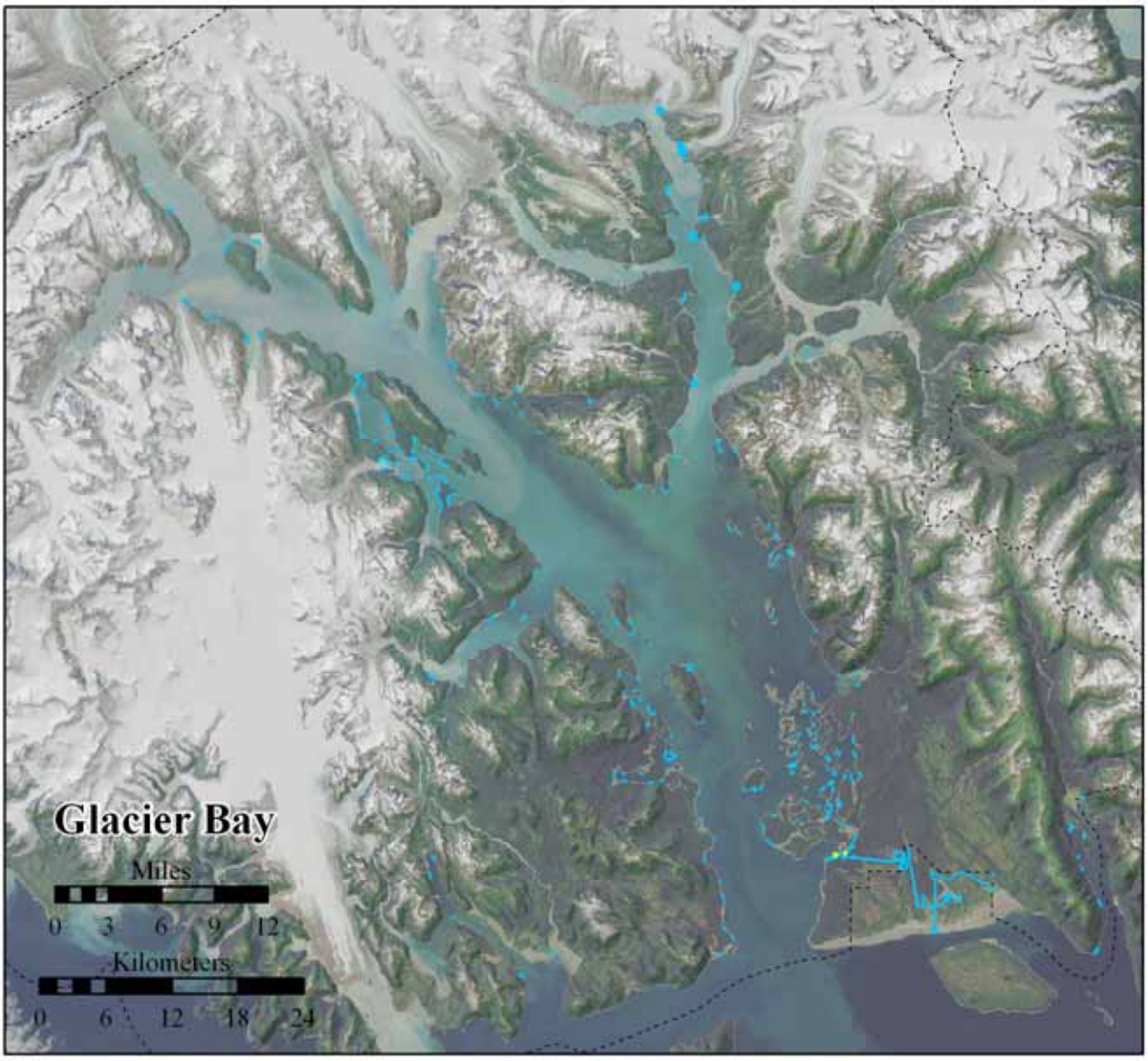
Absent in 2004-2006 Surveys

GLBA Boundary



Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006

Forget-me-not - *Myosotis* spp.



Reed Canarygrass - *Phalaris arundinacea*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

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GLBA Boundary

Alaska Region
Exotic Plant Management Team
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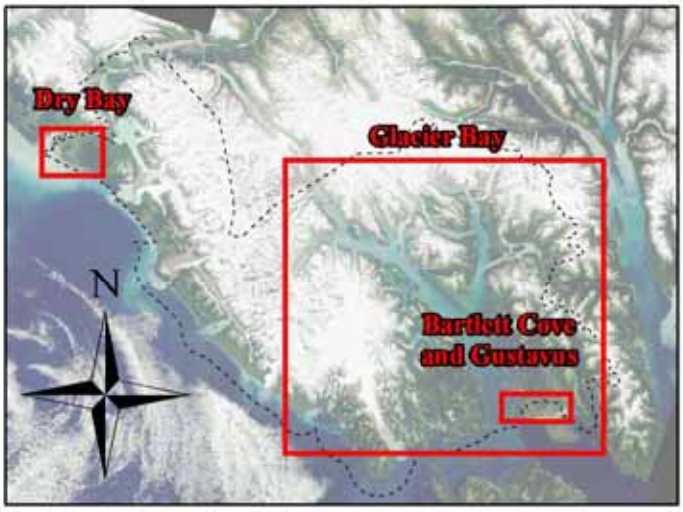
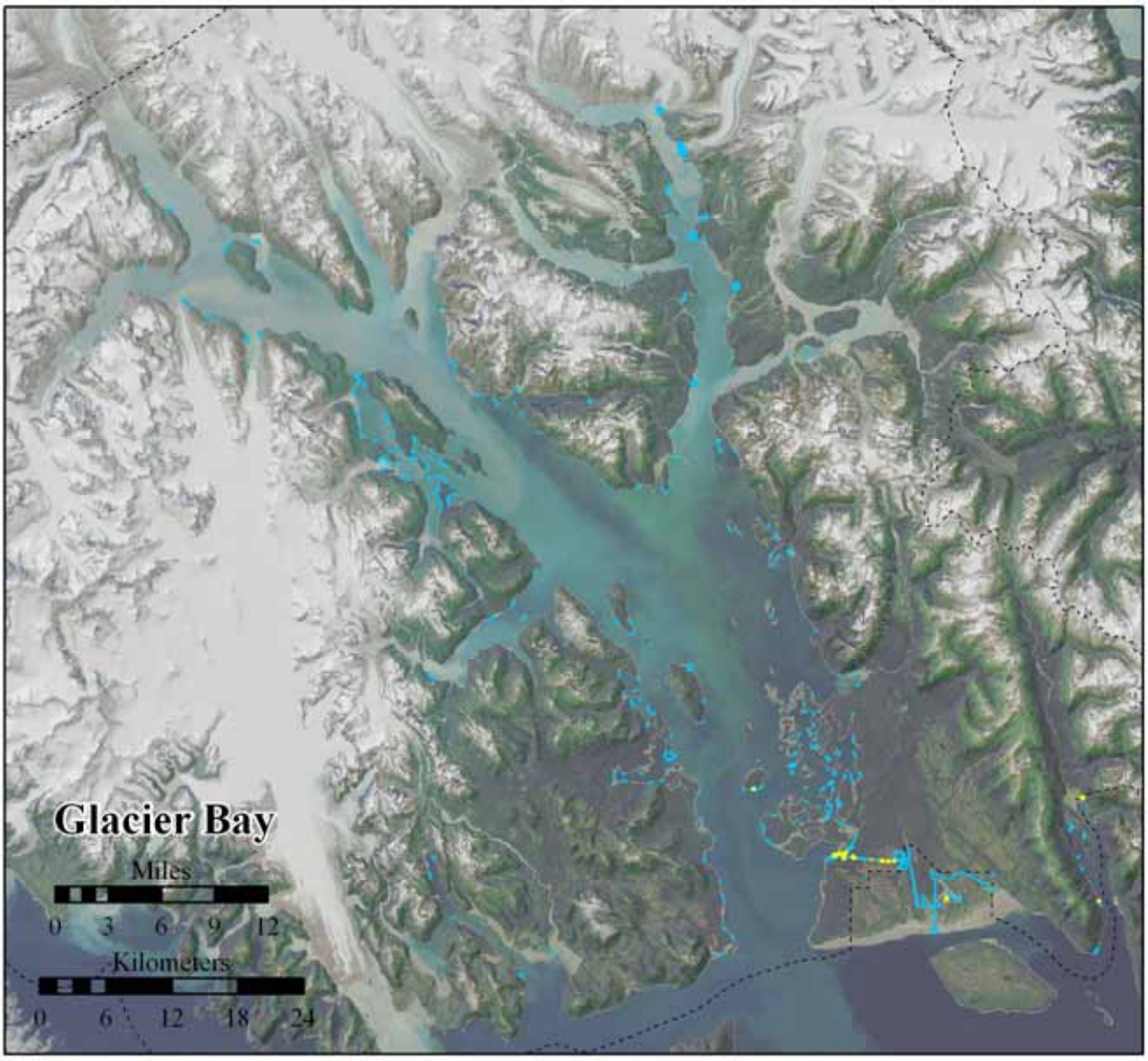


Reed Canarygrass - *Phalaris arundinacea*



Common Timothy - *Phleum pratense*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

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GLBA Boundary

Alaska Region
Exotic Plant Management Team
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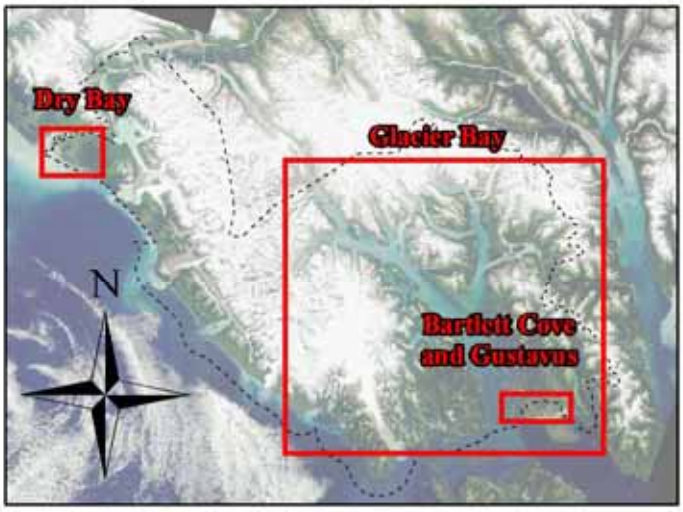
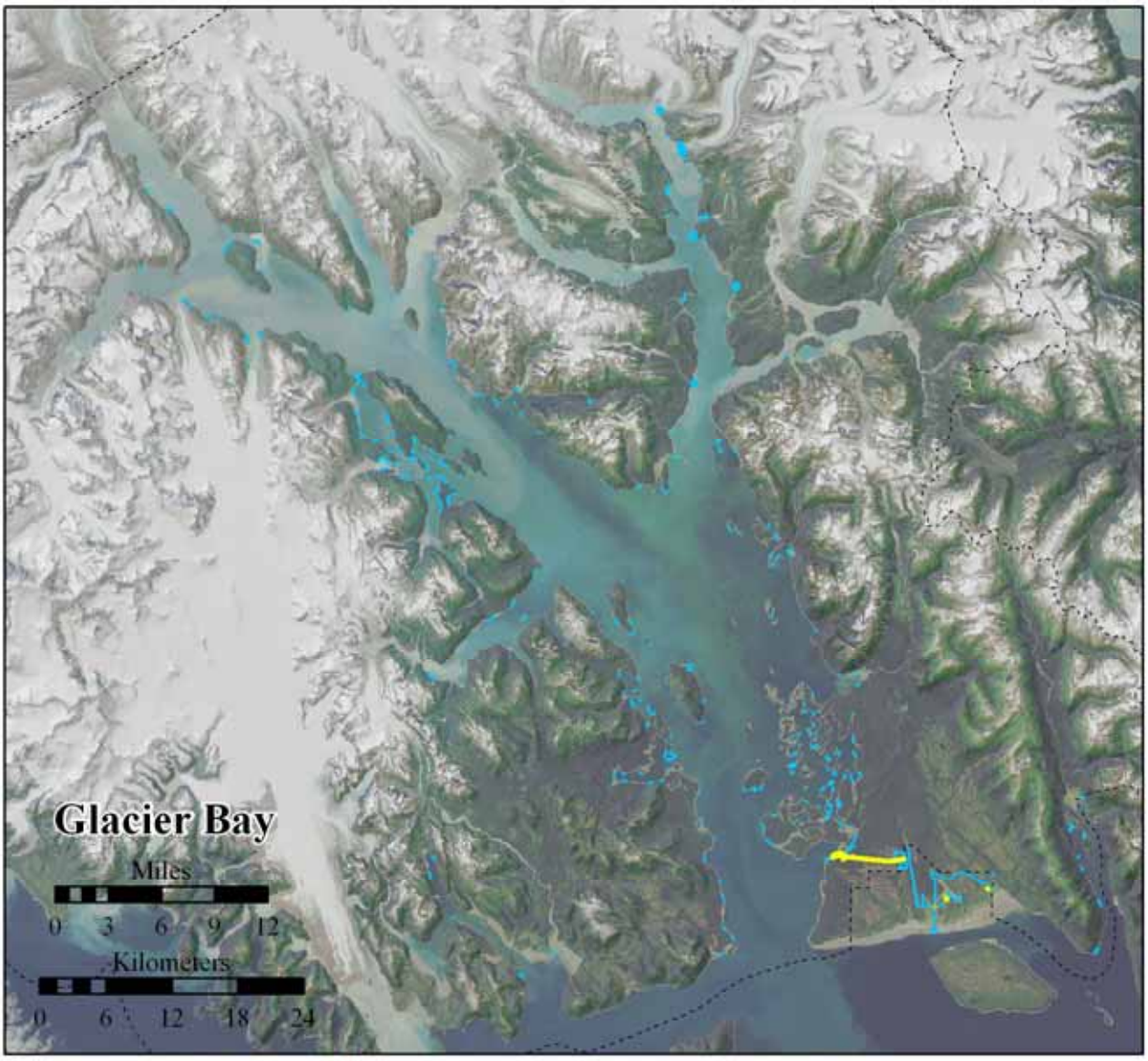
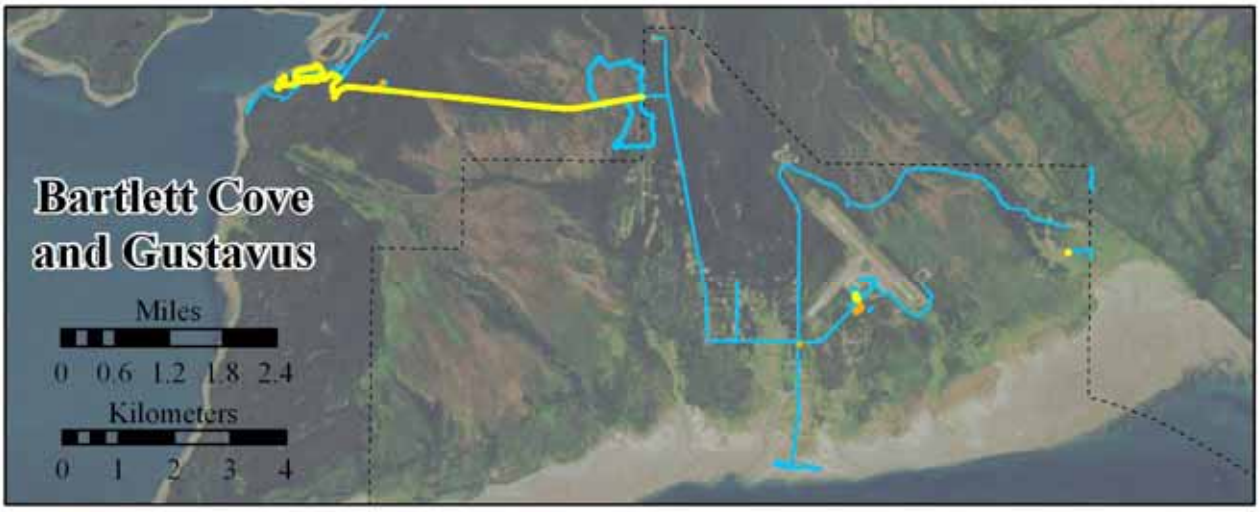


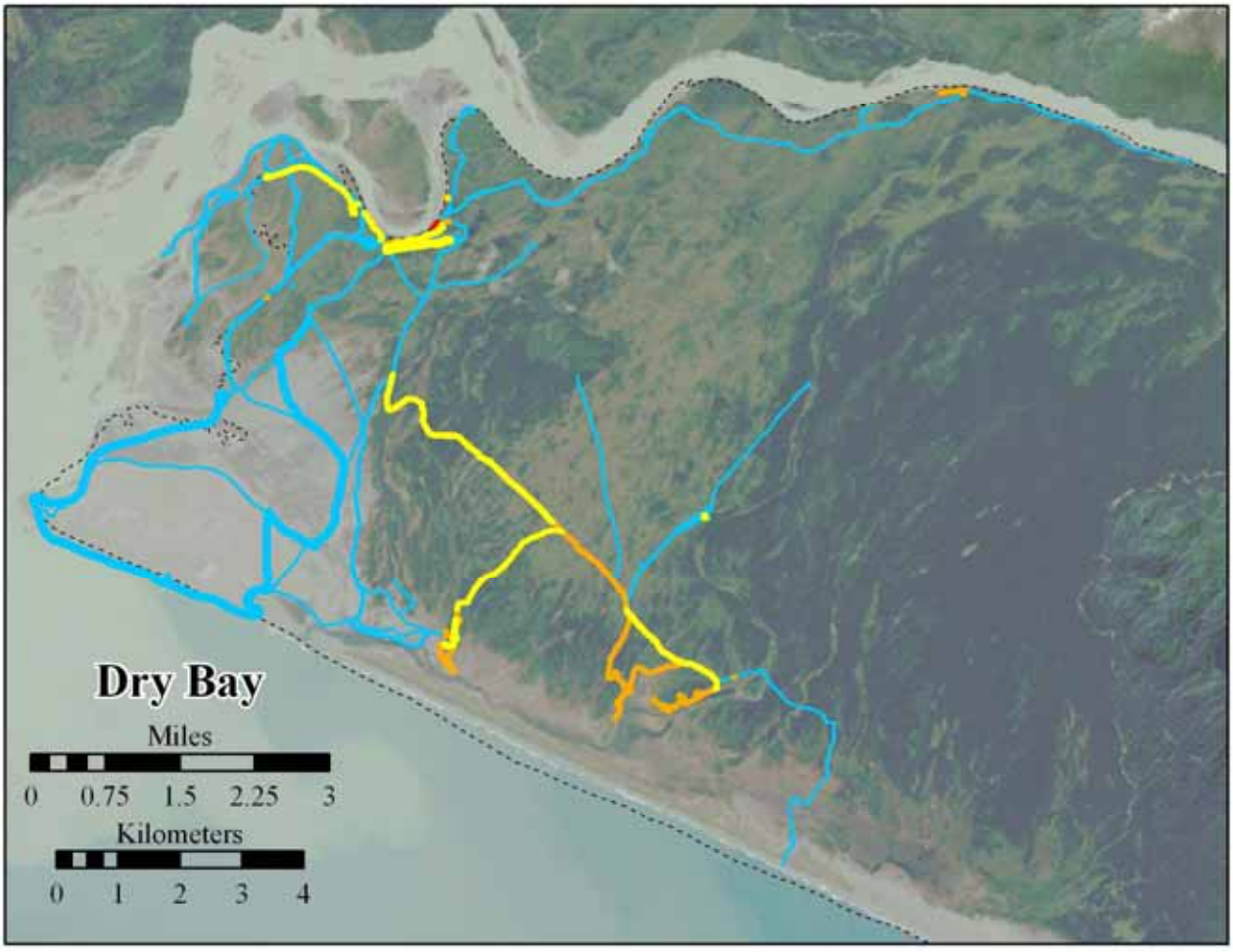
Common Timothy - *Phleum pratense*





Common Plantain - *Plantago major*

in Glacier Bay National Park and Preserve



Present in 2006 Survey Area

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GLBA Boundary

Alaska Region
Exotic Plant Management Team
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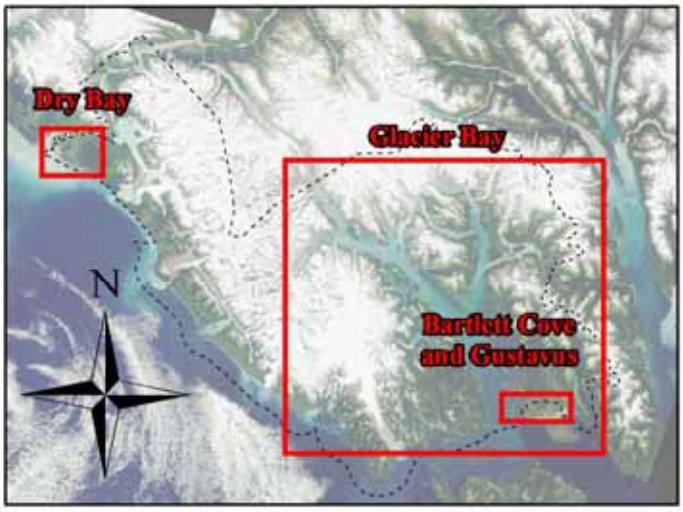
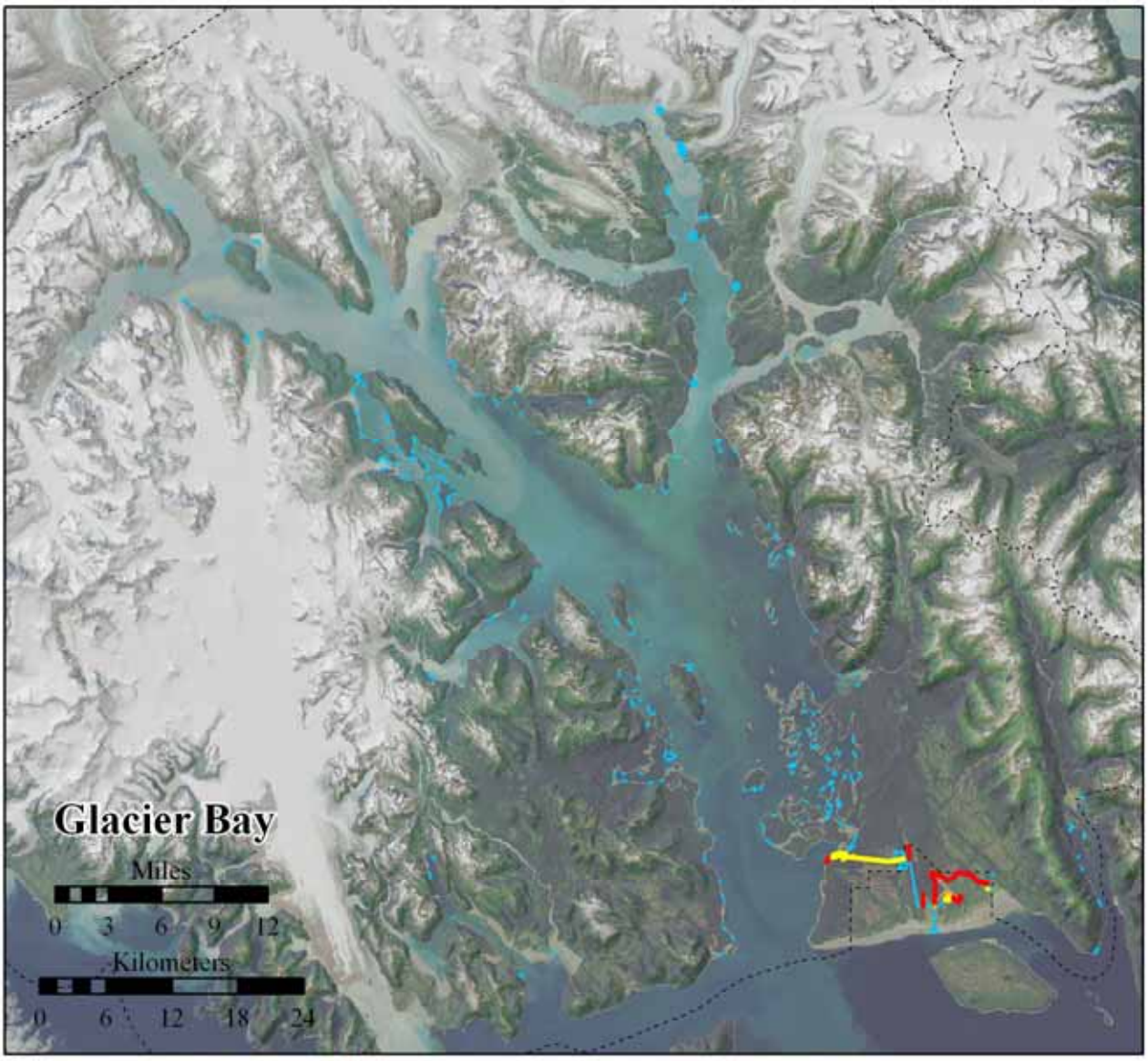
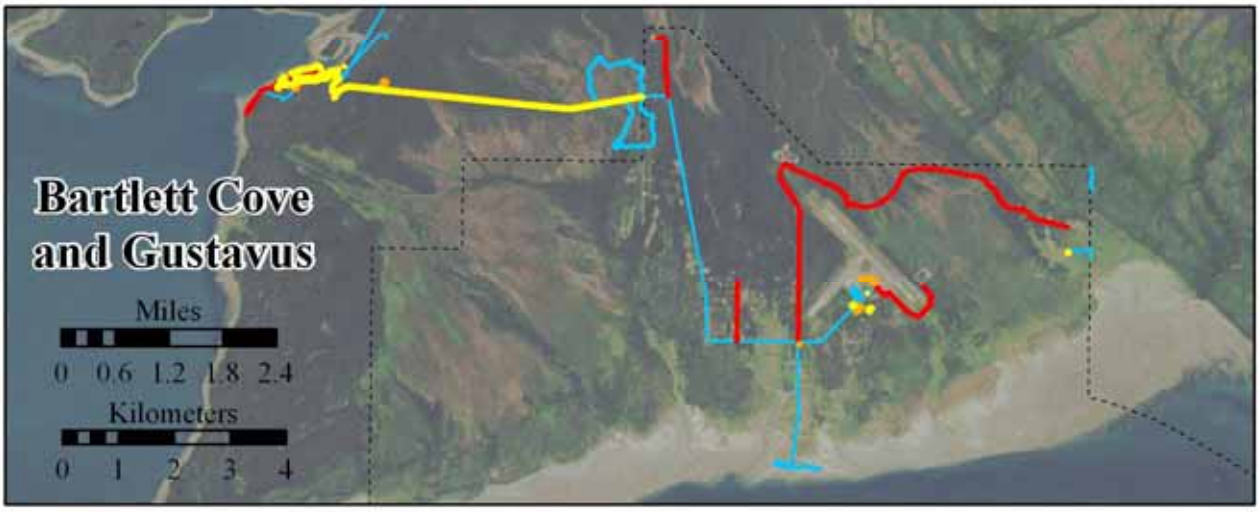


Common Plantain - *Plantago major*





Annual Bluegrass - *Poa annua*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

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GLBA Boundary

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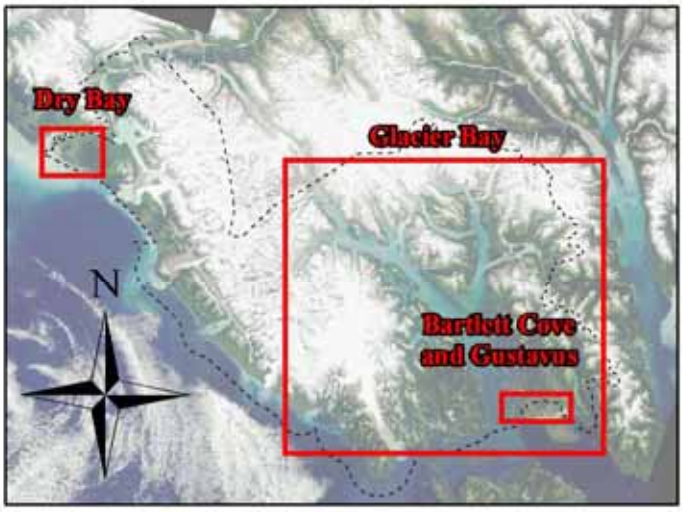
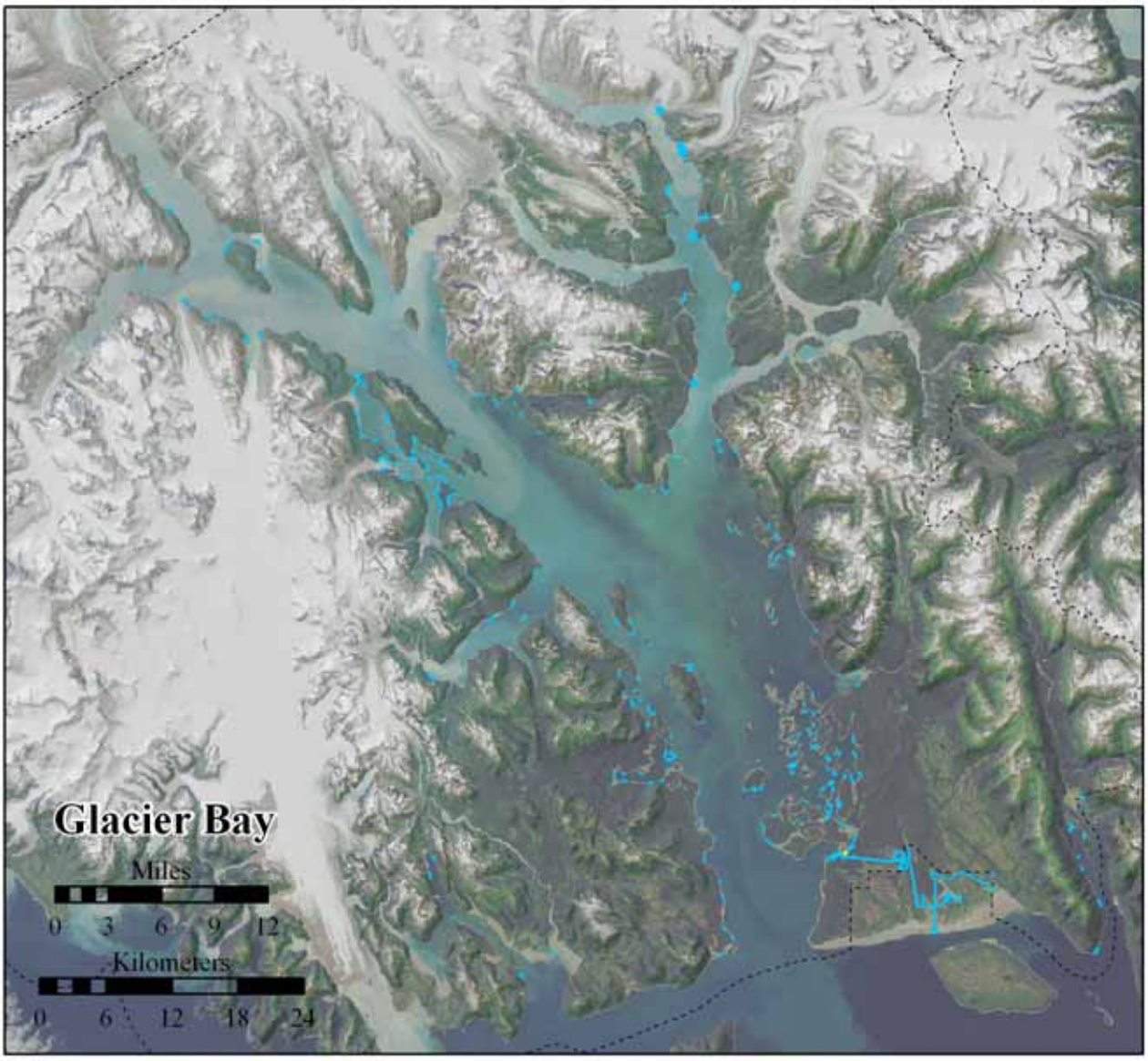


Annual Bluegrass - *Poa annua*



Kentucky Bluegrass - *Poa pratensis*

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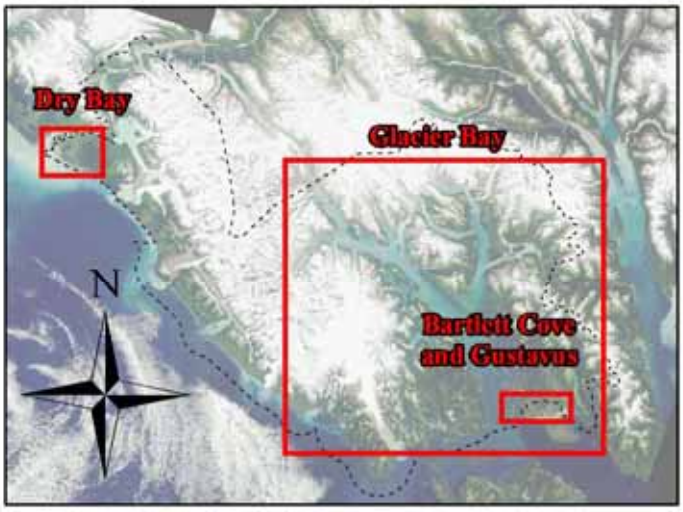
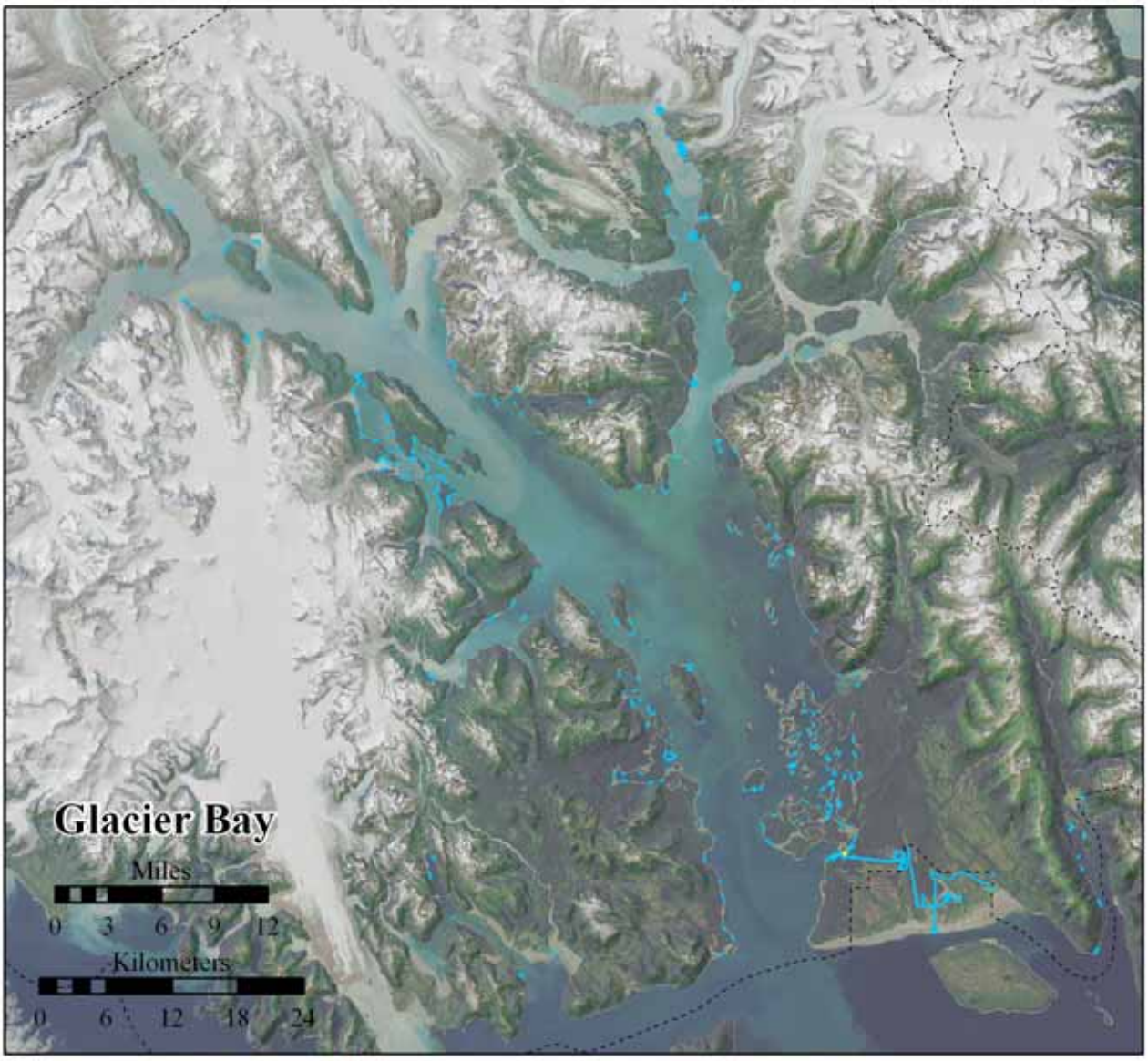


Kentucky Bluegrass - *Poa pratensis*



Tall Buttercup - *Ranunculus acris*

in Glacier Bay National Park and Preserve

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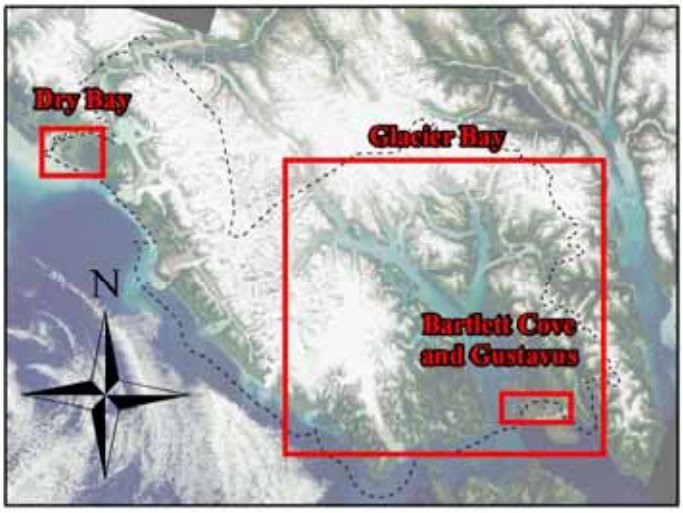
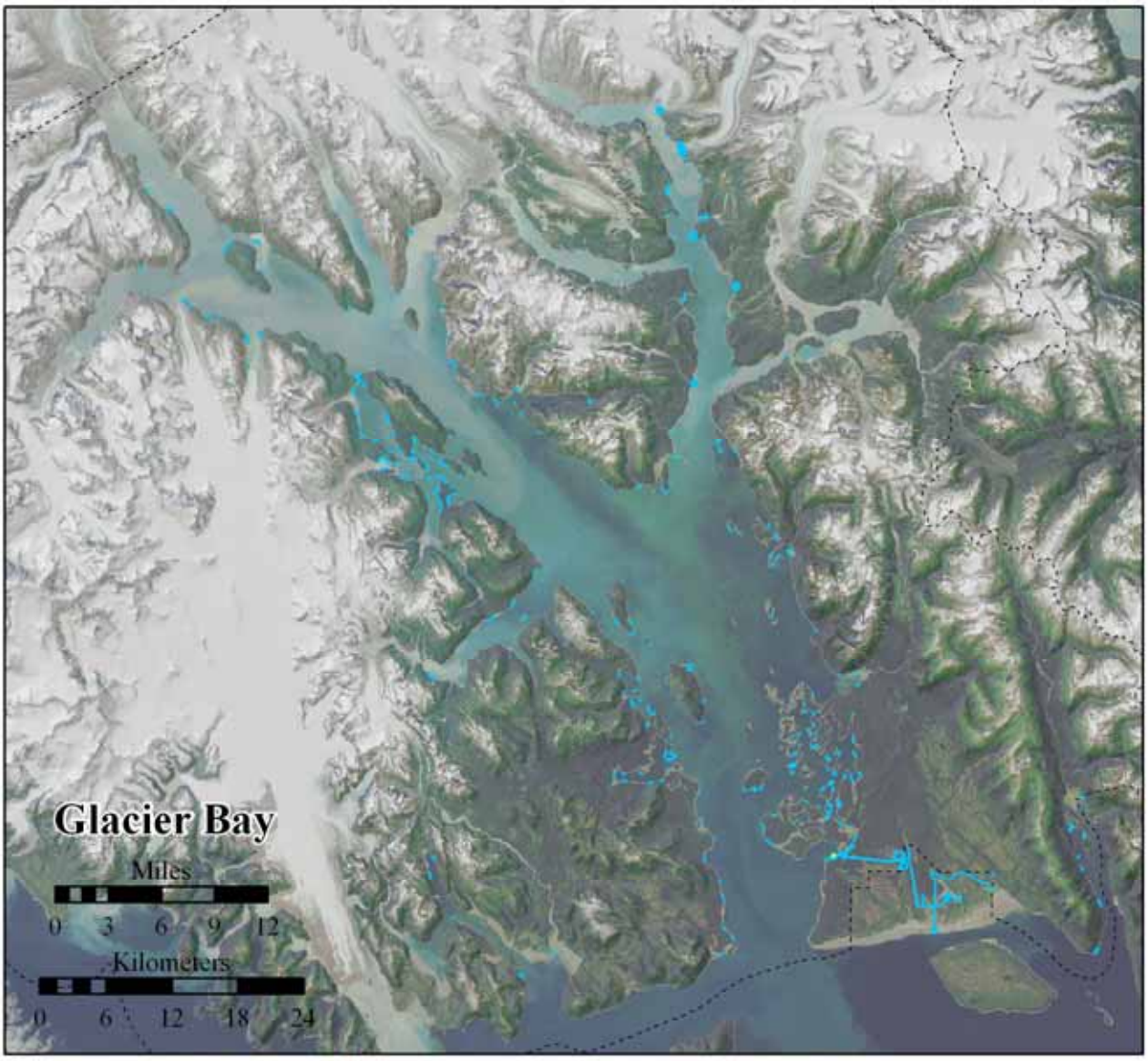


Tall Buttercup - *Ranunculus acris*



Creeping Buttercup - *Ranunculus repens*

in Glacier Bay National Park and Preserve

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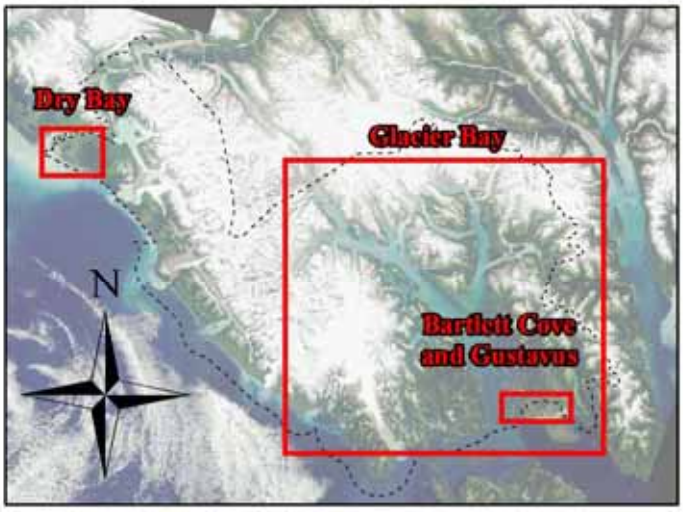
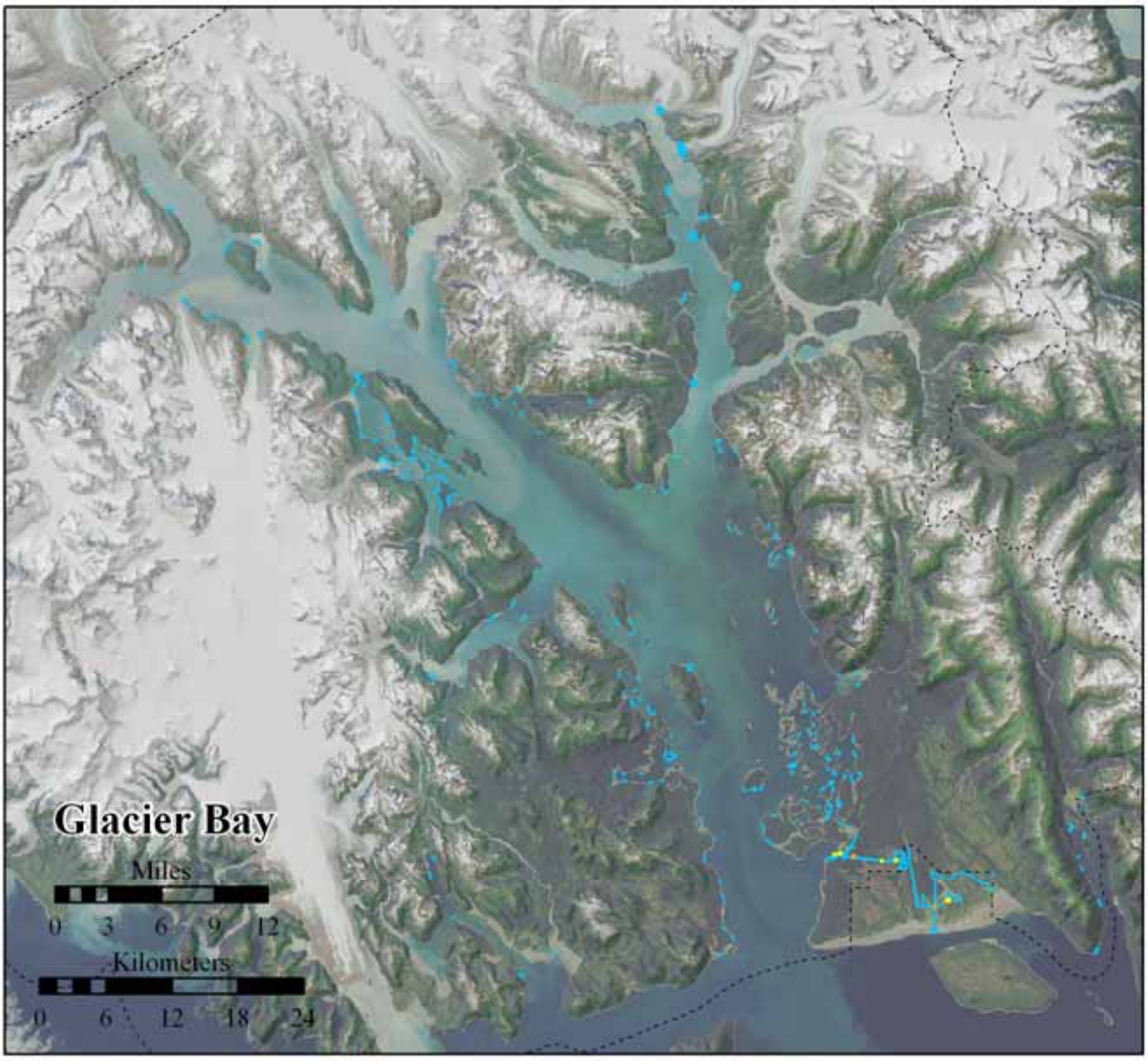


Creeping Buttercup - *Ranunculus repens*



Rhubarb - *Rheum rhabarbarum*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

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Present in 2004 Survey Area

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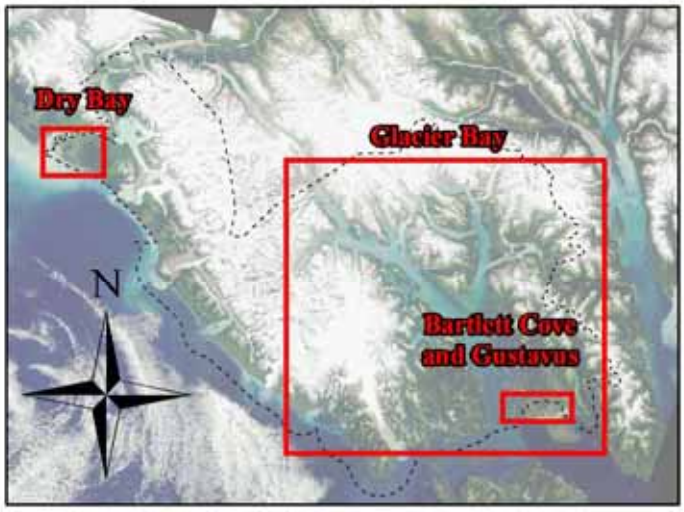
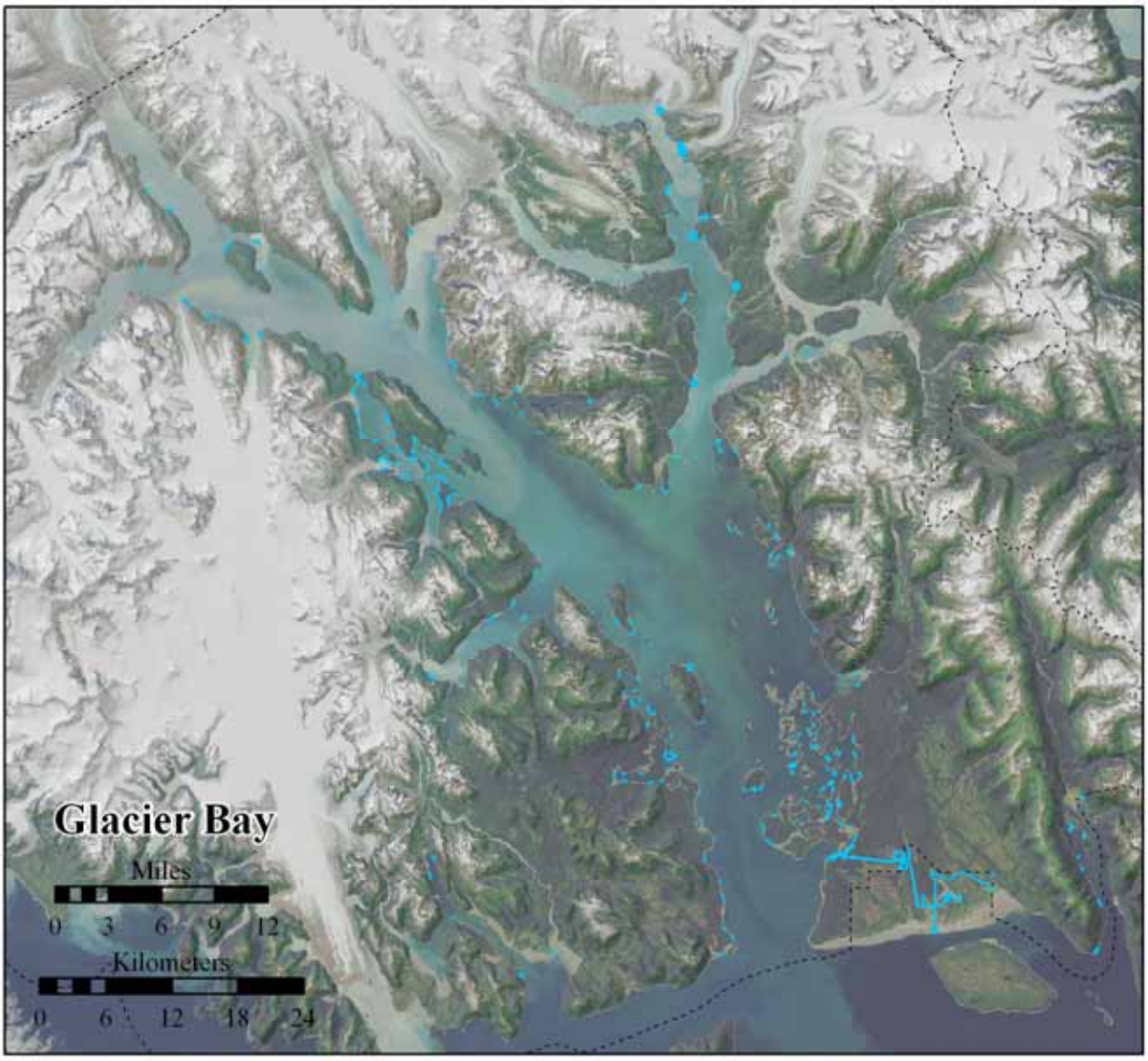
GLBA Boundary



Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006

Rhubarb - *Rheum rhabarbarum*



Rugosa Rose - *Rosa rugosa*

in Glacier Bay National Park and Preserve

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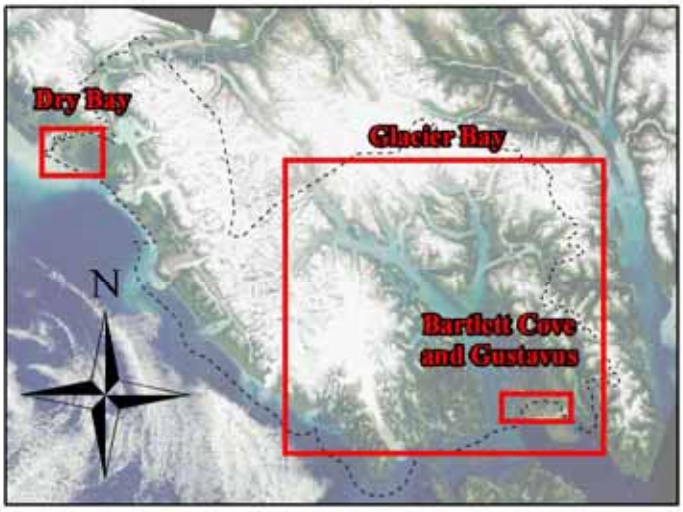
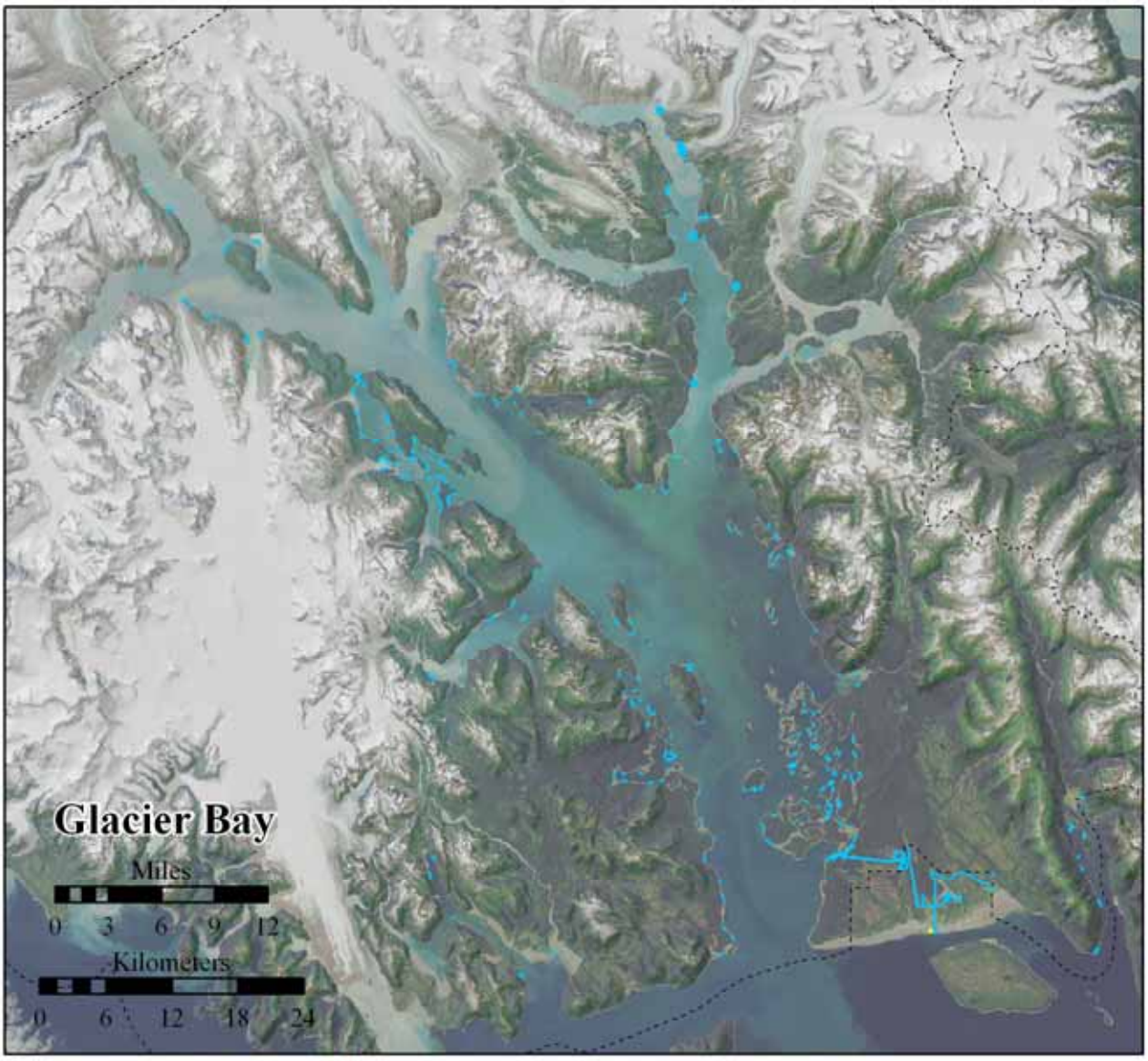


Rugosa Rose - *Rosa rugosa*



Red Raspberry - *Rubus idaeus*

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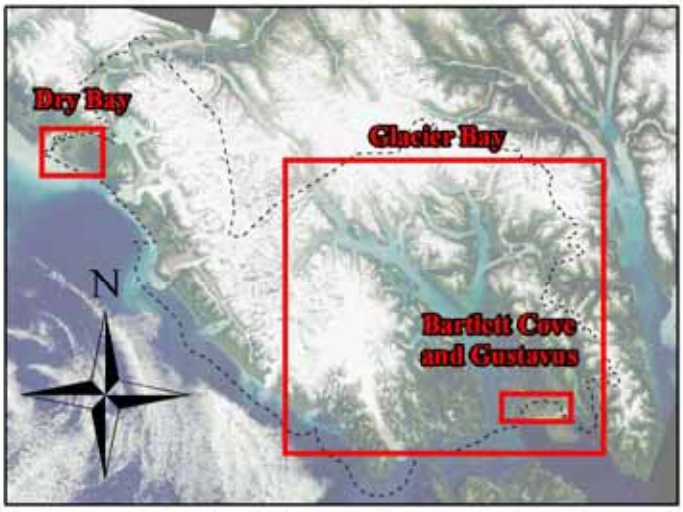
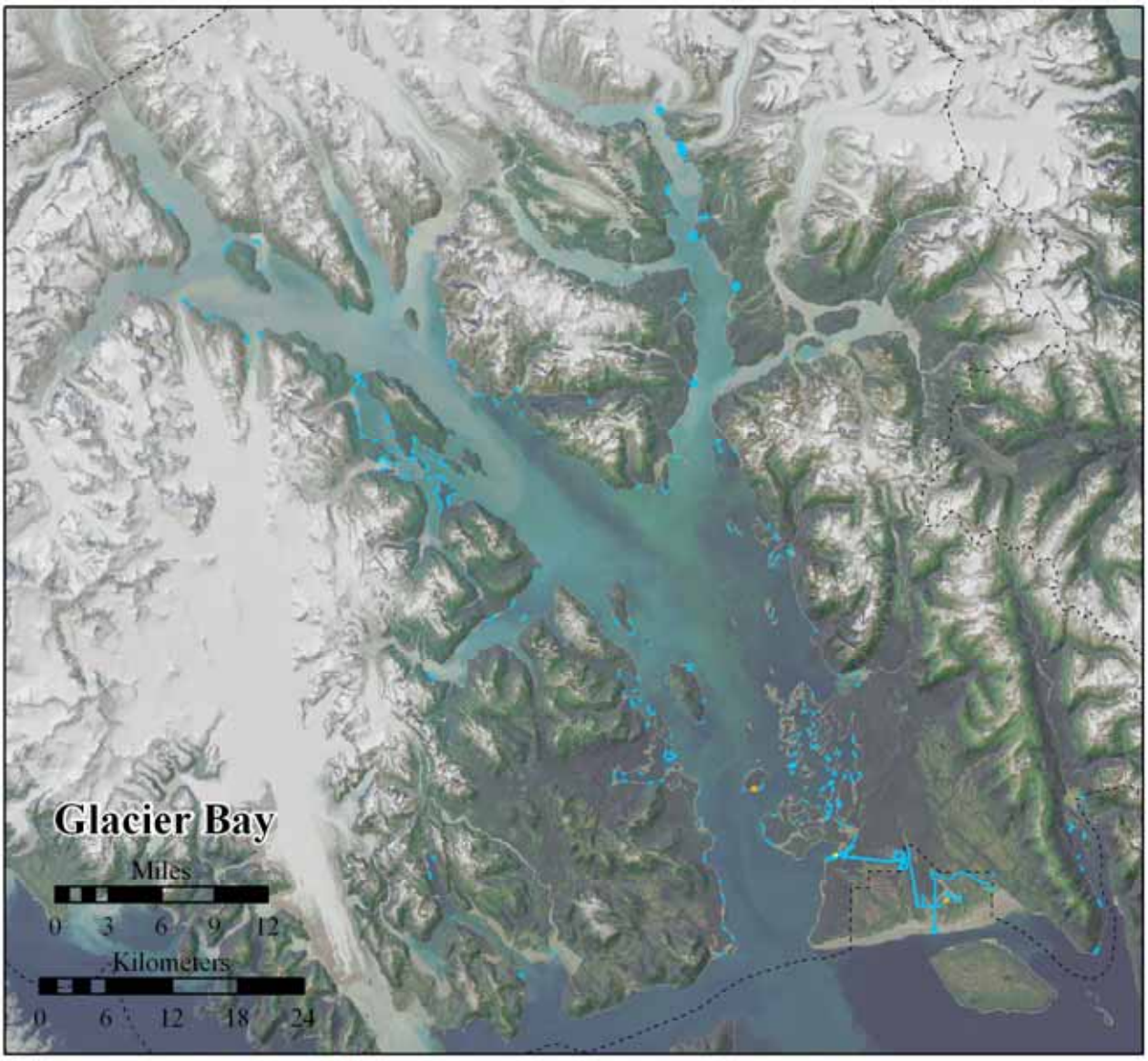
Projection: UTM 8N, NAD 83
Created: November 2006



Red Raspberry - *Rubus idaeus*



Sheep Sorrel - *Rumex acetosella*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

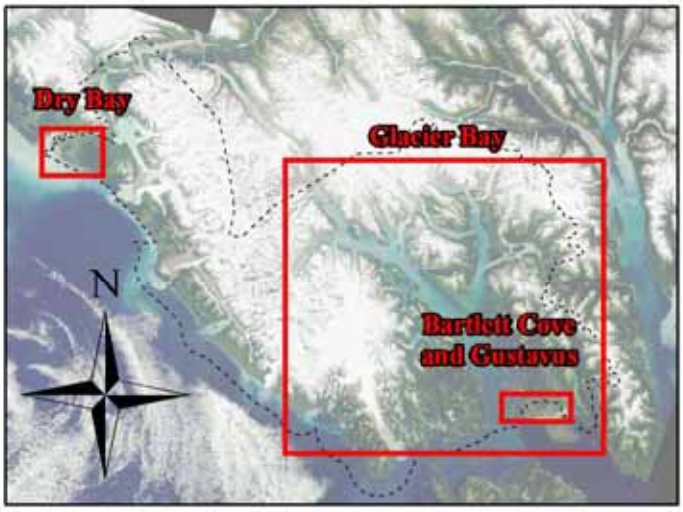
Present in 2005 Survey Area

Present in 2004 Survey Area

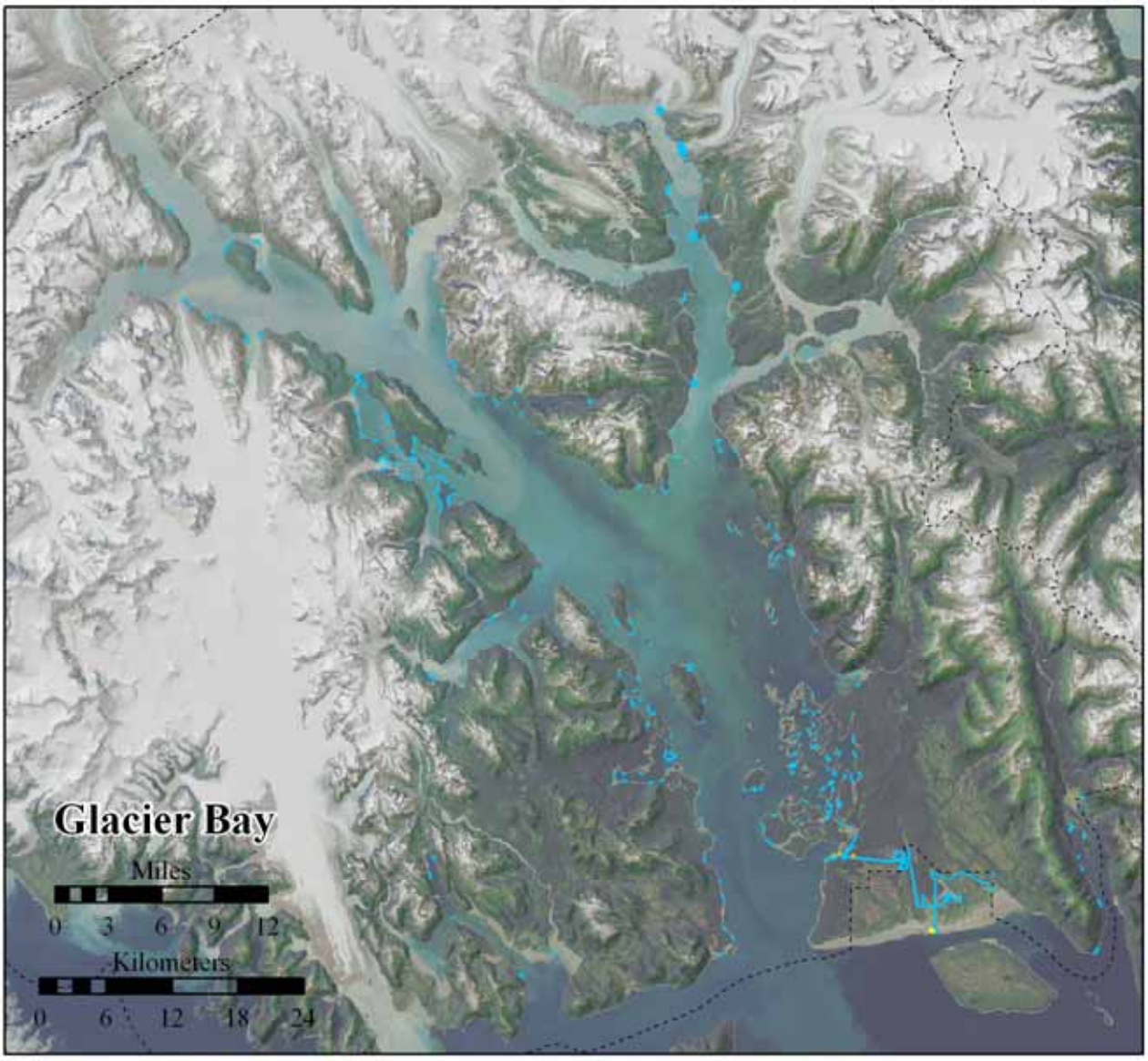
Absent in 2004-2006 Surveys

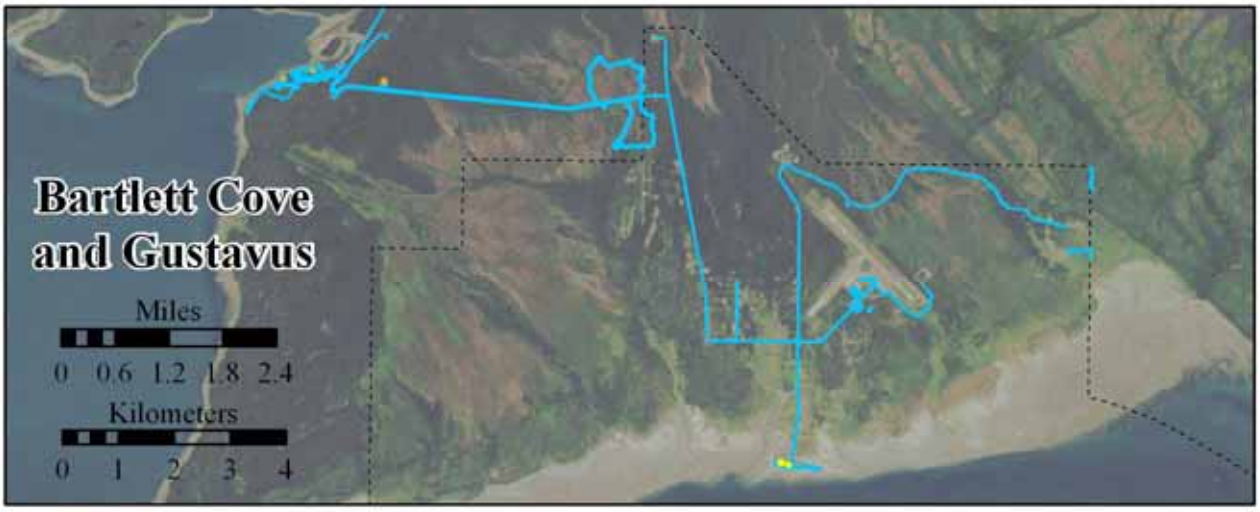
GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Sheep Sorrel - *Rumex acetosella*





Perennial Sowthistle - *Sonchus arvensis*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

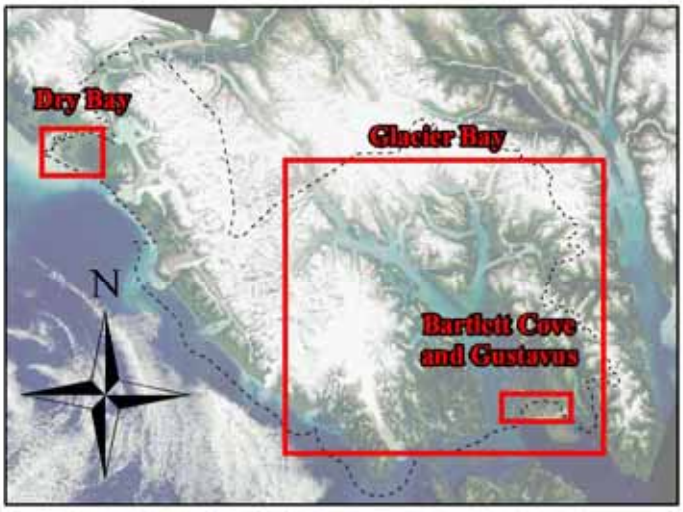
Present in 2005 Survey Area

Present in 2004 Survey Area

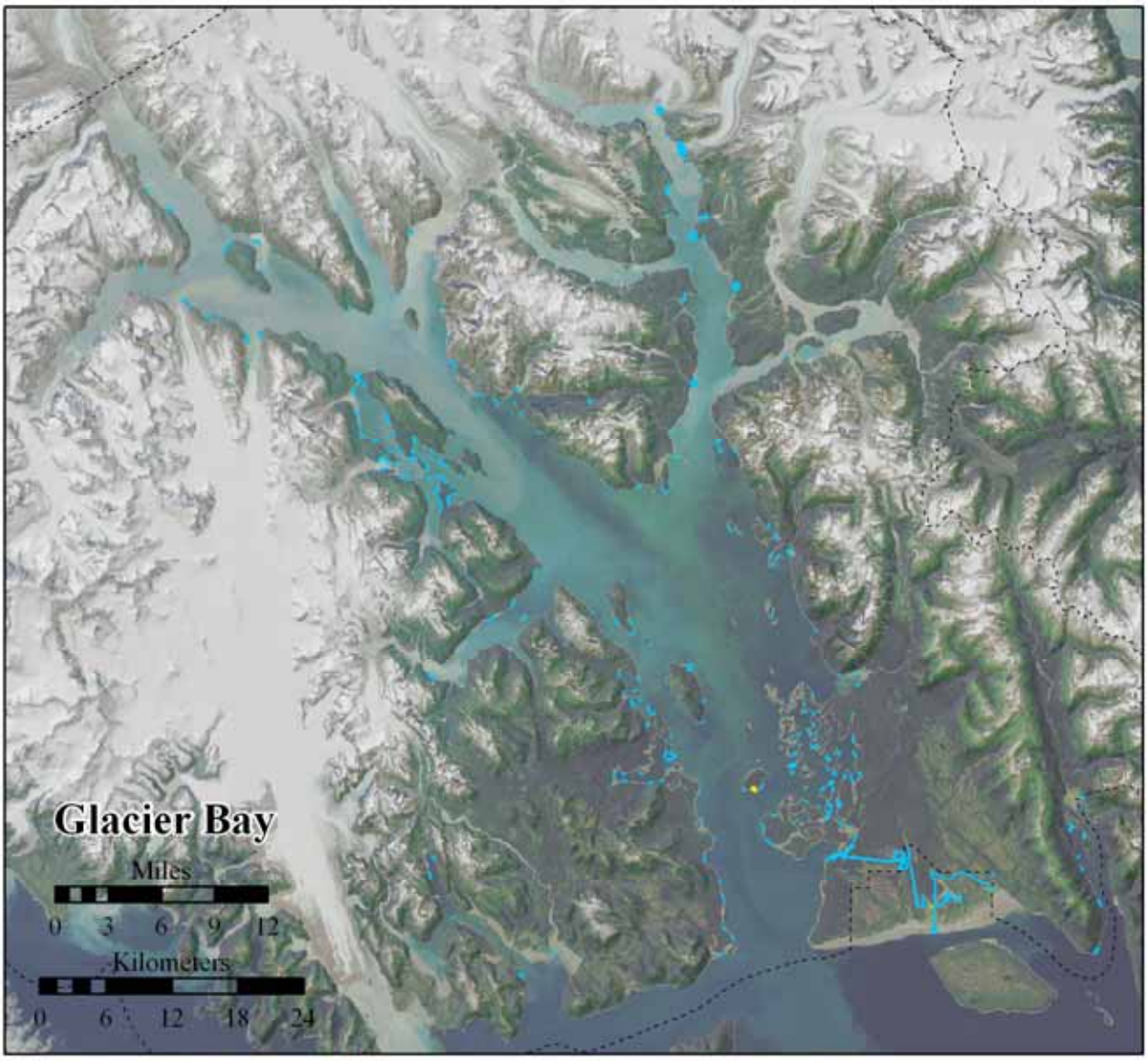
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Perennial Sowthistle - *Sonchus arvensis*



European Mountain Ash - *Sorbus aucuparia*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

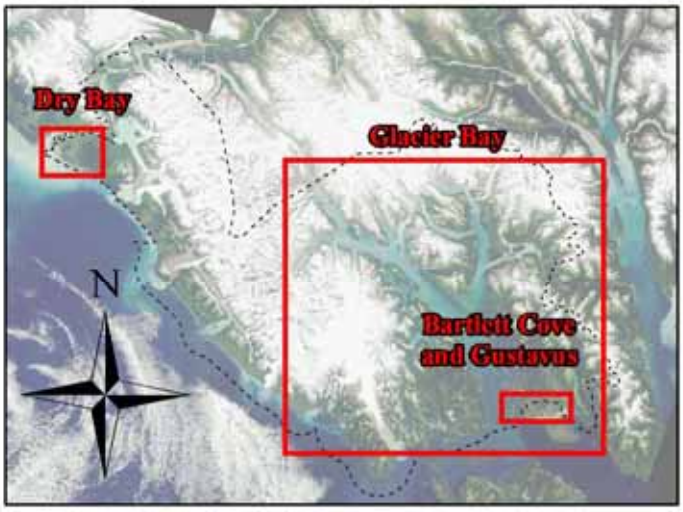
Present in 2005 Survey Area

Present in 2004 Survey Area

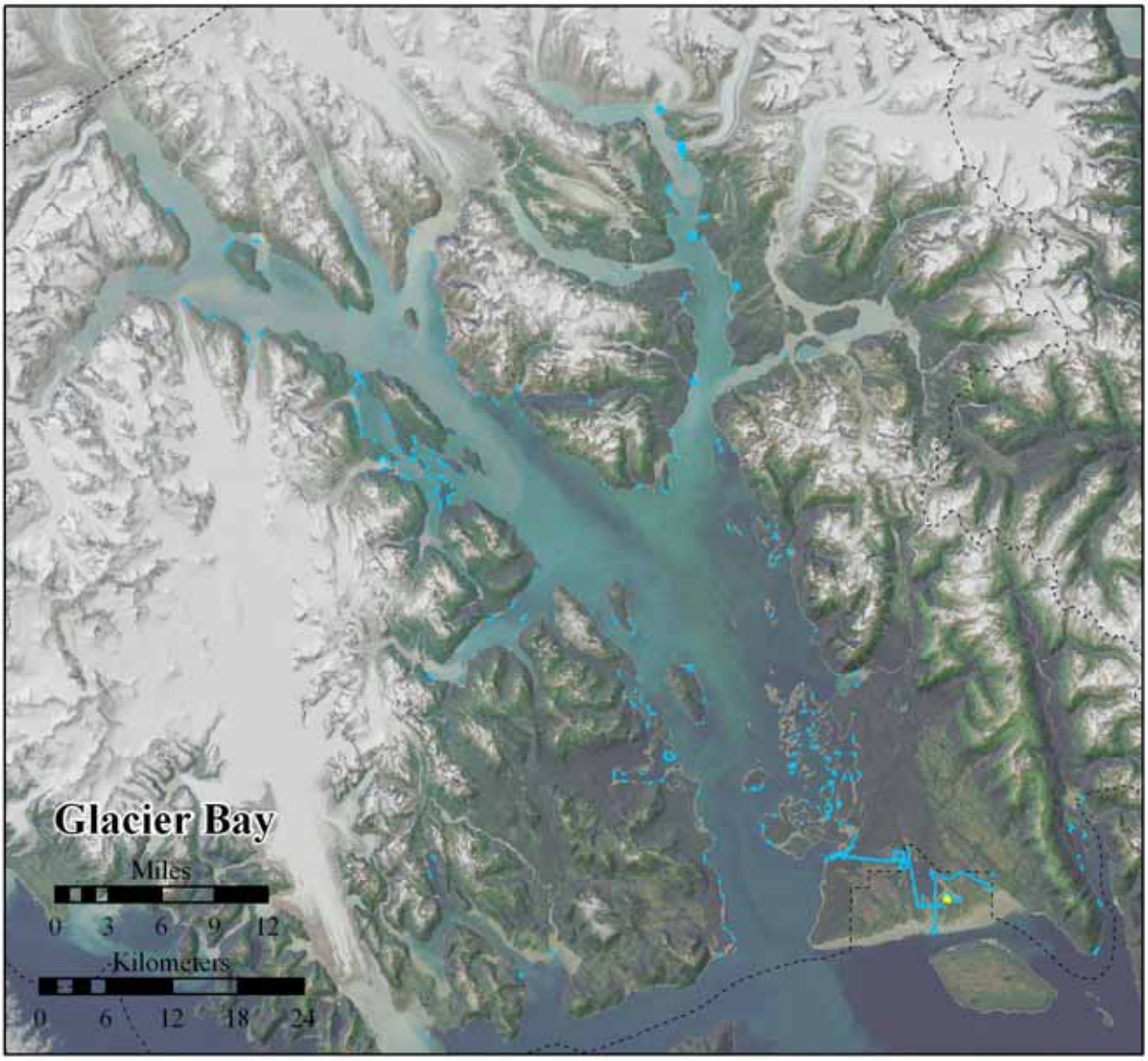
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



European Mountain Ash - *Sorbus aucuparia*



Chickweed - *Stellaria media*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

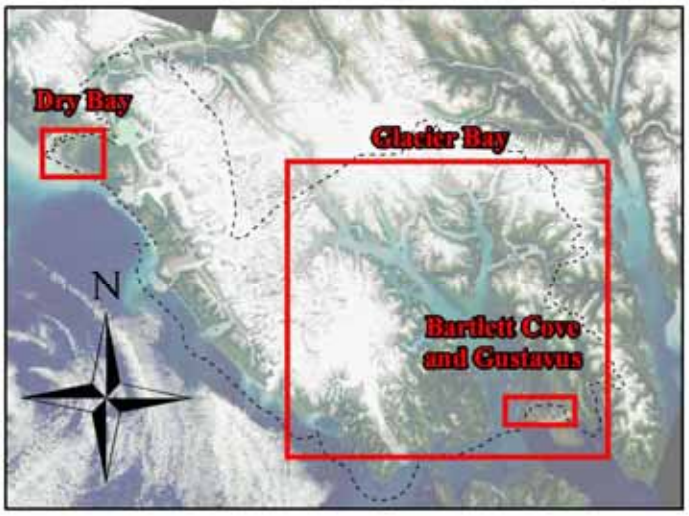
Present in 2005 Survey Area

Present in 2004 Survey Area

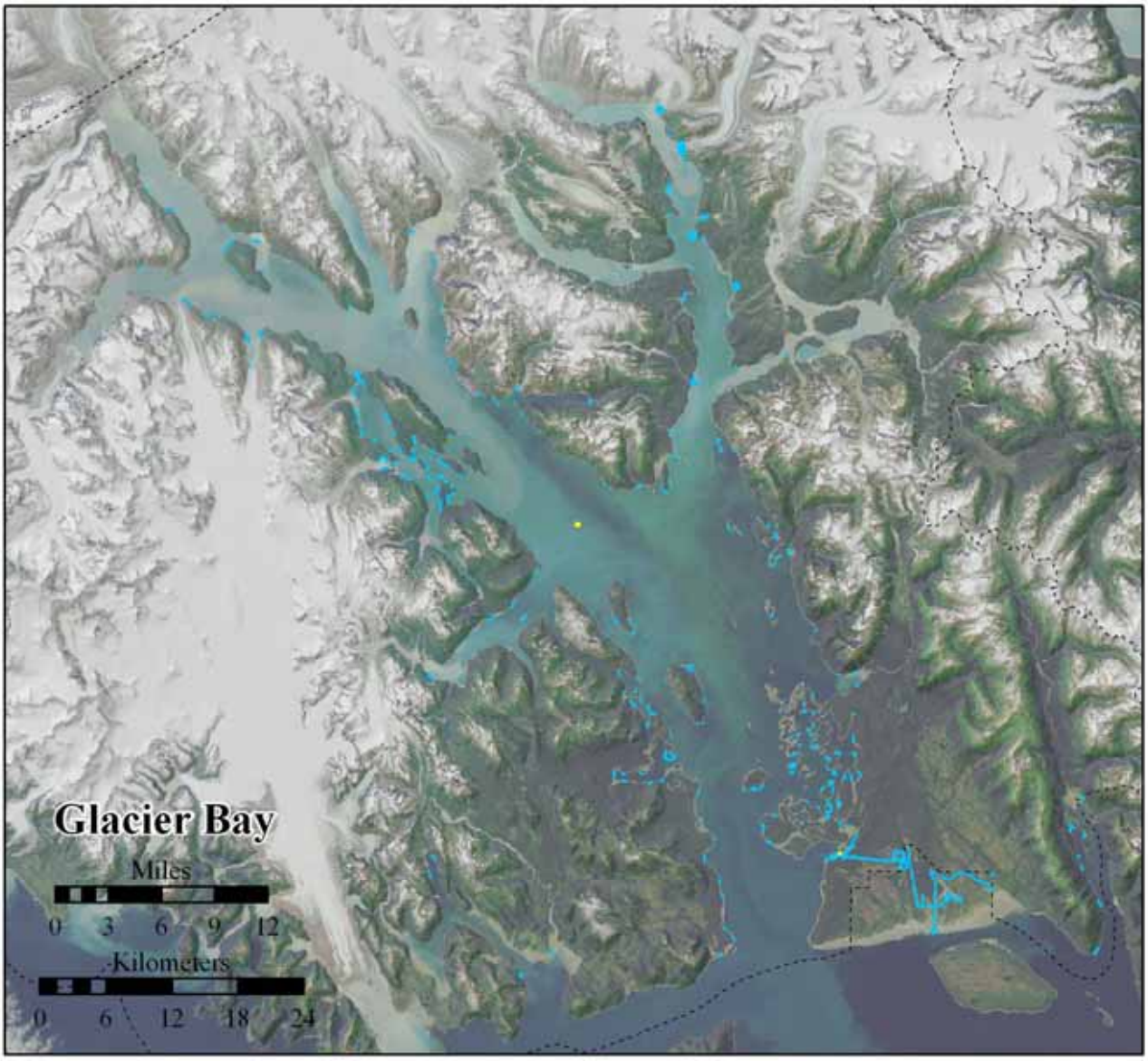
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Chickweed - *Stellaria media*



Common Comfrey - *Symphytum officinale*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

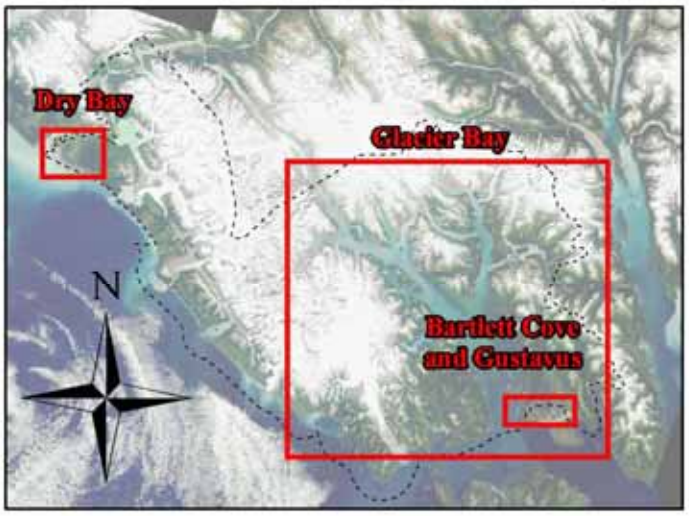
Present in 2005 Survey Area

Present in 2004 Survey Area

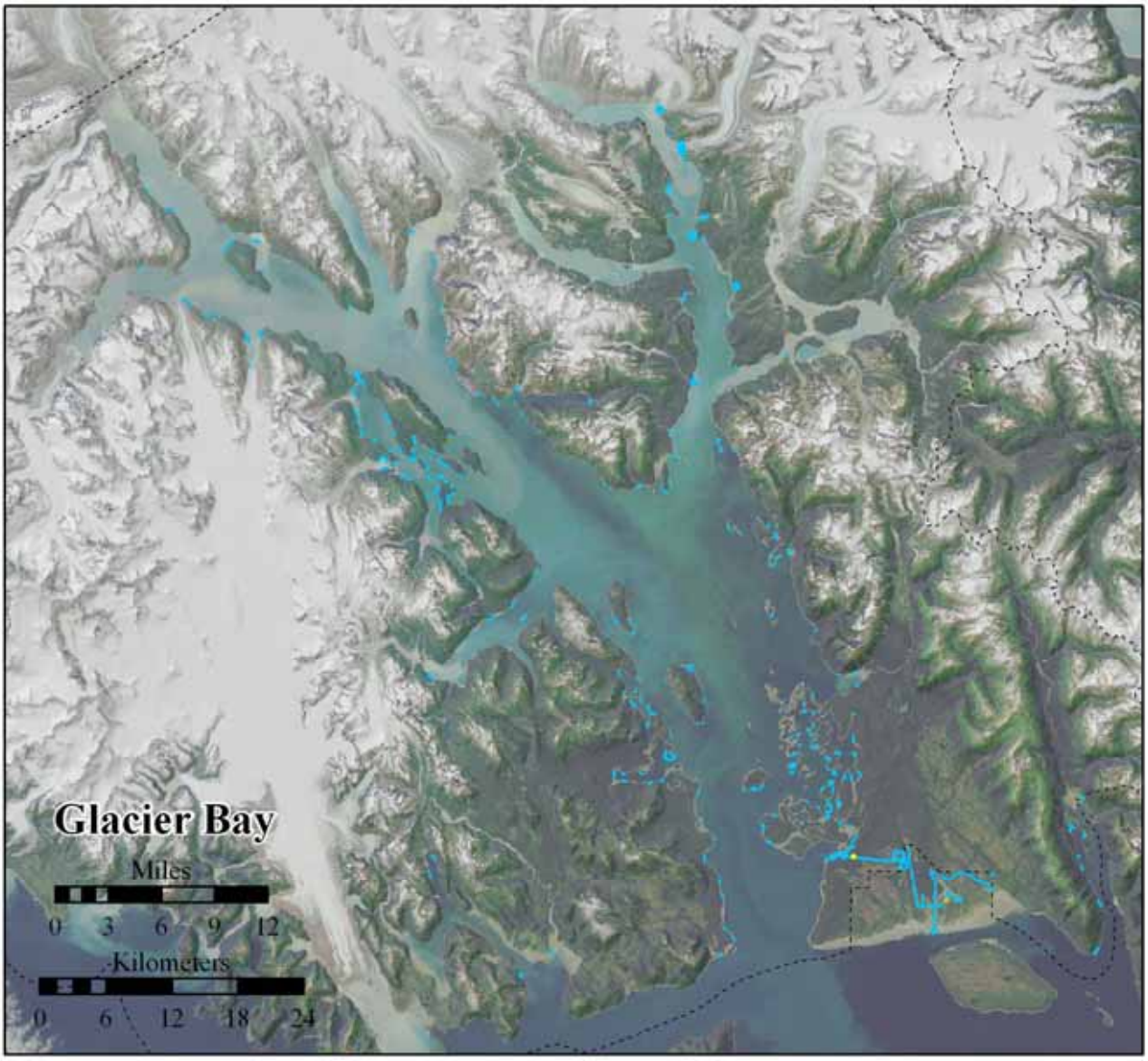
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Common Comfrey - *Symphytum officinale*



Common Tansy - *Tanacetum vulgare*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

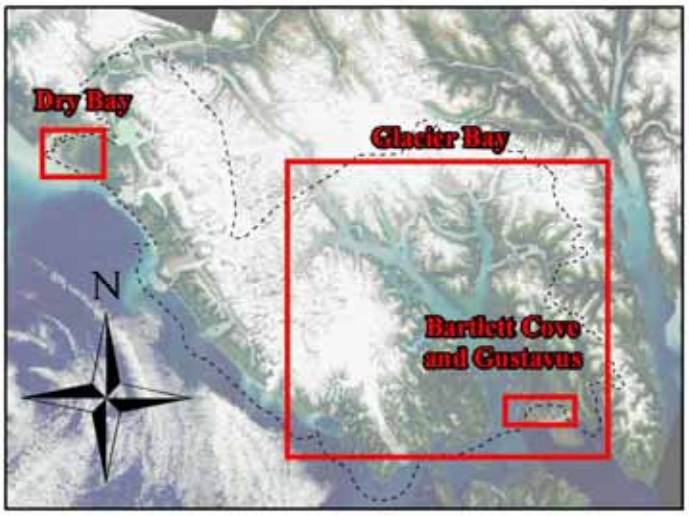
Present in 2005 Survey Area

Present in 2004 Survey Area

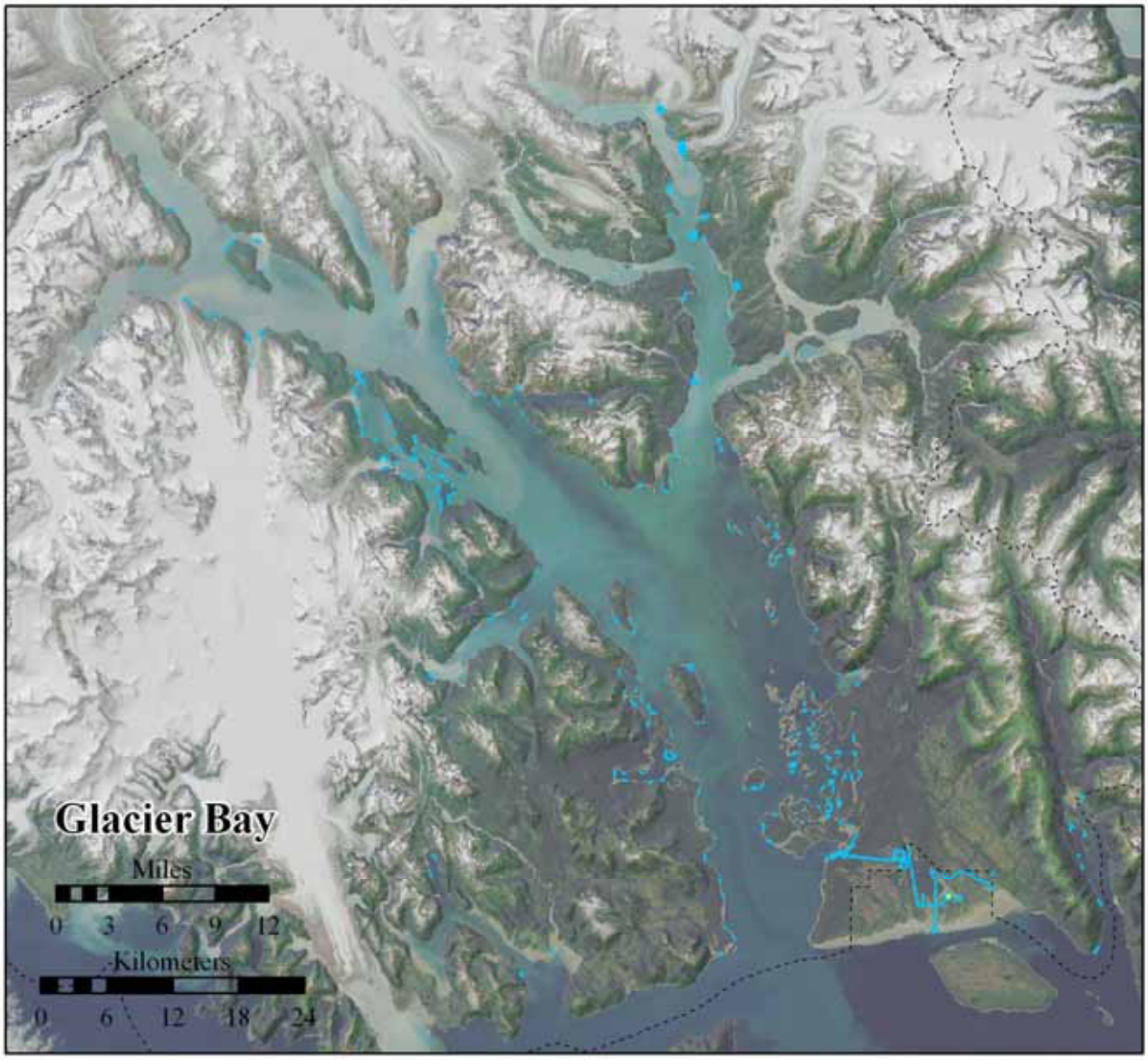
Absent in 2004-2006 Surveys

GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006

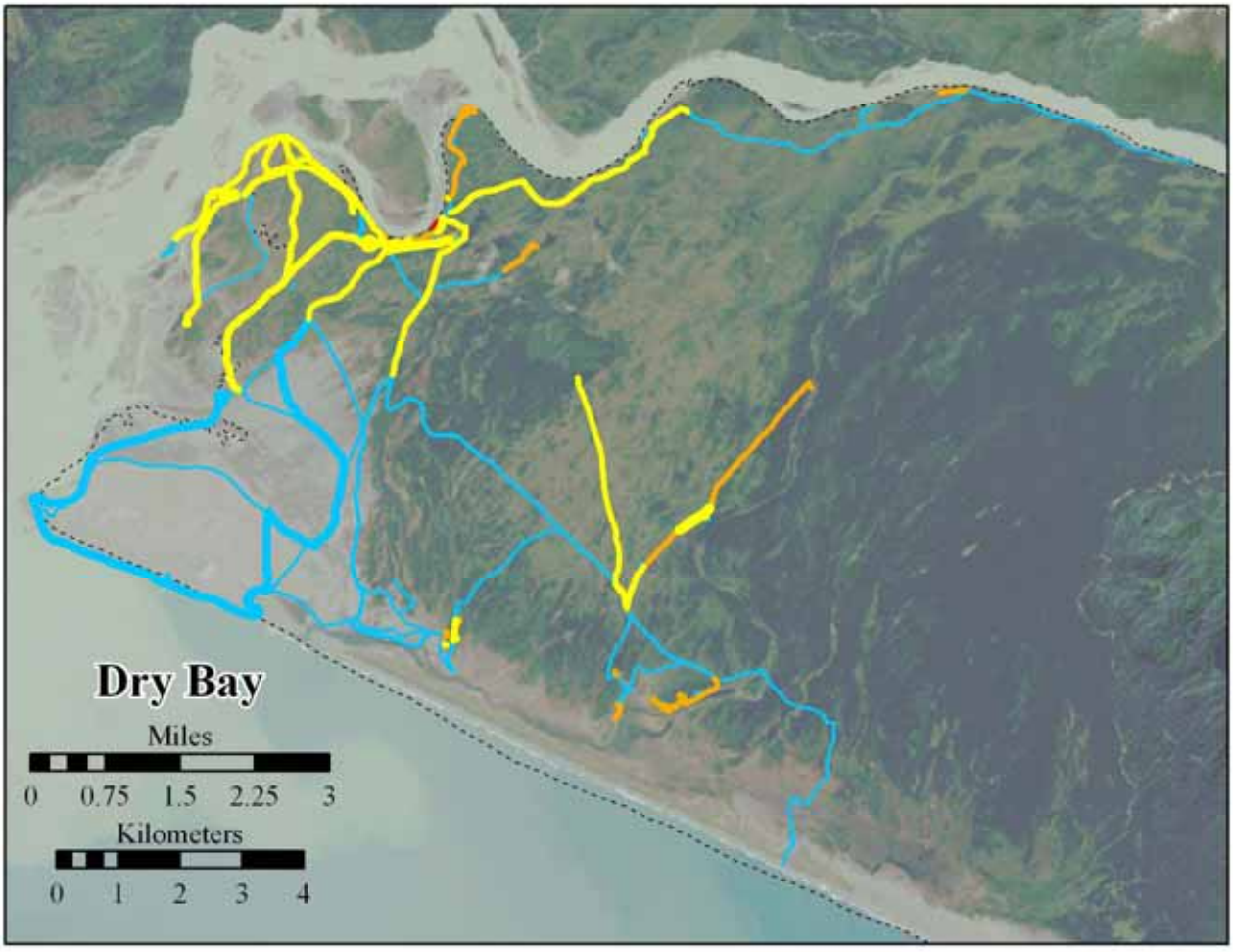


Common Tansy - *Tanacetum vulgare*



Common Dandelion - *Taraxacum officinale* ssp. *officinale*

in Glacier Bay National Park and Preserve



Present in 2006 Survey Area

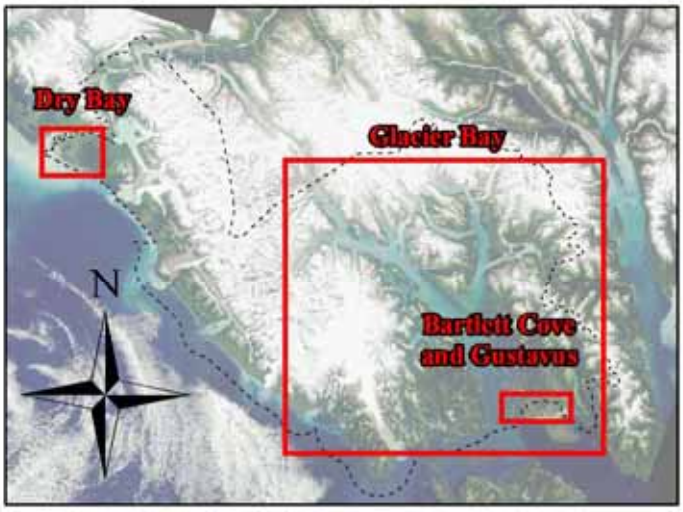
Present in 2005 Survey Area

Present in 2004 Survey Area

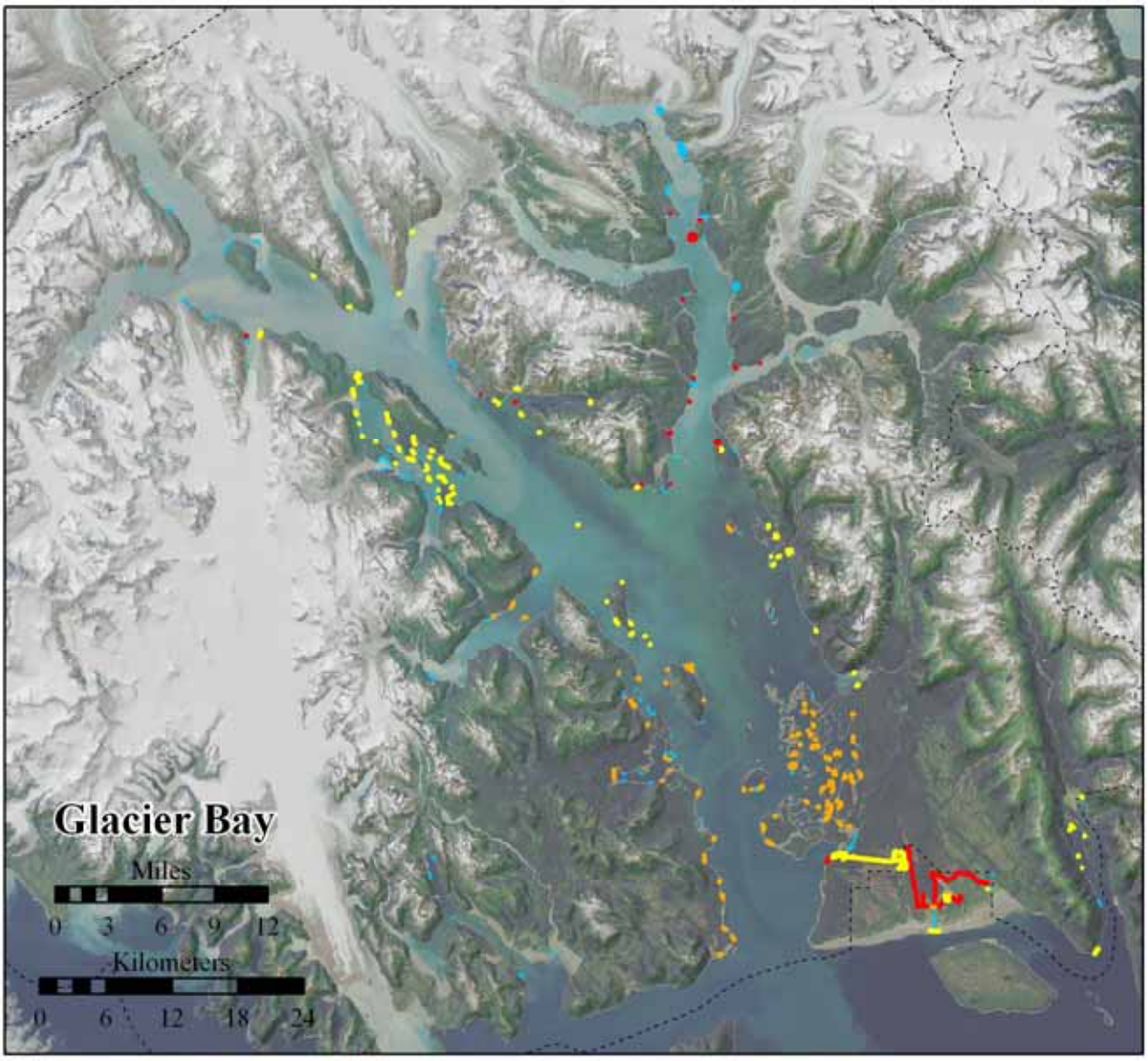
Absent in 2004-2006 Surveys

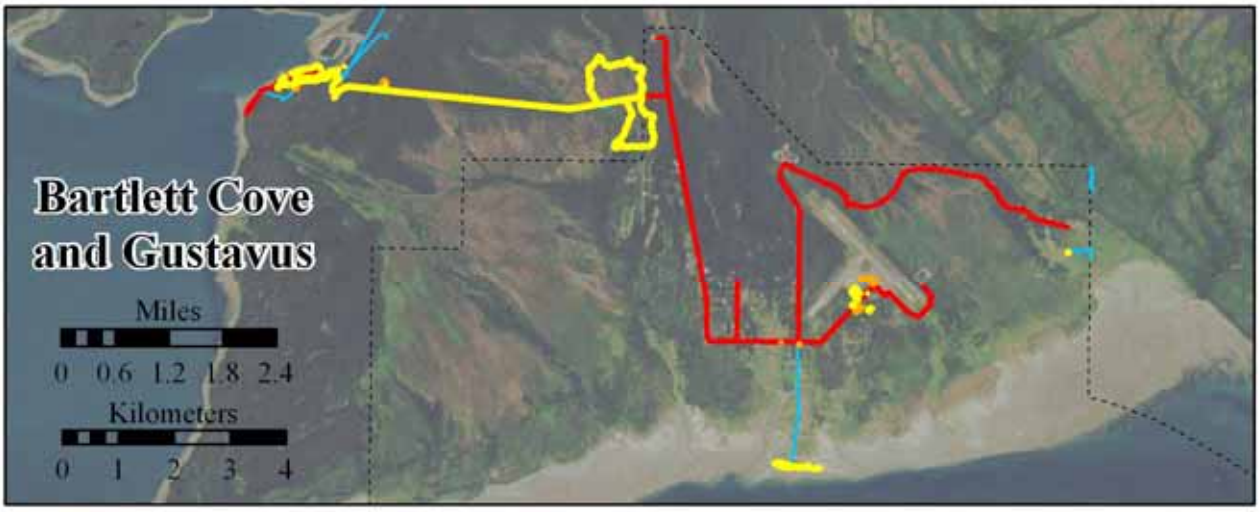
GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Common Dandelion - *Taraxacum officinale* ssp. *officinale*





Red Clover - *Trifolium pratense*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

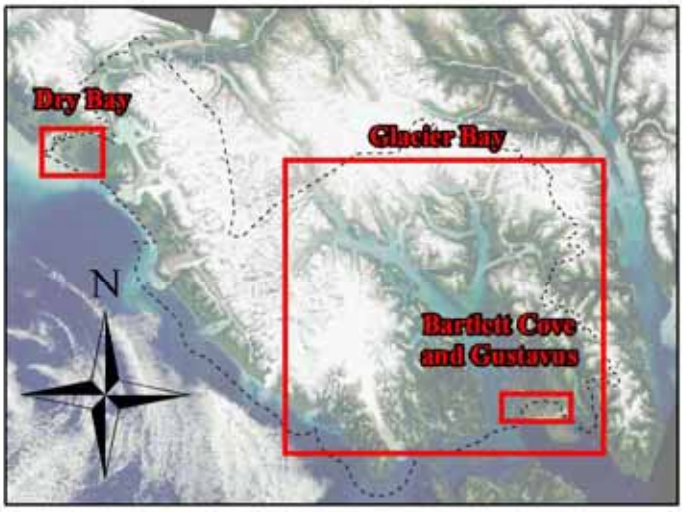
Present in 2005 Survey Area

Present in 2004 Survey Area

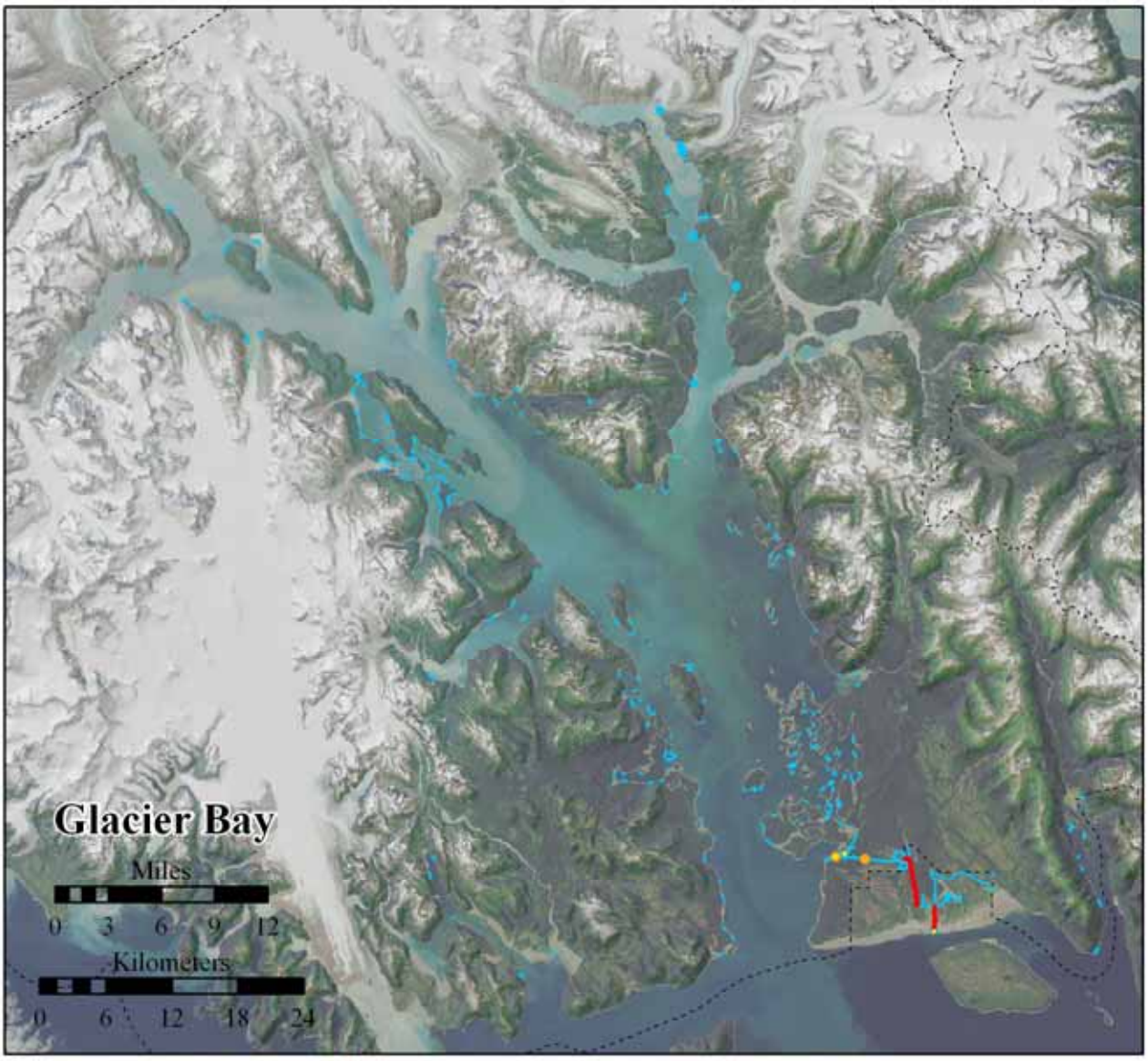
Absent in 2004-2006 Surveys

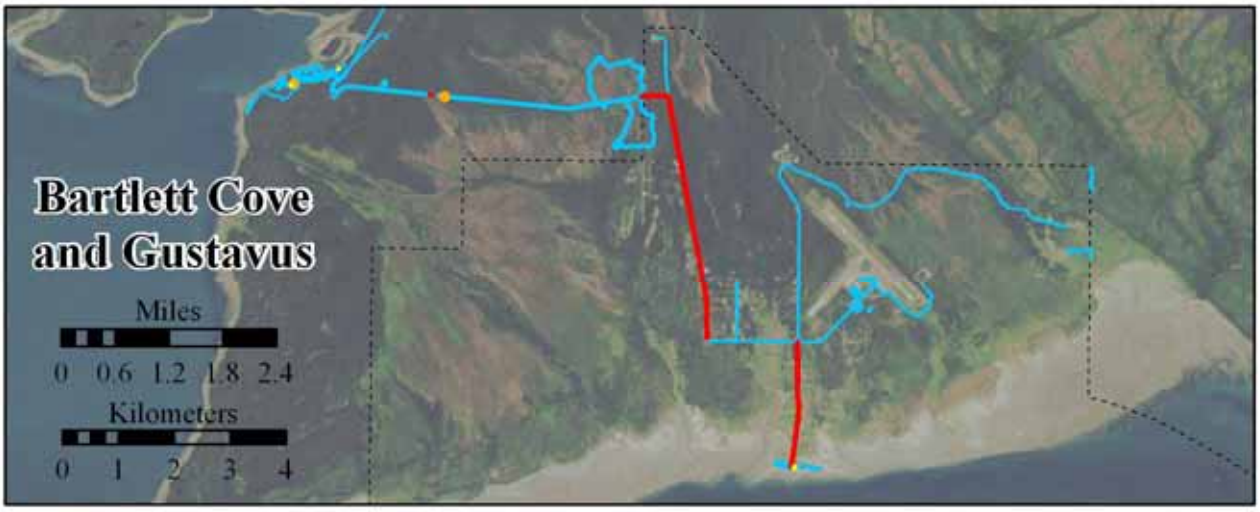
GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Red Clover - *Trifolium pratense*





White Clover - *Trifolium repens*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

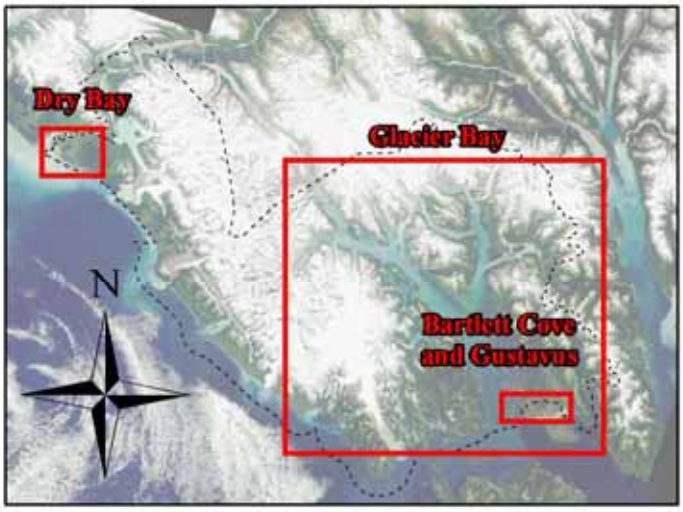
Present in 2005 Survey Area

Present in 2004 Survey Area

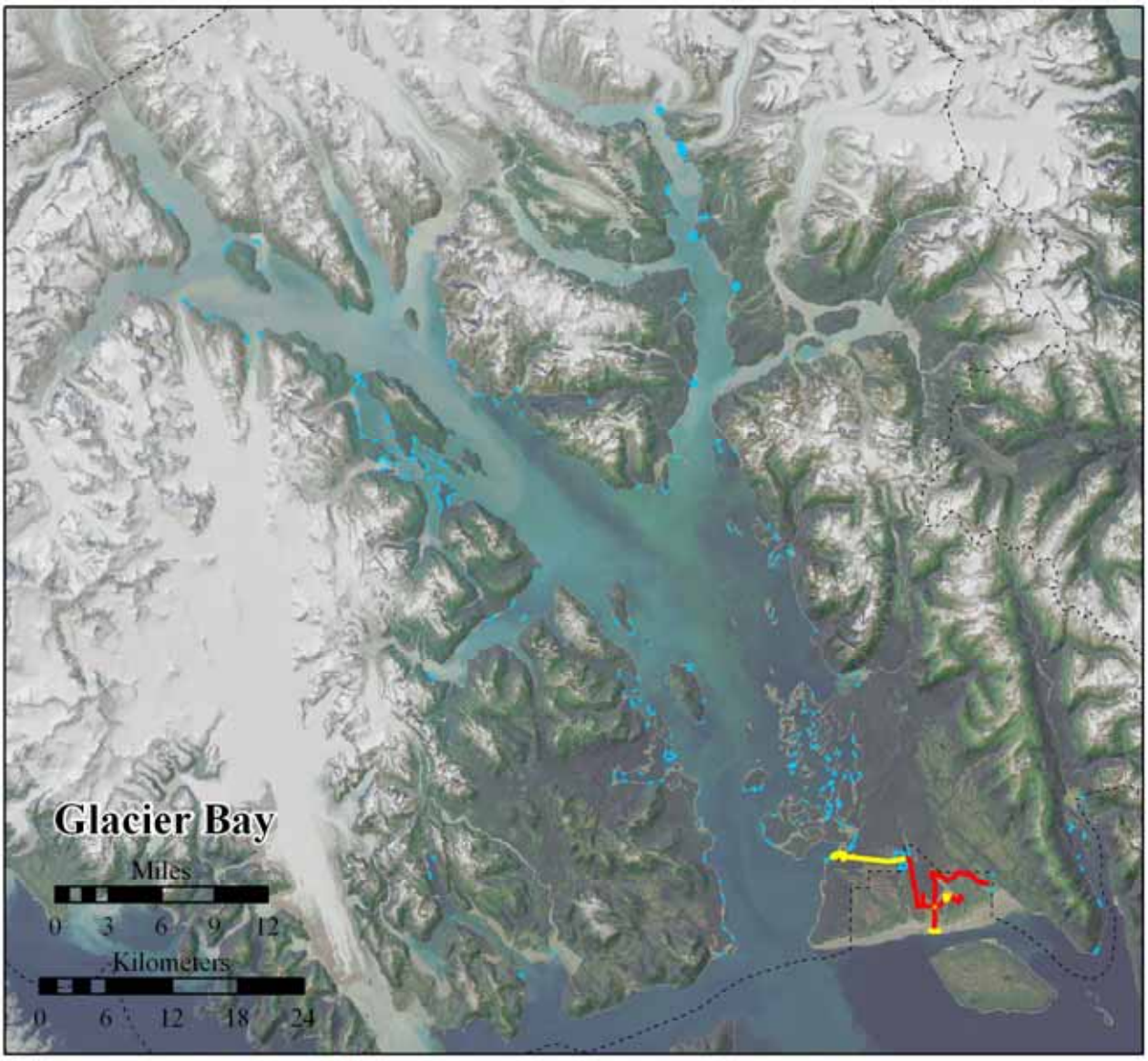
Absent in 2004-2006 Surveys

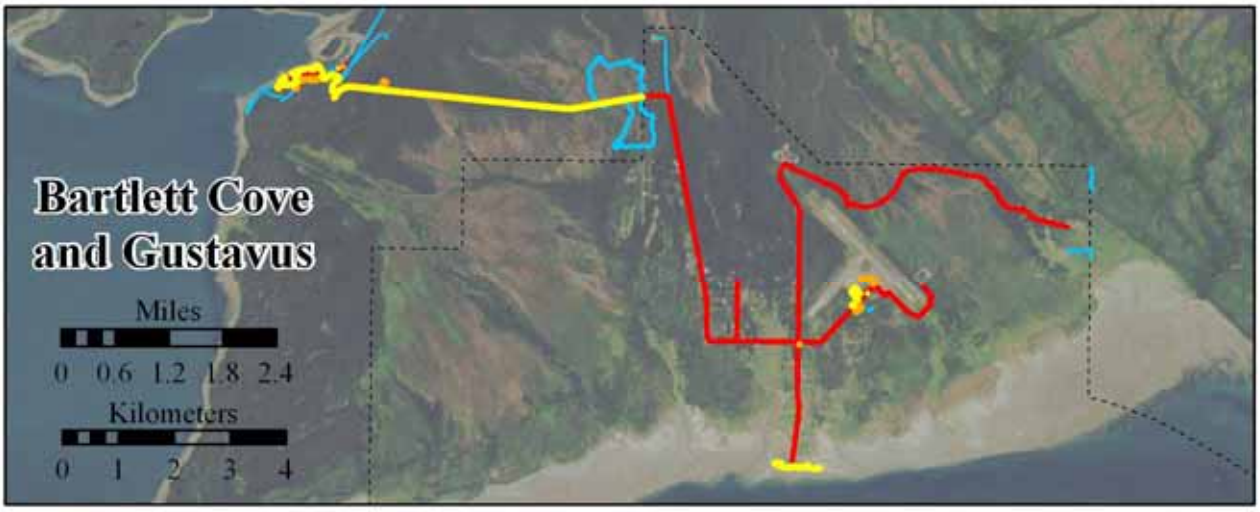
GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



White Clover - *Trifolium repens*





Common Wheat - *Triticum aestivum*

in Glacier Bay National Park and Preserve

Present in 2006 Survey Area

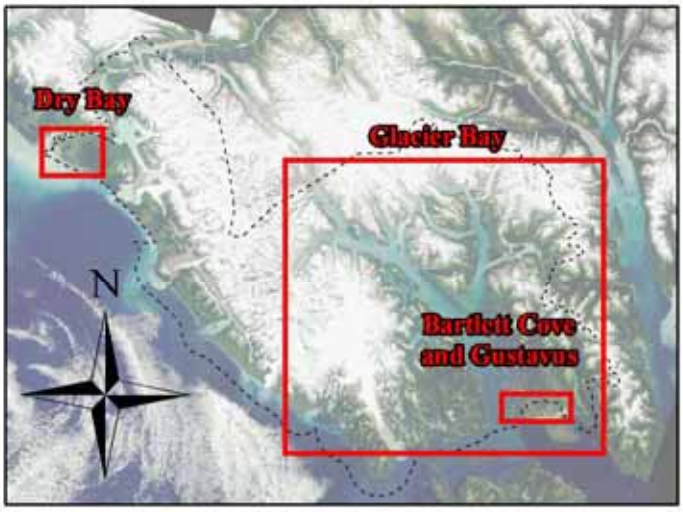
Present in 2005 Survey Area

Present in 2004 Survey Area

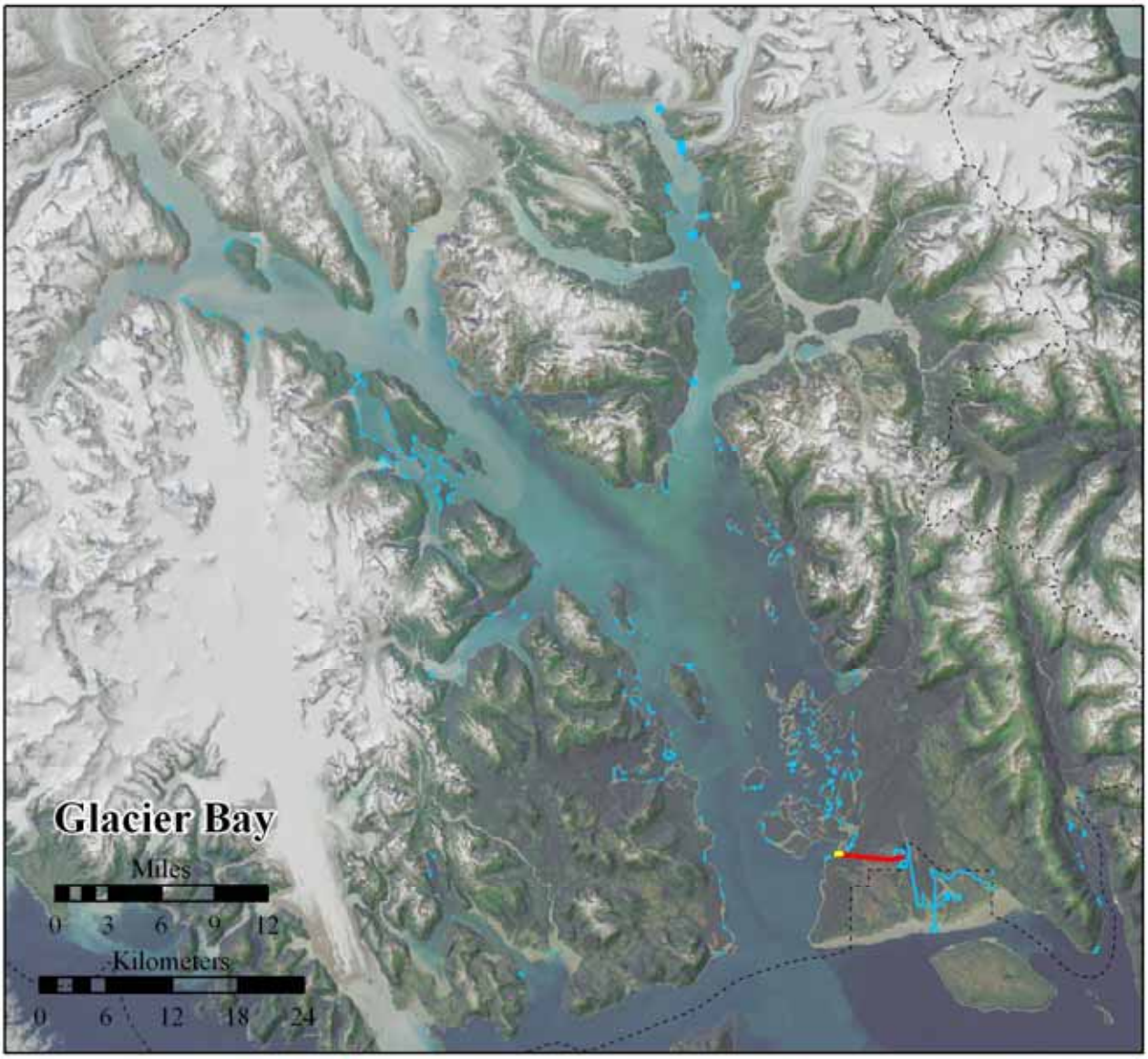
Absent in 2004-2006 Surveys

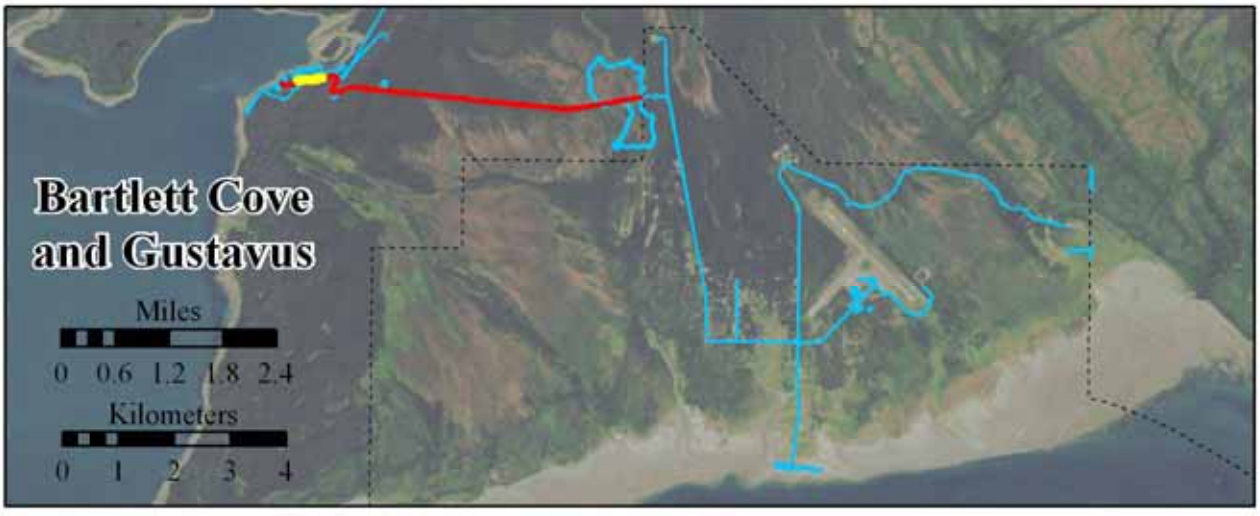
GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Common Wheat - *Triticum aestivum*





Areas of No Exotic Plants
in Glacier Bay National Park and Preserve

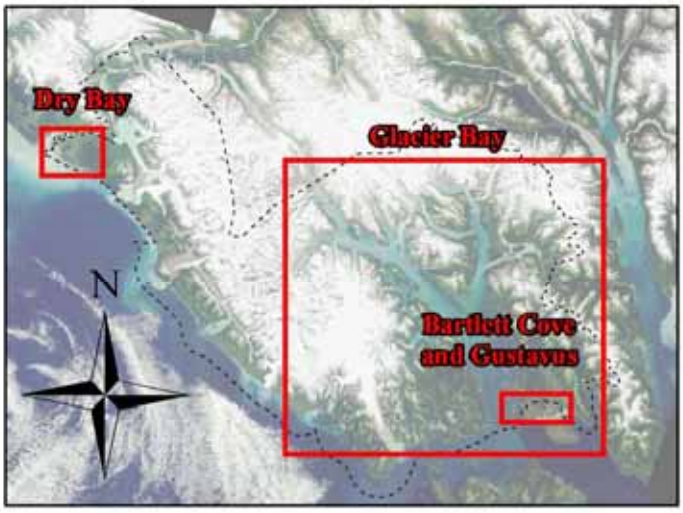
2004-2006 Surveys

No Exotic Species Found

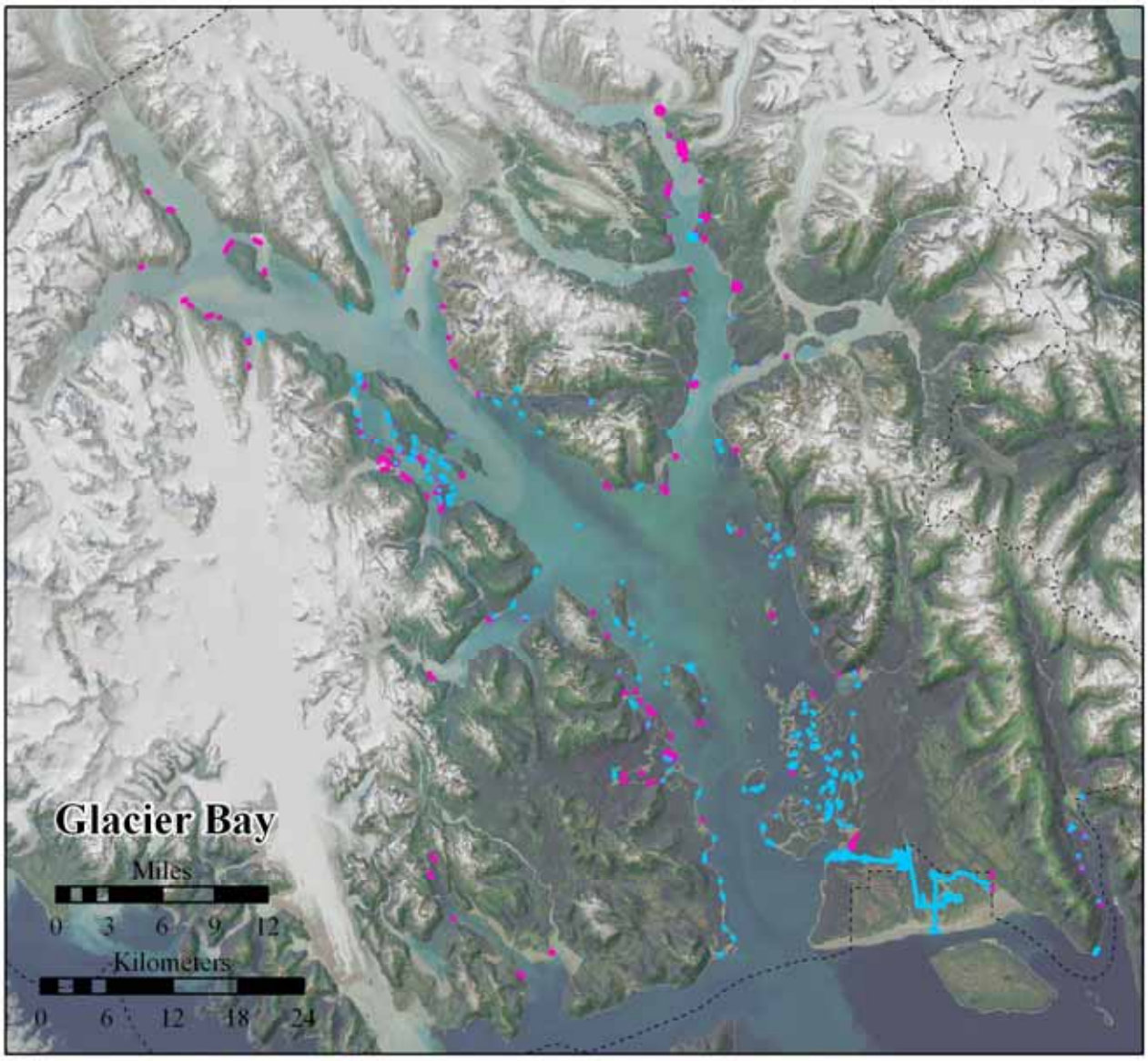
Exotic Specie(s) Found

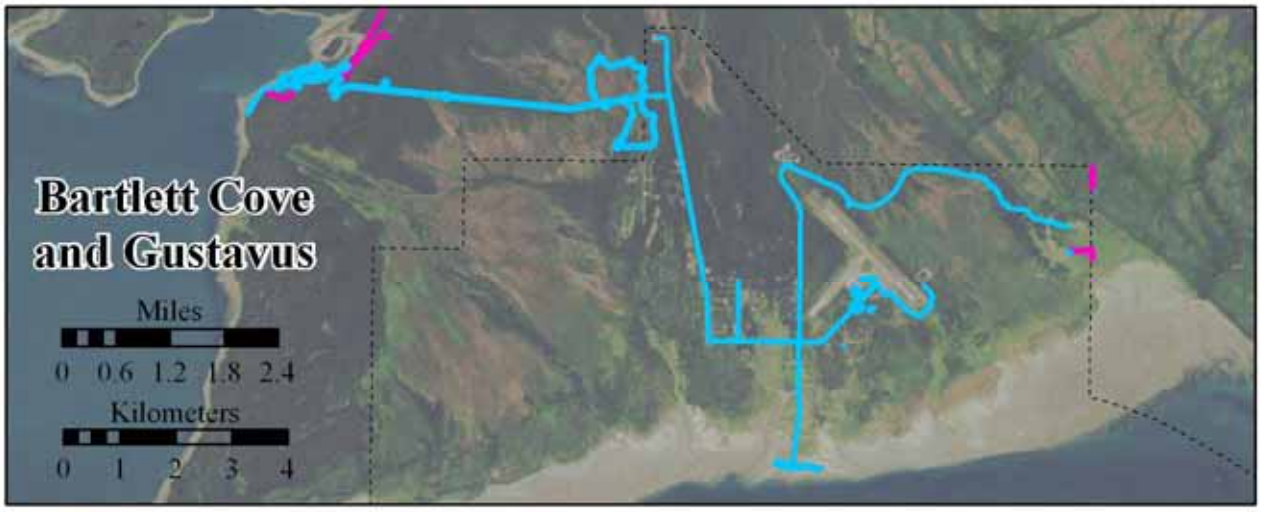
GLBA Boundary

Alaska Region
Exotic Plant Management Team
Projection: UTM 8N, NAD 83
Created: November 2006



Areas of No Exotic Plants





Appendix C – Species biographies of select species prepared by the Alaska Natural Heritage Program

All documents from:
http://akweeds.uaa.alaska.edu/akweeds_ranking_page.htm

Bromus inermis ssp. *inermis*
Capsella bursa-pastoris
Cerastium fontanum ssp. *vulgare*
Cirsium arvense
Dactylis glomerata
Elymus repens
Hieracium aurantiacum
Hordeum jubatum
Leucanthemum vulgare
Linaria vulgaris
Lolium perenne ssp. *multiflorum*
Lupinus polyphyllus ssp. *polyphyllus*
Matricaria discoidea
Melilotus alba
Phalaris arundinacea
Plantago major
Poa annua
Poa pratensis ssp. *pratensis*
Polygonum aviculare
Ranunculus repens
Ranunculus acris
Rumex acetosella
Rumex crispus
Silene spp.
Sonchus arvensis ssp. uliginosus
Sorbus aucuparia
Stellaria media
Tanacetum vulgare
Taraxacum officinale
Trifolium hybridum
Trifolium pratense
Trifolium repens

Smooth brome

Bromus inermis ssp. *inermis* Leyss

Synonyms: None
Other common name: None
Family: Poaceae

Description
Smooth brome is a perennial, rhizomatous plant from an extensive creeping rhizome. Stems are erect, hairless, up to 5 feet tall. Leaf blades are flat, 6 to 16 inches long and 5 to 15 mm wide, and nearly hairless. Leaf sheaths are closed, with a small V-shaped notch. Auricles are absent. A nodding, open panicle, 2 to 8 inches long, has 1 to 4 branches per node. Each branch has several spikelets, each 3/4 to 1¼ inches long. Spikelets are purplish brown. Seeds are elliptical, pale-yellow to dark-brown, about 1/2 inches long. A short awn, less that 3 mm long, may be present (Royer and Dickinson 1999).

The exotic subspecies *Bromus inermis* ssp. *inermis* and the native subspecies *Bromus inermis* ssp. *pumpellianus* (Scribn.) Wagnon both occur in Alaska. *Bromus inermis* ssp. *pumpellianus* (Scribn.) Wagnon can be distinguished by its pubescent nodes and leaf blades, as well as by awns on the lemmas (awns to 6 mm in length) (Butterfield et al. 1996, Hultén 1968).

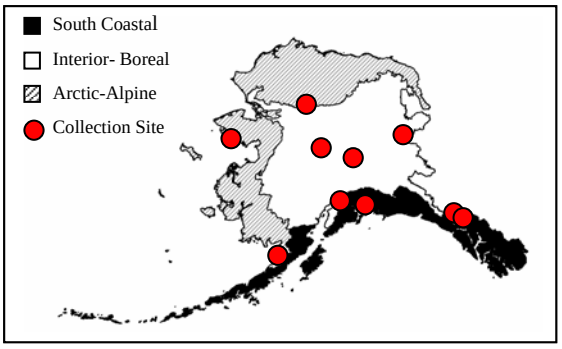
Ecological Impact
Impact on community composition, structure, and interactions: Smooth brome is a highly competitive. It forms a dense sod that often excludes other species, thus contributing to the reduction of species diversity in natural areas (Butterfield et al. 1996, Rutledge and McLendon). Smooth brome is an alternate host for the viral diseases of crops (Royer and Dickinson 1999, Sather 1987). It has high palatability for grazing animals (USDA 2002). In south Alaska hybrid swarms with *B. inermis* ssp. *pumpelliana* occur (Hultén 1968).
Impact on ecosystem process: Smooth brome may inhibit natural succession processes (Densmore et al. 2001, Rutledge and McLendon 1996).

Biology and Invasive Potential
Reproductive potential: Smooth brome reproduces by rhizomes and seeds. The number of seeds produced has a very wide range. Each plant is capable of producing 156 to 10,080 viable seeds (Butterfield et al. 1996, Sather 1987). In studies of McKone (1985) Smooth brome had significantly lower average seed set (17.2 per plant). Reproductive potential in Alaska is unknown. Most studies report a range of seeds longevity 2 to 10 years. Smooth brome maintains and readily expands its population base vegetatively, often aggressively (Butterfield et al. 1996, Rutledge and McLendon 1996).
Role of disturbance in establishment: Smooth brome can establish in undisturbed or lightly disturbed areas.
Potential for long-distance dispersal: Seeds may be transported short distances by wind and ants (Rutledge and McLendon 1996).
Potential to be spread by human activity: Smooth brome, often planted as a forage crop, persists after cultivation and infests surrounding vegetation. It can be transported with contaminated top soil (Densmore et al. 2001).
Germination requirement: Germination is primarily in the early spring, but it will occur in the early fall if soil moisture is adequate. Adequate soil nitrogen

is also necessary for seedling establishment (Butterfield et al. 1996).
Growth requirements: This species is suited to fine and medium textured soils, it is not adapted to coarse soils. pH ranging from 5.5 to 8. It prefers clays and loamy soils. Smooth brome has low anaerobic, calcareous, and saline tolerance. It grows best in highly fertile soil. It is fire tolerant, withstands temperatures to -38°F, and requires 90 frost-free days for reproduction. It does not require cold stratification for germination. Smooth brome is not shade tolerant (Dibbern 1947, Rutledge and McLendon 1996, USDA 2002).
Cogeneric weeds: *Bromus arenarius* Labill., *B. briziformis* Fischer and C. Meyer, *B. diandrus* Roth, *B. japonicus* Thunb. ex Murr., *B. hordeaceus* L., *B. madritensis* L. *B. secalinus* L., *B. stamineus* Desv., *B. sterilis* L., *B. tectorum* L., *B. trinii* Desv. (Wilken and Painter 1993, Royer and Dickinson 1999, USDA 2002).
Listing: Smoothe brome is listed as a weed in Tennessee (Royer and Dickinson 1999). However the species is not considered noxious in North America (Invaders Database System 2003, USDA 2002).

Distribution and Abundance
Smooth brome is a forage species. It has escaped throughout its range and is often considered to be a highly competitive weed of roadsides, forests, prairies, fields, lawns, and lightly disturbed sites (Butterfield et al. 1996, Rutledge and McLendon1996). In Alaska, exotic *Bromus inermis* has been widely planted as a pasture and forage crop, and as a revegetation grass along roadsides and along the Trans-Alaska Pipeline System corridor (Densmore et al. 2001).

Native and current distribution: Smooth brome is native to Eurasia. Its distribution range now includes Europe, temperate Asia, and North America . It is found throughout United States and Canada, except in the southeastern states (Royer and Dickinson 1999, USDA 2002). It has been reported from all eco-regions of Alaska (Densmore et al. 2001, Hultén 1968).



Distribution in Alaska

Management
Smooth brome can be a good target for selective control because it often occurs in single stands, or growing along with *Poa pratensis*. Cultural, chemical, and mechanical control methods have all been used with varying levels of success. Most herbicides are not specific for smooth brome (Butterfield et al. 1996, Rutledge and McLendon 1996). Unfortunately, most current control techniques are not effective in natural communities (J. Conn – pers. comm.).

References:

Butterfield, C., J. Stubbendieck, J. Stumpf. 1996. Species abstract of highly disruptive exotic plants. Jamestown, ND: Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/othrdata/exoticab/exoticab.htm (Version 16JUL97).

Conn, J. Weed Scientist, USDA Agricultural Research Service PO Box 757200 Fairbanks, Alaska 99775 tel: (907) 474-7652; fax (907) 474-6184. – Pers. com.

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Dibbern, J.C. 1947. Vegetative response of *Bromus inermis* to certain variation in environment. Botanical Gazette. 109: 44-58.

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

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McKone, M.J. 1985. Reproductive biology of several bromegrasses (Bromus): breeding system, pattern of fruit maturation, and seed set. American Journal of Botany 72(9): 1334-1339.

Royer, F. and R. Dickinson. 1999. Weeds of the Northern U.S. and Canada. The University of Alberta press. 434 pp.

Rutledge, C.R., and T. McLendon. 1996. An Assessment of Exotic Plant Species of Rocky Mountain National Park. Department of Rangeland Ecosystem Science, Colorado State University. 97 pp. Northern Prairie Wildlife Research Center Home Page. http://www.npwrc.usgs.gov/resource/othrdata/Explant/explant.htm (Version 15DEC98).

Sather, N. 1987. Element Stewardship Abstract for *Bromus inermis* Awnless Brome, Smooth Brome. The Nature Conservancy. Arlington, VA.

USDA (United States Department of Agriculture), NRCS (Natural Resource Conservation Service). 2002. The PLANTS Database, Version 3.5 (http://plants.usda.gov). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

Alaska Natural Heritage Program
Environment and Natural Resources Institute
University of Alaska Anchorage
707 A Street, Anchorage, Alaska 99501
Phone (907) 257-2780 Fax (907) 257-2789

Shepherd's purse

Capsella bursa-pastoris (L.) Medik. L.

Synonyms: *Bursa bursa-pastoris* (L.) Britt., *Bursa bursa-pastoris* (L.) Britt. var. *bifida* Crépin, *Bursa gracilis* Gren., *Capsella rubella* Reut., *Thlaspi bursa-pastoris* L.
Other common names: None
Family: Brassicaceae

Description
Shepherd's purse is an annual or winter annual from a taproot, with an erect simple or branched stem usually 3 to 18 inches tall. The plant can be smooth or with simple and star like hairs. Basal leaves in rosettes, 1 to 6 inches long and up to 1½ inches wide, oblanceolate, more or less entire to pinnately lobed. The clasping stem leaves with lobed margins are stalkless and reduced in size upwards. Small white flowers appear in terminal clusters. Flowers, up to 3/8 inches across, are composed of 4 green sepals, 4 white petals, 6 stamens, and 1 pistil. The flowering stalk elongates during fruit development. The fruit is a triangular pod, 3/8 inches long, with about 20 seeds. Seeds are round to oblong, dull orange (Douglas and Meidinger 1998, Royer and Dickinson 1999, Whitson at al. 2000).

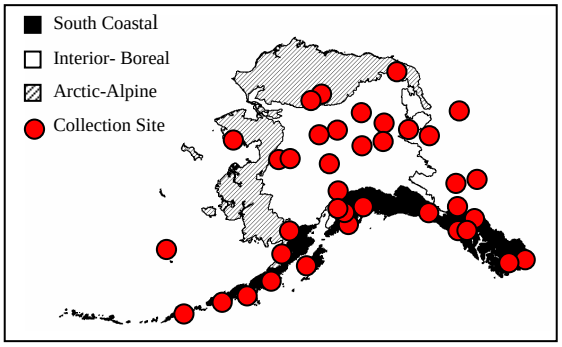
Shepherd's purse can be distinguished from native mustard, lyrate rockcress (*Arabis lyrata* L.), by its triangular seed pods, and its long, terminal racemose inflorescence.

Ecological Impact
Impact on community composition, structure, and interactions: Shepherd's purse is grazed by cattle, horses, yaks, sheep and rabbits (Crawley 1990). Its leaves are also eaten by insects and slugs (Aksoy et al. 1998, Dirzo and Harper 1980, Cook et al. 1996). Flowers are usually self-pollinated; however small insects, particularly flies and small bees, visit the flowers (Aksoy et al. 1998). Shepherd's purse is an host for nematode species and viruses (Royer and Dickinson 1999, Townshend and Davidson 1962).
Impact on ecosystem process: Shepherd's purse colonizes open ground and may inhibit the establishment of native species (Rutledge and McLendon 1996).

Biology and Invasive Potential
Reproductive potential: Shepherd's purse reproduces entirely by seeds. The number of seeds per plant varies mainly depending on habitat. Stevens (1932) recorded 38500 seeds per plant. Hurka and Haase (1982) in experiment recorded a minimum of 500 seeds and a maximum of 90000 seeds per plant. It can produce two or three generations in a year (Aksoy et al. 1998, Rutledge and McLendon 1996).
Role of disturbance in establishment: Shepherd's purse requires open soil and disturbance to germinate. Plants may appear on sites that have been redisturbed several decades after the last human disturbance (Densmore et al. 2001). In studies intense grazing led to greater densities of Shepherd's purse in perennial pastures (Harker et al. 2000).
Potential for long-distance dispersal: Seeds are small and light, and carried by wind or rain wash. They become sticky when moistened and can be dispersed on the feet of birds and mammals (Aksoy et al. 1998, Hurka and Haase 1982). Also they remain viable after passing through digestive tracts of birds, cattle, and horses (Rutledge and McLendon 1996).
Potential to be spread by human activity: Seeds may be transported in mud sticking to the feet of humans and to car tires (Aksoy et al. 1998, Densmore et al. 2001, Hurka and Haase 1982). Horticultural stock carried Shepherd's purse seeds as a contaminant (Hodkinson and Thompson 1997).
Germination requirements: Ripe seeds of Shepherd's purse are dormant and require a period of stratification before germination. Seeds germinate throughout the year, usually with a large peak in early

spring and a small peak in fall, at temperatures between 41°F and 86°F. Seeds of Shepherd's purse require light for germination (Aksoy et al. 1998, Baskin and Baskin 1986, Baskin and Baskin 1989, Popay and Roberts 1970).
Growth requirements: Shephard's purse is a plant of dry, open areas, showing some adaptability to moderate droughts. It is found mainly on clay to sandy loam with pH ranging from 5.0 to 8.0. Seedlings grow best at daytime temperatures of 68°F and nighttime temperatures of 59°F (Aksoy et al. 1998). This plant observed surviving winter temperatures as low as 10° F in Germany (Göppert 1881 cited in Aksoy et al. 1998).
Congeneric weeds: none
Listing: Capsella bursa-pastoris is listed as noxious weed in Colorado, Alberta, and Manitoba (Royer and Dickinson 1999, USDA, NRCS. 2006).

Distribution and abundance
Native and current distribution: Shephard's purse is native to Europe and West Asia. It has become cosmopolitan, and widely distributed throughout Europe, Asia, North America, Australia, and Africa. It was introduced into South America, New Zealand, and Tasmania (Hultén 1968). This species is well established in disturbed habitats of arctic of Greenland, Spitsbergen, Iceland, and Northland (Polunin 1957, Tolmatchev 1975). It has been documented in all ecogeographic regions of Alaska (Weeds of Alaska Database 2005, Hultén 1968, UAM 2004). Shepherd's purse is a common in cultivated crops, gardens, lawns, pastures, waste areas and roadsides (Alex and Switzer 1976, Aksoy et al. 1998, Royer and Dickinson 1999, Rutledge and McLendon 1996, Welsh 1974, Whitson at al. 2000).



Management
Shepherd's purse is a pioneer colonizer of disturbed areas and will not persist more than for 2-5 years unless the site is repeatedly disturbed. The plants can be easily pulled up by hand (Densmore et al. 2001).

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Common mouse-ear chickweed (*Cerastium fontanum* ssp. *vulgare* (Hartman) Greuter & Burdet)
Sticky chickweed (*C. glomeratum* Thuill.)

Family: Caryophyllaceae

Common mouse-ear chickweed and sticky chickweed share similar biological and ecological attributes. Their ecological and community impacts are believed to be comparable and therefore we treat these species together.

Cerastium fontanum ssp. *vulgare* Synonyms: *C. adsurgens* Greene, *C. fontanum* ssp. *holosteoides auct.* non (Fries) Salman, van Ommering & de Voogd, *C. fontanum* ssp. *triviale* (Link) Jalas, *C. holosteoides* auct. non Fries, *C. holosteoides* var. *vulgare* (Hartman) Hyl., *C. triviale* Link, *C. vulgatum* L. 1762, non 1755, *C. vulgatum* var. *hirsutum* Fries, and *C. vulgatum* var. *holosteoides* auct. non (Fries) Wahlenb.
Other common names: big chickweed

Cerastium glomeratum Synonyms: *C. acutatum* Suksdorf, *C. glomeratum* var. *apetalum* (Dumort.) Fenzl, and *C. viscosum* auct. non L.
Other common names: none

Common mouse-ear chickweed. Photo by Mary Ellen Harte

Description
Common mouse-ear chickweed is a biennial or short-lived perennial with taproot. Flowering stems are prostrate, rooting at the nodes, forming clumps up to 15 inches across. Stems, 2 to 15 inches long, are covered with stiff glandular hairs. Stem leaves are opposite, lanceolate to ovate, up to 1 inch long, 1-nerved, coarsely hairy on both surfaces. Leaves of the flowering stems are larger, up to 1½ inches long. Flowers are erect or spreading, inconspicuous, commonly several to many in open clusters. Small flowers have 5 white, 2-cleft petals, about ¼ inches long. Petals are equal or nearly equal to the sepals. Sepals are hairy, papery-margined. Seeds are small in cylindrical, 10-valved capsules up to ½ inches long (Douglas and MacKinnon 1998, Hultén 1968, Welsh 1974).


Sticky chickweed. Larry Allain @ USGS National Wetlands Research Center

Sticky chickweed is very similar to common mouse-ear chickweed. Sticky chickweed can be distinguished be viscid stem and leaves. Flowers of sticky chickweed are more or less tightly clustered. Petals are shorter or only slightly longer than sepals (Douglas and MacKinnon 1998, Hultén 1968).

Number of native chickweeds are known from meadows and rocky slopes of Alaska and Yukon (field chickweed - *C. arvense* L., Fischer's chickweed – *C. fischerianum* Ser., and Bering chickweed - *C. beeringianum* Cham. & Schlechtand). These are usually matted perennials with petals longer than the sepals (Douglas and MacKinnon 1998, Cody 2000). Common chickweed (*Stellaria media* (L.) Vill.) can be distinguished by having a single line of hairs along each internode (Johnson et al. 1995, Hultén 1968, Welsh 1974)

Ecological Impact

Impact on community composition, structure, and interactions: Common mouse-ear and sticky chickweeds have not been observed in undisturbed plant communities in Alaska and its impact on native community composition is not documented. These species are a host for some nematode species (Townshend and Davidson 1962).

Impact on ecosystem process: Impact of common mouse-ear and sticky chickweeds on ecosystem processes is unknown.

Biology and Invasive Potential

Reproductive potential: Common mouse-ear chickweed and sticky chickweed reproduce by seeds and stems rooting at the nodes (Ohio perennial and biennial weed guide 2006).

Role of disturbance in establishment: Anthropogenic or natural disturbances are essential for the establishment of common mouse-ear chickweed and sticky chickweed from seeds (Broughton and McAdam 2002, Jesson et al. 2000, Ryan et al. 2002).

Potential for long-distance dispersal: Seabirds probably have some role in transport of seeds. Viable seeds of *Cerastium* species were found in pellets of sea gulls (Gillham 1956).

Potential to be spread by human activity: Common mouse-ear chickweed is a weed of gardens and lawns. It can be transported with horticultural stock (Hodkinson and Thompson 1997).

Germination requirements: Germination occurs throughout the year with peak of germination in fall and early spring. Maximum germination occurs at light and alternating temperatures of 68°F and 50°F (Grime et al. 1981, Williams 1983).

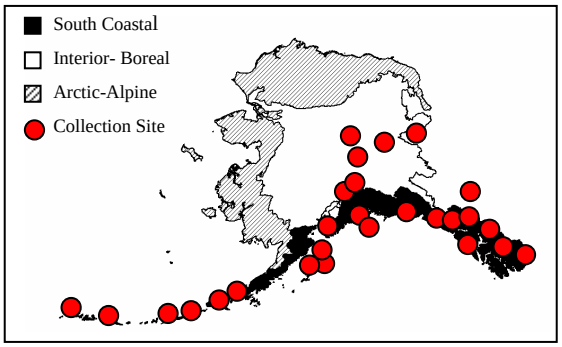
Growth requirements: The mouse-ear and sticky chickweeds are adapted to wide range of habitats, from dry open areas to moist woods, from mountain rocky slopes or river bars to nutrient rich sea-bird colonies (Jesson et al. 2000, Ryan et al. 2003). These weeds thrive in lawns and gardens and do not tolerate cultivation (Ohio perennial and biennial weed guide 2006).

Congeneric weeds: number of *Cerastium* species has been introduced into US but none of them listed as a noxious weed (USDA, NRCS 2006).

Listing: Cerastium fontanum ssp. *vulgarum* is listed as a noxious weed in Alberta and Manitoba, Canada. *Cerastium glomeratum* is not listed as a weed (Rice 2006).

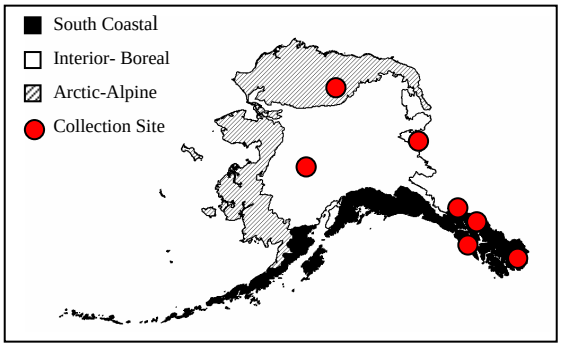
Distribution and abundance

Native and current distribution: Cerastium fontanum ssp. *vulgare* is native to Europe, Asia and Northern Africa. It is now found throughout the world. It is widely scattered in Alaska and Yukon. This species is a weed of roadsides, waste places, gardens and fields (Douglas and MacKinnon 1998, Welsh 1974).



Distribution of common mouse-ear chickweed in Alaska

Cerastium glomeratum is native to Eurasia. It is widespread in North America. It is known from many disjunct localities in Alaska and Yukon (Hultén 1968, Welsh 1974).



Distribution of sticky chickweed in Alaska

Management

Small population of common mouse-ear and sticky chickweeds can be controlled by hand-pulling. Herbicides can be effective when applied during active growth (AKEPIC 2005).

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Canada thistle

Cirsium arvense (L.) Scop.

Synonyms: *Breea arvensis* Less., *B. incana* (Gmel.) W.A. Weber, *Carduus arvensis* (L.) Robson, *Cirsium arvense* var. *argenteum* (Vest) Fiori, *C. arvense* var. *horridum* Wimmer & Grab., *C. arvense* var. *integrifolium* Wimmer & Grab., *C. arvense* var. *mite* Wimmer & Grab., *C. arvense* var. *vestitum* Wimmer & Grab., *C. incanum* (Gmel.) Fisch., *C. setosum* (Willd.) Bess. ex. Bieb., *Serratula arvensis* L.
Other common names: creeping thistle, California thistle, field thistle
Family: Asteraceae

Description
Canada thistle is a perennial from deep and extensive horizontal roots, which can form new shoots. Stems are mostly 1-4 feet tall, branching above. Leaves are alternate, lacking petioles, shallowly to deeply pinnatifid or merely lobed, the margin spiny. The leaf underside is often covered with soft, woolly hairs. Flowers are purple in heads ½ to ¾ inch in diameter. Male and female flowers heads appear on separate plants. Flowers are almost exclusively insect-pollinated. Fruits are brownish, with a tuft of hairs at the top (Whitson et al. 2000).


Canada thistle flower heads

Canada thistle is the only thistle in Alaska with narrow flowering heads and lacking a winged stem.

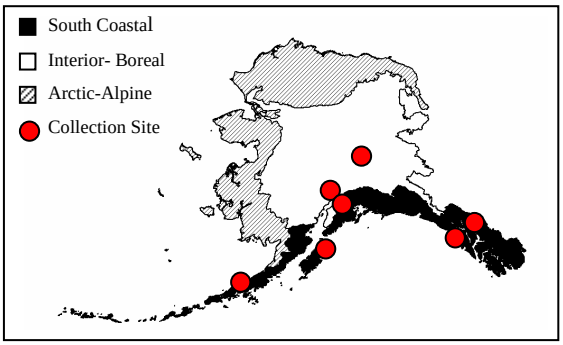
Ecological Impact
Impact on community composition, structure, and interactions: Canada thistle threatens natural communities by directly competing for water and nutrients and displacing native vegetation, decreasing species diversity. It produces allelopathic chemicals that assist in displacing competing plant species (Evans 1984, Hayden 1934). Pollinating insects appear to be drawn away from native species to visit Canada thistle (Zouhar 2001). This species has been reported to accumulate nitrates that cause poisoning in animals and the spiny leaves scratch animal skin, causing infection, at a minimum. It is a host for bean aphid and stalk borer, and for sod-web worm (Nuzzo 1997).
Impact on ecosystem process: Canada thistle can increase fire frequency and severity due to its abundant and readily ignited litter (Zouhar 2001).

Biology and Invasive Potential
Reproductive potential: Canada thistle readily propagates from stem and root fragments. It reproduces by seeds, but mostly spreads by lateral roots sending up new shoots each year. An individual plant may produce over 40,000 seeds a year (Royer and Dickinson 1999).
Role of disturbance in establishment: Canada thistle has been observed on natural areas around ponds and wetlands where water levels fluctuate, areas of soil erosion, gopher mounds. It apparently cannot become established or spread in undisturbed or good or excellent condition pastures (Bossard et al. 2000, Evans 1984, Zouhar 2001). Cultivation stimulates the growth of horizontal roots, thereby increasing the number of new upright shoots borne by the horizontal runners (Hayden 1934).
Potential for long-distance dispersal: The pappus breaks off easily from the seed and most seeds land near the parent plant. However a small proportion of seeds (0.2%) can disperse 1 km or more from the parent plant (Bostock and Benton 1979, Nuzzo 1997). The seeds float and are easily distributed by water. It can also be dispersed in dung. There is a belief that ducks and other waterfowls are the agents of distribution of Canada thistle seeds (Hayden 1934).
Potential to be spread by human activity: It spreads as a contaminant in crop seed, hay, and packing material. Additionally, it can be spread in mud attached to vehicle and farm equipment (Nuzzo 1997).
Germination requirements: Canada thistle seeds germinate best in the top 1 cm of soil at abundant soil

moisture and temperatures averaging from 68 to 86°F. New seeds will germinate in bright light. Approximately 90% of seeds germinate within one year; some seeds remain dormant in the soil for up to 20 years, however (Hutchison 1992). The deeper the seed is buried, the longer the viability (Nuzzo 1997).
Growth requirements: Canada thistle grows on variety of soil types: clay, loam, silt, gravel, and chalk. It does not tolerate shade (Nuzzo 1997).
Congeneric weeds: *Cirsium canescens* Nutt., *C. orchocentrum* Gray, *C. scariosum* Nutt., *C. undulatum* (Nutt.) Spreng., *C. vulgare* (Savi) Ten. (USDA 2002, Whitson et al. 2000).
Listing: Canada thistle has been declared noxious by 35 states and 6 Canadian provinces (Invaders Database System 2003). It is considered a serious pest in 37 countries (Zouhar 2001). It is a prohibited noxious weed in Alaska (Alaska Administrative Code 1987).

Distribution and Abundance
Canada thistle was introduced to North America in the early 17th century and was declared a noxious weed by the state of Vermont in 1975 (Nuzzo 1997). It is found throughout Canada and the northern half of the United States (USDA 2002). It is common on roadsides, railway embankments, lawns, gardens, abandoned fields, agricultural fields, and pastures. Natural areas invaded include prairies and wet grasslands (Canada, Dakota), sedge meadows (Wisconsin and Illinois). In eastern North America, it occurs in sand dunes, stream banks, lakeshores, swamps, and ditches (Nuzzo 1997).

Native and current distribution: Native to southeastern Europe, western Asia, and northern Africa. It now has a near global distribution, exclusive of Antarctica. It cccurs throughout Europe, northern and south Africa, western and central Asia, India, Japan, China, North and South America, New Zealand, Tasmania, and Australia (Hultén 1968, Nuzzo 1997).



Distribution of Canada thistle in Alaska

Management
Canada thistle is very difficult to control once established. The literature on *C. arvense* control focuses on agricultural systems. At this time, there are no control methods suitable for wide-spread use in natural areas. Greater effort is warranted in areas that have new or small invasions. A combination of mechanical, cultural, and chemical methods are more effective than any single method used alone. Potential biocontrol organisms are not adequately synchronized with Canada thistle's life cycle in North America (Nuzzo 1997).

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Last Updated April 4, 2006

Orchardgrass

Dactylis glomerata L.

Synonyms: None
Other common names: cocksfoot, orchard grass
Family: Poaceae

Description
Orchardgrass is a strongly tufted perennial, mostly 1½ to 3 feet tall. Leaf blades are flat, up to ½ inches wide, hairless, usually scabrous. Ligules are 1/8 to 3/8 inches long, somewhat hairy. Inflorescence is a panicle 1 to 4 inches long, compound of dense, one-sided, congested clusters. The branches are stiffly ascending to erect or spreading. Spikelets are three- to five-flowered, ¼ to ½ inches long, strongly compressed. Lemmas with soft awn tips up to 1 mm long (Hultén 1968, Welsh 1974).


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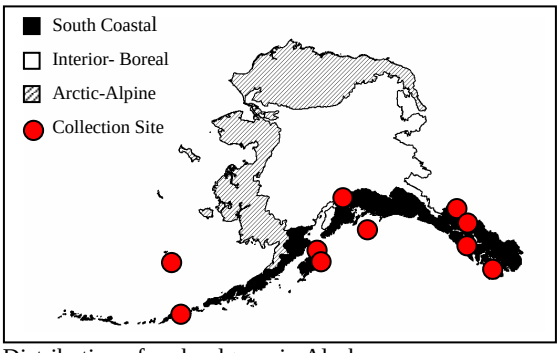
Orchardgrass can be confused with reed canarygrass (*Phalaris arundinacea*). Reed canarygrass has one-flowered spikelets. It usually has wider leaves and more narrow, pointed inflorescence. Reed canarygrass usually grows in wetter habitat than does orchardgrass.

Ecological Impact
Impact on community composition, structure, and interactions: Dense stands of orchardgrass may suppress growth of native shrubs (Anderson and Brooks 1975), but is it susceptible to replacement by native species and does not usually persist over one or two decades (Sullivan 1992).
Impact on ecosystem process: Orchardgrass is moderately nutritious and highly palatable to wildlife browsing animals. Orchardgrass also provides food and cover for number of small mammals, birds, and insects (Sullivan 1992).

Biology and Invasive Potential
Reproductive potential: Orchardgrass reproduces by seeds and by tiller formation (Beddows 1957).
Role of disturbance in establishment: Orchardgrass is usually associated with human disturbances (Williamson and Harrison 2002), but it is known to invade undisturbed coastal prairie grasslands (Corbin et al. 2004).
Potential for long-distance dispersal: Most seeds fall directly to the soil below the parent plant. Some seeds attach to animals and travel long distances (Beddows 1957).
Potential to be spread by human activity: Orchardgrass is widely used as a forage crop, and is recommended as a part of a seed mix for erosion control and pasture rehabilitation (Anderson and Brooks 1975, McLean and Clark 1980). It is a common commercial seed contaminant (Bush et al. 2005).
Germination requirements: Most seeds do not have innate dormancy and can germinate in the fall. Adequate soil moisture is the most critical factor for germination. Germination can occur in both light and darkness (Sullivan 1992). Seed germinates mainly in the top 2-3 inches of soil (Chippindale and Milton 1934).
Growth requirements: Orchardgrass is best adapted to well-drained, rich or moderately fertile soils with adequate water. Optimum growth is achieved at day temperatures between approximately 65° and 71° F. (Baker and Jung 1968). It prefers soils with pH range

of 5.8 – 7.5, but will tolerate pH as high as 8.5. It does not grow well on saline soils and areas with high water tables, but can withstand shading (Bush et al. 2005). Orchardgrass requires 120 frost free days for successful growth and reproduction and can withstand winter temperature to -43°F (USDA, NRCS 2006).
Congeneric weeds: None
Listing: Dactylis glomerata is declared noxious in New Jersey and Virginia (Rice 2006).

Distribution and abundance
Orchardgrass is a weed of waste areas, fields, yards, and roadsides in coastal Alaska (Hultén 1968, Welsh 1974).
Native and current distribution: Orchardgrass was introduced from Europe and it is now present throughout temperate Asia and North America. It is also introduced into South America, Australia, and New Zealand, and can be found in the arctic (Hultén 1968, Tolmachev et al. 1995).



Distribution of orchardgrass in Alaska

Management
Generally, mechanical methods are not effective in control of orchardgrass. Numerous herbicides are available for orchardgrass (Rutledge and McLendon 1996).

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Last Updated April 5, 2006

Quackgrass

Elymus repens (L.) Gould

Synonyms: *Agropyron repens* (L.) Beauv., *Elytrigia repens* (L.) Desv. ex B.D. Jackson, *Elytrigia vaillantiana* (Wulfen & Schreb.) Beetle, *Triticum repens* L., *Triticum vaillantianum* Wulfen & Schreb.
Other common name: dog grass, quickgrass, scotch, quitch, twitch
Family: Poaceae

Description
Quackgrass is a strongly rhizomatous perennial. The rhizomes are long and highly branched, yellowish-white, sharp-pointed, and somewhat fleshy. Its stems are erect and usually 1 to 3 feet tall. Leaf blades are ¼ to ½ inch wide, flat, pointed and have small auricles at the junction of blade and sheath. Leaf blades often have a diagnostic slight constriction at the tip. Blades are sparsely hairy above and hairless below. Spikelets are arranged in two long rows and born flatwise to the stem. The florets are awnless to short-awned. Seeds are elliptical, pale yellow to brown (Whitson et. al. 2000).

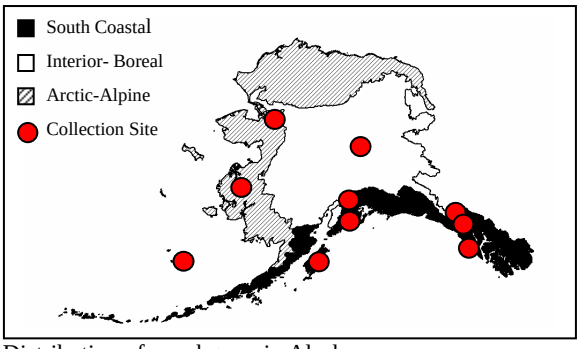
A number of *Lolium*, *Agropyron*, and *Elymus* grasses can be confused with quackgrass. However, quackgrass is rhizomatous, the leaves are broad, flat and slightly constricted at the tip, and spikelets are solitary.

Ecological Impact
Impact on community composition, structure, and interactions: Quackgrass is a strong competitor with cultivated crops and native grasses and forbs in prairies and grasslands. Where forming dense stands it can exclude regeneration of native woody species, and may also hinder the restoration of cropland, rangeland, pasture, and native grasslands. Additionally, it reduces the availability of soil moisture and limiting nutrients. Quackgrass can photosynthesize and grow during early spring, which may suppress species that photosynthesize and grow during the later, warmer part of season. This grass is allelopathic, producing ethylacetate extracts, cyclic hydroxamic acids and several other phytotoxins that may be exuded from its shoots and root and can suppress the growth or reproductive vigor of competing plants (FEIS 1996, Royer and Dickinson 1999, Whitson et al. 2000).
Impact on ecosystem process: Quackgrass may alter secondary succession following fires, where its cover can dramatically increase (FEIS 1996).

Biology and Invasive Potential
Reproductive potential: Quack grass is an aggressive perennial reproducing by seed and spreading by a shallow mass of rhizomes. Each stem can produce up to 400 seeds, although 20 to 40 is common. Seeds may remain dormant in the soil for 2 to 3 years (Batcher 2002). A plant may spread up to 3 m per year and can give rise to more than 200 new shoots (Royer and Dickinson 1999, Whitson et. al. 2000). It has no resprouting ability (USDA 2002).
Role of disturbance in establishment: This grass readily colonizes disturbed bared ground, but can invade undisturbed grassy habitats.

Potential for long-distance dispersal: Seeds dispersal mechanisms are unknown, although seeds remain viable after passing through the digestive systems of many domestic animals (Batcher 2002).
Potential to be spread by human activity: Many palatable hybrid crosses of quackgrass and other species have been developed and planted for livestock. It has been used to revegetate mine tailings (FEIS 1996).
Germination requirements: Seeds germinate either in the fall or spring. Alternating temperatures are required for germination (59° to 77° F diurnal fluctuations) (Batcher 2002).
Growth requirements: Quackgrass is adapted to coarse, fine and medium textured soils, pH 5.2 – 7.8. It is shade intolerant, no cold-stratification required for germination, it withstands temperatures to -43°F, and requires only 90 frost-free days. Optimum temperatures for growth are between 68° and 77°F. Rhizome growth seems to be favored by low temperatures (50°F) and long days (18 hours). This species has moderate summer porosity (FEIS 1996, USDA 2002).
Listing: Listed as Noxious in 27 states of the United States and 5 Canadian provinces (Invaders Database System 2003, USDA 2002). It is classified as a noxious weed in Alaska (Seed regulations 1987).

Distribution and Abundance
Introduced from Europe as a contaminant in hay or straw, it was first reported in North America in 1672. It has now been reported from every state in the U.S. and throughout Canada. This invasive grass is found in numerous natural terrestrial grassland communities as well as in agricultural fields in the temperate North America. It is early successional, and can invade gardens, yards, crop fields, roadsides, ditches, and other disturbed, moist areas. It can also colonize mixed-grass prairies and open woodlands. Some associate species of quackgrass include *Carex* spp., *Scirpus* spp., *Juncus* spp., *Bromus inermis*, *Poa pratensis*, and *Cirsium arvense* (FEIS 1996).
Native and current distribution: It is native to Eurasia (temperate Europe and Central Asia: Afghanistan, India, Pakistan). It is now found in South America (Argentina and Chile), North Africa, Australia, New Zealand, and Indonesia (Batcher 2002, Hultén 1968). It has been collected from all eco-regions in Alaska (Densmore et al. 2001, Hultén 1968, University of Alaska Museum 2003).



Distribution of quackgrass in Alaska.

Management
Successful control measures currently include applying herbicides, burning, tilling, and combinations of these three methods. Monitoring for two years after treatment is recommended (Batcher 2002).

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Introduction
These two species of hawkweed share very similar biological and ecological attributes. We treat the description, distribution and abundance separately, but combine the discussion of ecological impacts and control methods.

Orange hawkweed
Hieracium aurantiacum L.

Synonyms: none
Other common names: devil's paintbrush, king-devil
Family: Asteraceae

Description

Orange hawkweed is a perennial weed with shallow, fibrous roots, stolons, and well-developed basal rosettes. Leaves are oblanceolate to narrowly elliptic up to 5 inches long, hairy, and almost exclusively basal. Stems reach a height of 12 inches and bear up to thirty, 1/2 inch flower heads near the top. Flowers are red to orange. Stems and leaves exude milky latex when cut or broken. Each floret produces a single-seeded fruit. Seeds are oblong, purplish black, about 2 mm (ca. 1/16 of an inch) long. The upper surface and the margins of the first leaves have a few long hairs (Gleason 1968, Hultén 1968, Royer 1999).

Orange hawkweed. Photo by Michael Shephard, USDA Forest Service

No other composite species in Alaska has dark orange to red flower heads.

Meadow hawkweed
Hieracium caespitosum Dumort.

Synonyms: *Hieracium pratense* Tausch.
Other common names: yellow hawkweed
Family: Asteraceae

Description

Meadow hawkweed is perennial herb from a short, stout rhizome and long, leafy stolons. Stems erect, solitary, with glandular, starlike hairs, exuding milky juice when broken, Stem can reach a height of 3 feet. Basal leaves well-developed, persistent, oblanceolate to spoon-shaped, entire or minutely toothed, stalked, with non-glandular hairs, 2-10 inches long, 1 inch wide, stem leaves 1-3 reduced upwards. Stem bear up to 30 1/2-inch flower heads near the top. Ray flowers are yellow. Seeds are black, and tiny; pappus dirty white (Idaho's noxious weeds 2003, BC

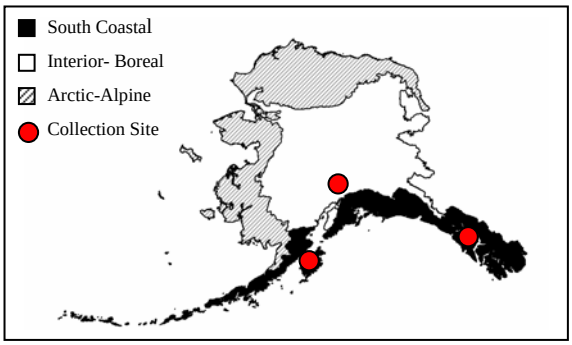
Meadow hawkweed. Photo by Michael Shephard, UDSA Forest Service

There are several yellow flowered species of hawkweeds in Alaska. Meadow hawkweed (*H. caespitosum*) has clusters of flowers near the tops of the stems, stolons, and no leaves on the stem. Mouseear hawkweed (*H. pilosella*) forms basal rosette, stolons, and produces only one yellow

flower head on a single slender stem. Narrow leaf hawkweed (*H. umbellatum*) has leaved stem, do not form basal rosette and has no stolons (Douglas et al. 1998). All native species do not have stolons.

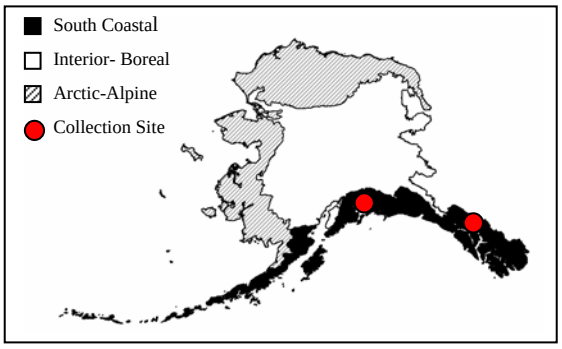
Distribution and Abundance

Orange hawkweed is indigenous to British Isles, South Scandinavia, west to Russia, and south to Mediterranean. It was introduced for use as an herbal remedy and ornamental before 1818. Now found on the Pacific coast, east to the Atlantic coast, and as far south as Indiana and West Virginia. It is also established in East Asia, Canada, and New Zealand. It can invade meadows, grasslands, rangelands, pastures, and borders of forests. It is commonly found on roadsides, disturbed areas and waste places. It has been collected in South Coastal (Juneau, Kodiak) and Interior-Boreal ecoregions in Alaska (AK Weeds Database 2004, Hultén 1968).



Distribution and Abundance

Meadow hawkweed is native to northern, central and eastern Europe. It was likely introduced into the United States in 1828. It is currently found from Quebec to Ontario and southward to Georgia and Tennessee. It was first reported in the Pacific Northwest in Washington in 1969. It can invade meadows, rangelands, pastures, and borders of forests (Idaho's noxious weeds 2003). It is commonly found on roadsides, disturbed areas and waste places (Douglas et al. 1998). Meadow hawkweed has been collected in Juneau and Valdez (AK Weeds Database 2005, M. Shephard – pers. com.).



Ecological Impact

Impact on community composition, structure, and interactions: Orange and meadow hawkweed form monocultures by establishing a dense mat of plants, lowers biodiversity and reduces the forage value of grasslands for grazing animals. These plants are successful competitors, crowding out native, pasture and range species (Pratcher et al. 2003). Hawkweed species are allelopathics (Murphy and Aarssen 1995). It hybridizes freely with native and non-native hawkweeds (Rinella and Sheley 2002).
Impact on ecosystem process: These plants likely reduce soil moisture and nutrient availability (J. Snyder – pers.com.).

Biology and Invasive Potential

Reproductive potential: Hawkweeds reproduce by seed, stolons, rhizomes, and root buds. Plants typically produce 12 to 30 seeds/flower (ca. 50-600/plant) and send out four to eight stolons each season. It can resprout from any fragments left in the soil. Seeds of orange hawkweed are viable up to 7 years. Infested areas can have extensive seed banks (Idaho's noxious weeds 2003).
Role of disturbance in establishment: Hawkweeds readily grow in cleared areas in forests. Mowing promotes flowering and spreading of stolons.
Potential for long-distance dispersal: Fruits are adapted to dispersal by wind, animals, and humans.
Potential to be spread by human activity: Seeds are easily carried by vehicles, animals and clothing. Orange hawkweed is common in urban areas due to its use as an ornamental.
Growth requirements: Hawkweeds grow on well-drained, coarse-textured and moderately low in organic matter soils. These plants prefer full sun or partial shade (Noxious Weed Control Program 2004).
Congeneric weeds: Five more species of *Hieracium* are listed as a noxious in US (USDA 2003).
Listing: Hieracium aurantiacum is listed as noxious weed in Colorado, Idaho, Minnesota (Secondary

Noxious Weed), Montana (Cat. 2), and Washington (Class B) (Pokorny and Sheley 2003, USDA 2003). *H. caespitosum* is considered a noxious in Idaho, Montana, Oregon, and Washington (Invaders Database System 2003).

Management

Mechanical methods (mowing, cutting, digging up) will not eliminate hawkweed. Treatment with selective herbicides is most effective. The site should be monitored for several years for plants growing from root fragments and from seed bank. There are no biological controls currently available.

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Last Updated February 11, 2005

Foxtail barley

Hordeum jubatum L.

Synonyms: None
Other common name: squirreltail grass
Family: Poaceae

Description
Foxtail barley is a non-rhizomatous annual to perennial grass, native to western North America. It grows 1 to 2 feet tall, and produces a nodding pale green to purple, bushy spike that fades to a tawny color and becomes very brittle at maturity. Leaf blades are 1/8 to ¼ inch wide. Leaves are grayish green and have a rough texture. The sheath margin has numerous soft hairs. The awns are up to 3 inches long. Seeds are elliptic, yellowish brown 1/4 inch long with 4 to 8 awns. Seeds have sharp, backward-pointing barbs (Hultén 1968, Royer and Dickinson 1999, Whitson et al. 2000).

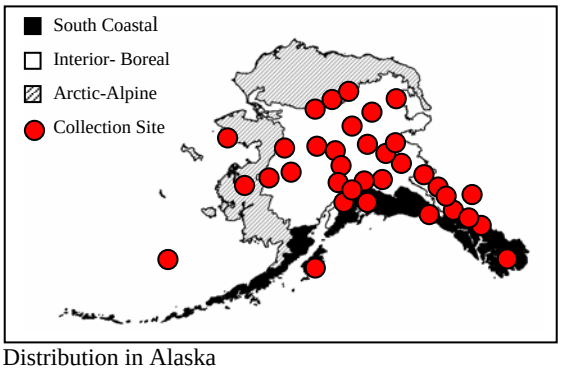
Foxtail barley is distinguished from cultivated barley (*Hordeum vulgare* L.) and the *Hordeum brachyantherum* by lemma awn length. *Hordeum brachyantherum* has awn lengths of ½ inch; foxtail barley has lengths of 1/2-3 inches; and cultivated barley of 10-15 cm in length. Foxtail barley hybridizes with *Agropyron* and *Hordeum* species. The hybrid *Hordeum brachyantherum* x *jubatum* is not uncommon in Alaska (Hultén 1968, Murry and Tai 1980, Welsh 1974).

Ecological Impact
Impact on community composition, structure, and interactions: In early summer foxtail is palatable to grazing animals. However, in late summer the sharp awns may cause damage to the mouth, eyes, and skin of animals. This plant is host for number of viruses (MAFRI 2004, Royer and Dickinson 1999, Whitson et al. 2000, Woodcock 1925).
Impact on ecosystem process: Foxtail barley accumulates high amounts of salt in leaves and roots, reducing soil salinity (Badger and Ungar 1990, Keiffer and Ungar 2002).

Biology and Invasive Potential
Reproductive potential: This plant reproduces entirely by seed. Each plant is capable of producing more than 180 seeds. Test in Alaska indicated that up to 67% of seeds remained viable during first year in the soil. Germinability decreased with burial and time. Less than 1% of buried seeds remaining viable for up to 7 years (Conn and Deck 1995, Badger and Ungar 1994).
Role of disturbance in establishment: Foxtail has become more abundant in response to human activities that increase soil salinity and soil contaminations (Bardger and Ungar 1990, Robson et al. 2004).
Potential for long-distance dispersal: Seeds can be dispersed large distances by both wind and animals (MAFRI 2004, Royer and Dickinson 1999).
Potential to be spread by human activity: Foxtail barley has been grown as an ornamental. It is also potential crop contaminant (USDA, ARS 2004).
Germination requirements: Foxtail barley produces two germination cohorts: one in the spring and one in the fall. Seed germination is inhibited by warm temperatures and salinity of more than 1 %. Seeds require a period of darkness for germination (Badger and Ungar 1994, Keiffer and Ungar 1997, Keiffer and Ungar 2002). Germination occurs only from a depth of 3 inches or less of soil (Royer and Dickinson 1999).
Growth requirements: Foxtail barley is adapted to a variety of soil textures, ranging from sandy loam to clay with pH from 6.4 to 9.5. It requires fairly moist conditions and cannot sustain itself during long dry periods (Tesky 1992). It is salt resistant and typically, restricted to soil with 0.3% to 0.9% total salts. The upper limit of soil NaCL for active growth and development is 1.0% (Badger and Ungar 1990).

Congeneric weeds: *Hordeum murinum* L., *H. pusillum* Nutt., *H. vulgare* are considered weeds in the United States (USDA 2002, Whitson et al. 2000).
Listing: Foxtail barley declared a noxious weed in Manitoba and Quebec (Invaders Database System 2003, USDA 2002).

Distribution and Abundance
It is common on roadsides, waste ground, and open fields (Royer and Dickinson 1999). It is most prevalent on soils with a high water table and high salinity content (Badger and Ungar 1990).
Native and current distribution: Foxtail barley is native to western North America that has become naturalized in eastern North America. The current range of *Hordeum jubatum* includes most of the United States except for the south Atlantic and Gulf Coast states (ITIS 2002, USDA 2002). Judging from herbarium records (ALA 2004), it is most likely to have been present in eastern interior Alaska prior to contact. However, it appears to have spread dramatically in the last half century associated with accelerated human disturbances.



Distribution in Alaska

Management
One it is established, foxtail barley is hard to eradicate. Planting disturbed areas with desirable plants and control of water levels is effective in reducing the amount of foxtail barley (Tesky 1992). This species can be control with herbicides (MAFRI 2004).

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Leucanthemum vulgare Lam.

Synonyms: *Chrysanthemum leucanthemum* L., *Leucanthemum leucanthemum* (L.) Rydb.
Common name: oxeye daisy, white daisy
Family: Asteraceae (Compositae)

Description

Oxeye daisy is a shallow-rooted plant with numerous stems from 1 to 3 feet tall. Stalked basal leaves are spatula-shaped, broadly toothed, and 2 to 5 inches long and 2 inches wide. The stem leaves are alternate, smooth, and glossy. The leaf stalks are short and clasp the stem. Solitary heads composed of white ray florets and yellow disc florets, 1 to 2 inches in diameter, are produced at the ends of stems. Seeds have no pappus (Hultén 1968, Royer and Dickinson 1999, Whitson et al. 2000).

In Alaska, the native arctic daisy (*Dendranthema arcticum*) could be confused with *Leucanthemum vulgare*. Arctic daisy is confined to rocky seashores and estuaries throughout coastal Alaska and is more low-growing, with wedge-shaped rather than spatulate basal leaves. All other Alaskan composite species with white ray flowers have either entire leaves or highly dissected leaves.

Ecological Impact

Impact on community composition, structure, and interactions: Oxeye daisy forms dense colonies, decreasing overall vascular plant diversity. It can quickly replace up to 50% of the grass species in pastures. The entire plant has a disagreeable odor and grazing animals avoid it. Moreover, the plant contains polyacetylenes and thiophenes that are generally highly toxic to insect herbivores. Oxeye daisy can host chrysanthemum stunt, aster yellows, tomato aspermy viruses, and several nematode species (Royer and Dickinson 1999). There is no known allelopathy potential.
Impact on ecosystem process: In heavy infestations there is an increase in the potential for soil erosion.

Biology and Invasive Potential

Reproductive potential: This species is a perennial that can spread both vegetatively and by seed. The plant flowers during its second year. Primarily insect pollinated, visitors include the insects from a number of different orders. Plant normally produces 1300 to 4000 fruits (Howarth and Welliams 1968). Seeds remain viable in the seed bank for at least 2-3 years.
Role of disturbance in establishment: Cutting, mowing, trampling and grazing promote establishment.
Potential for long-distance dispersal: Fruits are dispersed by wind, as well as in dung, but the fruits lack elongated pappus adapted for wind dispersal.
Potential to be spread by human activity: Seeds can be moved with timber, contaminated forage grass and legume seed. The plant continues to appear for sale in nurseries.
Germination requirements: Seedling germination is greater under increased moisture and is inhibited by continuous darkness. Dense groundcover can prevent establishment. Chilling and drought appear to have no effect on germination rates.
Growth requirements: Oxeye daisy is adapted to coarse and medium textured soil, pH 5.2-7. No cold-stratification required for germination. It withstands temperatures to -28°F, and requires 130 frost-free days (USDA 2002). This species has moderate summer porosity, and no coppice potential.
Listing: Noxious in Colorado, Minnesota (Secondary N. Weed), Montana (Cat. 1), Ohio, Washington (Class B), Wyoming (USDA 2002).

Distribution and Abundance

Introduced from Europe as an ornamental, it has escaped cultivation and is now common in native grasslands, pastures, waste areas, meadows, and roadsides. Oxeye daisy is a serious weed of 13 crops in 40 countries. In the U.S. it is found in every

state. It was introduced to the Pacific Northwest in the late 1800's.
Native and current distribution: Native to Europe (Mediterranean to Scandinavia) and Siberia. Populations have established in E. Asia, Iceland, Greenland, North and South America, Hawaii, Australia, and New Zealand (Hultén 1968).

Management
Oxeye daisy is easily killed by intensive cultivation. Herbicides active on oxeye daisy are available; these herbicides are not, however, specific. Application of nitrogen fertilizer is almost as effective as the herbicides at reducing canopy cover. Effective biocontrol insects or pathogens have not been found.

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Yellow toadflax

Linaria vulgaris P.Miller.

Synonyms: *Linaria linaria* (L.) Karst.
Other common name: butter and eggs, flaxweed, ramsted, wild snapdragon
Family: Scrophulariaceae

Description
The plant can reach a height of 2 feet and are rarely branched. Leaves are alternate, pale green, narrow, 2 ½ inches long. Flowers, resembling snapdragons, appear in dense terminal clusters. They are yellow with an orange throat and 1 to 2 inches long. The fruit is an ovate to egg-shaped capsule, 8 to 12 mm (ca. 3/8 – 1/2 inch) long. Seeds are flattened, ovate, winged (Royer and Dickinson 1999).

There are no other yellow, spurred species in Alaska that might be confused with yellow toadflax.

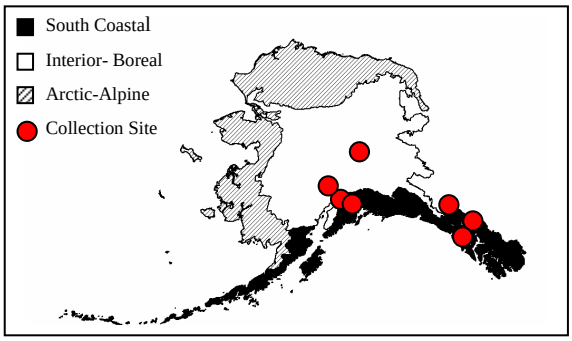
Ecological Impact
Impact on community composition, structure, and interactions: Yellow toadflax is a persistent, aggressive invader, capable of forming dense colonies; it can suppress native grasses and other perennials, mainly by intense competition for limited soil water. This species contains a poisonous glucoside that is reported to be unpalatable and moderately poisonous to livestock. Toadflax is an alternate host for tobacco mosaic virus.
Impact on ecosystem process: Unknown.

Biology and Invasive Potential
Reproductive potential: Yellow toadflax is a perennial that reproduces by seeds and creeping rhizomes. Plants are self-incompatible and insect pollinated. Seed production ranges from 1,500 to 30,000 seeds/individual, but seed viability is generally low. Seeds may remain dormant for periods up to 8-10 years. Vegetative reproduction may begin as soon as 2-3 weeks after germination, and it can establish from root fragments as short as ½ inch.
Role of disturbance in establishment: Disturbance promotes invasion and is necessary for establishment to occur. Once established, toadflax readily spreads into adjacent non-disturbed areas.
Potential for long-distance dispersal: Seeds are winged and can be carried by the wind. This species may also be dispersed by water and ants.
Potential to be spread by human activity: Toadflax can spread along highways. It has been found as a contaminant in commercial seed and is still is sold by some nurseries.
Germination requirements: Yellow toadflax requires open soil for germination (Densmore et al. 2001). Germination usually occurs in the top 2 cm of soil (Royer and Dickinson 1999). Germination success is generally low (Rutledge and McLendon 1996, Zouhar 2003).
Growth requirements: Seeds require a two to eight week period of chilling for successful germination (J. Gibson unpubl. data). It occurs on sandy and gravely soil on roadsides, pastures, cultivated fields, meadows, and gardens. Generally it does well in wet or dark areas with high fertility.
Congeneric weeds: *Linaria dalmatica* L., *L. genistifolia* (L.) P. Mill. (USDA 2002).
Listing: Linaria vulgaris is noxious in Colorado, Idaho, Nevada, New Mexico, Montana (Cat. 1), Oregon (B List), South Dakota, Washington (C List)

(Pokorny and Sheley 2003, USDA 2003). This species is a restricted noxious weed in Alaska (Alaska Administrative Code).

Distribution and Abundance

It was imported into North America in the late 1600s as an ornamental and for folk remedies. Yellow toadflax is found throughout the continental United States and in every Canadian province and territory.



Distribution of yellow toadflax in Alaska

Native and current distribution: Native to south-central Eurasia, the present world distribution includes most of Europe and Asia, Australia, New Zealand, South Africa, Jamaica, Chile, and North and South America (Hultén. 1968).

Management

Cutting, mowing and tilling are effective ways to eliminate plant reproduction through seeds. Herbicide treatment can significantly reduce plant infestation. The methods must be repeated annually for up to ten years to completely remove a stand. Vigorous, well adapted grasses can be used to compete with toadflax. Several insect species have been approved by the USDA. The weevil, *Gymnetron antirrhini*, is the most important agent for biological control in British Columbia and the northwestern U.S. Other species are shoot and flower-feeding beetle (*Brachypterolus pulicarius*) and root-boring moths *(Eteobalea serratella* and *E. intermediella*) (Carpenter and Murray 1998). (Fruits/seeds collected in Anchorage had ca. 20% infestation by an unknown weevil; M. Carlson - pers. obs.).

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Annual ryegrass

Lolium perenne ssp. multiflorum (Lam.) Husnot

Synonyms: *Lolium multiflorum* Lam., *L. multiflorum* var. *diminutum* Mutel, *L. multiflorum* var. *muticum* DC., *L. perenne* var. *aristatum* Willd., *L. perenne* var. *multiflorum* (Lam.) Parnell.
Other common names: Italian ryegrass, perennial ryegrass
Family: Poaceae

Description
Italian ryegrass is a short rhizomatous annual or biennial bunchgrass that grows from 1 to 3 feet tall. Culms are generally erect and often purplish at the base. Leaves are dark green, shiny, and prominently veined, the blades are flat, 1/8 to 1/4 inch wide; auricles are conspicuous. The spikes are distinctive with alternately arranged spikelets that are placed edgewise along the flowering stem, giving the spike a flattened appearance. The lemmas are conspicuously awned (Whitson et al. 2000).

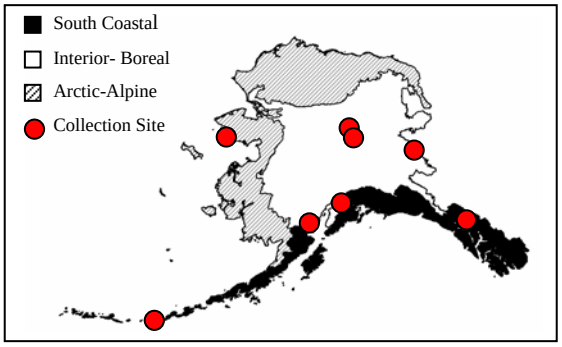
There are a number of similar looking grasses in Alaska, but *Lolium* has only one spikelet per node, which are oriented with the narrow edge towards the rachis. Within *Lolium*, the red-tinged base of Italian ryegrass, awned lemmas, and short glumes distinguish this weed from *Lolium perenne* ssp. *perenne* and *Lolium temulentum*.

Ecological Impact
Impact on community composition, structure, and interactions: Some varieties of ryegrass are capable of forming dense stands and can outcompete native vegetation. Other species may be inhibited by the thick litter accumulation of ryegrass (Facelli et al. 1987). Italian ryegrass can establish in early successional communities in the West, but it generally is replaced by tall herbaceous or shrubs (Carey 1995, Densmore et al. 2000). This species is very palatable and nutritious for all types of livestock and most wild ruminants (Carey 1995). It is readily hybridizes with other ryegrass species (Wilken 1993, Rutledge and McLendon 1996). Ryegrass is allelopathic, inhibiting the growth of other species (McKell et al. 1963).
Impact on ecosystem process: Italian ryegrass may increase rates of erosion following its planting. It is one of the most commonly used grasses for revegetating burned sites, but in addition to increasing erosion, it may also increase the risk of future fires (Carey 1995, Zedler et al. 1983). Observations in Alaska indicate that its impacts are minimal (Densmore et al. 2000).

Biology and Invasive Potential
Reproductive potential: Italian ryegrass regenerates entirely by seed. Seed banks of ryegrass appear to be limited and transient (Thompson and Grime 1979). Percent germination rapidly dropped off after 5 years for stored seeds (Rutledge and McLendon 1996).
Role of disturbance in establishment: Italian ryegrass colonizes disturbed areas and adjacent border habitats. It is highly shade intolerant (Carey 1995 and references therein).
Potential for long-distance dispersal: Seeds are relatively heavy and compact, and dispersal is limited (Rutledge and McLendon 1996). According to Carey (1995) they can be dispersed by animals.
Potential to be spread by human activity: Annual ryegrass has been recommended for erosion control in Denali National Park and Preserve (Densmore et al. 2000). It is also often used as a rotation crop,

range, pasture, hay, and turf crops. Many cultivars have been grown for pasture, hay, and silage (Carey 1995, USDA 2002). Italian ryegrass is a problematic weed in cereal crops and grass seed crops (Carey 1995).
Germination requirements: Seeds have no innate dormancy and will germinate when moisture is sufficient. They tolerate a wide range of diurnal temperature fluctuations and light regimes.
Growth requirements: Ryegrass establishes quickly and grows rapidly. It is adapted to a wide range of soil types and drainage regimes. It grows in soils with pH levels from 5 to 7.9. It does not thrive where there are extended periods of low temperatures or drought. It withstands temperatures to -8°F, and requires 150 frost-free days for reproduction. Italian ryegrass is a shade intolerant species (Carey 1995, USDA 2002).
Cogeneric weeds: *Lolium perenne* ssp. *perenne* L., *Lolium persicum* Boiss. & Hohen., *L. temulentum* L. (Hultén 1968, USDA 2002).
Listing: This species is not considered noxious in North America (Invaders Database System 2003).

Distribution and abundance
Ryegrass is widely planted for soil stabilization and as an agricultural crop. It can escape from cultivation and becomes naturalized on moderately disturbed sites, such as waste places and roadsides.
Native and current distribution: Italian ryegrass is native to central and southern Europe, north-west Africa and south-west Asia. It now occurs in nearly all of the United States. It has been introduced into South America, New Zealand, Tasmania, central and southern Africa (Beddows 1973, Hultén 1968, USDA 2002). This taxon has been collected in South Coastal, Interior-Boreal, and Arctic-Alpine eco-regions in Alaska (Hultén 1968, University of Alaska Museum 2003).



Management
In crops herbicides have been used to control established plants and prevent seed production, but this species is gaining resistance to several herbicides (Carey 1995). It does not appear to persist in sites where it was previously planted in Alaska (Densmore et al. 2000).

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Bigleaf lupine

Lupinus polyphyllus ssp. *polyphyllus* Lindl.

Synonyms: None
Other common names: None
Family: Fabaceae

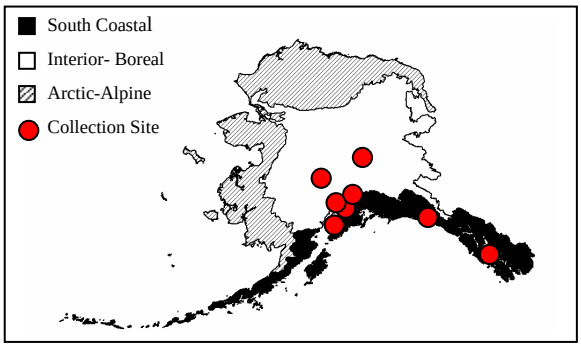
Description
This species is a perennial, mostly 1 to 3 feet tall. Stems are erect or ascending, few to several from the caudex, glabrous or hairy. Leaves are long-petiolated with 10-18 oblanceolate to elliptic, acute, large leaflets. Leaflets 1½ to 5 inches long 1/4 to 1 inch broad. Racemes are 2 ½ to 10 inches long. Flowers are blue (occasionally pale to deep pink) and 1/2 –3/4 inches long. Pods are 1 ½ to 2 inches long, distinctly hairy with 6-10 seeds (Hultén 1968, Welsh 1974).

Bigleaf lupine is distinguishable from all other lupines in Alaska by possessing more than 10 leaflets per leaf.

Ecological Impact
Impact on community composition, structure, and interactions: As a nitrogen-fixer bigleaf lupine likely alters soil conditions. It hybridizes freely with Nootka lupine (*L. nootkatensis* Donn ex Sims) (Welsh 1974). It is important floral resource for bumblebees (Jennersten et al. 1988).
Impact on ecosystem process: It is likely to delay establishment of native species in disturbed sites (Densmore et al. 2001).

Biology and Invasive Potential
Reproductive potential: The plant reproduces from seed and also forms extensive clones from creeping rhizomes. It has the ability to resprout after removal of aboveground growth (Densmore et al. 2001).
Role of disturbance in establishment: Lupinus polyphyllus appears to be spreading and very persistent in disturbed areas in Alaska (Densmore et al. 2001). It may persist in areas disturbed more than 15 years ago and invade sandy river terraces in southcentral Alaska (M.L. Carlson – pers. obs.)
Potential for long-distance dispersal: Pods open explosively, scattering seeds short distances.
Potential to be spread by human activity: Bigleaf lupine is cultivated as ornamental, escaping and locally well established (Densmore et al. 2001, Welsh 1974). It is spreading along the roads in Alaska (Hultén 1968).
Germination requirement: Seeds are characterized by a hard seed coat and long dormancy period, typical for the genus. However, *Lupinus polyphyllus* in Alaska is from commercial seed that has provably been selected for ability to germinate quickly (Densmore et al. 2001).
Growth requirements: Bigleaf lupine requires sunny sites with consistently moist soil. It tolerates partial shade.
Cogeneric weed: *Lupinus arboreus* Sims is considered as invasive wildland pest plant in California (CalEPPC 1999). *Lupinus nootkatensis* Donn ex Sims is a North American species that is invasive in northern Europe (Lid and Lid 1994).
Listing: Bigleaf lupine is not considered noxious in North America (Invaders Database System 2003, USDA 2002).

Distribution and Abundance
Bigleaf lupine is considered exotic to Alaska by most authors (Hultén 1968, Welsh 1974, Densmore et al. 2001). It has been widely seeded on roadsides in southcentral Alaska (Densmore et al. 2001). It is well-established in open to dense mixed forests, often near habitations from Fairbanks to southern Alaska where it is especially common in the Anchorage vicinity (Hultén 1968, Welsh 1974). This species is particularly abundant in burns in Matanuska-Susitna Valley (Lapina – pers. obs.). It is present in disturbed areas in Seward (Densmore et al. 2001), has been reported from Mitkof Island and the Kenai Peninsula (UAM 2003).
Native and current distribution: Bigleaf lupine is native to western United States and western Canada (USDA, ARS 2004). This plant has naturalized in Scandinavia (Jennersten et al. 1988, Lid & Lid 1994).



Distribution of bigleaf lupine in Alaska

Management
The plants can be eradicated when the populations are small by digging up rhizomes, but several weedings may be necessary to eliminate plants resprouting from rhizomes and from the seedbank (Densmore et al. 2001).

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Last Updated March 30, 2006

Pineappleweed

Matricaria discoidea DC.

Synonyms: *Artemisia matricarioides* auct. non Less, *Chamomilla suaveolens* (Pursh) Rydb., *Lepidanthus suaveolens* (Pursh) Nutt., *Lepidotheca suaveolens* (Pursh) Nutt., *Matricaria matricarioides* (Less) Porter, *M. suaveolens* (Pursh) Buch., *Santolina suaveolens* Pursh, *Tanacetum suaveolens* Pursh Hook.
Common name: disc mayweed
Family: Asteraceae.

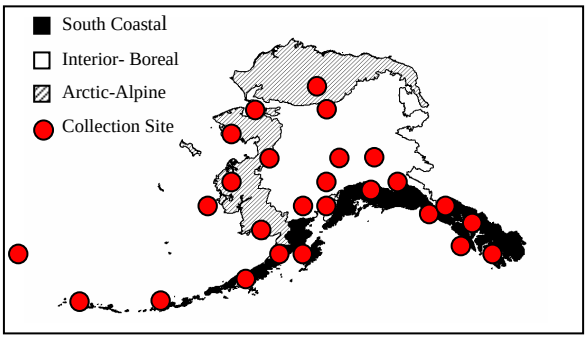
Description
Pineappleweed is a low-branching annual with leafy stems usually less than six inches tall, but sometimes up to one feet tall. The plant gives off a pineapple scent when crushed. Leaves are alternate, and divided several times into narrow segments. Small yellow disc florets are arranged in a cone-shaped head, 5 to 10 mm across. Ray florets are absent. Each head surrounded by several overlapping bracts with papery margins. It blooms from early spring to late autumn (Royer and Dickinson 1999, Whitson et al. 2000).

There are no other diminutive rayless composite species that may be confused with pineappleweed in Alaska.

Ecological Impact
Impact on community composition, structure, and interactions: This plant is not observed in undisturbed plant communities in Alaskan National Parks (Densmore et al. 2001). It has been reported as an alternate host for raspberry Scottish leaf curl virus (Royer and Dickinson 1999).
Impact on ecosystem process: Unknown.

Biology and Invasive Potential
Reproductive potential: Pineappleweed reproduces by seeds only.
Role of disturbance in establishment: Plants may appear when an area is disturbed by construction or trampling (Densmore et al. 2001).
Potential for long-distance dispersal: Seeds are gelatinous when wet and can stick to animals feet or fur. Seeds also can be dispersed by water (Rutledge and McLendon 1996).
Potential to be spread by human activity: Fruits disperse in mud attached to motor vehicles and can contaminate topsoil (Baker 1974, Hodkinson and Thompson 1997).
Germination requirements: Pineappleweed requires open soil and disturbance for germination (Densmore et al. 2001).
Growth requirements: Unknown.
Listing: Matricaria discoidea is listed as a weed in Kentucky, Nebraska, and Manitoba (Royer and Dickinson 1999, USDA, NRCS 2006).

Distribution and Abundance
Found throughout Canada and the United States. It is a common weed in Alaska, Yukon and Northwest Territories (Welsh 1974). It is often found growing on compacted soil in farmyards, waste areas, and roadsides.
Native and current distribution: Pineappleweed originated from western North America; it is now found in Europe, Asia, Greenland, Iceland, South America, and New Zealand (Hultén 1968).



Distribution of pineappleweed in Alaska

Management
Pineappleweed is easy to pull up, although several weedings may be necessary (Densmore et al 2001).

Herbicides are available, but this plant is resistant to a number of standard herbicides (Rutledge and McLendon 1996). No information is available on biological control.

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Last Updated March 30, 2006

White sweetclover

Melilotus alba Medikus

Synonyms: *Melilotus albus* Medik.
Other common names: None
Family: Fabaceae

Description
White sweetclover is a biennial plant 2 to 5 feet tall, branched. The leaves are trifoliate, alternate in arrangement, and ½ to 2 inches long. Fragrant white flowers are 1/8 to 1/4 inches long and arranged in many-flowered terminal and axillary racemes. Plants generally flower and die during the second year of growth. It flowers from June to October. Pods are normally black to dark grey and single-seeded. Seeds are yellow, ovate to kidney-shaped (Hultén 1968, Royer and Dickinson 1999).

White sweetclover is erect, tall, and branching separating it from all other trifoliate legumes in Alaska. *Melilotus albus* is distinguished from *M. officinalis* by having white rather than yellow flowers.

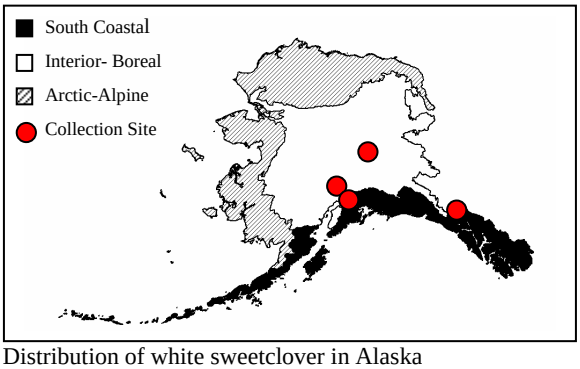
Ecological Impact
Impact on community composition, structure, and interactions: White sweetclover degrades natural grassland communities by overtopping and shading native species. It contains coumarin which is toxic to animals. Plants are visited by introduced honeybees, native solitary bees, wasps, and flies (Eckardt 1987). Sweetclover is associated with over 28 viral diseases (CUPPID 2003, Royer and Dickinson 1999). It is also reported as being allelopathic (USDA 2002).
Impact on ecosystem process: This species alters edaphic conditions due to nitrogen fixation (USDA 2002); and also has potential to alter sedimentation rates of river ecosystems (M. Shephard – pers. comm.).

Biology and Invasive Potential
Reproductive potential: Each plant is capable of producing up to 350,000 seeds. Seeds remain viable in the soil for up to 81 years (Klemow and Raynal 1981, Royer and Dickinson 1999, Rutledge and McLendon 1996). Thus large seed banks are common (Eckardt 1987).
Role of disturbance in establishment: White sweetclover readily invades open areas. Natural or human-caused fires produce excellent growing conditions by scarifying seeds and stimulating germination. The clearings in forested land are easily colonized by sweetclover. Establishment along early successional river bars is extensive for a number of river systems in interior, south-central and southeast Alaska. This species resprouts readily when cut or grazed (Eckardt 1987, WDNR 2003).
Potential for long-distance dispersal: Seeds may be dispersed by water (Eckardt 1987, Rutledge and McLendon 1996).
Potential to be spread by human activity: White sweetclover is used extensively as a forage crop, soil builder, and nectar source for honeybees (Eckhardt 1987, WDNR 2003). It often contaminates cereal grains, and can spread from vehicle tires (Royer and Dickinson 1999, Densmore et al. 2001).
Germination requirements: This species has high seed germination. Most germination and seedling development occurs in sufficient moisture in spring. Temperatures of less 59° F are optimal for

germination, and germination inhibitation occurs above 59° F (Eckardt 1987).
Growth requirements: Sweetclover is adapted to all soil textures, pH levels from 5-8, it is CACO3 tolerant, and is moderately saline tolerant, it is shade intolerant, and does not require cold-stratification for germination. It is fire tolerant, withstands temperatures to -38°F, and requires 120 frost-free days for reproduction. This species has relatively porous summer vegetation and no coppice potential (USDA 2002).
Congeneric weeds: *Melilotus officinalis* (L.) Lam (Hultén 1968).
Listing: Melilotus alba is "Exotic Pest" in Tennessee, "Ecologically Invasive" in Wisconsin, "Weed" in Kentucky and Quebec (Canada) (Royer and Dickinson 1999, USDA 2002).

Distribution and Abundance
It was reported in North America as early as 1664 as a forage crop. Now it has spread from cultivation and thrives in waste places and roadsides. White sweetclover is found in all 50 states and all but two Canadian provinces (Royer and Dickinson 1999, USDA 2002). It establishes in aspen woodlands, prairies (Butterfield et al. 1996, Rutledge and McLendon No Year), and riverine communities (Conn 2003, Stensvold 2000).

Native and current distribution: This species is native to the Mediterranean area and through central Europe to Tibet. It is introduced into South Africa, North and South America, New Zealand, Australia, Tasmania (Hultén 1968).



Distribution of white sweetclover in Alaska

Management
White sweetclover can be managed using mechanical controls (pulling, cutting); however, several treatments may be necessary. Biological control options have not been investigated because the plant is valued as an agricultural crop. Due to the long viability of seeds, sites must be monitored for many years following control actions (J. Conn – pers. comm., Eckardt 1987).

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Reed canarygrass

Phalaris arundinacea L.

Synonyms: *Phalaroides arundinacea* (L.) Raeusch.
Other common names: canary grass
Family: Poaceae

Description
Reed canarygrass is a robust, cool-season, sod-forming perennial that produces culms from creeping rhizomes, the culms grow ½ to 5 feet high. Leaf blades are flat, 2 to 6 inches long and ¼ to ½ inch wide. Flowers are arranged in dense, branched panicles. Immature panicles are compact and resemble spikes, but open and become slightly spreading at anthesis (Whitson et al. 2000). This taxon is morphologically variable, and more than ten varieties have been described.

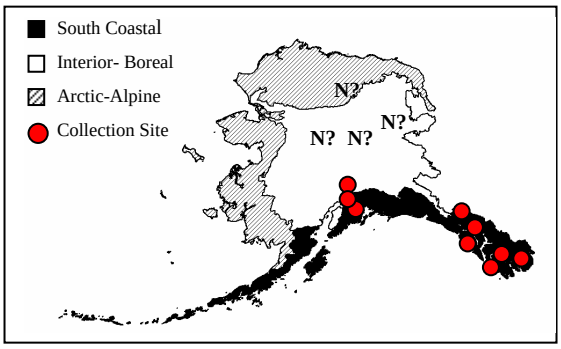
Reed canarygrass is unique having a single flower per spikelet and a more open, branched inflorescence (rather than a narrow spike as in timothy grass).

Ecological Impact
Impact on community composition, structure, and interactions: This grass form dense, persistent, monotypic stands in wetlands; these stands exclude and displace other plants. In Montana reed canarygrass poses a threat to the endangered aquatic plant *Howellia aquatilis*. Invasive populations of reed canarygrass are believed to be the result of crosses between cultivated varieties and native North American strains (Merigliano and Lesica 1998). Reed canarygrass grows too densely to provide adequate cover for small mammals and waterfowl. When in flower, it may case hay fever and allergies.
Impact on ecosystem process: It is promotes silt deposition and the consequent constriction of waterways and irrigation canals. Reed canarygrass may alter soil hydrology.

Biology and Invasive Potential
Reproductive potential: Reed canarygrass reproduces from seed and vegetatively from creeping rhizomes.
Role of disturbance in establishment: Invasion is promoted by disturbances such as ditching of wetlands and stream channelization, overgrazing, intentional planting, and alteration of water levels.
Potential for long-distance dispersal: Seeds have no adaptations for long-distance dispersal. Both rhizome fragments and seeds may wash downstream along streams and rivers.
Potential to be spread by human activity: Reed canarygrass has been planted widely for forage and erosion control.
Germination requirements: Seeds germinate more readily immediately following maturation. This species germinated well in experimental conditions after soaking in water at 50° C. Mechanical damage, increased light, and oxygen also successfully broke seed dormancy (Vose 1962).
Growth requirements: Reed canarygrass is adapted to fine and medium textured soils, pH 5.5-8. It is highly

anaerobic tolerant, shade intolerant, and does not require cold-stratification for germination. It is fire tolerant, withstands temperatures to -38°F, and requires 120 frost-free days for growth and reproduction. This species has dense porous summer vegetation, and no coppice potential (USDA 2002).
Listing: Phalaris arundinacea is a Noxious weed in Washington (Class C), Invasive weed in Nebraska, Tennessee, Wisconsin. It is a notorious global weed.

Distribution and Abundance
In the United States, the first agronomic trials probably began in the 1830s and it is now widespread in North America. Reed canarygrass is common in stream banks, margins of springs, and wet meadows, in central, south-central, and southeastern Alaska, southern Yukon, and northern British Columbia. It has ability to invade and dominate sedge meadows and wet prairies, may also pose a serious threat to upland oak savannas (Henderson 1991).
Native and current distribution: There is no consensus on its native status in North America (Merigliano and Lesica 1998) Hultén (1968) states, it is native to Europe, but some authors view it as native to Asia and North America as well (Welsh 1974). The present-day range extends throughout the Old and New Worlds, where it is found primarily in northern latitudes. Some populations of reed canarygrass are possibly native to Alaska. Four sites that may harbor native forms are from hot springs of interior Alaska (Big Windy, Kanuti, Kilo, and Manley Hot Springs; "N?" in figure).



Distribution of reed canarygrass in Alaska.

Management
Mechanical control methods may be feasible, however, the strategy may be too labor intensive and require a long-term time commitment. No herbicides are selective enough to be used in wetlands without the potential for injuring native species. Plants reestablish quickly from seeds after control methods are used. No biological control methods are known that are feasible for use in natural areas.

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Common plantain

Plantago major L.

Synonyms: *Plantago asiatica* auct. non L., *Plantago halophila* Bickn.
Other common name: broadleaf plantain, buckhorn plantain, great plantain, rippleseed plantain
Family: Plantaginaceae

Description
Common plantain is an annual, biennial, or perennial with a thick rootstalk and extensive fibrous roots (up to 3 feet deep and wide). Flowering stalks can grow to 2 feet tall, but generally are 6 to 8 inches tall. Common plantain is hairless, except for a few hairs on the underside of leaves. It has a basal rosette of stalked, ovate to cordate leaves with smooth margins. The leaves are 2 to 12 inches long and up to 4 inches wide, and strongly 3 to 5-ribbed. The flowers are borne on one to many spikes from a leafless stalk. It has numerous small (2-4 mm in diameter), greenish-white flowers that fade to brown. Flowers are wind and fly pollinated and self-compatible. The fruit is an ovate capsule that splits around the middle; containing 5 to 30 seeds. The seeds are brownish-black, small, and elliptic to 4-sided (Sagar and Harper 1964, Royer and Dickinson 1999). This taxon is morphologically very variable and many subspecific forms have been recognized (Sagar and Harper 1964).

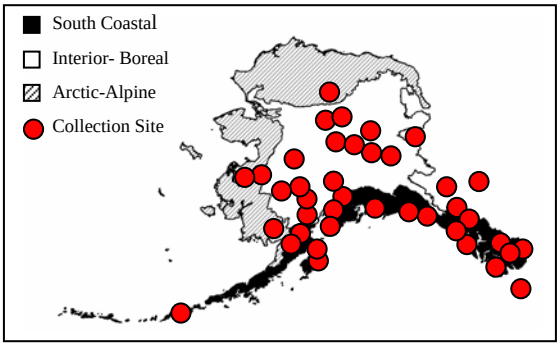
Six other species of plantain are known from Alaska, four of which are native. *Plantago major* is easily distinguished from these species by having broad, nearly hairless leaves and more than 6 seeds per capsule.

Ecological Impact
Impact on community composition, structure, and interactions: In Alaska, common plantain integrates into habitats with high disturbance and low interspecific competition (M.L. Carlson & I. Lapina – pers. obs.). It is known to reduce growth of corn and oats (Manitoba Agriculture and Food 2002). This taxon is an alternate host for number of viruses. Additionally, it serves as larval food for many species of butterflies and leaf miners (Sagar and Harper 1964).
Impact on ecosystem process: Unknown. This is an early pioneer species and may alter successional regimes.

Biology and Invasive Potential
Reproductive potential: Common plantain reproduces by seeds and from root fragments. A single plant can produce up to 14,000 seeds. Seeds are viable in soil for up to 60 years (Royer and Dickinson 1999, Rutledge and McLendon 1996).
Role of disturbance in establishment: Common plantain readily establishes in disturbed areas. In Alaska, plants often appear again on sites that have been redisturbed after previous disturbance (Densmore et al. 2001).
Potential for long-distance dispersal: Seeds are sticky when wet. They may adhere to soil particles, feathers, fur, skin, or vehicles (Royer and Dickinson 1999, Rutledge and McLendon 1996).
Potential to be spread by human activity: The plant travels widely with humans. Seeds can be spread by vehicles, contaminated topsoil, and commercial seeds (Hodkinson and Thompson 1997).
Germination requirements: This species has high variation in dormancy length, some seeds germinate in early spring, but many germinate later in the growing season. Seeds require light for germination. Between 60-90% germination of seeds is common (Palmblad 1968, Rutledge and McLendon 1996).
Growth requirements: It occupies a wide range of soils such as loam, clay, and sand, with pH ranging from 4.8 to 7.3. It is quite resistant to trampling, withstands temperatures to -38°F, and requires 85 frost-free days for successful growth and reproduction. It grows in infertile soil and has intermediate shade tolerance (Rutledge and McLendon 1996, USDA 2002).

Congeneric weeds: *Plantago media* L., *P. lanceolata* L., *P. patagonica* Jacq. (Royer and Dickinson 1999, Whitson et al. 2000).
Listing: Common plantain is listed as an invasive weed in Connecticut, Washington, Manitoba, and Quebec (USDA 2002). *Plantago* species are restricted noxious weeds in Alaska (Alaska Administrative Code 1987).

Native and current distribution
Many experts believe this taxon originated in Europe (Hultén 1968, Dempster 1993, Whitson et al. 2000), but it is now cosmopolitan in distribution. However, according to USDA Plants Database and ITIS (2003) this taxon is considered native to Alaska, Hawaii, and the continental US. Hitchcock and Cronquist (1973) recognize a native variety (var. *pachyphylla* Piper) of saline habitats and introduced variety (var. *major* L.). Greater study, using molecular and morphological markers and paleoecological study is necessary to tease apart the patterns of nativity of this species in Alaska.
Plantago major has been reported from all eco-regions of Alaska (Densmore et al. 2001, Hultén 1968, University of Alaska Museum 2003) and is found within 200 km of the arctic treeline. This species is a common weed in cultivated fields, lawns, roadsides, and waste areas. It can be found in open woods and in valleys and mid-montane sites.



Management
The plants can be pulled with relative ease, although several weedings may be necessary to eliminate plants germinating from buried seeds and root fragments. It is easily controlled by herbicides (Densmore et al. 2001, Rutledge and McLendon 1996).

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Last Updated December 21, 2004

Annual bluegrass

Poa annua L.

Synonyms: *Poa annua* var. *aquatica* Aschers., *Poa annua* var. *reptans* Hausskn.
Other common name: walkgrass
Family: Poaceae

Description
Poa annua is an annual to short-lived perennial tufted grass that often roots at lower nodes and can forms large mats. The stems are bright green and decumbent to more or less erect, ranging from 1¼ to 12 inches long. Leaf blades are soft-haired and 1/16 to 1/8 inch (1-4 mm) wide, light green, and prow-tipped. The flattened sheaths are loose and hairless. The inflorescence is 3/4 to 4 inches long and oval to pyramid-shaped (Hutchinson and Seymour 1982, Royer and Dickinson 1999). This species is very variable and numerous infraspecific taxa have been described (Hutchinson and Seymour 1982).

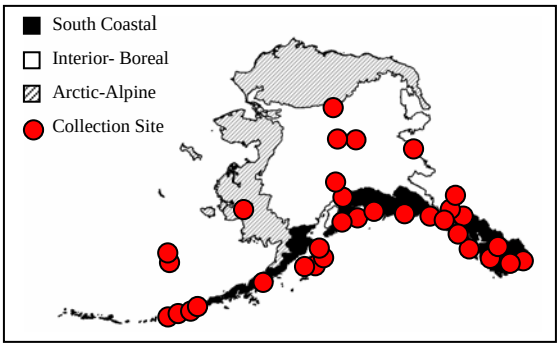
Poa annua is the only primarily annual bluegrass in Alaska. It is also identified by the presence of a small (1/2 the size of the second) claw-like first glume.

Ecological Impact
Impact on community composition, structure, and interactions: Annual bluegrass often forms dense mats that can reduce nutrient availability in the upper soil horizons. However, generally it does not compete well with established plants. This species hybridizes with *P. glauca* and *P. pratensis* at least in Britain. The seeds are eaten by numerous species of bird. Vegetative portions are probably eaten by deer since their scat often contains its seeds. A wide range of invertebrates feed on annual bluegrass (Hutchinson and Seymour 1982).
Impact on ecosystem process: As a pioneer species *Poa annua* often dominates and may limit colonization by native species. Results from the field experiments suggested that native seed germination and survival is reduced by the presence of annual bluegrass litter (Bergelson 1990).

Biology and Invasive Potential
Reproductive potential: Annual bluegrass reproduces primarily by seed. It grows and reproduces rapidly. Seed production may exceed 20,000 in a season under ideal conditions (Hutchinson and Seymour 1982, Rutledge and McLendon 1996). Longevity of seeds varies from about a year to about 6 years for decumbent varieties (Chippendale and Milton 1934, Hutchinson and Seymour 1982, Roberts and Feast 1973).
Role of disturbance in establishment: It persists on sites that are kept open by trampling by livestock or human activities (Hutchinson and Seymour 1982). Cutting annual bluegrass below 1/4 to ½ inch increases seedling vigor and increases the competitive ability of this grass. This taxon readily establishes along introduced mineral substrates in south-central and southeast Alaska (M.L. Carlson & I. Lapina – pers. obs.).
Potential for long-distance dispersal: Annual bluegrass has a low to medium potential for dispersal based on seed weight and seed shape. Seeds are likely dispersed by rain, wind, and birds. Seeds remain viable after passing through the digestive tracts of some animals such as cows, horses, and deer (Hutchinson and Seymour 1982, Rutledge and McLendon 1996).
Potential to be spread by human activity: Seeds can be carried in mud on boots and vehicles. It is commonly transported as an impurity of lawn grass seed (Hutchinson and Seymour 1982, Rutledge and McLendon 1996, Whitson et al. 2000).
Germination requirement: Annual bluegrass starts germinating in late summer or fall as soil temperatures fall below 70°F and significant moisture is available. It continues to germinate throughout winter if temperatures are not too cold (cf. Hutchinson and Seymour 1982).

Growth requirements: Annual bluegrass is adapted to all soil textures with pH 4.8 – 8.0. It has a relatively low nutrient requirement and grows well in moist areas in full sun. It withstands temperatures to -47°F, and requires 60 frost-free days for growth and reproduction. Annual bluegrass has low drought and fire tolerance (USDA 2002).
Congeneric weeds: *P. pratensis* L., *P. compressa* L., *P. trivialis* L. (Hultén 1968, Royer and Dickinson 1999, Whitson et al. 2000).
Listing: This plant listed as invasive weed in 15 states of the United States (Royer and Dickinson 1999, USDA 2002).

Distribution and Abundance
Poa annua thrives in lawns, gardens, cultivated crops, pastures, roadsides, areas of habitation and other open areas (Hutchinson and Seymour 1982).
Native and current distribution: Annual bluegrass is a native of Europe but is now distributed worldwide. It was introduced to North Africa, Mexico, Central and South America, New Zealand, Australia. It is also found above the Arctic circle (Hultén 1968, Hutchinson and Seymour 1982). This taxon has been collected in South Coastal, Interior-Boreal, and Arctic-Alpine ecoregions in Alaska (Hultén 1968, University of Alaska Museum 2003).



Management
Controlling annual bluegrass manually is very expensive and inefficient. Hoeing or hand-weeding must be done frequently, as new flushes of seedling plants germinate after the older seedlings are removed. A number of herbicides are available, but they are not specific to annual bluegrass (Rutledge and McLendon 1996).

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Kentucky bluegrass (*Poa pratensis* ssp. *pratensis* L.)

Spreading bluegrass (*Poa pratensis* ssp. *irrigata* (Lindm.) Lindb. f.)

Rough bluegrass *(Poa trivialis* L.)

Family: Poaceae

Kentucky bluegrass, spreading bluegrass, and rough bluegrass share similar biological and ecological attributes. Their ecological and community impacts are believed to be comparable and therefore we treat these species together.

Poa pratensis ssp. *pratensis* Synonyms: *Poa agassizensis* Boivin & D. Löve, *Poa angustifolia* L., *Poa pratensis* ssp. *agassizensis* (Boivin & D. Löve) Taylor & MacBryde, *Poa pratensis* ssp. *angustifolia* (L.) Lej., *Poa pratensis* var. *angustifolia* (L.) Gaudin, *Poa pratensis* var. *domestica* Laestad., *Poa pratensis* var. *gelida* (Roemer & J.A. Schultes) Böcher, *Poa pratensis* var. *iantha* Wahlenb.
Taxonomic notes: Kentucky bluegrass is a subspecies of a larger species complex with native and non-native forms. The systematics of this group and nativity of its components does not appear to be well understood. ITIS and PLANTS databases treat this subspecies as native to Alaska; however, we adopt the treatment of local experts (Hultén 1968, Cody 1996), who consider it introduced to Alaska and the Yukon.
Other common names: none

Poa pratensis ssp. *irrigata* Synonyms: *Poa pratensis* var. *rigens* (Hartman) Wahlenb., *Poa pratensis* ssp. *rigens* (Hartman) Tzvelev, *Poa pratensis* ssp. *subcaerulea* (Sm.) Hiitonen, *Poa subcaerulea* Sm.
Taxonomic notes: this subspecies in the *P. pratensis* complex appears to be universally treated as non-native.
Other common names: none

Poa trivialis Synonyms: none
Other common names: none

Description
Kentucky bluegrass and spreading bluegrass are strongly rhizomatous, mat-forming, perennials, ranging from 0.5 to 2.5 feet tall. Rough bluegrass lacks rhizomes and is tufted with decumbent bases of the culms growing to 3 feet tall. Leaf blades are flat to folded, smooth, with a double mid-rib. Leaf tips are prow-shaped as in most *Poa* species. Sheaths are rounded to somewhat keeled, partially closed, and smooth. The inflorescence is a broadly pyramidal compact panicle. Spikelets are coarse and large in all three taxa (Sather 1996, Welsh 1974).


Kentucky bluegrass

Kentucky bluegrass and spreading bluegrass can be separated from other Alaskan *Poa* taxa by a combination of traits. Most notable is that it is rhizomatous and mat-forming with relatively wide (1.5-4 mm) flat leaves. Kentucky bluegrass generally has 5 branches on the lowest whorl of the inflorescence, while spreading bluegrass most often has 2 branches on the lowest whorl and has shorter, spreading culms. Both of these taxa also have large anthers (1-2 mm long), a tuft of long cobwebby hairs at the base of the lemma, but not between the keel and marginal nerve. Additionally, they have normal glumes (short, broad, and rounded).


Spreading bluegrass

Rough bluegrass is distinguished by an acute, long (4-5 mm) ligule of upper leaves, a very prominent nerve between keel and marginal nerve on lemma, and by narrow, curved, highly acute first glume (Hultén 1968).


Rough bluegrass

Ecological Impact

Impact on community composition, structure, and interactions: Kentucky bluegrass is known to compete with native species, reducing overall diversity and altering species composition (Rutledge and McLendon 1996, Sather 1996, Wisconsin DNR 2003). It is less nutritious and has a shorter growing period than native grasses and therefore it can negatively impact grazing species (Sather 1996). However, Kentucky bluegrass has been noted for positive effects in wildlife management. It can be an important component in the diets of elk and mule deer. The leaves and seeds are eaten by many species of rodents, rabbits, and songbirds. Kentucky bluegrass-dominated grasslands create habitat for species of small mammals and birds (Uchytil 1993). It is a host for number of pest insects and diseases (Butterfield et al. 1996). In Alaska, this species is rarely found in undisturbed sites (J. Conn – pers. comm.)

Impact on ecosystem process: Kentucky bluegrass may retard or cause long-term alterations to successional patterns (Butterfield et al. 1996). This species does not appear to seriously hamper succession in Alaska.

Biology and Invasive Potential

Reproductive potential: These grasses are reproductively aggressive, spreading from seed and rhizomes in the case of Kentucky and spreading bluegrasses. Kentucky bluegrass can produce 200 seeds per panicle in the first year. In soil samples from a pasture in the Netherlands a maximum of 560 seed/m^2 was reported (Sather 1996). The production of more than 1000 seeds per rough bluegrass plant has been documented (Froud-Williams and Ferris 1987). Rhizomes can extend the horizontal growth of the bluegrass plants as much as 2 square meters in 2 years (Rutledge and McLendon 1996, Sather 1996).

Role of disturbance in establishment: Kentucky bluegrass readily establishes by seeds on disturbed sites. The species increases with grazing and burning (Sather 1996, Weaver and Darland 1948). These grasses appear to require some level of substrate disturbance for successful invasion.

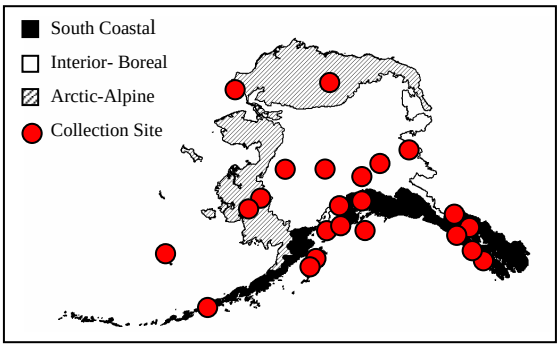
Potential for long-distance dispersal: Seeds can be spread short distances (Froud-Williams and Ferris 1986). These grasses do not have clear adaptations for long-distance dispersal.

Potential to be spread by human activity: They are commonly planted as a lawn and pastures grasses. Over 100 cultivars have been developed (Butterfield et. al. 1996). It is used in Alaska, Colorado, and Wisconsin for soil stabilization along highway road ways (Uchytil 1993).

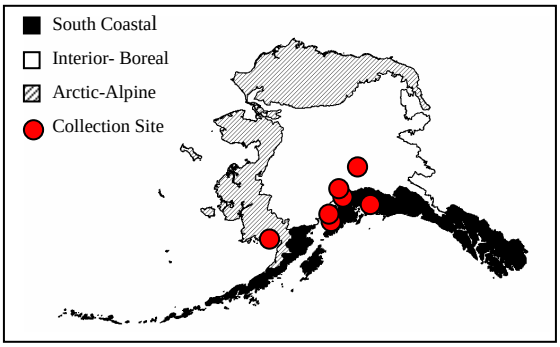
Germination requirement: *Poa pratensis* is a fall germinating species. Freshly harvested seeds require a cold treatment at 41° to 59°F for 10-14 days for germination. *Poa trivialis* can germinate in a wide range of temperatures, but those less than 50°F delay germination. Both species require light, but are known to germinate from depths as great as 42 inches

within the first four years after burial (Sather 1996, Froud-Williams and Ferris 1987, Budd 1970).
Growth requirements: These grasses are adapted to fine and medium textured soils with pH between 5 and 8. These grasses prefer rich soils. Precipitation optimum ranges of 20 to 50 inches annually. Kentucky and spreading bluegrasses do not tolerate shading. Kentucky bluegrass withstands temperatures to -38°F, and requires 90 frost-free days. Optimum temperatures for growth are between 61° and 90°F. Rough bluegrass withstands temperatures to -28°F, and requires 120 frost-free days (Gubanov et al 2003, USDA 2002).
Congeneric weeds: *Poa annua* L. and *P. compressa* L. (Hultén 1968, Royer and Dickinson 1999, Whitson et al. 2000).
Listing: Poa pratensis listed as an invasive weed in Nebraska and Wisconsin. *Poa trivialis* is restricted weed seed in New Jersey and Virginia (Invaders Database System 2003, USDA 2002).

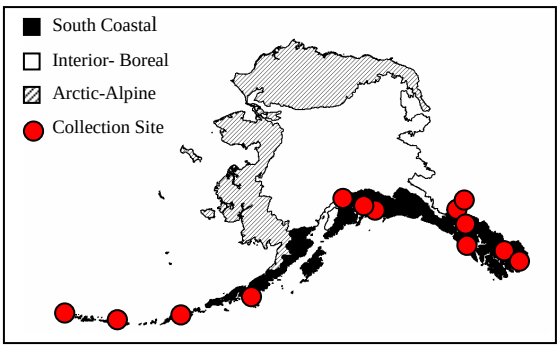
Distribution and Abundance
Kentucky, spreading, and rough bluegrasses can be found in meadows, open woodlands, prairies, and disturbed sites. In the western states, Kentucky bluegrass frequently occurs as an understory species, dominant in open aspen, ponderosa pine, sagebrush, and riparian habitats (Uchytil 1993).
Native and current distribution: Kentucky bluegrass is generally considered to be an exotic in North America. However, some botanists argue that populations in remote mountain meadows of the western United States may be native (Gleason and Cronquist 1963). It is found naturalized in all states and in Canada from Labrador to the west coast. Spreading bluegrass is clearly an introduced lawn grass. These grasses have been introduced into S. America, New Zealand, and Australia (Hultén 1968). Kentucky bluegrass and spreading bluegrass have been collected in all ecogeographic regions in Alaska (however, many of these collections may represent native subspecies). Rough bluegrass is documented in South Coastal ecogeographic region (Weeds of Alaska Database 2005, UAM 2005, Hultén 1968).



Distribution of Kentucky bluegrass (*Poa pratensis*) in Alaska



Distribution of spreading bluegrass (*Poa pratensis* ssp. *irrigata*) in Alaska



Distribution of rough bluegrass (*Poa trivialis*) in Alaska

Management
These bluegrasses rarely produce pure stands. Kentucky bluegrass's rhizomatous habit permits it to penetrate areas between plants. Eradication of the grass may not be feasible, since practices that will damage it generally harm the co-occurring species more (Sather 1996). The only realistic management goals may be to reduce vigor and contain its spread (Butterfield et al. 1996, Uchytil 1993).

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Prostrate knotweed

Polygonum aviculare L.

Synonyms: *Polygonum aviculare* L. var. *vegetum* Ledeb., *Polygonum heterophyllum* Lindl., *Polygonum monspeliense* Pers.
Other common names: yard knotweed
Family: Polygonaceae

Description
Prostrate knotweed is an annual, 1 to 3 feet tall. Plants are green or bluish green, sometimes whitish from powdery mildew. Stem is striate, terete to triangular. Leaves are alternate, lance-shaped to oblong, ½ to 2 ½ inches long with silvery papery sheaths at each node. Inflorescences are clusters at leaf axils. Flowers are small, closed or semi-closed. Tepals are green or reddish with white, pink, or red margins. Achenes are three-angled, light to dark brown, 1.2 to 4.2 mm, dull, usually tubercled. Apex of achene is not beaked (FNA 1993+, Welsh 1974, Whitson et al. 2000).

Robert H. Mohlenbrock @ USDA-NRCS PLANTS Database / USDA NRCS. 1995. *Northeast wetland flora: Field office guide to plant species*. Northeast National Technical Center, Chester, PA.

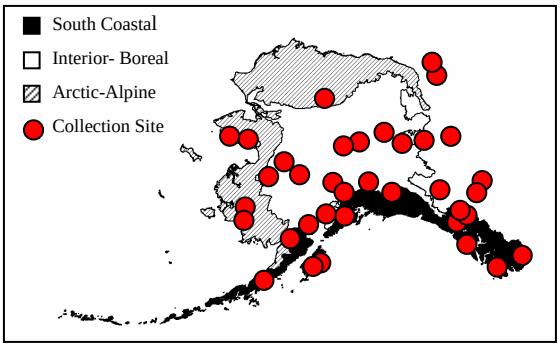
Prostrate knotweed is extremely similar to other knotweed species in North America. Leathery knotweed (*P. achoreum* S.F. Blake) may occur as weeds and may be confused with prostrate knotweed. However, leathery knotweed plants are light green or yellowish, and its tepals are green with yellow margins. Leathery knotweed has uniformly tubercled achenes. Native to Alaska Fowler's knotweed (*P. fowleri* B.L. Robins.) is rarely reddish or purple tinged. It also can be distinguished from prostrate knotweed by beaked at apex achenes and sometimes zigzagged stems. Alaska knotweed (*P. humifusum* sp. *caurianum* (B.L. Robins.) differs from prostrate knotweed by its opposite leaves at proximal nodes (FNA 1993+, Hultén 1968). *Polygonum* is a complex taxa and proper identification is necessary before any control actions have been taken.

Ecological Impact
Impact on community composition, structure, and interactions: Prostrate knotweed is capable of colonizing disturbed ground and creating dense layers. Many farmland birds and mammals use prostrate knotweed as habitat as well as a food source (Firbanks and Smart 2002, Watson et al. 2003). Sixty-one species of insects have been observed to feed on prostrate knotweed (Marshall et al. 2003, Wilson et al. 1999). Flowers are frequently visited by insects, particularly by bees and flies. Prostrate knotweed is a host for number of fungi, viruses, and nematode species (Costea and Tardif 2005, Townshend and Davidson 1962).
Impact on ecosystem process: Prostrate knotweed quickly covers bare soil. It may prevent native species from establishing on the site. Toxins from root and leaves of the plant alter soil content and make soil unsuitable for certain native species (Alsaadawi and Rice 1982, Kloot and Boyce 1982).

Biology and Invasive Potential
Reproductive potential: Prostrate knotweed reproduces by seed (Costea and Tardif 2005). A single plant may produce from 125-200 to 6400 achenes (Stevens 1932).
Role of disturbance in establishment: Prostrate knotweed colonizes disturbed ground. Plants may appear on sites that have been redisturbed several decades after the last human disturbance (Densmore et al. 2000). Prostrate knotweed tends to grow on patches of soil disturbed by animals (Milton et al. 1997).
Potential for long-distance dispersal: Achenes can be dispersed by birds and animals after ingestion. The seeds float and can be dispersed by irrigation water, rain streams, and water courses (Costea and Tardif 2005).

Potential to be spread by human activity: Seeds can be easily carried on footwear, motor vehicles or farm machinery. Seeds can also contaminate harvested crop, seeds, topsoil, and horticultural stock (Hill et al. 1999, Hodkinson and Thompson 1997). Some seeds are not damaged after passing through the digestive tracts of domestic animals and birds (Costea and Tardif 2005).
Germination requirements: Most seeds of prostrate knotweed are dormant and germinate in spring after a moist chilling period. Seeds germinate in a single flush, at temperatures as low as 41°F. In addition, a smaller percentage of seeds can germinate during the summer and autumn at temperatures of 68°-77°F. Seedlings emerge from the top inch of soil. Some seeds can geminate in darkness, but the germination percentage is higher under light conditions (Baskin and Baskin 1990, Chepil 1946).
Growth requirements: Prostrate knotweed is common on all types of soils. It grows well in heavily compacted, poorly aerated and poor in nutrient soils. The species can also tolerate drought, low soil fertility, temporary flooding, high salt content, and heavy metal contamination (Ajmal Khan and Ungar 1998, St-Arnaud and Vincent 1988, Foderaro and Ungar 1997).
Congeneric weeds: *Polygonum cuspidatum* Sieb. & Zucc., *P. perfoliatum* L., *P. polystachyum* Wallich ex Meisn., *P. sachalinense* F. Schmidt ex Maxim. are declared noxious in a number of American states (USDA, NRSC 2006). Also *Polygonum arenastrum* Jord. ex Boreau, *P. caespitosum* Blume, *P. convolvulus* L., *P. orientale* L., *P. persicaria* L., and *P. lapathifolium* L. are listed as a weeds in the PLANTS Database (USDA, NRSC 2006). A number of native to North America *Polygonum* species have a weedy habit and are listed as noxious weeds in some of the American States. Although the latest taxonomy considers these species as members of three different genus: *Polygonum*, *Fallopia* and *Persicaria* (FNA 1993+), they are closely related taxa and can be considered as congeneric weeds.
Listing: Polygonum aviculare is listed as a noxious weed in Quebec (Rice 2006).

Distribution and abundance
Native and current distribution: Prostrate knotweed is one of the most widespread weeds in the world. It is especially common in the northern hemisphere. It has been introduced into Central and South Africa, South and North America, Australia and New Zealand (Gubanov et al. 2003, Hultén 1968). Prostrate knotweed is common along roadsides, sidewalks and paved areas. It also occurs in gardens and cultivated fields (Alex and Switzer 1976).



Management
Mechanical methods used for the control of prostrate knotweed are usually not efficient alone. They are more effective in combination with chemical treatments. Several insect species have been suggested as a potential biocontrol agent for this weed (Costea and Tardif 2005).

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Introduction
These two species of buttercups share similar biological and ecological attributes. We treat the description, distribution and abundance separately, but combine the discussion of ecological impacts and control methods.

Creeping buttercup
Ranunculus repens L.

Synonyms: *Ranunculus repens* var. *degeneratus* Schur, *R. repens* var. *erectus* DC., *R. repens* var. *glabratus* DC., *R. repens* var. *linearilobus* DC., *R. repens* var. *pleniflorus* Fern., *R. repens* var. *typicus* G. Beck, *R. repens* var. *villosus* Lamotte.
Common name: none
Family: Ranunculaceae

Description

Creeping buttercup is a perennial herb with stems up to 3 feet long and slender fibrous roots. Decumbent stems root freely at their nodes and are often slightly hollow with long spreading hairs. Basal leaves are ½ to 3 ½ inches long and up to 4 inches wide, egg-shaped to triangular, and 3-foliolate with toothed margins. Light-colored spots are often present on the basal leaves. Stem leaves are alternate with the lower long-stalked form transitioning upward to the simple to 5-parted bracts. Flower stems are long and erect. Flowers are few and showy with 5 yellow petals; petal number may be 6 to 9. Globose seedheads contain about 12 flattened and rounded fruits with a short backward-turned beak (Douglas and Meindinger 1999, Welsh 1974, Whitson et al. 2000). The plant overwinters as a rosette with small green leaves (Harper 1957).

Infestation of creeping buttercup. Photo by Thomas Heutte, USDA Forest Service

Tall buttercup
Ranunculus acris L.

Synonyms: none
Common names: meadow buttercup
Family: Ranunculaceae

Description

Tall buttercup is a biennial or short-lived perennial herb growing from a cluster of fibrous roots. Erect stems are up to 3 feet tall, smooth and hollow, leafy below and branched above. Basal leaves are long-stalked, divided deeply into 3 to 7 coarsely lobed segments and persistent. Stem and basal leaves are soft-haired on both sides. The flowers are long-stalked with 5 shiny golden-yellow petals and 5 sepals. Seeds are disc-shaped, reddish brown with a short hook (Douglas and Meindinger 1999, Welsh 1974, Royer and Dickinson 1999).

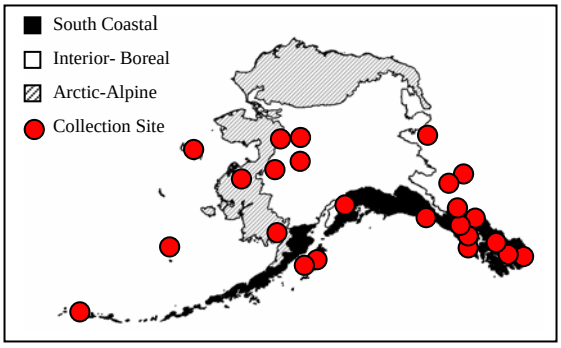
Photo by Kenneth J. Sytsma, University of Wisconsin-Madison, Wisconsin State Herbarium

Photo by Tom Heutte, USDA Forest Service

Creeping buttercup can be distinguished from other buttercup species by its horizontal growth habit, creeping stems that root at the nodes, spherical head of achenes and long (6-10 mm) petals (Douglas and Meidiger 1999, Hultén 1968).

Distribution and Abundance

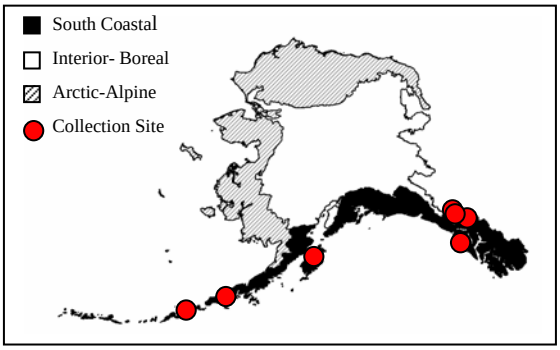
Creeping buttercup originated in Europe and extends northward to 72° N in Norway. It is now naturalized in many temperate regions of the globe including North, Central, and South America, Asia, Africa, Australia, and New Zealand (Harper 1975, Hultén 1968, NAPPO 2003). In Alaska this species has been documented from all ecogeographic regions (Hultén 1968). It occurs on disturbed soils including gardens, croplands, grasslands, woodlands, and semi-aquatic communities, such as swamps, margins of ponds, rivers, and ditches (Harper 1957, Lovett-Doust et al. 1990).



Tall buttercup can be distinguished from other buttercup species by its upright growth habit and deeply lobed and toothed leaves.

Distribution and Abundance

Tall buttercup is widely distributed across Europe, ranging north to 71° N in Norway. It has established in North America, South Africa, Asia, and New Zealand (Harper 1957, Hultén 1968). In Alaska this species has been documented from the South Coastal ecogeographic region. It is found in grassland, woodland, and occasionally sand dune communities.



Ecological Impact

Impact on community composition, structure, and interactions: The secondary compound protoanemonin released in the sap of creeping and tall buttercups is poisonous and can cause death to grazing animals if consumed. Geese and other birds readily eat leaves and seeds of buttercup (Lovett-Doust et al. 1990). The flowers are visited by honey bees, butterflies, moths, bugs, and beetles for pollen or nectar. Buttercups host microorganisms and viruses, insects, and nematodes (Harper 1957, Lovett-Doust et al. 1990, Royer and Dickinson 1999).

Hybridization has been documented between *Ranunculus acris* and *R. uncinatus* (Welsh 1974).
Impact on ecosystem process: Buttercup readily occupies open areas and may hinder colonization by native species.

Biology and Invasive Potential
Reproductive potential: Reproduction may be by seed, stolon, or rhizome (Harper 1957).
Role of disturbance in establishment: Seedlings establish readily in open ground and rapidly colonize bare areas in the year following germination (Harper 1957).
Potential for long-distance dispersal: Although most seeds are dropped near the parent plant, some seeds are dispersed farther by wind or in the dung of birds, farm animals, and small rodents (Harper 1957, Lovett-Doust et al. 1990).
Potential to be spread by human activity: Seeds can be dispersed by attachment to clothes and tires. Creeping buttercup may have been introduced as an ornamental plant into North America (Lovett-Doust et al. 1990).
Germination requirements: Seed germination usually occurs in late spring. Successful germination and early establishment appears to require open soil.
Growth requirements: Buttercups are adapted to a very wide range of soil types. Because they can withstand waterlogging buttercups occur mainly in heavy wet clay soils but can also thrive in sand or gravel if adequate moisture is present. Buttercups do not establish on well-drained soils. They are able to tolerate some salinity and can be found on beaches and in salt marshes. They can tolerate frost, but not prolonged dry periods (Harper 1957, Lovett-Doust et al. 1990).
Congeneric weeds: *Ranunculus abortivus* L., *R. arvensis* L., *R. bulbosus* L., *R. sardous* Crantz are invasive in other areas of the United States (USDA 2002).
Listing: Ranunculus repens and *R. acris* are considered weeds in the United States and Canada (Royer and Dickinson 1999, Whitson et al. 2000).

Management
Herbicides are generally recommended for control of buttercups. Plants may be weakened by cultivation, but parts of the caudex and stolon may regenerate and cause population increases. Plowing provides ideal conditions for germination of seed and is therefore not recommended as an eradication technique (Harper 1957, Lovett-Doust et al. 1990).

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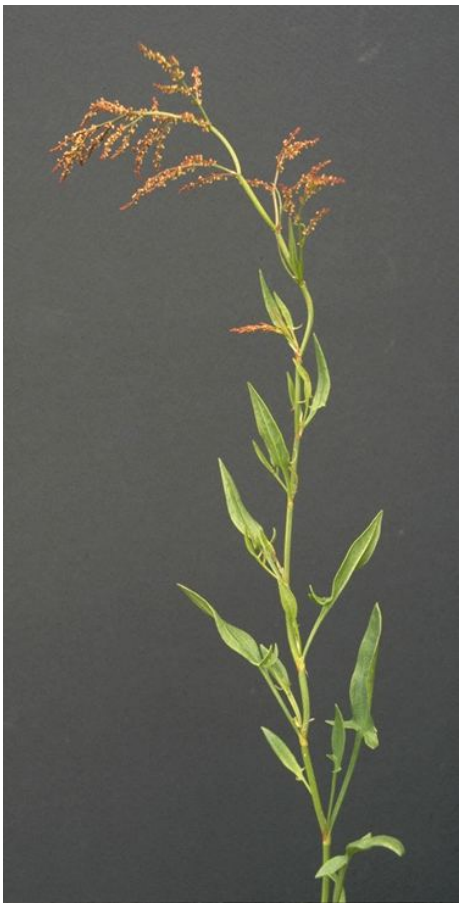
Sheep sorrel (*Rumex acetosella* L.)

Synonyms: *Acetosella acetosella* (L.) Small, *A. tenuifolia* (Wallr.) A. Löve, *A. vulgaris* (Koch) Fourr., *Rumex acetosella* ssp. *angiocarpus* (Murb.) Murb., *R. acetosella* var. *pyrenaeus* (Pourret) Timbal-Lagrave, *R. acetosella* var. *tenuifolius* Wallr., *R. angiocarpus* Murb., *R. tenuifolius* (Wallr.) A. Löve
Other common names: field sorrel, red sorrel, common sheep sorrel
Family: Polygonaceae

Description
Sheep sorrel is an annual or sometimes a perennial, ½ to 2 feet tall, with slender, creeping rhizomes. Lower leaves are arrow-shaped with 2 conspicuous basal lobes pointing outward. Leaf blades are ½ to 3 inches long. Basal leaves are long stalked. Stem leaves are more slender and sometimes without basal lobes, short stalked to sessile. A membranous sheath surrounds the stem at each node. Leaves and stems have a sour taste. Flowers are arranged in branched loose, leafless, terminal panicles. The male and female flowers are born on separate plants. The male flowers are orange-yellow and the female flowers are red-orange. Flowers consist of three scale-like sepals and three petals. The fruits are small, three-angled, enclosed in three persistent flower scales (Pojar and MacKinnon 1994, Whitson et al. 2000).

The native Alaska grassleaf sorrel (*R. graminifolius*) is found in a few locations north of the Brooks Range and Beringia sorrel (*R. beringensis*) is a native species of the Alaska Peninsula north to the arctic slope along the Bering Sea. Both species are similar to sheep sorrel, but have narrowly linear leaves, sometimes without basal lobes (FNA 1993+, Hultén 1968).
Introduced garden sorrel (*R. acetosa* L.) has been recorded from Kodiak and Unalaska (Hultén 1968, UAM 2006). It is a perennial, stout plant up to 3 feet tall. The leaves are oblong-lanceolate, up to 4 inches long with lobes pointing downward. It can be distinguished from native garden sorrel (*R. lapponicus*) by having a short, broad, strongly fringed sheaths (Douglas and MacKinnon 1999). Native garden sorrel is widespread in all ecogeographic regions of Alaska (UAM 2006).

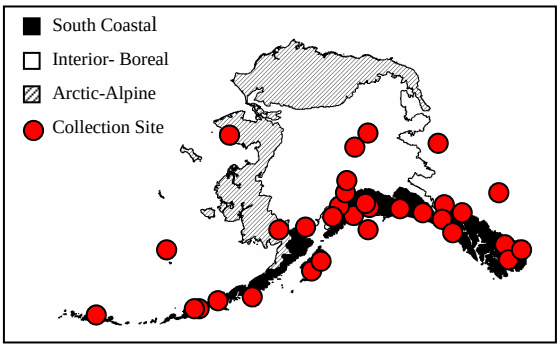
Ecological Impact
Impact on community composition, structure, and interactions: Sheep sorrel is able to form dense stands and displace native grasses and forbs. This plant contains oxalic acid which can be poisonous to livestock and may be toxic to wildlife species (Cal-IPC 2005). Sheep sorrel is grazed by mule deer (Nixon et al. 1970, Kruger and Donart 1974). Sheep sorrel seeds are a rich source of food for birds (Schmidt 1936, Swenson 1985, Wilson et al. 1999).
Impact on ecosystem process: Sheep sorrel is documented as one of the common colonizers of the burned areas (Hall 1955, Fonda 1974, Weaver et al. 1990). This species may impede the reestablishment of the native species and affect natural successional processes.


Sheep sorrel flowering stem. Oregon State University, Weed Science.

Biology and Invasive Potential
Reproductive potential: Sheep sorrel reproduces by seeds and from creeping roots and rhizomes (Kiltz

1930). The plant is capable of producing up to 1,600 seeds per season (Stevens 1932, Escarre and Thompson 1991).
Role of disturbance in establishment: Sheep sorrel rapidly colonizes clearcuts, burned, and flood-disturbed sites (Hall 1955, Fonda 1974, Weaver et al. 1990). Animal disturbances such as mole hills or cattle tracks can be sufficient for establishment of sheep sorrel in natural communities (Putwain et al. 1968).
Potential for long-distance dispersal: Seeds can be dispersed by wind, water, and insects (ants) (Houssard and Escarre 1991).
Potential to be spread by human activity: Seeds of sheep sorrel can be transported on vehicle tires, agricultural equipment, with nursery stock, or contaminated seeds and hay (Gooch 1963). Seeds remain viable after passing through the digestive tracts of domestic birds and animals (Evershed and Warburton 1918, Dorph-Peterson 1925).
Germination requirements: Sheep sorrel requires open soil for germination (Putwain et al. 1968).
Growth requirements: Sheep sorrel grows in a wide range of soil types, including sandy loam, sand, silt, and gravel. It prefers acidic soils with low fertility.
Congeneric weeds: *Rumex crispus* L. is declared a Noxious in Iowa (USDA, NRCS 2006).
Listing: Rumex acetosella is declared a Noxious in Connecticut and Iowa (USDA, NRCS 2006).

Distribution and abundance
Native and current distribution: Sheep sorrel is a forb of European origin. Today it is naturalized throughout temperate North America and has been introduced into South America, Africa, and Hawaii (Hultén 1968). Sheep sorrel is a weed of disturbed sites, such as roadsides, abandoned fields, gardens, lawns, and pastures (Pojar and MacKinnon 1994, Welsh 1974, Whitson et al. 2000). It can also become established in grasslands (Swenson 1985), montane meadows (Boyd et al. 1993, Leege et al. 1981), and undisturbed open forests (Fyles 1989). Sheep sorrel can be found on riverbars, beaches (Fonda 1974, Pojar and MacKinnon 1994), and freshwater and brine marshes (Fiedler and Leidy 1987). It has been used for revegetation in mining regions.



Management
Control of sheep sorrel can be difficult because of its creeping rhizomes and long-lived seeds. Plants are too low to be affected by mowing or grazing and it usually survives prescribed burning. Repeated cultivation and frequent removal of resprouted plants will eventually exhaust the population. Several herbicides are available for use in pastures and lawns. Liming the soil may also help eradicate sheep sorrel (Rutledge and McLendon 1996).

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Curly dock (*Rumex crispus* L.)

Bitter dock (*R. obtusifolius* L.)

Dooryard dock (*R. longifolius* DC.)

Family: Polygonaceae

Rumex crispus Synonyms: None
Other common names: Curley dock, narrowleaf dock, sour dock, yellow dock
Rumex obtusifolius Synonyms: *Acetosa oblongifolia* (L.) A.& D. Löve, *Rumex obtusifolius* ssp. *agrestis* (Fries) Danser, *R. obtusifolius* ssp. *sylvestris* (Wallr.) Rech. f., *R. obtusifolius* var. *sylvestris* (Wallr.) Koch
Other common names: bluntleaf dock, broadleaf dock
Rumex longifolius Synonyms: *R. domesticus* Hartman
Other common names: None

Description
Curly dock, bitter dock, and dooryard dock are closely related and are very similar in appearance. These are robust perennials with a fleshy deep taproot. The reddish erect stems are usually unbranched and grow up to 5 feet tall. Before flowering plants develop a basal rosette of leaves. Basal leaves are lance-shaped, up to 12 inches long. Flowers are small, greenish red, in dense terminal clusters up to 2 feet long. The flower is composed of three outer green tepals and three inner red tepals. The entire plant turns reddish-brown at maturity. The fruit is three-sided and enclosed by the inner winged tepals. Curly dock has truncate or cuneate base of the leaves and strongly crisped margins. Dooryard dock and bitter dock can be distinguished from other species by the heart-shaped leaf bases and smooth, normally entire, flat margins. Bitter dock can be also distinguished from other docks by its tepals with distinctly dentate margins (FNA 1993+, Royer and Dickinson 1999, Whitson et al. 2000).

Several native docks with basal rosette of leaves occur in Alaska. Arctic dock (*R. arcticus*) and western dock (*R. occidentalis*, also known as *R. fenenstratus*) can be found in wet meadows, marshes, and river banks throughout Alaska. These species can be distinguished by a combination of characteristics (see table below). Hybrids between many species of the subgenus *Rumex* commonly occur (Cavers and Harper 1964).


Curly dock (*Rumex crispus*) flowering stem.

Comparison and distinguishing characteristics of five species of *Rumex*

Species	**basal leaves**	**flower clusters**	**fruit scale**
curly dock (*R. crispus*), introduced	tapered bases, strongly crisped margins	dense	entire margins, with 3 tubercles
bitter dock (*R. obtusifolius*), introduced	broad, heart-shaped bases, margins entire, flat	usually lax and widely spaced	distinctly dentate, tubercles usually 1
dooryard dock (*R. longifolius*), introduced	rounded-truncate bases, margins entire	normally dense	margins entire, tubercles normally absent
arctic dock (*R. arcticus*), native	tapered bases, margins entire, flat	interrupted	margins entire, tubercles absent
western dock (*R. occidentalis*), native	heart-shaped or rounded bases, margins entire	dense to interrupted	margins entire, tubercles absent

Ecological Impact

Impact on community composition, structure, and interactions: Curly dock and dooryard dock readily establish in semi-natural graminoid-forb roadside habitats in Southcentral Alaska and create a new layer of vegetation (M. Carlson – pers. obs., I. Lapina – pers. obs.). It likely pushes out native species once established. The seeds and vegetation of docks can be toxic to animals (Royer and Dickinson 1999). Bitter dock is avoided by rabbits, but it appeared to be a favorite food plant of deer (Amphlett and Rea 1909, cited in Cavers and Harper 1964). Dock species are also an alternate host for number of viruses, fungus (Dal Bello and Carranza 1995), and nematodes (Edwards and Taylor 1963, Townshend and Davidson 1962).

Impact on ecosystem process: Impact of exotic docks on ecosystem processes has not been documented.

Biology and Invasive Potential

Reproductive potential: Plants reproduce only by seeds. The number of seeds per plant may vary from less than 100 to more than 60,000 per season. Plants can resprout from underground parts of the plant after damage (Cavers and Harper 1964, Monaco and Cumbo 1972).

Role of disturbance in establishment: Seedlings of dock usually do not become established in closed communities. Soil disturbance and removal of vegetation are required for dock's establishment (Cavers and Harper 1964).

Potential for long-distance dispersal: Seeds can be dispersed for a long distance by wind and water. The spines on the seeds of bitter dock facilitate distribution on animals' fur and bird feathers (DiTomaso and Healy 2003, Cavers and Harper 1967).

Potential to be spread by human activity: Seeds can be easily dispersed by attaching to clothing and fur of domestic animals. Seeds can also pass thought the digestive system of cattle (Cavers and Harper 1964). Curly dock is a common contaminant of commercial seeds (Dorph-Petersen 1925, Singh 2001) and soil (DiTomaso and Healy 2003).

Germination requirements: Seeds germinate at the optimum temperature of 68°-77° F in both light and dark. Germination can occur in any month, but peaks with the seedling emergence in early spring and fall (Benvenuti et al. 2001, Cavers and Harper 1964).

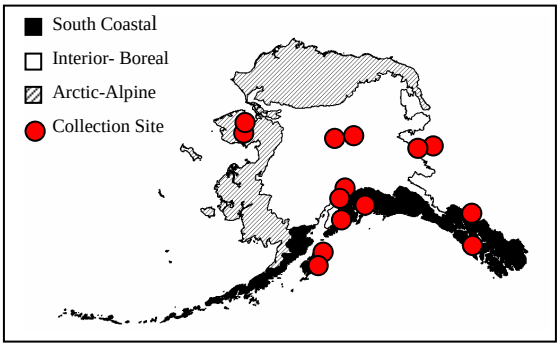
Growth requirements: These docks are found on nearly all type of soils, except the most acidic. They are most adapted to moist to wet soils and can tolerate poor drainage. Mature plants can withstand severe cold and drought (Cavers and Harper 1964, DiTomaso and Healy 2003).

Congeneric weeds: *Rumex acetosella* is declared noxious in Connecticut and Iowa (USDA, NRCS 2006).

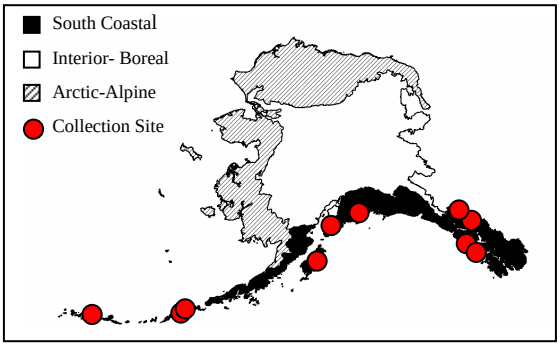
Listing: Rumex crispus is declared noxious in Indiana, Iowa, Michigan and Minnesota (USDA, NRCS 2006).

Distribution and abundance

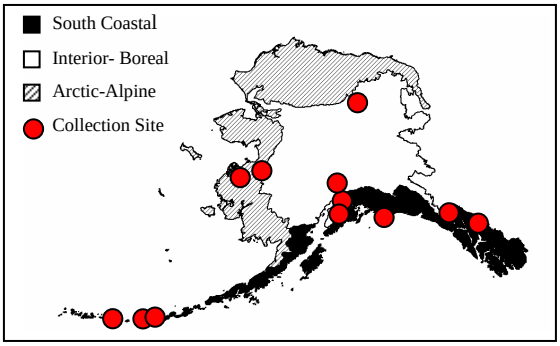
Native and current distribution: Curly, bitter and dooryard dock are indigenous to Europe and Asia. They have been introduced into North and South Africa, North and South America, Australia and New Zealand.



Distribution of curly dock (*R. crispus*) in Alaska



Distribution of bitter dock (*R. obtusifolius*) in Alaska



Distribution of dooryard dock (*R. longifolius*) in Alaska

They are species of disturbed substrates, such as agricultural fields, roadsides, and waste grounds (DiTomaso and Healy 2003, Hultén 1968, Welsh 1974). These species are especially likely to invade riparian areas, including wet meadows, riverbanks, pond edges, and irrigation ditches (DiTomaso and Healy 2003).

Management

All exotic docks are very difficult to eradicate. High seed production, long-lived seed banks, and the ability to regenerate from root fragments make control difficult. Hand-cutting plants below the ground or herbicide application can control infestations (Cavers and Harper 1964, DiTomaso and Healy 2003).

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Last Updated March 29, 2006

Introduction
A number of *Silene* species have been introduced to Alaska. Because these species share similar biological and ecological attributes we treat each species description, distribution and abundance separately, but combine the discussion of ecological impacts and control methods.

Night-flowering catchfly *Silene noctiflora* L.

Synonyms: *Melandrium noctiflorum* (L.) Fries
Other common names: night-flowering silene, sticky cockle
Family: Caryophyllaceae

Description

Night-flowering catchfly is an annual plant with sticky hairs throughout and 1 to 3 woody stems growing up to 3 feet tall. Stems are swollen at the nodes. Leaves are opposite, covered with sticky hairs and are reduced in size upwards. Basal leaves are stalked, oblong and 1½ to 7 inches long whereas stem leaves are stalkless, 1 to 3 inches long and up to 1½ inches wide. Fragrant flowers in terminal clusters open at night. The 5, deeply notched petals are white to pink, ¾ to 1½ inches long and enclose 10 stamens and 3 styles. The fruit is a capsule with 3 compartments, opening at maturity by 6 backwards-curling teeth. There are 10 distinct green veins on the seed capsule. Seeds are kidney-shaped, grey, and about 1 mm long (Douglas and MacKinnon 1998, Royer and Dickinson 1999).

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Night-flowering catchfly is often confused with white cockle (*Silene latifolia* ssp. *alba*). Night-flowering catchfly has perfect flowers with both stamens and styles in the same flower, while white cockle has male and female plants and a female calyx with 20 prominent veins.

White cockle *Silene latifolia ssp. alba* L.

Synonyms: *Lychnis alba* P.Mill., *L. vespertina* Sibthorp, *Melandrium album* (P. Mill.) Garcke, *Silene alba* (P. Mill.) Krause, *S. pratensis* (Rafn) Godr. & Gren.
Other common names: bladder campion, evening lychnis, white campion
Family: Caryophyllaceae

Description

White cockle is a short-lived perennial or biennial growing 1 ½ to 3 ½ feet tall. Plants are either male or female. Both plant sexes have coarse, sticky hairs. Leaves are opposite, linear and about ¾ inches wide and 1 to 4 inches long. Similar to night-flowering catchfly, lower leaves are stalked, while upper leaves are stalkless. Fragrant flowers, about 1 inch across, open in the evening and close in the morning. Flowers are composed of 5, deeply notched white petals that enclose 10 stamens on male flowers and 4 or 5 styles in female flowers. The male calyx has 10 prominent veins whereas the female calyx has 20 prominent veins on calyx. The fruit is an ovate capsule, ½ to ¾ inches long, which opens by 10 teeth. Seeds are kidney-shaped, grey to brown, and about 1.5 mm long (Douglas and MacKinnon 1998, Royer and Dickinson 1999, Whitson et al. 2000).

Jennifer Anderson @ USDA-NRCS PLANTS Database

Bladder campion
Silene vulgaris (Moench) Garcke

Synonyms: *Oberna commutate* (Guss.) S. Ikonnikov, *Silene cucubalis* Wibel, *S. inflate* Sm., *S. latifolia* (P. Mill.) Britten & Rendle, non Poir.
Other common names: bladder silene, cowbell, maiden's tears, rattleweed
Family: Caryophyllaceae

Description

Bladder campion is a hairless perennial rising from a woody rootstock. Stems are up to 3 feet tall, branched from the base, smooth, and swollen at the nodes. Leaves are stalkless, smooth, ovate or lanceolate, 1¼ to 3¼ inches long and ½ to 1¼ inches wide. A white, powdery film gives leaf surfaces a pale green appearance. Flowers, about ½ inches wide, are found in clusters of 5 to 30 at the ends of branches. The flower is composed of 5 united and deeply notched petals, 10 stamens, and 3 styles. The initially slender calyx develops to a greatly inflated, often purplish, papery sac-like structure surrounding the bulbous fruit. Fruit opens at the toothed calyx top. The numerous seeds are small and grayish (Douglas and MacKinnon 1998, Royer and Dickinson 1999, Whitson et al. 2000).

Brother Alfred Brousseau @ USDA-NRCS PLANTS Database

White cockle is similar to bladder campion, but is more or less hairy and has male and female flowers on different plants. Night-flowering catchfly has

Red catchfly
Silene dioica (L.) Clairville

Synonyms: *Lychnis dioica* L., *Melandrium dioicum* (L.) Cross. & Germ., *Melandrium dioicum* ssp. *rubrum* (Wieg.) D. Löve
Other common names: red campion
Family: Caryophyllaceae

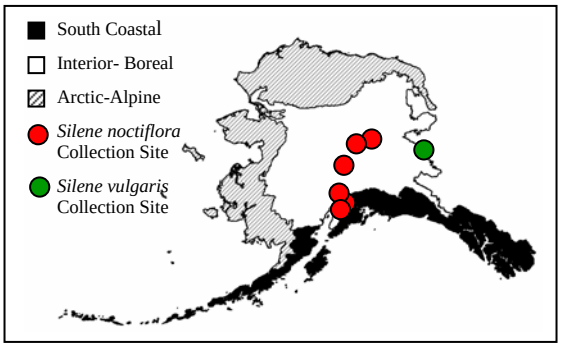
Description

Red catchfly is biennial or perennial herb rising from a fibrous root. Stems are erect, several, branched, glandular above, and 2 to 3 feet tall. Leaves are hairy. Egg-shaped basal leaves narrow to winged stalks. Stem leaves are opposite, broadly elliptic, 1½ to 4 inches long, and 1 to 1½ inches wide. Unisexual flowers are arranged in clusters. The flower is composed of 5, deeply notched, red to purplish or pink petals. The fruit is an egg-shaped capsule with 5 toothed valves. Seed are black (Douglas and MacKinnon 1998).

sticky hairs throughout (Douglas and MacKinnon 1998).

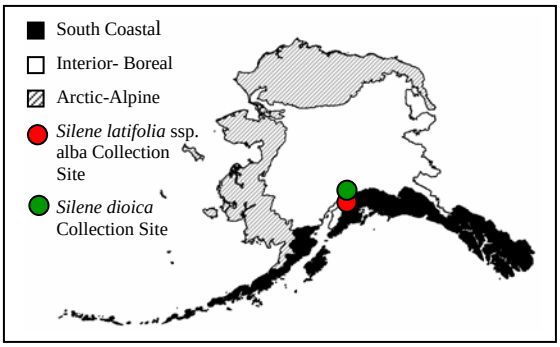
Distribution and Abundance in Alaska

Night-flowering catchfly has been collected from Fairbanks, Anchorage, Nome, Juneau, Healy, and the Kenai Peninsula (Hultén 1968, UAM 2004). Bladder campion has been documented from the Yukon Territory and in the vicinity of Dawson (Cody 1996, UAM 2004). Both species are found on disturbed sites such as roadsides and waste areas.



Distribution and Abundance in Alaska

White cockle has been documented from Eklutna Valley and the Matanuska and Susitna valleys in Alaska (AK Weed Database 2004, UAM 2004). Red catchfly has been collected from Palmer, Alaska (AK Weed Database 2004). All plants were collected on disturbed ground.



Ecological Impact

Impact on community composition, structure, and interactions: These species compete for moisture, nutrients, and sunlight in pastures and crowd native plants. The species are unpalatable to grazing animals. *Silene* species are alternate hosts for numerous viruses (Royer and Dickinson 1999). Hybrids of *S. dioica* and *S. latifolia* ssp. *alba* have been collected in Canada (Douglas and MacKinnon 1998). Plants are pollinated by moth, bee, and butterfly (Kay et al. 1984).
Impact on ecosystem process: *Silene* species occupy disturbed ground and likely hinder colonization by native species. These weeds can decrease soil moisture and nutrient availability (Royer and Dickinson 1999).

Biology and Invasive Potential

Reproductive potential: These plants reproduce primarily by seed. Each plant of night-flowering catchfly is capable of producing up to 2,600 seeds, over 82% of which are viable after 5 years. White cockle plants produce over 24,000 seeds (Royer and Dickinson 1999) and red catchfly plants produced more than 4,500 seeds in an experimental garden in Britain (Kay et al. 1984). White campion and bladder campion are able to reproduce vegetatively by root and stem fragments (Whitson et al. 2000).
Role of disturbance in establishment: Silene species can colonize open ground. Buried seeds remain viable and germinate readily after soil disturbance (Guide to Weeds in British Columbia 2002).
Potential for long-distance dispersal: Most seeds fall from the parent plant to the ground and are therefore not dispersed long distances (Guide to Weeds in British Columbia 2002).
Potential to be spread by human activity: Seeds are very similar to those of crop clovers and are difficult to separate. Consequently seed impurities have been a major source of dispersal. Seeds also are capable of germination after passing through the digestive tract of domestic animals (McNeill 1980, Royer and Dickinson 1999, Whitson et al. 2000).
Germination requirements: Some seeds germinate in the autumn but most remain dormant over the winter. Seeds germinate readily at a relatively high temperature of 68°F. Some populations may require light for germination. (Guide to weeds in British Columbia 2002, McNeill 1980, Thompson 1975).
Growth requirements: Silene species typically grow on sandy or gravelly substratum, but are also found on loamy soils (McNeill 1980).

Congeneric weeds: The *Silene* genus is comprised of a number of serious agricultural weeds (Royer and Dickinson 1999, Whitson et al. 2000).
Listing: Night-flowering catchfly, white cockle, and bladder campion are declared Federal noxious weeds in Canada. These species are also listed as weeds in Connecticut, Wisconsin, and Washington (Royer and Dickinson 1999).

Distribution and abundance
Native and current distribution: Silene species were introduced to North America from Europe and Asia. They are now found throughout Canada and the United States. These plants are important weeds of pastures, grain fields, and gardens. They are also found along highways, railroad tracks, and in waste places (Gubanov et al. 2003, McNeill 1980, Royer and Dickinson 1999)

Management
Mowing or burning is unlikely to control *Silene* species because of its large seed bank. Cultivation usually increases the infestation by facilitating the spread of *Silene*. Herbicides provide limited control as *Silene* species are resistant or somewhat resistant to many common herbicides. No biological control agent is available (Guide to weeds in British Columbia 2002, McNeill 1980).

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Perennial sowthistle

Sonchus arvensis ssp. *uliginosus* (Bieb.) Nyman

Synonyms: *Sonchus arvensis* var. *glabrescens* Guenth., Grab.& Wimmer, *Sonchus uliginosus* Bieb.
Other common name: field sowthistle, marsh sowthistle, moist sowthistle, perennial sowthistle, sowthistle
Family: Asteraceae (Compositae)

Description
Sonchus arvensis is perennial plant usually 2 to 4 feet tall, succulent. It has an extensive horizontal root system that grows up to 10 feet deep. All parts of the plant contain white milky juice. Leaves are alternate, lance-shaped, 2.5 to 16 inches long. Leaves have a clasping base and soft prickly margins which vary from deeply toothed to nearly entire. The flower head is bright-yellow 1 to 2 inches wide. The dark-green floral bracts and flower stalks covered with yellow gland-tipped hairs. Seeds are dark brown, prominently ridged and wrinkled, with a tuft of soft white pappus bristles (Royer and Dickinson 1999, Whitson et al. 2000).
Sonchus arvensis ssp. *uliginosus*, found in Alaska, lacking the glandular hairs on involucre bracts and flower stalk. The floral bracts are green with white margins. Both are common on disturbed soils (Royer and Dickinson 1999, Whitson et al. 2000).

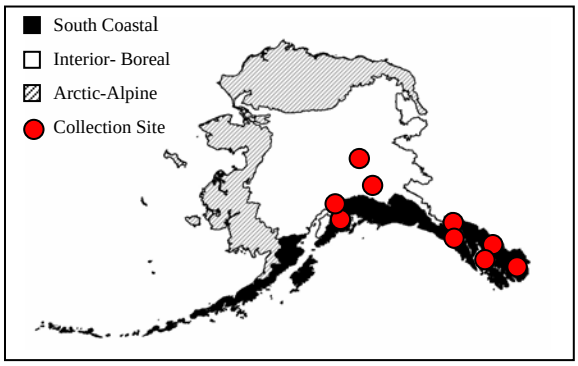
Ecological Impact
Impact on community composition, structure, and interactions: At high densities *Sonchus arvensis* has drastically reduced water resources and possibly decreased number of plants in communities (Butterfield et al. 1996). It is also a host of number of plant pests. This plant is acceptable feed for rabbits and other foraging animals (Noxious Weed Control Board 2003).
Impact on ecosystem process: Perennial sowthistle may modify or retard the successional establishment of native species (Butterfield et al. 1996).

Biology and Invasive Potential
Reproductive potential: Reproduces by seeds and horizontal roots. Each plant can produce 4,000-13,000 seeds, which may remain dormant in the soil for up to six years. However viability is commonly under 40% (Royer and Dickinson 1999). Plant is capable of producing new plant from buds on the rhizome near 2 feet depth. Spreading rootstocks are the primary means of invasion into new areas (Royer and Dickinson 1999, Rutledge and McLendon 1996).

Potential for long-distance dispersal: Seeds possess hairs and spread by wind (Royer and Dickinson 1999, Rutledge and McLendon 1996). Also seeds may become attached to animals (Butterfield et al. 1996).
Potential to be spread by human activity: Seeds can be moved in vehicles and farm equipment. The seeds may also contaminate commercial seeds and hay (Butterfield et al. 1996, Noxious Weed Control Board 2003).
Germination requirements: Seeds germinate at ¼ to 1¼ inches depth; optimal temperature is between 77 and 86° F. Plant cover and litter promote germination

(Butterfield et al. 1996, Royer and Dickinson 1999, Rutledge and McLendon 1996).
Growth requirements: Although perennial sowthistle is adapted to a variety of soils, it prefers rich, non-compacted moist fine textured soil with pH range of 5.2 to 7.2. This plant can survive temperatures to 3.2° F (Butterfield et al. 1996, Rutledge and McLendon 1996).
Congeneric weeds: *Sonchus arvensis* ssp. *uliginosus* (Bieb.) Nyman, *S. asper* (L.) Hill, *S. oleraceus* L. (Whitson et al. 2000).
Listing: Noxious weed in 20 states of the United States and 5 Canadian provinces. It is declared federal noxious weed in US and Canada (Invader Database System 2003, Royer and Dickinson 1999). It is a prohibited noxious weed in Alaska (Alaska Administrative Code 1987).

Distribution and Abundance
Sonchus arvensis is common in gardens, cultivated crops, roadsides, and fertile waste areas (Rutledge and McLendon 1996, Whitson et al. 2000). It may occur on disturbed sites of prairies, woods, meadows, lawns, streams, and lake shores (Butterfield et al. 1996, Gubanov et al. 1995, Noxious Weed Control Board 2003).
Native and current distribution: Native to Europe, western Asia, and Iceland. It has spread widely throughout the northern United States and southern Canada.



Distribution in Alaska

The plant has also established in South America, Australia, and New Zealand (Noxious Weed Control Board 2003, USDA 2002). The first North American report was from Pennsylvania in 1814 (Butterfield et al. 1996).

Management
Biological, chemical, and mechanical control methods have been used on this species. Mechanical treatment for several years should be done few times a season to reduce seed production and root reserves. This weed relatively resistant to many common broadleaf herbicides (Butterfield et al. 1996, Rutledge and McLendon 1996).

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European mountain ash

Sorbus aucuparia L.

Synonyms: *Pyrus aucuparia* (L.) Gaertn., *Sorbus aucuparia* L. var. *xanthocarpa* Hartwig & Rumpler
Other common names: rowan
Family: Rosaceae

Description
European mountain ash is an upright tree growing up to 25 – 40 feet high with a rounded open crown. The bark is grayish or yellowish green and smooth. Leaves are alternate, pinnately compound, and 5 to 8 inches long. The leaflets number 11 to 15 and are dull dark green above and paler below. Clusters (3 to 5 inches across) of small white flowers appear in May. Fruits are bright deep orange small pomes, ripening in September, persistent (Welsh 1974).

European mountain ash is distinguishable from all other native species of *Sorbus* in Alaska as being a tree (all the other species are shrubs).

Ecological Impact
Impact on community composition, structure, and interactions: Unknown – however, this species is able to integrate into largely undisturbed coastal rainforest communities and dominate (e.g., Sitka Nat. Historic Park). It has been reported to invade forest communities in Wisconsin (Wisconsin Department of Natural Resourses 2003).

Impact on ecosystem process: Unknown. Fruits are highly desirable to birds, so there is a potential for alterations in abundance and composition of avian fauna (Gilman and Watson 1994). European mountain ash hybridizes with native *S. scopulina* and *S. sitchensis* where there ranges overlap (Pojar and MacKinnon 1994).

Biology and Invasive Potential
Reproductive potential: European mountain ash is a perennial that grows rapidly (max. 35 ft at 20 years), establishes by seeds, cuttings, or propagates by bare roots. However, there is no vegetative spread (USDA 2002). Seeds are numerous and small (125,000/lbs), with many thousands of seeds produced per plant per year. Seeds have a strong innate dormancy that lifts gradually over a few years. The seeds remain viable in the soil for five years or more (Granström 1987). *Germination requirements:* This species germinated well in experimental conditions of multiple years in moist soil (2 cm in soil, under moss/litter layer) in central Sweden then full light and 20° C (Granström

1987). Cold-stratification is necessary for successful germination (USDA 2002).
Growth requirements: This species is suited to coarse textured soils (no adaptation to fine soils) of pH ranging from 5.5 to 7.5. It is unsuited to anaerobic, calcareous, saline, or low moisture soils. It grows in moderately fertile soil and has intermediate shade tolerance (USDA 2002).
Role of disturbance in establishment: Unknown.
Potential for long-distance dispersal: Spread by birds (thrushes and waxwings) and small mammals (Dickinson and Campbell 1991) and by ornamental planting.
Potential to be spread by human activity: European mountain ash is widely planted as an ornamental in southern and southeastern Alaska, where it has escaped (Welsh 1974). It has been reported to be spread as contaminant of horticultural stock (Hodkinson and Thompson 1997). It has moderate summer foliage porosity. There is no known toxicity, allelopathy, or coppice potential.

Cogeneric weeds: number of *Sorbus* species has been introduced into North America; however no one is listed as a weed.
Listing: not listed in any state.

Distribution and Abundance
Originally from most of Europe, northern Africa, and western Asia, it has naturalized in 27 northern states, in many climatic areas, throughout moist cool regions of North America. It is unsuited to interior Alaska (i.e., USDA hardiness zone 2 or less).
Native and current distribution: Europe (Spain to Balkans, north to British Isles/Nordic countries, and east to Ural Mountains), Iceland.

Management
Control measures for this species are largely untested. It has the ability to resprout after cutting. Many natural seed predators are present in Scandinavia, which likely limit its spread and establishment. It is unknown if these or similar predators are present in North America.

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Common chickweed

Stellaria media (L.) Vill.

Synonyms: None
Other common names: chickweed, nodding chickweed
Family: Caryophyllaceae

Description
Common chickweed is an annual or winter annual, mat-forming plant up to 12 inches tall. Stems are prostrate, rooting at the nodes, usually with a single line of hairs along each internode. Leaves are opposite, egg-shaped to elliptic, up to 1½ inch long; hairy. The lower leaves are stalked, but the upper leaves are stalkless. The small, white, star-shaped flowers have 5 petals that are so deeply cleft they appear as 10. The capsules are egg-shaped, straw colored and up to ¼ inches long. The capsule contains many tiny reddish brown seeds (Douglas and MacKinnon 1998, Hultén 1968, Sobey 1981, Whitson et al. 2000).

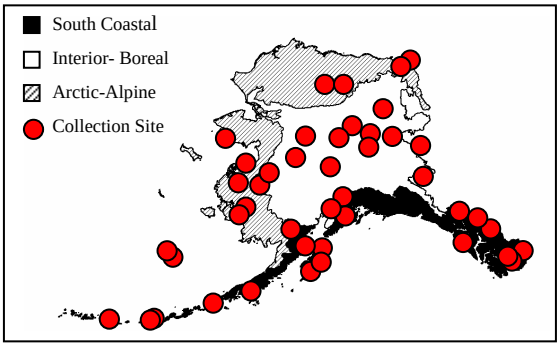
There are several native species of *Stellaria* in Alaska. Common chickweed is distinguished from other *Stellaria* species by having lower leaves with stalks and the line of hairs along the internodes. Exotic mouse-ear chickweed (*Cerastium fontanum*) is similar mat-forming weed, but it differs in being more or less hairy all over and its flowers have notched (not deeply cleft) petals (Douglas and MacKinnon 1998, Hultén 1968, Whitson et al. 2000).

Ecological Impact
Impact on community composition, structure, and interactions: Common chickweed is able to create dense mats of shoots up to 12 inches long, shading young seedlings of other plants (Turkington et al. 1980). The shoots and seeds of common chickweed are eaten by many animals and birds, both domesticated and wild. Many insect species feed on the plant (Batra 1979, Firbank and Smart 2002, Watson et al. 2003). A large number of nematode species have been reported to attack chickweed (Taylor 1967, Townshend and Davidson 1962, Murant 1970). This plant is also an important host for a number of viruses and fungal species. The flowers of common chickweed are usually self-pollinated, however, cross-pollinating by insects has been recorded. Common chickweed is reported to contain poisonous glycosides and high nitrate levels (Case 1957, Sobey 1981).
Impact on ecosystem process: The impact of common chickweed on ecosystem processes is unknown.

Biology and Invasive Potential
Reproductive potential: Common chickweed reproduces mainly by seeds. Seed output per plant can be from 600 to 15 000 (Lutman 2000, Stevens 1957, Stevens 1932). Vegetative reproduction by fragmentation of stems can also occur (Sobey 1981).
Role of disturbance in establishment: Common chickweed occurs and persists on disturbed lands with both continual or periodic soil disturbances. Chickweed is relatively quickly replaced by perennial plants if the disturbance ceases (Sobey 1981).
Potential for long-distance dispersal: Seeds can be transported by horses, cattle, deer, pigs, sparrows, quail, and gulls (Gillham 1956, Sobey and Kenworthy 1979). It is also known to be dispersed by ants and earthworms. Seeds are also capable of surviving immersion in sea water (Sobey 1981).
Potential to be spread by human activity: Seeds can be transported in mud and dust on boots, animal hooves and machinery. Seeds of chickweed also contaminate some commercial seeds, horticultural stock and topsoil (Hodkinson and Thompson 1997, Sobey 1981, Turkington et al. 1980).
Germination requirements: Germination of chickweed occurs throughout the year, with distinct peaks in spring and autumn. Optimum depth for germination is ¼ to ½ inches, with very few seeds germinating at depths greater than 1 inch (Sobey

1981). The optimum constant temperature for germination appears to be in the range from 54°F to 68°F. Inhibitory of germination occurs when the temperature exceeds 86°F. Alternation of temperature enhances germination (Roberts and Lockett 1975).
Growth requirements: Common chickweed is found in a wide variety of habitats and soil textures. Soil pH ranges from 4.8 to 7.3. It prefers soil with high level of nitrogen supply. Chickweed can readily tolerate very low temperatures, and can even flower and fruit under a snow cover at temperatures as low as -16°F (Lyre (1957) cited in Sobey 1981). Chickweed is notably sensitive to drought (Roberts and Dawkins 1967).
Congeneric weeds: A number of *Stellaria* species has been introduced into the United States, however none of them are listed as a noxious weed (USDA, NRCS. 2006).
Listing: Stellaria media is listed as a noxious weed in Alberta, Manitoba, and Quebec (Rice 2006).

Distribution and abundance
Native and current distribution: Chickweed is native to Europe. It has been spread throughout the world and became one of the most completely cosmopolitan species. It extends from the tropical regions of Africa, South America and Asia to Arctic and sub-Antarctic islands (Hultén 1968, Polunin 1957). In its native range common chickweed is a plant of coastal banks and cliffs, especially in and around the breeding colonies of sea-birds and seals. However, it is more often found on cultivated ground and waste places (Douglas and MacKinnon 1998, Sobey 1981, Welsh 1974, Whitson et al. 2000).



Management
Mechanical methods can manage chickweed effectively, but all plant fragments should be removed or deeply buried in the soil, since plant shoots have the ability to re-root, if partially covered by soil. Common chickweed can be controlled by a variety of chemicals; however, it is resistant to a number of commonly used herbicides. Strong perennials can be used to prevent chickweed reestablishment (Guide to weeds in British Columbia. 2002, Sobey 1981).

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Common tansy

Tanacetum vulgare L.

Synonyms: *Chrysanthemum uliginosum* Pers., *C. vulgare* (L.) Bernh., *Tanacetum vulgare* var. *crispum* DC
Other common name: garden tansy
Family: Asteraceae (Compositae)

Description
Common tansy is rhizomatous perennial 1½ to 6 feet tall. The stems are often purplish-red at the base. Leaves are alternate, 2 to 10 inches long and 1½ to 3 inches wide, deeply divided into numerous, toothed segments. The plant is gladular, giving it a strong odor. Stems have 20 to 200 yellow flower heads without ray florets. Each flower head is button-like, ¼ to ½ inches wide. Seeds are yellowish-brown without pappus or with a short 5-toothed crowns (Royer and Dickinson 1999, Whitson et al. 2000).

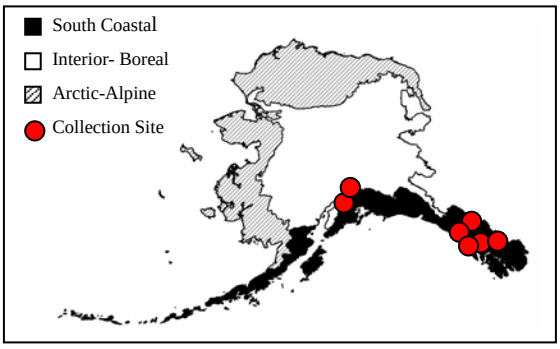
Common tansy resembles tansy ragwort (*Senecio jacobaea* L.), an introduced perennial from Europe. However, tansy ragwort has ray florets and seeds with pappus (Royer and Dickinson 1999).

Ecological Impact
Impact on community composition, structure, and interactions: Common tansy has been reported as unpalatable and somewhat poisonous to livestock. It is also an alternate host for viruses (Royer and Dickinson 1999).
Impact on ecosystem process: It can grow along irrigation ditches and streams, restricting water follow (CWMA 2004).

Biology and Invasive Potential
Reproductive potential: Tanacetum vulgare reproduces by both seed and rootstalks. Each plant is capable of producing over 50,000 seeds (Royer and Dickinson 1999, Whitson et al. 2000). It can spread quite aggressively by vegetative means (Plants for a future 2002).
Role of disturbance in establishment: It is generally restricted to disturbed sites. However it has been observed growing in undisturbed beach meadows in Haines, Alaska (M. Shephard – pers. com.).
Potential for long-distance dispersal: Plants lack a well developed pappus and therefore are unlikely to be wind dispersed.
Potential to be spread by human activity: Tansy has been used as an ornamental and medicinal remedy. It has escaped and become widely established. It is also potential seed contaminant (CWMA 2004, USDA, ARS 2004).
Germination requirements: It is known to germinate in vegetated areas (US Department of the Interior 2004).
Growth requirements: The plant is adapted to all soil textures; it requires well-drained moist soil. It is can grow on acidic, neutral and basic soils. It is not shade tolerant (Plants for a future 2002).
Congeneric weeds: *Tanacetum corymbosum* (L.) Schultz-Bip. and *Tanacetum parthenium* (L.) Schultz-Bip. (ITIS 2002)

Listing: Common tansy is listed as a noxious weed in Colorado, Minnesota, Montana, Washington, Wyoming, Alberta, British Columbia, and Manitoba (Invaders Database System 2003, USDA 2002).

Native and current distribution:
Common tansy is a native of Europe and Western Asia and has become established in the United States and Canada (USDA, ARS 2004). It has been reported from Interior-Boreal and South Coastal ecogeographic regions of Alaska (AK Weed Database 2004).
This plant is generally found along roadsides, waste areas, streambanks, and pastures (Whitson et al. 2000). However this species has been reported invading beach meadows in Haines, Alaska (M. Shephard –pers. com.).



Management
Tansy is aggressive weed and difficult to control (CWMA 2004, Plants for a future. 2002).

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Common dandelion

Taraxacum officinale G.H. Weber. Ex. Wiggers

Synonyms: None
Other common name: blowball, dandelion, faceclock
Family: Asteraceae (Compositae)

Description
Common dandelions are 2 to 20 inches tall. Leaves are 2 to 16 inches long, 1/2 to 4 inches broad, pinnately lobed to pinnatifid, with a large, rounded terminal lobe. Leaves are stalkless. The midrib of the leaf is often hollow and winged near the base. Yellow flower heads are composed of ray florets and rise from the basal leaves on hollow stalks. Heads are 1 to 2 inches across, and surrounded by 2 rows of floral bracts. The whole plant contains a white milky juice (Welsh 1974).

The genus *Taraxacum* is a taxonomically confusing group, due to asexual reproduction and local diversification. The genus has been subject to many divergent interpretations, with hundreds of specific names have been published.

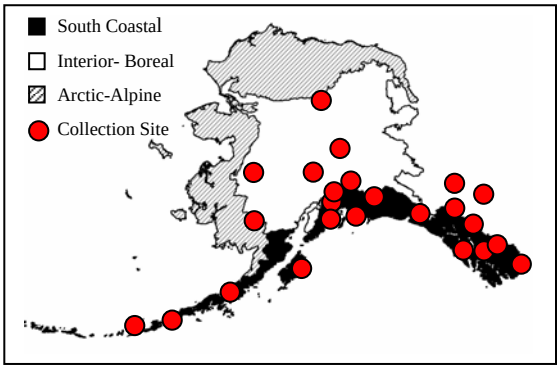
Current taxonomic treatments describe *T. officinale* as encompassing three subspecies, two introduced in Alaska (ssp. *officinale* and ssp. *vulgare*) and one native (ssp. *ceratophorum*) in the state (USDA Plants Database 2003). The non-native subspecies lack horns on the involucral bracts and have substantially larger heads than all native subspecies and species of Alaskan dandelions. The native species are found primarily in undisturbed herbaceous, especially alpine meadows.

Ecological Impact
Impact on community composition, structure, and interactions: Dandelion competes with native plants for moisture and nutrients. It is commonly eaten by moose, bears, sharp-tailed grouse, pocket gophers, deer, elk, and bighorn sheep. Sage grouse and deer populations benefit from increased production of dandelion (Esser 1993). This species is important source of nectar and pollen for bees in Alaska (Esser 1993). Its presence may therefore alter pollination ecologies of co-occurring plants. It is also an alternate host for number of viruses (Royer and Dickinson 1999).
Impact on ecosystem process: Dandelion is one of the earliest colonizers after disturbances and likely causes modest impacts in natural succession. It may achieve a peak in dominance within two to three years (Auchmoody and Walters 1988). In Alaska it often establishes in existing herbaceous layer, changing the density of the layer. It also can form a new herbaceous layer on nearly mineral soil along banks and roadsides.

Biology and Invasive Potential
Reproductive potential: Dandelion reproduces by seeds and by new shoots from the root crowns (Whitson et al. 2000). Each plant produces up to 5,000 seeds (Royer and Dickinson 1999). The species creates a long-lived seedbank (Pratt 1984). Seeds of dandelion were viable up to 5 years in soil samples from Montana (Bard 1952), and up to 9 years in experiments in Nebraska (Burnside et al. 1996).
Role of disturbance in establishment: Dandelion readily colonizes disturbances. It sprouts from the caudex after cutting (Staniforth and Scott 1991). It is

generally found on disturbed substrates in Alaska, but also establishes in meadows (M. Carlson – pers. obs.).
Potential for long-distance dispersal: Spreading pappus and light seed weight enable seeds travel a considerable distances by wind. In tall grass prairie communities in Iowa, achenes of dandelion were blown several hundred meters from the nearest source population (Platt 1975).
Potential to be spread by human activity: It is likely spreading by vehicles and horticultural materials (Hodkinson and Thompson 1997). It is a common contaminate in crop and forage seeds (Rutledge and McLendon 1996).
Germination requirements: Seeds must be in the top 1 inch of soil to germinate (Royer and Dickinson 1999). Litter and mulch inhibit germination. Germination is highest on burned sites (Esser 1993).
Growth requirements: Common dandelion is adapted to all type of soils with pH levels of 4.8 – 7.5. This species withstands temperatures to -38°F, and requires 100 frost-free days. It has relatively porous summer vegetation and does not require cold stratification for germination (USDA 2002).
Congeneric weeds: *Taraxacum scanicum* Dahlstedt (Hultén 1968).
Listing: Noxious weed in Alberta, Manitoba, Quebec, Saskatchewan (Invaders Database System 2003).

Distribution and abundance
Native and current distribution: Dandelion is of Eurasian origin but has become naturalized throughout the United States. It occurs in all 50 states and almost all Canadian provinces. Also it is introduced into southern Africa, South America, New Zealand, Australia, and India (Esser 1993, Hultén 1968). *Taraxacum officinale* has been reported from all three primary eco-regions of Alaska (Hultén 1968, ALA 2004). It invades meadows in Glacier Bay National Park and Preserve, and Nenana and Stikine Rivers bars (M. Shephard – pers. obs.). Dandelain colonizes burned areas in Kenai Peninsular (P. Spencer – pers. obs.).



Dandelion grows in moist sites, including lawns, meadows, pastures and overgrazed areas. It is also occurs along highway and railroad rights-of-ways, waste places, and old fields. It is a threat in montane forest and alpine zones of western Montana since it invades partially disturbed or undisturbed native communities. In Montana, dandelion competes with conifer seedlings (Esser 1993).

Management
Dandelion can be readily controlled with herbicides and spring burning. Hand pulling is generally ineffective as plants readily resprout from unextracted rootcrowns.

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Last Updated November 24, 2004

Alsike clover

Trifolium hybridum L.

Synonyms: *Trifolium elegans* Savi
Other common names: none
Family: Fabaceae (Leguminosae)

Description
Alsike clover is a perennial up to 6-20 inches tall with ascending to erect stem which is not rooting at the nodes. Leaves are palmately trifoliate, the leaflets obovate or ovate to elliptic. Heads are many flowered, and the flowers are pink to reddish or white (Welsh 1974).

This is the only white to pink-flowered clover in Alaska that has erect stems, not rooting at the nodes.

Ecological Impact
Impact on community composition, structure, and interactions: Alsike clover forms dominant stands, and may delay establishment of native species. It has a symbiotic relationship with nitrogen fixing cyanobacteria. It is highly palatable to grazing animals. This species serves as a host for multiple crop diseases.
Impact on ecosystem process: This species alters edaphic conditions due to nitrogen fixation (USDA 2002).

Biology and Invasive Potential
Reproductive potential: Alsike clover reproduces by seeds. It produces an abundance of seeds. Seeds are viable for greater than three years. No vegetative reproduction occurs.
Role of disturbance in establishment: In Alaska is observed only in disturbed sites (Densmore et al. 2001).
Potential for long-distance dispersal: Alsike clover has no innate adaptations for long-distance dispersal.
Potential to be spread by human activity: It is widely cultivated forage and cover crop. Additionally, it is seeded for erosion control.
Germination requirements: The seeds do not germinate until the seed coat is sufficiently broken down (by decay or abrasion) to admit water. It can germinate in vegetated areas.
Growth requirements: This clover is adapted to fine and medium textured soils with pH levels ranging between 6 and 7.5. It is shade intolerant. No cold-stratification is required for germination. It withstands temperatures to -38°F, and requires 110 frost-free days for successful reproduction (USDA 2002). This species has moderate summer porosity.
Congeneric weeds: *Trifolium arvense* L., *T. campestre* Schreb., *T. incarnatum* L., *T. repens* L. (USDA, NRCS 2006).
Listing: not listed in any state.

Distribution and Abundance
Alsike clover has been planted for lawns and revegetation on roadsides and other disturbed areas (Kubanis 1982). It has escaped from cultivation and established in disturbed sites in more temperate parts of Alaska and the Yukon Territory (Welsh 1974).
Native and current distribution: It is native to Europe, western Asia, and northern Africa. It has been introduced and naturalized throughout the temperate regions of both hemispheres (Hultén 1968). It is known from all American States, except for Texas (USDA 2002).

Management
Populations are widespread and dense along roadsides in Alaska. It would be virtually impossible to eradicate this species. The priority is to keep plant from establishing in new disturbed sites. Several herbicides can be used to control clover.

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Last Updated August 15, 2006

Red clover

Trifolium pratense L.

Synonyms: *Trifolium pratense* L. var. *frigidum* auct. non Gaudin, *T. pratense* L. var. *sativum* (P. Mill.) Schreb.
Other common names: None
Family: Fabaceae

Description
Red clover is a perennial herb from a taproot, up to three feet tall, with several erect or ascending stems. The whole plant is covered with soft hairs. Leaves are alternate, compound with three leaflets, lance-elliptic, ½ to 2½ inches long, often with V-shaped marks. Stipules persistent, conspicuously veined, up to one inch long. Inflorescence is a dense, globe-shaped head, 1 to 1½ inches wide. Flowers are pink, purple, or red. Pods are egg-shaped, one-two-seeded (Welsh 1974, Douglas et al. 1999).


Inflorescence and leaf of red clover. Tom Huette, USDA Forest Service.


Red clover along the road. Tom Huette, USDA Forest Service.

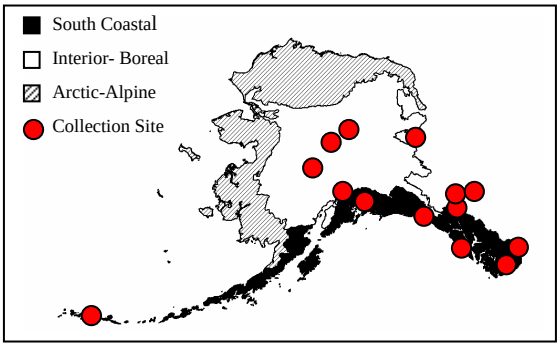
There are many other exotic clover species in Alaska. Pink to red flowers distinguish red clover from other clovers. White clover (*T. repens*) and alsike clover (*T. hybridum*) are similar but are generally more prostrate and have smaller leaflets and white to pinkish flowers (Hultén 1968).

Ecological Impact
Impact on community composition, structure, and interactions: Red clover is capable of creating very dense stands (Gettle et al. 1996a) and large biomass (Gettle et al. 1996b, Hofmann and Isselstein 2004), which influences the structure of the community. Red clover can also reduce the number of individual of grass species in the community (Gettle et al. 1996a). Moose and mule deer can graze on red clover. The leaves of red clover are also eaten by beaver, woodchuck, muskrat, meadow mice, and sharp-tailed grouse. Seeds are eaten by crow, horned lark, and ruffed and sharp-tailed grouse. Red clover is visited by bumblebees and sometimes by introduced honeybees (Graham 1941).
Impact on ecosystem process: Red clover increases soil nitrogen levels by fixing atmospheric nitrogen (USDA, NRCS 2006). The alteration of soil condition may delay establishment of native species (Rutledge and McLendon 1996) and facilitate colonization by other exotic plant species.

Biology and Invasive Potential
Reproductive potential: Red clover reproduces by seeds. It can produce a moderate amount of seeds (11 – 1,000) (Densomore et al. 2001).
Role of disturbance in establishment: If seeded, red clover can successfully establish in pastures (Gettle et al. 1996a, b). Soil disturbances, and cutting or grazing of competitive vegetation facilitate establishment (Guretzky et al. 2004, Hofmann and Isselstein 2004).
Potential for long-distance dispersal: Seeds of red clover are large and are not adapted to long distance dispersal.
Potential to be spread by human activity: Red clover is a forage crop. It is also recommended for erosion control. Seeds of red clover are commercially available. It has been planted for forage in Alaska (Panciera et al. 1990, Sparrow et al. 1993).

Germination requirements: Red clover can be seeded by drill or broadcast. For agricultural purposes seed should be inoculated. Seeds germinate in ¼ to ½ inch soil depth (USDA, NRCS 2006). Optimum temperature range for germination is from 59° to 68°F (Brar et al. 1991).
Growth requirements: Red clover is best adapted to medium and fine textured well-drained soils. It grows best on soils with pH 6.0 to 7.5. Red clover requires a minimum of 90 frost free days for successful growth and reproduction (USDA, NRCS 2006). Seedlings of red clover can withstand temperatures as low as 28°F. Some seedlings can survive temperatures as low as 17°F (Meyer and Badaruddin 2001).
Congeneric weeds: *Trifolium arvense* L., *T. campestre* Schreb., *T. incarnatum* L., *T. repens* L. (USDA, NRCS 2006).
Listing: Trifolium pratense is not considered invasive in North America (Rice 2006).

Distribution and abundance
Native and current distribution: Red clover is often planted as a forage crop, escapes and becomes established on roadsides, clearcuts, lawns, gardens and meadows (Rutledge and McLendon 1996, Welsh 1974). Red clover is native to southeastern Europe and Asia Minor. Today its distribution range includes Europe, southwest Asia, Africa, and North America (Hultén 1968). Red clover can be found throughout the United States and Canada (USDA, NRCS 2006).



Distribution of red clover in Alaska

Management
Red clover can be controlled by mechanical methods (Densmore et al. 2001). It is appear to be resistant to some chemicals (Rutledge and McLendon 1996).

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White clover

Trifolium repens L.

Synonyms: *Trifolium repens* L. var. *atropurpureum* hort.
Other common names: ladino clover, Dutch clover
Family: Fabaceae (Leguminosae)

Description
White clover is a perennial prostrate plant. The stems are up to 2 feet long, rooting at the nodes. Leaves are alternate, palmately trifoliate with ovate leaflets. Flowers white to pinkish white appear in terminal globe-shaped clusters. Seeds are round and very small (776,000/lbs) (USDA 2003, Welsh 1974).

This is the only decumbent white to pink-flowered clover in Alaska.

Ecological Impact
Impact on community composition, structure, and interactions: White clover rapidly invades vegetated and bare areas and became dominant (Thorhallsdottir 1990). Plant may delay establishment of native species. It is reported to be poisonous to cattle. It is an alternate host for alfalfa mosaic and pea mottle viruses (Royer and Dickinson 1999).
Impact on ecosystem process: White clover alters edaphic conditions due to nitrogen fixation (USDA 2002).

Biology and Invasive Potential
Reproductive potential: This species reproduced by seeds and creeping stems that root at nodes. White clover is mostly self-incompatible, and is cross pollinated by insects. It can produce large number of seeds. Some seeds retain viability after 30 years.
Role of disturbance in establishment: In Alaska it is found in sites disturbed in recent years (Densmore et al. 2001).
Potential for long-distance dispersal: Most seed is likely spread incidentally be the movement of animals and humans.
Potential to be spread by human activity: This species is seeded because of its ability to fix nitrogen and quickly stabilize soil.
Germination requirements: white clover can germinate without cold stratification at the temperature 50°F and above.
Growth requirements: White clover is adapted to fine and medium textured soils, pH levels of 6 – 7.5. It is shade intolerant. This species withstands temperatures to -39°F, and requires 150 frost-free days. This species has relatively porous summer vegetation (USDA 2002).
Congeneric weeds: *Trifolium arvense* L., *T. campestre* Schreb., *T. incarnatum* L., *T. repens* L. (USDA, NRCS 2006).
Listing: listed as a weed in Nebraska.

Distribution and Abundance
White clover was common as a forage crop in Canada prior to 1749 (Royer and Dickinson 1999). Now it is a weed of waste areas, lawns, and ditches. White clover is found throughout Canada and the United States and is often found north of the Arctic Circle. It also occurs in the moist meadows in the yellow pine and spruce fir ranges in Arizona (Parker 1990).
Native and current distribution: White clover is native to Europe and Asia. It has been introduced to north and southern Africa, North and South America, New Zealand, Australia, Tasmania, and India (Hultén 1968).

Management
Populations are widespread and relatively dense. Eradication would be very difficult for this species. The priority is to keep plant from establishing in new disturbed sites. Several herbicides can be used to control white clover.

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