Invasive Plant Management in Glacier Bay National Park and Preserve
Gustavus, Alaska
Summer 2005 Field Season Report

Figure 1 – A coastal meadow in the Beardslee Islands with native Nootka lupine (*Lupinus nootkatensis*) and painbrush (*Castilleja* sp.) invaded by dandelions (*Taraxacum officinale* ssp. *officinale*).

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Abstract

For the second 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 201 ha (497 acres) of the park and adjoining lands that were inventoried, twelve new species were documented bringing the total count of non-native plant species observed to 37. The most widespread species is common dandelion (*Taraxacum officinale* ssp. *officinale*), which has invaded coastal meadows and anthropogenically disturbed areas parkwide. Bartlett Cove has the greatest number of non-native species present. In the backcountry of Glacier Bay proper, mouse-ear chickweed (*Cerastium fontanum*), oxeye dasiy (*Leucanthemum vulgare*), American red raspberry (*Rubus idaeus*), perennial sowthistle (*Sonchus arvensis*), and common dandelion (*Taraxacum officinale* ssp. *officinale*) have been detected. Dry Bay's greatest threat is bigleaf lupine (*Lupinus polyphyllus*), which is successfully outcompeting other species in both open meadows and shaded understory areas. Throughout the season, control efforts removed approximately 1500 kg (3300 lb) of non-native plants. In subsequent years, inventory work should be repeated 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 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 problem, but research and active management must begin now (Spencer 2001).

Glacier Bay National Park and Preserve (GLBA) is unique among Alaska NPS units with respect to exotic plants for several reasons. Two factors make it vulnerable to invasion: GLBA protects a large land area in the most temperate region of the state, and 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.

The purpose of surveys in GLBA during the 2005 field season was 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, new areas of the park were examined to broaden the knowledge of the invasive plant concerns within the park. Information on the status and number of exotic plant species in GLBA will be used to help prioritize areas in the park and state for long-term monitoring and control of these species on Alaska NPS lands.

Methods and Materials

Fieldwork at Glacier Bay National Park and Preserve occurred from May through September 2005 following the protocol written by the Alaska Regional Office. Areas inventoried included parts of Bartlett Cove; most of the established ORV trails in Dry Bay; and selected areas of the Glacier Bay backcountry, including parts of the Beardslee Islands, Berg Bay, Fingers Bay, mid-bay islands, the West Arm, and Dundas Bay. Effort focused on areas most likely affected by human activity or susceptible to colonization by non-native species based on land topography. While on site, digital photos were taken opportunistically. Where feasible and strategic, infestations were controlled through hand pulling.

For the second year, Trimble GeoXT GPS units were used for all data collection during inventory and control events. Equipped with a standardized data dictionary (Table 1) used by the Exotic Plant Management Team for all parks in the Alaska Region, the GeoXT can achieve submeter accuracy and ensure data integrity. Areas with and without non-native species were inventoried in sufficient detail to allow annual 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 (nationwide NPS database for exotic plant data) and AKEPIC (a collaborative, multi-agency web-based database for tracking Alaskan exotic plants).

Table 1 - Fields used in GPS data dictionary and GIS shapefile for invasive plant surveys, summer 2005.

LocationID	Location ID (GLBA = bartlett_cove, beardslees, dry_bay, east_arm, gustavus, main bay. or west_arm; SITK = other)
Dstrbncs	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)
LctnDscrpt	Location Description
BufferM	Buffer distance (in meters) to convert points and lines to polygons
Taxon	Dominant exotic species
Phenology	Phenology of dominant exotic species (rosette, no_flower, full_flower, in_seed, stand_dead, or none)
CvrClssPer	Cover class percentage of dominant exotic species (0, 1, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, 95, 100)
Action	Inventory, Monitor, Treatment, or Retreatment
Treatment	Treatment type (none, Pull/Dig-Manual, Cut, Basal Bark, Basal- thinline, other)
CntrlEffrt	Projected/actual control effort (low <1 hour, medium 1-8 hours, high >8 hours)
Undetermined	Stem count of dominant exotic species
Remarks	Remarks
StartDate	Date of site visit
StartTime	Time of site visit
AssocPark	Associated park (GLBA or SITK)
Recorder	Recorder (WSR = Whitney Rapp)
Taxon2, Taxon3…	Additional 4 fields for 4 other exotic taxa for each unique site including fields for Phenology, Cover Class Percentage, and Stem Count
Spatial Accuracy Fields	Range of attributes to describe spatial information and precision
Acres	GIS-calculated acreage of each infested or uninfested area

The data collected using the GPS was differentially corrected using the closest base station (Gustavus, AK) and edited in GPS Pathfinder Office (Trimble, version 3.00). The corrected files were exported as shapefiles for use in ArcGIS (ESRI, version 9) by EPMT personnel at the Alaska Regional Office.

Results

During the 2005 field season, approximately 201 ha (497 acres) were surveyed with the focus of the effort on areas frequented by people both currently and historically, the coastline, and areas previously not surveyed. Survey work during 2005 added significantly greater resolution to data on distribution and abundance of the known non-native species.

Inventory work in 2005 resulted in the documentation of 12 new non-native species within and near GLBA (Appendix A). An additional six species were located that had previously been documented in or near the park with herbarium specimens, but had not been found during previous non-native plant surveys. This brings the total count of non-native plant species to 37. The newly identified and located species include wild chive (*Allium schoenoprasm*), orchardgrass (*Dactylis glomerata*), orange hawkweed (*Hieracium aurantiacum*), hairy cat's ear (*Hypochaeris radicata*), tall buttercup (*Ranunculus acris*), creeping buttercup (*Ranunculus repens*), curly dock (*Rumex crispus*), perennial sowthistle (*Sonchus arvensis*), European mountain ash (*Sorbus aucuparis*), common comfrey (*Symphytum officinale*), alsike clover (*Trifolium hybridum*), and an unidentified mint family member (Lamiaceae). The species located this year that were previously collected for herbarium specimens include shepherd's purse (*Capsella bursa-pastoris*), foxtail barley (*Hordeum jubatum*), pineapple weed (*Matricaria discoidea*), marsh forget-me-knot (*Myosotis palustris*), American red raspberry (*Rubus ideaus*), sheep sorrel (*Rumex acetosella*), and chickweed (*Stellaria media*). Non-native species previously identified within GLBA that were not relocated in 2005 include *Achillea millefolium, Alopecurus pratensis, Linaria vulgaris, Lychnis chalcedonica,* and *Poa palustris*. Appendix B shows the locations of many of the non-native species observed during 2005. 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.

Control efforts of non-native species were focused primarily in Bartlett Cove 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 the Glacier Bay Lodge in Bartlett Cove. 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 with help from the SAGA (Southeast Alaska Guidance Association) crew in July. The SAGA crew also assisted in removing the only known population of tall buttercup. The single specimen of hairy cat's ear within the park was removed in July. During August and September, common timothy (*Phleum pratense*) was removed from roadside locations in much of Bartlett Cove. Other species that were controlled opportunistically in Bartlett Cove include creeping buttercup, common plantain, white clover, red clover, alsike clover, and mouse-ear chickweed. Perennial sowthistle flower heads were removed from Strawberry Island in August; however, the remainder of the plants were left intact. Another population of this species located in Gustavus was partially controlled in September. Throughout the field season, approximately 1500 kg (3300 lb) of non-native plants were removed.

Figure 2 – Survey work in Dundas Bay revealed no non-native plant species.

Discussion

With the identification of 12 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. There are several other specimens, primarily grasses, that have been sent to Alaska Natural Heritage Program for positive identification and could increase the number of non-native species detected in 2005.

Achillea millefolium

Specimens of both common yarrow (*Achillea millefolium*) and boreal yarrow (*A. borealis*) have been identified in the GLBA herbarium. *A. borealis* is generally considered native to Alaska and *A. millefolium* may be either native or introduced. In correspondance with Debra Trock, the author of the *Achillea* section of the *Flora of North America*, *A. borealis* is no longer recognized as a species or as a variety of *A. millefolium*. In addition, there are no definitive morphological characteristics for determining nativity. Genetically, it is difficult to determine nativity as well. Work by Ron Tyrl of Oklahoma State University determined that *A. millefolium* is a cosmopolitan polyploid complex of both native and introduced plants that have hybridized, producing tetraploid, hexaploid, octaploid and pentaploid populations (Trock pers comm. 2005). Based on these factors, all yarrow found in the park with the typical white to pale pink flowers will be treated as native unless additional information suggests otherwise.

Allium schoenoprasum

An *Allium* species that keys out to be wild chives (*A. schoenoprasum*) was found growing in several places in Dry Bay; however, the plants were beyond flowering so positive identification is uncertain. This species is listed as non-native by some sources (ITIS.usda.gov, Plants.usda.gov) and native by other sources (Klinkenberg 2004, Hultén 1968). Further work is needed to verify the taxonomy and nativity of this species to determine whether it should be a species of management concern.

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.

Bromus inermis

Smooth brome is growing 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 known as an invader of wetland habitats in the lower 48 states.

Figure 3 – *Cerastium fontanum* growing thickly near the Visitor Information Station (VIS) in Bartlett Cove.

Capsella bursa-pastoris

Common in disturbed areas of Gustavus including near the airport, shepherd's purse has been found growing only 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. All plants were removed in September; however, some plants had already dropped seeds.

Cerastium fontanum

Mouse-ear chickweed is common in Bartlett Cove and Gustavus growing along roadsides and in disturbed areas. The species is present in scattered locations in Dry Bay. A population of *C. fontanum* was also found on Young Island in the Beardslee Islands. The population in the Beardslees should be controlled since this is the only

known location in the backcountry. Other populations of the species should be controlled as time permits.

Dactylis glomerata

Orchardgrass has been found growing scattered along the roads in Bartlett Cove and in Gustavus. At this point, it is growing in a low enough density that it could be targeted for complete removal in 2006.

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. Effort in 2006 should be made to locate and eliminate this species since it can become very aggressive.

Figure 4 – Jenni Burr and Erica Madison volunteered to help remove *Cerastium fontanum* from near the VIS.

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, and South Sandy Cove, it does not appear to be an invasive threat. Continued monitoring of the species is warranted.

Hypochaeris radicata

A single specimen of hairy cat's ear was removed from the Bartlett River trailhead. No other individuals of this species have been observed in the park or in Gustavus.

Figure 5 – *Leucanthemum vulgare* growing in a field in Dry Bay.

Leucanthemum vulgare

Ox-eye daisies have proven very successful at growing in the vicinity of GLBA. As a result, this species was targeted for removal in 2005. All known populations of *L. vulgare* were removed in Bartlett Cove. A single population of daisies growing in a Dryas (*Dryas drummondii*) mat at a popular camping area in Reid Inlet was controlled. Some of the populations of daisies in Dry Bay were controlled; however, additional effort before mid-July is needed in subsequent years, particularly around the Hazen's house. In general, areas surrounding flowering daisy populations have abundant seedlings, which are often cryptic due to their low-growing rosette of leaves. Due to these seedlings, all areas where daisies were controlled in 2005 will need to be revisited in 2006 and subsequent years to remove any persistent plants. Ox-eye daisies are very prevalent in Gustavus, and landowners are very fond of the flowers. Outreach efforts will need to continue to educate Gustavus residents that the species poses a risk to the native flora. Shasta daisies, which are also non-native but less invasive, may provide a suitable alternative. Additionally, the native arctic daisy (*Dendranthema arcticum*) was transplanted to two gardens in Gustavus in 2005 to see how it performs in cultivation.

Figure 6 – Monica Rectenwald triumphant that a population of daisies in Dry Bay have been removed.

Linaria vulgaris

Butter and eggs is common in some areas of Gustavus; however, 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.

Lolium perenne ssp. *perenne/multiflorum*

Both *Lolium perenne* ssp. *perenne* and *L perenne* ssp..*multiflorum* (perennial ryegrass) have been identified growing along the recently paved roadsides in Bartlett Cove. Both subspecies were seeded as part of the revegetation process after the road construction. Although these plants were intended to be short-lived, there recurrence after more than three years suggests that they may be reseeding. Continued monitoring of these species is necessary.

Lupinus polyphyllus

Figure 7 – In addition to invading open meadows, *Lupinus polyphyllus* appears to spread vegetatively in the shaded understory of Dry Bay's forests.

Large-leaved lupine is native to the Pacific Northwest; however, most sources consider the species introduced to Alaska (Hultén 1968). In Gustavus, a pink-flowered cultivar is commonly planted; however, 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. The species is occupying both open meadow and shaded understory habitats in very dense colonies that are excluding native species. It appears that most of the plants are spreading vegetatively by rhizomes since only a fraction of the population was flowering. Most of the areas already occupied by *L. polyphyllus* are relatively free from human disturbance and are responding to natural disturbance resulting from successional processes, which further makes this species a threat to the native ecosystem. It is difficult to know when the species was introduced to Dry Bay. It is absent from the GLBA herbarium; however, Greg Dudgeon, a former ranger in Dry Bay, can remember the species as being prevalent as early as 1990. 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.

Lychnis chalcedonica

Maltesecross is an escaped ornamental species that was observed in Gustavus during the 2004 inventory. It was not relocated in 2005 during surveys; however, it was included in several of the 4th of July flower arrangements from Gustavus residents. Future inventories should continue to look for this species.

Matricaria discoidea

Pineappleweed 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.

Myosotis palustris

No species of forget-me-nots are native to Southeast Alaska; however, since they are the state flower, they have been planted widely, including this year in planter boxes at the Glacier Bay Lodge. They have escaped cultivation around the Glacier Bay Lodge and in Gustavus and are thriving in moist areas, including drainage ditches. It is possible that multiple *Myosotis* species are present. Efforts should be made to remove the plants in June of 2006 before seed is set. In addition, Glacier Bay Lodge should be encouraged to plant native species or annual species with minimal threat of reseeding and not to sell Alaska wildflower mixes, which often include invasive species.

Figure 8 – 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.

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. With the potential of the grass being native, removal does 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). Since reed canarygrass has never been seen in GLBA outside of Gustavus/Bartlett Cove, it is most likely a result of human introduction.

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 their subsequent difficulty in removal. Reed canarygrass is the highest ranked species (83, Appendix A) according to its threat to the native ecosystem currently present in GLBA. 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 dug out with the aid of the SAGA crew, yielding approximately 725 kg (1600 lbs). Regrowth is likely over subsequent years, so these areas need to be retreated annually. A stand of a variegated cultivar is growing beside Andy Varni's home in Dry Bay (Fig. 8). This stand is bounded by the home and a walkway and does not appear to be spreading as vigorously as the non-variegated forms.

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, all the located plants on the south side of the main road and some of the plants on the north side of the road were removed. Time did not permit the removal of additional plants. In the backcountry, there are reports of the species being seen; however, all specimens observed in 2005 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.

Plantago major

Common plantain is growing 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. As a result, this species' presence should continue to be inventoried and plants should be controlled as time permits; however, it should not be made a top management priority.

Poa palustris

A single herbarium specimen of fowl bluegrass was collected from Drake Island; however, 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.

Ranunculus acris

Tall buttercup was found growing in a dense stand between the Bartlett Cove fuel and pulic use docks near the former location of the kayak racks. The plants were dug out; however, they were already dropping seed. In addition, it is difficult to distinguish the seedlings of *R. acris* from the native *R. uncinatus*. For these reasons, this site will need to be resurveyed and treated before early July 2006.

Ranunculus repens

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 and near the depot. Like *R. acris*, it is difficult to distinguish seedlings of *R. repens* from the native buttercup. 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, investing the resources in trying to control the relatively small populations of this species early is warranted.

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.

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 these populations in 2006.

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.

Sonchus arvensis

Perennial sowthistle is well established 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 were found in the herbaceous areas between the forest and the shoreline. The larger population appears bound by physical conditions of hydric soils, the intertidal, and the shaded forest margin that prevent continued vegetative expansion. The smaller, more eastern population appears to have room for continued expansion. In addition, this species could spread by seed to start new populations elsewhere. In 2005, all the flower heads were removed from the plants; however, time and personnel were not available to fully control the plants. A population of *S. arvensis* has also established along the roadside across from the Gustavus Inn in Gustavus. All the flowering plants and about half of the non-flowering plants were removed in September 2005. Due to the restricted extent of this species and its ability to form dense colonies, it is recommended that this species be targeted for removal in 2006.

Sorbus aucuparia

European mountain ash trees have been planted by landowners around Gustavus. The proliferous 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 (Table 2).

Table 2 – Comparison of traits of native and non-native mountain ash species (Klinkenberg 2004, Hultén 1968).

	Sorbus aucuparia **(non-native)**	***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

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, continued monitoring is recommended.

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 is still within the bounds where it was planted; however, both of the other populations have spread by seed to form new populations. Since this species is successfully reproducing and spreading, it should be removed at least in Bartlett Cove and Gustavus where the original plantings have been abandoned.

Figure 9 – Due to glacial rebound, Glacier Bay has extensive coastal meadows that are being created as the land rises from the bay. These meadows are widely invaded by *Taraxacum officinale* ssp. *officinale*.

Tanacetum vulgare

Tansy is another species often planted for its easy-care, ornamental nature; 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 this summer. Future inventory work should determine whether the species is spreading into the park.

Taraxacum officinale ssp. *officinale*

In 1935, William S. Cooper collected *Taraxacum officinale* from the Bartlett Cove area (Cooper 1939). Today, it is common to see dandelions in open, non-wetland areas in the herbaceous area above the intertidal within most parts of Glacier Bay proper. Their distribution is still patchy near the glaciers; however, they have the ability to succeed in very young soils previously colonized only by native, early successional species. In Dry Bay, dandelions are present, but their densities are much lower than in Glacier Bay proper. Survey work in Dundas Bay resulted in finding no invasive species, including dandelions. Observations made by Sean and Janet Neilson 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 observed. Arresting the spread of this species will be extremely labor and time intensive based on the widespread distribution of the species and its ability to disperse seeds long distances by wind and animals. For example, South Marble Island in the middle of Glacier Bay proper was glowing yellow from dandelion flowers in early spring, and this island is not visited by humans and is 2.6 km (1.6 miles) from the next closest island.

Figures 10 & 11 – Before and after images of the flagpole area near the VIS showing how the removal of dandelions affects the view.

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 have differences in the involucral bracts. The invasive species has long, smooth, bright green involucral bracts that curl downward away from the flower. In contrast, the native species will have involucral bracts that may be dark colored, widely triangular, clasping the flower, or have bumps on them. 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 understading the effects.

Trifolium hybridum and *T. pratense*

Both alsike and red clover have patchy distributions throughout Bartlett Cove and Gustavus. The plants are easily removed, so all known plants in Bartlett Cove in 2005 were controlled. In Dry Bay, a single red clover specimen was found in the garden of Brad Swanson. 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. In 2006, all plants in Bartlett Cove should be removed, and Brad Swanson should be contacted again.

Figure 12 – The only known clover in Dry Bay is growing in Brad Swanson's garden.

Trifolium repens

Since the recent paving (2001-2002), revegetation (through 2004), and erosion control (through 2005) work on the road to Bartlett Cove, white clover has become well established along the length of the disturbed area. White clover is 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. Although it is difficult to remove, its distribution is still at a point that control efforts are warranted, so this should be a priority species in 2006.

Triticum aestivum

Figure 13 – White clover with interspersed dandelions forms a dense mat that becomes very difficult to remove since it forms roots at the branch nodes.

Wheat hybrids are growing along most of the roadways in Bartlett Cove from seed used during the revegetation 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. At least some of the seeds have proven fertile since viable seed has been produced in 2004 and 2005. Many of these seeds have germinated while still in the seed head in September to October in both years and may be

perpetuating the species. A control area (~ 50 m long) along the north side of the road between two large boulders near the permanent housing driveway was cleared of all flower heads to determine whether this would affect the density of the wheat in 2006. Both wheat hybrids are supposed to be annuals to short-lived perennials and should be dying naturally since at least two seasons have passed. Depending on the density of the wheat in 2006, the plants should be cut low to the ground before early July 2006. A second cutting may be needed in late August since the plants have shown that they can send up a second group of flower heads.

Unidentified Lamiaceae

An unidentified species in the mint family was removed from near the Glacier Bay Lodge. A specimen will be identified by the Alaska Natural Heritage Program. 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 species should be surveyed for again in 2006 since the plant was in seed when removed. The Glacier Bay Lodge should be encouraged to plant native species and annual species with minimal risk of reproducing in Alaska.

Outreach/Education

In 2005, several outreach/education programs were conducted in the park and the community. In May, the Resource Management division presented programs to the kayak guide companies and other interested residents. At this program, I introduced the park's new Invasive Plants Program and the list of non-native species, provided handouts, and informed the guides how they could help inventory and prevent the spread of species by keeping their gear and boots clean. Before the school year ended, program volunteer Susan Tran led a program with the elementary school about the threat of non-native plants. On July 4th, an invasive, exotic flower arranging contest was sponsored at Gustavus' celebration that brought in over 25 entries. In addition to the arrangements, people could pick up invasive species literature or talk to me about the issues Gustavus and

Figure 14 – Whitney Rapp showing a few of the arrangements brought for judging at the Gustavus 4th of July Invasive, Exotic Flower Arranging Contest.

GLBA face. On July 13, Susan Tran led a native species celebration potluck with Gustavus children following Story Hour at the Gustavus Library, which included crafts, face painting, and conversations – all centered on the theme of native plant values and threats by invasive exotics. A community weed pulling event was sponsored on July 16 near the VIS. I led plant walks and discussions with the SAGA crew in July and Hoonah City Schools in August. All GLBA employees received informative emails periodically throughout the summer updating them on the program's progress and species of concern.

In 2006, a 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. A follow-up contest at the 4th of July will be 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 control species, collect native plant seeds, or otherwise assist the program is also important.

Other Thoughts

Although GLBA and Gustavus are geographically isolated, they are not immune to invasion by non-native species. To date, 37 non-native species have been identified within GLBA and Gustavus; however, many more species in nearby communities have not yet been observed. Resources, both time and people, to continue to inventory and control invasive species must be made available consistently for the long term to maintain the unique assemblage of native species and preserve the vast wilderness that we are entrusted to preserve in its natural condition.

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, and follow through with subsequent control of non-native species. A nursery area and seed bank should be created to facilitate revegetating areas.

In addition to the species documented in this report, there are several additional cultivated vegetable and flower species, including rhubarb, 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 display invasive tendencies; however, a long term plan should be in place to remove these plants if the residencies become abandoned.

Recommended Plans for 2006 Field Season

Prevention and proactive removal will save time and money in the future with regards to invasive plant management. Maintaining trained personnel to lead the program is essential. For control events, recruiting volunteers will ensure rapid removal.

Priority Species for Treatment in 2006:

Capsella bursa-pastoris
Cerastium fontanum on Young Island
Dactylis glomerata
Hypochaeris radicata
Leucanthemum vulgaris
Myosotis spp.
Phalaris arundinacea
Phleum pratense
Ranunculus acris
Ranunculus repens
Rumex acetosella
Sonchus arvensis
Symphytum officinale
Trifolium hybridum
Trifolium pratense
Trifolium repens

April

- Provide educational program to interpretive rangers during their training.
- Plan for the 2006 field season, including ensuring adequate field assistants will be available.

May

- Provide educational program to maintenance employees working outside and interested community members.
- Survey for *Taraxacum officinale* ssp. *officinale* when they are in peak bloom. Recruit volunteer crews to remove plants from most frequented areas near Lodge and Visitor Information Station.
- Encourage Glacier Bay Lodge to plant native species or minimal threat annual species around lodge.
- Plan and deliver a program for the Gustavus School before the school year ends.
- Ongoing data processing.

June

- Continue inventorying and controlling all non-native species.
- Continue inventorying park to determine distribution of non-native species.
- Remove *Myosotis* plants near lodge.
- Ongoing data processing.

July

- Continue inventorying and controlling all non-native species.
- Sponsor 4th of July contest at Gustavus celebration.

- Retreat *Ranunculus acris* near outer dock before middle of the month.
- Retreat *Phalaris arundinacea* throughout Bartlett Cove.
- Control *Ranunculus repens* throughout Bartlett Cove.
- Retreat and locate new populations of *Leucanthemum vulgare.*
- Go to Dry Bay before the middle of the month for inventory and control work.
- Ongoing data processing.

August

- Control *Phleum pratense* and *Dactylis glomerata*, particularly along the road.
- Continue inventorying and controlling all non-native species.
- Ongoing data processing.

September

- Continue inventorying and controlling all species.
- 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 the regional level, Jeff Heys and Penny Bauder have answered questions, processed data, and assisted in multiple other ways. For funding my position, I would like to thank the Alaska Region Exotic Plant Management Team, the Southeast Alaskan Coastal Cluster, and Glacier Bay National Park and Preserve. The GLBA maintenance division has lent me tools, allowed the SAGA crew to work with me, 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 SAGA crew, Susan Boudreau, Wendy Bredow, Jenni Burr, Miriam Fisher, Chris Gabriele, Bonnie Harris, Sarah Keefer, Lynda Lancaster, Linda Lieberman, Bob and Ellie McCreery, Erica Madison, Monica Rectenwald, Rose Salazar, Lewis Sharman, Justin Smith, Susan Tran, and Kaina Young. Without these volunteers, 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]	AK Weeds Ranking[b]
yarrow	*Achillea millefolium* **	1	48
wild chives	*Allium schoenoprasum* *, **	3	not ranked
meadow foxtail	*Alopecurus pratensis*	1	not ranked
smooth brome	*Bromus inermis*	1, 2, 3	62
shepherd's purse	*Capsella bursa-pastoris*	1, 3	not ranked
mouse-ear chickweed	*Cerastium fontanum*	1, 2, 3	not ranked
orchardgrass	*Dactylis glomerata*	3	not ranked
orange hawkweed	*Hieracium aurantiacum*	3	71
foxtail barley	*Hordeum jubatum* **	1, 3	63
hairy cat's ear	*Hypochaeris radicata*	3	not ranked
oxeye daisy	*Leucanthemum vulgare*	2, 3	61
butter and eggs	*Linaria vulgaris*	1	63
perennial ryegrass	*Lolium perenne* ssp. *perenne/multiflorum*	1, 2, 3	41
bigleaf lupine	*Lupinus polyphyllus* **	2, 3	53
maltesecross	*Lychnis chalcedonica*	2	not ranked
pineappleweed	*Matricaria discoidea*	1, 3	34
marsh forget-me-not	*Myosotis palustris*	1, 3	not ranked
reed canarygrass	*Phalaris arundinacea*	1, 2, 3	83
common timothy	*Phleum pratense*	1, 2, 3	56
common plantain	*Plantago major*	2, 3	44
fowl bluegrass	*Poa palustris*	1	not ranked
tall buttercup	*Ranunculus acris*	3	54
creeping buttercup	*Ranunculus repens*	3	54
American red raspberry	*Rubus idaeus* **	1, 3	not ranked
sheep sorrel	*Rumex acetosella*	1, 3	not ranked
curly dock	*Rumex crispus*	3	not ranked
perennial sowthistle	*Sonchus arvensis*	3	59
European mountain ash	*Sorbus aucuparia*	3	53
chickweed	*Stellaria media*	1, 3	not ranked
common comfrey	*Symphytum officinale*	3	not ranked
common tansy	*Tanacetum vulgare*	2, 3	57
common dandelion	*Taraxacum officinale* ssp. *officinale*	1, 2, 3	62
alsike clover	*Trifolium hybridum*	3	57
red clover	*Trifolium pratense*	1, 2, 3	not ranked
white clover	*Trifolium repens*	1, 2, 3	59
common wheat	*Triticum aestivum*	2, 3	not ranked
	Unidentified Lamiaceae *	3	not ranked

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

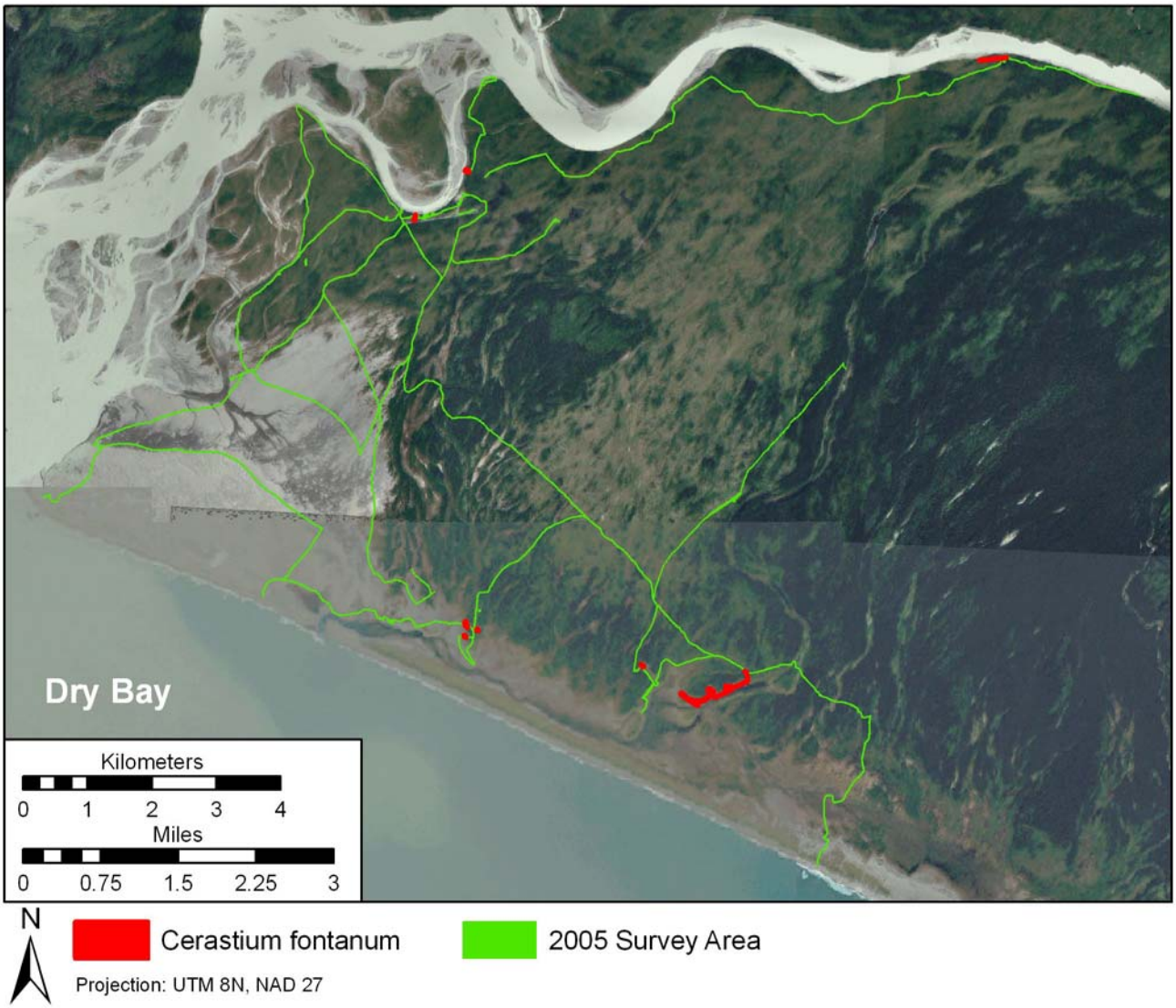
[b] - Ranking according to threat to native ecosystems in Alaska from low (0) to high (100) (http://akweeds.uaa.alaska.edu/akweeds_ranking_geo.htm).

* Species identification requires verification

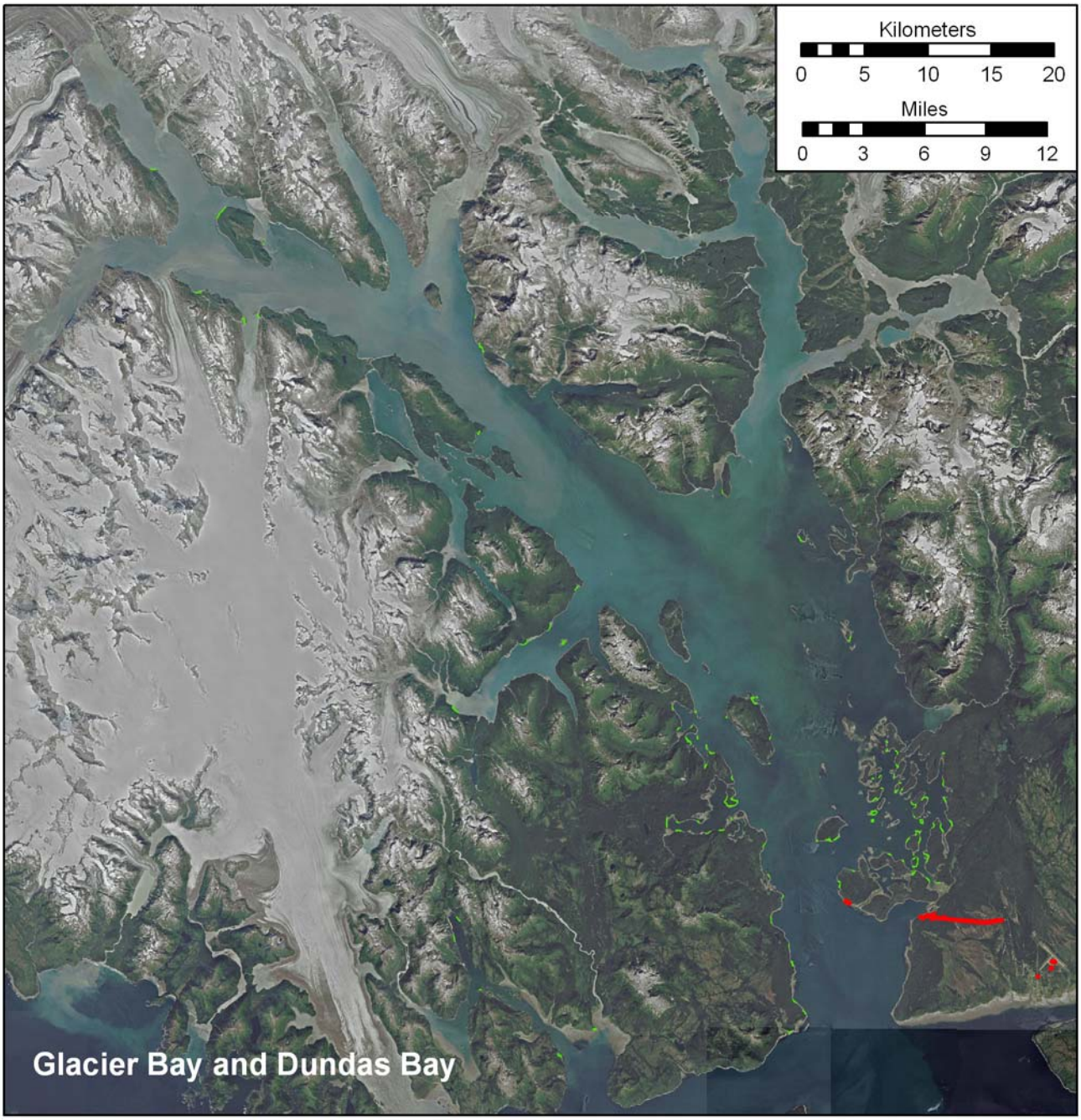
** Species nativity in question for this location

Appendix B – 2005 location maps of selected invasive plants in GLBA 2005

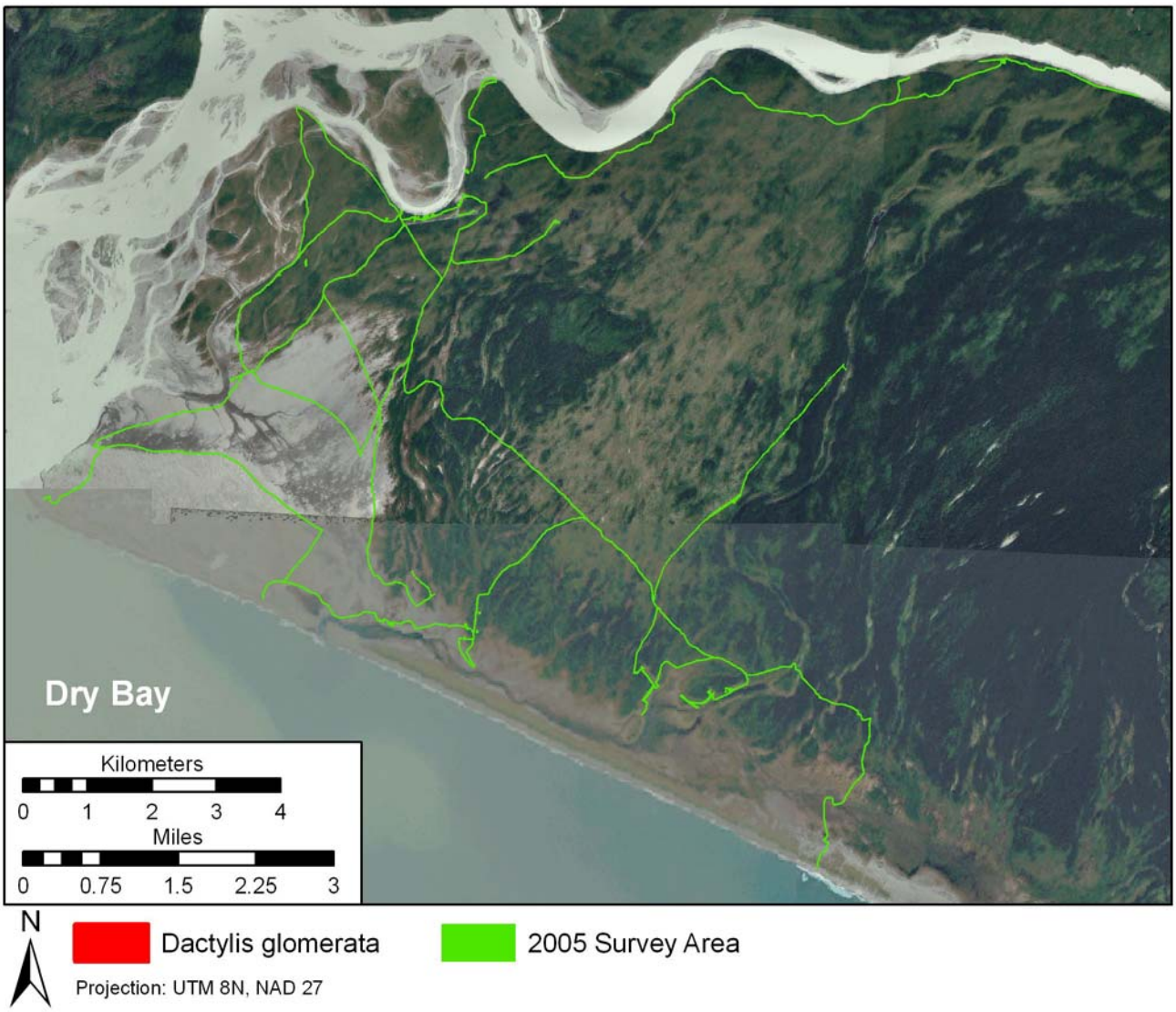
Cerastium fontanum distribution in Dry Bay in 2005



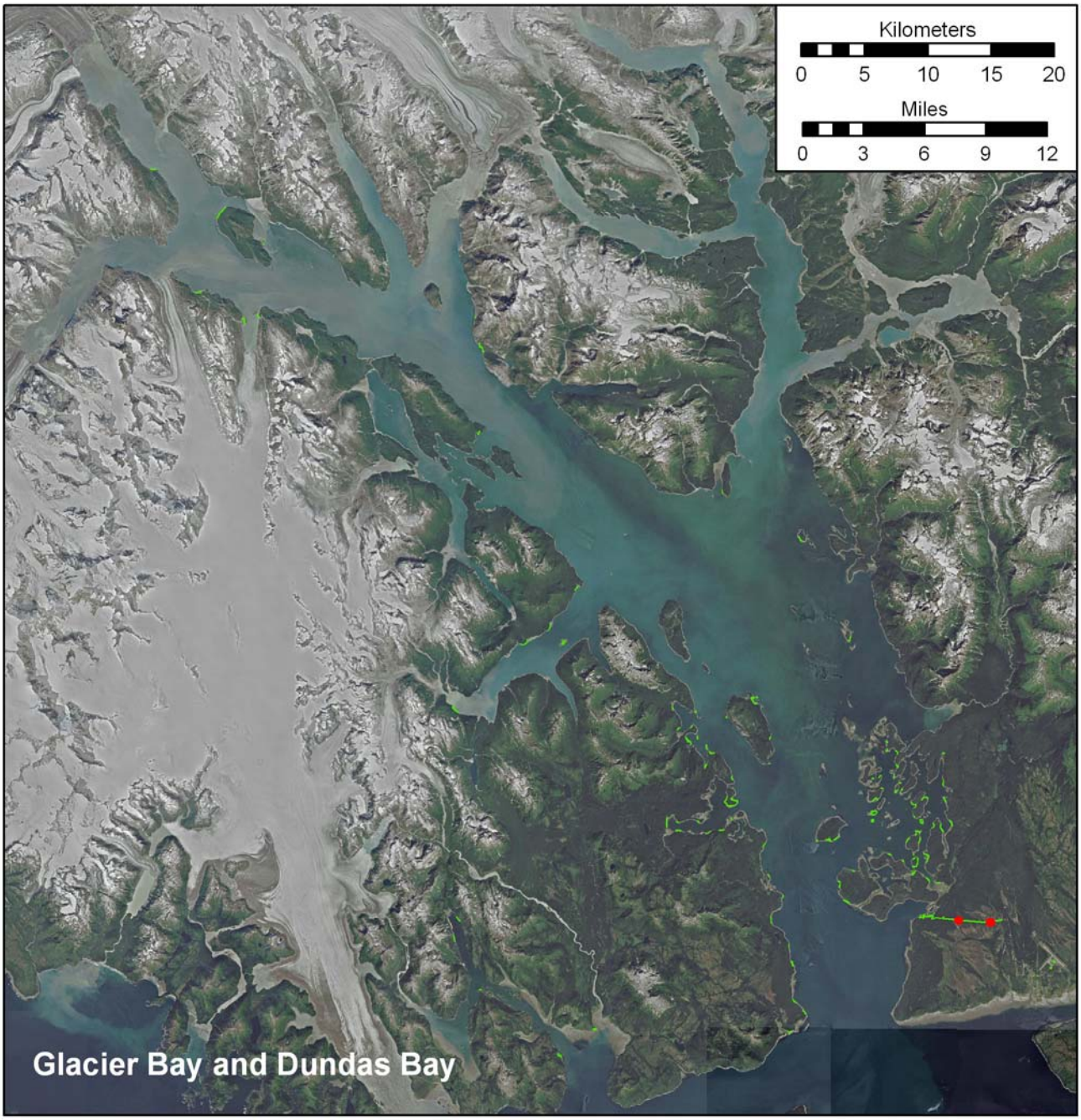
Cerastium fontanum distribution in Glacier Bay in 2005



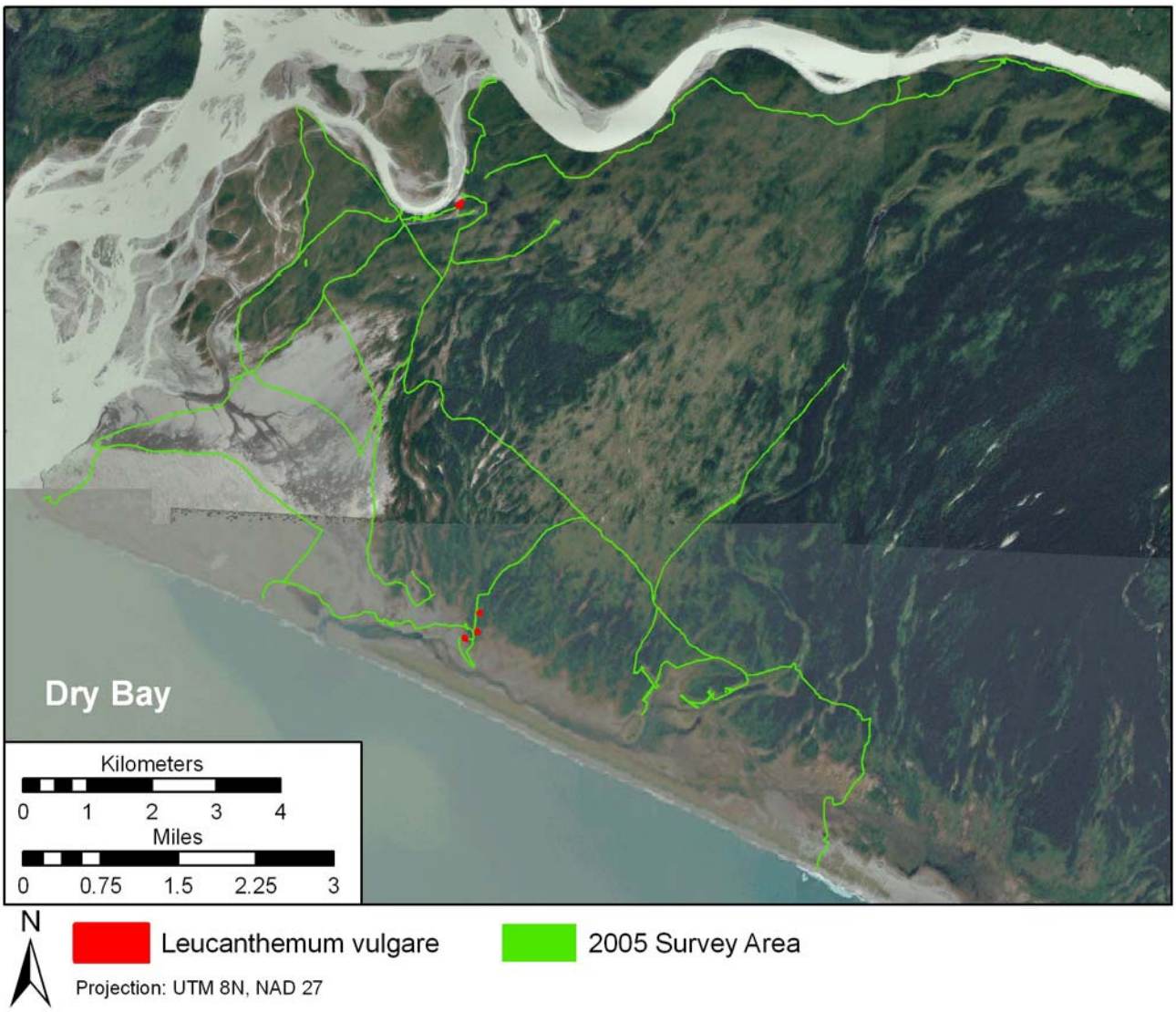
Dactylis glomerata distribution in Dry Bay in 2005



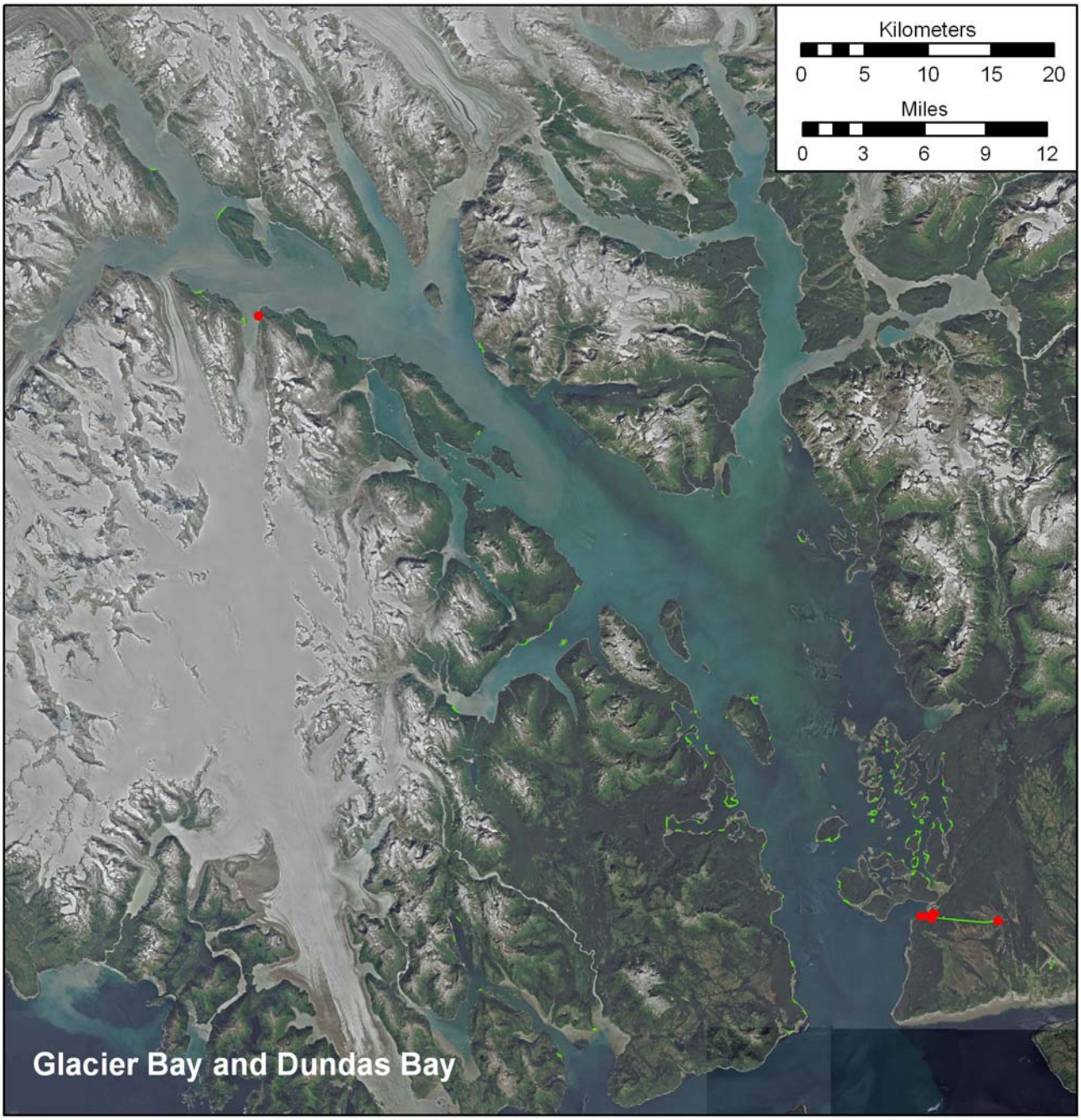
Dactylis glomerata distribution in Glacier Bay in 2005



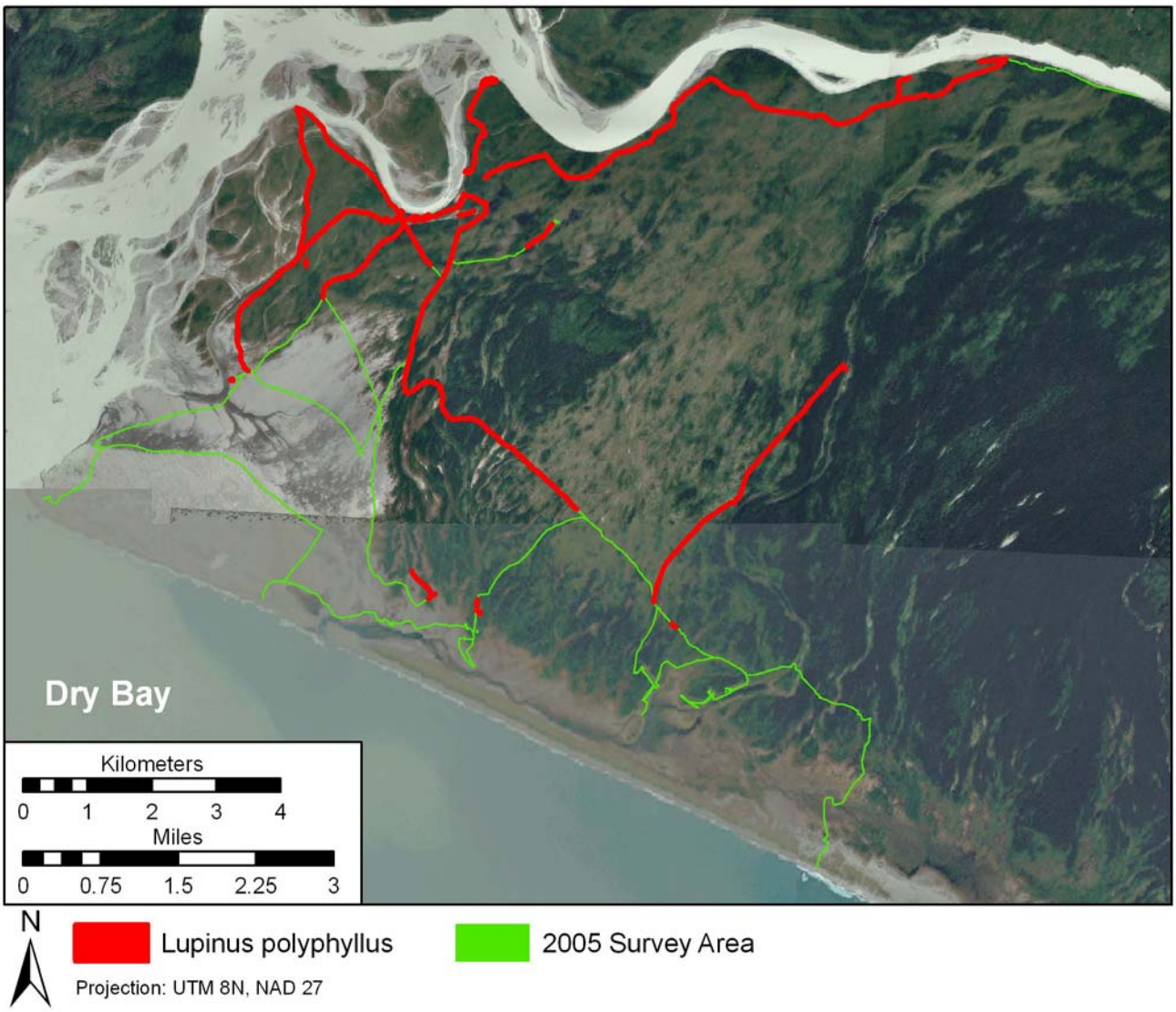
Leucanthemum vulgare distribution in Dry Bay in 2005



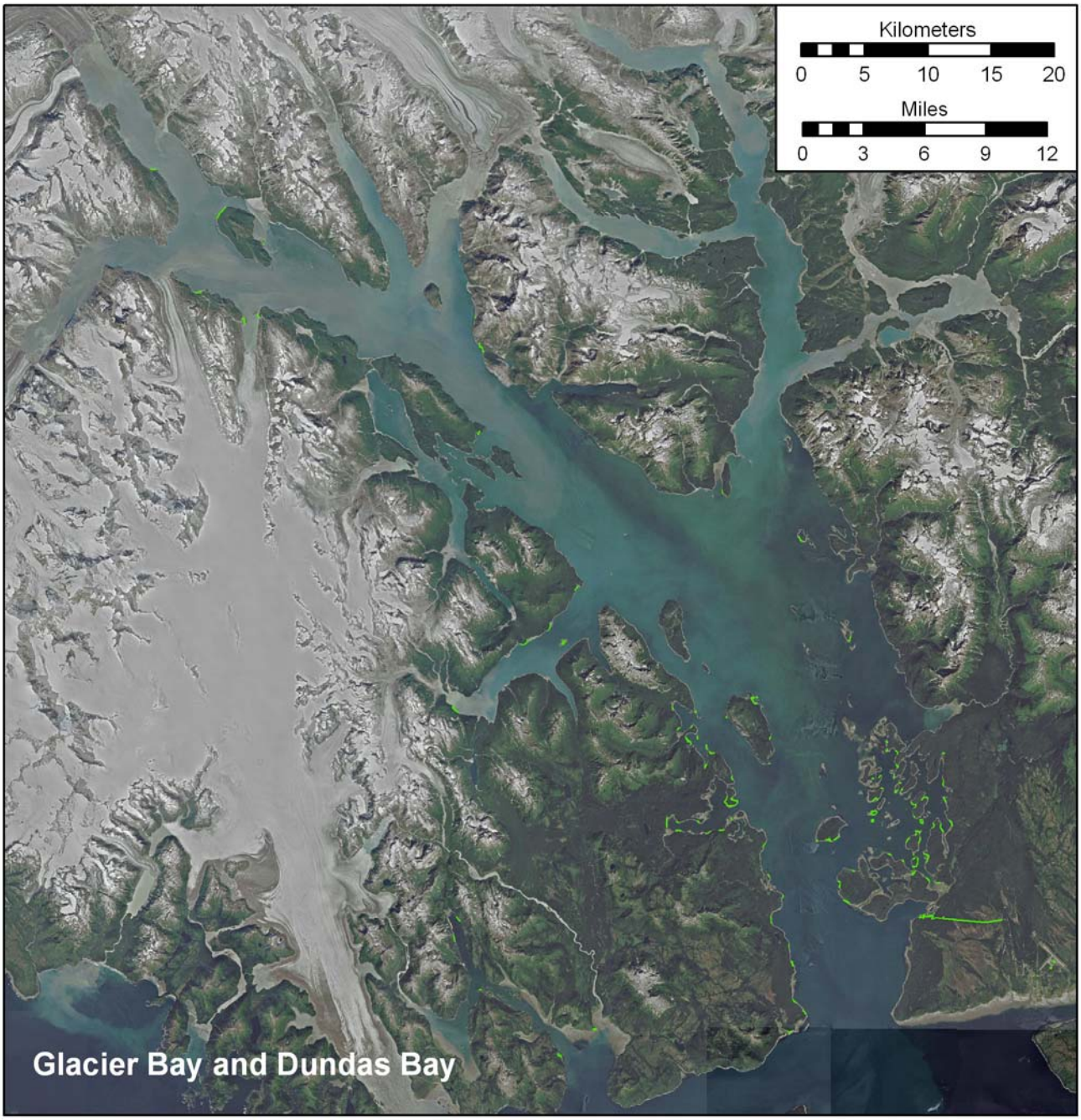
Leucanthemum vulgare distribution in Glacier Bay in 2005



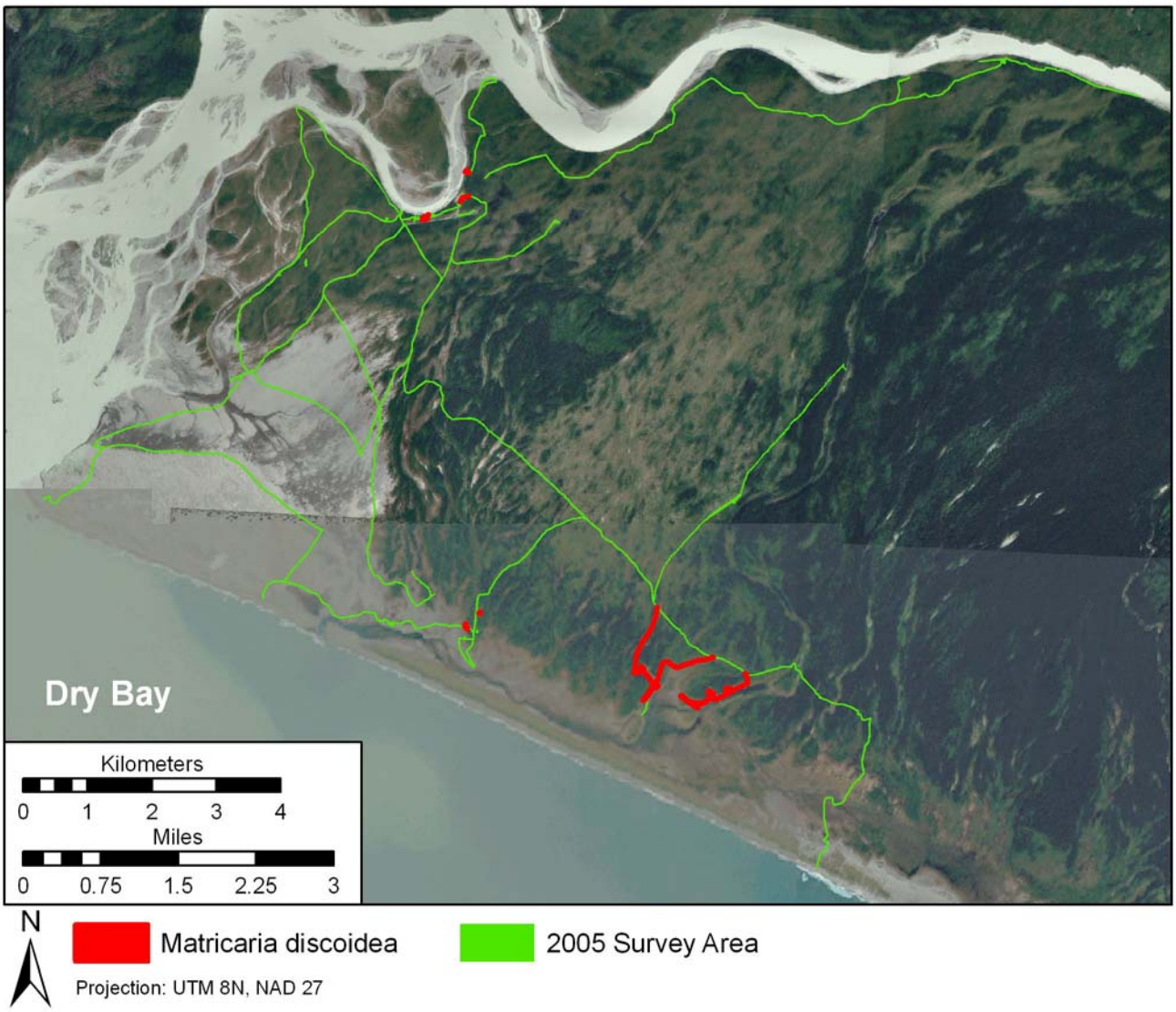
Lupinus polyphyllus distribution in Dry Bay in 2005



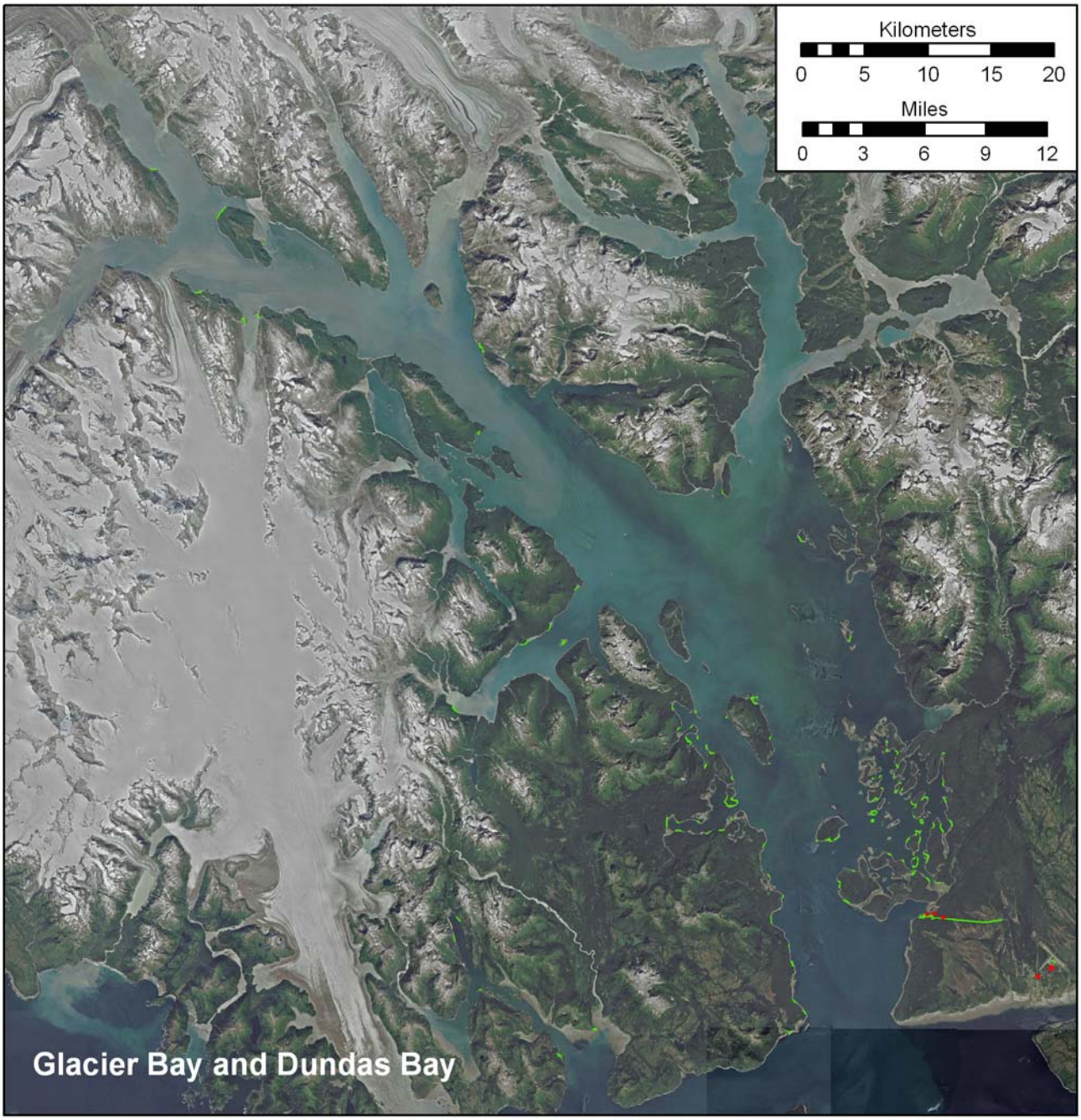
Lupinus polyphyllus distribution in Glacier Bay in 2005



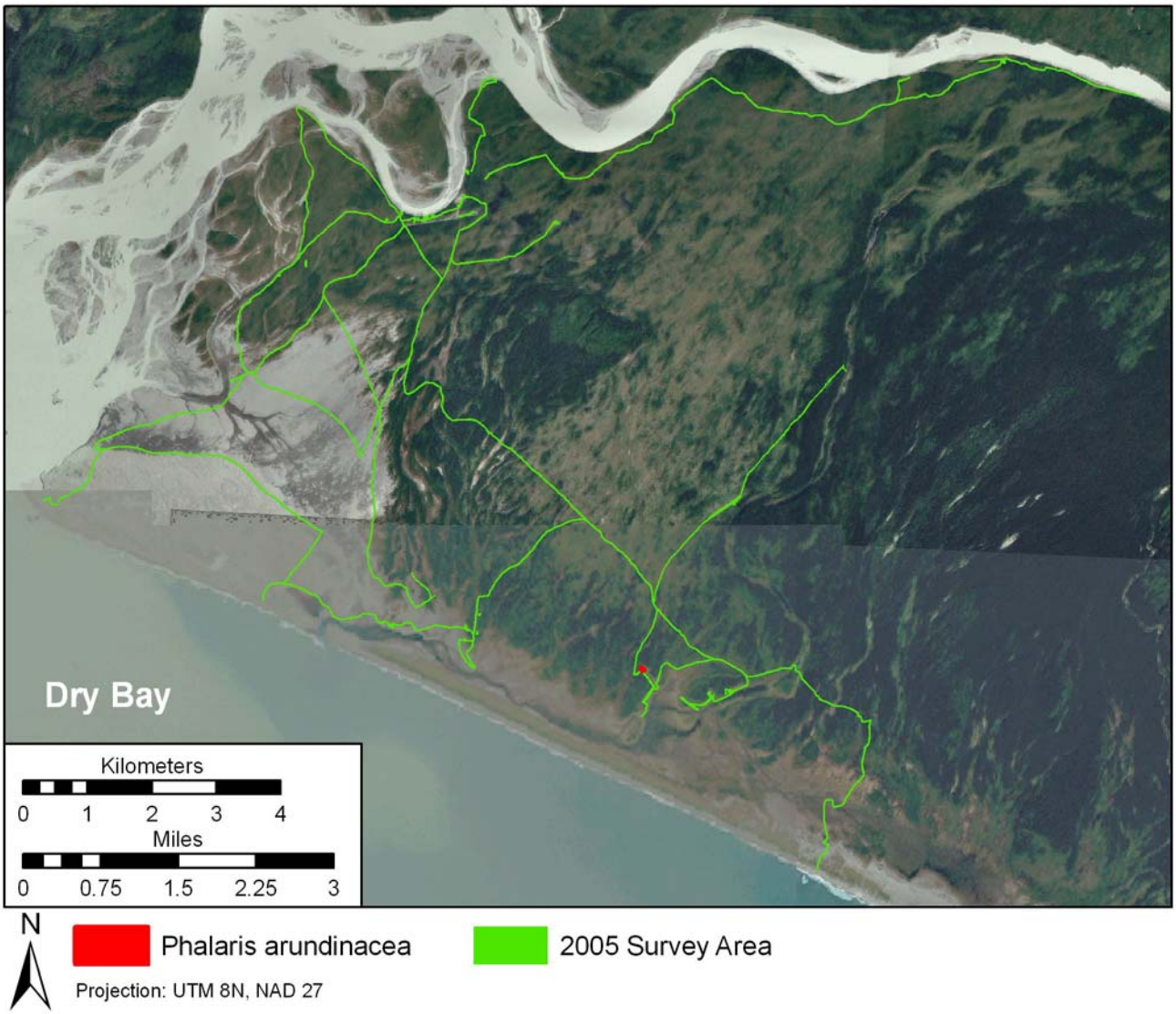
Matricaria discoidea distribution in Dry Bay in 2005



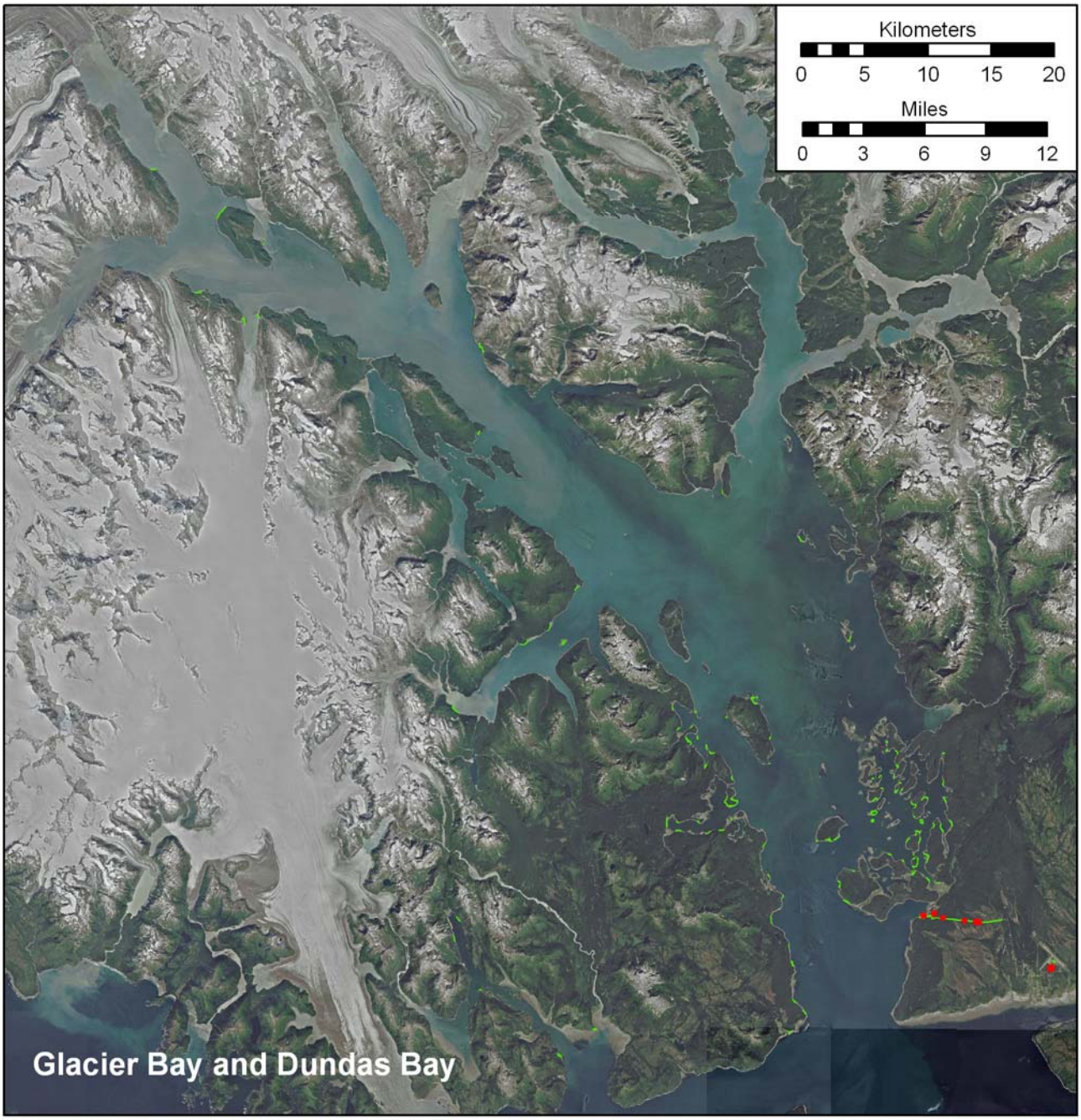
Matricaria discoidea distribution in Glacier Bay in 2005



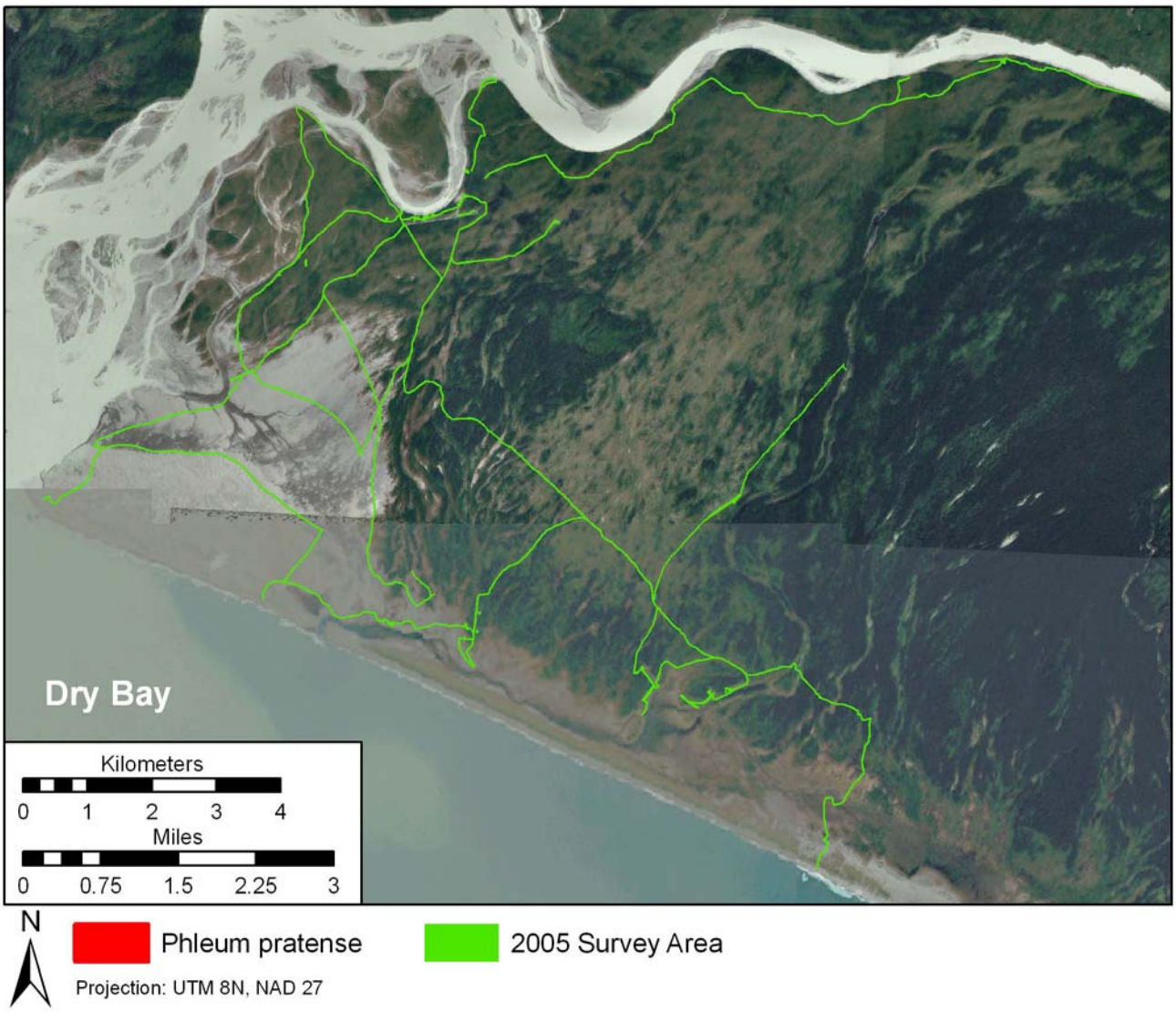
Phalaris arundinacea distribution in Dry Bay in 2005



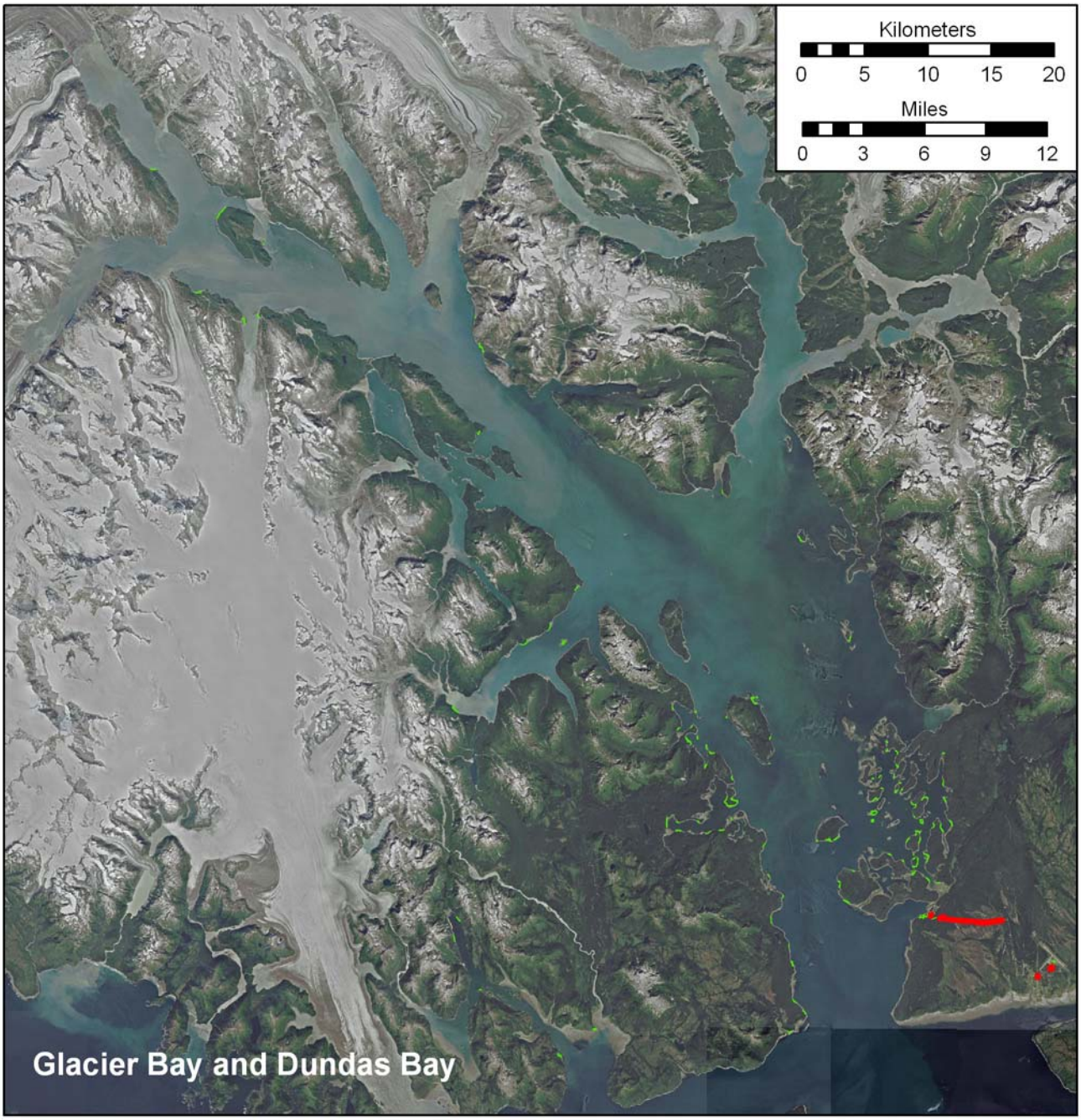
Phalaris arundinacea distribution in Glacier Bay in 2005



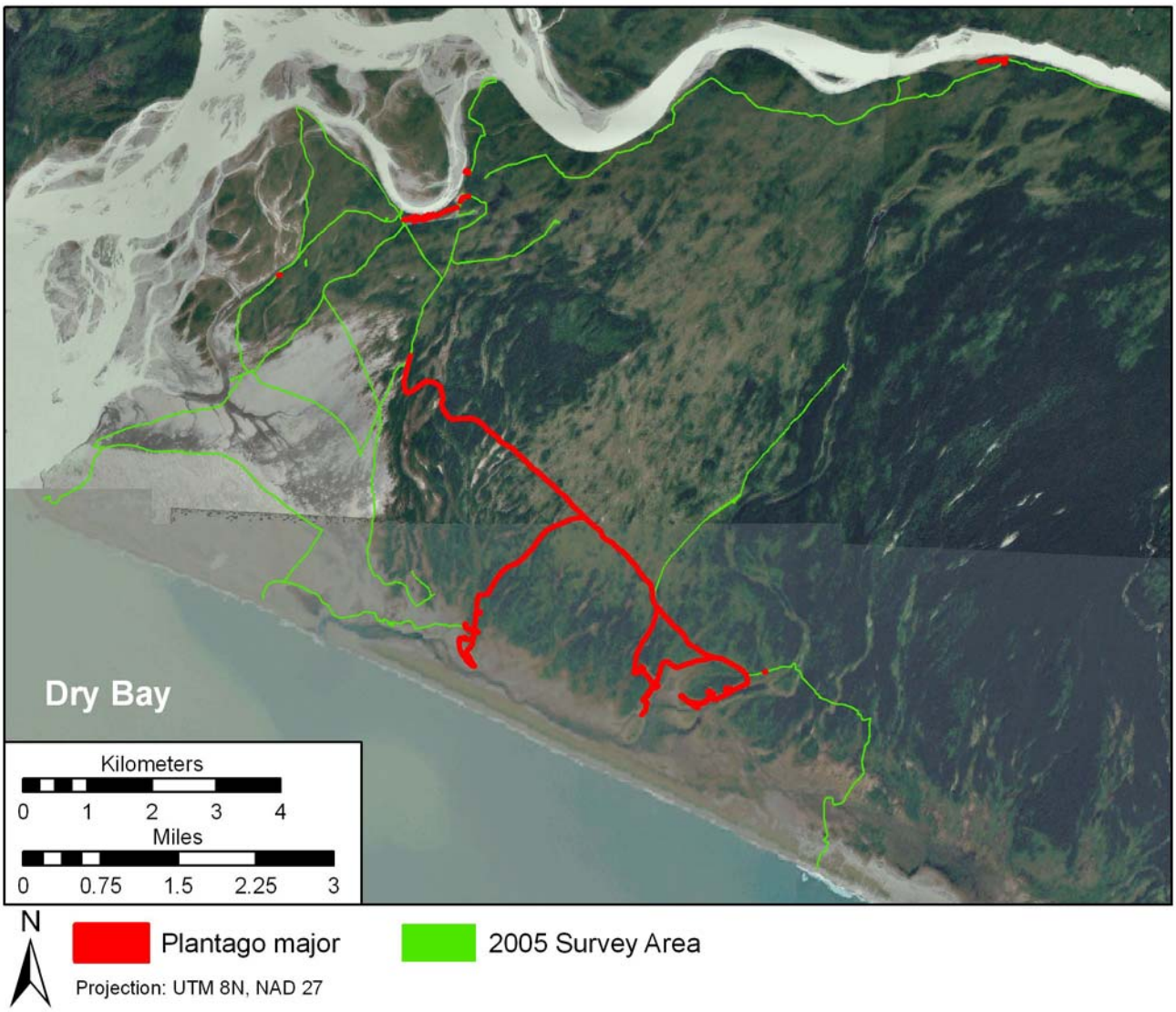
Phleum pratense distribution in Dry Bay in 2005



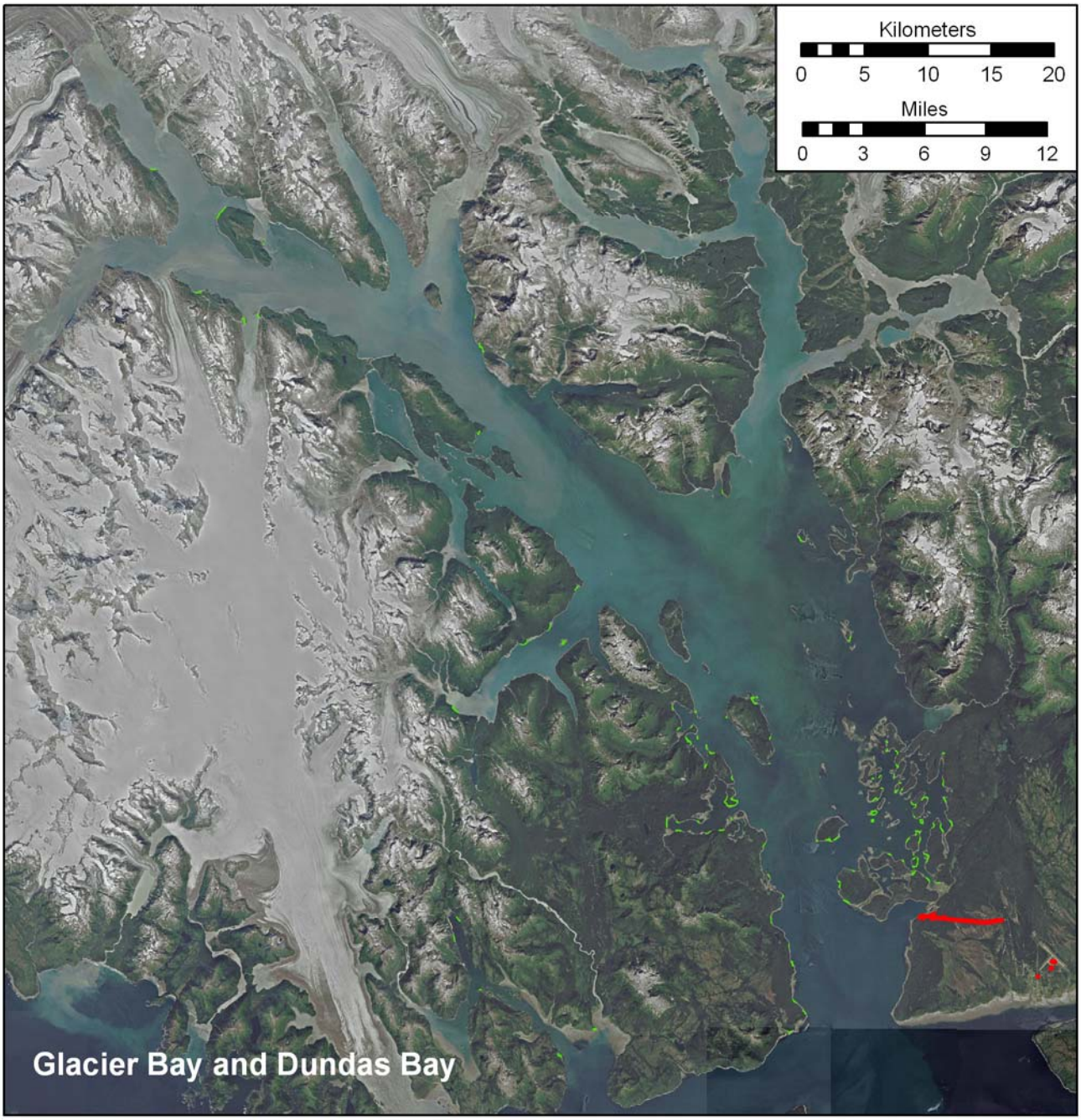
Phleum pratense distribution in Glacier Bay in 2005



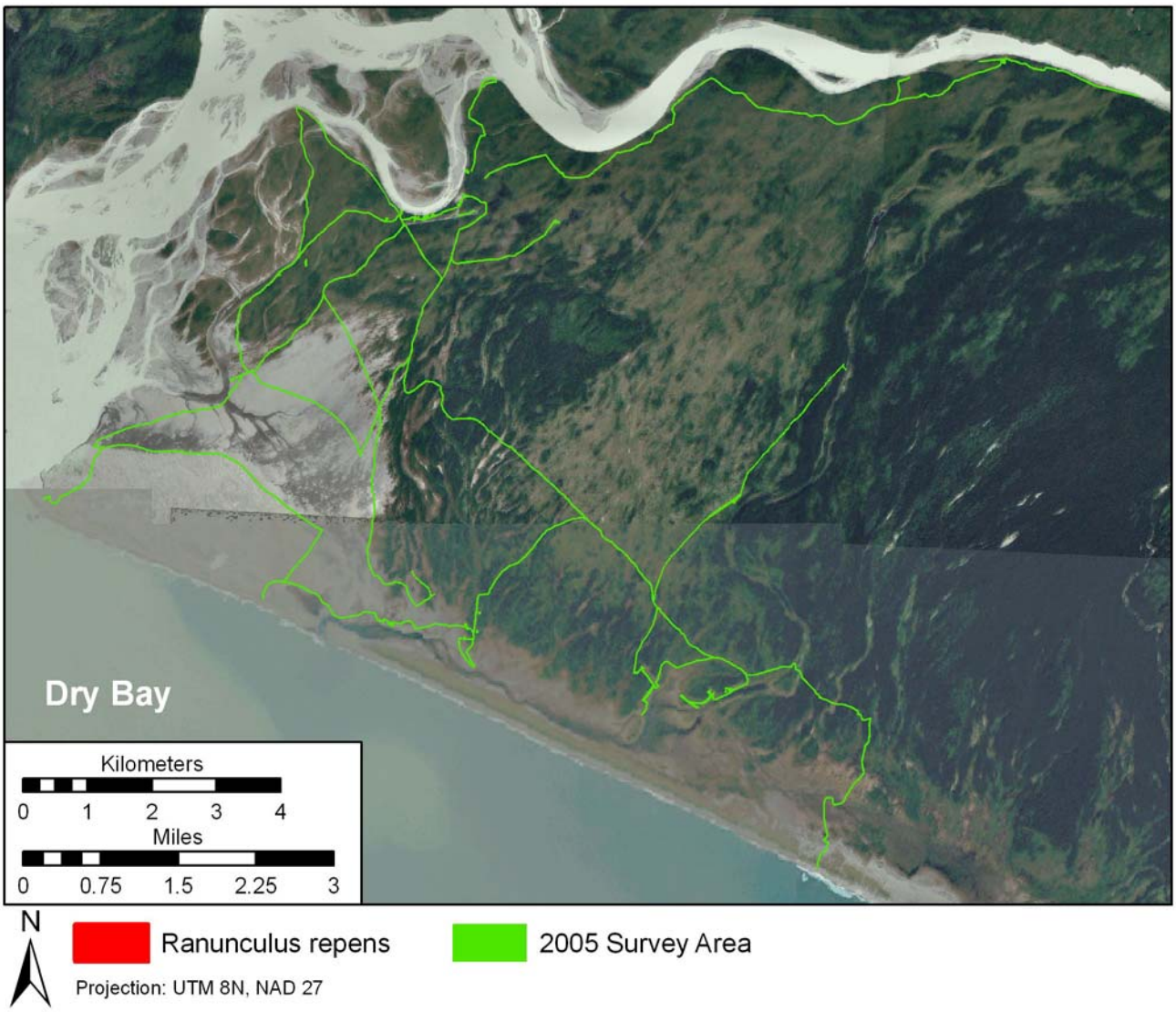
Plantago major distribution in Dry Bay in 2005



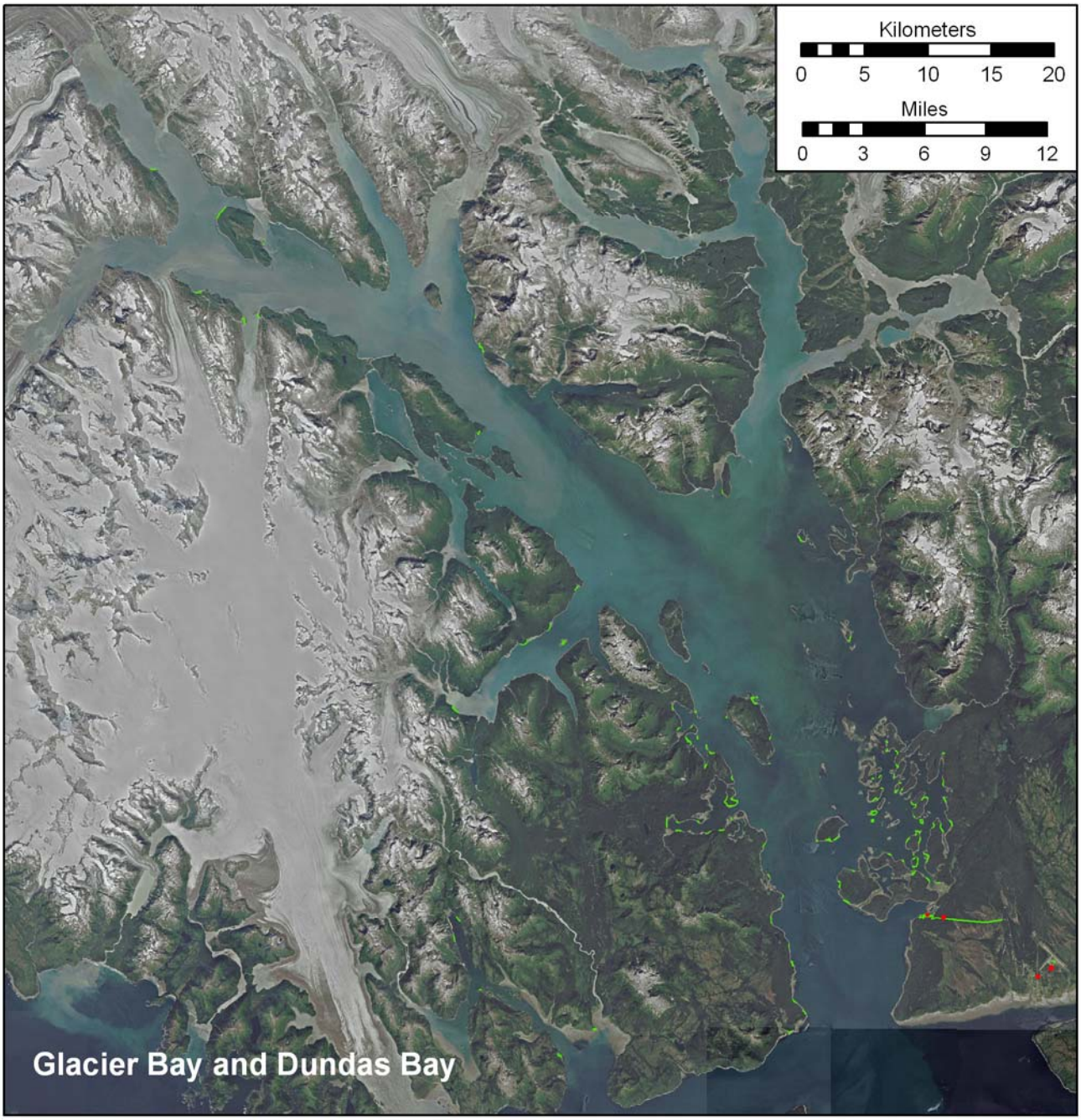
Plantago major distribution in Glacier Bay in 2005



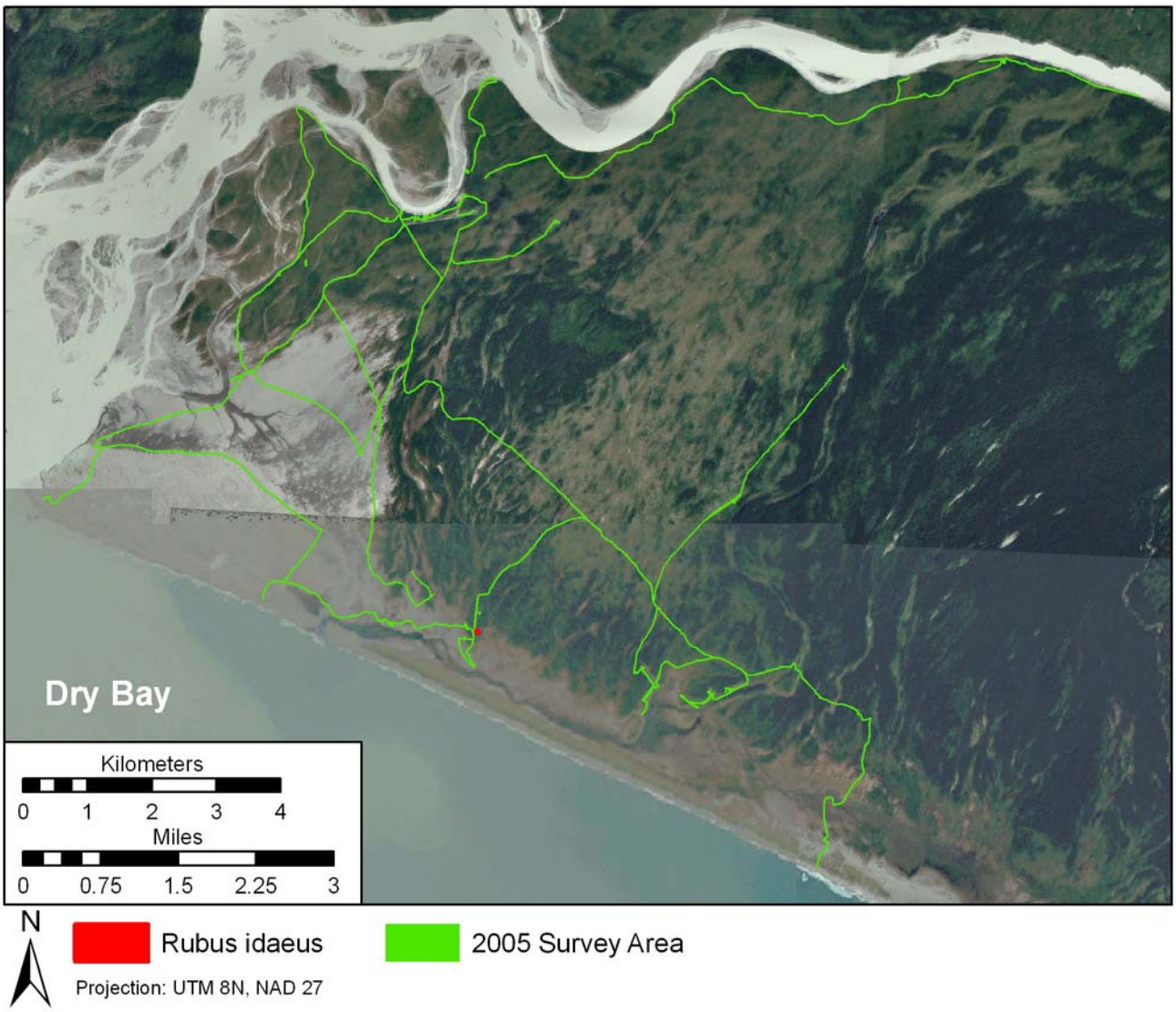
Ranunculus repens distribution in Dry Bay in 2005



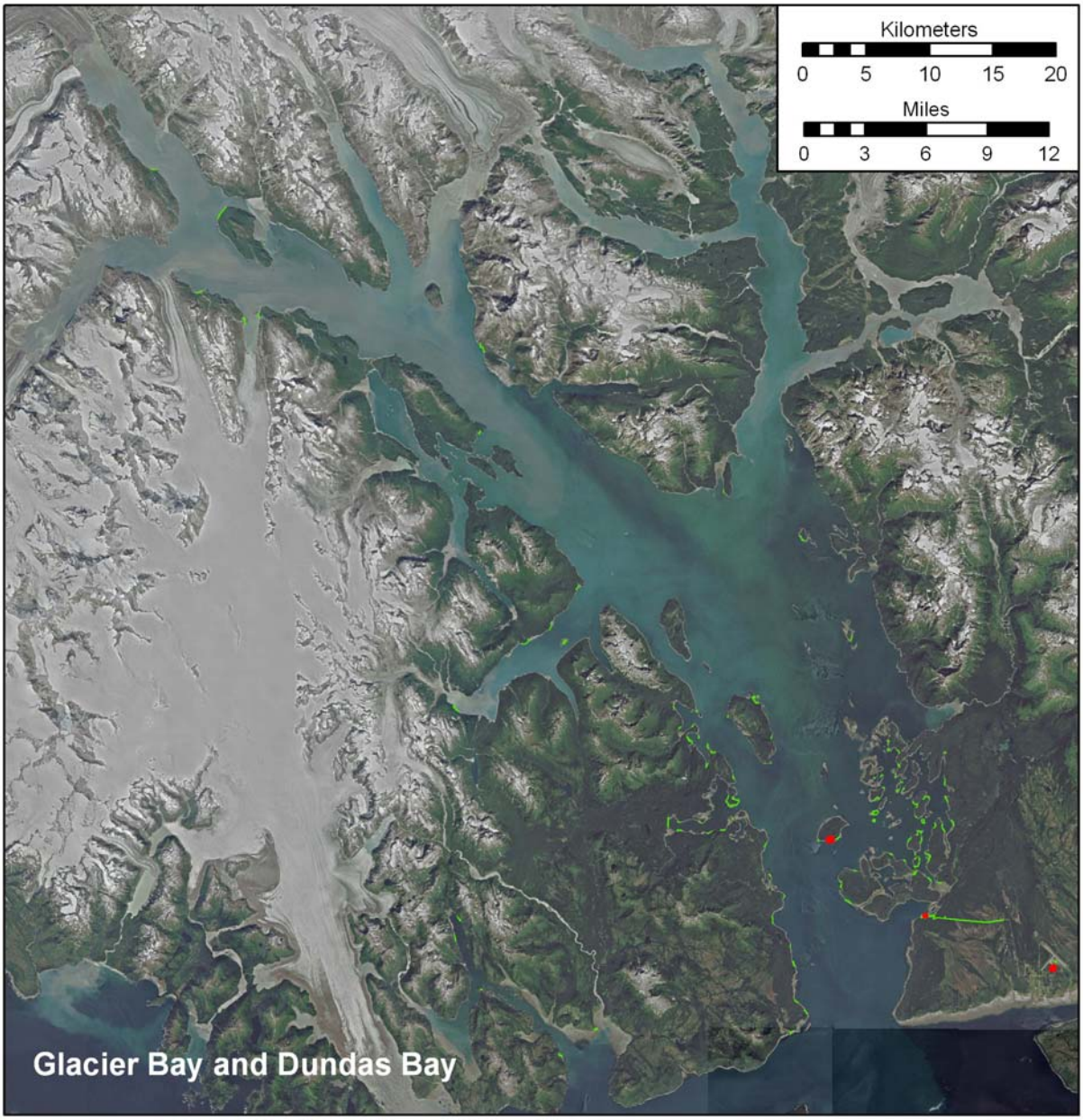
Ranunculus repens distribution in Glacier Bay in 2005



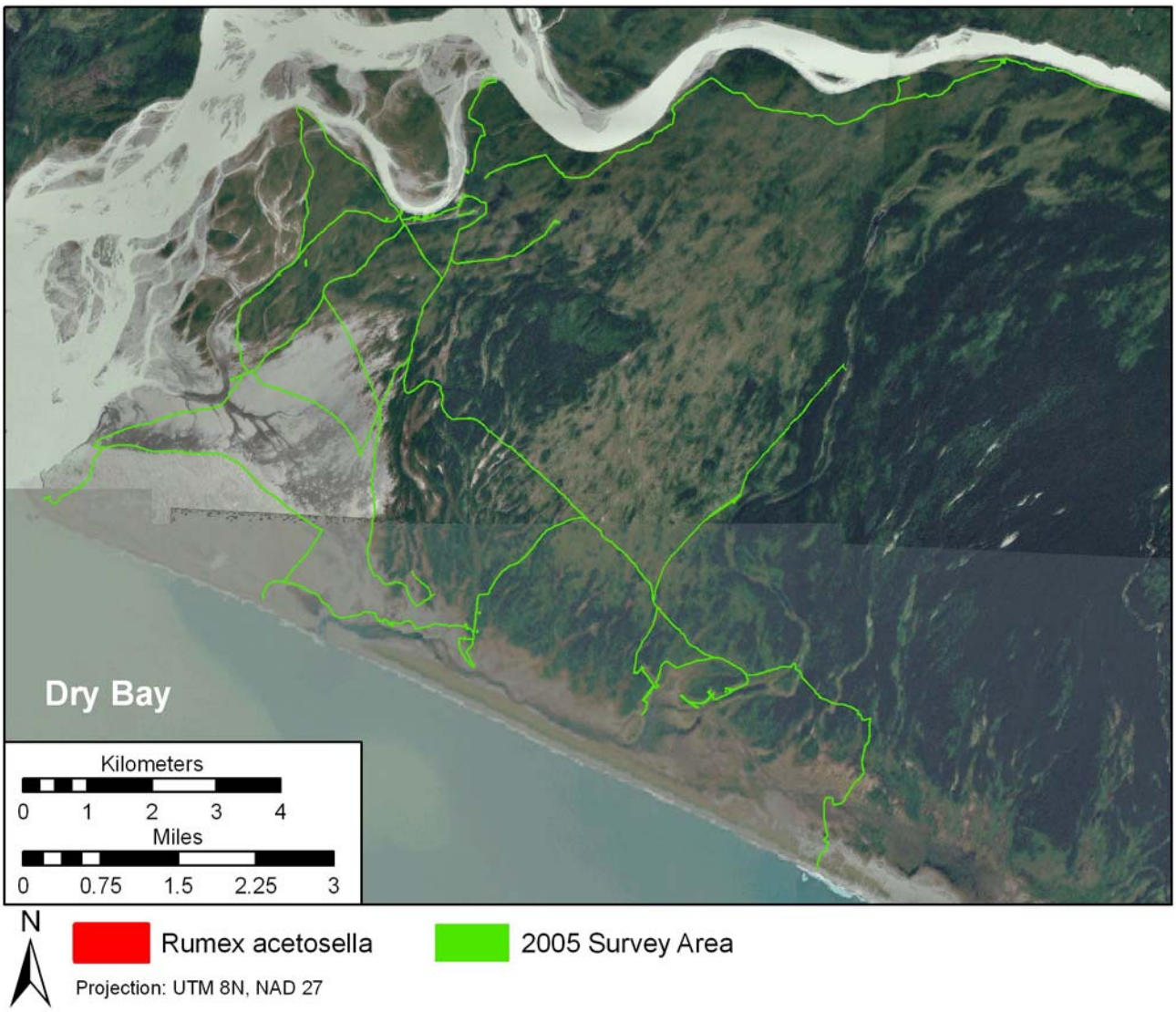
Rubus idaeus distribution in Dry Bay in 2005



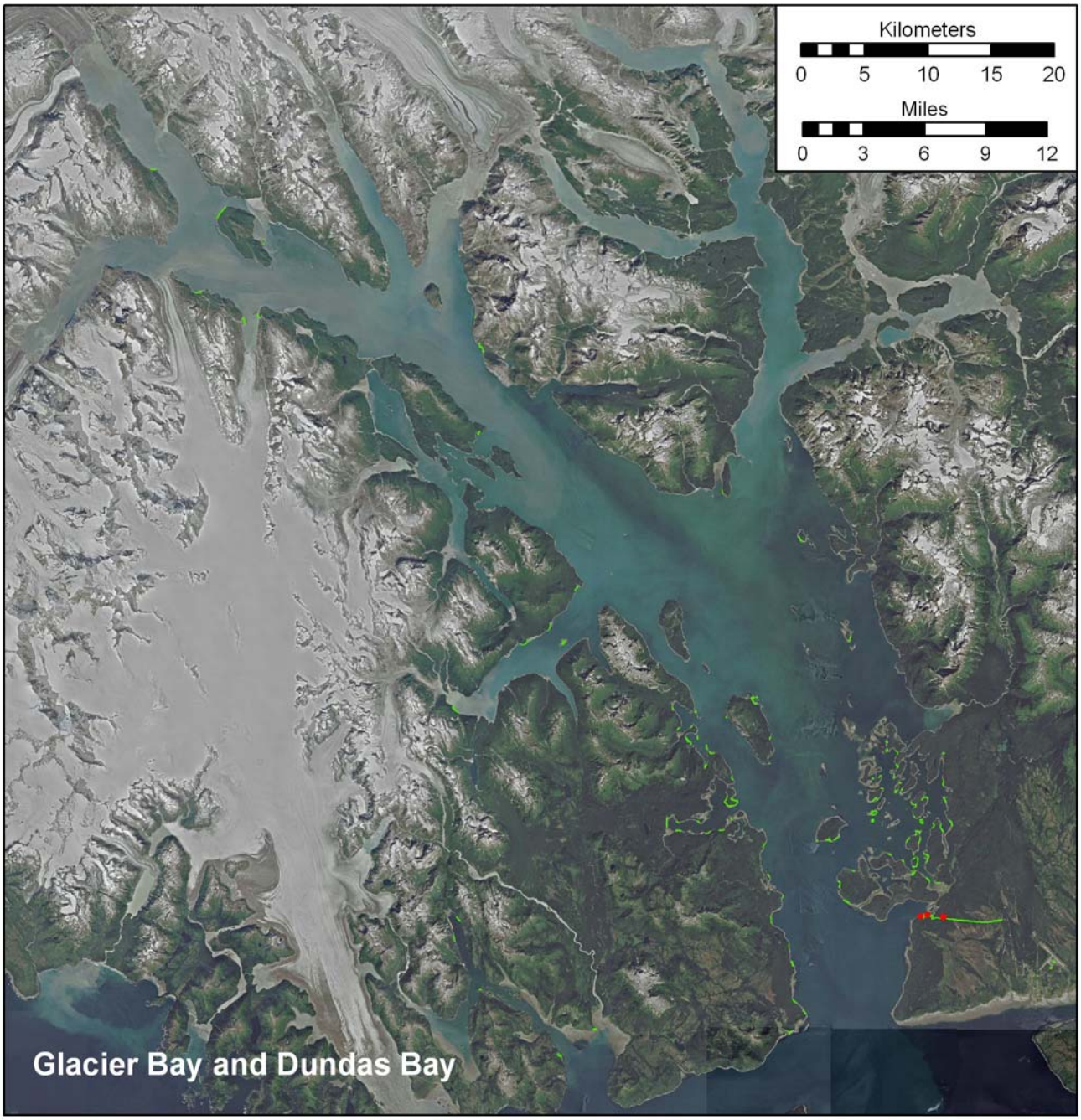
Rubus idaeus distribution in Glacier Bay in 2005



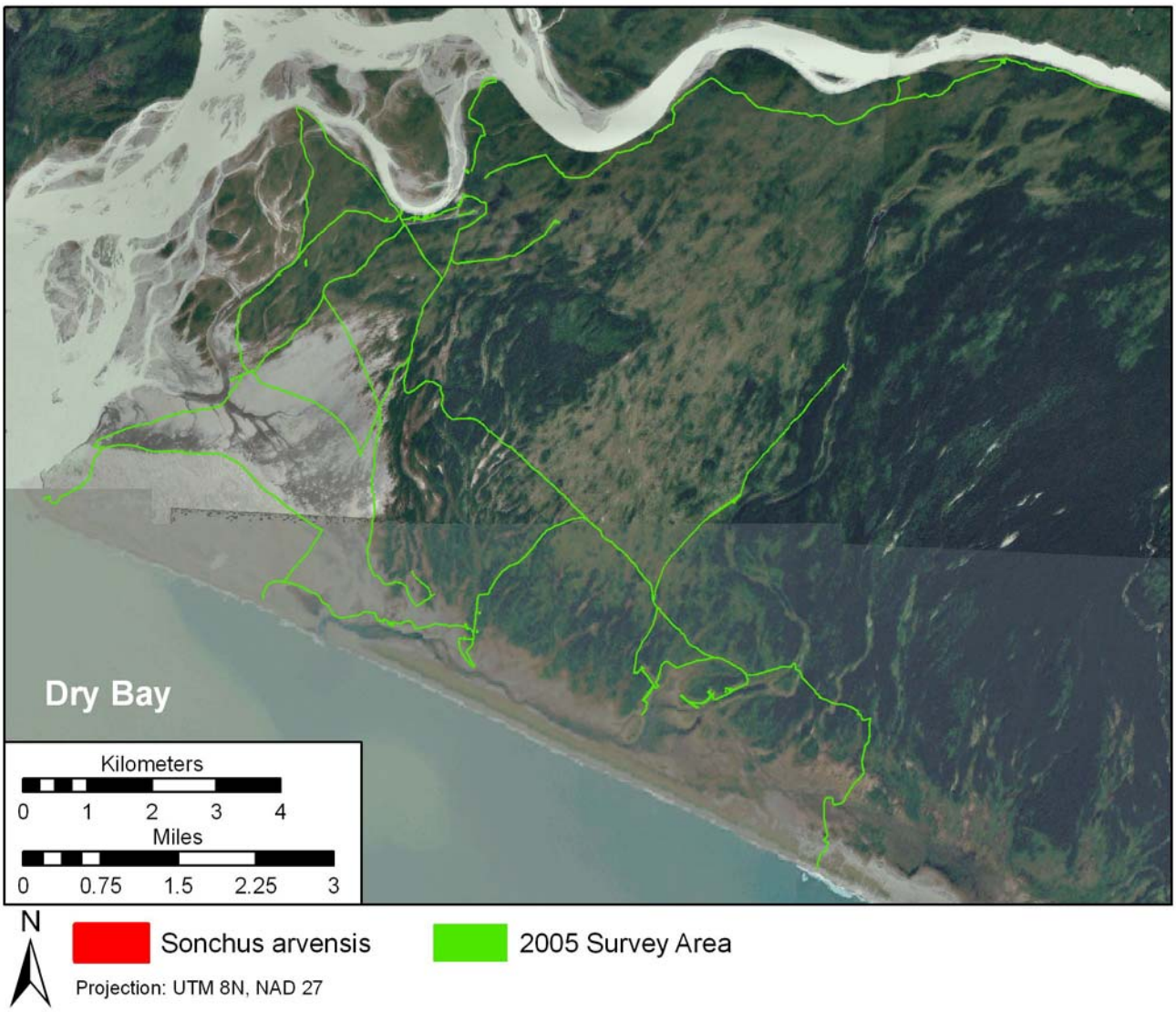
Rumex acetosella distribution in Dry Bay in 2005



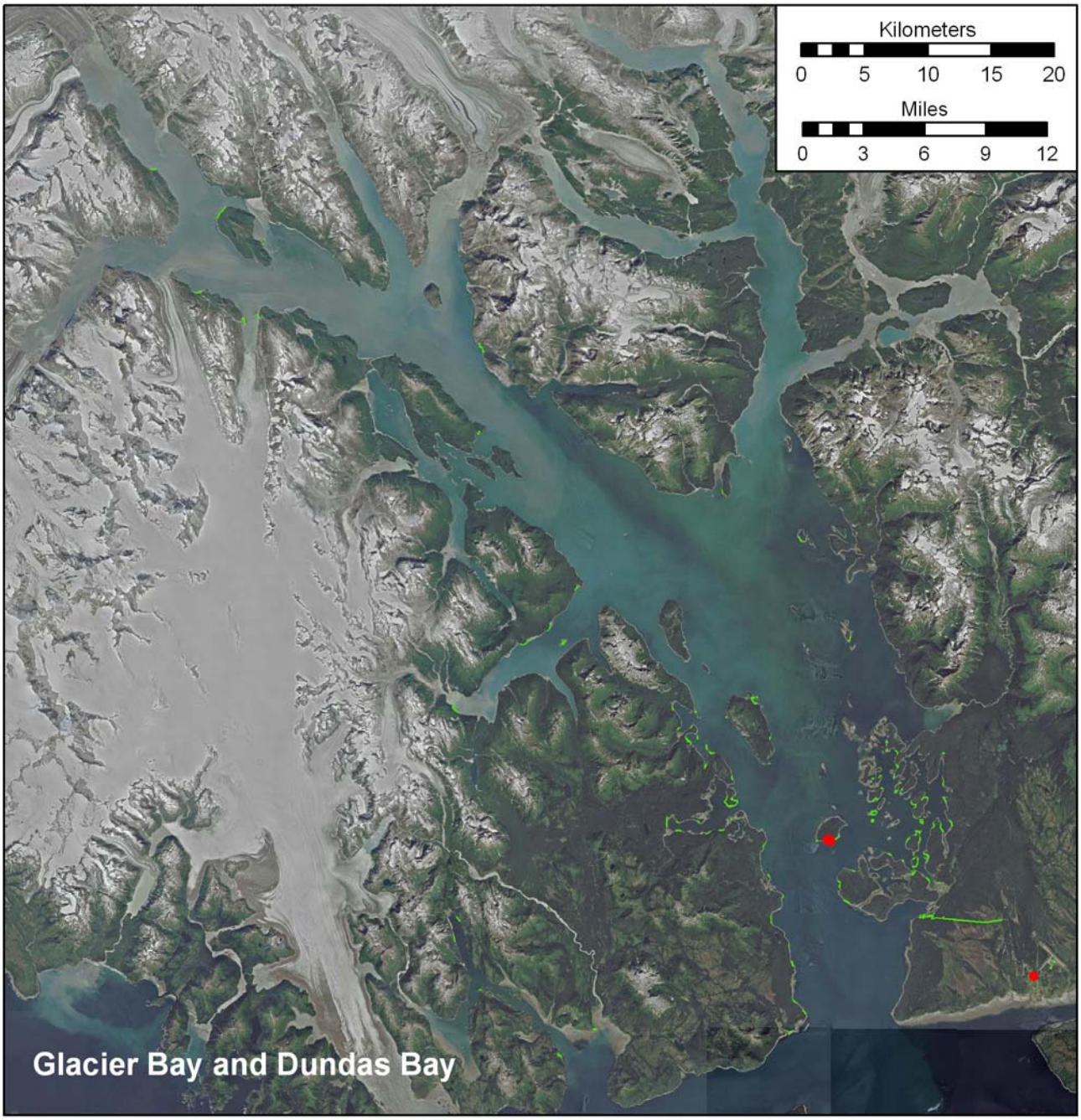
Rumex acetosella distribution in Glacier Bay in 2005



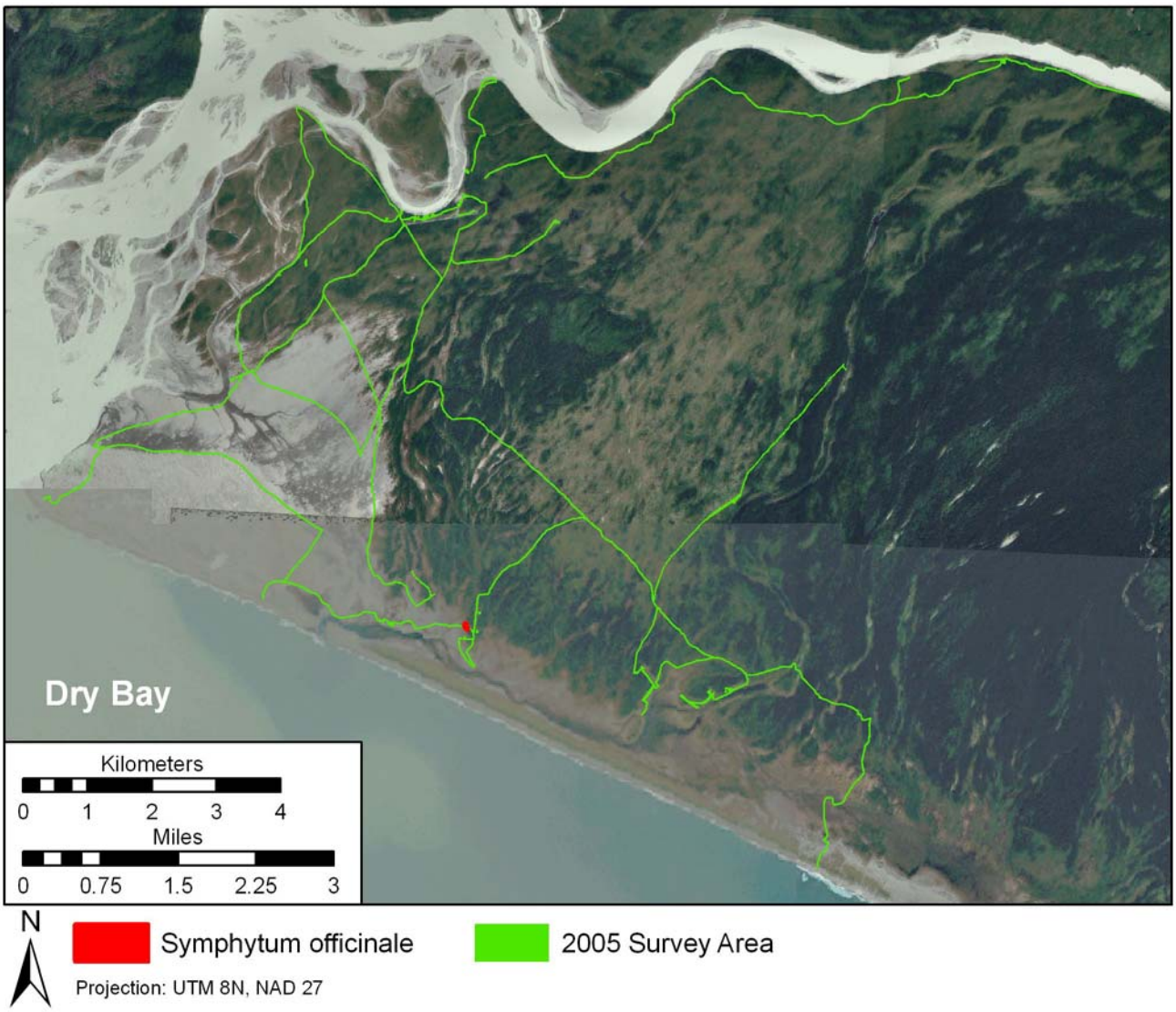
Sonchus arvensis distribution in Dry Bay in 2005



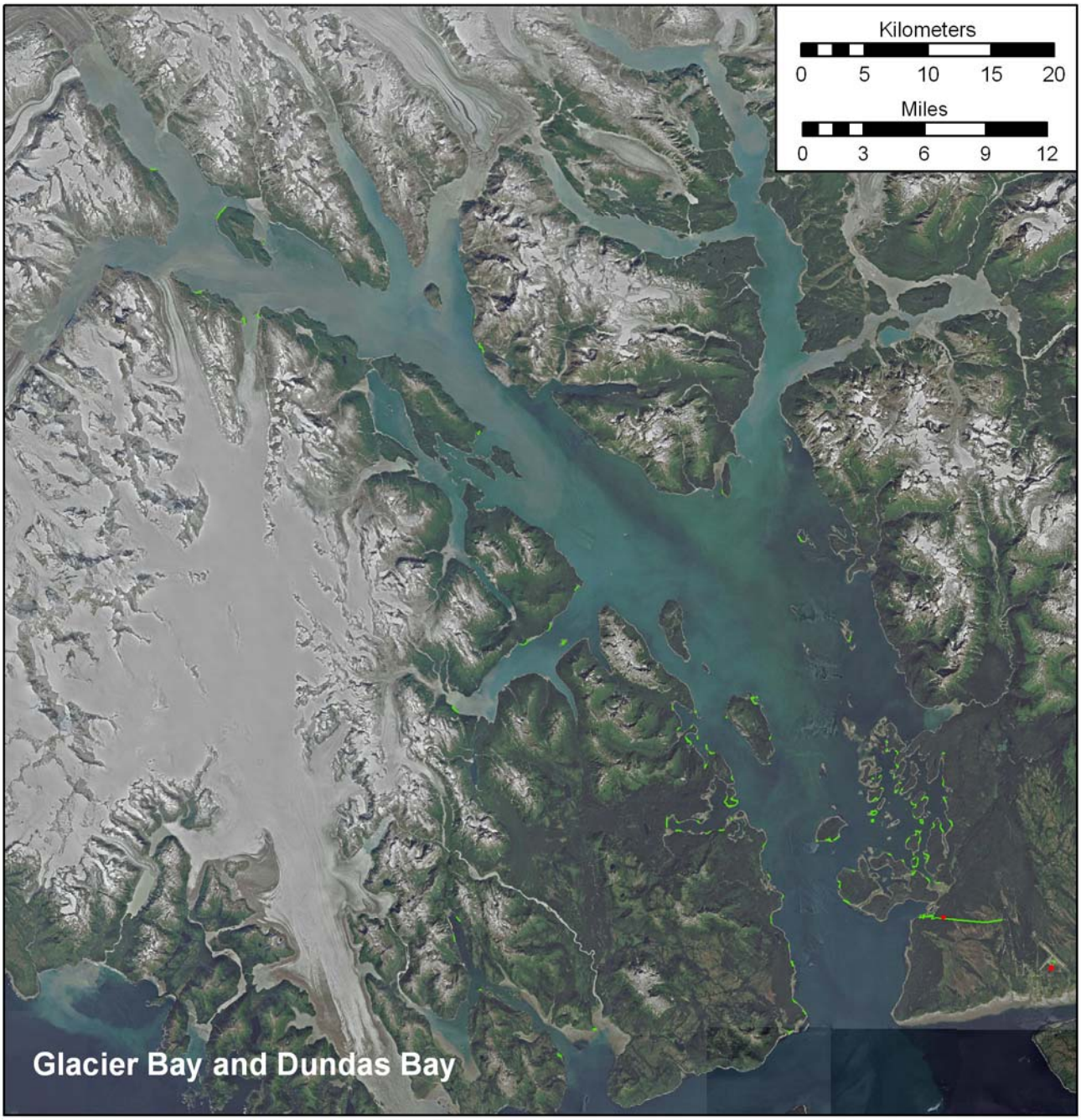
Sonchus arvensis distribution in Glacier Bay in 2005



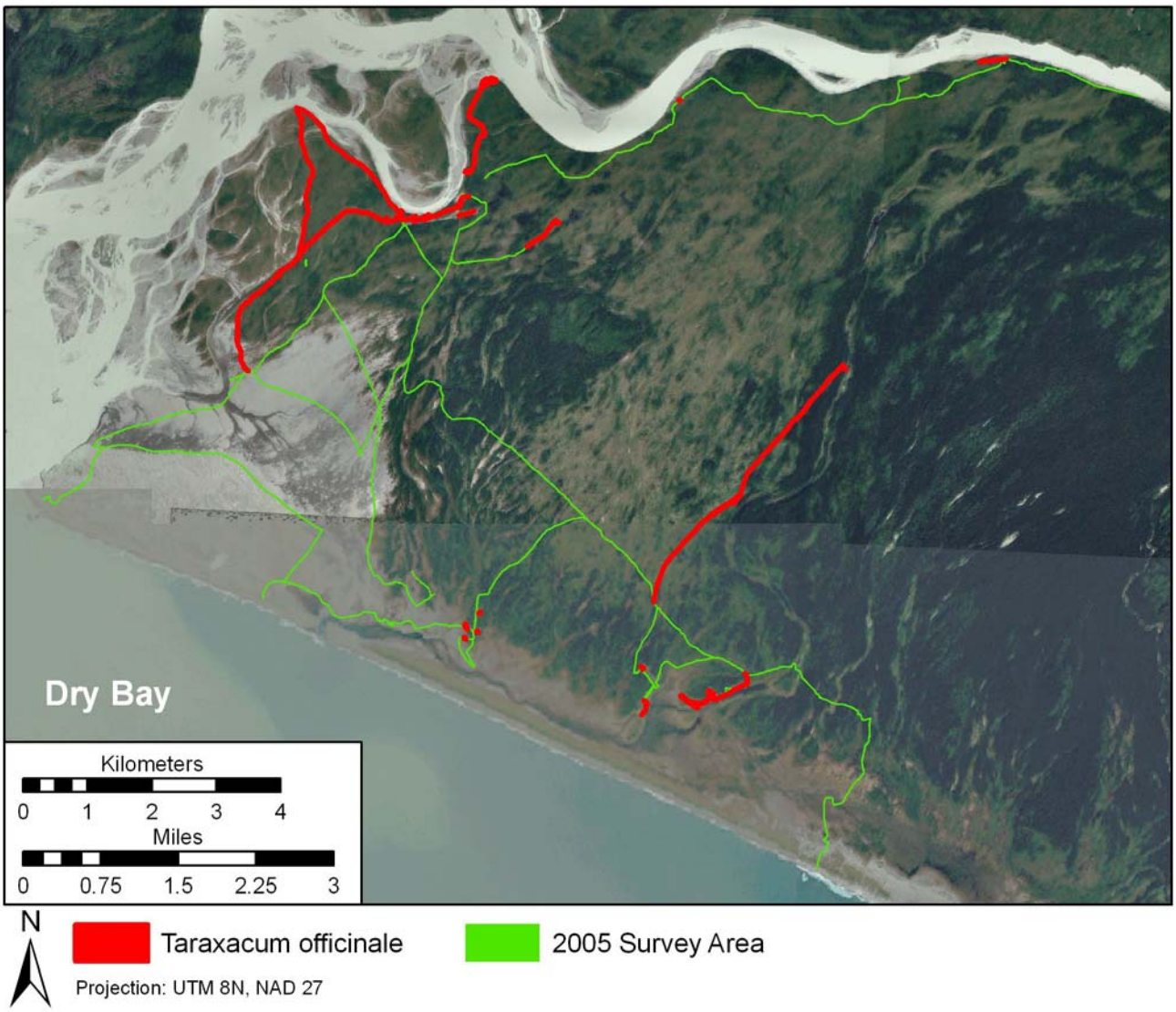
Symphytum officinale distribution in Dry Bay in 2005



Symphytum officinale distribution in Glacier Bay in 2005



Taraxacum officinale ssp*. officinale* distribution in Dry Bay in 2005



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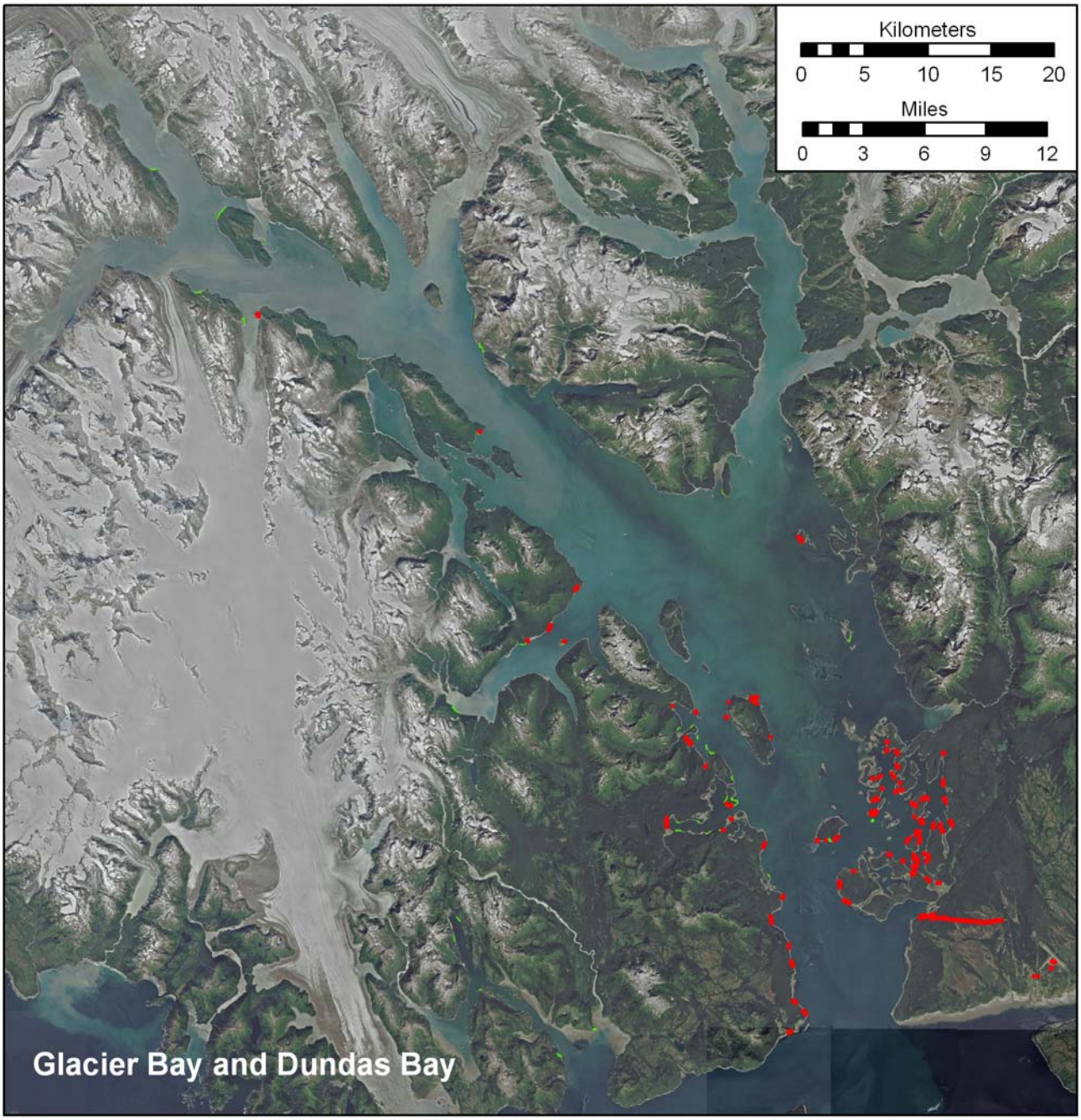
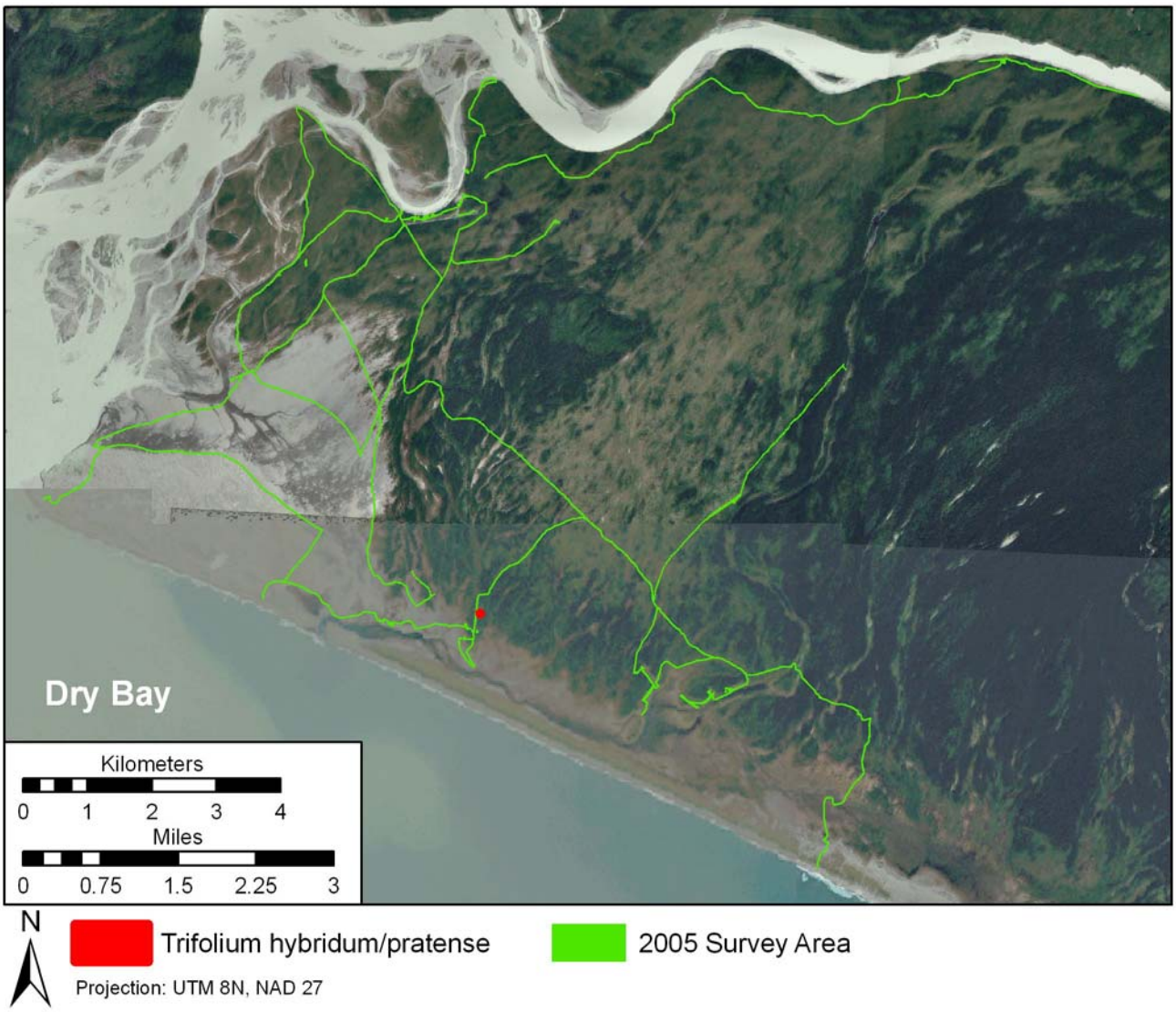
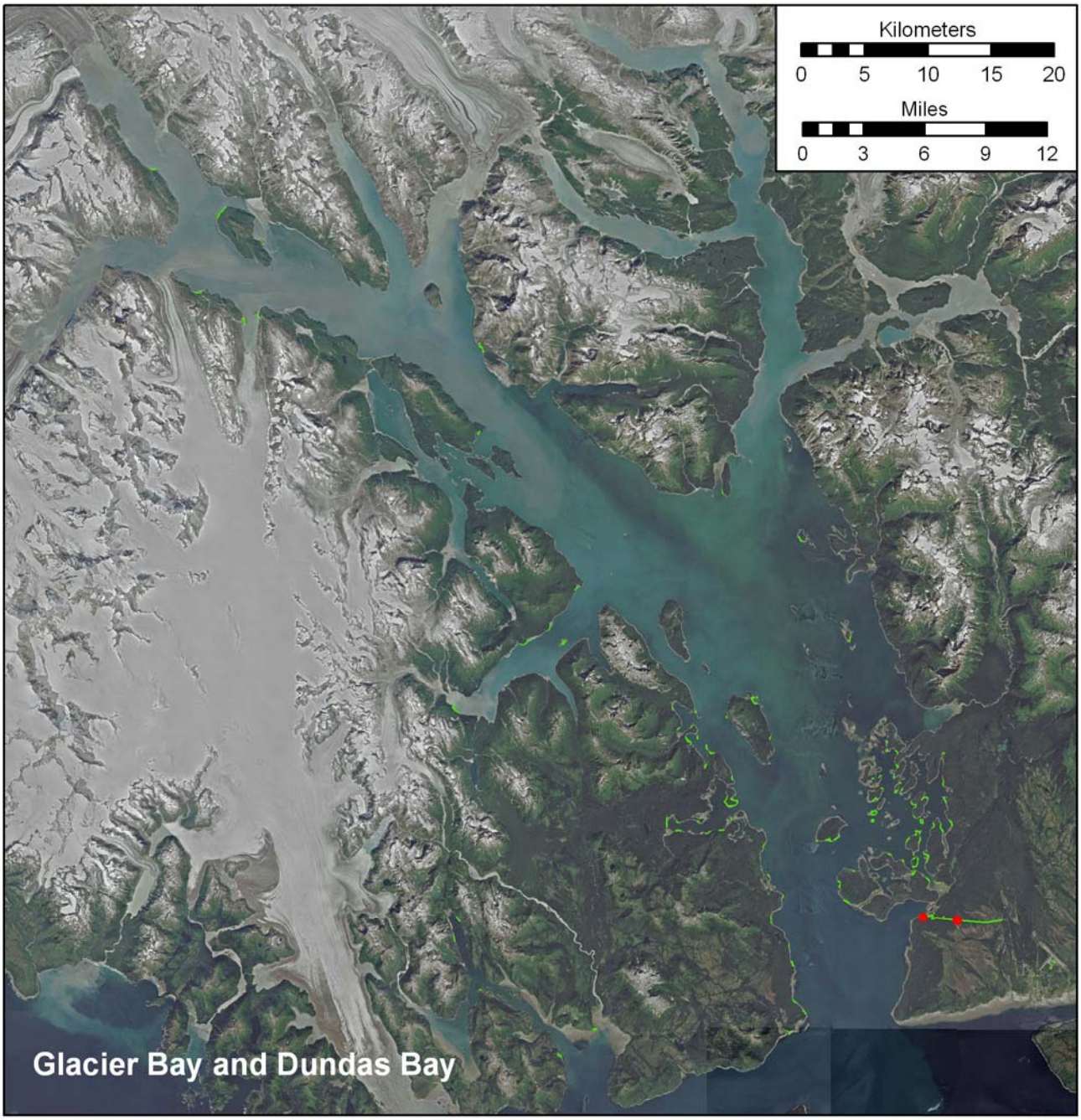


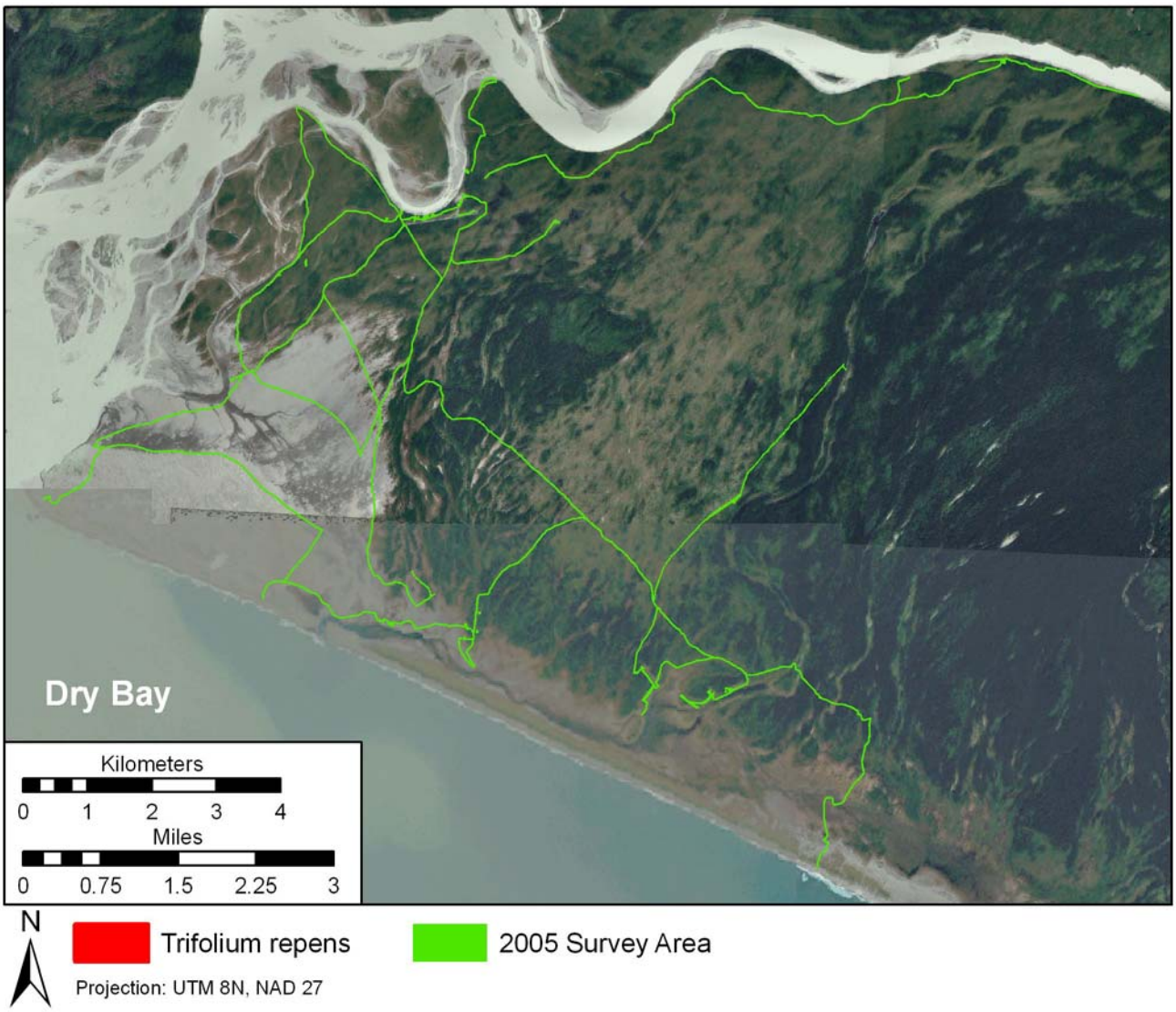
Trifolium hybridum/pratense distribution in Dry Bay in 2005



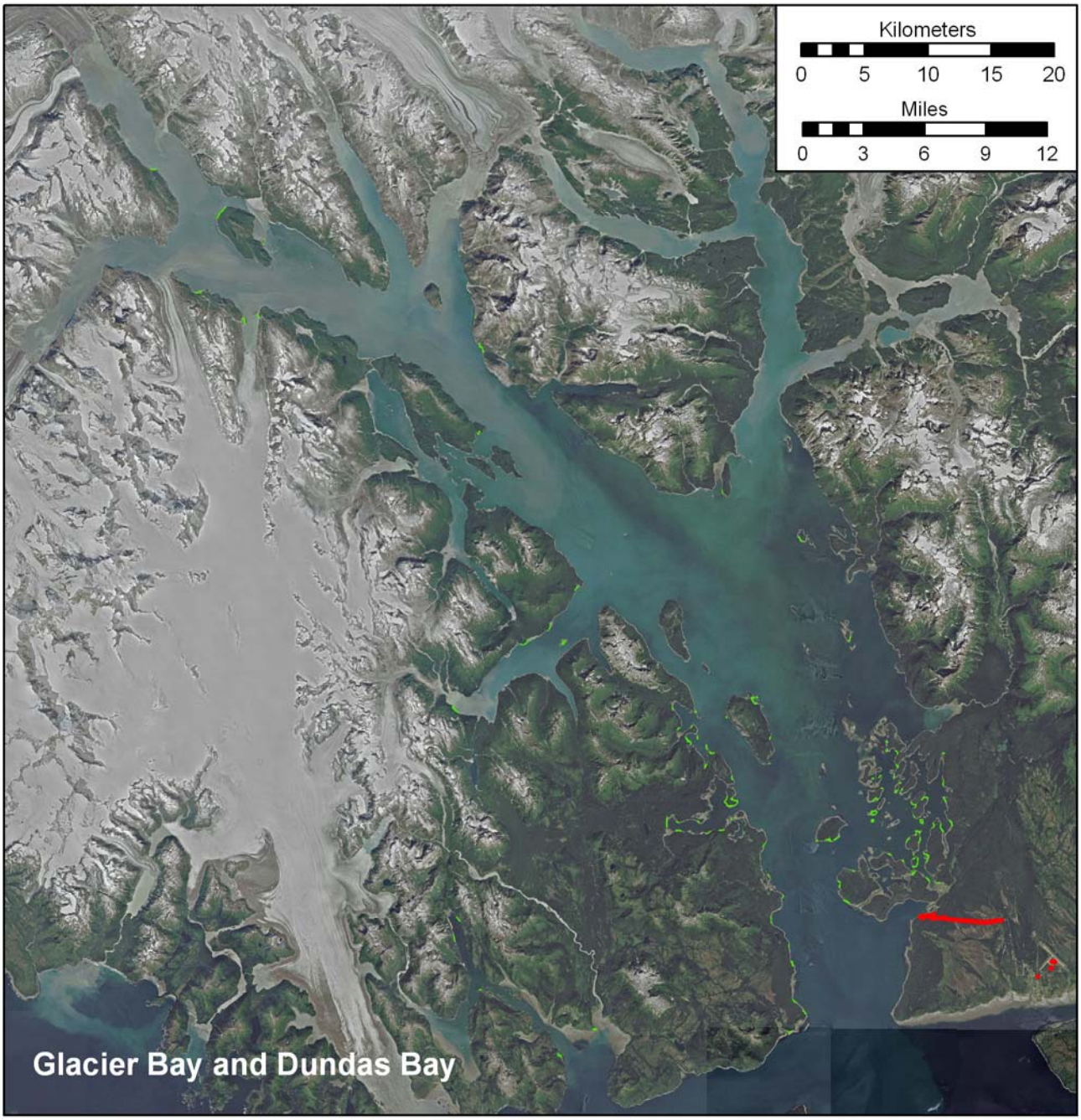
Trifolium hybridum/pratense distribution in Glacier Bay in 2005



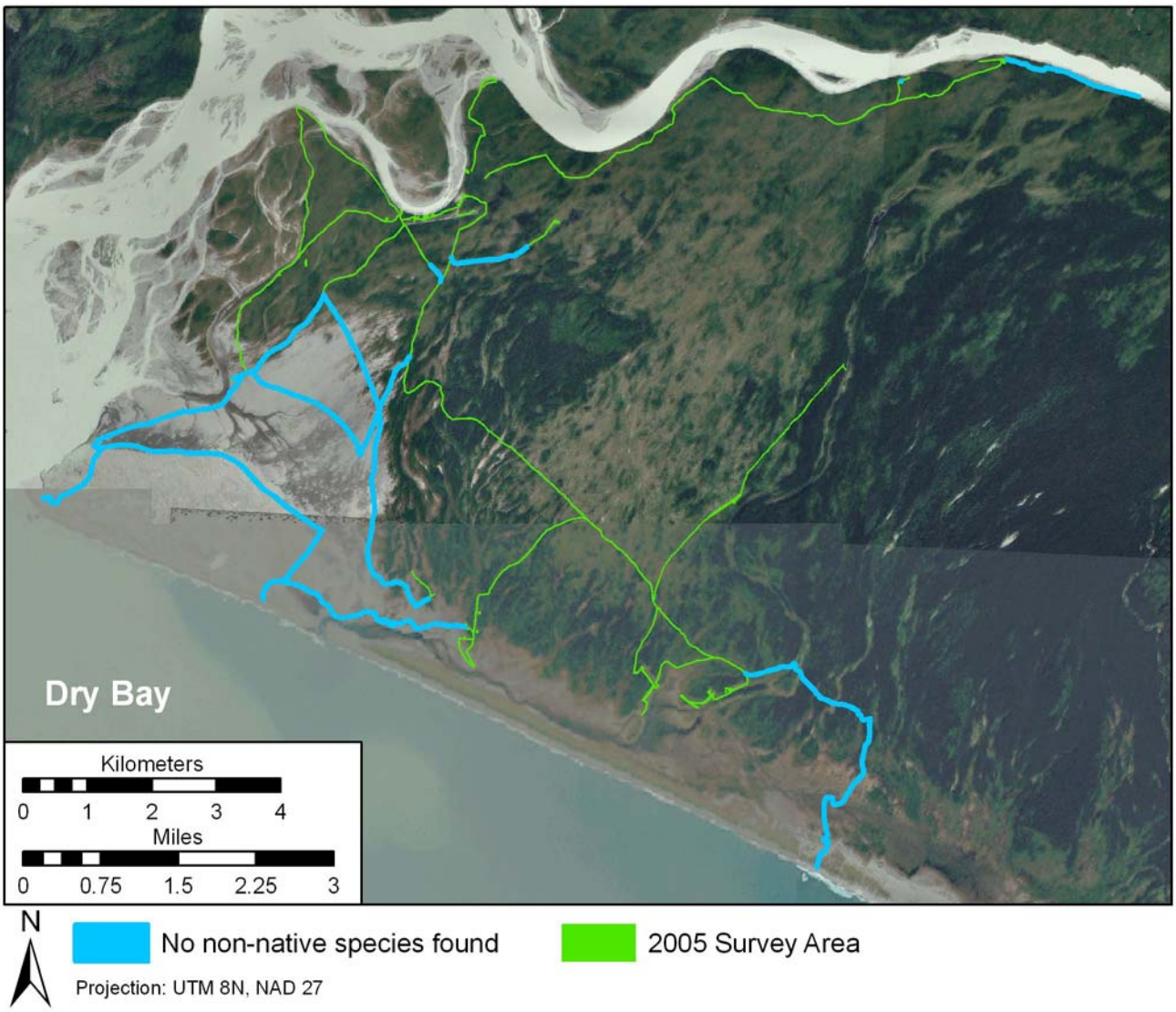
Trifolium repens distribution in Dry Bay in 2005



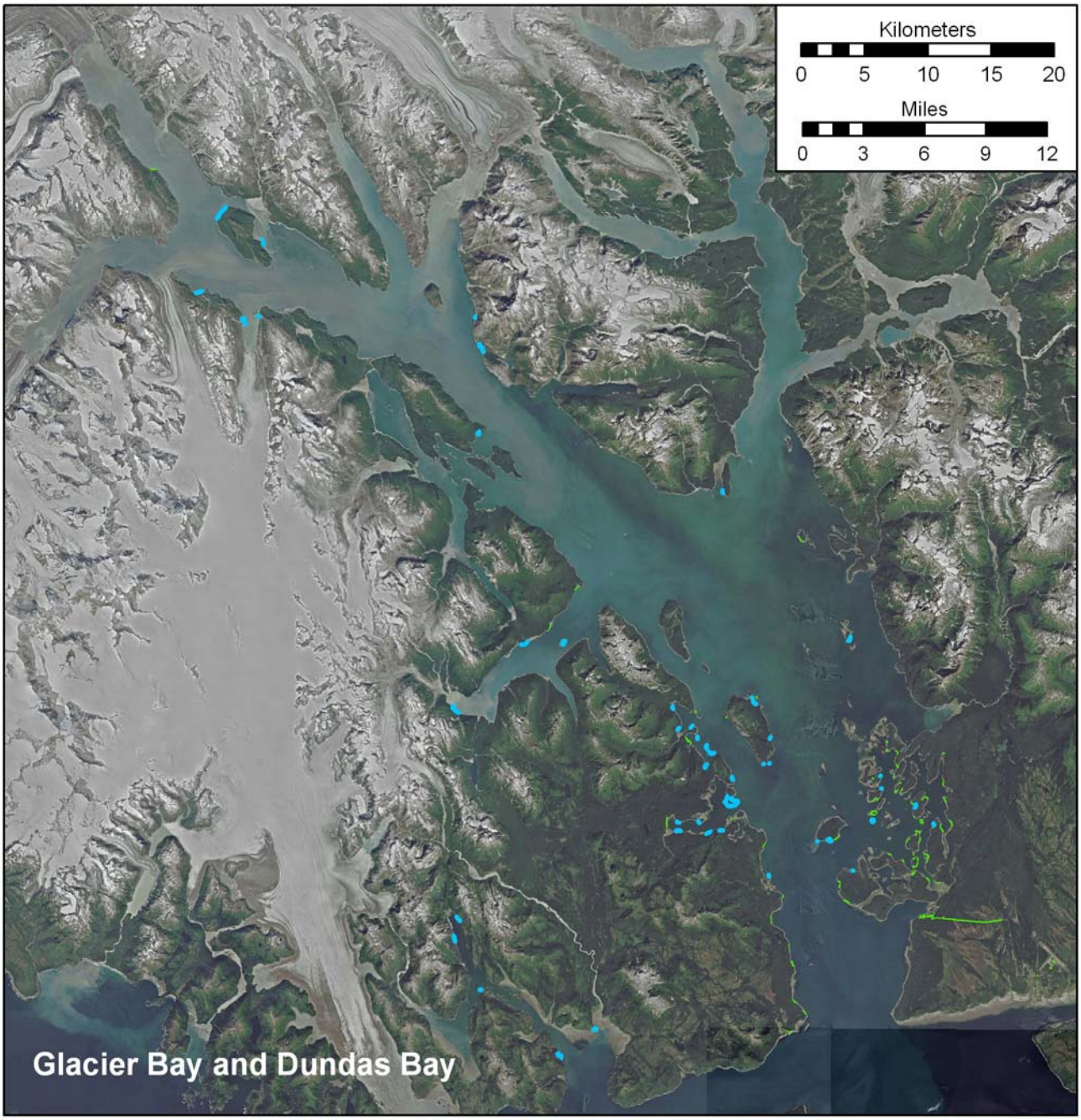
Trifolium repens distribution in Glacier Bay in 2005



Areas without Non-Native Species in Dry Bay in 2005



Areas without Non-Native Species in Glacier Bay in 2005



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

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

Achillea millefolium var. millefolium
Bromus inermis ssp. *inermis*
Hieracium aurantiacum
Hordeum jubatum
Leucanthemum vulgare
Linaria vulgaris
Matricaria discoidea
Phalaris arundinacea
Plantago major
Ranunculus repens
Ranunculus acris
Sonchus arvensis ssp. *uliginosus*
Sorbus aucuparia
Tanacetum vulgare
Taraxacum officinale
Trifolium hybridum
Trifolium repens

Common Yarrow

Achillea millefolium var. *millefolium* L.

Synonyms: Achillea millefolium L.
Other common name: none
Family: Asteraceae (Compositae)

Description
Common yarrow is an aromatic, rhizomatous perennial forb, growing 1 to 3 feet tall. Plants have woolly stems and leaves. The leaves are equally spaced along the stem; the blade is lanceolate 2 to 6 inches long and ¼ to 1 inch wide and finely divided into many narrow leaflets. The inflorescence has many small heads in a flat-topped cluster; each head has five white or pink ray flowers, and 10 to 20 disk flowers. The achenes are 1-2 mm long, flattened and hairless (Royer and Dickinson 1999, Whitson et al. 2000).

There appears to be both native and introduced genotypes of common yarrow in Alaska. Hultén (1968) describes the introduced taxon as having a combination of non-linear ultimate leaflets and light-brown margined involucral bracts, while the native taxa have either dark-brown margined bracts or linear ultimate leaflets. Hitchcock et al. (1955) describe the European taxon as found only in the eastern US in disturbed sites. The non-native form was described as having short and broad terminal leaflets, small heads (4-5 mm high), short ray flowers (2-3 mm long), weaker pubescence, and light margined involucral bracts (Hitchcock et al. 1955). The non-native taxon apparently can be distinguished by having a chromosome number of 2N = 54, while the native taxa have 2N = 36. Lid and Lid (1994), however, report a range of chromosome numbers for the European form, ranging from 2N = 18 – 72. In Alaska it is common to observe a wide range and combination of these morphological traits in single remote populations as well as disturbed roadside populations (Carlson, Lapina, and Lipkin pers. obs.). The various forms hybridize extensively creating a large variation in of morphology (ITIS 2004, Hurteau and Briggs 2003).

Identification of non-native *Achillea millefolium* remains dubious. Greater morphological, genetic, cytological, and ecological investigations are necessary to determine to what extent non-native genotypes are present in Alaska.
Another invasive species in Alaska sneezeweed (*Achillea ptarmica*) distinguished from A. millefolium by having incise, serrate leaves with very broad rachis (Hultén 1968).

Ecological Impact
Impact on community composition, structure, and interactions: Common yarrow tends to replace native species on rangelands, especially if heavily grazed or disturbed (Aleksoff 1999, Hurteau and Briggs 2003). It is slightly toxic to animals (Ohio State University 2004, USDA 2002). Common yarrow is an alternate host for chrysanthemum stunt virus (Royer and Dickinson 1999).
Impact on ecosystem process: Common yarrow is a pioneer species, but is also able to germinate and establish in grass turf (Bourdôt et al 1984). It colonizes open sites and is a good soil binder due to its extensive rhizomes; it persists throughout successions (Aleksoff 1999).

Biology and Invasive Potential

Reproductive potential: Common yarrow reproduces both by seed and rhizomes. A single plant is capable of producing over 4,000 seeds (Aleksoff 1999, Royer and Dickinson 1999).

Role of disturbance in establishment: Yarrow colonizes open disturbed sites, but it can also germinate and establish in grass turf (Bourdôt et al 1984). It tends to persist on overgrazed pastures (Collins 1987).

Potential for long-distance dispersal: Seeds can be dispersed short distance (6 feet) by wind (Bourdôt et al. 1985), but lack pappus.

Potential to be spread by human activity: Yarrow propagules often contaminate commercial seeds and gardens throw-outs (Hodkinson and Thompson 1997, USDA, ARS 2004). Due to its extensive rhizome system yarrow has been used in erosion control. There are numerous ornamental cultivars, which are readily available from commercial sources (Aleksoff 1999, Hurteau and Briggs 2003, Ohio State University 2004, USDA 2002).

Germination requirements: The viability of recently dehisced seeds exceeds 90%. Seed showed 41% germination after 9 years in dry storage (Bourdôt et al. 1985, Ohio State University 2004). Seeds germinate from no more than a 1 inch depth. They require light for germination and warm temperature s (65 -75° F) (Hurteau and Briggs 2003, Royer and Dickinson 1999).

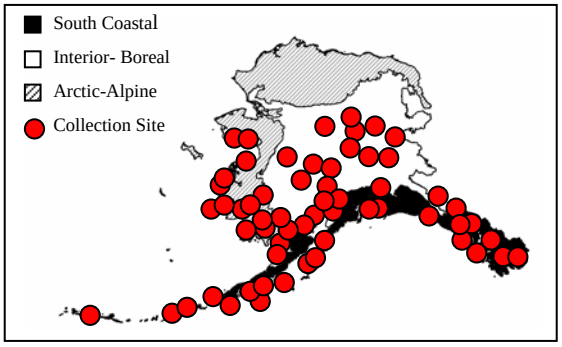
Growth requirements: Common yarrow is adapted to medium textured soils with pH ranging 6 to 8. It is drought and fire tolerant. The species can withstand winter temperature -38° F and requires 120 frost free days for development and reproduction. It does not tolerate shade and soil salinity (USDA 2002). Bourdôt et al (1984) report that it is moderately shade tolerant.

Congeneric weeds: *Achillea ptarmica* L. is invasive species in Alaska and other states. *A. filipendulina* Lam. is introduced but not weedy species (J. Riley – pers. com., USDA 2002).

Listing: Achillea millefolium is declared a noxious weed seed in Alaska (Invaders Database System 2003). It is considered a weed in Manitoba (Royer and Dickinson 1999).

Distribution and abundance

Native and current distribution: Common yarrow is a cosmopolitan weed, originally native to Europe and western Asia. It is now it is found throughout the temperate Northern Hemisphere, in all Canadian provinces and United States, except for the southwestern states, and in Mexico (Aleksoff 1999, Royer and Dickinson 1999, Whitson et al. 2000). The species has been recorded from all ecogeographic regions in Alaska (UAM 2004, Weeds of Alaska Database 2004). It generally occupies dry, well-drained, open sites including grassland, meadows, open forest, roadsides, and waste areas (Aleksoff 1999, Hurteau and Briggs 2003).



Management

Common yarrow does not survive cultivation and frequent mowing will suppress plant. Several herbicides are effective in controlling this species (Aleksoff 1999, Ohio State University 2004).

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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).

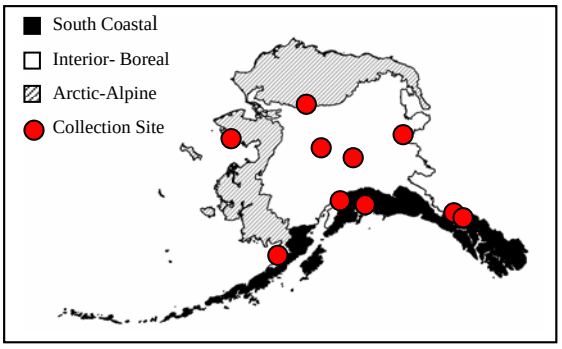
Ecological Impact
Impact on community composition, structure, and interactions: Smooth brome is a highly competitive. It forms a dense sod that often excludes other species, thus contributing to the reduction of species diversity in natural areas (Butterfield et al. 1996, Rutledge and McLendon). Smooth 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.).

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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

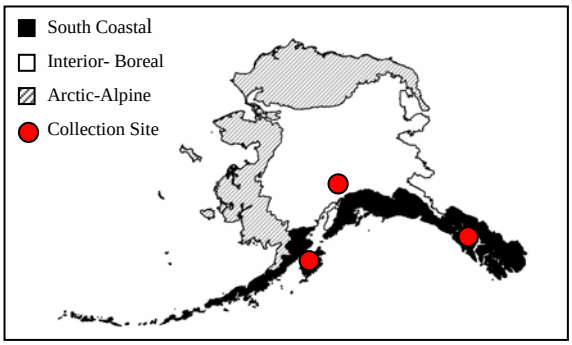
Meadow hawkweed. Photo by Michael Shephard, UDSA Forest Service

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.

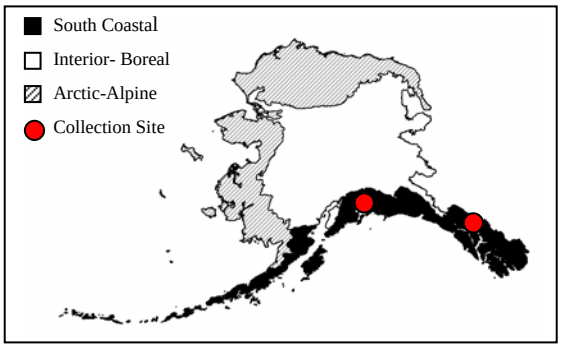
Distribution and Abundance

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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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).

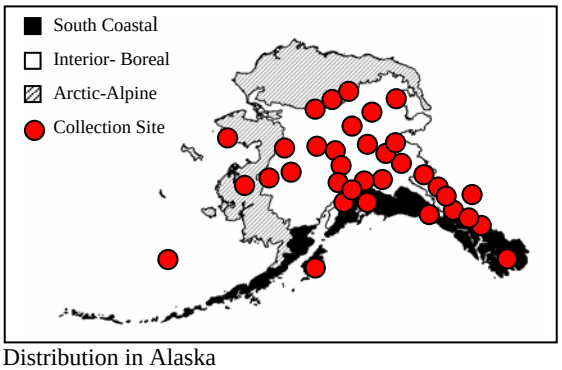
Foxtail barley is distinguished from cultivated barley (*Hordeum vulgare* L.) and the *Hordeum brachyantherum* by lemma awn length. *Hordeum brachyantherum* has awn lengths of ½ inch; foxtail barley has lengths of 1/2-3 inches; and cultivated barley of 10-15 cm in length. Foxtail barley hybridizes with *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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Linaria vulgaris P. Miller.

Synonyms: *Linaria linaria* (L.) Karst.
Common name: yellow toadflax, butter and eggs, 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.
Growth requirements: Germination is minimal without a two to eight week period of chilling (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.
Listing: 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.
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; pers. obs.).

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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, *Matricaria suaveolens* (Pursh) Buch., *Santolina suaveolens* Pursh, *Tanacetum suaveolens* Pursh Hook.
Common name: disc mayweed, pineappleweed.
Family: Asteraceae.

Description

Pineappleweed is a low-branching annual with leafy stems up to 1 + feet tall, but is generally less than 6 inches 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 *Matricaria discoidea* 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.
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 or vehicles.
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).
Growth requirements: Unknown.
Listing: Listed as a weed in Kentucky, Nebraska, and Manitoba (Royer and Dickinson 1999, USDA 2002).

Distribution and Abundance

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

Management

The plants are easy to pull up, although several weedings may be necessary. Herbicides are available, but this plant is resistant to some herbicides. No information is known about biological control.

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Phalaris arundinacea L.

Synonyms: *Phalaroides arundinacea* (L.) Raeusch.
Common name: reed canarygrass, 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: Reproduction is from seed and vegetatively by stout, creeping rhizomes in reed canarygrass.
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 no cold-stratification is required for germination. It is fire tolerant, withstands temperatures to -38°F, and requires 120 frost-free days. This species has dense porous summer vegetation, and no coppice potential (USDA 2002).
Listing: 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.

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).

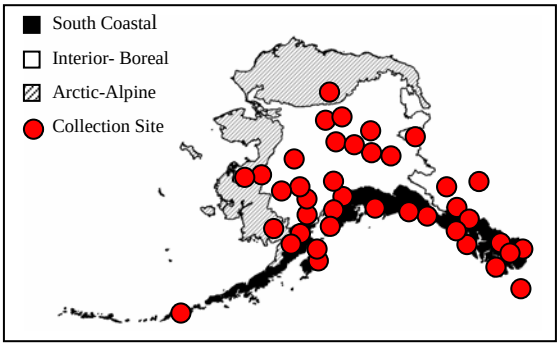
Six other species of plantain are known from Alaska, four of which are native. *Plantago major* is easily distinguished from these species by having broad, nearly hairless leaves and more than 6 seeds per capsule.

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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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).

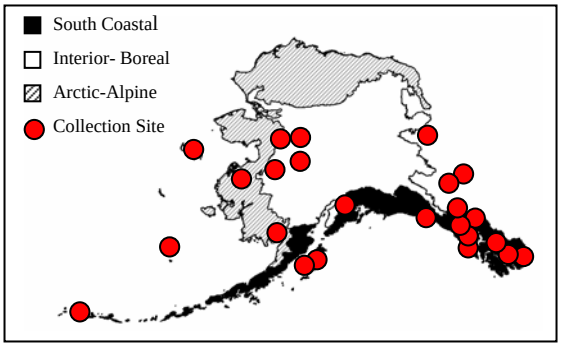
Photo by Kenneth J. Sytsma, University of Wisconsin-Madison, Wisconsin State Herbarium

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

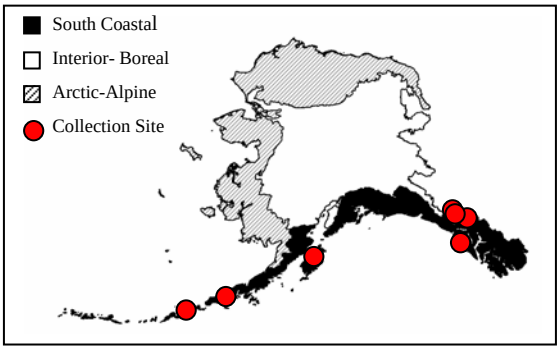
Creeping buttercup originated in Europe and extends northward to 72° N in Norway. It is now naturalized in many temperate regions of the globe including North, Central, and South America, Asia, Africa, Australia, and New Zealand (Harper 1975, Hultén 1968, NAPPO 2003). In Alaska this species has been 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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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).

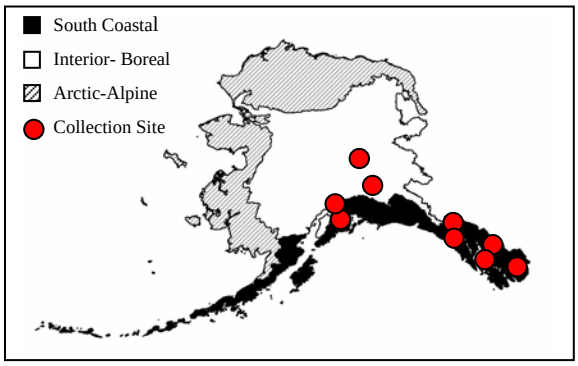
Ecological Impact
Impact on community composition, structure, and interactions: At high densities *Sonchus arvensis* has drastically reduced water resources and possibly decreased number of plants in communities (Butterfield et al. 1996). It is also a host of number of plant pests. This plant is acceptable 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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Last Updated November 24, 2004

Sorbus aucuparia L.

Synonyms: *Pyrus aucuparia* (L.) Gaertn.
Common name: European mountain ash, rowan
Family: Rosaceae

Description
European mountain ash is an upright tree growing 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 (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.
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 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).

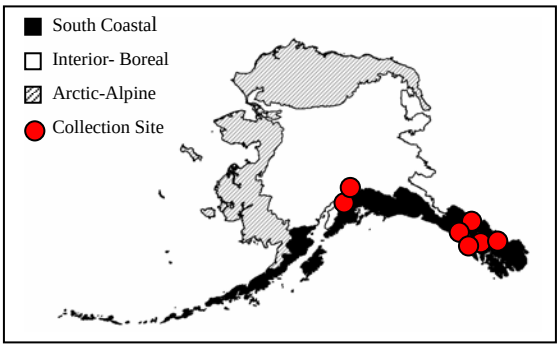
Common tansy resembles tansy ragwort (*Senecio jacobaea* L.), an introduced perennial from Europe. However, tansy ragwort has ray florets and seeds with pappus (Royer and Dickinson 1999).

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.

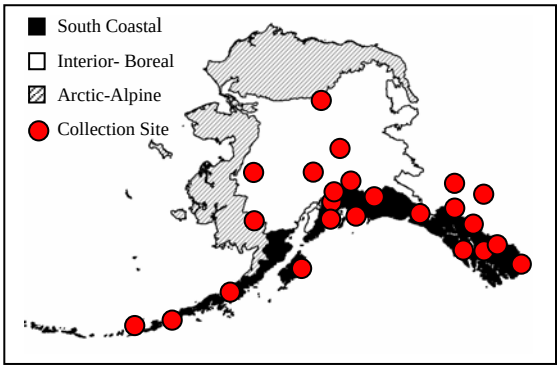
Current taxonomic treatments describe *T. officinale* as encompassing three subspecies, two introduced in Alaska (ssp. *officinale* and ssp. *vulgare*) and one native (ssp. *ceratophorum*) in the state (USDA Plants Database 2003). The non-native subspecies lack horns on the involucral bracts and have 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

Trifolium hybridum L.

Synonyms: *Trifolium elegans* Savi
Common name: alsike clover
Family: Fabaceae (Leguminosae)

Description
Alsike clover is a perennial. 6-20 inches tall, stems are ascending to erect and 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.
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 50 states, except 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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Trifolium repens L.

Synonyms: none.
Common name: white clover, 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 trifoliolate 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. Has high seeds abundance. Long lived seeds, some 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: Soil temperatures of at least 50°F are required for germination.
Growth requirements: White clover is adapted to fine and medium textured soils, pH levels of 6 – 7.5. It is shade intolerant, no cold-stratification is required. This species withstands temperatures to -39°F, and requires 150 frost-free days. This species has relatively porous summer vegetation (USDA 2002).
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: It is native to Europe and Asia. It has been introduced to north and southern Africa, N. and S. 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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