National Park Service
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Natural Resource Stewardship and Science

Invasive Plant Management in Kenai Fjords National Park

2023 Summary Report

Natural Resource Report NPS/KEFJ—2024





ON THIS PAGE
KEFJ biological science technician and SCA intern manually treat common dandelion at Yalik Glacier Beach.
Photography by NPS/Christina Kriedeman

ON THE COVER
Top left: KEFJ biologist applies herbicide to annual bluegrass at Holgate Public Use Cabin. Top right: KEFJ biological science technician and SCA intern apply herbicide at the Nature Center Plaza pumphouse. Lower left: KEFJ IPMT identifying invasive grasses on Herman Leirer Road. Lower right: KEFJ biological science technician and SCA intern apply herbicide at North Arm, Nuka Bay.
Photography by top left: NPS/Kelli Palaka; top right and lower left: NPS/Emily Anger; lower right: NPS/Christina Kriedeman.

Invasive Plant Management in Kenai Fjords National Park

2023 Summary Report

Natural Resource Report NPS/KEFJ—2024

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Abstract

This report serves as an overview of the Kenai Fjord National Park's (KEFJ) Invasive Plant Management Team's (IPMT) 2023 seasonal activities. The 2023 KEFJ IPMT consisted of a biologist, a biological science technician, a Student Conservation Association (SCA) intern, and two Youth Conservation Corps (YCC) employees. We surveyed and treated sites in 3 primary areas: Exit Glacier Area, the Coast, and Seward. Twelve invasive plant species were identified this year in the park. We used both hand pulling and herbicide methods to control invasive plant populations. We surveyed a total of 40.7 acres for invasive plants across the park. We manually treated 0.80 acres and chemically treated 0.31 acres of invasive plants. We used the spot spraying method to apply 4.6 gallons of Milestone herbicide mix at a rate of 6 ounces per acre, 0.87 gallons of Roundup Custom herbicide mix at a rate of 52 ounces per acre, and 2.75 gallons of Habitat herbicide mix at a rate of 48 ounces per acre in the Exit Glacier Area at the campground, Nature Center Plaza, Employee Housing, Harding Icefield Trail, Herman Leirer Road, and the Outwash Plain; the Seward area at the Maintenance Facility; and the Coast area at the rock ridge south of Dinglestadt Glacier, beach at the Head of North Arm, Aialik Public Use Cabin (PUC) and Holgate PUC. Wet weather impacted our ability to apply herbicide in the 2023 season and we were forced to manually treat many areas where we would have applied herbicide. We discovered a new non-native species on the Harding Icefield Trail identified as Kuepfer's buttercup (*Ranunculus kuepferi*). This is the first time this species was recorded in Alaska. In addition to manual and chemical treatment of invasive plants, we participated in outreach and partnership activities, including the 18th Seward Community Weed Pull that drew involvement from 22 volunteers which included seven kids from the Seward Boys and Girls Club. We hand pulled 380 pounds of bird vetch (Vicia cracca) at the Seward Middle School. We also attended the Kenai Peninsula Cooperative Invasive Species Management Area (KP-CISMA) spring invasive plant identification and herbicide safety training in Kenai, AK. We contributed to the Alaska-wide invasive defoliating moth monitoring program for the 12th year by installing five pheromone traps in the Exit Glacier Developed Area; no invasive moths were detected. Our primary recommendations for the 2024 season and beyond include monitoring annual bluegrass populations which were treated with the herbicide Habitat for the first time this year to determine effectiveness of the herbicide and identify any impacts to non-target vegetation; prioritizing chemical retreatment of invasive plant populations in the Maintenance Facility, Harding Icefield Trail and Herman Leirer Road locations during the summer; continuing treatment of existing invasive plant populations in coastal areas and surveying of high use coastal sites; use of the new Visitor Use Reporting System (VURn) online activity reporting database for Commercial Use Authorizations (CUA) holders to identify additional high use areas on the Coast; and continued involvement in moth monitoring, partnerships and outreach opportunities.

Acknowledgements

2023 was a successful year for the Kenai Fjords National Park Invasive Plant Management Team due in large part to the following individuals and their contributions: Student Conservation Association (SCA) intern Clarice Perry, for her invaluable assistance in the field and management of the Harding Icefield Trail register data and calibration surveys; Youth Conservation Corps (YCC) employees Makena Desermia and Emily Anger, for their support in the removal of invasive plant species, and for their positive attitudes and readiness to assist no matter the conditions; Alaska Regional IPMT Liaison Anna O'Brien and GIS Specialist Joel Cusick, for the pre-season regional training and continued advice and guidance provided throughout the season; Nathan Bawtinhimer, for logistical support and coordination of our Coastal trips on the M/V Couloir; Brandon Russel and Nathaniel Charbonneau, for logistical support and coordination of our Coastal trip on the M/V Serac; past KEFJ interpretive ranger, Yuri Blanco-Bezares, for her keen eyes and excellent plant identification skills, and Alaska Regional GIS Coordinator and Lead GIS Data Manager Angie Southwold, for data processing.

Thank you all for your support.

List of Terms

AKEPIC Alaska Exotic Plants Information Clearinghouse

AKISP Alaska Invasive Species Partnership

ACCS Alaska Center for Conservation Science

CUA Commercial Use Authorization

DNR Alaska Department of Natural Resources

EPMT Exotic Plant Management Team (historic name, used interchangeably with IPMT)

GIS Geospatial Information System

GPS Global Positioning System

GNSS Global Navigation Satellite System

IPMT Invasive Plant Management Team (new name replacing EPMT)

KEFJ Kenai Fjords

KP-CISMA Kenai Peninsula Cooperative Invasive Species Management Area

M/V Motor Vessel

NISIMS National Invasive Species Information Management System

NPS National Park Service

PUC Public Use Cabin

PUPS Pesticide Use Proposal System

RV Recreational Vehicle

SCA Student Conservation Association

SNOTEL Snow Telemetry Automated Weather and Climate Data Collection Station

VRP Visitor and Resource Protection

VURn Visitor Use Reporting System (Commercial Use Authorization (CUA) holders' activity reporting database)

YCC Youth Conservation Corps

Introduction

The Kenai Fjords National Park Invasive Plant Management Team (IPMT) has monitored, mapped, and treated invasive plants in the park since 2004 using a strategy of early detection and rapid response (EDRR). EDRR aims to detect and remove invasive plants from an area before they spread, become established, or cause harm. Removal of invasive plants in KEFJ includes both manual (hand pulling) and chemical (application of herbicide) treatment methods. The method used can vary by location and is determined based on population size, proximity to high-traffic public use areas, weather, and additional factors.

The management of invasive species in the park is divided into 3 primary areas: Exit Glacier Area, the Coast, and the Seward area (Figure 1). The Exit Glacier Area includes the only vehicle-accessible road and established hiking trails in the park and has the highest number of visitors each summer. The Exit Glacier Area has the largest populations and highest diversity of invasive plants found within the park boundary and is also easily accessible for the IPMT to provide treatment, making it a high priority for invasive species management.

The Coast area has fewer visitors and no developed trails but is also a high priority for the KEFJ IPMT. Small and isolated invasive plant populations have been found in areas that are used by visitors, such as Public Use Cabins (PUC) and popular camping areas. The Coast, however, is remote, and access is limited to aircraft or boat traffic making it difficult to survey for and treat invasive plant populations. It is important to continue to monitor the coastal areas so that small invasive plant populations remain controlled and do not become further established to avoid the need for additional, more costly, intervention by the IPMT.

The Seward area includes the Maintenance Facility, Shea Parking Lot, and Visitor Center, which are all park properties located outside the park's boundary. These sites are located near roads and properties that are infested with invasive plants, and thus have a high diversity of species on these properties. Control efforts have been primarily focused on the Maintenance Facility because park vehicles and other equipment are staged there. It is important that invasive plants are managed here to prevent park vehicles and employees from becoming vectors for the spread of invasive plants into the park. The Shea Parking Lot and the Visitor Center are surveyed and treated as time allows.

Prevention, restoration, and outreach are also tools used by the KEFJ IPMT to reduce the number of invasive plant populations established in the park. These efforts include: the maintenance of boot brushes with interpretive displays that are made available to the public at established trail heads and in the Seward area to prevent the spread of invasive plant seeds into remote areas; the provision of hand-held brushes to park staff for cleaning shoes and clothing before working in remote areas of the park; the collection of native plant seed for the park's seed bank for future restoration projects; and finally, the involvement in outreach throughout the year, including NPS employee presentations, community events and social media posts. Through the strategic management of invasive plant species, the KEFJ IPMT is dedicated to the preservation of native ecosystems and flora within the park.

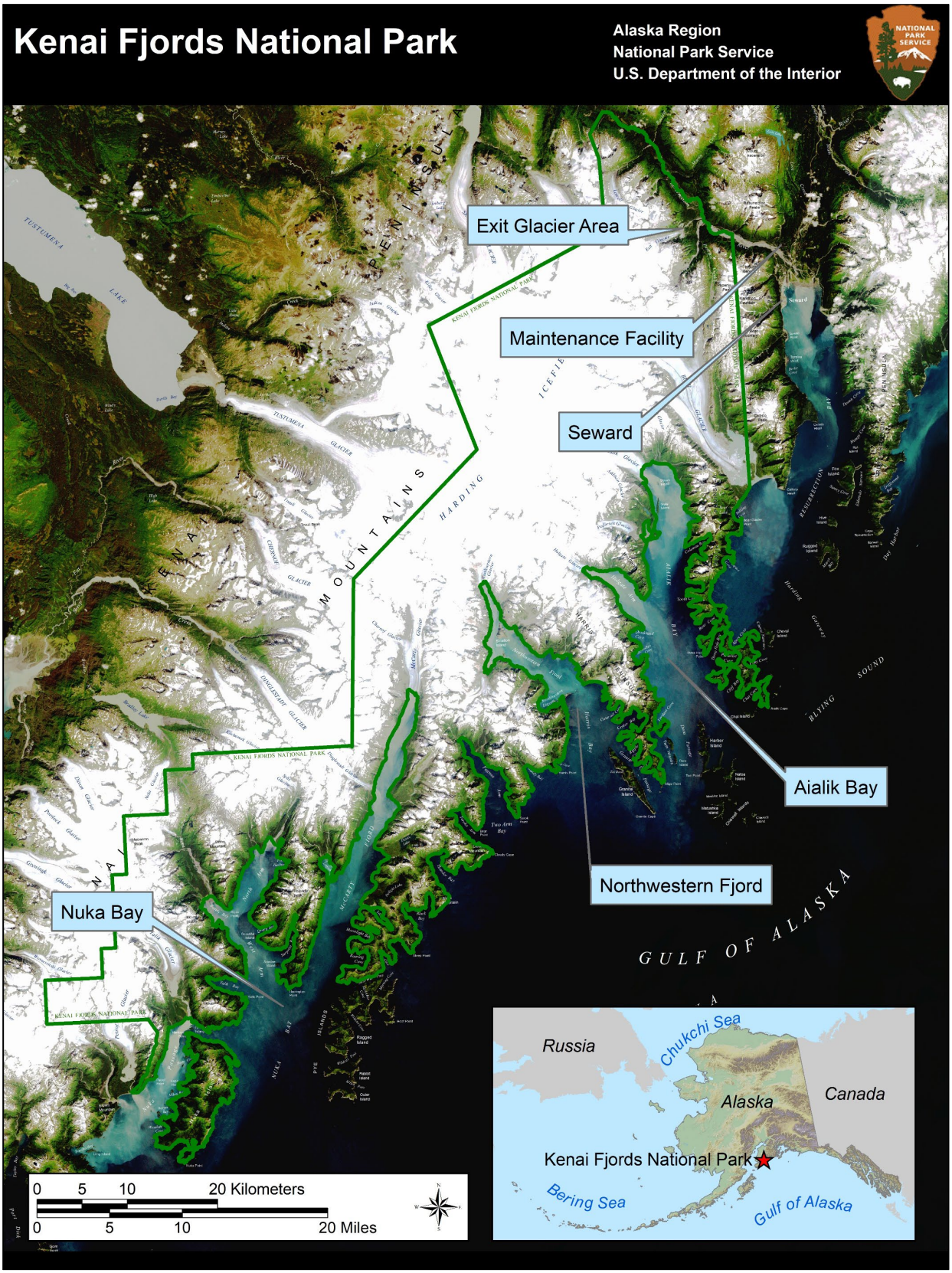


Figure 1. Overview of Kenai Fjords National Park.

Methods

Methods for data collection and processing followed the Alaska Invasive Plant Management Team 2023 Field Protocol (O'Brien, 2023) and the Alaska Invasive Plant Management Team 2023 Office Protocol (O'Brien, 2023) developed by the Alaska Regional IPMT program. These protocols outline methods for data collection and processing. We created a schedule for survey and treatment efforts for the season based on recommendations from the previous year's final summary report and from weekly field reports completed in 2022. See Table 1 for a list of project areas included in the 2023 field season schedule.

Table 1. KEFJ 2023 Project Areas

Areas	Field Sites
Exit Glacier	Herman Leirer Road, Exit Glacier Parking Area, Campground, SNOTEL, Nature Center Plaza, Glacier View Loop Trail, Glacier Overlook Loop Trail, Harding Icefield Trail, Nike Stripe, Outwash Plain, Employee Housing, Pump House
Coastal	Resurrection Bay, Aialik Bay, Northwestern Fjord, Nuka Bay
Seward	Maintenance Facility

Prioritizing Treatment

Because resources and staffing are limited for invasive plant management, the planning and prioritization of invasive plant treatment is guided by a variety of factors including population size, invasiveness ranking, geographic location, and ease of access. Prioritization in KEFJ is informed by an invasiveness ranking system developed by the Alaska Center for Conservation Science (ACCS) in collaboration with land managers, biologists, and weed scientists across the state. This invasiveness ranking system includes at least 170 known invasive plants within the state and is based on a scale of 0 to 100; a plant ranked as 0 is no threat to native ecosystems, while a plant ranked at 100 is a very high threat to native ecosystems. The invasiveness ranking system for invasive plants in Alaska is based on an initial climate screening and an evaluation of ecological impacts, biological characteristics and dispersal ability, ecological amplitude and distribution, and feasibility of control (Carlson et al. 2008). Invasive plants with a medium to high invasiveness ranking (50 to 100) are a high priority for control efforts for KEFJ IPMT across the park.

In the Exit Glacier Area, the primary goal is to reduce the populations of invasive plants in the developed areas and to prevent their spread down trails and into the undeveloped areas which have been naturally disturbed by glacier-fed hydrology. These types of areas commonly have little native vegetative cover and invasive plants do not have to compete with native plants for space. On the Coast and in remote areas, the treatment of all invasive plant populations is also a high priority. Currently there are few known invasive plant populations in coastal areas of the park and these populations are still small. If invasive plant populations can be discovered while they are still small and easy to treat, there is a greater chance that they can be contained to reduce spread or be completely eradicated. Our goal is to treat all coastal invasive plant populations at least once during

the summer. As the opportunity arises, we resurvey sites and retreat when conditions allow. In the Seward Area, the Maintenance Facility is our highest priority because it stages NPS equipment that is used by NPS employees who frequent other areas of the park. Some departments, such as Maintenance and Trail Crew, visit the Maintenance Facility daily prior to traveling elsewhere in the park to complete their work. Our goal in the Maintenance Facility is to treat invasive plants at least twice in a year to reduce the populations and prevent the hitchhiking of seeds into remote areas of the park.

Control Methods

Manual Treatment

Manual treatment involved removing a plant or plant parts by either hand pulling or by using hand tools to dig up the plant. We used this method on invasive plant populations that were small and were easily hand pulled, and on species that did not have rhizomatous roots. Flower heads were removed before herbicide was applied to prevent plants from developing viable seeds after treatment. We put all plant parts that we manually controlled into bags and disposed of them at the Seward Waste Transfer Facility.



YCC employee uses manual methods (hand pulling) to remove common dandelion on the Glacier Overlook Loop Trail (NPS/Christina Kriedeman).

Chemical Treatment

We used three types of herbicides to chemically treat invasive plants in 2023. Milestone (Aminopyralid) was applied to broadleaf plants at a rate of 6 ounces per acre. Roundup Custom (Glyphosate) was applied to grasses and some broadleaf plants at a rate of 52 ounces per acre, and Habitat (Imazapyr) was applied to annual bluegrass at a rate of 48 ounces per acre in a pilot project to test the effectiveness of treating this species. We treated annual bluegrass with Roundup Custom for

multiple years and it has not been effective at reducing populations because of the seed bank that remains in the soil. Our goal is to try using Habitat, which provides preemergence and postemergence residual control, to see if we can control annual bluegrass that has sprouted as well as the seeds that are already in the soil. We hope to be able to control populations over a few seasons of applications and reduce the amount of herbicide used over time. One concern with using Habitat is the potential impact it may have on non-target plant species located near application areas, so as a precaution we avoided applying Habitat to annual bluegrass populations located under the dripline of any trees. We will continue to apply Roundup Custom to annual bluegrass populations under tree driplines to keep them from producing additional seeds and to control grass as it sprouts. Two additional adjuvants were added to all herbicide mixtures. We added Spreader 90, a surfactant used to improve herbicide coverage and adhesion to a plant's surface, at a rate of 0.08 ounces per gallon, and Turf Trax Blue, a blue dye colorant used to indicate where herbicide was sprayed, at a rate of 0.5 ounces per gallon. We applied the herbicide mixture using backpack sprayers calibrated to a rate of 32 gallons per acre. We used a spot spray method to apply herbicide at an estimated 4 ml per spray. The biological science technician and SCA intern applied herbicide under the Alaska pesticide applicator license of the KEFJ biologist. All herbicide use was approved and reported using the National Park Service (NPS) Pesticide Use Proposal System (PUPS).



Biological science technician adding chemical to create the herbicide mix (NPS/Morgan Valone).

We used laminated herbicide labels for each backpack sprayer that included the product name of each chemical added, the concentration per gallon, calibration rate of the backpack sprayer and the carrier solution of the mix.

Data Collection and Analysis

Data collection and processing methods followed guidelines provided in the Alaska IPMT Field and Office Protocols. In 2023, we changed data collection tools from what we had been using since 2003. We moved from using Trimble GPS units which can be used to collect both information and spatial

data in one unit, to using tablets with separate GNSS receivers to collect data. We collected data using a Samsung Galaxy Tab Active3 tablet and a Trimble R1 GNSS (Global Navigation Satellite System) Receiver. ESRI Field Maps software was used to collect data on the tablet and Trimble Mobile Manager was used to connect the Trimble R1 receiver to the tablet. Data was downloaded and edited using ArcGIS Online (AGOL). Data was submitted to the Alaska Region IPMT throughout this online platform and reviewed for accuracy regularly throughout the summer. Finalized data was post-processed into a Geospatial Information System (GIS) geodatabase by the Alaska Regional GIS Specialist and Alaska Region IPMT Liaison. The AK Regional IPMT submitted the data to both the Alaska Exotic Plants Information Clearinghouse (AKEPIC) and the National Park Services' National Invasive Species Information Management System (NISMS) databases.

We also documented all herbicide use in an Excel spreadsheet and through Herbicide Data Sheets. Weekly field reports were completed to document invasive plant work and timing of control activities. All field notebook pages were scanned and stored on the KEFJ network drive.

The KEFJ IPMT utilized standardized polygons to collect herbicide treatment data on Herman Leirer Road, in the Exit Glacier Parking Lot, the Outwash Plain, and at the Maintenance Facility. This data collection method utilizes a standard boundary for a given treatment area that remains constant from year to year. The use of standardized polygons allows for the collection of a single GPS/GNSS point with herbicide use information for each standardized polygon, instead of having to remap the entire perimeter of a population every year. This method allows for efficient data collection in the field, and the amount of herbicide used each season within the standardized polygons can be compared to the previous years' data to determine efficacy of treatments and to track herbicide use more accurately over time (Appendix B, C, D, E).

The KEFJ IPMT used handheld tally counters to calculate the amount of herbicide used when we applied small amounts of herbicide in standardized polygons or treated small populations. We used a standard herbicide amount per squirt applied with backpack sprayers to each plant to calculate the number of gallons sprayed. Each squirt is equivalent to 0.001 gallons of herbicide mix. This number multiplied by the tally count gave us our total gallons of herbicide used.

Personnel

The KEFJ IPMT had 5 members in 2023. The KEFJ biologist managed the invasive program in the park including completing planning and herbicide applications, compliance requirements, and supervising the biological science technician, SCA intern and two Youth Conservation Corps (YCC) employees. The biological science technician served as the field crew lead, planned field activities throughout the season, applied herbicide and pulled invasive plants, recorded, and processed data, kept track of herbicide use totals, and completed weekly field reports. The SCA intern assisted in herbicide application and hand pulling as well as data collection and processing. The two YCC employees assisted with surveying and hand pulling invasive plants.



KEFJ Invasive Plant Management Team 2023 (NPS/Aaron Vachowski).

Results

2023 Season Overview

The 2023 KEFJ IPMT completed a variety of projects over the summer including, invasive plant survey and control, collection of native seeds, outreach, and education, and monitoring for defoliating moths in the Exit Glacier Area. We completed our work with a team of 5 individuals: one biologist, one biological science technician, one Student Conservation Association (SCA) intern, and two Youth Conservation Corps (YCC) employees. We also worked collaboratively on projects with staff from the NPS Alaska Regional IPMT, Kenai Peninsula Cooperative Invasive Species Management Area (KP-CISMA) partners, and the SCA trail crew working with the KEFJ maintenance team.

Invasive plant management activities were completed in three primary areas of the park: the Exit Glacier Area, the Coast, and Seward (this includes the Maintenance Facility and other park properties outside of the park boundary). We spent the most time surveying and controlling invasive plants in the Exit Glacier Area since it is the only area in the park that is accessible by road and the most visited area in the park (Appendix A). We used both manual treatment (hand pulling) and herbicide application to treat a total of 1.1 acres of invasive plants across all park properties (Table 2). We manually treated 0.31 acres in 2023. Due to the high numbers of rainy days during the summer, we manually treated many sites where herbicide application would have been more efficient and effective. We used 4.61 gallons of Milestone herbicide mix to treat 0.14 acres; 2.75 gallons of Habitat herbicide mix to treat 0.08 acres, and 1.00 gallons of Roundup Custom mix to treat 0.03 acres. This is the first year we used the herbicide Habitat in KEFJ.

Table 2. Summary of Kenai Fjords National Park Invasive Plant Work in 2023.

Invasive Plant GPS Data **NPS Lands**			
Year	**Species Acres Surveyed[1]**	**Species Acres Infested[2]**	**Acres Treated[3]**
2023	40.70	1.11	1.11

The January 2018 NPS Land Status geodatabase was used to delineate NPS lands in acreage calculations.
[1]Acres surveyed represent the total area mapped.
[2]Acres infested represent the area of a mapped infestation multiplied by the percent cover of invasive plants in that mapped area.
[3]Acres treated represent the area of a mapped infestation multiplied by the percent cover of invasive plants in that mapped area and by the percent of the infestation treated.

Across our 3 focus areas, we treated 12 species of invasive plants (Table 3). We found common dandelion (*Taraxacum officinale*) and annual bluegrass (*Poa annua*) in all 3 areas: the Exit Glacier Area, the Coast, and Seward.

We collected a non-native Kuepfer's buttercup (*Ranunculus kuepferi*) on the Harding Icefield Trail in the Exit Glacier Area. This plant was discovered in 2022 by an Interpretive Ranger, but we were unable to collect the plant while it was still flowering that year. This specimen was collected in 2023 and sent to the Alaska Center for Conservation Science botanist at University of Alaska Anchorage for identification and documentation. Identification was confirmed by the botanist that holds its namesake, Philippe Kuepferi, and he believes it is the first time it has been observed outside its range in Europe (J. Fulkerson, personal communication, October 26, 2023).

We also saw in increase in the oxeye daisy population around the Exit Glacier area from previous years. Oxeye daisy (*Leucanthemum vulgare*) was found on Herman Leirer Road, the Glacier View Loop Trail, and the Glacier Overlook Loop Trail in the Exit Glacier Area. On the Glacier Overlook Loop Trail, oxeye daisy was found again in the same location that it was last seen in 2018 (Geier and Kriedeman 2019).

We were unable to treat any of the common dandelion populations in the Outwash Plain standardized polygons on the south side of Exit Creek in 2023. Weather conditions were wet and rainy for much of June and early July and Exit Creek became too high to safely cross to access the area later in the summer.

Table 3. Invasive plant species and locations in 2023.

Species		**AKNHP Ranking**	**Location**			
Latin Name	**Common Name**		**Exit Glacier**	**Coast**	**Shea Lot***	**Maintenance**
Alopecurus pratensis	meadow foxtail	52	X	—	—	—
Anthemis cotula	stinking chamomile	41	H	—	—	—
Bromus inermis	smooth brome	62	H	—	—	—
Capsella bursa-pastoris	shepherd’s purse	40	H	—	X	H

Capsella rubella	pink shepherd's purse	—	—	—	—	H
Chenopodium album	lambsquarters	37	H	—	—	—
Cerastium fontanum	big chickweed	36	X	—	X	X
Crepis tectorum	narrowleaf hawksbeard	56	H	—	—	H
Elymus repens	quackgrass	59	—	—	X	—
Galeopsis spp.	hemp nettle	50	—	—	X	—
Hordeum jubatum	foxtail barley	63	X	—	—	—
Leontodon autumnalis	fall dandelion	51	H	—	—	—
Leucanthemum vulgare	oxeye daisy	61	X	—	X	H
Linaria vulgaris	yellow toadflax	69	H	—	—	—
Matricaria discoidea	pineapple weed	32	X	H	X	X
Papaver croceum	Icelandic poppy	39	H	—	—	—
Phleum pratense	common timothy	54	X	H	H	—
Plantago major	common plantain	44	X	H	X	X
Poa annua	annual bluegrass	46	X	X	X	X
Poa pratensis	Kentucky bluegrass	52	H	—	—	
Polygonum aviculare	prostrate knotweed	45	H	—	X	H
Ranunculus acris	tall buttercup	54	H	—	—	—
Ranunculus kuepferi	Kuepfer's Buttercup	—	X	—	—	—
Rumex acetosella	common sheep sorrel	51	H	—	X	—
Rumex crispis	curly dock	48	H	H	X	—
Stellaria media	common chickweed	42	H	—	X	X
Taraxacum officinale	common dandelion	58	X	X	X	X
Trifolium hybridum	alsike clover	57	H	—	—	—
Trifolium pratense	red clover	53	H	—	—	—
Trifolium repens	white clover	59	X	—	X	H

Key: X=Present, H=Historically Present

*Shea lot was not surveyed in 2023, species noted here were last detected in 2022.

We surveyed areas along the Coast on four separate occasions in 2023. On the first occasion in July, we spent six days onboard the M/V Serac surveying and treating sites in Nuka Bay and Northwestern Fjord. The following week in July, we spent two days in Aialik Bay. We closed the two Public Use Cabins (PUCs) for a week and applied the herbicide Habitat to annual bluegrass populations growing around the cabins. We have treated these populations with Roundup Custom several times, but it has not successfully reduced the size and density of these populations. This was a pilot project to determine if the herbicide Habitat is effective at controlling this annual grass. While assisting with a KEFJ physical science program trip on the M/V Serac trip in August, we spent three days opportunistically surveying for invasive plants at sites in McCarty Fjord and Northwestern Fjord. We

also took a daytrip in mid-August to Aialik Bay to resurvey areas where we applied Habitat around the Public Use Cabins and surveyed additional sites.

In the Seward area, we focused our efforts on the Maintenance Facility where park vehicles and equipment are moved to and from the park. We applied herbicide to five species: common dandelion, common chickweed (*Stellaria media*), big chickweed (*Cerastium fontanum*), pineapple weed (*Matricaria discoidea*) and annual bluegrass.

We completed several outreach and education activities this year. We held the 18th Seward Community Weed Pull at the Seward Middle School in coordination with KP-CISMA partners. We had 22 participants from the Seward Boys and Girls Club, US Forest Service, Homer Soil and Water Conservation District, Kenai Watershed Forum, National Park Service, and Seward community members. We hand pulled a total of 380 pounds of bird vetch (*Vicia cracca*). We developed social media posts about invasive plant topics for the park's social media. We also presented, both formally and informally to park staff and the public, on IPMT successes and goals and ways to reduce impact on the spread of invasive species in the park. We also presented an update on the park's invasive species work at the Kenai Peninsula Fish Habitat Science Symposium.

We did not complete any restoration projects in 2023 but we did collect seeds from five species of native plants in the Exit Glacier Area for use in future restoration projects.

As part of the Alaska Division of Agriculture Alaska-wide monitoring program, we installed five Delta insect traps with pheromone lures to monitor for invasive defoliating moths, such as (*Lymantria dispar dispar and L.dispar asiatica*) or commonly known as spongy moths, around the Exit Glacier Area. Invasive defoliating moths have not yet been found in the park and this trend continued with all traps yielding negative results in 2023.

Notable Weather Conditions

A winter with a high snowpack that lingered in the Spring and a summer with many wet and rainy days impacted our ability to complete field work this summer. At the beginning of May, there was still 51.4 inches of snow on the ground in the Exit Glacier area and the cool temperatures in May and June (Table 4) slowed snow melt and plant phenology.

Table 4. 2023 Exit Glacier area monthly precipitation and average daily temperatures.

Month	May	June	July	August	Total
Monthly precipitation (in)	4.3	4.2	4.7	7.9	21.1
Average daily temperature (F)	41.3	49.6	54,5	54.7	-

(USDA 2023)

When invasive plants did sprout, rainy and wet conditions throughout June, July and August kept us from applying herbicide to many of our project sites and we had to hand pull plants instead. Because of rainy weather in June and a melting snowpack at high elevations, Exit Creek water levels were too high to safely cross by the time we had some stretches of dry weather later in early July. Since we

could not safely cross the creek, we were never able to apply herbicide to the large populations of common dandelion that are located on the south side of the creek this year.

Exit Glacier Area

Herman Leirer Road

The Herman Leirer Road area consists of eight standardized polygons split between the north and south sides of the road (Appendix B). We treated all eight standardized polygons in 2023. We treated standardized polygons closest to the Resurrection River Bridge (N4, S4) first and then continued toward the parking lot. Snow along the road melts first near the bridge and invasive plant populations begin sprouting earliest in this area. We used a total of 2.745 gallons of Milestone herbicide mix to spot spray common dandelion (*Taraxacum officinale*) and 1 population of white clover (*Trifolium repens)* on June 13 and 14. We also manually treated big chickweed (*Cerastium fontanum*) on June 13. On July 5, we resurveyed polygons N4 and S4 and manually pulled 66 common dandelion flower heads. We did not fully retreat the Herman Leirer Road standardized polygons for common dandelion for a second time in 2023 because of rainy weather and time constraints.



Biologist and biological science technician apply herbicide to common dandelion on Herman Leirer Road (NPS/Emily Anger).

Later in the summer on July 27, 28 and Aug 1, we resurveyed all 8 standardized polygons for invasive grasses when they were in flower, but also treated other species opportunistically. On July 28, we hand pulled white clover (*Trifolium repens)*, oxeye daisy (*Leucanthemum vulgare)* and common plantain (*Plantago major)*. We found meadow foxtail (*Alopecurus pratensis)* spread across 3 of the standardized polygons during our first survey and treated it on August 1 with 0.066 gallons of Roundup Custom herbicide mix. On August 1 and 14, we surveyed areas where foxtail barley (*Hordeum jubatum*) had been treated in previous years. We manually treated approximately 16 plants

in total. We resurveyed these areas again on August 22 and did not find any additional foxtail barley specimens.

On August 18, we treated a population of big chickweed and four common dandelion individuals with 0.2790 gallons of Roundup Custom herbicide mix. Roundup Custom was used in lieu of Milestone because we had excess Roundup Custom that was already mixed and needed to be used before the end of the season.



Biologist, biological science technician, and YCC employee use handheld lenses and field guides to identify native and non-native grasses on Herman Leirer Road (NPS/Emily Anger).

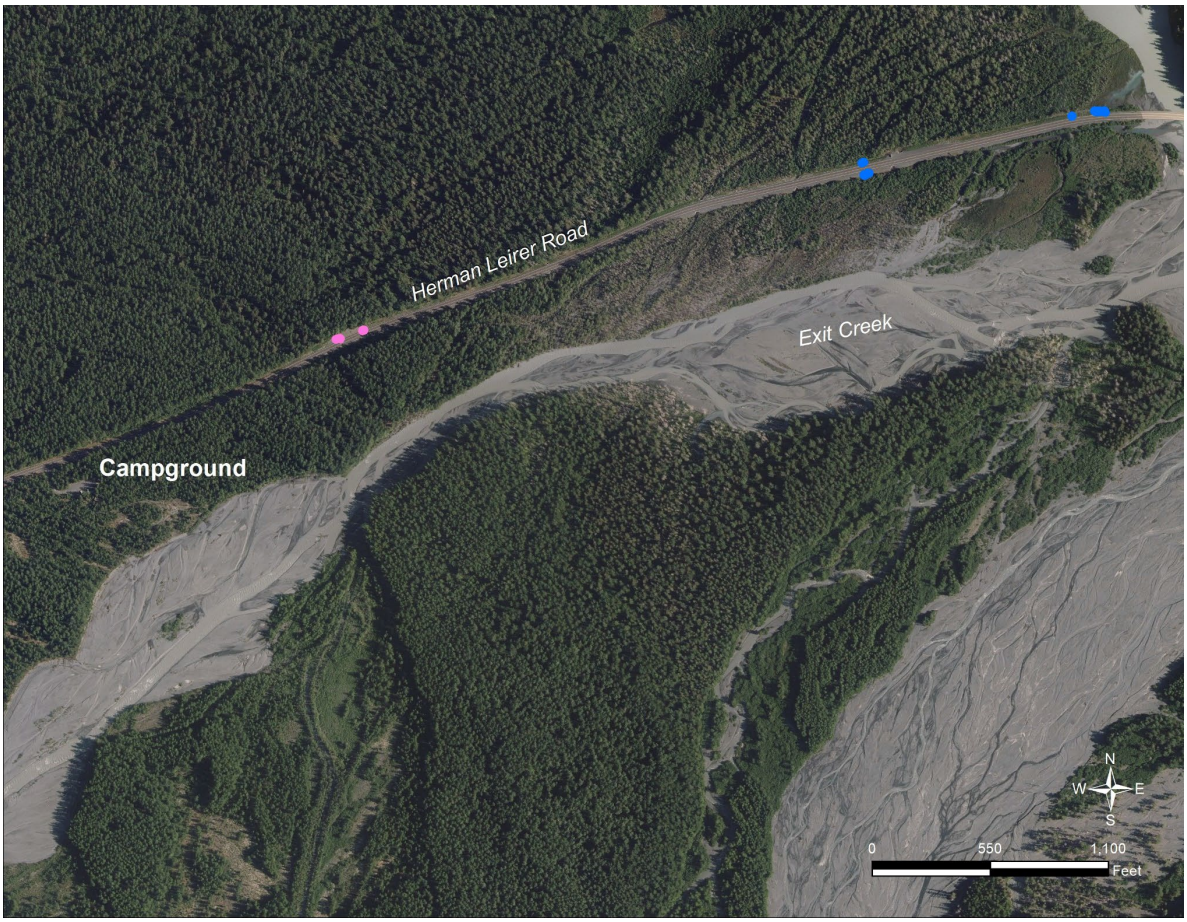


Figure 2. Invasive grasses meadow foxtail (blue) and foxtail barley (pink) treated on Herman Leirer Road.

Exit Glacier Parking Area

The Exit Glacier Parking Area, which provides access to the Nature Center and associated trails, consists of nine standardized polygons that vary in size and correspond to the different islands of vegetation present in the parking lot (Appendix C). When weather conditions allow, we apply herbicide in all polygons except for polygons EG_PL_3 and EG_PL_4. These two polygons are high-traffic areas for the public because of their location relative to the Nature Center and pedestrian walkway. We always manually treat EG_PL_3 and EG_PL_4 to reduce public-herbicide exposure.



Biological science technician and YCC employee manually treat annual bluegrass in the Exit Glacier Parking Lot (NPS/Emily Anger).

In 2023, we manually treated invasive plants in all the Exit Glacier parking lot standardized polygons instead of applying herbicide because of rainy weather conditions early in the season. We surveyed and hand pulled common dandelion and common plantain in all the standardized polygons twice during the summer. We surveyed and treated the parking lot once throughout June 9, 12, 14, and 15, and a second time across July 28, August 2, 17, 18 and 22. On July 24, we applied 0.02 gallons of Milestone herbicide mix to common dandelion in the east end of EG_PL_1 near the entrance to the parking lot. This was the only polygon where herbicide was applied in the Exit Glacier Parking Area in 2023. We also hand pulled white clover *(Trifolium repens*), pineapple weed (*Matricaria discoidea*), and big chickweed (*Cerastium fontanum*), and common timothy (*Phleum pratense*) in 2023 (Figure 3).

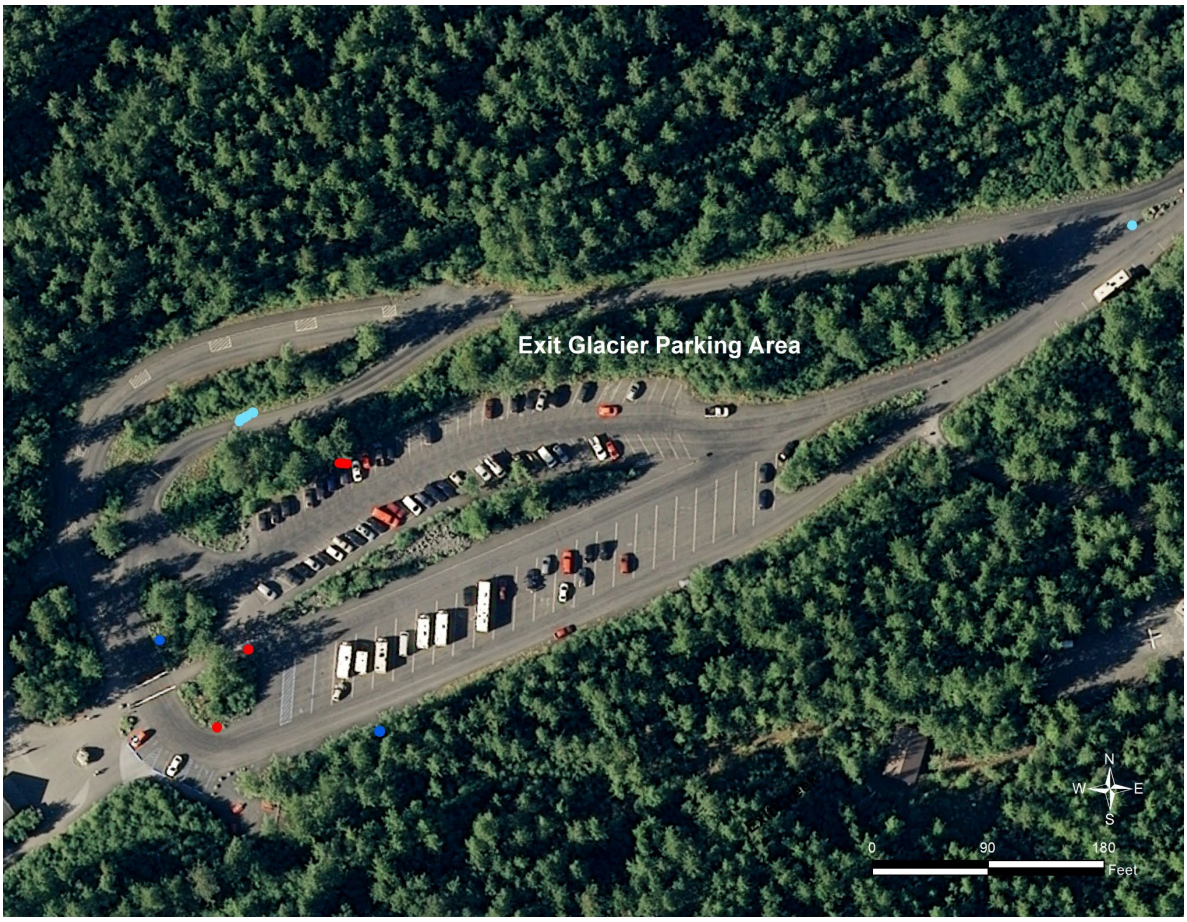


Figure 3. White clover (red), big chickweed (light blue), and common timothy (dark blue) were mapped, and hand pulled in the Exit Glacier Parking Area.

Campground

Exit Glacier campground consists of the campground parking lot, 12 walk-in tent sites and the various trails to each tent site (Figure 4). We surveyed Exit Glacier campground on June 12 and July 24 and hand pulled annual bluegrass (*Poa annua*) and common dandelion in the campsites and along the trails. We hand pulled one population of common dandelion in the parking lot. On July 25, we revisited the parking lot of the campground area and applied 0.235 gallons of Habitat herbicide mix to annual bluegrass.

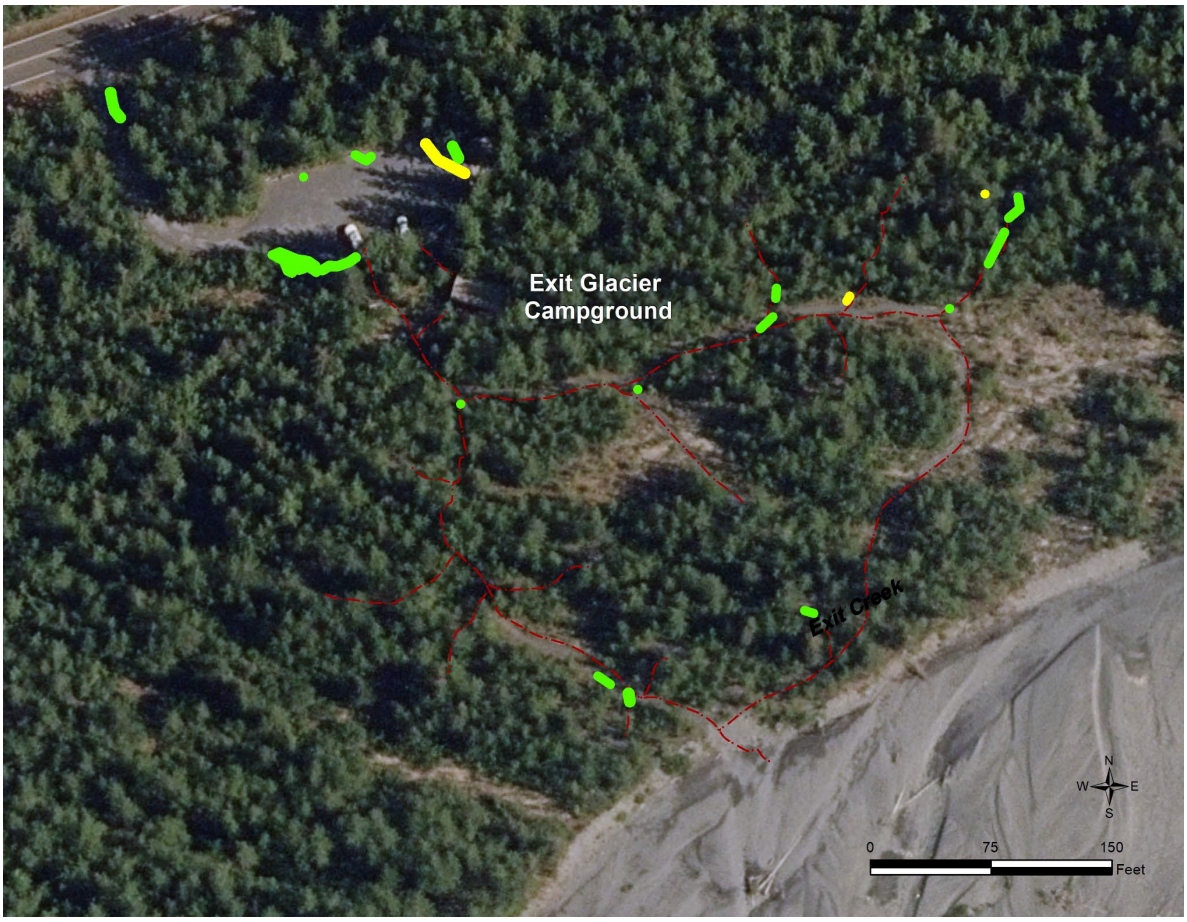


Figure 4. Common dandelion (yellow) and annual bluegrass (green) treated in the campground.

SNOTEL

The Snow Telemetry Automated Weather and Climate Data Collection Station (SNOTEL) site is a small open area located west of Employee Housing that houses specialized equipment for local climate monitoring (Figure 5). We first found common dandelion here in 2012 (Fulton 2013). During the 2023 season, we surveyed the SNOTEL site on June 27 and August 7 and did not find any invasive plants. We have not found invasive plants here since 2020 (Gage and Kriedeman 2022, Visconti and Kriedeman 2023).

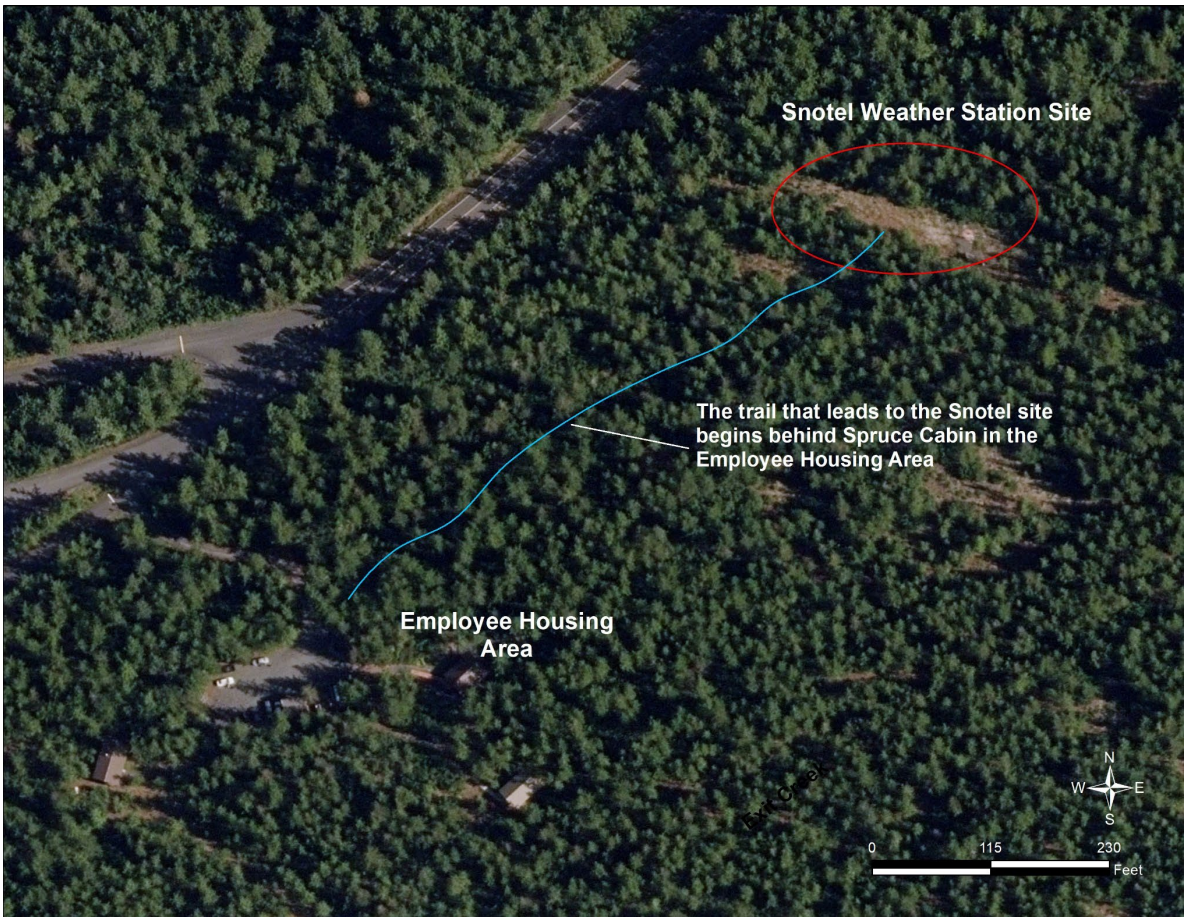


Figure 5. Location of the Snotel and access route behind Spruce Cabin.

Employee Housing

The Employee Housing area is southeast adjacent to the Exit Glacier Parking Area and includes the employee housing parking lot, Trail Builder's Camp and trails and areas around the three cabins (Alder, Spruce, Willow) (Figure 6). We surveyed the entire Employee Housing area over June 28 and July 3. We hand pulled common dandelion in all areas except around the Willow Cabin. We hand pulled common plantain in the parking lot, and one population of big chickweed in front of Alder Cabin.

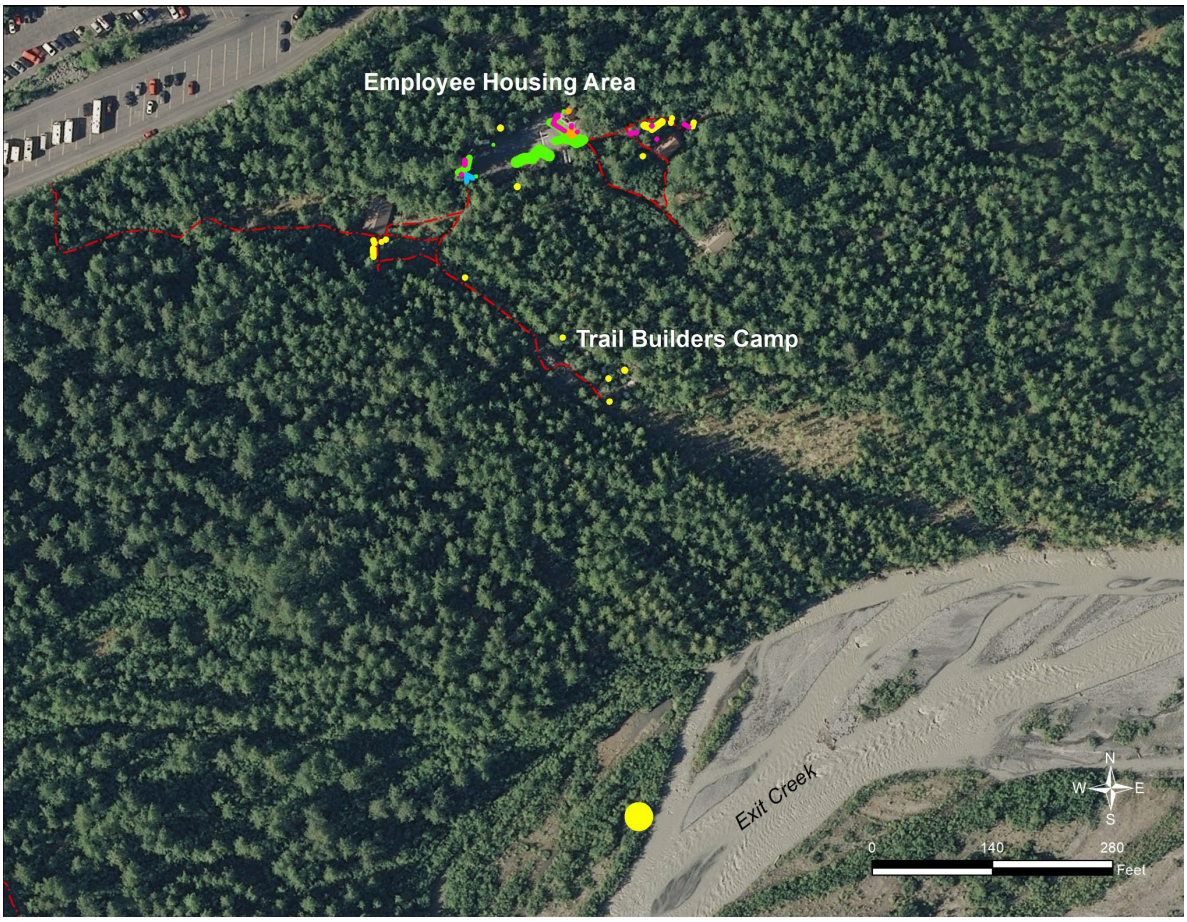


Figure 6. Common dandelion (yellow), annual bluegrass (green), common plantain (pink), pineapple weed (orange) and big chickweed (blue) treated in the Employee Housing Area and the Trail Builder's Camp.

On August 2 in the employee housing parking lot, we hand pulled common plantain, applied 0.049 gallons of Habitat herbicide mix to annual bluegrass and applied 0.118 gallons of Milestone herbicide mix to big chickweed and pineapple weed. We returned to the employee housing parking lot on August 22 and completed the first round of herbicide treatment and applied 0.240 gallons Roundup Custom herbicide mix to annual bluegrass and pineapple weed. We used Roundup Custom herbicide mix on August 22 because we had some mix left in a backpack sprayer and needed to use it before the end of the season.

Nature Center Plaza

Nature Center Plaza incorporates the area around the Nature Center, the picnic area behind the Nature Center, the Pavilion, and the pump house (Figure 7). On June 15, 28, July 3 and August 22 we surveyed the area around the Nature Center and picnic area and hand pulled common dandelion, common plantain, and big chickweed. We surveyed the Pavilion on June 15 and hand pulled common dandelion and common plantain. We applied 0.303 gallons of Habitat herbicide mix to

annual bluegrass on the trail behind the Nature Center, including the picnic area, on July 24. We treated annual bluegrass with 0.592 gallons of Habitat herbicide mix on the path leading to the pump house on July 24 and 25.

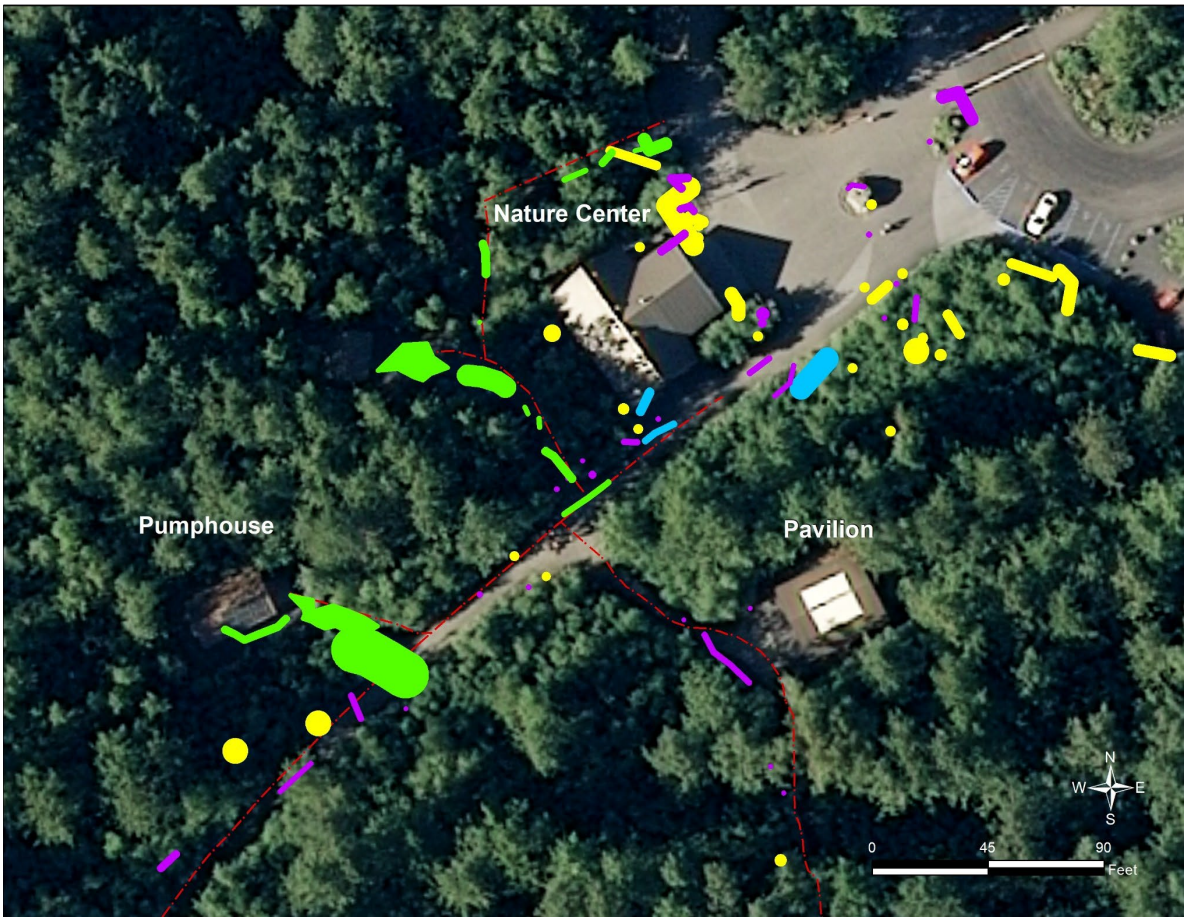


Figure 7. Common dandelion (yellow), common plantain (purple), big chickweed (blue) and annual bluegrass (green) treated in the Nature Center Plaza.



SCA intern applies Habitat herbicide mix to annual bluegrass in the Pump house area (NPS/Emily Anger).

Glacier View Loop Trail

The Glacier View Loop Trail includes the loop trail that begins at the Nature Center, the open space in the middle of the Glacier View Loop Trail and areas north of the main paved trail (Figure 8). We surveyed the loop trail on June 15, 16 and 27 and hand pulled common dandelion and common plantain dispersed along the trail. We hand pulled 11 common dandelions located off the trail below the bridge south of the Pavilion. We also hand pulled a few individual big chickweed plants and one oxeye daisy (*Leucanthemum vulgare*) on the paved portion of the loop trail. On July 28, we hand pulled annual bluegrass along a portion of the paved section of the trail with the help of the Student Conservation Association (SCA) trail crew.

On June 17 and July 3, we hand pulled 21 common dandelion plants that were dispersed throughout the open space in the middle of the Glacier View Loop Trail. We typically use herbicide to treat this population of common dandelion since it is not located near the trail, but the area was too wet to apply herbicide on the days we surveyed. We resurveyed this area on August 7 and hand pulled nine additional common dandelion plants.



YCC employee manually treats common dandelion in the open space in the middle of the Glacier View Loop Trail while SCA intern records associated data (NPS/Makena Desermia).

In 2020, common dandelion populations were discovered in the forest northwest of the main Glacier View Loop Trail and west of the pump house (Gage and Kriedeman 2021). In 2023, we surveyed the areas closest to the pump house on June 28 and hand pulled three common dandelion plants. On July 3, we surveyed the locations farthest from the pump house and main trail, but no invasive plants were found.

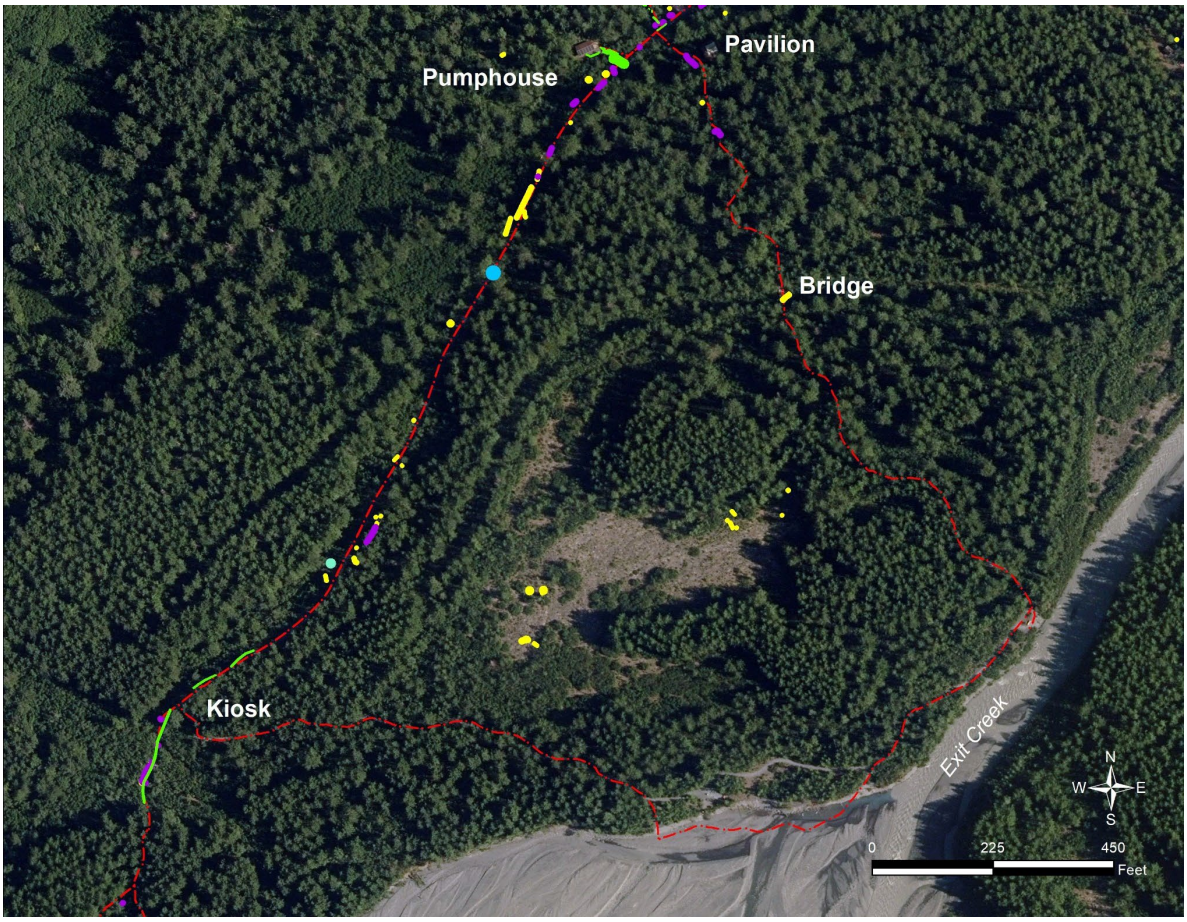


Figure 8. Common dandelion (yellow), common plantain (purple), annual bluegrass (green), big chickweed (blue) and oxeye daisy (aqua) treated on the Glacier View Trail.

Glacier Overlook Loop Trail

The Glacier Overlook Loop Trail includes the trail starting just passed the stone kiosk, the Glacier Overlook Loop Trail itself and the short trails that go out to the outwash plain (Figure 9). We surveyed the Glacier Overlook Loop Trail on June 8, 28 and August 14. We hand pulled common dandelion and common plantain scattered along the trail. On June 8, 28, and August 14, we hand pulled common dandelion and common plantain from an area on the mountain side of the loop trail in an area covering about 6,098 square feet. This population has been treated since 2007, but this summer we found that population covered a more expansive area than had previously been documented.



Mature oxeye daisy discovered and manually treated on the Glacier Overlook Loop Trail with field notebook for size reference (NPS/Kelli Palaka).

On June 8, we found a mature oxeye daisy plant below the glacier overlook with a basal leaf diameter of 10 inches. Oxeye daisy was discovered in this same location in 2018 when 36 rosettes were hand pulled and was not found again until this year (Geier and Kriedeman 2019). On June 28 and August 14, we also hand pulled three populations of big chickweed, including a population that covered an area of nearly 34 square feet, larger than we have seen in previous years.

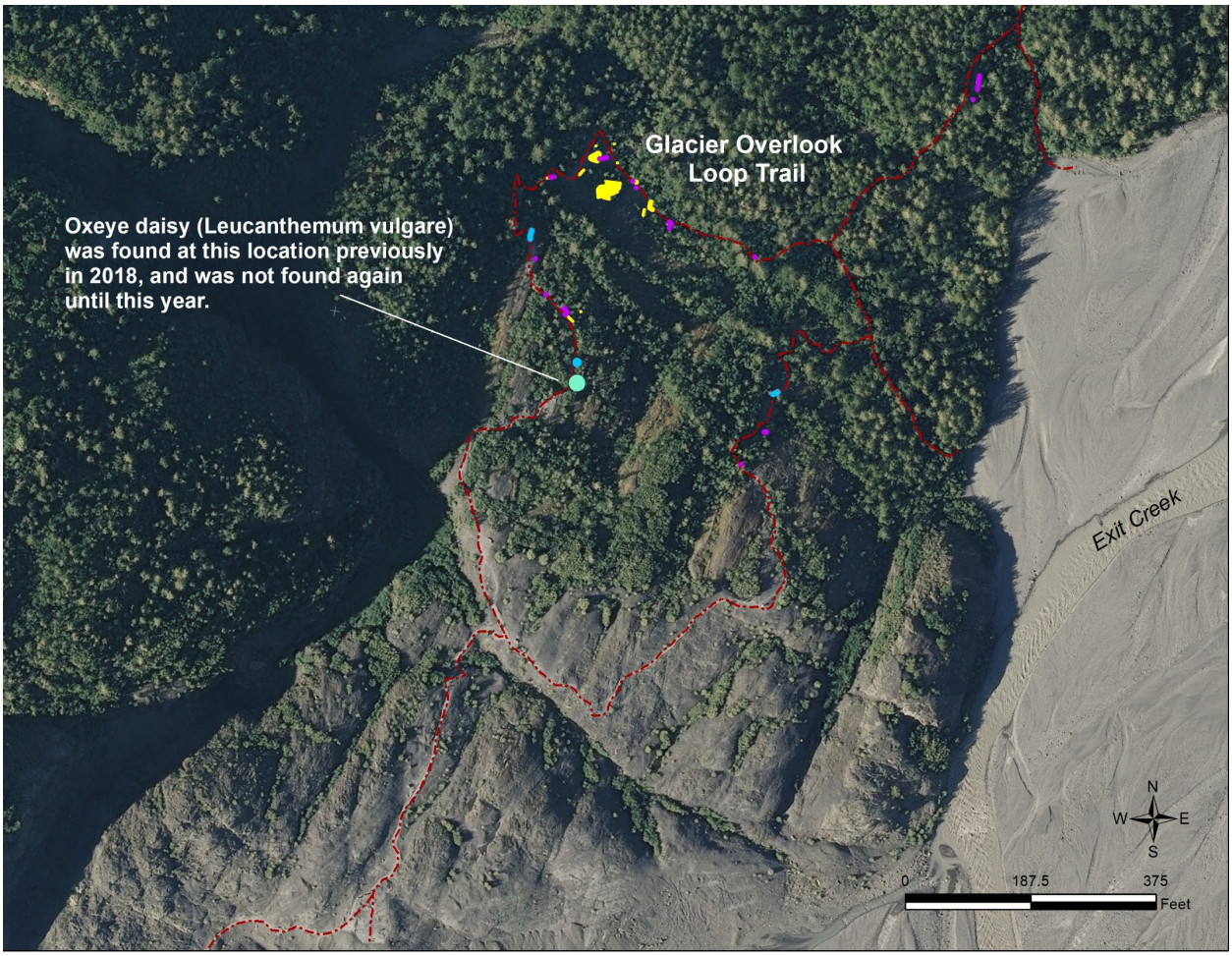


Figure 9. Common dandelion (yellow), common plantain (purple), big chickweed (blue) and oxeye daisy (aqua) treated on the Glacier Overlook Loop Trail.

Harding Icefield Trail

The Harding Icefield Trail is a 4.1-mile one-way trail that ascends approximately 3,000 feet in elevation and ends with panoramic view of the Harding Icefield. On June 21, we surveyed the Harding Icefield Trail up to Marmot Meadows (mile 1.4) and three areas located next to the trail where common dandelion had been found in previous years. These off-trail areas are located at mile 0.25 where there is an abandoned section of trail, mile 1.1 between the bridge and Marmot Meadows and at mile 1.4 at the beginning of Marmot Meadows. We hand pulled 1 common dandelion and three common plantain plants along the trail between the beginning of the trail and mile 0.25. We hand pulled 12 common dandelion plants on the trail at mile 1.1. We also hand pulled common dandelion in the off-trail areas at mile 1.1 (46 plants) and at mile 1.4 (16 plants) (Figure 10).

On July 25, we returned to the common dandelion population at mile 1.1 and applied 0.039 gallons of Milestone herbicide mix. We surveyed the Harding Icefield Trail to the end of the trail on August 10 but did not find additional invasive plants on the trail.



Biological technician manually treats common dandelion on the Harding Icefield Trail while SCA intern records data (NPS/Emily Anger).

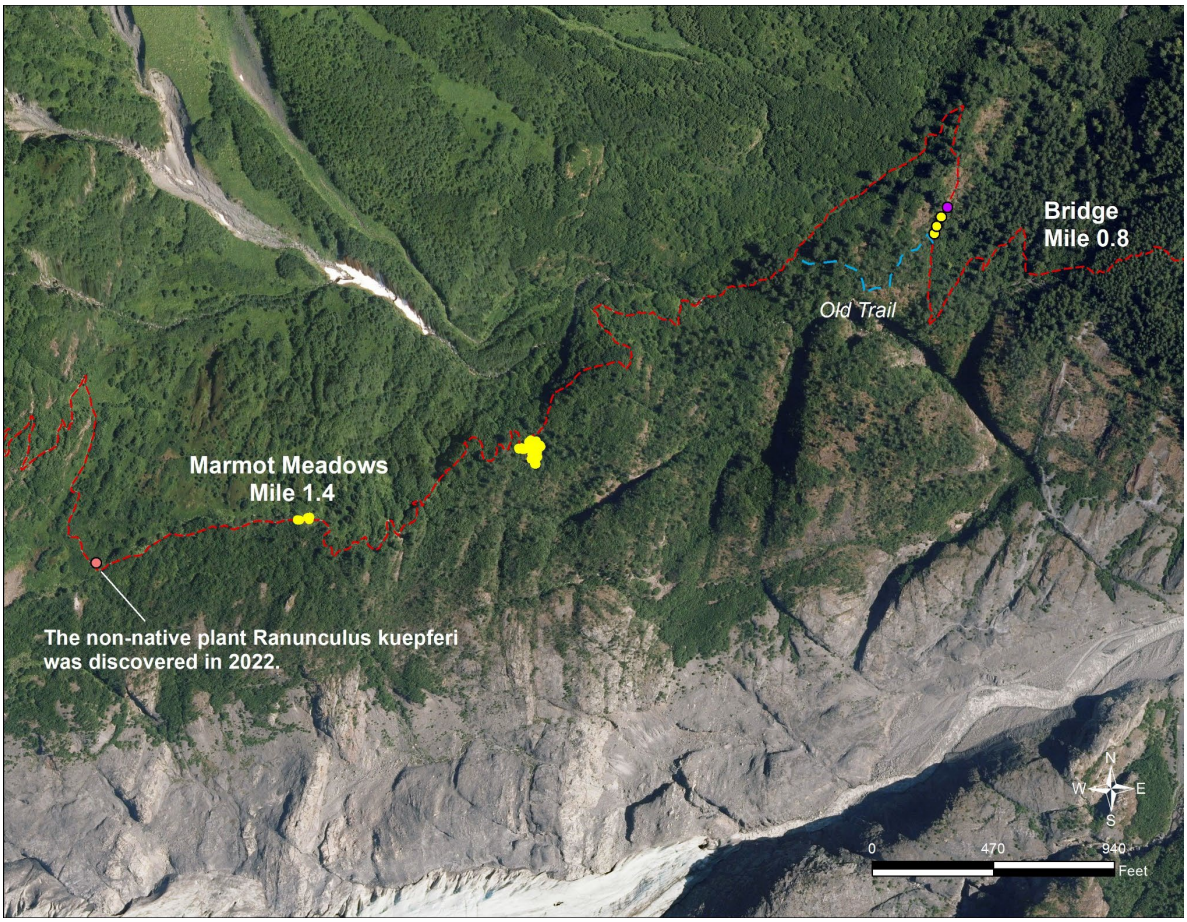


Figure 10. Common dandelion (yellow), common plantain (purple) and Kuepferi's buttercup (pink) treated on the Harding Icefield Trail.

In 2022, we received a report and photo of an unfamiliar Ranunculus species located in Marmot Meadows by a park interpretive ranger, but we did not have the opportunity to collect the plant while it was still in flower. We surveyed the area in 2023 and found one plant (Figure 11). We collected the plant, pressed it, and sent the specimen to the Alaska Center for Conservation Science botanist at University of Alaska Anchorage for identification. The plant was positively identified as Kuepfer's buttercup (*Ranunculus kuepferi*) by the botanist the plant was named after, Philippe Kuepfer. He said that as far as he knows this species has never been observed beyond the Alps, northern Apennines and Corsica (J. Fulkerson, personal communication, October 26, 2023). This is an interesting find and hopefully it was just a non-native hitchhiker that found its way to KEFJ on a hiker's shoe and doesn't turn out to be an invasive plant in the park.



Kuepfer's buttercup (*Ranunculus kuepferi*) discovered in Marmot Meadows on the Harding Icefield Trail (NPS/Clarice Perry).

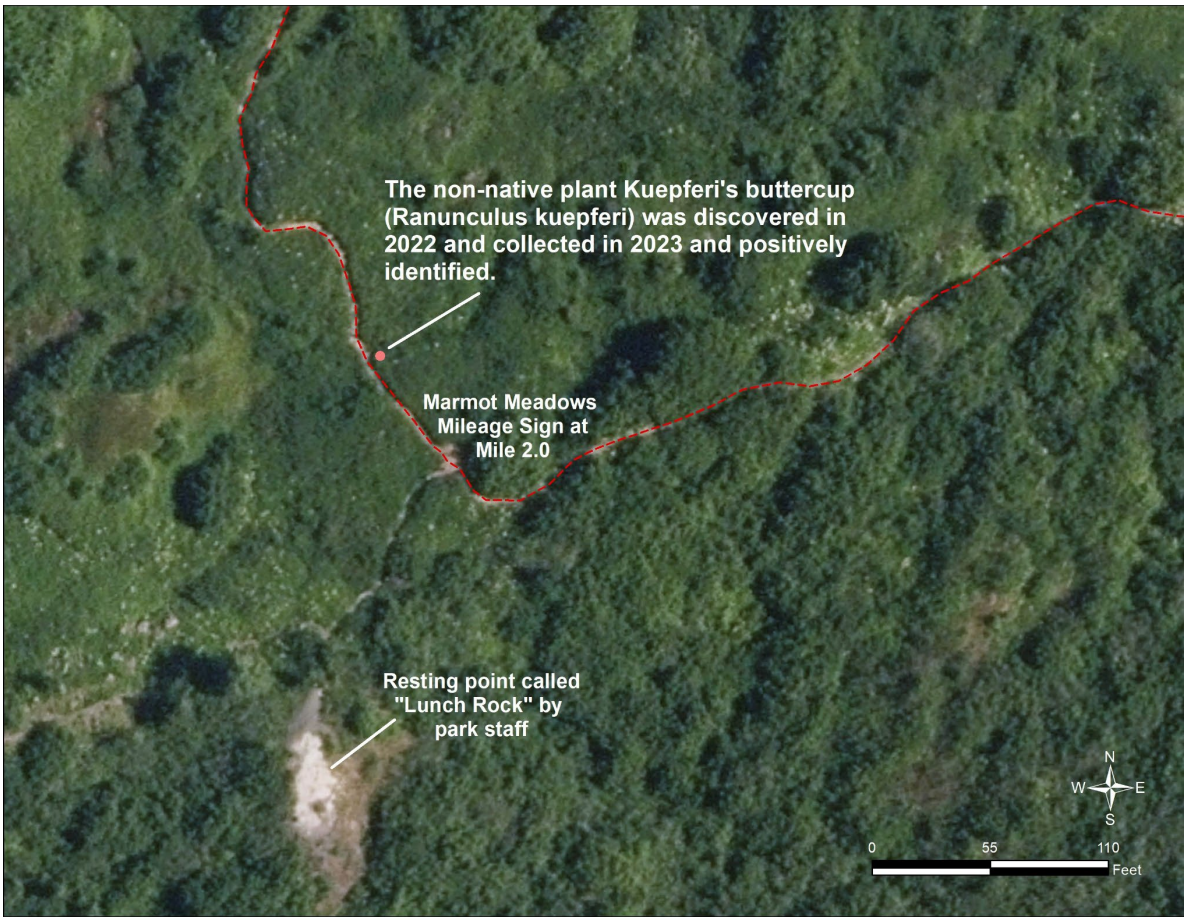


Figure 11. Kueperi's buttercup was collected on the Harding Icefield Trail and identified in 2023.

Nike Stripe

Nike Stripe is an open area located approximately 0.4 miles north of the park entrance sign on Herman Leirer Road. Common dandelion was first discovered in Nike Stripe in 2002 (Bryden 2002). From 2004 until 2012, common dandelion was manually treated via hand pulling (Fulton, 2013) and from 2012-2020 the population was treated with herbicide. Surveys in 2021 and 2022 found no common dandelion. In 2023, we surveyed the area on August 23 and found one common dandelion on route to the Nike Stripe and another within the Nike Stripe (Figure 12). We hand pulled both individuals.



Biological science technician manually removes common dandelion on route to Nike Stripe while SCA intern records associated data (NPS/Christina Kriedeman).

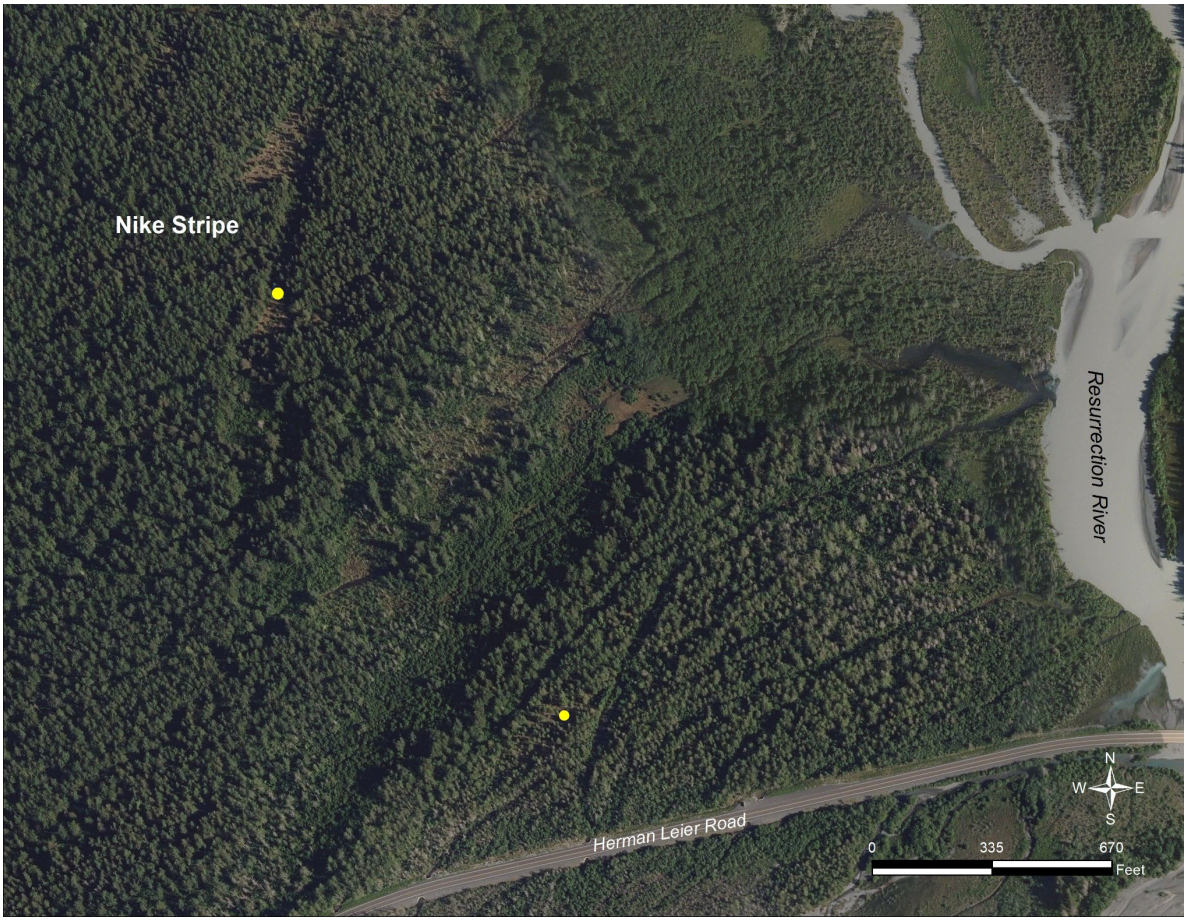


Figure 12. Common dandelion (yellow) found for the first time since 2020 on the hike from Herman Leirer Road and in the Nike Stripe.

Outwash Plain

The Outwash Plain includes 10 standardized polygons located south of Herman Leirer Road and Exit Creek, and additional scattered populations which are mapped individually (Appendix D). To reach the 10 standardized polygons it is necessary to cross Exit Creek, which fluctuates in volume throughout the season and can become unsafe to cross when water levels get high. The populations of common dandelion are sizeable enough that we need to apply herbicide to treat them efficiently and effectively; a dry weather window is required to treat these areas. Unfortunately, wet weather conditions in June prevented us from treating the area south of Exit Creek until the creek was too high and unsafe to cross, so none of the standardized polygons or areas south of Exit Creek were treated in 2023.

On June 14, we surveyed the area south of the Resurrection River Bridge where common dandelion had been treated in previous years (Figure 13). We applied 0.033 gallons of Milestone herbicide mix. We returned on August 18 to survey the remaining area and applied 0.016 gallons of Roundup Custom herbicide mix to common dandelion. The herbicide Roundup Custom was used instead of Milestone because we had leftover herbicide mix left in a backpack sprayer that needed to be used before the end of the season.



Biologist marks the boundary of a common dandelion population in the outwash plain south of the Resurrection River Bridge (NPS/Makena Desermia).

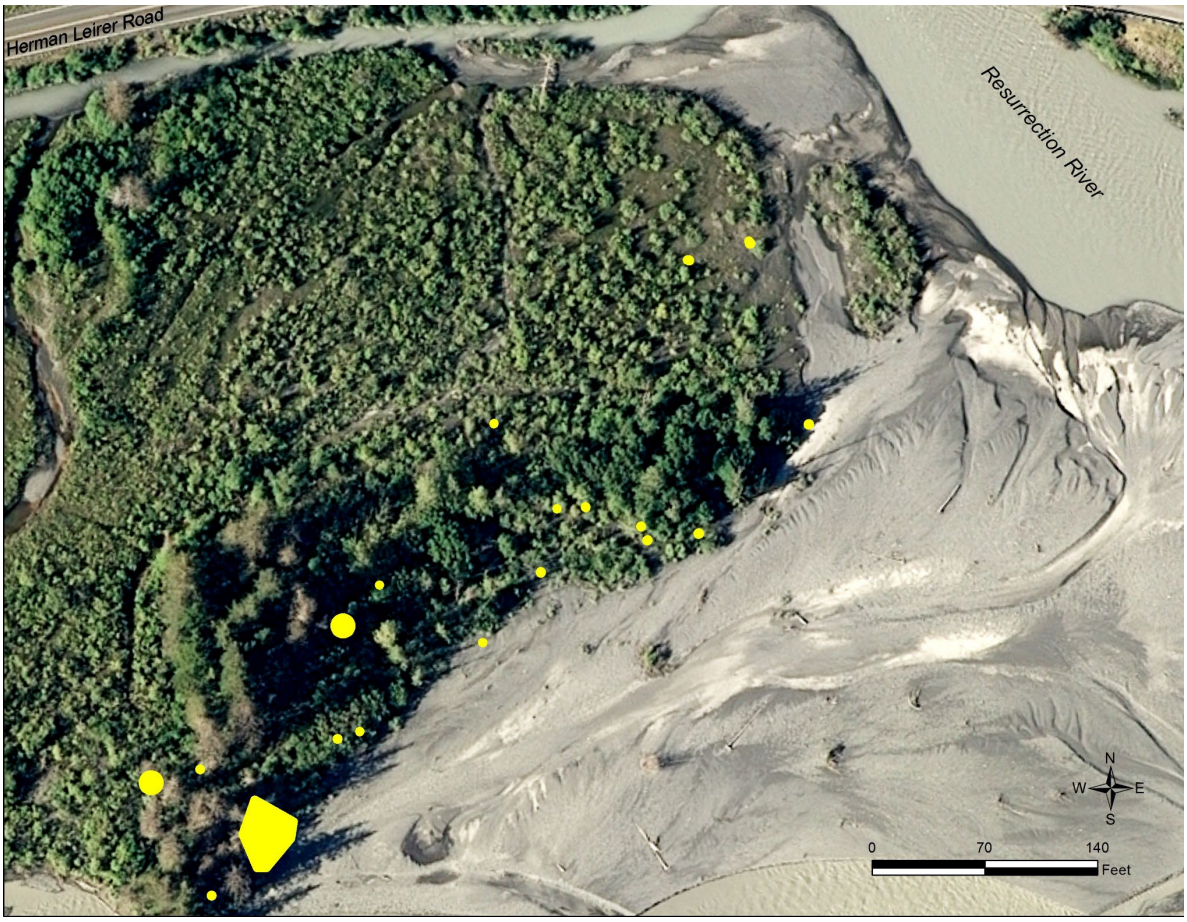


Figure 13. Common dandelion outliers on the outwash plain south of the Resurrection River bridge.

Coastal Areas

Resurrection Bay

No surveys were completed in Resurrection Bay during the summer of 2023.

Aialik Bay

We made two trips to Aialik Bay to survey and treat invasive plant populations along the coast over the summer (Figure 14). On our first trip on July 18 and 19, our priority was applying herbicide to populations of annual bluegrass (*Poa annua*) at the Aialik and Holgate Public Use Cabins (PUC). We closed the cabins for public use during the week of July 17 through 21 to allow a window of time to select a day that was dry enough to apply herbicide and to avoid any conflicts with visitors. We applied the herbicide Roundup Custom in 2020 and 2021, but it was not effective in reducing the density of these populations (Visconti and Kriedeman 2022). With the guidance of the Alaska Regional IPMT Liaison, we decided to apply the herbicide Habitat since it is more persistent in the soil and effects the seed bank already found in the soil from sprouting. On July 18, we surveyed the Aialik PUC and applied 0.271 gallons of Habitat herbicide mix to annual bluegrass. Since this is the first year we used Habitat in the Park, we decided to hand pull any annual bluegrass found under the

dripline of any trees. We did this to ensure that we did not impact trees in the vicinity of our treatment area until we have a better understanding of how nearby, non-target vegetation is impacted. We surveyed the Holgate Public Use Cabin (PUC) in on July 18 and applied 0.146 gallons of Habitat herbicide mix to annual bluegrass. We also surveyed the campsite at Abra Cove, and hand pulled 8 stems of annual bluegrass.



Biologist applies the Habitat to annual bluegrass on the back side of the Holgate Public Use cabin (NPS/Kelli Palaka).

On July 19, with permission from the Kenai Fjords Glacier Lodge, we surveyed the outer beach at Pederson Lagoon and the road that leads to the lodge. The Kenai Fjords Glacier Lodge stores kayaks at the outer beach (locally called Pedersen Point), and lodge guests are also picked up and dropped off here. Although this area is not located on park property, we have surveyed and manually treated invasive plants here since 2011 (Fulton 2012). We treat this area to help prevent the spread of invasive plants on to park lands at the upper lagoon where the lodge takes clients on guided hikes. We hand pulled 24 stems of annual bluegrass on the roads that lead from the beach to the lodge. We did not find any invasive plants near the kayak storage area. We also surveyed the camping easement managed by the park inside Pederson Lagoon and did not find any invasive plants.



Biological science technician surveys Pederson Lagoon camping easement for invasive plants (NPS/Christina Kriedeman).

On July 19, we surveyed the south side of the beach at Quicksand Cove where the bear resistance food storage locker is located, but we did not find any invasive plants.

We returned to Aialik Bay for a day trip on August 15, and resurveyed the Aialik PUC, Holgate PUC and Abra Cove. We hand pulled annual bluegrass from the Aialik PUC and Holgate PUC, but the application of the herbicide Habitat on July 18 seemed to be mostly effective. We did not find any additional annual bluegrass at Abra Cove. We also surveyed the Holgate camping beach and the beach at McMullen Cove on August 15 but found no invasive plants.

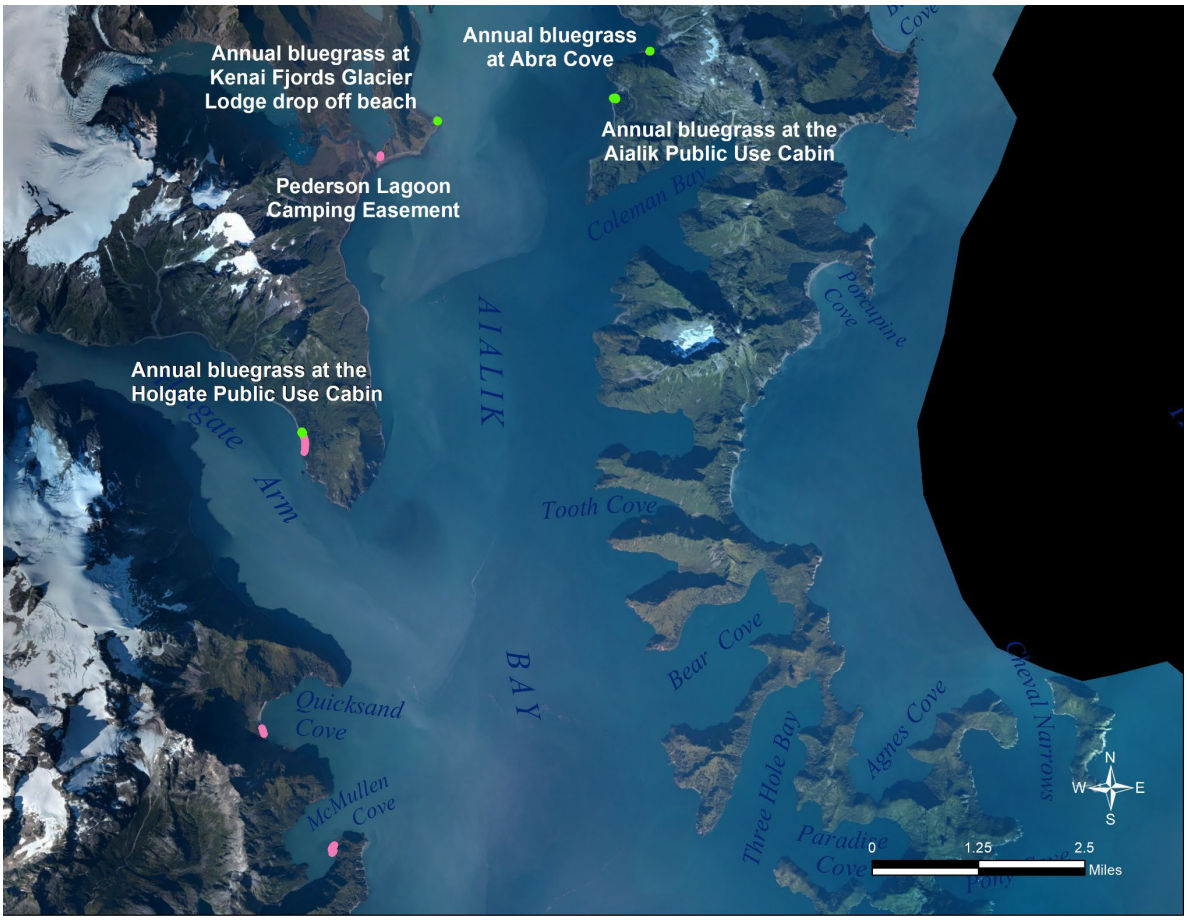


Figure 14. Populations of annual bluegrass treated (green) and areas surveyed and no invasive plants found (pink) in Aialik Bay.

Northwestern Fjord

We surveyed three of the primary campsites in Northwestern Fjords on July 14. We hand pulled a small population of annual bluegrass at the camping spit located on the east side of Northwestern Fjord north of the moraine and on July 14. We also surveyed the campsite at Sunlight Glacier and Northeastern Glacier but did not find any invasive plants (Figure 15).

In 2023, the KEFJ physical science program installed timelapse cameras in Northwestern Fjord, Aialik Bay and McCarty Fjord to monitor harbor sea ice habitat. Park staff visited the time-lapse camera sites a few times during the summer to service the cameras. On August 8, we assisted with the camera maintenance and opportunistically surveyed the camera site in Northwestern Fjord for invasive plants but did not find any (Figure 15).

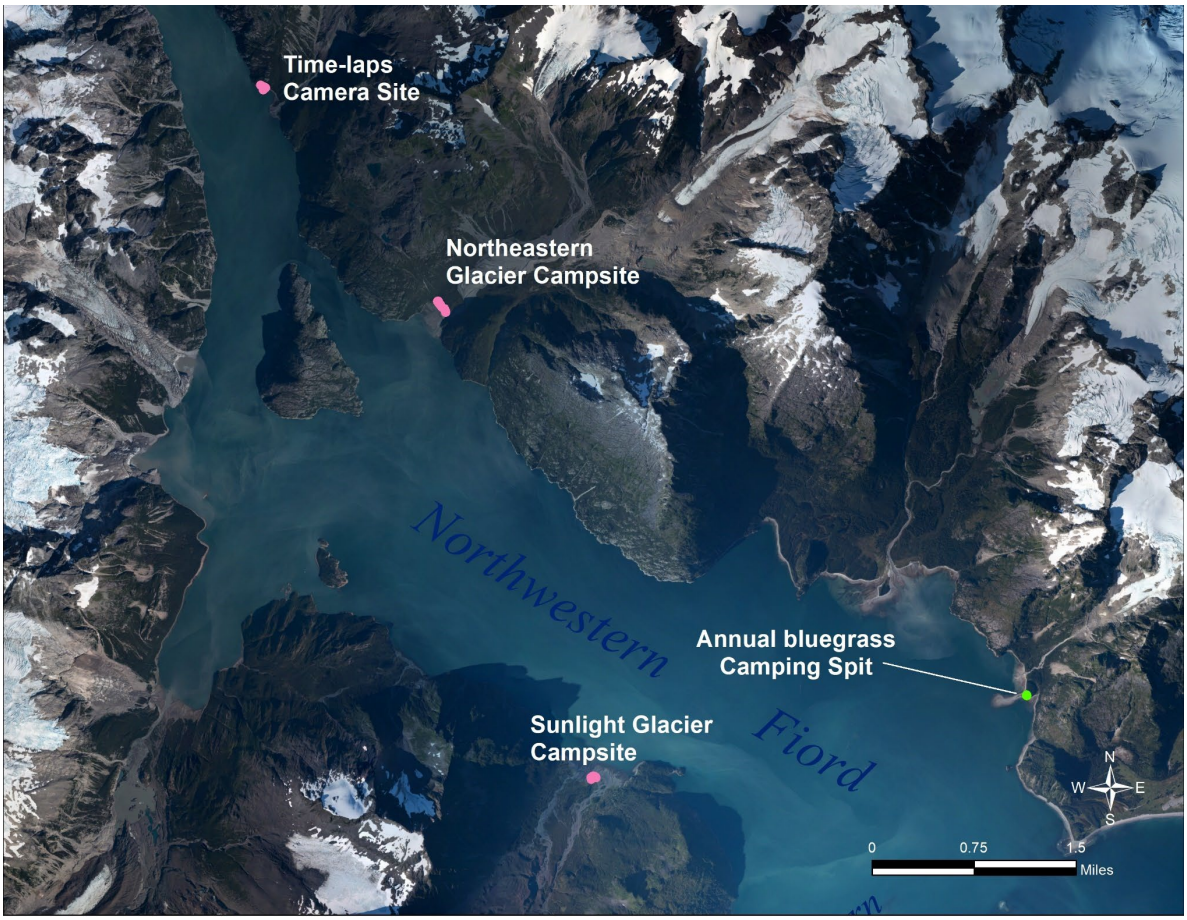


Figure 15. Annual bluegrass was hand pulled at a campsite on the east side of the fjord (green) and three additional sites where surveyed and no invasive plants were found (pink).



Biologist and biological science technician survey Northeastern Glacier beach for invasive plants (NPS/Clarice Perry).

McCarty Fjord

On July 13, we surveyed the rock ridge south of Dinglestadt Glacier in McCarty Fjord for common dandelion and applied 0.226 gallons of Milestone herbicide mix (Figure 16). This population of common dandelion was discovered in 2006 and was manually treated until 2013 (Wetherbee 2006, Frank 2013). In 2014, herbicide application was deemed to be a more efficient and effective means of control because of the remote location and ability to only treat plants once a year (Frank 2013). Because of time constraints and wet weather conditions, this is the first time we have surveyed and treated this population with herbicide since 2021.

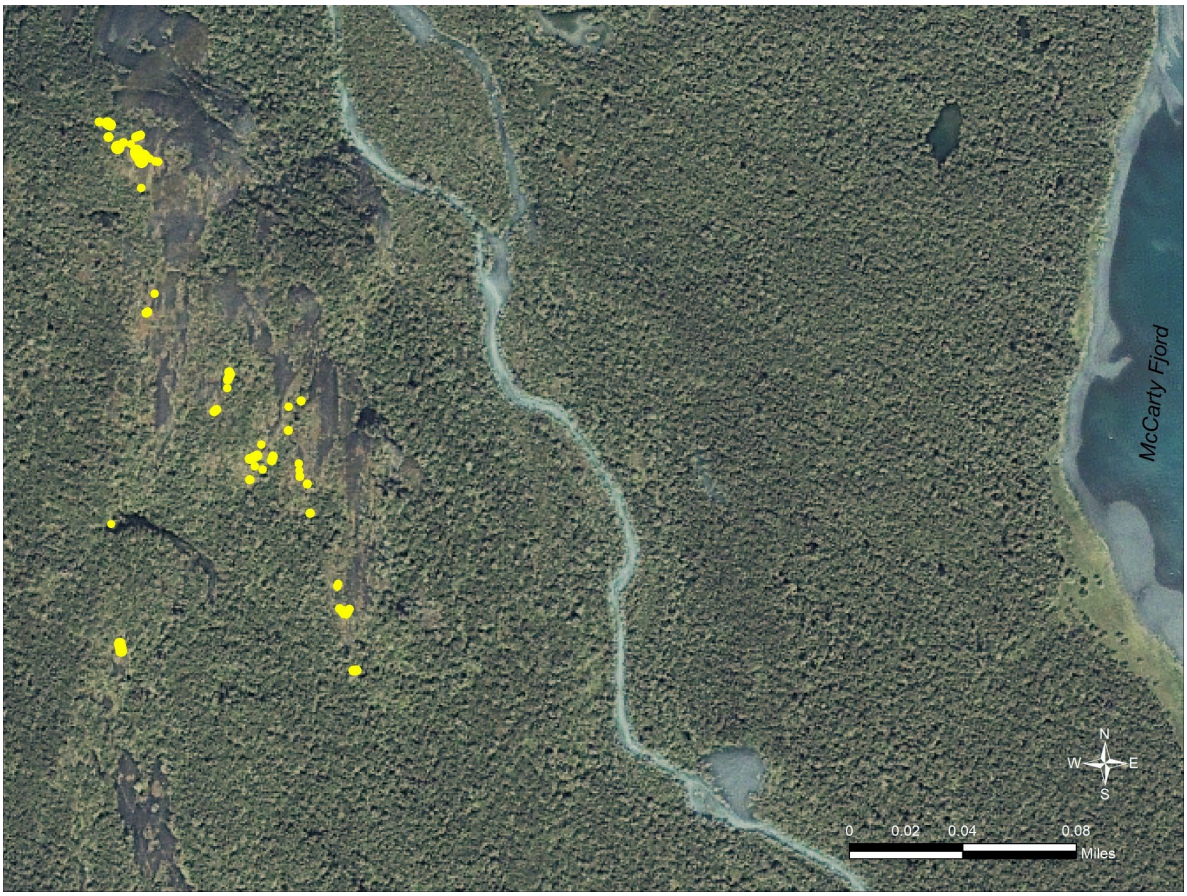


Figure 16. Common dandelion populations (yellow) treated with Milestone on the rocky hillside south of Dinglestadt Glacier.



Biological science technician applies Milestone to common dandelion on the rock ridge south of Dinglestadt Glacier (NPS/Clarice Perry).

On August 9, we opportunistically surveyed for invasive plants at the site where the KEFJ physical science program installed timelapse cameras in McCarty Fjord to monitor harbor sea ice habitat (Figure 16). We did not find any invasive plants. We also surveyed James Lagoon Beach for invasive plants while other park staff completed a COASST (Coastal Observation and Seabird Survey Team) bird mortality survey and found no invasive plants.

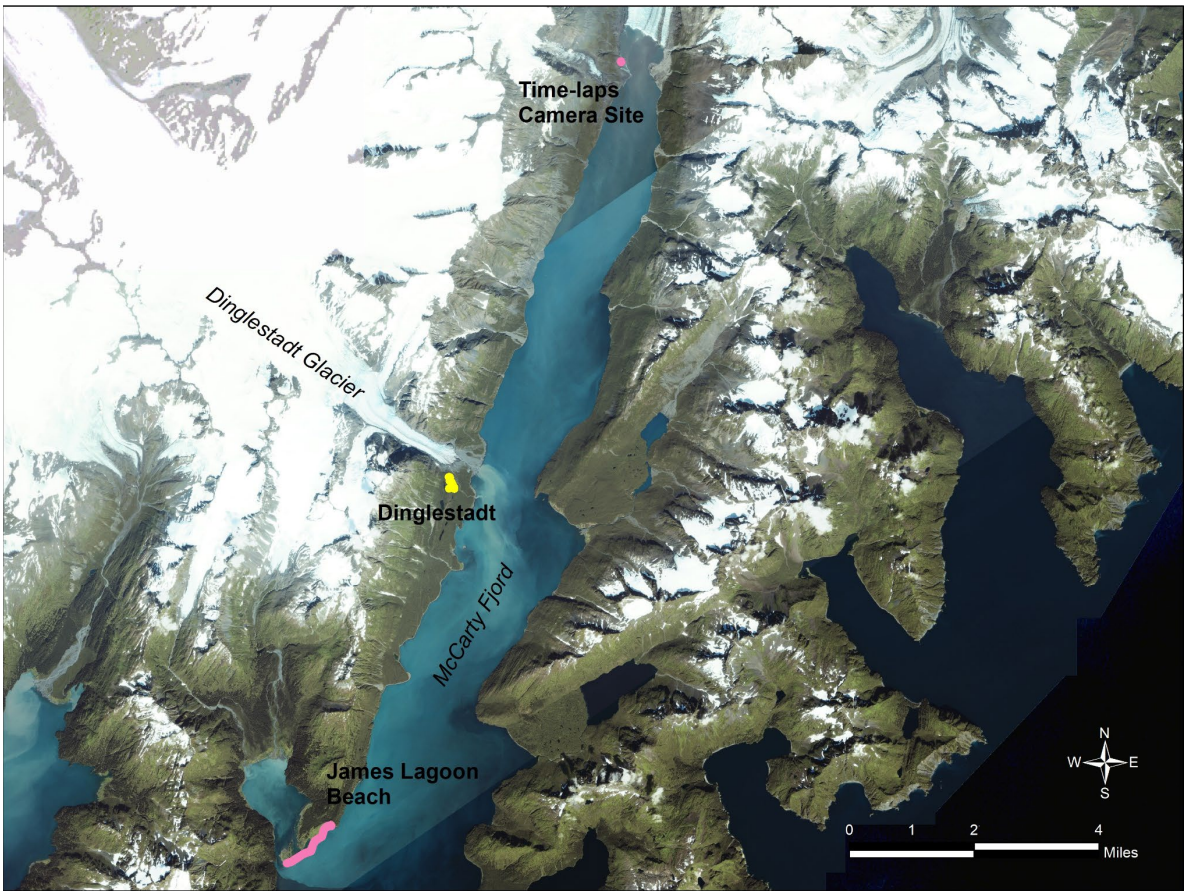


Figure 17. Common dandelions treated south of Dinglestadt Glacier (yellow) and areas surveyed where no invasive plants were found (pink).

North Arm

On July 12 we survey a known population of common dandelion on the beach at the head of North Arm in Nuka Bay. We applied 0.106 gallons of Milestone herbicide mix to several populations of common dandelion at the top of the beach (Figure 17). Initially there was only one population that we were treating for several years, but in 2022 and again in 2023 we found more scattered populations of common dandelion north of where the original population was discovered.



SCA intern and biological science technician apply Milestone to common dandelion at the head of North Arm (NPS/Christina Kriedeman).

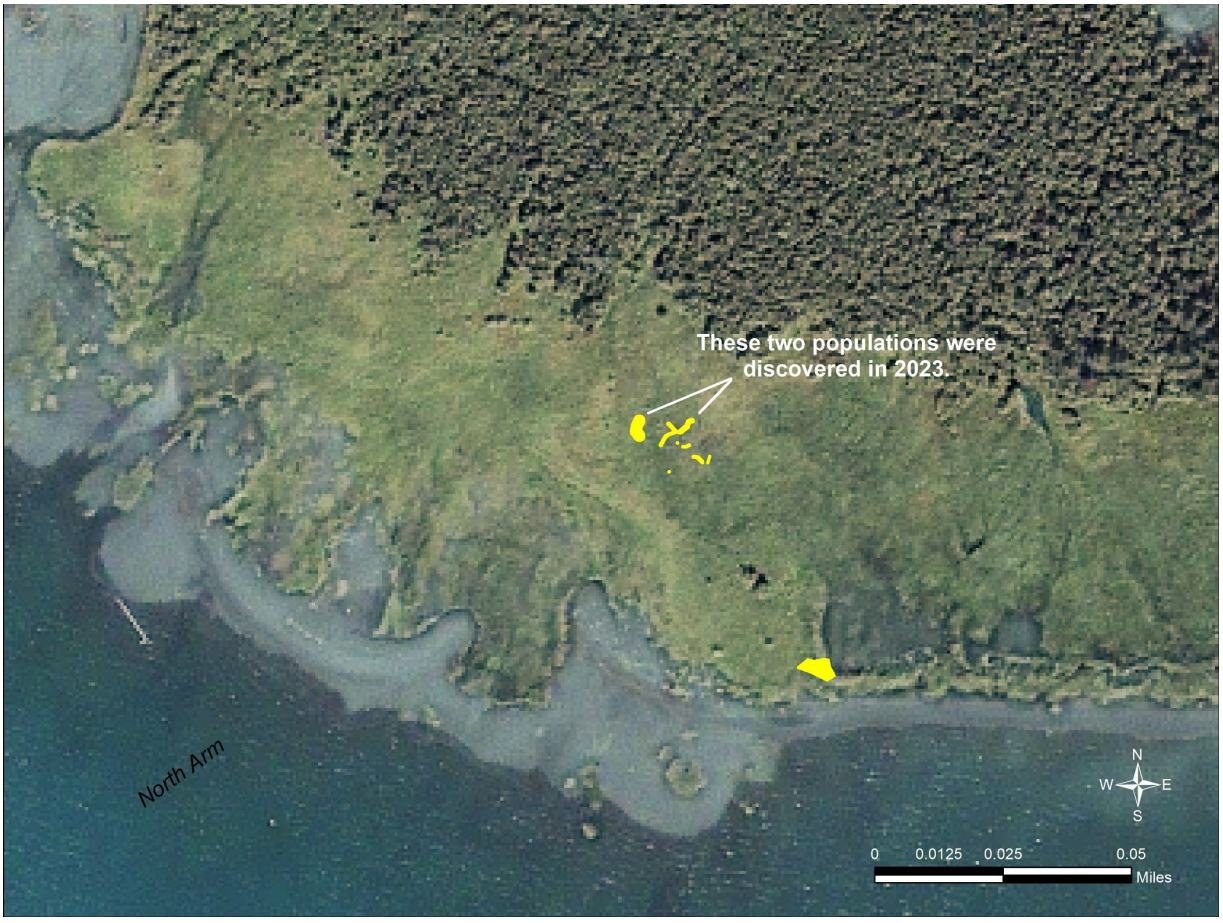


Figure 18. Common dandelion (yellow) treated with Milestone on the beach at the head of North Arm in Nuka Bay.

Surprise Bay

In 2022, non-historic buildings and mining equipment were removed from the abandoned Waterfield-Goyne mine in Surprise Bay and Kenny mine in Palisades Lagoon. Although all heavy equipment used for the site cleanup was cleaned and inspected before use in the park as per the contract terms, we decided to survey these sites over the next several years to ensure no invasive plant populations became established in these newly disturbed sites. On July 11, we surveyed the Waterfield-Goyne mine site but did not find any invasive plants. On July 12, we surveyed the Kinney mine site, including the access road and the site where an old cabin and woodshed were removed, and did not find any invasive plants (Figure 18).

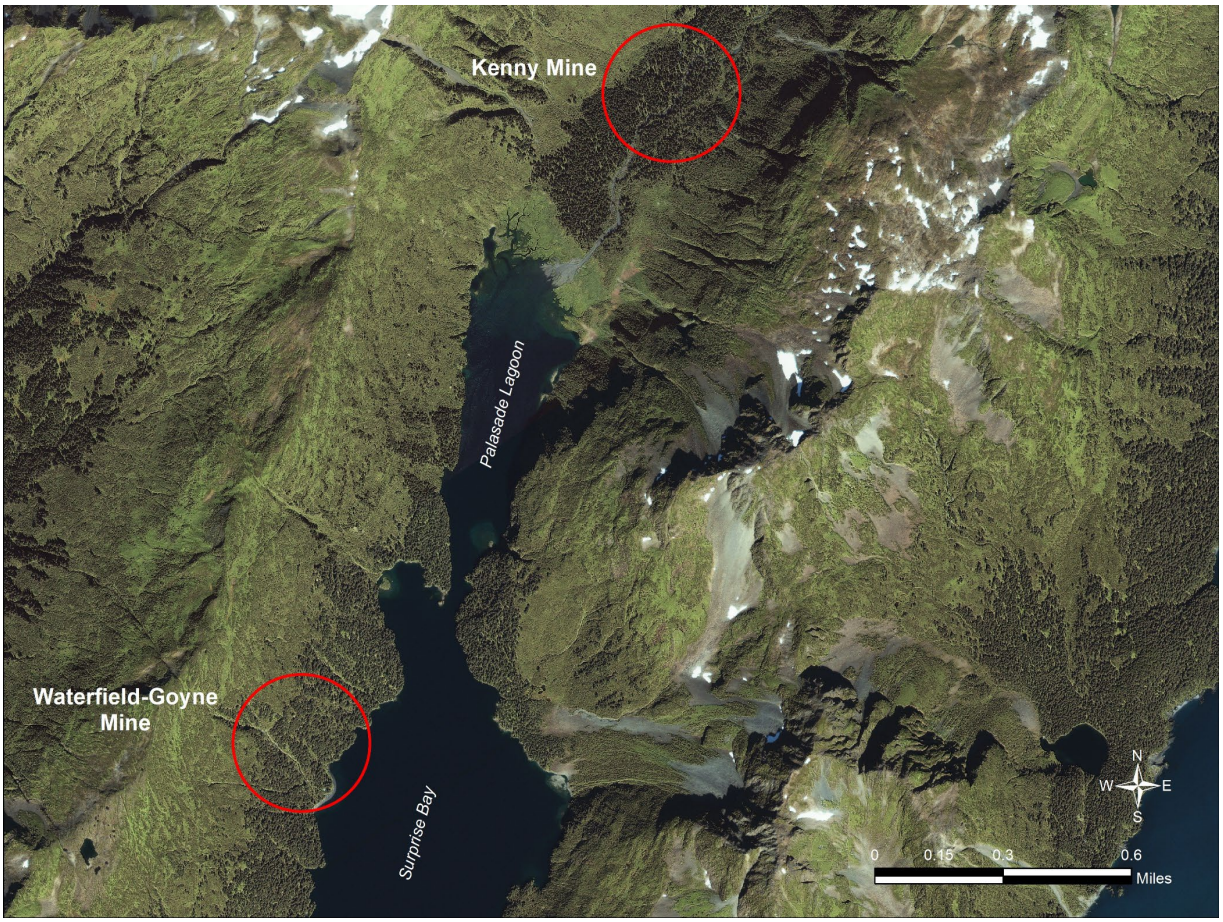


Figure 19. Waterfield-Goyne and Kenny mine sites surveyed after mine cleanup projects were completed in 2022.

Nuka Passage

In 2022, a common dandelion population at Yalik Glacier beach, north of Nuka Island was confirmed to be within the park boundary and flower and seed heads were removed (Visconti and Kriedeman 2023). In 2023 on July 11, we hand pulled 359 common dandelion plants at Yalik Glacier beach

(Figure 19). Ideally, we would have applied Milestone to the common dandelion in this area, but rainy weather did not allow for herbicide applications.



SCA intern and biological science technician search for invasive common dandelion in a field of lupine (*Lupinus nootkatensis*) at Yalik Glacier beach (NPS/Christina Kriedeman).

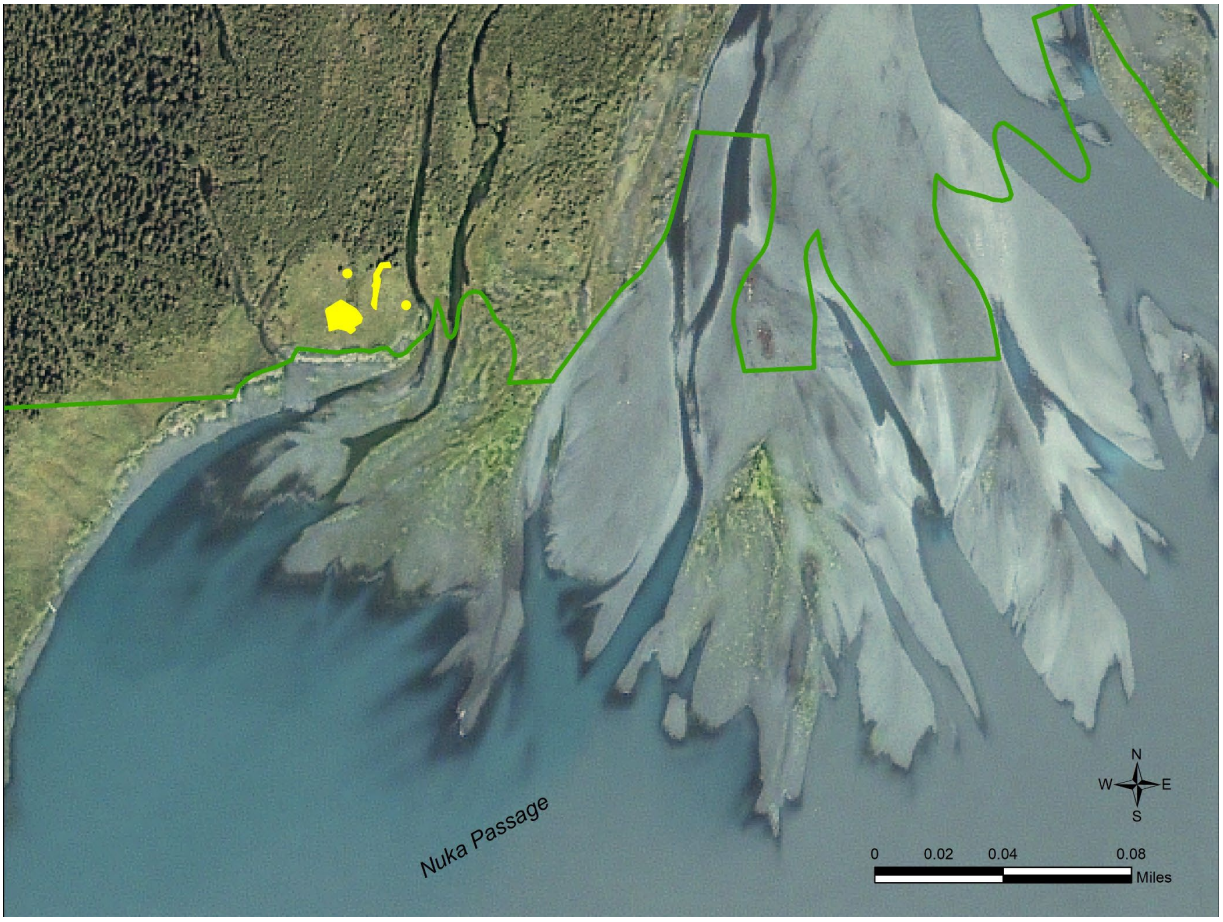


Figure 20. Common dandelion (yellow) was hand pulled at the beach at Yalik Glacier drainage in Nuka Passage

Seward

In 2023, we did not survey, or control invasive plants found around the KEFJ Visitor Center or Shea Parking Lot located in the city of Seward. It should be noted that bird vetch (*Vicia cracca*), white clover (Trifolium repens), scentless false mayweed (*Tripeurospermum inodorum*), white sweet clover (*Melilotus alba*) and common dandelion were seen growing out of the grasses planted by a contractor during the development of the Visitor Center outdoor interpretive exhibit that was constructed in 2022. Photos were taken of the plants, and they were hand pulled when they were identified, but a plan to either actively control these plants or possibly removing the existing grasses and replaced with native plants that are not infested with invasive species should be considered.

Maintenance Facility

The Maintenance Facility is owned by the park but is outside the park boundary; it consists of one standardized polygon (Appendix E) that outlines the maintenance yard fence, and the area outside of the maintenance yard fence that is also on park property (Figure 20). We surveyed the standardized polygon for common dandelion, common chickweed (*Stellaria media*), big chickweed (*Cerastium fontanum*) and pineapple weed (*Matricaria discoidea*) on June 26, July 26 and August 1 and applied

0.845 gallons of Milestone herbicide mix to these 4 species. We surveyed outside of the maintenance yard fence north of the entrance gate on June 26 and August 1 and applied 0.479 gallons of Milestone herbicide mix to common dandelion, common chickweed, big chickweed, and pineapple weed. This population was discovered in 2021 and is in an area that was disturbed by equipment used during a maintenance yard construction project.



SCA intern, biological science technician and YCC employee work together to chemically treat common dandelion, common chickweed, big chickweed and pineapple weed in the maintenance yard standardized polygon (NPS/Christina Kriedeman).

On July 20, we applied 0.104 gallons of Roundup Custom herbicide mix in the area outside the maintenance yard fence to common plantain (*Plantago major*) and annual bluegrass (*Poa annua*). In the standardized polygon, we applied 1.156 gallons of Habitat and 0.104 gallons of Roundup Custom to annual bluegrass on July 21. We used Roundup Custom instead of Habitat on annual bluegrass that was within the drip line of large trees both inside and outside of the maintenance yard fence to protect them from possible herbicide impacts. Habitat is a non-selective herbicide that is persistent in the soil, so we maintained a buffer around trees where we did not apply Habitat until we have a better idea of how it affects adjacent, non-target vegetation. We returned on September 5 and applied 0.128 gallons of Roundup Custom herbicide mix to treat annual bluegrass. Roundup Custom was used instead of Habitat because we had leftover herbicide mix left in a backpack sprayer that needed to be used before the end of the season.

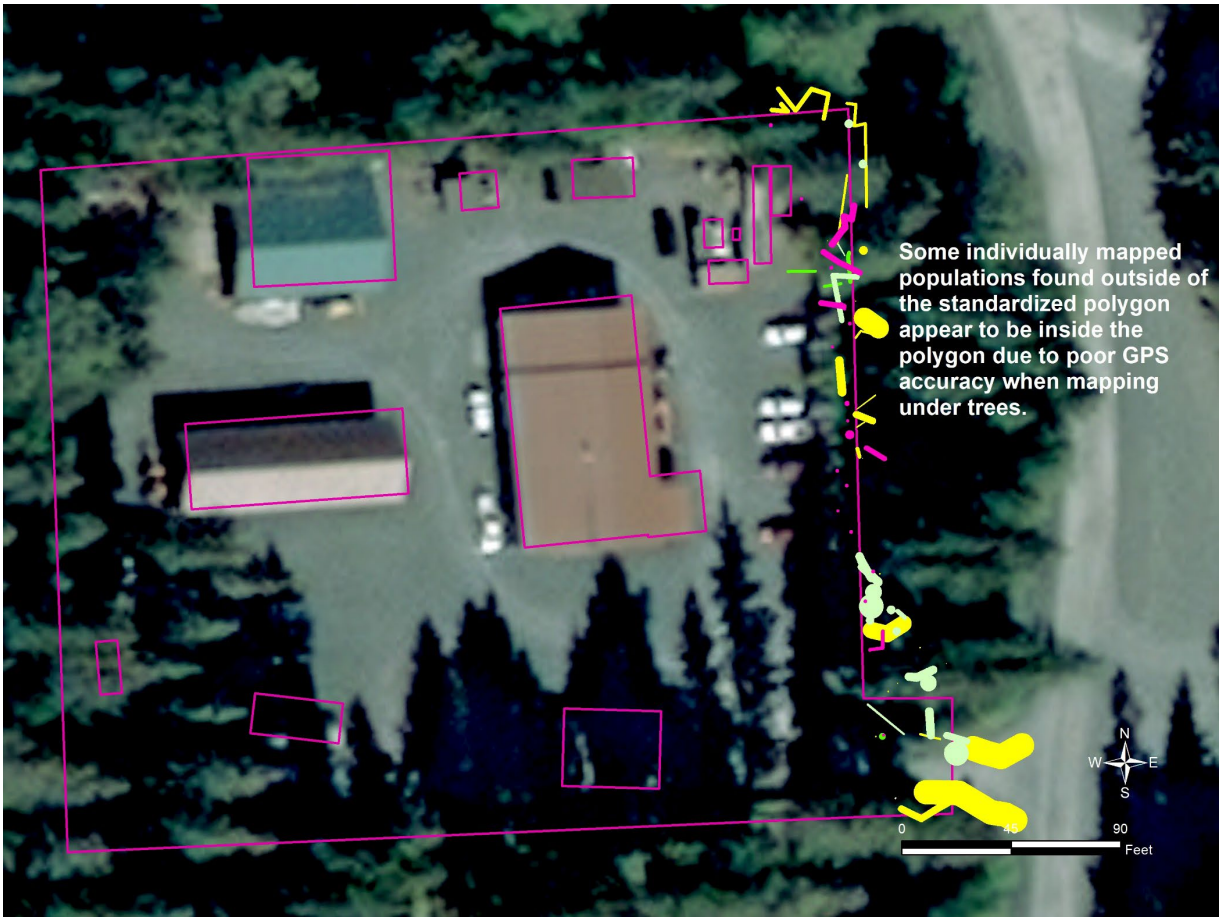


Figure 21. Populations of common dandelion (yellow), common plantain (pink), common chickweed (light green), and annual bluegrass (green) mapped and treated outside the maintenance standardized polygon (outline in pink)

Prevention

Prevention is the most effective and economical approach to invasive species management. To help prevent the spread of invasive species, we have two boot brushes in the Exit Glacier area that include interpretive information for the public. Boot brushes work by cleaning off and collecting dirt and potential seeds from the shoes of park visitors and employees, reducing the chance of these seeds moving into remote areas of the park where management is more expensive and logistically difficult. One boot brush is installed at the orientation panel in front of the Nature Center and the other is located at the Harding Icefield Trail register. We examined these boot brushes throughout the season for damage or excess buildup of dirt and performed maintenance as needed.

An additional two boot brushes are located at the Seward Harbor; one is near the Kenai Fjords National Park's Visitor Center located next to the south boat ramp, and the second is at the north boat ramp where there is frequent traffic from water taxis and accompanying passengers and gear. These boot brushes were installed through a collaboration between KEFJ IPMT and KP-CISMA partners in 2021 (Visconti and Kriedeman 2022). The installation was part of a Peninsula-wide effort to educate the public on the transmission of invasive species via boat access ports. We inspected and cleaned

these boot brushes twice throughout the season. On our initial visit on June 2, we discovered the interpretive sign missing from the boot brush post at the north boat ramp, but it was found to be reinstalled later in the summer. It is assumed that the Seward Harbor Master maintenance staff reinstalled the sign after it fell off the mounting post. Because we thought the sign was stolen, we ordered a replacement sign, so it will be available to replace the existing signs as they are damaged or fade over time.

We also prioritized the daily use of handheld boot brushes before we headed out to our work sites and as we moved between different areas in the park. Handheld boot brushes are kept in the team vehicle for easy access to help reduce the chance that we introduce or spread invasive plants around the park. In addition, we distributed handheld boot brushes to Visitor and Resource Protection (VRP) backcountry rangers at the beginning of the season to encourage them to clean their shoes before traveling to remote areas of the park.



YCC employee cleans their boots with a handheld boot brush prior to starting work in the Exit Glacier Campground (NPS/Emily Anger).

Restoration

On August 16 and September 8, we collected native plant seeds in the Exit Glacier Area to supplement the park's seed bank for use in future restoration projects. We collected meadow barley (*Hordeum brachyantherum*), alpine timothy (*Phleum alpinum*), spiked trisetum (*Trisetum spicatum*), bluejoint reed grass (*Calamagrostis canadensis*), and Merten's sedge (*Carex mertensii*). We will send the seeds to the Alaska Department of Agriculture Plant Material Center located in Palmer, AK for cleaning. No restoration projects were completed this season.



SCA intern collects meadow barley (*Hordeum brachyantherum*) seed heads for future restoration projects at the Nature Center Plaza (NPS/Kelli Palaka).

Outreach and Education

Outreach and education are a vital part of invasive species management. Each year we aim to communicate our program goals and the importance of invasive species prevention and management to park employees, park visitors and the Seward public. In 2023, we presented on IPMT program accomplishments, season goals and how to help in IPMT efforts at the KEFJ spring training for interpretation staff and interns. We gave an informational talk to the Student Conservation Association trail crew about the importance of cleaning equipment before doing work on the trails and how to minimize the impact of trail maintenance work on June 26. On July 28, we teamed up with the six SCA trail crew members and hand pulled invasive plants in the Exit Glacier Area; we taught them how to identify the common invasive plants in the park and answered questions about IPMT efforts throughout the season. We also posted on social media about the results of the 18th Seward Community Weed Pull and our efforts to manage common dandelion out on the coast.

IPMT outreach and education aimed at park staff showed evidence of impact in 2023 with interpretive ranger collaboration leading to the discovery of the Kuepfer's buttercup (*Ranunculus kuepferi*) on the Harding Icefield Trail and the rediscovery of the oxeye daisy (*Leucanthemum vulgare*) on the Glacier View Loop Trail.

On June 23, in cooperation with KP-CISMA partners, we hosted the 18th Seward Community Weed Pull at the Seward Middle School from 10am-2:30pm. KP-CISMA partners included the Chugach National Forest, Kenai Watershed Forum, and Homer Soil and Water District. We hand-pulled 380

pounds of the invasive plant bird vetch (*Vicia cracca*). Seven kids from the Seward Boys and Girls club attended along with 15 adult volunteers from agency partners and the Seward community.



Kenai Fjords biologist and US Forest Service ecologist weigh bird vetch (*Vicia cracca*) that was manually removed from the Seward Middle School during the Seward Community Weed Pull (NPS/Kelli Palaka).

Partnerships

We participated in two important Alaska-based partnerships in 2023: the Kenai Peninsula Cooperative Invasive Species Management Area (KP-CISMA) partnership and the Alaska Invasive Species Partnership (AKISP). These are crucial avenues for information sharing, updates and organizing collaborative events throughout the year.

The KP-CISMA partnership includes federal and non-governmental organizations that collaborate in or are directly involved with the management of invasive species on the Kenai Peninsula. On April 21, we presented an overview of invasive species management work being competed in the park at the KP-CISMA sponsored portion of the Alaska Fish Partnership conference in Kenai, Alaska. IPMT seasonal staff participated in the KP-CISMA plant identification training on May 18 at the Kenai River Center in Soldotna, Alaska. We also participated in KP-CISMA quarterly meetings that bring together partners to discuss accomplishments, events, and news around invasive species on the Kenai Peninsula.

The AKISP is a state-wide group made up of both governmental and non-governmental organizations working towards a common goal of invasive species management across the state. We participated in virtual monthly membership meetings and attended the Alaska Invasive Species Partnership annual workshop in Anchorage for three days in Anchorage, Alaska. We also attended the 3-day green crab response drill workshop held on August 28-31 in Homer, Alaska.

Invasive Defoliating Moth Monitoring

As a part of an Alaska-wide monitoring program conducted under a cooperative agreement between the State of Alaska Division of Agriculture and United States Department of Agriculture, we have been monitoring for invasive defoliating moths in the Exit Glacier area since 2011 (Fulton, 2011). Defoliating invasive moth species such as *Lymantria dispar dispar and L. dispar asicatica*, or spongy moths, have not established in the State of Alaska, but egg masses have been found on recreational vehicles and on barges carrying shipping containers in the past (USFS 2010).

In 2023 we installed five Delta insect traps that contained a pheromone lure meant to attract male spongy moths. We installed these throughout the Exit Glacier developed area where moths are most likely to be introduced. Traps were hung from deciduous trees at the following locations: the campground, the employee housing area, Exit Glacier parking lot, and the Nature Center Plaza. We monitored all traps monthly. We replaced all traps on July 5 because the amount of precipitation we received in June waterlogged the traps and they lost their rigidity and effectiveness. Traps were removed on September 8 and data sheets were sent to the Alaska Division of Agriculture project lead. We did not detect any spongy moths.



YCC employee installs trap for defoliating moths (*Lymantria disparasiatica*) in the employee housing parking lot in the Exit Glacier Area (NPS/Makena Desermia).

Discussion and Recommendations

Annual Bluegrass

Although annual bluegrass is only given a 46 out of 100 ranking on the Invasiveness Ranking System for Non-Native Plants of Alaska (Carlson et al. 2008) and appears so far to not spread into areas established with native vegetation, we have seen it spreading farther along trails and into disturbed areas in greater densities, especially in the Exit Glacier area.

Annual bluegrass (*Poa annua*) is currently found in all three areas of the park: the Exit Glacier Area, Seward, and the Coast. It was first mapped and treated in the Exit Glacier Area in 2010 through manual efforts (Kurtz 2010). It was determined that manual control was not effective on larger populations, and we began applying herbicide to select populations in 2017. The herbicide Roundup Custom was applied to annual bluegrass populations in the Exit Glacier area and in the Maintenance Facility yard from 2017 through 2022, and at the two coastal Public Use Cabins in 2020 and 2021. These applications of Roundup Custom did not decrease the density of any of these populations because of the accumulation of seeds in the soil that continued to sprout after herbicide was applied (Visconti and Kriedeman 2023). Since annual bluegrass populations have become more wide-spread and has a low invasiveness ranking we decided to prioritize remote populations, populations that are small and isolated and populations that are large source populations that are in areas where seeds could be easily spread into the park.

In 2023 we decided to use the herbicide Habitat in a pilot project to treat annual bluegrass after consultation with the Alaska IPMT regional liaison. Habitat was selected because it provides residual weed control in the soil and treats both sprouted plants as well as the seed bank which has built up in the soil. We applied Habitat to annual blue grass located around the coastal PUC cabins, in the Maintenance Facility, as well as a few priority populations in the Exit Glacier area.

Habitat is a non-selective herbicide, and untreated non-target plants can be affected by the residual herbicide in treated soil through root uptake (BASF Corporation 2004b). With this in mind, we applied Habitat using spot treatment methods and refrained from applying it within the drip line of large trees. In the Maintenance Facility, we used Roundup Custom to treat annual bluegrass in areas that fell within the drip line of large trees and Habitat in areas outside of their drip lines. In other areas we hand pulled grasses that were too close to non-target vegetation. We will assess any impacts to non-target plants in 2024 after the first year of application and compare the treatment results between Roundup Custom and Habitat in the populations treated so that effectiveness can be compared and can inform future management decisions. If Habitat is found to be more effective at treating annual bluegrass than Roundup Custom, we recommend broadcast spraying populations in areas that are not near trees or other non-target vegetation to cover soil that contains the seed bank around the grasses so that they are killed by residual herbicide in soil.

We continue to hand pull small populations that are in areas that may impact visitor use and that have not built up a large seed bank. These types of populations have been reduced in size and density by hand pulling grasses.

Re-treatment

Weather was a factor this year in our ability to chemically retreat many areas, but retreatment of invasive plant populations using herbicide at least once in a season should remain a high priority because it increases the effectiveness of chemical treatment overall. This year at the Maintenance Facility we fully treated annual bluegrass only once with Habitat and Roundup Custom, for those plants found within the drip lines of trees, once during the summer. When we revisited this site at the end of the season to use up remaining Roundup Custom mix, we estimated that we only retreated approximately 1% of the annual bluegrass that had sprouted since our initial herbicide application.

We suggest fully retreating the Maintenance Facility and other priority populations of annual bluegrass at least once, and additional times as well as time allows, because of the amount of annual bluegrass that can sprout from seeds after initial herbicide applications.

Invasive plant populations along the Harding Icefield Trail and Herman Leirer Road are also sites where we recommend prioritizing chemical retreatment because of the remoteness of the Harding Icefield Trail common dandelion populations, and because of the size of the populations on Herman Leirer Road. Other areas should be retreated as time and resources allow.

We resurveyed and manually retreated most sites in the Exit Glacier area, except for the Nike Stripe. In most cases, we found additional plants that were missed or that had sprouted after the first treatment. We strongly recommend that all areas in the Exit Glacier Area are resurveyed throughout the summer as time and resources allow to increase the effectiveness of treatment. As possible, coastal areas should also be resurveyed and retreated to control any additional plants that sprout or that were missed after initially surveys.

Standardized Polygons

The use of standardized polygons for documenting and tracking herbicide use increases efficiency and data quality. We recommend that the IPMT continue to use the established standardized polygons at the following sites: Herman Leirer Road, Exit Glacier Parking Area, Outwash Plain and Maintenance Facility.

Although standardized polygons are intended to be a tool to measure herbicide use over time, we chose to use standardized polygons to track plants we hand pulled within some of the standardized polygons this summer. We had many rainy days in June when we could not apply herbicide, so we decided to hand pulled plants to prevent them from going to seed and spreading. We used the standardized polygon so that we would not have to map each individual population of plants within the standardized polygons because it can be very time consuming when you have a dense population of invasive plants and we were only treating on species of plant, common dandelion. We counted all the plants we hand pulled and used this data to account for area treated.

Any new invasive plant species found or plants that need to be individually relocated in subsequent years within the standardized polygons should be mapped individually (not selecting the standardized polygon naming protocol in Field Maps) even when herbicide is being applied to the plant, because plants treated using the standardized polygon will not show up individually in GIS. The plant will only be part of a list of plants treated in an attributes table associated with the larger standardized polygon and won't be seen individually when viewing in GIS.

Additional standardized polygons can be considered but they should be for areas that are routinely surveyed or treated for invasive species, have large or dense enough infestations that treating as a polygon makes logical sense, and their use should increase efficiency of tracking treatment without confusion. An example of a new, potentially useful, standardized polygon would be one that borders the area outside of the Maintenance Facility fence. We visit this area multiple times a year and treat the same species throughout the area. Using a standardized polygon here would reduce personnel

time spent mapping individual invasive plant populations each time we treat and retreat this area. We recommend reviewing the previous year's data collected in this area and creating a new standardized polygon in this location.

Oxeye Daisy

Oxeye daisy (*Leucanthemum vulgare*) was manually removed from three locations in the Exit Glacier Area this year: Herman Leirer Road, the Glacier View Loop trail, and the Glacier Overlook Loop trail. We continue to find only a few plants each year in the Exit Glacier area, but populations along Herman Leirer Road outside the park have continued to spread and have become denser from the Seward Highway down the road to the park boundary and has become a concern. We talked to our KP-CISMA partners about our concerns and learned that Chugach National Forest already had plans to treat invasive plant populations on the State of Alaska road right-of-way along Herman Leirer Road adjacent to their property in 2024. Chugach National Forest shares a boundary with the park near the Exit Glacier area and Herman Leirer Road passes through their property. They agreed to add oxeye daisy to their control efforts. We plan to help with herbicide applications during the summer of 2024 as permitting allows. We recommend continuing to collaborate with Chugach National Forest to control the oxeye daisy and other invasive plant populations along Herman Leirer Road outside of the park boundary into the future.

Ranunculus kuepferi

The single Kuepferi's buttercup (*Ranunculus kuepferi)* that was discovered in 2022 on the Harding Icefield Trail is also noteworthy. The plant was positively identified as Kuepfer's buttercup (*Ranunculus kuepferi*) in 2023 and it is the first time it has been identified in Alaska or outside its native range (J. Fulkerson, personal communication, October 26, 2023). It is unknown if this plant will become invasive, and we recommend resurveying at the site where this plant was collected in early June over the next several years to ensure that there are no other plants growing in the area.

Big Chickweed

Three populations of big chickweed (*Cerastium fontanum)* were found and treated this year along Herman Leirer Road, the Exit Glacier Parking Area, and the Glacier Overlook Loop trail. Because of the larger size of these populations, it is likely that a seed bank has established in the soil and additional plants will sprout in the coming years. These populations are still relatively small and should be treated before the they become more widespread. We recommend resurveying and treating these areas over the next few years to continue to reduce the population size with the goal to fully eradicate this species at these sites.

Nike Stripe and SNOTEL Sites

This year during our survey of the Nike Stripe, two common dandelion plants were found and manually treated; one plant was found on route to the Nike Stripe and another on the north end of the Nike Stripe itself. Common dandelion had not been found in this area since 2020. We recommend continued monitoring of the Nike Stripe and SNOTEL areas into the future. Even though these areas have been free of invasive species in recent years, the use of these areas by park staff and other scientists or the failure to treat just one plant in previous years could lead to the reintroduction of species once thought eradicated.

Roadside Brushing

Each year maintenance staff mechanically brush roads and trails around the Exit Glacier Area, including the sides of Herman Leirer Road and the Exit Glacier Parking Lot, to keep vegetation low to address maintenance and safety concerns. We typically collect native seed and survey for invasive grasses in these areas in July and August. We wait until later in the season to control invasive grasses because they are more easily detected and identified when they are flowering, and seed heads are visible. Native plant seeds are typically ready for harvest later in the summer during as well. It is important to maintain communications and coordinate with maintenance staff beginning in late June to ensure that we have time to identify and flag grasses of interest that we do not want to be cut prior to brushing events. We recommend weekly to bi-weekly communication with maintenance staff to ensure that current plans of action are clear to everyone.

Coastal Priorities

Because coastal areas of the park are more difficult to access and treat because of their remote location, surveying for and treating all invasive plant populations in coastal areas each summer remain a high priority. Incorporating surveys to new areas or locations that are less used by visitors should be something we do each year as time allows because invasive plant populations have been discovered in some unlikely locations in the past.

For common dandelion infestations found along the rock ridge south of Dinglestadt Glacier, at Yalik Glacier beach and at the Head of North Arm, we recommend using chemical treatment for the foreseeable future, whenever weather conditions allow, until populations can feasibly be managed through manual treatment. Currently, these populations span a wide enough area that manual treatment would require excessive time and personnel to be effectively used as a management tool. This year, the manual removal of 359 common dandelion plants at Yalik Glacier Beach required three people working for three hours; the time required to manage this population would have been significantly reduced if we used chemical treatment methods.

Common dandelion populations on the rock ridge south of Dinglestadt Glacier is located next to a glacial outwash plain and it is challenging to access because of changes in water courses and thick vegetation. An alternate route may soon need to be considered as alders are becoming quite thick and tall along the route, we are currently using to access this population. Access to this population has changed over the years as the glacier has melted and the river formed by the glacier has moved from the south side to the north side of the glacier terminus. This is a dynamic area, and the easiest and safest route needs to be reassessed as the landscape changes.

We recommend that high use campsites in Aialik Bay, Nuka Bay, and Northwestern Fjord continue to be surveyed for invasive plants on a yearly basis. As far as we know, these areas and the Public Use Cabins (PUCs) have the highest visitation along the coast which means there is a higher likelihood that invasive plants will be introduced at these locations. We also recommend monitoring areas at the two PUCs in Aialik Bay where annual bluegrass was chemically treated with the herbicide Habitat over the next few years. We want to track the effectiveness of this herbicide on

annual bluegrass and determine if any nearby, non-target vegetation was impacted and if we need to reapply herbicide after the initial treatment.

This year we had the opportunity to monitor the park's physical science program's time-laps camera installation sites in McCarty and Northwestern Fjords. These camera installation sites will be reinstalled for one more summer and we should revisit these sites if the opportunity arises in 2024. Park staff are well-informed on best practices for reducing the spread of invasive species, but seeds and plant propagules can still accidentally be transported on equipment and clothing and be spread into the park. We recommend doing opportunistic monitoring for invasive plants as opportunities arise. We can't monitor every area in the park, but when we do assist with other resource management team projects, it is a good opportunity to incorporate invasive plant surveys as time allows.

In 2022, contractors removed non-historic buildings and mining equipment from the abandoned Waterfield-Goyne and Kinney mines in Nuka Bay. We surveyed areas disturbed during the project at these sites in 2023 and did not find any invasive plants. We recommend that these sites continue to be surveyed for invasive plants over the next few years to ensure that nothing was introduced during these projects. In September 2023, soil contaminated by past mining and was in danger of eroding into a nearby creek was removed at the Glass-Heifner mine in Beauty Bay. Contractors removed a portion of the contaminated soil using heavy equipment and stabilized the erosion occurring near the stream, but not all the contaminated soil was removed, and the project will continue during the summer of 2024. We recommend that this site also be prioritized for yearly surveys after the project is completed to ensure that invasive plants were not introduced during the project.

In late August 2023, we received word that a dandelion was discovered at the Kenai Fjords Glacier Lodge earlier in the summer. Although we were unable to confirm this siting, we recommend contacting the lodge manager during the spring of the 2024 season to discuss the issues with invasive plants and ensure that they are equipped with the necessary resources to properly identify and remove common dandelion and other common invasive plants on their property. Kenai Fjords Glacier Lodge staff guide their clients on to park land and they could easily serve as vectors for the spread of invasive plants into the park.

This year, the Alaska Region Commercial Services program implemented a new online data reporting system for companies with Commercial Use Authorizations (CUA) to report the number of clients they guided in the park and the locations they accessed. We will be able to create reports from the database that identify locations where CUA-holders guide clients and we can use this information to prioritize surveys in coastal areas of the park. We recommend using this data to select coastal survey sites for the 2024 season that we were unaware of to add to our coastal survey plan.

Visitor Center

The KEFJ Visitor's Center located in Seward was briefly surveyed in September 2023 and invasive species, including bird vetch (*Vicia cracca*), white clover (Trifolium repens), scentless false mayweed (*Tripeurospermum inodorum*), white sweet clover (*Melilotus alba*) and common dandelion were seen growing out of the grasses planted by a contractor during the development of the Visitor

Center outdoor interpretive exhibit that was constructed in 2022. Photos were taken of the plants, and they were hand pulled when they were identified, but a plan to either actively control these plants or remove them entirely should be considered. We recommend manually treating any invasive plants found growing with the landscape grasses in 2024. In the future, removing the existing grasses and soil, and replaced them with native plants that are not infested with invasive species should be considered.

Shea Parking Lot

The Shea Parking Lot was not treated in 2023 but continues to be a concern because of the number and density of invasive plants found growing in the parking lot. The Shea Parking lot is the parking area for the park Headquarters building in downtown Seward and is located a few blocks away next to a park storage building. The two gravel parking lots are not paved and are surfaced with gravel and have become infested with invasive plants. The parking lot is a staging area for park vehicles and is an area frequented by park employees. We are concerned that invasive plants growing on the parking lot will be spread into the park on vehicle tires and on employee's shoes. We have tried hand pulling invasive plant populations there, but they have become too large to control manually. The use of herbicide, however, would require yearly application and would likely need to persist indefinitely into the future because there is an endless source of invasive plant seeds from the yards of surrounding property. Paving the parking lot surface would be the best way to stop the growth of invasive plants, but installing and maintaining pavement is currently cost prohibitive.

Currently maintenance staff mows the area surrounding the parking lot regularly throughout the summer, which has helped to reduce the number of invasive plants that go to seed, but at present, there is no simple course of action for a long-term solution.

In the short-term, we recommend that the Maintenance team continue to mow the lot throughout the season and that this issue is given additional consideration in the future to reach a more effective long-term solution.

Planning

The KEFJ IPMT plans to write a five-year invasive plant management plan with the assistance of the Alaska region IPMT liaison. Past treatment methods will be compiled and compared over time to determine efficacy of treatment strategies and to help guide future work plans. This plan will include goals, priorities, and objectives for the coming years in a written document.

Prevention

Prevention is the most important practice that we can implement park-wide to reduce the number of invasive plants that are spread into the park. Once invasive plants are established it is often costly and time consuming to try to control these populations, especially if they are established in more remote areas of the park. It is important to implement simple precautions like cleaning shoes and gear before working and recreating in the park. This practice needs to be a priority for visitors as well as park staff. We currently maintain boot brushes at trailheads in the park and at two locations at the Seward Boat Harbor that provide both a place to clean shoes as well as educational material explaining why it is important. We also provided handheld boot brushes to all the resource

management team as well as to the backcountry rangers. This is the park staff that hike off trail and work in remote locations and simply cleaning shoes before heading out in the field can reduce the chances that park staff are part of the problem. We also work with the maintenance staff to ensure tools and equipment is clean before it is used in the park. Other ways we try to reduce the spread of invasive plants into the park is through including requirements for cleaning gear and equipment in scientific research permits and in contracts with outside business doing projects in the park.

Partners

We should continue to be involved in partnerships with agencies, groups, and organizations to share information and resources and collaborate on local projects. Participation in the state-wide invasive species organization Alaska Invasive Species Partnership (AKISP) monthly virtual meetings is a great way to stay connected with other groups managing invasive species around the state. Attending the annual fall AKISP workshop provides an opportunity to engage with partners in person and to earn continuing education credits for pesticide applicator license renewal.

We should also continue to be an active member of the Kenai Peninsula Cooperative Invasive Species Management Area (KP-CISMA), which focuses primarily on invasive species work in the Kenai Peninsula. We attend quarterly meetings, and, in the fall of 2023, we presented about the invasive species management activities currently going on in the park at the invasive species portion of the Fish Habitat Science Symposium sponsored by the KP-CISMA. The KP-CISMA also provides spring training for seasonal employees. KEFJ IPMT seasonal staff typically attend the training days that best apply to the survey work we do. We also coordinate with the KP-CISMA to organize the annual Seward community weed pull and invite the Seward Boys and Girls Club to participate when they are available. In 2024, the Chugach National Forest, one of our KP-CISMA partners, agreed to treat oxeye daisy along Herman Leirer Road while they are doing other planned herbicide treatments along the road right-of-way. Oxeye daisy is spreading down the road from the Seward Highway and is beginning to show up more often in the Exit Glacier area in our surveys.

Invasive Defoliating Moth Monitoring

We have installed and monitored for invasive defoliating moth using traps in the Exit Glacier area of Kenai Fjords National Park since 2011 (Fulton, 2011). This is part of a state-wide monitoring project led by the Alaska Department of Agriculture. Involvement in this project requires only a negligible amount of time and resources and provides important monitoring data that becomes part of state-wide database. We recommend that our involvement in the spongy moth monitoring program continue to be a priority.

Safety

Safety is the highest priority for the KEFJ IPMT and nothing we do is more important than everyone returning safely home at the end of the day. Continuing to provide a workplace where everyone feels safe and is empowered to provide input or ask questions should continue to be part of the team's work culture. We should continue to conduct safety tailgate meetings every day before we head out to work in the field. It is a good time to ensure everyone has the appropriate gear and knows what the plan is for the day.

Kenai Fjords National Park has a dynamic and changing landscape and working in this environment can be unpredictable and at times dangerous. Additional hazards occur while working in the field with rapidly melting glaciers and a changing environment. It can be difficult to plan for glacier outburst floods and landslides, but being aware that these hazards exist can help us think about the safest way to do our field work. An increasing number of outburst floods have occurred in Exit Creek in the last few years, and we must cross Exit Creek to access invasive plant populations on the other side. Although we cannot mitigate this type of risk, we can look at water levels in the creek, increases in temperatures and changes occurring at the Exit Glacier terminus to help guide our decisions about when and where to do field work. It is important for the field crew to be aware of this risk and keep it in mind when planning work near Exit Creek and other landscapes directly impacted by glaciers.

Personnel

The 2023 IPMT consisted of a biologist, a biological science technician, an SCA intern and two YCC employees. Five personnel are ideal for the field crew because this is what is required to successfully treat our largest invasive plant populations. A team of five people makes it possible to complete herbicide treatments, carry necessary gear, and to have additional eyes on the ground to spot invasive plants during survey and treatment efforts. We recommend employing the same number of personnel in future years, as this combination provides enough resources for a successful season of invasive plant management. Employing interns and high school-age teens also provides learning opportunities and career growth for younger generations.



KEFJ IPMT celebrating a summer of successful invasive plant management (NPS/Clarice Perry).

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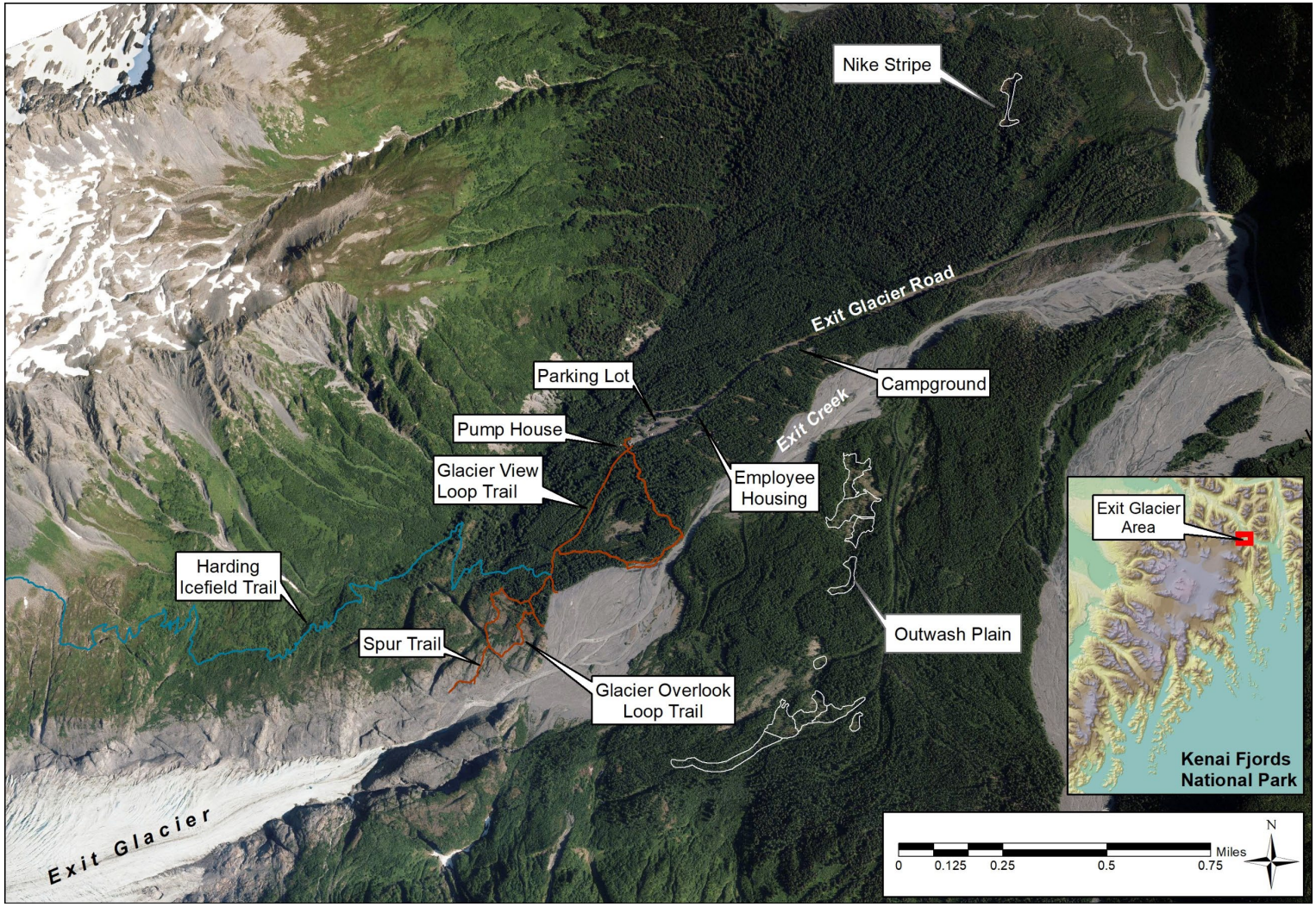
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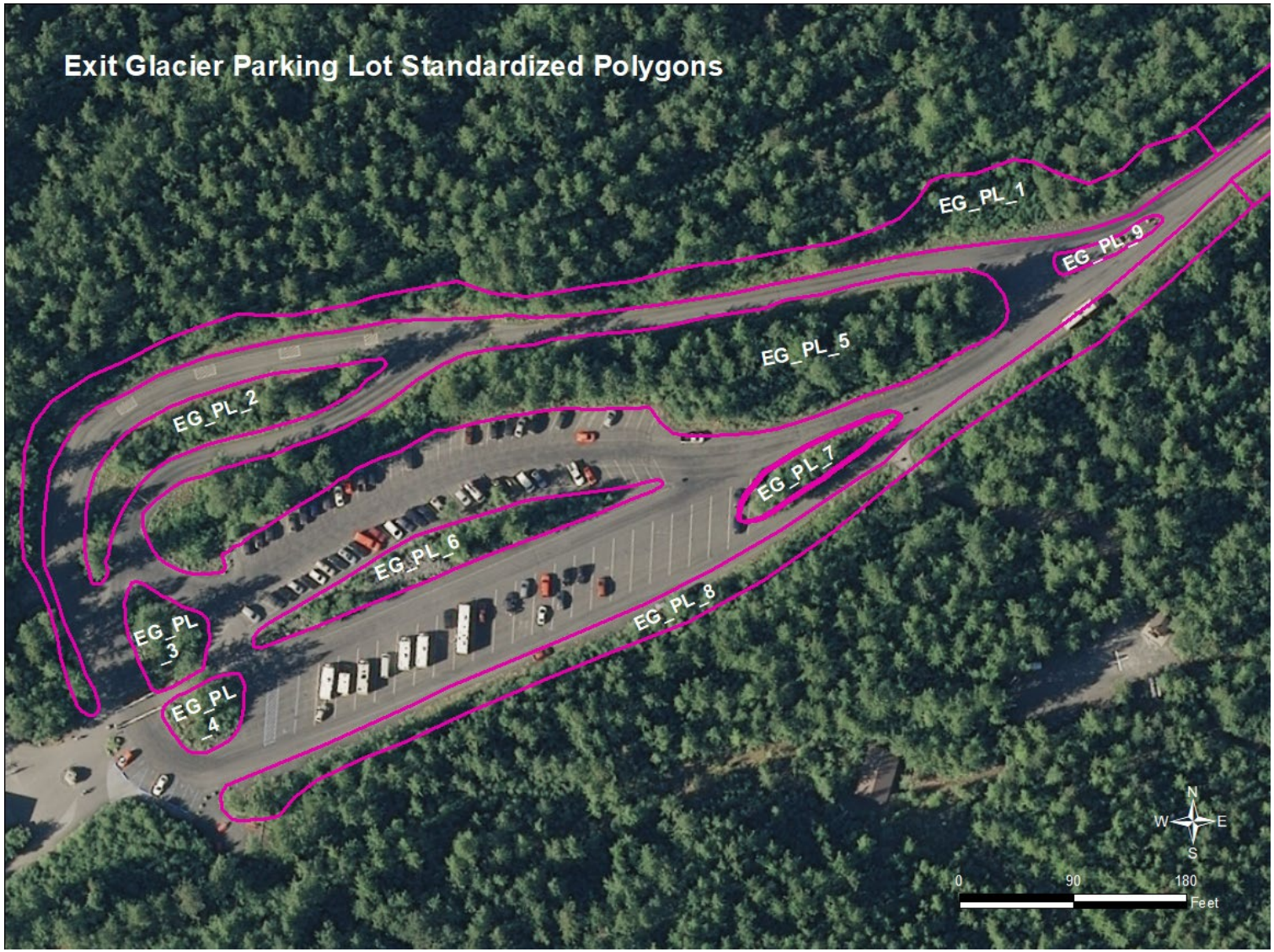
Appendix A: Exit Glacier Survey Areas



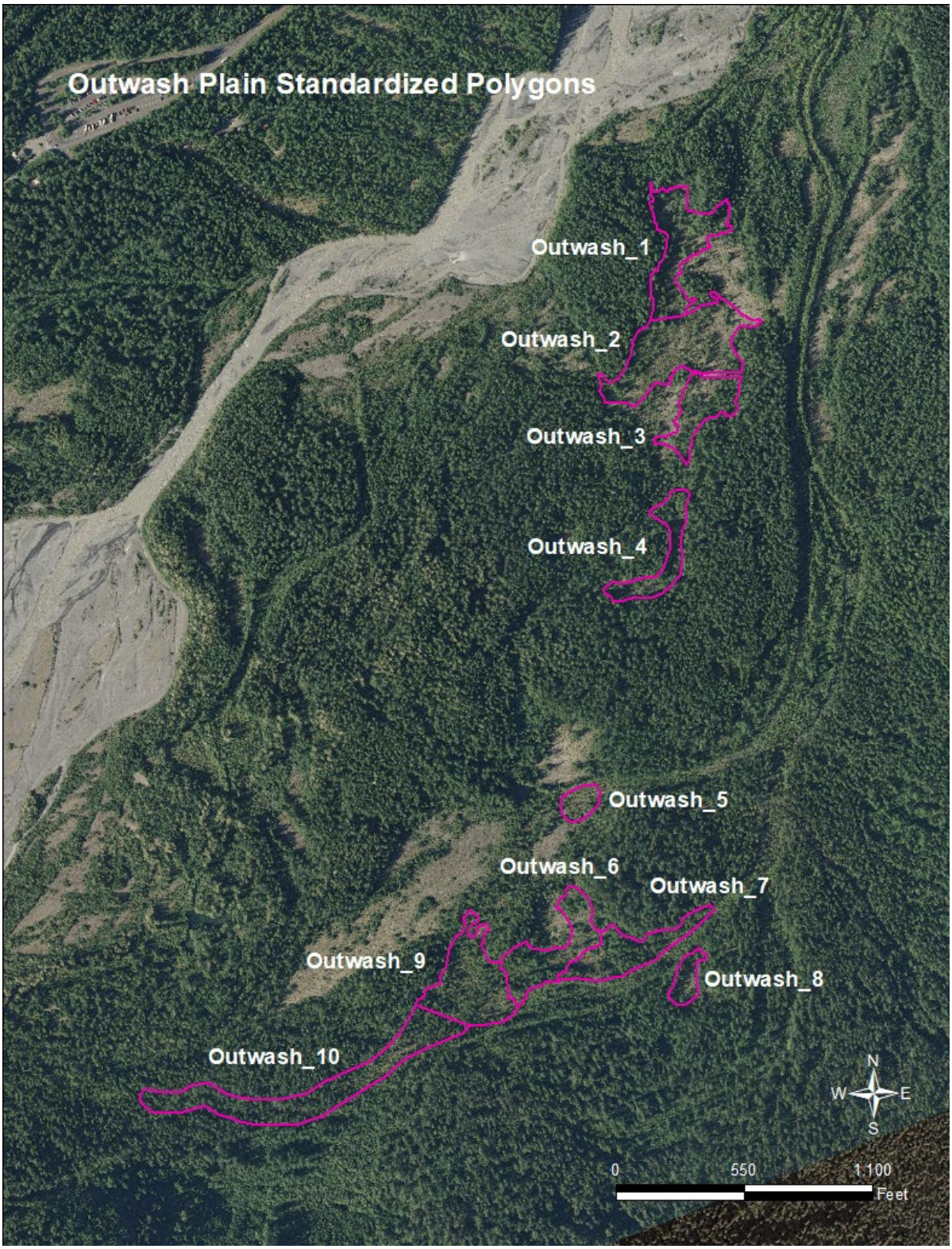
Appendix B: Herman Leirer Road Standardized Polygons



Appendix C: Exit Glacier Parking Lot Standardized Polygons



Appendix D: Outwash Plain Standardized Polygons



Appendix E: Maintenance Facility Standardized Polygon



The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS KEFJ, April 2024

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U.S. Department of the Interior

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