



Invasive Plant Management in Kenai Fjords National Park

2024 Summary Report

Natural Resource Report NPS/KEFJ /NRR—2024



**ON THIS PAGE**

Western columbine on the shore of Delight Lake.

Photography by NPS/Seth Adams.

ON THE COVER

Top left: AK Regional IPMT mixes herbicide at KEFJ. Top right: Common dandelion. Lower left: Biological science technician and SCA intern applying herbicide at Yalik Glacier Beach, Nuka Bay. Lower right: KEFJ IPMT Team hiking down the trail to treat an invasive plant population with herbicide.

Photography by top left and lower left: NPS/Christina Kriedeman; top right NPS/Kelli Palaka; lower right NPS/Anna Kirker

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2023 Summary Report

Natural Resource Report NPS/KEFJ—2024

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Abstract

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). This report serves as an overview of the Kenai Fjord National Park's (KEFJ) Invasive Plant Management Team's (IPMT) 2024 seasonal activities. The KEFJ IPMT surveyed and treated sites in three primary areas: Exit Glacier Area, the Coast, and Seward. We used both manual treatment (hand pulling) and chemical treatment (herbicide application) methods to control invasive plant populations. Thirteen invasive plant species were identified in the park this year. We surveyed and mapped a total of 52.5 acres in the park. We manually treated 0.29 acres and chemically treated 0.92 acres of invasive plant infestations. We used the spot spraying method to apply 8.24 gallons of Milestone herbicide mix at a rate of 6 ounces per acre, 1.03 gallon of Roundup Custom herbicide mix at a rate of 52 ounces per acre, and 8.45 gallons of Habitat herbicide mix at a rate of 48 ounces per acre on selected invasive plant populations in the Exit Glacier Area, at the Maintenance Facility, and on the Coast. The water level of Exit Creek remained too high to cross safely throughout most of the season, which meant we were unable to treat the known invasive plant populations in the Outwash Plain that are only accessible by crossing the creek in 2024. In addition to manual and chemical treatment of invasive plants, we participated in outreach and partnership activities, including the 19th Seward Community Weed Pull in June, and the Seward Science Symposium in August. We also contributed to the Alaska-wide invasive defoliating moth monitoring program for the 13th year. We installed five pheromone traps in the Exit Glacier Developed Area; no invasive moths were detected. The Alaska Regional IPMT completed *Elodea* surveys on Delight and Desire Lakes, and none was found. Our primary recommendations for the 2024 season and beyond include: prioritizing treating highly ranking invasive plant species, 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; continuing to monitor annual bluegrass populations treated with the herbicide Habitat to determine effectiveness of the herbicide and identify any impacts to non-target vegetation; and continuing involvement in moth monitoring, partnerships and outreach opportunities.

Acknowledgements

2024 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 Jenna Cooper, for her dedication to the thorough implementation of IPMT projects and her enthusiastic and positive attitude; Youth Conservation Corps (YCC) employees Aiden Knapp and Anna Kirker, for their support in the removal of invasive plant species, and for their positive attitudes and readiness to assist no matter the conditions; Alaska region 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; Cara Wallschlaeger, for logistical support; Nathan Bawtinheimer, for coordination of our Coastal trips on the M/V Couloir; Mike Stewart and Nathaniel Charbonneau, for logistical support and coordination of our Coastal trip on the M/V Serac; and Alaska Regional GIS Coordinator and Lead GIS Data Manager Angie Southwold, for data processing.

Thank you all for your support.

List of Terms or Acronyms

AGOL ArcGIS Online

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

EDRR Early Detection Rapid Response

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

Esri Environmental Systems Research Institute, Inc

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 with support and guidance from the Alaska Regional Invasive Plant Management Team. Early detection and rapid response (EDRR) is the primary management strategy that we use; 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, how plants reproduce and spread, proximity to high-traffic public use areas, weather, and additional factors.

The management of invasive species in the park is divided into three primary areas: the 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 plant 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 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 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 there is 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.

Kenai Fjords National Park

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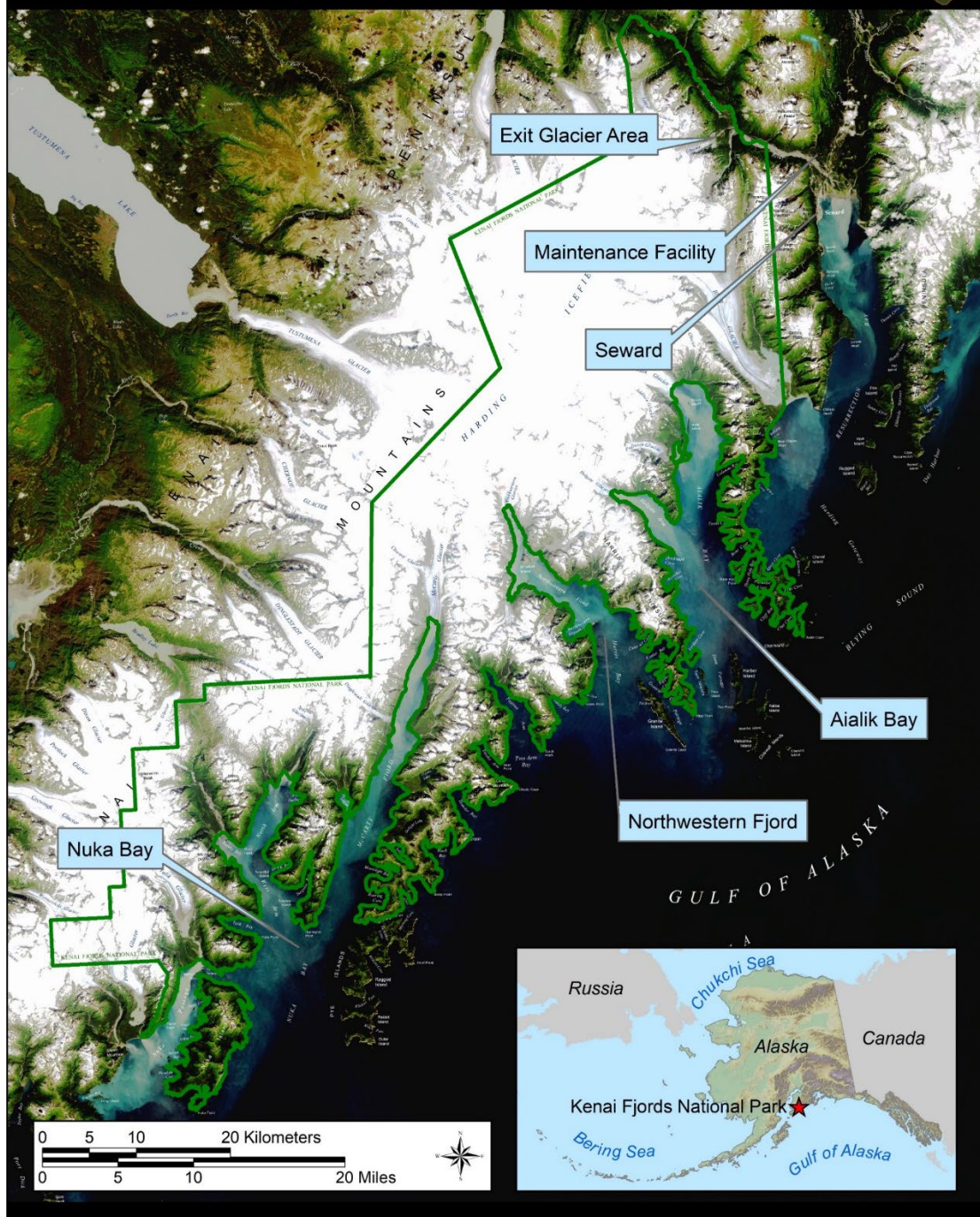


Figure 1. Overview of Kenai Fjords National Park.

Methods

Methods for data collection and processing followed the Alaska Invasive Plant Management Team 2024 Field Protocol (O'Brien, 2024a) and the Alaska Invasive Plant Management Team 2024 Office Protocol (O'Brien, 2024b) 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 2023. See Table 1 for a list of project areas included in the 2024 field season schedule.

Table 1. KEFJ 2024 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 (Carlson et al. 2008). 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 populations when conditions allow. In the Seward area, the Maintenance Facility is our highest priority because it is where vehicles and equipment are staged and used by NPS employees across 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 and plant parts 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 that could resprout if pieces were left in the soil. 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.



KEFJ Biologist hand pulling an invasive plant (NPS/Anna Kirker).

Chemical Treatment

We used three types of herbicides to chemically treat invasive plants in 2024. 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 the second year of a pilot project to test the effectiveness of treating this species. We treated annual bluegrass with Roundup Custom for multiple years and it was not effective at reducing populations because of the remaining seed bank was established 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 where the plants roots extend out into the application area. As a precaution we avoided applying Habitat to annual bluegrass populations located under the dripline of spruce trees to avoid exposing the roots to the herbicide. 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).



KEFJ IPMT employees distribute mixed herbicide between backpack sprayers (NPS/Jenna Cooper).

We attached laminated herbicide labels to 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 (O'Brien 2024a, O'Brien 2024b). 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 within Herbicide Data Sheets. Weekly field reports were completed to document invasive plant work and timing of control activities. All field notebook pages and paper datasheets were scanned and stored on the KEFJ and Alaska Region IPMT network drive.

We used the Avenza Pro application (with an NPS license) on the tablets to navigate to previous year's treatment sites. We created maps from the previous year's data in ESRI's ArcGIS Pro, exported them to a georeferenced PDF, and uploaded them to the tablet.

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 associated 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).

On invasive plant populations where more than 0.25 gallons of herbicide mix were applied, we used visual assessment of the level of herbicide mixture within the backpack sprayer tank to determine the total amount of herbicide used. Because it is difficult to assess changes of less than 0.25 gallons in the backpack sprayer with great accuracy, we used handheld tally counters to calculate the amount of herbicide when small amounts were applied. Each tally represented 1 squirt that was applied with the backpack sprayer. Each squirt was equivalent to 0.001 gallons (4 ml) of herbicide mix. This number multiplied by the tally count gave us our total gallons of herbicide mix used.

Personnel

The KEFJ IPMT had five members in 2024. The KEFJ biologist managed the invasive program in the park including completing pre-season planning, compliance requirements, herbicide applications, and hiring 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.

Results

2024 Season Overview

The 2024 KEFJ IPMT completed a variety of projects over the summer including, invasive plant survey and control, revegetation, 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 five 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 1.2 acres of invasive plants across all park properties (Table 2); including retreatments. We manually treated 0.3 acres in 2024. We used 8.24 gallons of Milestone herbicide mix to treat 0.3 acres; 8.45 gallons of Habitat herbicide mix to treat 0.6 acres, and 1.03 gallons of Roundup Custom mix to treat 0.005 acres. This is the second year we used the herbicide Habitat in KEFJ.

Table 2. Summary of Kenai Fjords National Park Invasive Plant Work in 2024.

Invasive Plant GPS Data			
NPS Lands			
Year	Species Acres Surveyed ¹	Species Acres Infested ²	Acres Treated ³
2024	52.55	1.22	1.21

The January 2018 NPS Land Status geodatabase was used to delineate NPS lands in acreage calculations.

¹Acres surveyed represent the total area mapped.

²Acres infested represent the area of a mapped infestation multiplied by the percent cover of invasive plants

in that mapped area.

³Acres 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 three focus areas, we treated 13 species of invasive plants (Table 3). We found common dandelion (*Taraxacum officinale*) and annual bluegrass (*Poa annua*) in all three areas: the Exit Glacier Area, the Coast, and Seward.

We were unable to treat any of the common dandelion populations in the Outwash Plain standardized polygons on the south side of Exit Creek for the second year in a row in 2024. Exit Creek became too high to safely cross relatively quickly in the season. Our ability to treat the known invasive plant populations in the Outwash Plain was therefore impacted; we were unable to apply herbicide here in 2023 or 2024.

Table 3. Invasive plant species and locations in 2024.

Species		AKNHP Ranking	Location			
Latin Name	Common Name		Exit Glacier	Coast	Shea Lot*	Maintenance
<i>Alopecurus pratensis</i>	meadow foxtail	52	X	—	—	—
<i>Anthemis cotula</i>	stinking chamomile	41	H	—	—	—
<i>Bromus inermis</i>	smooth brome	62	H	—	—	—
<i>Capsella bursa-pastoris</i>	shepherd's purse	40	H	—	X	H
<i>Capsella rubella</i>	pink shepherd's purse		—	—	—	H
<i>Chenopodium album</i>	lambsquarters	37	H	—	—	—
<i>Cerastium fontanum</i>	mouse-ear chickweed	36	X	—	X	X
<i>Crepis tectorum</i>	narrowleaf hawksbeard	56	H	—	—	H
<i>Elymus repens</i>	quackgrass	59	—	—	X	—
<i>Galeopsis spp.</i>	hemp nettle	50	—	—	X	—
<i>Hordeum jubatum</i>	foxtail barley	63	X	—	—	—
<i>Leontodon autumnalis</i>	fall dandelion	51	H	—	—	X
<i>Leucanthemum vulgare</i>	oxeye daisy	61	X	—	X	H
<i>Linaria vulgaris</i>	yellow toadflax	69	H	—	—	—
<i>Matricaria discoidea</i>	pineapple weed	32	X	H	X	X
<i>Papaver croceum</i>	Icelandic poppy	39	H	—	—	—
<i>Phleum pratense</i>	common timothy	54	X	H	H	—
<i>Plantago major</i>	common plantain	44	X	H	X	X
<i>Poa annua</i>	annual bluegrass	46	X	X	X	X
<i>Poa pratensis</i>	Kentucky bluegrass	52	H	—	—	
<i>Polygonum aviculare</i>	prostrate knotweed	45	H	—	X	H
<i>Ranunculus acris</i>	tall buttercup	54	H	—	—	—
<i>Ranunculus kuepferi</i>	Kuepfer's Buttercup		H	—	—	—

<i>Rumex acetosella</i>	common sheep sorrel	51	H	—	X	X
<i>Rumex crispis</i>	curly dock	48	H	H	X	—
<i>Stellaria media</i>	common chickweed	42	H	—	X	X
<i>Taraxacum officinale</i>	common dandelion	58	X	X	X	X
<i>Trifolium hybridum</i>	alsike clover	57	H	—	—	—
<i>Trifolium pratense</i>	red clover	53	H	—	—	—
<i>Trifolium repens</i>	white clover	59	X	—	X	H

Key: X=Present, H=Historically Present

*Shea lot was not surveyed in 2024, species noted here were last detected in 2022.

We surveyed areas along the Coast on three separate occasions in 2024. On the first occasion in July, we spent five 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 manually treating and surveying for invasive plants in Aialik Bay. On the third occasion in August, the Aialik Public Use Cabin (PUCs) was closed for a week for maintenance, and we took the opportunity to apply the herbicide Habitat to annual bluegrass populations growing around the cabin. We have treated these populations with Roundup Custom several times prior to 2023, but it had not successfully reduced the size and density of these populations. This was the second treatment in a pilot project started in 2023 to determine if the herbicide Habitat is effective at controlling this annual grass. We also manually retreated the Holgate Public Use Cabin on this occasion.

In June 2024, the AK Regional IPMT performed surveys for two species of *Elodea*, *Elodea canadensis* and *Elodea nuttallii*, in Delight and Desire Lakes located in McCarty Fjord. Using a float plane, three crew members were dropped on site and camped in the area while surveys were being completed. This was the second time both lakes were surveyed. *Elodea* was not detected in either lake.

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 seven species: common dandelion, common chickweed (*Stellaria media*), big chickweed (*Cerastium fontanum*), pineapple weed (*Matricaria discoidea*), common sheep sorrel (*Rumex acetosella*), fall dandelion (*Leontodon autumnalis*) and annual bluegrass. Two of these species, fall dandelion (*Leontodon autumnalis*) and common sheep sorrel (*Rumex acetosella*), had not previously been detected here. These populations were treated with herbicide during the first survey, and they were not detected again during the second survey.

We completed several outreach and education activities this year. We held the 19th Seward Community Weed Pull at the Forest Acres Campground in Seward in coordination with KP-CISMA partners. We had 17 participants from the US Forest Service, Homer Soil and Water Conservation District, National Park Service, and Seward community members; together, we hand pulled thousands of chokecherry (*Prunus virginiana*) seedlings. 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, goals, and ways to reduce impact on the spread of invasive species in the park. We also submitted an informational poster to the Seward Science Symposium that highlighted KEFJ IPMT efforts and lessons learned.

We completed four restoration projects in 2024: one at the Exit Glacier Campground, one on the Glacier View Loop Trail, one at the leach field near the Nature Center Plaza, and another on the glacial moraine near the “1889” sign on Herman Leirer Road. We also collected seeds from six 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 2024.

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 invasive plants in all eight standardized polygons in 2024. We conducted our first surveys and invasive plants treatments in standardized polygons closest to the Resurrection River Bridge (N4, S4) 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.



KEFJ IPMT and Alaska Regional IPMT work together to chemically treat invasive plants found on Herman Leirer Road (NPS/Christina Kriedeman)

We used a total of 6.70 gallons of Milestone herbicide mix to spot spray common dandelion (*Taraxacum officinale*), white clover (*Trifolium repens*), and big chickweed (*Cerastium fontanum*) on Herman Leirer Road throughout the 2024 season. This included two treatments in all Herman Leirer Road standardized polygons and an additional treatment of a big chickweed infestation. During the first full treatment we applied 5.68 gallons of Milestone herbicide mix to common dandelion, 0.03 gallons to white clover, and 0.02 gallons to big chickweed on June 12, 13, and 17. We applied 0.68 gallons to common dandelion and 0.01 gallons to white clover on June 18, 19, and 27 during the second treatment. On July 31, we applied 0.26 gallons to a 10.8 square foot big chickweed infestation.



KEFJ Biologist and YCC Employee identify invasive grasses on Herman Leirer Road (NPS/Kelli Palaka).

On July 25, 26, and August 9, we resurveyed six of the standardized polygons (N4, S4, N3, S3, N2, S2) for invasive grasses while they were in flower. We did not survey standardized polygons N1 and S1 because they had been brushed by maintenance before we had the opportunity to survey for invasive grasses. Meadow foxtail (*Alopecurus pratensis*), foxtail barley (*Hordeum jubatum*), and common timothy (*Phleum pratense*) were all found during our surveys in 2024 (Figure 2). Meadow foxtail (*Alopecurus pratensis*) was found spread across three of the standardized polygons and was treated with 0.5 gallons of Roundup Custom herbicide mix on August 9. Foxtail barley (*Hordeum jubatum*) was manually treated on July 26 and August 1 and 19; 14 plants were treated in total. An additional survey was performed for foxtail barley on August 26, but no additional plants were found. Common timothy (*Phleum pratense*) was first manually treated on June 12 and again on August 1; 11 plants were found in total.

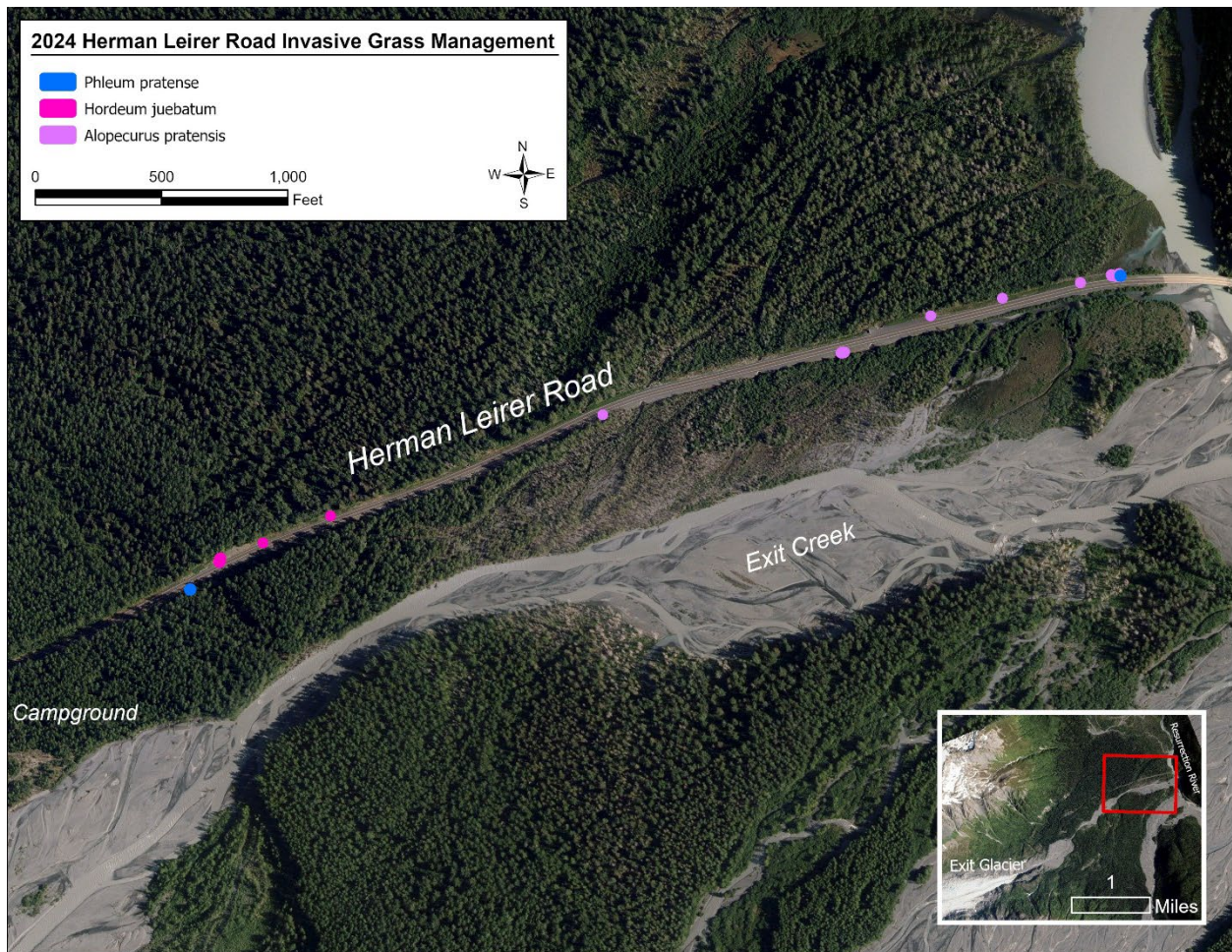


Figure 2. Invasive grasses meadow foxtail (*Alopecurus pratensis*), foxtail barley (*Hordeum jubatum*), and common timothy (*Phleum pratense*) treated on Herman Leirer Road (NPS/Kelli Palaka).

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 to high priority species of invasive plants 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, so we currently control all the invasive plant populations in these two polygons manually to reduce impacts to visitors.



Alaska Regional IPMT employee manually treats common plantain (*Plantago major*) in the Exit Glacier Parking Area (NPS/Kelli Palaka).

In 2024, we manually treated invasive plants in all the parking lot standardized polygons twice during the summer. The first survey and treatment occurred across June 19 and 24; populations of common dandelion, big chickweed, and common plantain were found. A population of white clover was mapped during this survey so we could relocate it during herbicide applications later in the summer, but we did not find it again. It was likely crushed by vehicles parking along the roadside. On June 19, 0.02 gallons of Milestone herbicide mix were applied to common dandelion in EG_PL_9 and in the east end of EG_PL_1 near the entrance to the parking lot. These were the only polygons where herbicide was applied in the Exit Glacier Parking Area in 2024 because in general, populations in the parking lot were small enough to hand pull and we prioritized herbicide application in other Exit Glacier Area sites when the weather allowed. The second survey and treatment occurred throughout July 2, August 1, 6, 7, 13, and 17. Dandelion, plantain, and pineapple weed were found and manually treated. The patch of big chickweed found during the first survey persisted throughout the summer and needed to be manually treated again during the survey on August 6 (Figure 3).

Annual bluegrass (*Poa annua*) was also found in all standardized polygons in the Exit Glacier Parking Lot. Due to resource constraints, however, annual bluegrass was only manually removed on August 6 in EG_PL_5, when we were assisted by a crew of five volunteers from the Student Conservation Association (SCA) trail crew.



Figure 3. Big chickweed (*Cerastium fontanum*), and common dandelion (*Taraxacum officinale*) outliers 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). On June 17, we opportunistically treated a population of common dandelion in the campground parking lot with 0.02 gallons of Milestone herbicide mix while on our way to assess Exit Creek water levels. We surveyed the entire Exit Glacier Campground on June 20 and manually treated common dandelion and annual bluegrass on the trails, in the campsites, and in the parking lot. Common plantain and big chickweed were also manually treated in the parking lot. On July 31, pineapple weed was found and treated with 0.03 gallons of Milestone herbicide mix in the campground parking lot.

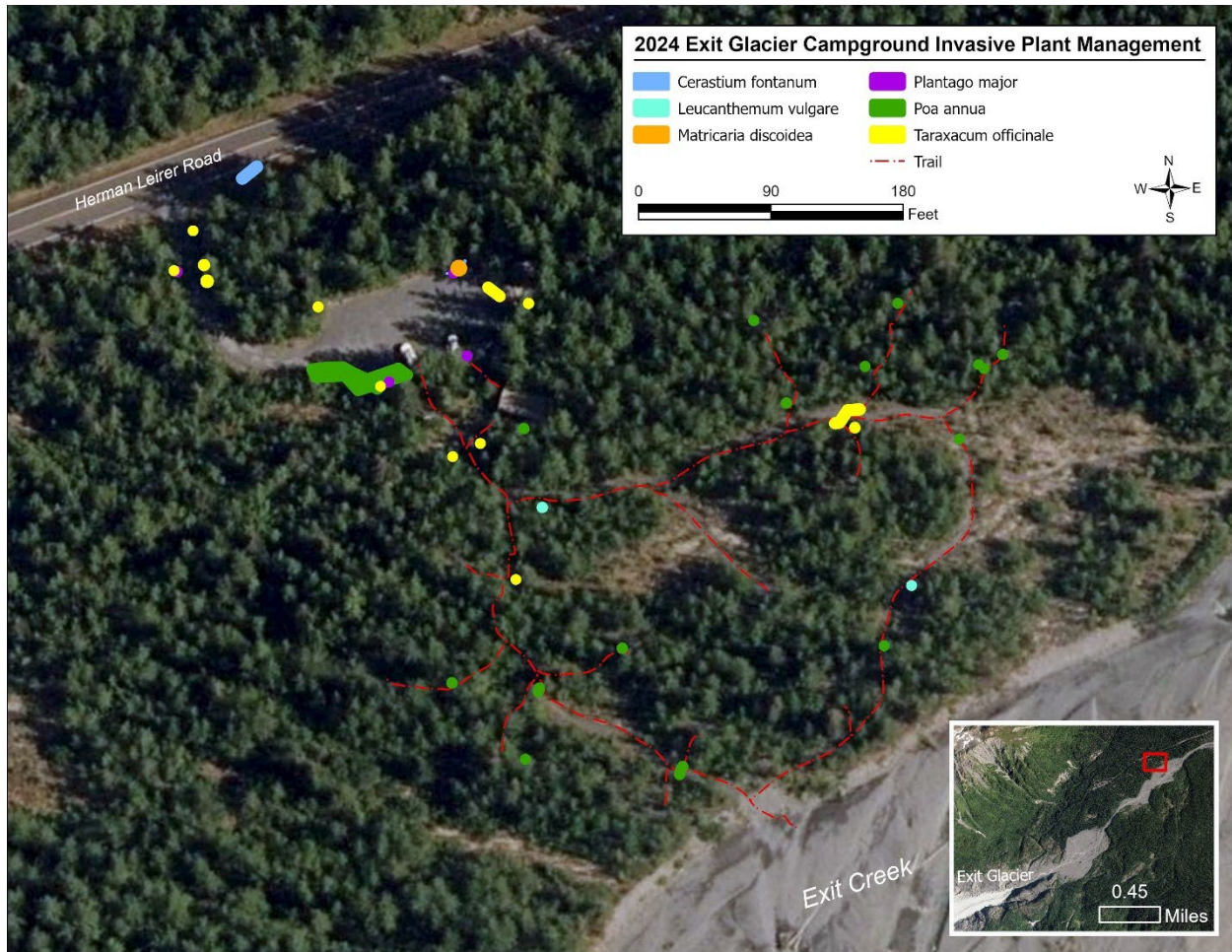


Figure 4. Common dandelion (*Taraxacum officinale*), annual bluegrass (*Poa annua*), big chickweed (*Cerastium fontanum*), pineapple weed (*Matricaria discoidea*) and oxeye daisy (*Leucanthemum vulgare*) treated in the campground (NPS/Kelli Palaka).

A second survey of the campground was performed on August 1 and 20. Oxeye daisy (*Leucanthemum vulgare*) was manually treated on both occasions, once on the trails to the walk-in tent sites and again off trail in an area closed to the public for restoration activities. This is the first-time oxeye daisy was discovered in the campground.

We treated annual bluegrass on August 13 in the campground parking lot with 0.71 gallons of Habitat herbicide mix.

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 2024 season, we surveyed the SNOTEL site on June 25 and did not find any invasive plants. We have not found invasive plants here since 2020 (Gage and Kriedeman 2022, Visconti and Kriedeman 2023, Palaka and Kriedeman 2024a).

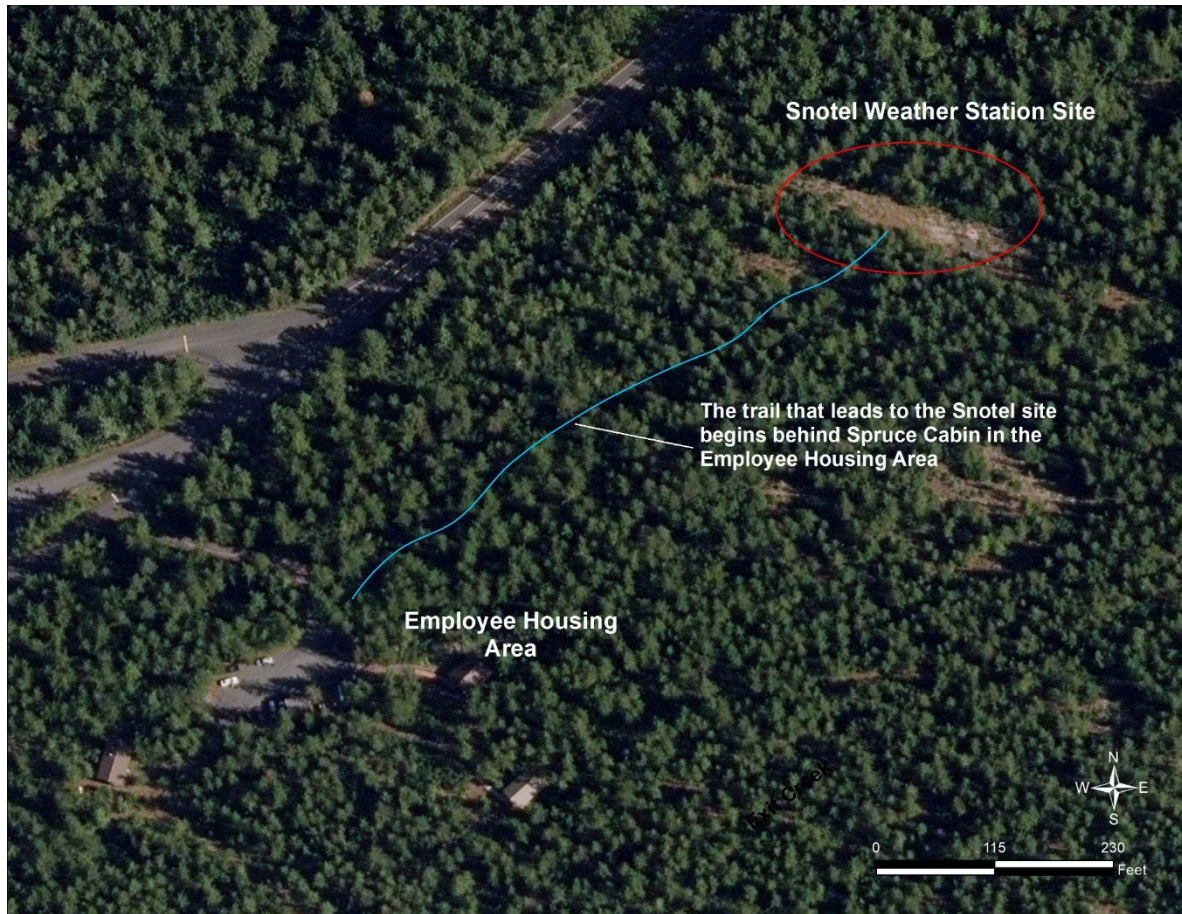


Figure 5. Location of the Snotel and access route behind Spruce Cabin.

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 twice over the 2024 season on June 20 and July 22. Common plantain, common dandelion, big chickweed, and annual bluegrass were found and manually treated on these occasions. While surveying for revegetation locations on August 16, 1 common dandelion plant was manually treated near Spruce cabin.

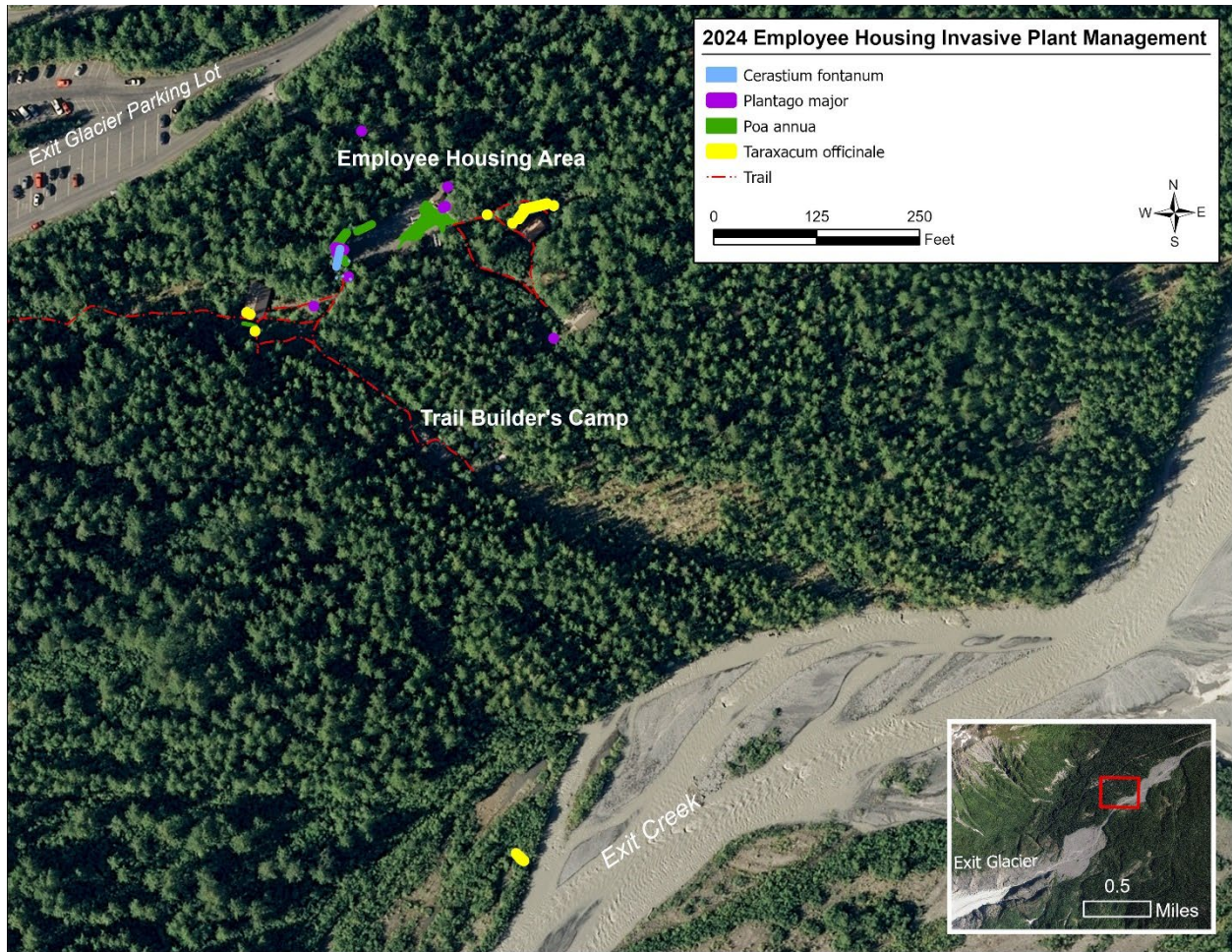


Figure 6. Common dandelion (*Taraxacum officinale*), annual bluegrass (*Poa annua*), common plantain (*Plantago major*), and big chickweed (*Cerastium fontanum*) treated in the Employee Housing Area and the Trail Builder's Camp (NPS/Kelli Palaka).

On July 31, big chickweed was treated with 0.08 gallons of Milestone herbicide mix in the employee housing parking lot. Annual bluegrass was chemically treated with 0.92 gallons of Habitat herbicide mix on August 20 in the parking lot and in a 52.8 square foot area in front of Alder cabin.



SCA intern applies herbicide to annual bluegrass (*Poa annua*) in the Employee Housing Parking Lot (NPS/Kelli Palaka).

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). Across June 20, July 22 and 31, we surveyed the area around the Nature Center and picnic area twice in 2024, and hand pulled common dandelion, common plantain, big chickweed, and white clover. We surveyed the Pavilion on June 11 and July 7 and hand pulled common plantain.

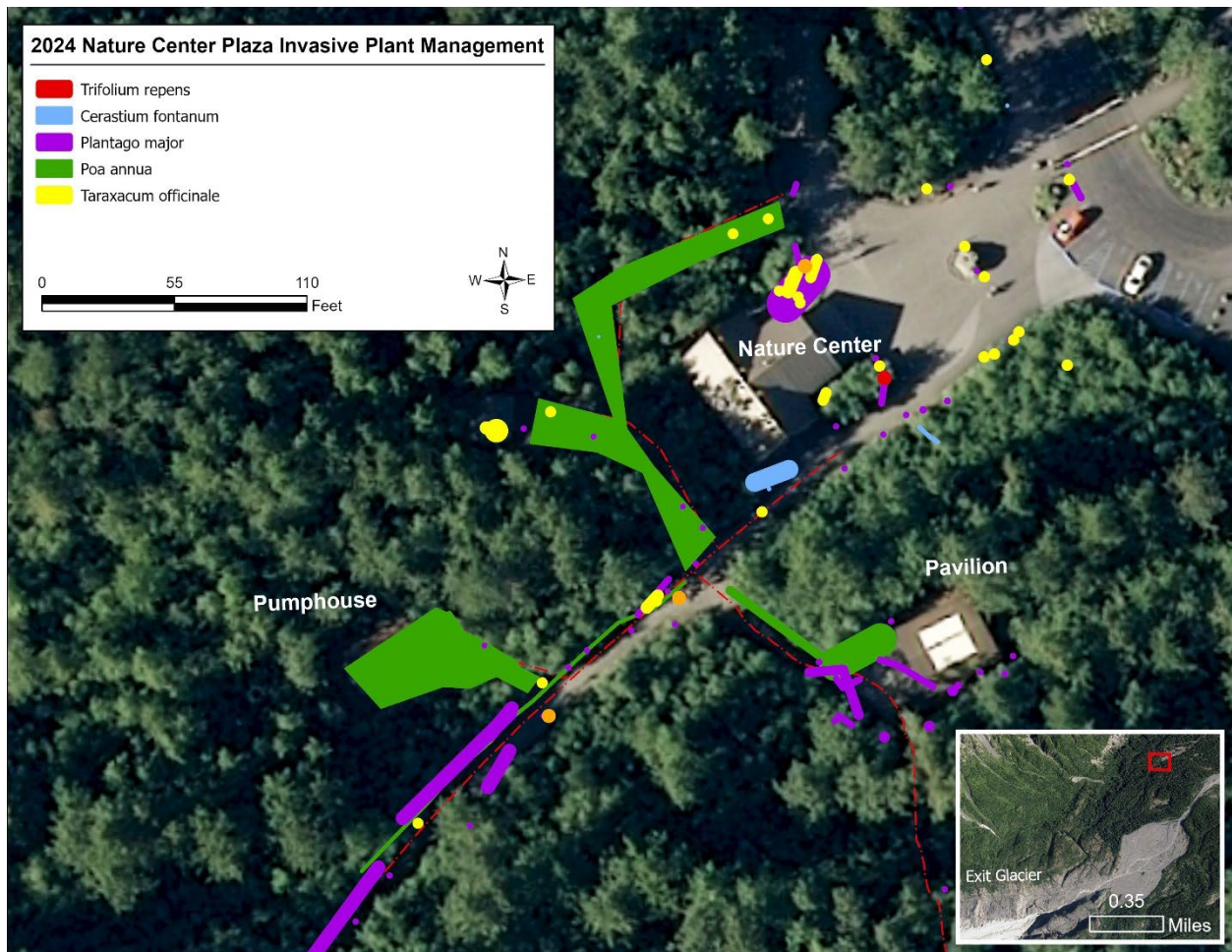


Figure 7. Common dandelion (*Taraxacum officinale*), common plantain (*Plantago major*), big chickweed (*Cerastium fontanum*), white clover (*Trifolium repens*) and annual bluegrass (*Poa annua*) treated in the Nature Center Plaza (NPS/Kelli Palaka).

We applied 0.5 gallons of Habitat herbicide mix to annual bluegrass on the trail behind the Nature Center, including the picnic area, and 0.67 gallons of Habitat herbicide mix to annual bluegrass on the path leading to the pump house on August 13.



YCC employees manually treat invasive plants in the Nature Center Plaza (NPS/Jenna Cooper).

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). In 2024, we surveyed the loop trail three times across June 6, 10, 11, 20, 24, July 1, and August 8 and hand pulled common dandelion and common plantain. We also hand pulled big chickweed, white clover, and pineapple weed dispersed along the paved portion of the trail. On August 6, we hand pulled annual bluegrass along a portion of the paved section of the trail and near the Pavilion entrance with the help of the Student Conservation Association (SCA) trail crew.

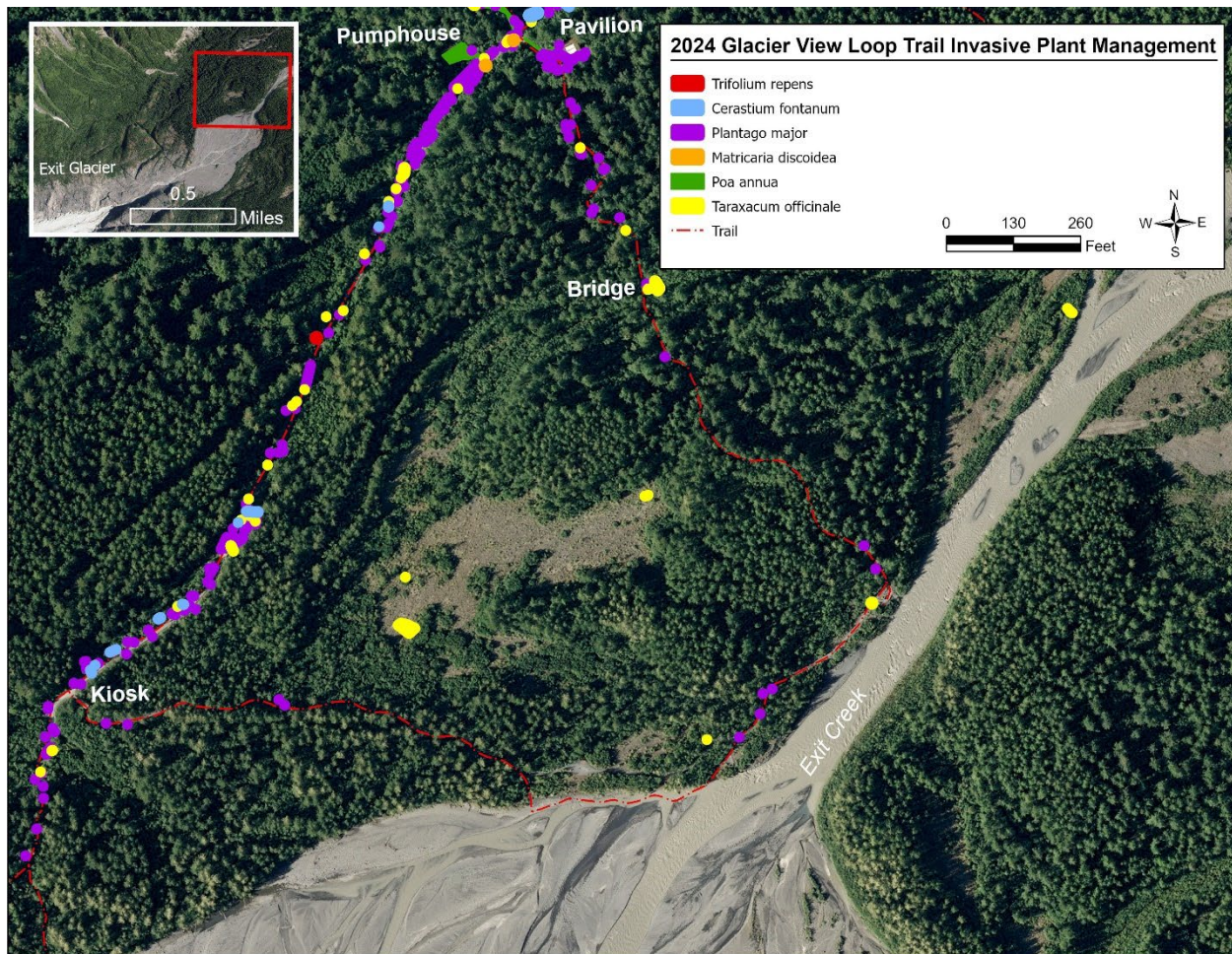


Figure 8. Common dandelion (*Taraxacum officinale*), common plantain (*Plantago major*), annual bluegrass (*Poa annua*), big chickweed (*Cerastium fontanum*) and pineapple weed (*Matricaria discoidea*) treated on the Glacier View Loop trail.

We surveyed the open space in the middle of the Glacier View Loop Trail twice in 2024 on June 26 and August 8. On June 26, we treated common dandelion with 0.01 gallons of Milestone herbicide mix. No additional invasive plants were found on August 8.

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 2024, on July 22, we surveyed the areas where these populations were previous found, but no invasive plants were found. The native vegetation in this area is growing in thicker, making it is more difficult to see the full understory; it is possible that there were small dandelions under the taller vegetation that were missed.



KEFJ IPMT search for invasive plants in the open space in middle of the Glacier View Loop Trail (NPS/Christina Kriedeman).

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 three times in 2024, on June 5, 24, and July 1. Common dandelion and common plantain were found scattered along the trail and hand pulled. Big chickweed populations were also found in two separate locations and were hand pulled.

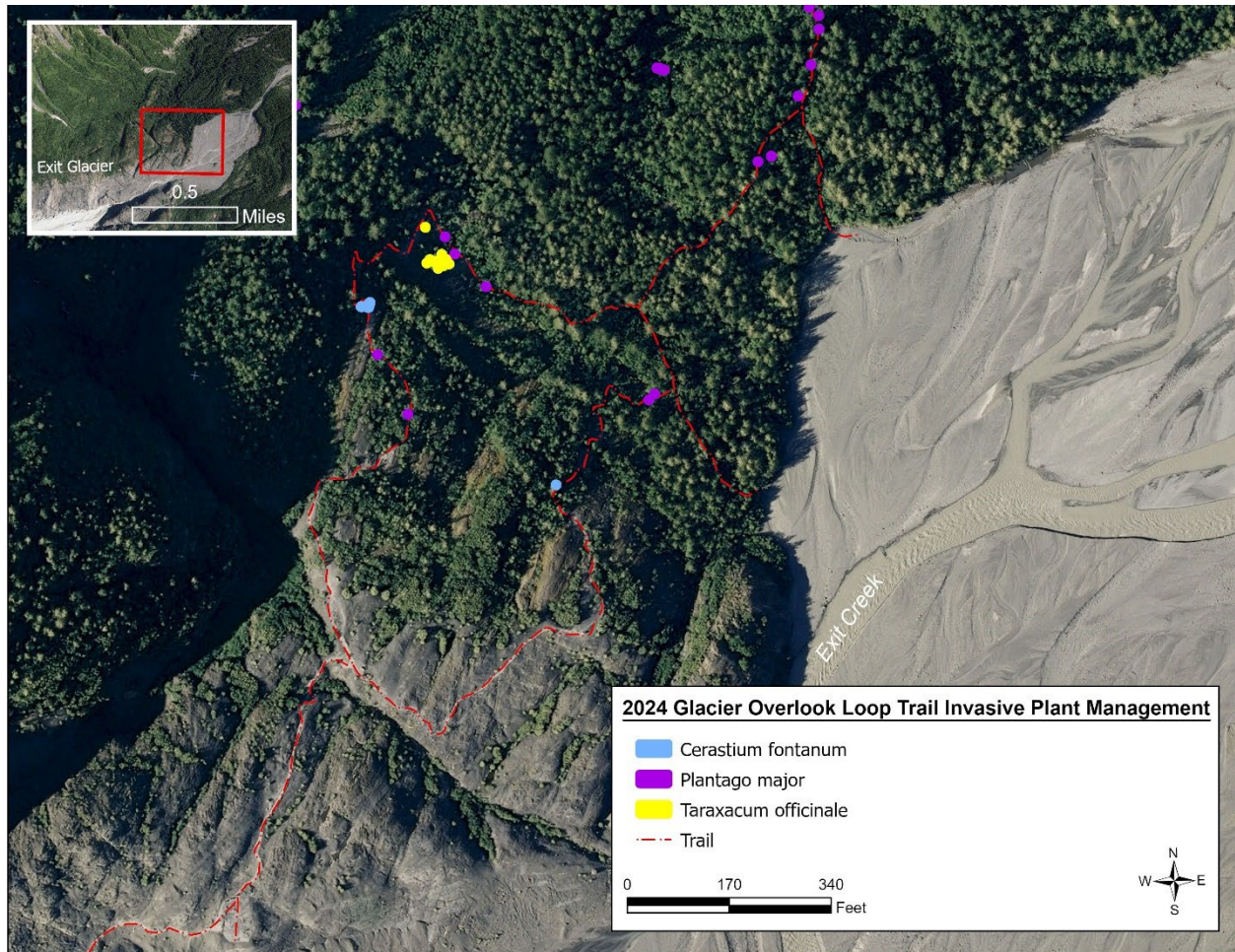


Figure 9. Common dandelion (yellow), common plantain (purple), big chickweed (blue) and oxeye daisy (aqua) treated on the Glacier Overlook Loop Trail.

In 2018 and 2023, oxeye daisy was found below the glacier overlook (Geier and Kriedeman 2019, Palaka and Kriedeman 2024a). This area was searched during each survey in 2024, but no plants were found.

On June 5, 24, and July 1, we hand pulled 136 common dandelions 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 2008, but in 2023 we found that population covered a more expansive area than had previously been documented (Kurtz 2008, Palaka and Kriedeman 2024a).



YCC employees and KEFJ Biological Science Technician manually treat big chickweed (*Cerastium fontanum*) on the Glacier Overlook Loop Trail (NPS/Jenna Cooper).

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. Each year we survey the entire trail with a focus on three areas located next to the trail where common dandelion has 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.

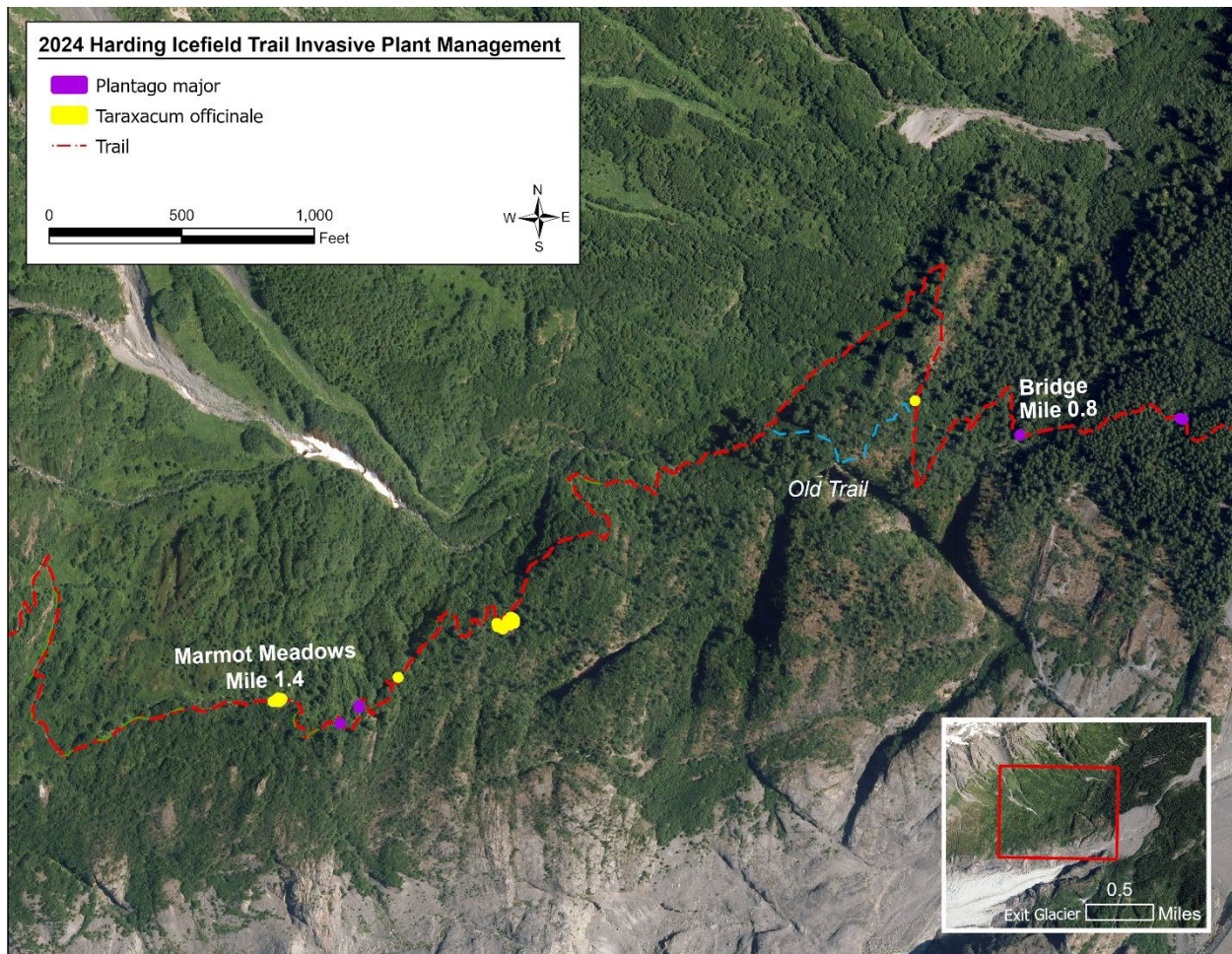


Figure 10. Common dandelion (*Taraxacum officinale*) and common plantain (*Plantago major*) treated on the Harding Icefield Trail.

On June 20, July 2, and August 27 we surveyed the Harding Icefield Trail up to Marmot Meadows (mile 1.4) and the three off-trail areas. We hand pulled 1 common dandelion and 32 common plantain plants along the trail between the beginning of the trail and mile 0.25 and 2 common dandelions and 5 common plantains along the trail between mile 1.1 and mile 1.4. We also hand pulled common dandelion in the off-trail areas at mile 1.1 (22 plants) and at mile 1.4 (26 plants) (Figure 10).

Furthermore, we surveyed the Harding Icefield Trail to the end of the trail (mile 4.1) on July 23. Beyond Marmot Meadows, we found annual bluegrass in patches about half-way up to the Top the Cliffs. We could not treat these patches at the present time because of the extent of the invasion, but these patches were mapped on August 27 for treatment consideration in the future. On August 27, we also surveyed a social trail just above Marmot Meadows and before the traverse for invasive plants; we found annual bluegrass and mapped our observation. No other invasive plants were found on the trail above Marmot Meadows.



YCCs from the interpretation team assist KEFJ IPMT in manually treating common dandelion (*Taraxacum officinale*) on the Harding Icefield Trail (NPS/Kelli Palaka).

In 2023, Kuepfer's buttercup (*Ranunculus kuepferi*), a non-native plant species, was found in Marmot Meadows on the Harding Icefield Trail at mile 1.6 (Palaka and Kriedeman 2024a). This buttercup is native to the Alps, northern Apennines, and Corsica, and was an interesting find because it had not yet been recorded in Alaska. We surveyed the area where the Kuepfer's buttercup was found in 2023, but no additional plants were found in 2024.

Nike Stripe

The area locally known as the Nike Stripe is an open area located approximately 0.4 miles north of the park entrance sign on Herman Leirer Road (Figure 11). 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 (Gage and Kriedeman 2021). Surveys in 2021 and 2022 found no common dandelion (Gage and Kriedeman 2021, Visconti and Kriedeman 2023). In 2023, one common dandelion was found on route to the Nike Stripe and another within the Nike Stripe (Palaka and Kriedeman 2024a). We surveyed the entire Nike Stripe and the areas located on route to the Nike Stripe in 2024, but no invasive plants were found.

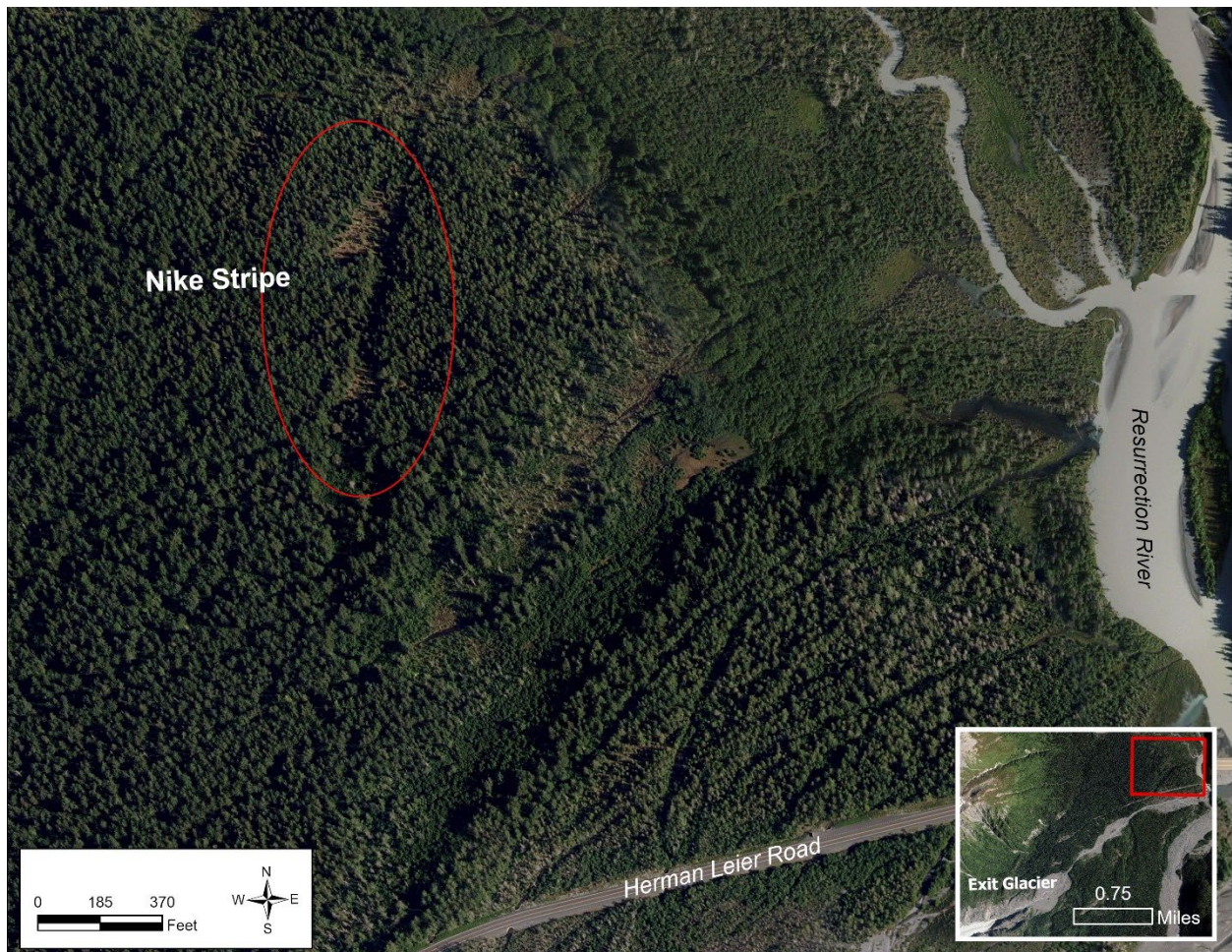


Figure 11. Location of the area locally known as the Nike Stripe north of Herman Leirer Road where no invasive plants were found in 2024.



SCA intern searches for invasive plants in the Nike Stripe (NPS/Kelli Palaka).

Outwash Plain

The Outwash Plain includes 10 standardized polygons infested with common dandelion 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 typically increases in volume as snow melts and during rain events throughout the season and can become unsafe to cross when water levels get high. Mid-June and early July is typically the window where creek levels are low enough to cross and plants have not gone to seed yet. The populations of common dandelion are sizeable enough that we need to apply herbicide to treat them effectively, so a dry weather window is required to treat these areas as well. Unfortunately, this summer, high creek levels throughout the season prevented us from treating the area south of Exit Creek, so none of the standardized polygons or areas south of Exit Creek were treated in 2024. This is the second year in a row we were not able to treat this population as we had the same difficulties in 2023.

On June 18, we surveyed the area south of the Resurrection River Bridge where common dandelion had been treated in previous years (Figure 12). We applied 0.127 gallons of Milestone herbicide mix. In 2024, we discovered and chemically treated a patch of well-established common dandelion just across the stream from Herman Leirer Road standardized polygon S4. This area should be surveyed next year as some plants were likely missed. We also surveyed for and treated common dandelion

outliers found between the Glacier View Loop Trail and Employee Housing; we used 0.004 gallons of Milestone herbicide mix in this area.



KEFJ IPMT apply herbicide to a patch of common dandelion (*Taraxacum officinale*) in the Outwash Plain (NPS/Kelli Palaka).

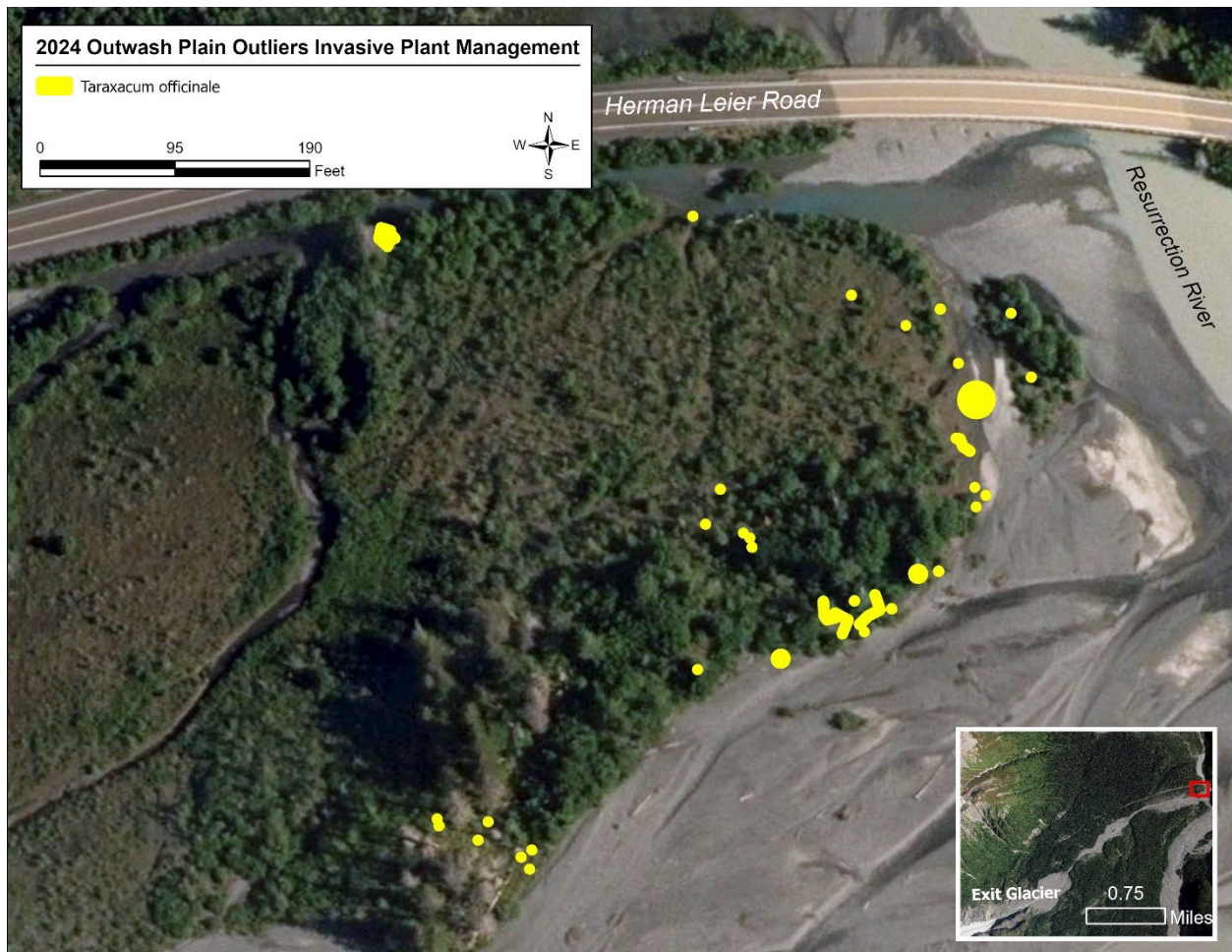


Figure 12. Common dandelion outliers on the Outwash Plain south of the Resurrection River bridge.

Coastal Areas

The IPMT completed three trips to survey for and treat invasive plants in coastal areas of the park in 2024. On July 8-12, we visited a total of 8 sites in the vicinity of Nuka Bay and Northwestern Fjord and treated three of these sites for invasive plants. On July 15-16, we visited a total of 10 sites throughout Aialik and Resurrection Bay and treated 4 sites for invasive plants. We opportunistically retreated 2 sites in Aialik Bay on August 14.

Resurrection Bay

On July 17, we surveyed the beach at Bulldog Cove in Resurrection Bay and the social trail leading from the beach to the lake on west side of the cove for invasive plants, but none were detected.



SCA intern surveys for invasive plants in Bulldog Cove (NPS/Kelli Palaka).

Aialik Bay

We made two trips to Aialik Bay to survey and treat invasive plant populations along the coast over the summer (Figure 13). Our first trip was on July 16 and 17 and we prioritized Aialik and Holgate Public Use Cabins (PUC) where there are known infestations of annual bluegrass. We manually treated annual bluegrass located around the cabins and on the trail leading to the cabins at both sites.

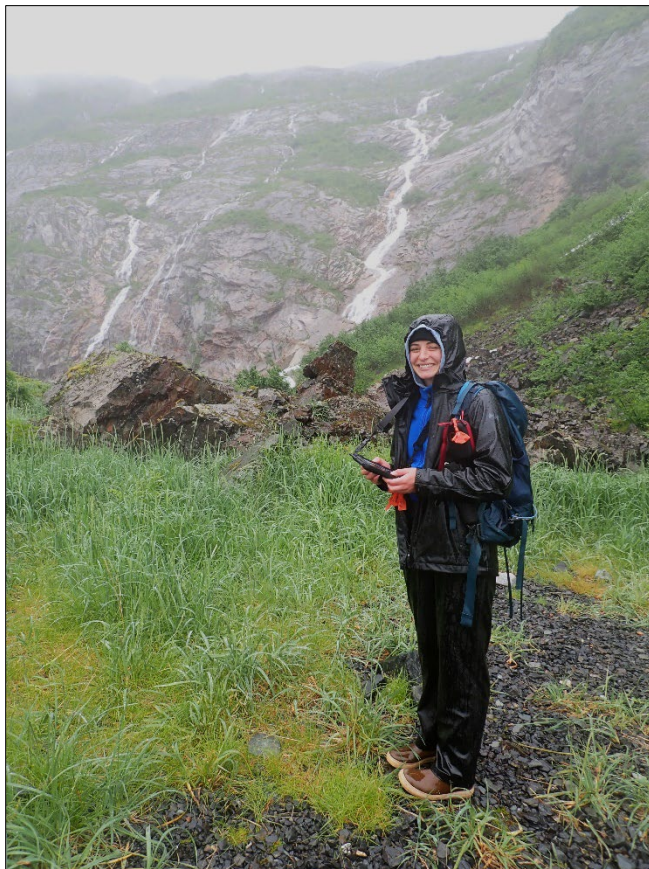


SCA intern manually treats annual bluegrass (*Poa annua*) at the Aialik Public Use Cabin (NPS/Kelli Palaka).

On July 16, with permission from the Kenai Fjords Glacier Lodge, we also 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 2011). 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 20 stems of annual bluegrass on the roads that lead from the beach to the lodge, and we hand pulled 17 stems of annual bluegrass near the kayak storage area. We also surveyed the campsite at Bear Cove, the campsite at Abra Cove, and the camping beach at Holgate. We hand pulled 10 stems of annual bluegrass at Abra Cove. No invasive plants were detected at Bear Cove or on Holgate camping beach.

On July 17, we surveyed McMullen Cove, Verdant Cove, and the northeastern most point of Aialik Bay directly across from Aialik Glacier and east of the Skee Glacier outwash plain. No invasive plants were detected at these locations.



SCA intern maps annual bluegrass (*Poa annua*) found in Abra Cove (NPS/Kelli Palaka).

We returned to Aialik Bay for a day trip on August 14. The Aialik PUC was closed for public use the week of August 12 through 16 for maintenance and IPMT took the opportunity to apply herbicide to the annual bluegrass population residing there. 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 2023). In 2023, with the guidance of the Alaska Regional IPMT Liaison, we applied the

herbicide Habitat since it is more persistent in the soil and works to control the seed bank already found in the soil from sprouting (Palaka and Kriedeman 2024a). We surveyed the Aialik PUC in 2024 and decided to continue with Habitat herbicide treatments. We applied 0.50 gallons of Habitat herbicide mix to annual bluegrass found along the trail to the cabin. Due to the proximity to where maintenance staff were working, we hand pulled 68 stems of annual bluegrass located near the cabin. We also resurveyed Holgate PUC on August 14 and hand pulled 65 stems of annual bluegrass.

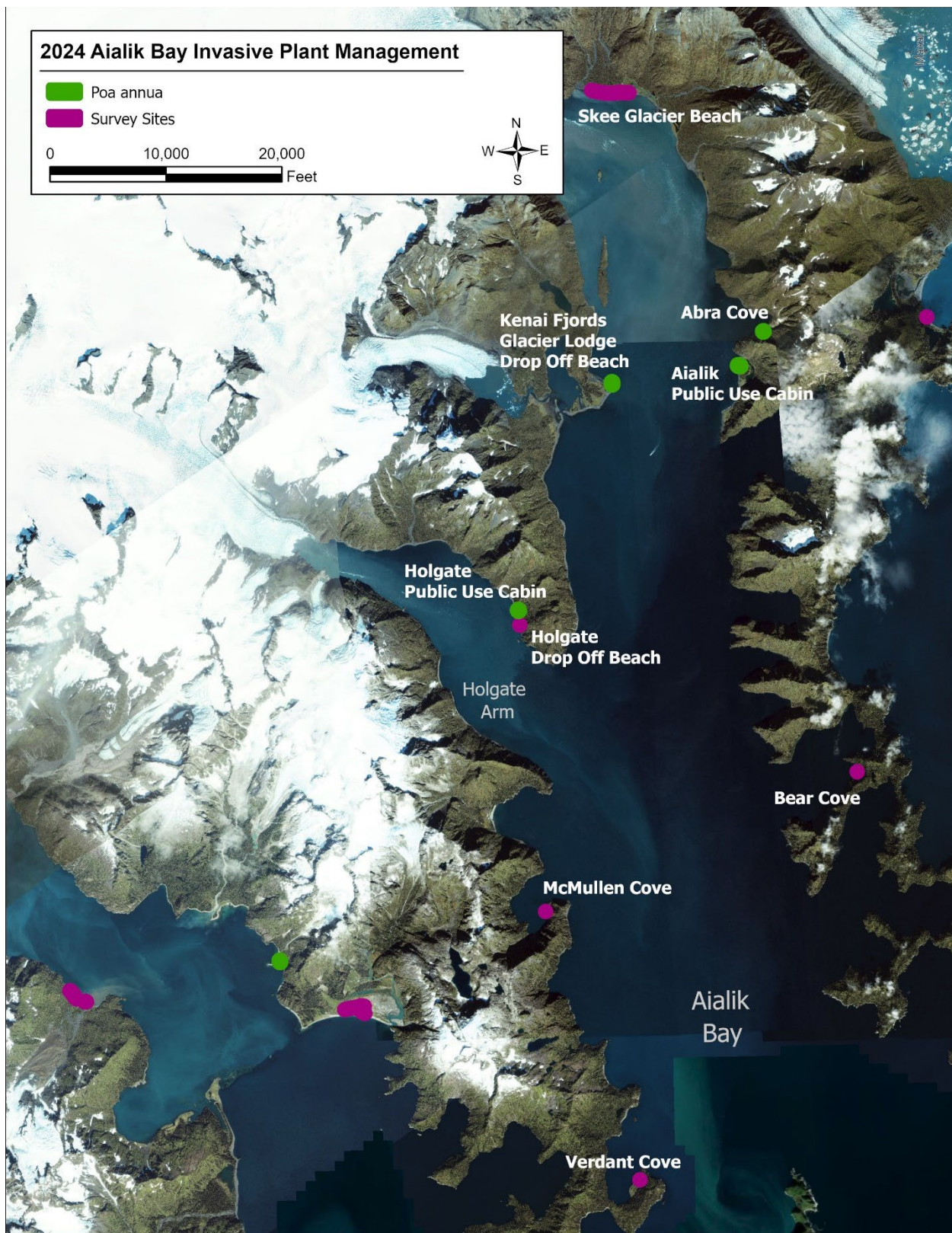


Figure 13. Populations of annual bluegrass (*Poa annua*) treated (green) and areas surveyed with no invasive plants found (pink) in Aialik Bay

Northwestern Fjord

In Northwestern Fjord, we surveyed two primary campsites, Sunlight Glacier campsite and the camping spit located on the east side of Northwestern Fjord north of the moraine, on July 11 (Figure 14). We hand pulled 159 annual bluegrass plants in a small area in front of the food storage locker at the camping spit. No invasive plants were found at Sunlight Glacier.

In 2018, a remote airstrip was discovered behind the beach known as Long Beach during a Southwest Alaska Inventory and Monitoring Network (SWAN) coastal marsh survey. The soil is very sandy in this area and native vegetation is easily disturbed by plane wheels. The area where planes land had very little native vegetation growing. We surveyed the site for invasive plants in 2021 and no invasive plants were found (Gage and Kriedeman, 2021). We resurveyed the airstrip again this year on July 11. No invasive plants were detected.

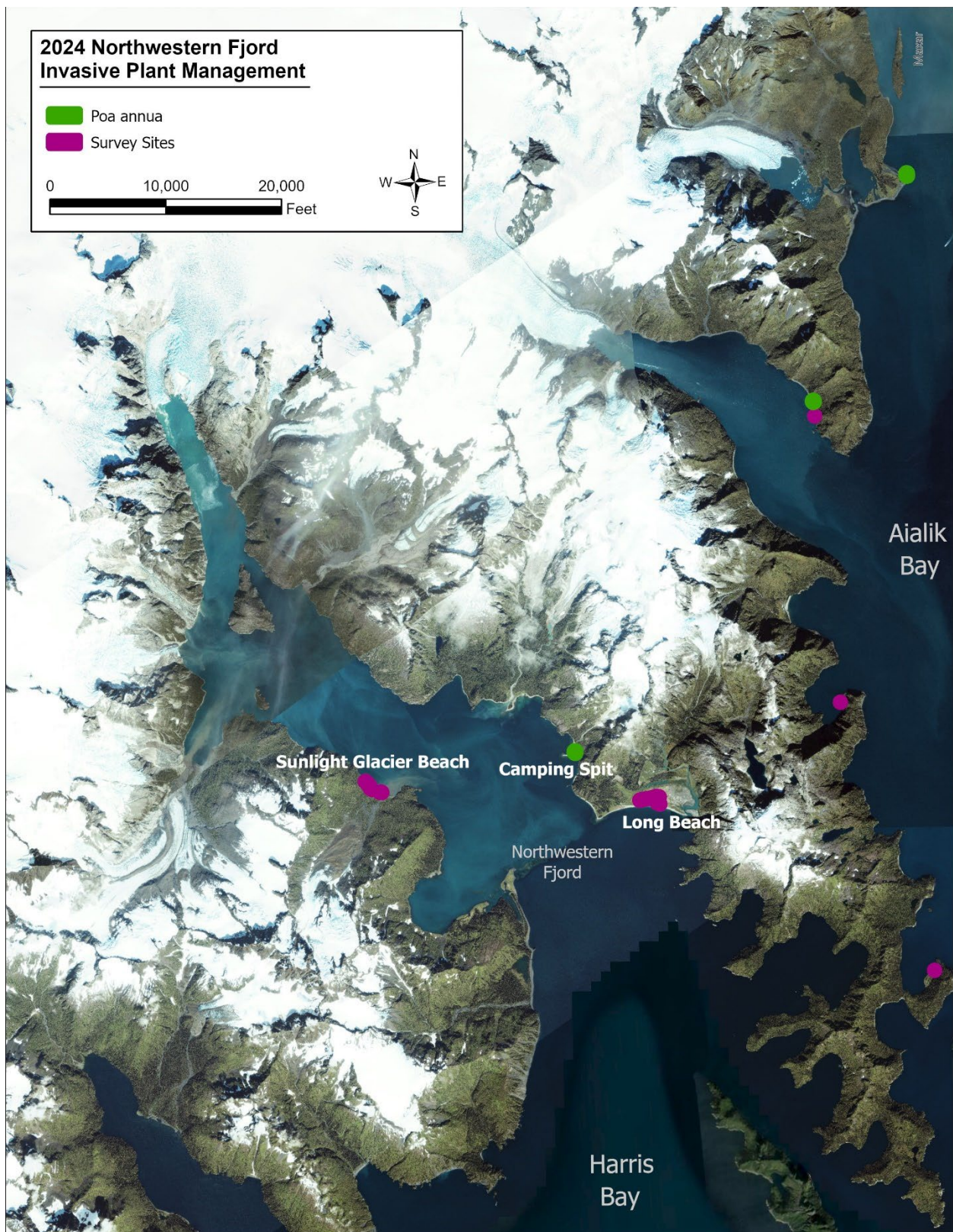


Figure 14. Annual bluegrass (*Poa annua*) was hand pulled at a campsite on the east side of the fjord and two additional sites where surveyed and no invasive plants were found (pink).



SCA intern surveys for invasive plants at the Long Beach airstrip in Northwestern Fjord (NPS/Christina Kriedeman).

McCarty Fjord

On July 10, we surveyed the Delight campsite and trail easements in McCarty Fjord. Easements in the park grant the public and NPS staff temporary access to camp and hike through private land that is owned by the Port Graham Native corporation. The beach campsite easement allows the public to camp on Port Graham Native corporation lands for 24 hours and is located above the beach north of McCarty Lagoon. The trail easement grants access to Delight Lake and another campsite easement next to the lake. There is also a campsite and gear cache next to the lake that has been used by various organizations who installed fish weir infrastructure to monitor sockeye salmon populations that are part of a commercial fishery. Currently, the weir is not being used and aerial surveys are being used to count fish. No invasive plants were found in any of these areas.



KEFJ IPMT survey the Delight Lake Trail Easement for invasive plants (NPS/Christina Kriedeman).

***Elodea* Monitoring**

Delight and Desire Lakes are the only two large lakes within Kenai Fjords National Park boundary that could be at risk for *Elodea* infestation (Figure 15). They both have sockeye salmon fisheries associated with the lakes, and float planes, which can be a vector for the spread of *Elodea*, may land on the lakes, although anecdotal information leads us to believe planes do not land at either lake regularly. Because of the potential risk of exposure, both lakes have previously been surveyed twice using visual and rake throw surveys. Delight Lake was surveyed in 2016 and 2018, and Desire Lake was surveyed in 2017 and 2018. eDNA samples were collected at each lake as well and no *Elodea* was detected. eDNA samples were collected at Delight Lake in 2016 and Desire Lake in 2017. During all previous surveys no aquatic vegetation at all has been found to be growing in either lake.

In 2023, *Elodea* was discovered to be infesting Crescent Lake in the Chugach National Forest located on the east side of the Kenai Peninsula about 26 miles north of Seward. This could increase the risk of Delight and Desire Lake being infested with *Elodea*, but we don't have information informing us that float planes are landing regularly on the lakes. Most planes and sport fisherman have been seen at the outer beaches where the lakes drain into McCarty Fjord. More information about float plane use on these lakes needs to be determined to better understand the risks of *Elodea* infestation.

In June 2024, the AK Regional IPMT completed surveys for *Elodea* in both Delight and Desire Lakes. On June 25, three crew members were flown via float plane to Delight Lake. The crew surveyed Delight Lake, camped in the area, and surveyed Desire Lake the following day on June 26. Both lakes were surveyed using two methods. First, the area was visually assessed and if they could determine that no *Elodea* was present, they considered the area clear. If the bottom of the lake was not visible, crew members performed rake throw survey methods as outlined in the Standard Operating Procedure for *Elodea* Detection in Alaska Lakes document (Fulkerson 2023). The inflow and outflow of each lake was surveyed along a transect, but no *Elodea* was found in 2024.

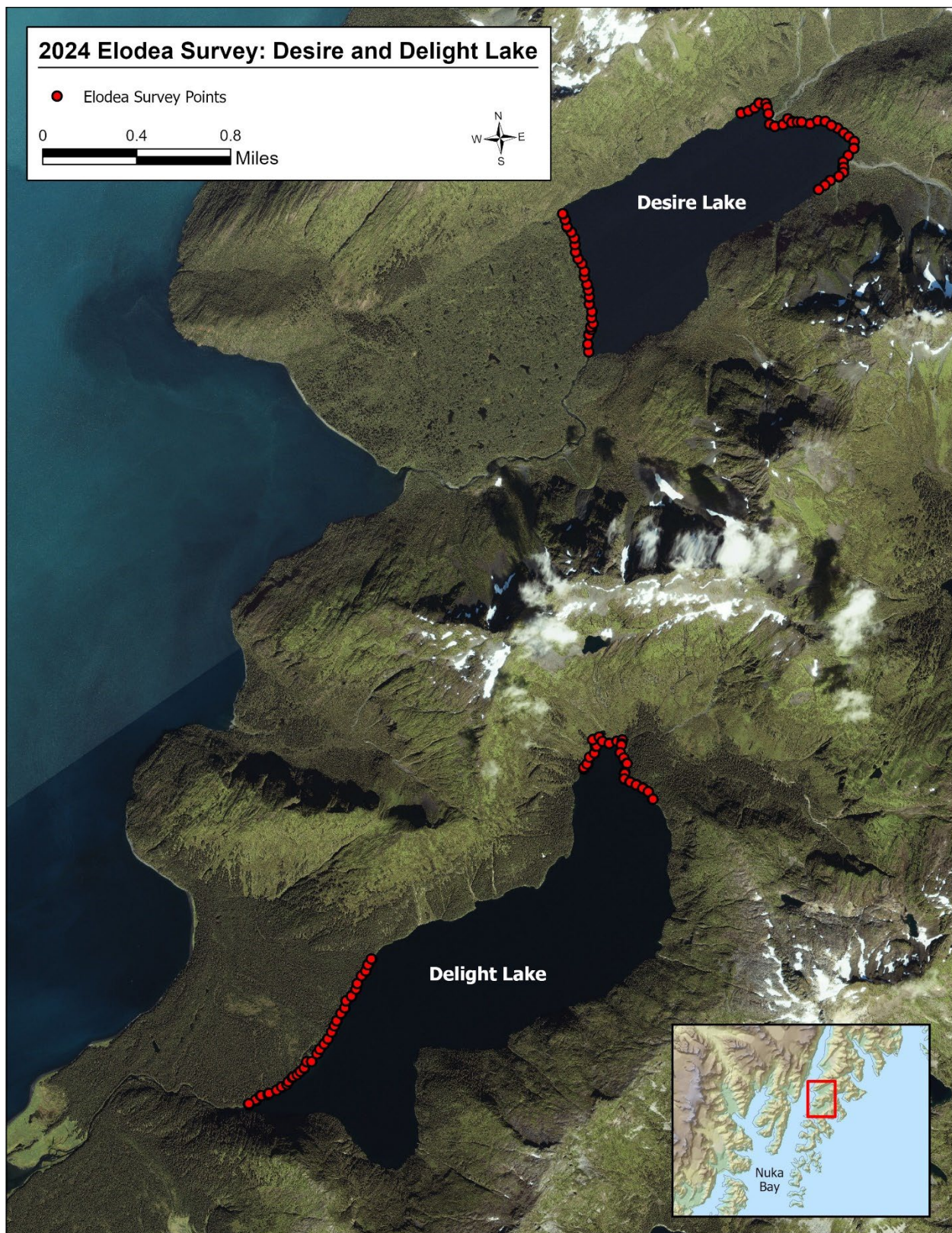


Figure 15. Sites surveyed for *Elodea* by the Alaska Regional IPMT along Desire and Delight Lakes in 2024.



AK Regional IPMT crew perform rake throw surveys for *Elodea* in Delight Lake (NPS/Seth Adams).

North Arm

On July 9, we surveyed a known population of common dandelion on the beach at the head of North Arm in Nuka Bay. Initially there was only one population here that we were treating for several years starting in 2014, but in 2022, 2023, and again in 2024 we found more scattered populations of common dandelion north of where the original population was discovered (Frank 2014, Visconti and Kriedeman 2023, Palaka and Kriedeman 2024a). Due to the rainy weather, we were unable to treat these populations with herbicide in 2024. We hand pulled 242 common dandelions in total (Figure 16). We also surveyed an additional area of the beach, northwest of the known population, but no additional invasive plants were found here.

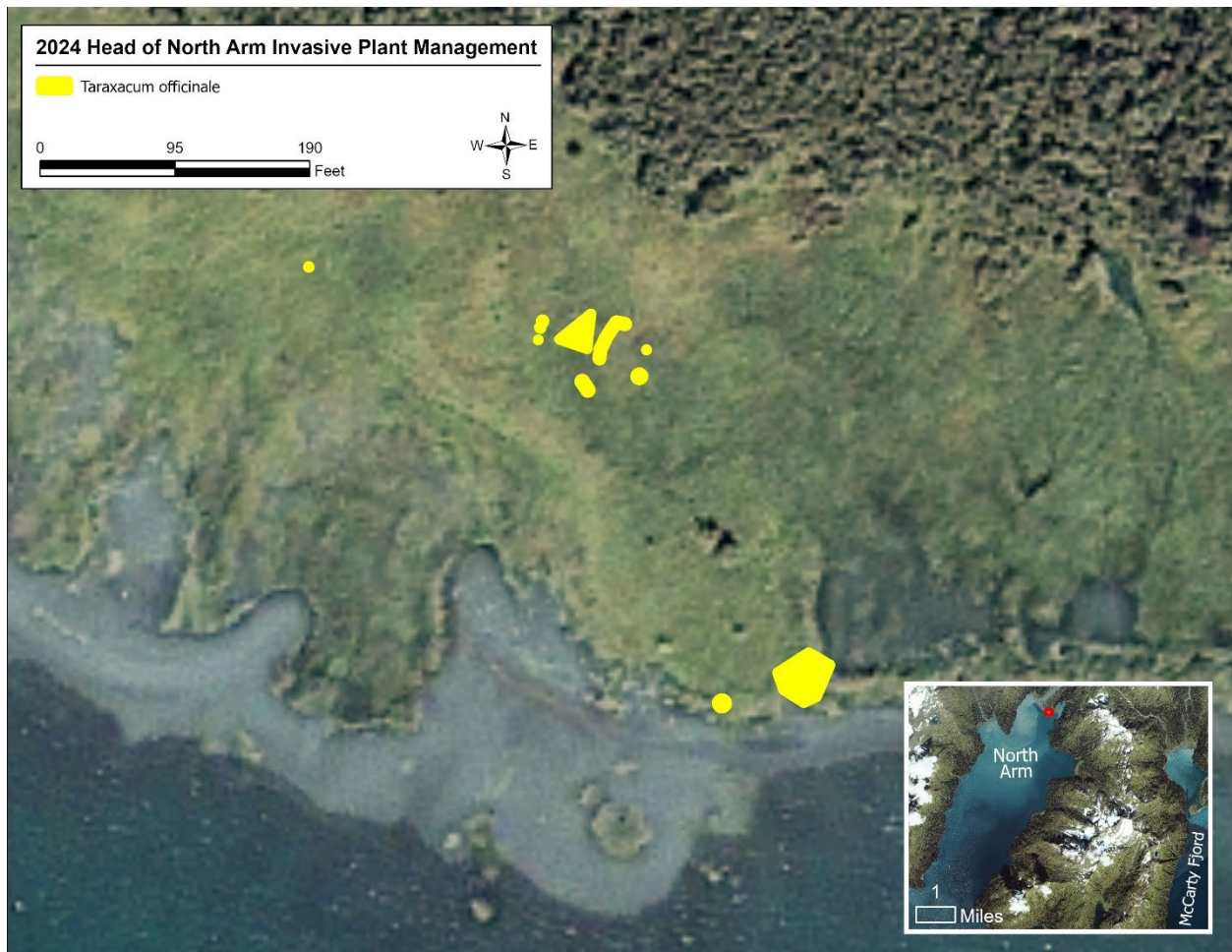


Figure 16. Common dandelion (*Taraxacum officinale*) manually treated on the beach at the head of North Arm in Nuka Bay.



KEFJ Biologist manually treats common dandelion (*Taraxacum officinale*) at the Head of North Arm in Nuka Bay (NPS/Kelli Palaka).

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 (Figure 17). 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 three years to ensure no invasive plant populations became established in these newly disturbed sites. We first surveyed these areas in 2023 and performed our second survey of these two sites in 2024.

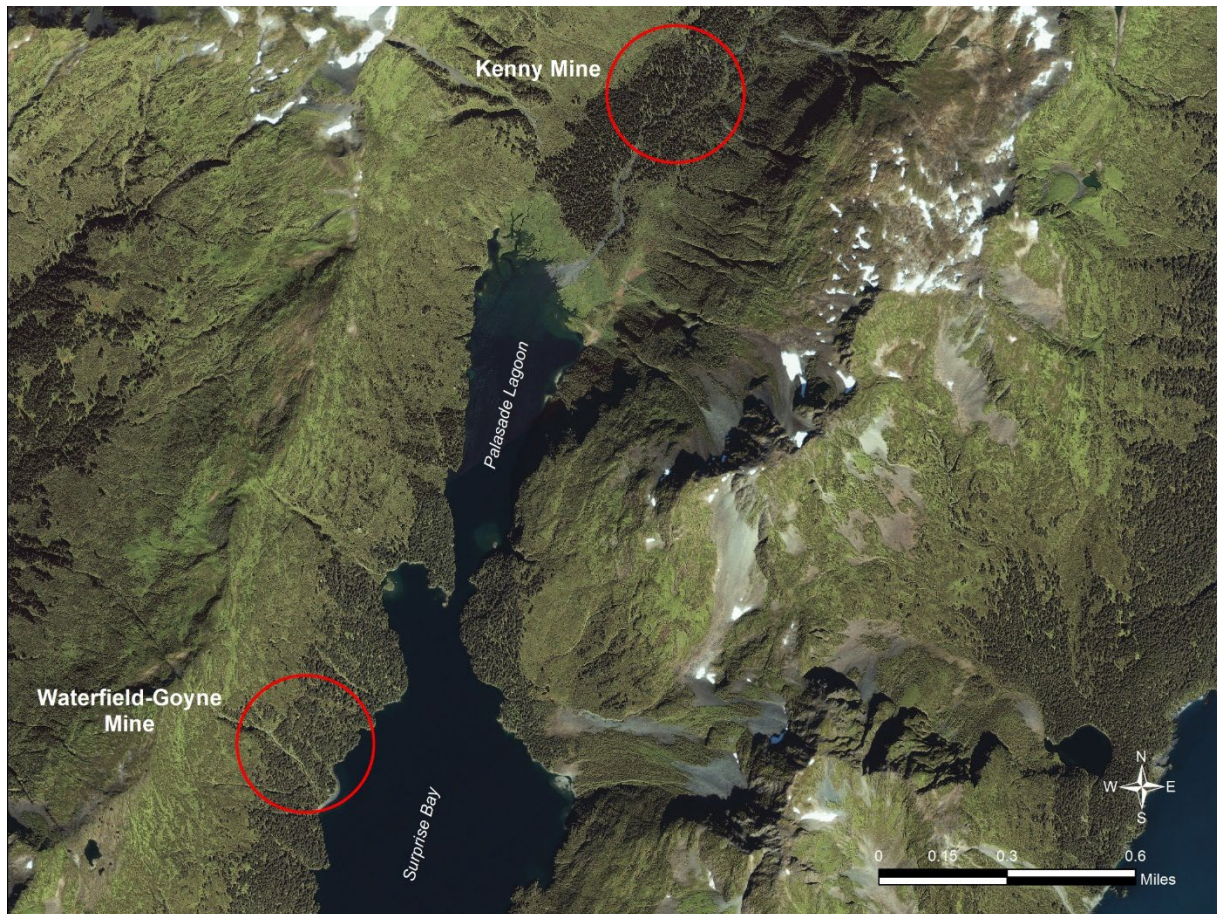


Figure 17. Waterfield-Goyne and Kenny mine sites surveyed after mine cleanup projects were completed in 2022.

On July 9, we surveyed the Kinney mine site, including the access road and the site where an old cabin and woodshed were removed, but did not find any invasive plants again this year. We also surveyed the Waterfield-Goyne mine site; at the time of survey, we noticed a grass specimen growing in the area disturbed during the cleanup that was not familiar to us. We collected the plant, pressed it, and sent the specimen to the Alaska Center for Conservation Science (ACCS) botanist at University of Alaska Anchorage for identification. The ACCS botanist positively identified the grass as a native *Dinna latifolia* (J. Fulkerson, personal communication, August 6, 2024). No invasive plants were detected at Waterfield-Goyne mine again in 2024.

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). Due to rainy weather during our survey in 2023, we were unable to apply herbicide to this population and were required to hand pull plants instead (Palaka and Kriedeman 2024a). In 2024 we applied herbicide on this populations for the first time on July 9, we applied 0.067 gallons of Milestone herbicide mix to this population of common dandelion (Figure 18).

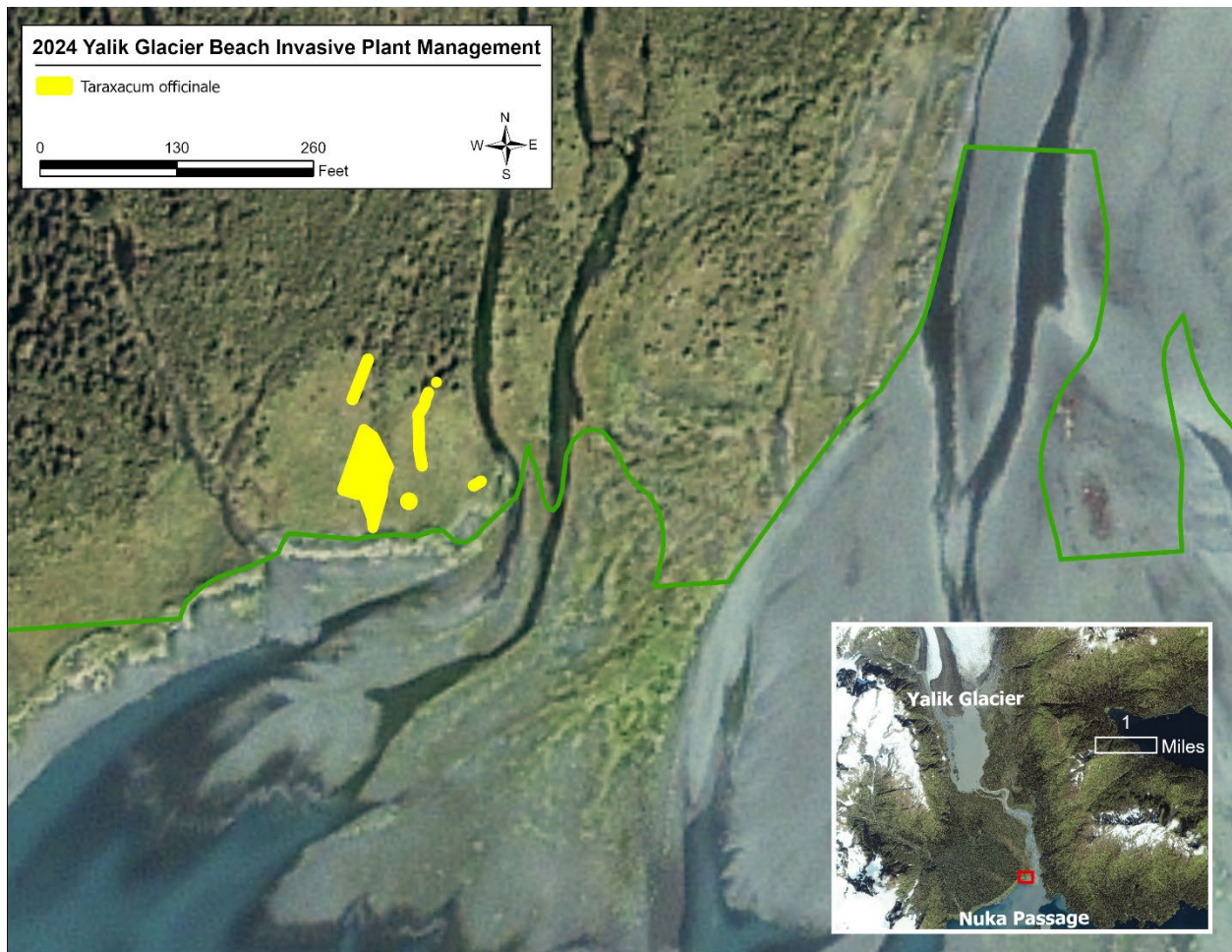


Figure 18. Common dandelion (*Taraxacum officinale*) was chemically treated at the beach at Yalik Glacier drainage in Nuka Passage.



KEFJ Biological Science Technician mapping the common dandelion (*Taraxacum officinale*) at Yalik Glacier Beach (NPS/Christina Kriedeman).

Seward Area

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 19).

On June 26, we surveyed outside of the maintenance yard fence north of the entrance gate. We treated common dandelion with 0.02 gallons of Milestone herbicide mix and hand pulled 34 common plantains. This population was discovered in 2022 and is in an area that was disturbed by equipment used during a maintenance yard construction project (Visconti and Kriedeman 2023). We briefly examined the standardized polygon for invasive species at this time, but many plants were not present yet or were just beginning to sprout so we postponed treatment to a later date.



Figure 19. Populations of common dandelion (*Taraxacum officinale*), common plantain (*Plantago major*) mapped and treated outside the maintenance standardized polygon (outlined in pink) and sheep sorrel (*Rumex acetosella*) and fall dandelion (*Leontodon autumnalis*) found within the standardized polygon.

We treated common dandelion, common chickweed (*Stellaria media*), big chickweed (*Cerastium fontanum*) and pineapple weed (*Matricaria discoidea*) in the maintenance yard standardized polygon on July 30 and September 3. We also detected sheep sorrel (*Rumex acetosella*) and fall dandelion (*Leontodon autumnalis*) for the first time. In total, we applied 1.18 gallons of Milestone herbicide mix to these six species.



Fall dandelion (*Leontodon autumnalis*) found in the KEFJ Maintenance Facility (NPS/Aiden Knapp).

On August 12 and September 3, we applied 5.16 gallons of Habitat herbicide mix and 0.53 gallons of Roundup Custom herbicide mix to annual bluegrass in the standardized polygon. 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.



KEFJ Biological Science Technician applies herbicide to invasive plants in the Maintenance Facility (NPS/Aiden Knapp).

Shea Parking Lot

The Shea Parking Lot is owned by the park but is outside the park boundary located in the City of Seward. This parking lot serves as a base for many NPS vehicles and has the potential to act as a vector for invasive species since it is visited daily by park staff headed out to the Exit Glacier Area and Coast. We did not survey or control invasive plants in the Shea Parking Lot in 2024. This area was last surveyed in 2022.

Visitor's Center

The Visitor's Center is another park facility in the City of Seward and is centrally located next to the boat harbor. The landscaping around the building is gravel and many of the common invasive plants found adjacent to the property are now growing in this gravel area. We typically do not pull invasive plants around this building, but because we had extra help from the SCA trail crew this summer, we hand pulled what we could for an afternoon on August 7. We hand pulled common dandelion, white clover (*Trifolium repens*) and alsike clover (*Trifolium hybridum*), sheep sorrel (*Rumex acetosella*), common chickweed (*Stellaria media*), annual bluegrass, big chickweed, and yellow toadflax (*Linaria vulgaris*) found around the building.

In 2022, 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. A number of these invasive plants are more of a concern as they have a higher invasiveness ranking and are not a common invasive plant in the Seward area. We have photographed and hand pulled these plants for the last two years. A plan to either actively control these plants or possibly remove the existing grasses and replace them with native plants that are not infested with invasive species should be considered.



YCC employee and SCA intern manually treat invasive plants at the Visitor's Center (NPS/Jenna Cooper).

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. This reduces 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 their accompanying passengers and gear. These boot brushes were installed through a collaboration between KEFJ IPMT and KP-CISMA partners in 2021 (Visconti and Kriedeman 2023). 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 May 31 and June 24. On June 24, we removed vegetation around the boot brush located at the north boat ramp and added gravel around the base to improve the appearance and increase visibility.



YCC employee rakes in gravel at the north boat ramp boot brush (NPS/Jenna Cooper).

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 the Student Conservation Association (SCA) trail crew at the beginning of their season to encourage them to clean their shoes before traveling to more remote areas of the park.

Restoration

We identified four sites in the Exit Glacier Area for restoration projects this summer. We used native seeds from the park's seed bank that we collected in the Exit Glacier Area in previous years.

On August 19, we reseeded the exposed gravel area on the glacial moraine next to the 1889 sign on Herman Leirer Road. This area was first seeded in 2017 after the area was cleared of all vegetation and graded during a road construction project in 2016. This area was reseeded again in 2019 and 2021, but bare gravel areas remained likely due to the dry soil conditions and steep slope of the site (Sampson and Kriedeman 2020, Gage and Kriedeman 2021). In 2024, we dug pockets in the remaining exposed gravel areas to improve rainwater capture and increase the likelihood of seed germination, which was also the technique used in 2021 with greater success than previous attempts at reseeding this site. We added seed mix to these pockets and then lightly raked over the area to better incorporate the seed mix into the gravel. We reseeded the area with Merten's sedge (*Carex mertensii*), western columbine (*Aquilegia Formosa*), lupine (*Lupinus notkatensis*), alpine timothy (*Phleum alpinum*), meadow barley (*Hordeum brachyantherum*), spiked trisetum (*Trisetum spicatum*), blue-joint reedgrass (*Calamagrostis canadensis*), red fescue (*Festuca rubra*) and goat's beard (*Aruncus diocus*). Goat's beard was used more sparingly in pockets located closer to the road. Photos were taken at previously established photo points from 2017 to monitor revegetation success.



Photo point monitoring of revegetation progress in 2018, 2019, and 2024 of the glacial moraine next to the 1889 sign on Herman Leirer Road that was first seeded in 2017 (NPS/Top left unknown, top right unknown, Bottom left Sierra Sampson, Bottom right Jenna Cooper).

We seeded a section of abandoned trail across from campsite number eight at the Exit Glacier Campground on August 20 and 26. This trail used to connect the campsite loop but was washed out by Exit Creek in 2023. The trail crew added rocks and signage to the abandoned trail to deter people from using the trail. However, the lack of vegetation meant that the area was still highly visible to visitors and susceptible to trampling and the introduction of invasive plants; oxeye daisy was found

here while surveying the area for potential revegetation sites in 2024. We planted seeds in sections between rocks and moss patches along the old trail to avoid having a distinct line of vegetation in an area otherwise populated by lichen, moss, and willow and alder trees. First, we broke up the soil to a depth of 1-2 inches, then added seed mix, and finally, lightly raked over the area. We seeded the area with spiked trisetum, alpine bluegrass (*Poa alpina*), meadow barley, alpine timothy, western columbine, Merten's sedge, goat's beard, lupine and red fescue. We installed a revegetation sign at the old trail entrance to deter visitors from entering the area and, established photo points to monitor the progress of the project over time.

On August 30, we seeded a social trail located on the creek side of the Glacier View Loop trail between the 1951 moraine sign and the open area with a bench overlooking the outwash plain. This social trail has two entrances and makes a small loop from the Glacier View Loop trail. We broke up the soil to a depth of 1-2 inches added our seed mix, and then lightly raked the soil back over the area. Seeds from the following species were used: goat's beard, lupin, Merten's sedge, spiked trisetum, alpine timothy, alpine bluegrass, red fescue, western columbine, and blue-joint reedgrass. One revegetation sign was installed at each entrance to the social trail. We established photo points to monitor the site.



SCA Intern planting native seeds on a social trail leading from the Glacier View Loop Trail (NPS/Kelli Palaka).

We also seeded the leach field for the bathrooms located on the south side of the Nature Center Plaza on September 6. We scattered Merten's sedge seeds along a faint social trail and throughout the more

barren sections of the leach field to assist with native plant establishment. We established photo points to monitor the progress of the site.

Furthermore, we collected native plant seeds in July and August in the Exit Glacier Area to supplement the park's seed bank for use in future restoration projects. We collected seeds from a list of native plants that were determined to grow easily from seed in the Exit Glacier Area (Kriedeman 2014). Seeds we collected in 2024 included meadow barley, alpine timothy, spiked trisetum, western columbine, lupine, and alpine bluegrass. We sent the seeds to the Alaska Department of Agriculture Plant Material Center located in Palmer, AK for cleaning.

Outreach and Education

Outreach and education are a vital part of invasive species management at Kenai Fjords National Park. Each year we aim to communicate the importance of invasive species prevention and management to park employees, park visitors and the local community. In 2024, we took part in the following outreach and education opportunities:

- We presented on IPMT program accomplishments, season goals, and how to help reduce the spread of invasive plants in the park at the KEFJ spring training for interpretation staff on May 15.
- In July, when the Student Conservation Association trail crew arrived, we gave them an informational talk about how to reduce the spread of invasive plants while doing trail work in the park and gave them information about common invasive plants. We also provided them with handheld boot brushes to encourage prevention efforts.
- Over five days during the summer, we provided opportunities for eight YCCs and two SCA interns from other park teams to experience a day-in-the-life working in the field with the IPMT. We taught them about invasive plant survey and data collection techniques, how to identify common invasive plants, and we performed hands-on invasive plant removal in the Exit Glacier Area.
- We created several social media posts over the summer which highlighted: Alaska native plant month, Alaska invasive species week, the upcoming Seward Community Weed Pull event, the results of our 19th Seward Community Weed Pull, and revegetation and restoration projects.
- On June 21, in cooperation with KP-CISMA partners, we hosted the 19th Seward Community Weed Pull at the Forest Acres Campground in Seward, AK from 10am-2:30pm. KP-CISMA partners included the Chugach National Forest and Homer Soil and Water District. A total of 17 volunteers from agency partners and the Seward community were in attendance. Together, we hand-pulled thousands of invasive plant chokecherry (*Prunus virginiana*) seedlings.
- In September 2024, the IPMT submitted an informational poster to the Seward Science Symposium titled “*Kenai Fjords National Park Invasive Plant Management Team: Twenty*

Years of Managing Invasive Plants” that highlighted our work and key lessons learned (Appendix F). The Seward Science Symposium is a free event aimed at increasing the awareness of science and research taking place in Seward and nearby communities and was held on September 6 and 7. Our IPMT poster was on display to the public during the poster session and art walk on September 6 and again during the scientific presentation sessions on September 7.

Partnerships

In 2024, we participated in two important Alaska-based partnerships: the Kenai Peninsula Cooperative Invasive Species Management Area (KP-CISMA) partnership and the Alaska Invasive Species Partnership (AKISP). These partnerships are crucial channels for information sharing, organizing collaborative events, and controlling invasive plant populations adjacent to the park and around the Kenai Peninsula.

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. In 2024, we participated in KP-CISMA quarterly meetings that bring together partners to discuss goals and accomplishments, events, and information around invasive species on the Kenai Peninsula. Together with partners, we also organized the 19th Seward Community Weed Pull that occurred on June 21. Through the KP-CISMA, the KEFJ IPMT, United States Forest Service (USFS), and Homer Soil and Water District (HSWD) identified a plan to control the population of oxeye daisy that is spread along Herman Leirer Road outside of the park boundary on USFS land. This year, HSWD was able to map the infestation, which will inform preparations for herbicide treatment planned in 2025.



Seward Community Weed Pull participants (NPS/Seth Adams)

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 and information sharing across the state. We participated in the Alaska invasive species partnership annual workshop held in Sitka, Alaska virtually in November of 2023 and in 2024 we participated in virtual monthly membership meetings.

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 2024 we installed five Delta insect traps that contained a pheromone lure meant to attract male spongy moths on June 10. 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 Exit Glacier Campground, the Employee Housing Area, Exit Glacier Parking Area, and the Nature Center Plaza. We monitored all traps monthly. We replaced all traps on August 16 because the amount of precipitation we received in June and July waterlogged the traps and they lost their rigidity and effectiveness. Traps were removed on September 11 and data sheets were sent to the Alaska Division of Agriculture project lead. We did not detect any spongy moths.



SCA Intern deploys a spongy moth trap in the Exit Glacier Area (NPS/Kelli Palaka).

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 so far, appears 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 (Geier and Kriedeman 2018). 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 have 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 farther 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 Region IPMT liaison. Habitat was selected because it provides residual control in the soil and treats both sprouted plants as well as the seed bank which has built up in the soil. We continued use of the herbicide Habitat for a second year in 2024; we applied Habitat to annual bluegrass located around the Aialik PUC cabin, 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 2004). 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. Upon visual assessment in 2024, we did not notice any impacts to non-target plants. We also did not notice a large improvement in treatment results between Roundup Custom and Habitat in populations treated in 2023. This could be because of the sheer abundance of seeds within the seed bank. Effectiveness should continue to be monitored to inform future management decisions. If Habitat is found to be more effective at treating annual bluegrass than Roundup Custom after the second year of application, we recommend broadcast spraying annual bluegrass 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 of annual bluegrass 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.

Re-treatment

Rainy weather in Kenai Fjords can be a major factor in our ability to chemically retreat many areas. However, 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. We suggest fully retreating the Maintenance Facility and other priority populations of annual bluegrass at least once, and additionally as time allows. This is because of the amount of annual bluegrass that can sprout from seeds already in the soil 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.

Oxeye Daisy

Two specimens of oxeye daisy (*Leucanthemum vulgare*) were manually removed from the Exit Glacier Campground in 2024 for the first time. One of these specimens were found off trail on an area closed to the public for restoration. We continue to find only a few plants each year in the Exit Glacier Area, but populations from the Seward Highway down along Herman Leirer Road to the park boundary have continued to spread and become denser, becoming more of a concern. In 2023, we spoke with 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 and began surveying for and mapping infestations in the summer of 2024. We plan to help with herbicide applications during the summer of 2025 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

In 2022, a single Kuepfer's buttercup (*Ranunculus kuepferi*) was discovered on the Harding Icefield Trail. The plant was collected in 2023 and was positively identified as Kuepfer's buttercup (*Ranunculus kuepferi*). It was the first time it had been identified in Alaska or outside its native range (J. Fulkerson, personal communication, October 26, 2023). We did not find this plant again in 2024

despite surveying the area three times. It is unknown if this plant will become invasive, but we recommend resurveying at the site where this plant was collected in June over the next several years to ensure that there are no other plants growing in the area.

Nike Stripe and SNOTEL Sites

This year during our survey of the Nike Stripe no invasive plants were detected. In 2023, 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. Prior to this, 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 Area, 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 this time 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 in July and August with maintenance staff to ensure that current plans of action are clear to everyone.

Coastal Priorities

Coastal areas of the park are more difficult to access and treat because of their remote location, thus surveying for and treating all invasive plant populations in coastal areas each summer remains 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. These populations are in very remote areas in the park, can only be accessed by boat, and typically are only treated once per summer. Manual treatment requires more time and personnel and can be less effective if the area cannot be treated often throughout the growing season, so is not the most effective management tool. Because of rainy, wet conditions this year, it took three people working for three hours to manually remove 242 common dandelion plants at the Head of North Arm; 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 are 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 campsites 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 during the summer of 2023 and 2024. We want to track the effectiveness of this herbicide on annual bluegrass and determine if Habitat is working well to reduce these populations, if we need to continue treating with Habitat, and if any nearby, non-target vegetation was impacted.

In 2023, we heard anecdotally that park visitors might be hiking up to Southwestern Glacier from the beach in Northwestern Fjord. To get to the glacier visitors would have to trek over a mile from the beach through vegetated areas that may be more suitable for invasive plant establishment than some of the other rocky and sandy beaches in the area. We recommend prioritizing the survey of this area in 2025 to confirm if there are visitors hiking in the area and if this area should be surveyed in the future.

We also recommend doing opportunistic monitoring for invasive plants when we have the chance to work on other park projects in the field. There is no way that we can monitor every area in the park, but when we do assist with other resource management team projects that take us to new areas 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 2024 and did not find any invasive plants. We recommend that these sites continue to be surveyed for invasive plants in 2025, and then for a final time in 2027 to ensure that nothing was introduced during these projects. That will provide four years of monitoring over five years.

In September 2023 and 2024, soil contaminated by past mining that 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 in 2023. The contracted project was completed in 2024 and the area has been stabilized, but it is anticipated that more work will continue to remove additional contaminated soils in 2025. We recommend that this site also be prioritized for yearly surveys for five years 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. We confirmed the siting with the lodge manager in June 2024. The lodge manager told us there was one common dandelion plant seen near their kayak storage area next to the beach in 2023, but they had not seen any evidence of it in June 2024 when we received her email. We surveyed this area in July of 2024 and did not find a common dandelion in this location. The lodge clients disembark here from the boat that brings them out to the lodge from Seward. We recommend continuing to survey the area around the kayak storage area and the road near the beach to ensure that any new invasive plants that may arrive are detected early. 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. The park should consider working with the lodge manager and staff to develop a gear cleaning policy for staff and clients. We could also assist with developing interpretive messaging and setting up a boot cleaning station. This type of partnership should be established through the resource management team lead and the lodge owner during the fall or winter before the busy summer season.

In 2023, 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 in the future 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 when the database becomes fully functional to help guide the selection of coastal survey sites in the future.

Visitor Center

The KEFJ Visitor's Center located in Seward was surveyed in August 2024 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 in 2022 during the construction of the Visitor Center outdoor interpretive exhibit. 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. If time allows, we recommend manually treating any invasive plants found growing with the landscape grasses in 2025. In the near future, however, removing the existing grasses and soil, and replacing 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 2024 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 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.

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 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; simply cleaning shoes before heading out in the field can reduce the chances that park staff are a part of the problem. We also work with the maintenance staff to ensure tools and equipment are clean before they are 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 Alaska Invasive Species Partnership's (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 on the Kenai Peninsula. We attend quarterly meetings and participate in events sponsored by the KP-CISMA. The KP-CISMA also provides spring training for seasonal employees in Soldotna, AK. KEFJ IPMT seasonal staff typically attend the training days that best apply to the survey work we do and travel can be completed in a day trip. We also coordinate with the KP-CISMA to organize the annual Seward Community Weed Pull. In previous years we invited the Seward Boys and Girls Club to participate, but we could not find a contact for the organization this year. The Seward Boys and Girls Club is housed in the Seward Teen and Youth Center building and we recommend trying to

find a contact next year because it is a good opportunity to engage local youth in a fun invasive plant control project.

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. The Chugach National Forest began surveying for and mapping infestations on Herman Leirer Road in 2024.

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 Highlight

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, but it can be difficult to plan for glacier outburst floods and landslides. 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. We should continue to conduct safety tailgate meetings every day before we head out to work in the field to remind ourselves of both rare hazards and hazards that we face daily.

Personnel

The 2024 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.



The 2024 KEFJ IPMT attempting to cross Exit Creek (NPS).

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.



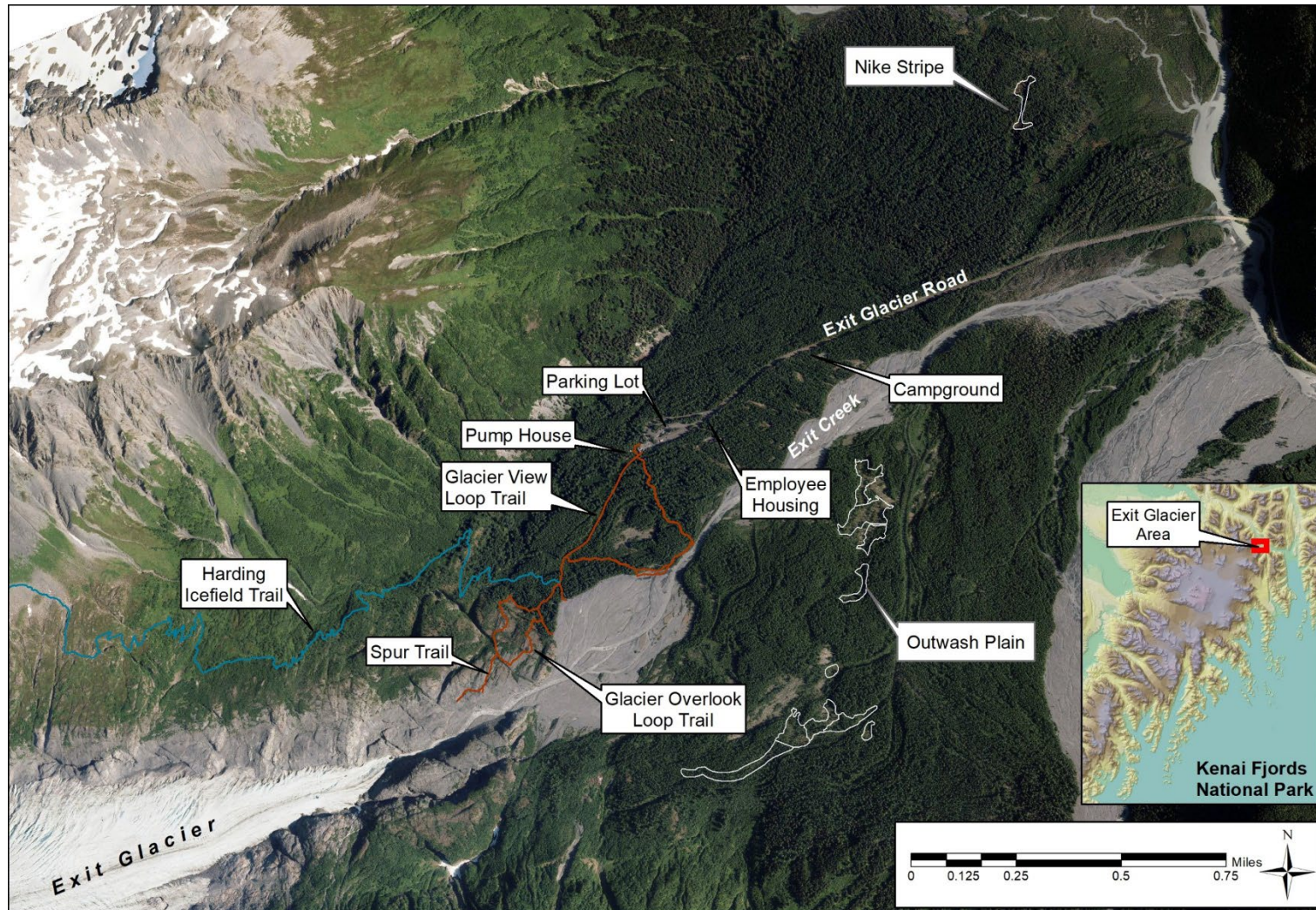
KEFJ Biologist Christina Kriedeman retires this year and says good-bye to the KEFJ IPMT after managing the program for 20 years!

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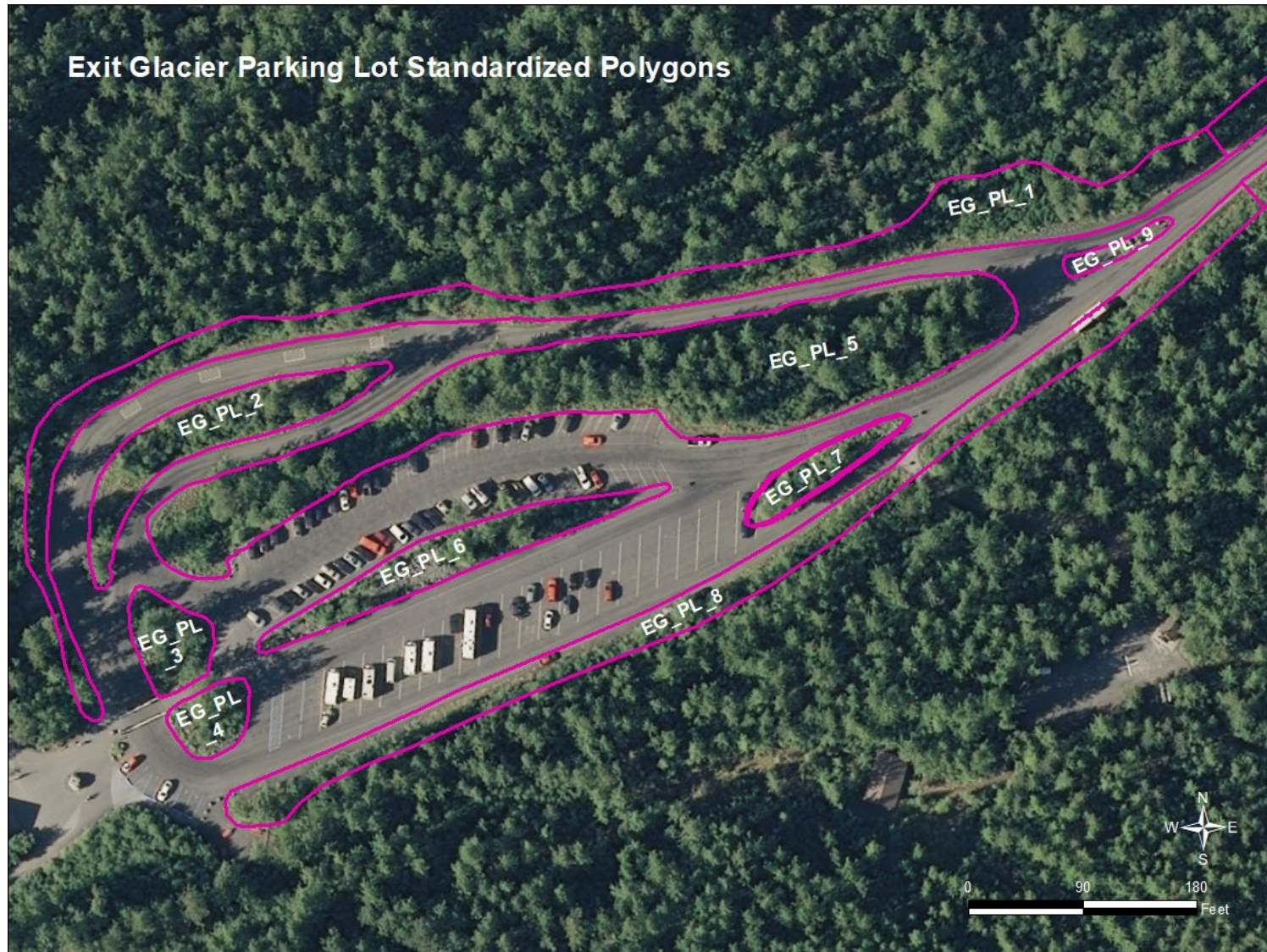
Appendix A: Exit Glacier Survey Areas



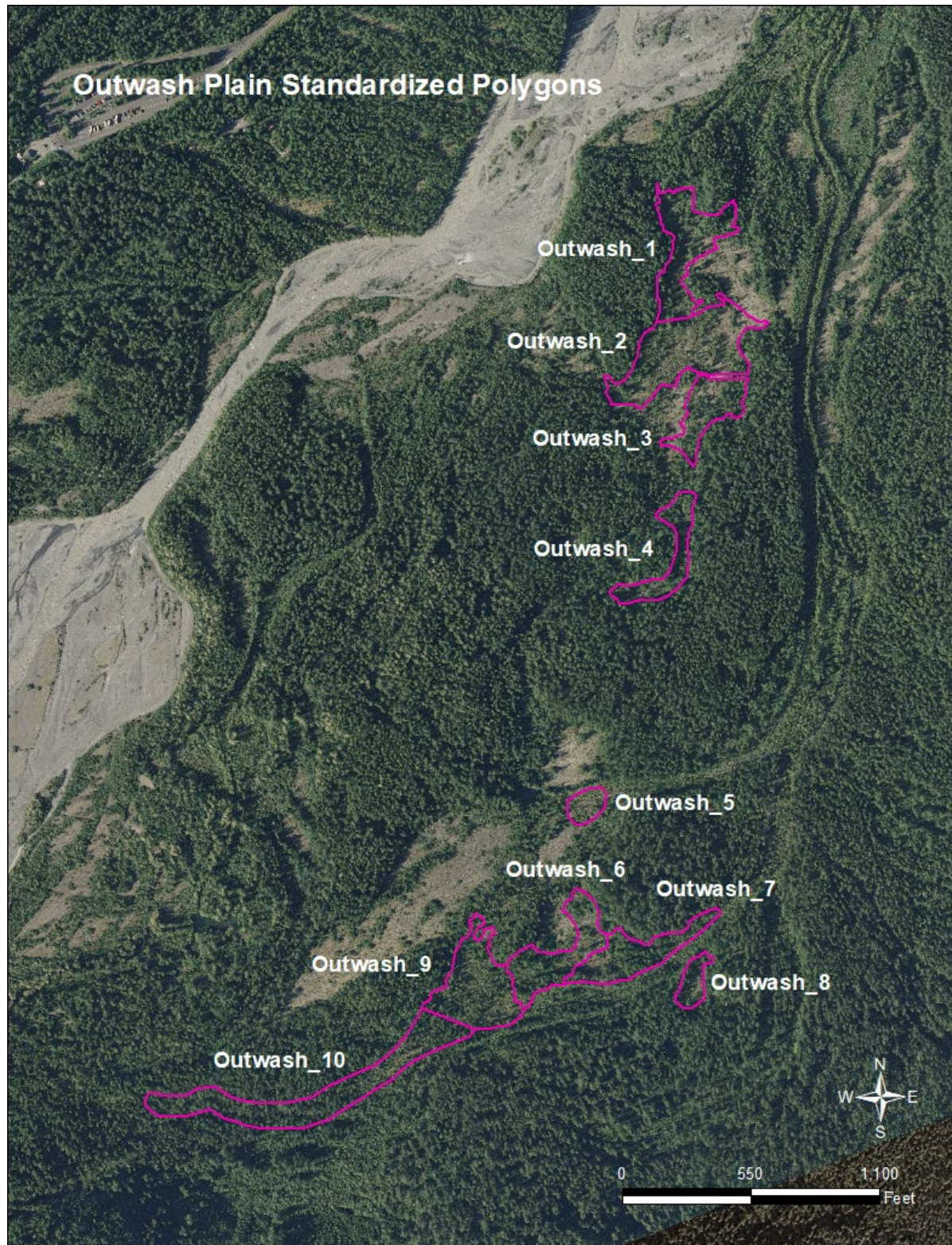
Appendix B: Herman Leirer Road Standardized Polygons



Appendix C: Exit Glacier Parking Lot Standardized Polygons



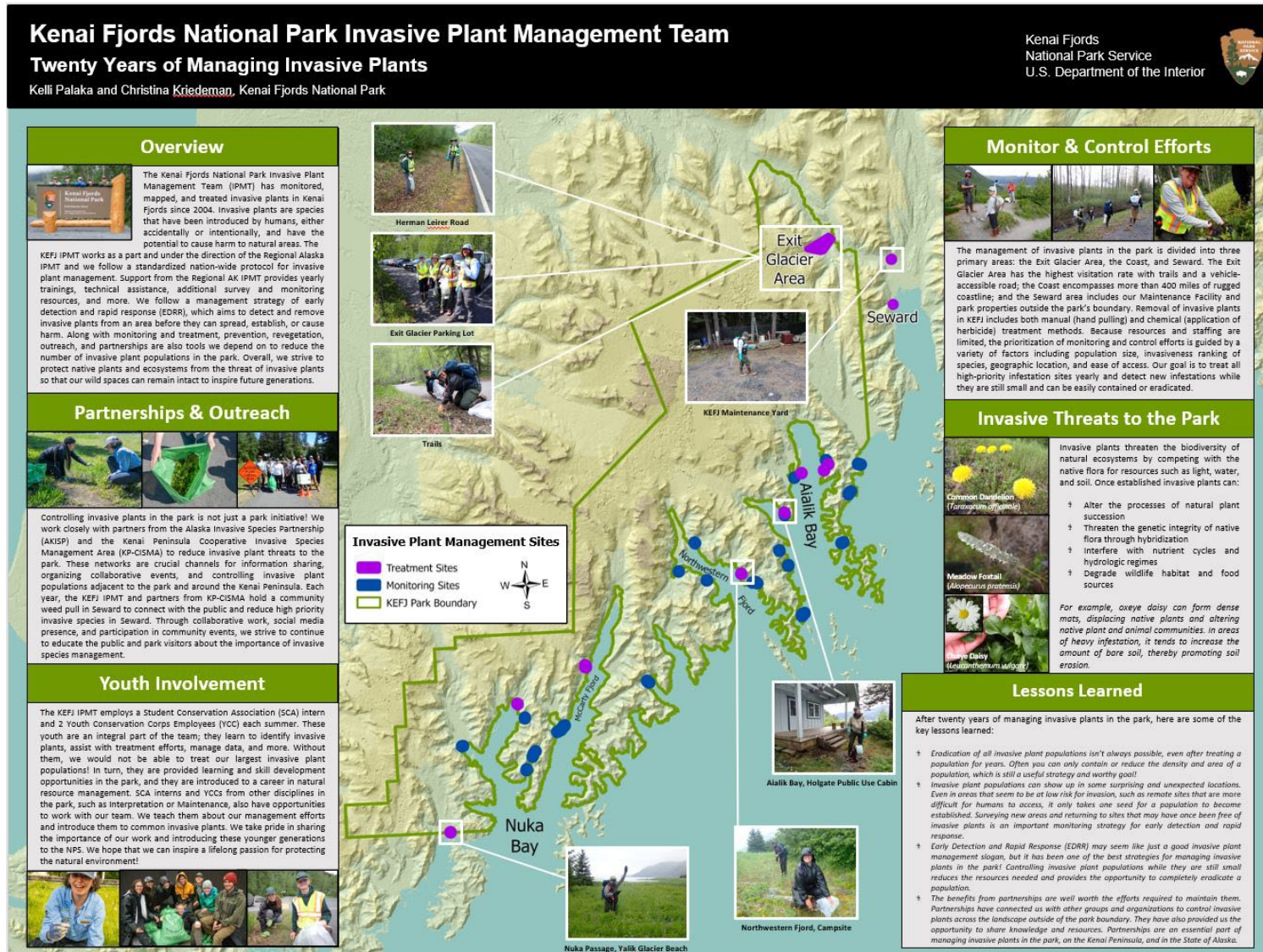
Appendix D: Outwash Plain Standardized Polygons



Appendix E: Maintenance Facility Standardized Polygon



Appendix F: Invasive Plant Management Science Symposium Poster 2024



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, October 2024

National Park Service
U.S. Department of the Interior



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