



Invasive and Exotic Plant Management in Klondike Gold Rush National Historical Park

2015 Summary Report

Natural Resource Report NPS/KLGO/NRR—2016/1120



**ON THIS PAGE**

Photograph of Kevin Hauser analyzing the distribution of invasive plants and collecting GPS data to be converted into GIS data
Photograph courtesy of Shannon Millard.

ON THE COVER

From top left moving clockwise: The first orange hawkweed plant found at the Skagway Reservoir; Reed canary grass found on the eastern shore of Pullen Creek; Canada thistle, found increased dramatically in density and size since 2012.
Photographs by Kevin Hauser.

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Abstract

The 2015 season marked the twelfth consecutive year of the Exotic Plant Management Team (EPMT) program at Klondike Gold Rush National Historical Park (KLGO). This year, the EPMT staff focused on three primary objectives; monitoring the extent of known infestations and accurately documenting the distribution and abundance of invasive species in and around the park, controlling existing infestations to prevent their spread into or within the park, and providing education and outreach to park staff and the community. This year largely focused on informing the public about how to detect and report invasive species early. Early detection helps minimize the spread and severity of infestations. Service crew members, park staff, and volunteers devoted approximately 900 hours toward managing invasive and exotic species found in and around KLGO. In total, 34.53 acres were surveyed over the course of the season, and 3.97 acres of this area were surveyed within park boundaries. Within the areas surveyed, 4.28 acres were found to be infested with invasive plant species, and 0.27 of these infested acres were within park boundaries. Of the areas infested, a total of 1.54 acres were treated, 0.10 acres of which were on park lands. More than 500 pounds of invasive plants were manually removed this season. Overall, 45 invasive and exotic plants have been documented in and around the park. Two new invasive species were discovered for the first time 2015. Orange hawkweed that was found growing near the Skagway Reservoir and Laughton Glacier. Perennial cornflower that was found planted as an ornamental on private property on 8th Avenue between Alaska Street and Main Street. A species of particular concern is Canada thistle, first documented and controlled in 2012 on the Klondike Highway. Canada thistle currently poses a serious threat for Skagway and areas that are connected to the highway. A highlight of the season was the removal of reed canary grass and restoration project that followed at Sheep Camp.

Acknowledgments

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The author would also like to recognize all of the indefatigable volunteers and their generous support to benefit the Exotic Plant Management Team at Klondike Gold Rush National Historical Park this season; Joanne and Andrew Beierly for their continued dedication to the removal of white sweet clover; Deb Boettcher for her enthusiasm and assistance at Junior Ranger Day and her successful identification and reporting of invasive plants; the Students Today Leaders Forever service group for controlling invasive plants in the Nelson Slough Restoration Site; all of the volunteers who participated in the annual community weed pull; as well as the countless park staff and citizens that have provided their support to the program by controlling invasive plants and educating others about the threats that they pose.

Their hard work is appreciated and should be recognized. Their combined effort and perseverance have made it possible to have such a successful season to protect and preserve the diverse and native ecosystem of Klondike Gold Rush National Historical Park.

Abbreviations

AACD	Alaska Association for Conservation Districts
AKDOT	Alaska Department of Transportation
AKNHP	Alaska Natural Heritage Program
EDRR	Early Detection and Rapid Response
EPMT	Exotic Plant Management Team
GIS	Geographic Information Systems
GPRA	Government Performance and Results Act
GPS	Global Positioning System
KLGO	Klondike Gold Rush National Historical Park
NPS	National Park Service
SAGA	Southeast Alaska Guidance Association
SCA	Student Conservation Association
STC	Skagway Traditional Council
STLF	Students Today Leaders Forever
TIWC	Taiya Inlet Watershed Council
USFWS	United States Fish and Wildlife Service

Introduction

KLGO is located in Southeast Alaska at the northern terminus of the Lynn Canal. The park is approximately 13,000 acres that is divided between three separate units. Each of these units is located within the river valleys of the Taiya River and Skagway River. These three distinct units create an area rich in biodiversity, encompassing a unique ecological gradient that includes lowland tidal flats, coastal rainforest, sub-alpine boreal forest, high-alpine meadow, and alpine tundra. This gradient is largely due to varying elevation and aspect found within the park, ranging from sea level to about 6,000 feet at the peaks of the coastal mountains.

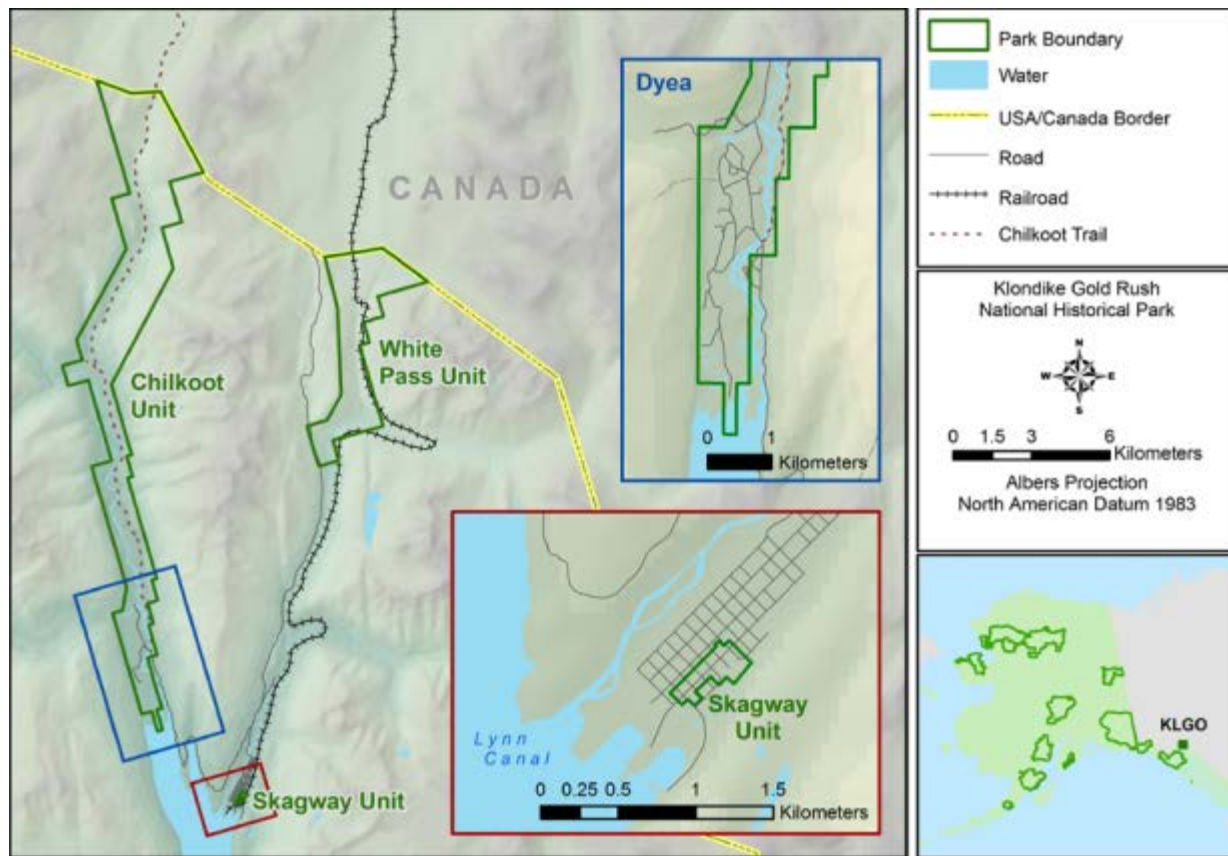


Figure 1. Boundary map of Klondike Gold Rush National Historical Park (Bernatz et al., 2011).

Though rich in biodiversity and ecotones, KLGO is highly vulnerable to the introduction and spread of invasive and exotic plant species. The park's geographic and ecological conditions are not only beneficial to the native plants that grow within the area, but also serve as an ideal habitat for non-native species. In addition to the parks' natural characteristics, the threat of exotic plants being introduced into the area is aided by the ever-growing anthropogenic influence in the region. There are three reasons that make KLGO particularly at risk of introduction of exotic plants due to human activity: 1) the influx of park visitors every year who intentionally or unintentionally transport exotic plants throughout the area via a variety of different methods, 2) the local horticultural interest in Skagway of landowners planting invasive plants as ornamentals for gardens, and 3) maintenance

activities to help improve and build infrastructure of the park, oftentimes leading to soil disturbance that fosters the introduction of exotic plants. The multitude of ecological niches created by such diverse ecosystems and high annual visitation creates ideal conditions for the spread and establishment of exotic and invasive plants.

The boundaries of KLGO are unique in that there are three separate units of the park interspersed with private, municipal, USDA Forest Service, and state-owned lands. These three distinct units are as follows: the Skagway Unit, the Dyea-Chilkoot Unit, and the White Pass Unit. Each of these units is unique in terms of their visitor use, terrain, ecology, and vectors for plant introduction.

Consequently, each unit has a unique invasive and exotic plant management strategy. Many of the infestations of invasive plants are found on lands neighboring park boundaries, necessitating efforts to monitor and control invasive plants on non-NPS property.

According to Hodkinson et al. (1997), humans play a significant role in seed spread and dispersal. Exotic plant species are often voluntarily introduced due to garden throw-outs from horticultural stock, or have been introduced through the vector of development and maintenance projects. These projects create disturbed areas and therefore ideal locations for invasive plant colonization. It has also been shown that seeds may be dispersed both short and long distances through epizoochory, the unintended external carrying of propagules via dispersal agents such as shoes and tires (Hodkinson 1997, Wichmann et al., 2009). The amount of foot and vehicle traffic that Skagway receives due to its high visitation creates an opportunity for invasive plant species introduction and spread. While the controlling present populations remains a high priority, the most effective method for controlling plants is to prevent the establishment of invasive species (USDA 2007).

The Alaska EPMT has been tasked with inventorying, monitoring, and controlling of invasive plants within the national parks of Alaska since 2004. Over the past 12 years, EPMT staff have collected baseline data that catalogs the dispersal and spread of invasive species, conducted annual monitoring surveys, established community outreach and prevention methods, and controlled emerging infestations throughout and surrounding the park. More specifically, KLGO EPMT have focused on the strategy of early detection and rapid response (EDRR), where species are prioritized on a system of triage. This system focuses first on small populations of species of high invasiveness, and later on larger populations of low invasiveness rankings (Carlson et al., 2008). This early response approach to emerging infestations, coupled with increased public education and awareness, has helped to keep the threat of invasive species manageable in KLGO.

Alaska is situated in a unique position compared to the contiguous United States, in that relatively few invasive plant species have established themselves in the state. When compared to other NPS units in Alaska, KLGO is second only to Glacier Bay National Park and Preserve in the number of exotic plant species documented (48 species observed as of 2011). This emphasizes the point that KLGO is in a vulnerable position due to high visitation and anthropogenic vectors that create potential routes for invasive plant species establishment and dispersal. Therefore, appropriate steps must be taken to ensure that more species are not allowed to colonize and current populations are not allowed to spread.

Methods

Field work for the 2015 season was conducted between May and August. Methods for all data collection, data management, and mapping were in compliance with the protocol developed by the Alaska Region Exotic Plant Management Team (Million et al., 2015). EPMT staff utilized existing data, recommendations from previous years, this season's phenology, and available labor, to prioritize treatment of species and infestations, select equipment, and choose appropriate control methods.

Given the cultural significance of many areas in KLGO, special care was taken to ensure that no cultural resources were disturbed during EPMT activities. Tools were selected that would minimize the amount of damage to any potential cultural resources that could be uncovered or buried under work sites.



Figure 2. Compliance tool used near cultural resource sites to minimize possible damage to artifacts buried during control work.

Defining Work Areas

To facilitate planning control efforts, the park and surrounding areas were divided into six work areas. Fieldwork was organized and conducted using these work areas, therefore the results and recommendations in this report are divided by work area. The six work areas are as follows:

1. Dyea
2. Nelson Slough Restoration Site
3. Chilkoot Trail
4. Dyea Road
5. Skagway
6. Klondike Highway and White Pass Unit

Highest priority was given to controlling and potentially eradicating infestations within the first three work areas, as these are areas contained within park boundaries. Meanwhile, containment and prevention was emphasized in the final three work areas. Despite Nelson Slough and the Chilkoot Trail being within the Dyea unit of KLGO, they are treated as separate work areas. Nelson Slough is unique and receives special attention as a work area because it has a high concentration of invasive species and has been an area of large focus and remarkable improvement over the past several years. The Chilkoot Trail is treated separately because of its historical and cultural significance. The Chilkoot Trail's high amount of visitor traffic make it a primary conduit for seed dispersal; thus, it deserves special accommodation. Though only small portions of the Dyea Road and the Klondike

Highway intersect park boundaries, they were still considered priority work areas for EMPT because they serve as primary vectors by which invasive species spread into the park.

Much of the EPMT fieldwork in 2015 was directed toward outreach and education. While it is important to control invasive species once they have been introduced into an area, it is equally as important to control the source of invasive species to contain them as much as possible. Human activity serves as a large driving force and can exacerbate the spread of invasive plants. Providing a wide array of outreach and education to staff and visitors can help the KLGO EPMT with reporting and early detection of invasive species, which could minimize their spread into park lands.

Prioritization of Species and Treatment

Control work in KLGO was prioritized by geographic location, extent, and an invasiveness ranking system. The Alaska Invasiveness Ranking System is an index that provides rankings on a scale from 0 to 100 based on four subcategories for each species: potential ecological impacts, biological attributes and dispersal ability, distribution, and feasibility of control (Carlson et al., 2008). The index is specific to the Alaska region and was used extensively to prioritize treatment in KLGO. Species with a higher invasiveness rank and a smaller geographic extent were considered the highest priority for management. Conversely, species with a lower invasiveness rank and a larger geographic extent were considered lowest priority for management.

In 2006, the Natural Resources staff at KLGO and the Alaska Regional EPMT staff established six high priority species found in or near the park: bird vetch (*Vicia cracca*), common tansy (*Tanacetum vulgare*), white sweetclover (*Melilotus alba*), oxeye daisy (*Leucanthemum vulgare*), yellow toadflax (*Linaria vulgaris*), and narrowleaf hawksbeard (*Crepis tectorum*). For the past ten years the monitoring and eradication of these six species has been the top priority of EPMT at KLGO as these plants are all considered species of greatest concern in Alaska (Carlson et al., 2008). In 2015, three more species of high priority were added to the list: ornamental jewelweed (*Impatiens glandulifera*) first documented in 2007, reed canary grass (*Phalaris arundinacea*) first documented in 2011, and Canada thistle (*Cirsium arvense*) first documented in 2012. A new species of high priority that has never been documented in the area of KLGO was added to the list this season: orange hawkweed (*Hieracium aurantiacum*). All of the aforementioned species were included because of their high invasiveness ranking and relatively small extent, making them targets for eradication. Fortunately only four of these high priority species have been found within the park and have a limited geographic extent. Preventing the spread of these species into the park through aggressively treating any infestations found in or near the park boundaries, is top priority.

Tools for Identification and Data Collection

The primary field guides referenced for plant identification were Flora of the Pacific Northwest (Hitchcock and Cronquist, 1973), Plants of the Pacific Northwest Coast (Pojar and Mackinnon, 1994), Flora of Alaska and Neighboring Territories (Hulten 1968), and Identification of Non-Native Plants in Alaska (Flagstad et al., 2015). Additional materials used for identification were A Field Guide to Alaska Grasses (Skinner et al., 2012) and How to Identify Grasses and Grasslike Plants (Harrington 1977). Most of the plants encountered were also available at the KLGO herbarium, as well as the KLGO natural resources exotic pressed plant collection, started in 2010.

All Spatial data on the invasive plant infestations were collected using two GPS units, the Trimble GeoXH6000® data logger, and the Trimble Recon® datalogger with either the Trimble Tornado L1® or Trimble Hurricane L1® antennas.

Control Methods

The primary control method employed for invasive plant removal was hand pulling, combined with hand tools such as trowels. The largest concern with this method was that the entire root system must be removed for the treatment to be effective. Plants with a tap root are usually pulled easily and effectively, but those with rhizomatous root systems require special care to remove the entire root system. Many invasive plants in the region can regenerate from root segments left in the soil when proper hand pulling techniques are not employed. This is quite frequent with invasive species like common tansy, yellow toadflax, oxeye daisy, and orange hawkweed.

All removed plants were bagged on site, weighed in the KLGO maintenance building, and transported by KLGO maintenance staff to the Skagway city incinerator to be burned. This method minimized the potential for seed dispersal while disposing of the invasive species. Care was also taken to ensure bags used in town were not reused outside of Skagway due to the potential for unwanted seed dispersal.

The discovery of reed canary grass on the Chilkoot Trail in 2011 necessitated the use of different control methods as the infestation was too large to be reasonably controlled by digging the plants by hand. In past seasons, EPMT staff implemented shade covers to eliminate the reed canary grass by depriving them of sunlight. Shade covers were created by layering layers of 6mm opaque black plastic followed by a layer of black non-woven geotextile. After finding this method deficient at fully controlling reed canary grass, shade covers were expanded and fortified. Shade covers were staked down with landscape staples and the margins of the shade covers were secured by rocks. This method of control was not effective and it was determined that chemical control should be used to control the infestation in the 2015 season.

Personnel

The full-time EPMT staff member at KLGO during the 2015 season was Kevin Hauser, a Student Conservation Association intern. Work conducted by this staff member spanned from May 26th to August 7th. A total of 18 people volunteered for the Community Weed Pull held at the Skagway Airport. Jami Belt, Shelby Surdyk, Rachel Ford, Andrew Beierly, and Joanne Beierly volunteered and dedicated a large amount of time toward the treatment of exotic and invasive plants within Dyea and Skagway.



Figure 3. Chris Overbaugh uses herbicide to control Reed Canary Grass at Sheep Camp

Results

2015 Season Overview

The 2015 EPMT staff inventoried 34.53 acres and treated 1.54 infested acres in and around the park this season. More than 900 person-hours were logged by the EPMT staff this season while performing activities associated with the program. Survey work during 2015 resulted in the documentation of one new non-native species, orange hawkweed. Control work this season focused on the Dyea and Chilkoot Trail Unit with specific emphases on the Nelson Slough Restoration Site in Dyea, the Dyea Road, and the Sheep Camp Campground on the Chilkoot Trail. More than 500 pounds of invasive plants were removed and incinerated in the 2015 season. Table 1 summarizes KLGO EPMT work conducted in 2015.

Table 1. Summary of Klondike Gold Rush National Historical Park Exotic Plant Management Work.

Year	Invasive GPS Data NPS Lands (non-NPS lands)		
	Species Acres Surveyed ¹	Species Acres Infested ²	Acres Treated ³
2004	43.531 (52.497)	7.838 (6.842)	0.792 (1.505)
2005	3.106 (6.45)	3.099 (2.617)	0.732 (2.436)
2006	63.145 (74.35)	4.577 (2.308)	2.912 (0.726)
2007	1.481 (7.673)	0.487 (5.513)	0.011 (1.676)
2008	5.842 (47.974)	2.063 (22.159)	0.235 (1.351)
2009	11.931 (83.259)	2.453 (21.645)	0.388 (2.504)
2010	34.638 (245.513)	3.914 (56.212)	0.502 (9.362)
2011	49.720 (98.718)	11.278 (50.695)	3.045 (8.583)
2012	31.430 (153.766)	20.987 (86.004)	0.911 (5.282)
2013	83.455 (182.7)	5.701 (36.220)	0.771 (2.431)
2014	0.63 (4.27)	0.19 (0.74)	<0.001 (0.09)
2015	3.97 (30.56)	0.27 (4.01)	0.10 (1.44)

The January 2015 NPS Land Status geodatabase was used to delineate NPS lands in acreage calculations.

1. Acres surveyed represent the total area mapped.

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

3. Acres treated represent the area of a mapped infestation multiplied by the percent cover of invasive plants in that mapped area and by the percent of the infestation treated.

Skagway

Of all six work areas, Skagway has the highest number and greatest extent of exotic and invasive plant species. A total of 45 invasive plant species have been documented, including one new invasive species documented for the first time in 2015. EPMT work within Skagway this season focused primarily on early detection of newly introduced species, control of the most aggressive invasive species, and containment of all other species to reduce them from spreading. Work this season focused on education and outreach to residents of Skagway, as most invasive species were found as horticultural stock that have escaped cultivation and spread to roadsides, private and public lots, and municipal and state properties. The NPS unit in Skagway encompasses only 12 square blocks of the city's historic district, making most of the infestations found outside of park boundaries.



Figure 4. Ornamental jewelweed found as an ornamental outside Corrington's Alaska Ivory on Broadway Street.

Reed canary grass, a high priority because of its high invasiveness and small geographic extent, was found and recorded once again in the 2015 season. The infestation is located along the edges of the southern portion of Pullen Creek, south of the Lower Dewey trailhead bridge and north of Congress Way. The infestation is isolated to the area associated with the 2007 Pullen Creek restoration project, during which reed canary grass was most likely introduced. In past seasons, the manual removal of reed canary grass was ineffective, time consuming, and ultimately an unfeasible method of control. As a result, no manual control efforts were given to remove reed canary grass since 2012. Rather, reed canary grass is being contained from spreading further along Pullen Creek and to other sensitive areas by removing the inflorescence of each culm before it goes to seed. Clipping the flowering heads of reed canary grass has proved to be a simple and effective means for preventing its dispersal, but is no substitute for removal. Due to the prohibition of herbicide use within the town of Skagway, it remains difficult to effectively treat reed canary grass.

Through control work over the past several years, EPMT staff has seen a dramatic reduction in the density and extent of white sweetclover populations in Skagway. While white sweetclover has been documented in limited areas and has a high invasiveness ranking, the apparent downward trend in areal coverage makes it much more of a target for control. In Skagway, white sweetclover has been found primarily in the southwestern and northern portions of town. The control of this species is difficult because of its location on private land, where EPMT control work is not allowed. In past years, white sweetclover has been found and recorded in the gravel lots of Petro Marine Services,

next to the High School Softball Field at the corner of 16th Avenue and Main Street, the eastern side of State Street between 17th and 18th Avenues, the Seven Pastures dump site, and the White Pass and Yukon Route Railroad Yard. Much of the present location of white sweetclover in Skagway is located along the medians and the fence along the perimeter of the Skagway Airport. In several locations just outside of the fencing, white sweetclover has been spreading. Efforts to locate and manually remove white sweetclover in the neighborhood around the airport were undertaken by two concerned long time community residents, Andrew and Joanne Beierly. The partnership with these dedicated residents has been going on for several years and have continued again this season.

As of the 2015 season, ornamental jewelweed was identified and recorded at seven different locations throughout Skagway, all on private lands. In 2011, there was one infestation of ornamental jewelweed that was located on Skagway municipal property in the public park at 6th Avenue adjacent to Pullen Creek. This infestation was controlled in 2011 and has not been found in the 2015 season, making it the fourth year without recording or documentation. Throughout the town of Skagway, many of the ornamental jewelweed infestations were located at local businesses: Corrington's Alaska Ivory, Dedman's Photo Shop, Skagway Outlet Store, and Starfire. All businesses, minus Starfire, had been contacted about the invasive plants in 2010 and 2011 but received a negative response from local business owners. The three other infestations of ornamental jewelweed are located at the corner of 5th Avenue and State Street, 15th Avenue and Broadway Street, and 20th Avenue between State and Main Street. Many of these infestations have escaped planter beds and pose risk to riparian environments nearby. All sites of infestation were monitored during the 2015 season and no contacts with private businesses and residences were made.

In the entire town of Skagway, there is only one documented location of common tansy at 5th Avenue and Broadway Street. Though the lot in which the infestation is maintained by NPS staff, it is owned by local business, Corrington's Alaskan Ivory. In 2012, a proposal to remove and replace the infestation was drafted and presented to maintenance staff for removal, but it was denied. The infestation was monitored during the 2015 season, but no efforts to contact maintenance staff or the local business owner were made.

Bird vetch has been documented on municipal property on the east side of Spring Street at the intersection of 9th Avenue and across from the abandoned salmon hatchery. Since its first documentation in 2006, the infestation has



Figure 5. The only occurrence of bird vetch within Skagway climbing up native vegetation.



Figure 6. Yellow toadflax escaping a planter bed outside of NPS housing at the Peniel Mission.

past EPMT staff, its increasing geographic spread has made it more difficult to control; thus, it has become lower priority to treat. Much of the yellow toadflax within Skagway is located along dense stands along railroad tracks, a vector for continued spread of the infestation. Future EPMT staff should concentrate efforts on manually removing yellow toadflax from the NPS maintenance yard, as the species in this area can easily be distributed elsewhere throughout Skagway and KLGO.

Another invasive plant species documented throughout Skagway is narrowleaf hawksbeard. This species is similar to yellow toadflax in that within the past several years, its geographic extent has grown rapidly and is oftentimes considered a common weed. The only infestations of narrowleaf hawksbeard that were treated and controlled in the 2015 season were ones that were isolated and concentrated in small, manageable patches.

been contained to the same area with minimal spread. The tenacious and aggressive nature of bird vetch has allowed the plant to grow over native vegetation and could become a much more serious problem in future years if not controlled properly. According to prior documentation, manual removal of this species has proven ineffective. This season, bird vetch was manually removed from the site, but will need to be pulled again in years to come until chemical treatment on the property is permitted.

Yellow toadflax is an invasive species in Skagway that was horticulturally introduced and has spread rapidly throughout various parts of the town. In fact, its spread is so prolific that it is considered a common weed in the area. Though yellow toadflax was once a higher priority invasive species to



Figure 7. A new infestation of big leaf lupine planted as an ornamental.

Future EPMT staff should concentrate efforts on manually removing narrowleaf hawksbeard from the NPS maintenance yard, as the species in this area can easily be distributed elsewhere throughout Skagway and KLGO.

Big leaf lupine, found and recorded for the first time in 2013, was monitored again in the 2015 season. Prior to this year, the only known infestation was located on private property in a garden on 5th Avenue between Main Street and State Street. However, this season big leaf lupine was found at four locations within Skagway. One new infestation was found in a garden outside a shop on State Street between 2nd Avenue and 3rd Avenue. Another infestation was found on 8th Avenue between Alaska Street and Main Street in an ornamental bed. The last infestation was found on 4th Avenue between Alaska Street and Main Street. Due to time constraints, these new locations were not documented.

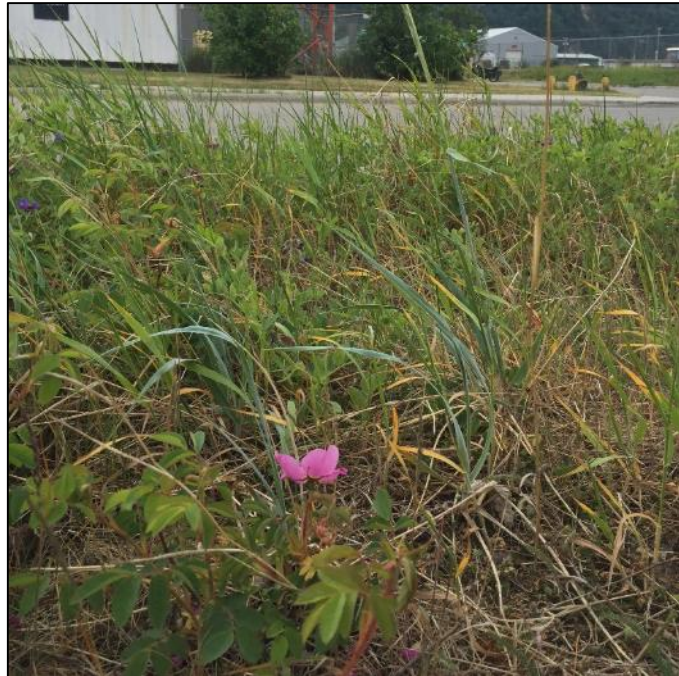


Figure 8. A small and presumably young rugosa rose bush growing across from the Maintenance Building.

Perennial cornflower (*Centaurea montana*) was found for the first time in Skagway this season. While examining photographs of big leaf lupine after the season had ended, EPMT staff zoomed in on the image and found perennial cornflower also planted as an ornamental within the garden. This infestation is located on 8th Avenue between Alaska Street and Main Street. Due to the finding of this species post-season, data for the infestation was not formally collected and local landowners were not notified.

Aside from the presence of higher priority invasive species within Skagway, it was important to address some of the lower priority, more woody invasive species. Most commonly found within Skagway is rugosa rose, a popular shrub that is planted as an ornamental, escapes gardens, and becomes established as dense infestations outside of contained areas. Due to the wide extent of the invasive plant and the plant's potential historical significance, no efforts were made to treat it this season. Another woody, ornamental invasive plant found extensively within Skagway is Siberian peashrub. While this plant is located throughout town, its most important documentation is on NPS property at the Peniel Mission and along Pullen Creek on the east side of State Street between 13th and 14th Avenues. Ornamental tree, European mountain ash, is also be found throughout town. In fact, the tree can even be found on three NPS properties: the Peniel Mission, the historic Moore Homestead, and the Duplex. First found in 2012, the European bird cherry growing across the street from the Skagway Brewing Company at the corner of Broadway and 7th Avenue was confirmed during the 2015 season. Additionally, three chokecherry trees, also first recorded in 2012, were

confirmed and recorded in the 2015 season. These trees were located at the corner of 11th Avenue and State Street in the parking lot of the Church of the Latter Day Saints.

Infestations of common dandelion, white clover, tall buttercup, common groundsel and common sheep sorrel among others are so abundant in Skagway that it would not be feasible to survey and effectively control them. Data was not collected for these species in the 2015 season.

Skagway Airport

The Skagway Airport has remained a focus area for EPMT efforts throughout the program's history. This marked the seventh year that EPMT staff conducted a community weed pull at the airport. EPMT staff coordinated with Missy Tyson of the Alaska Department of Transportation to obtain permission and access to perform surveys and host this year's event.

White sweetclover is the most prevalent species within the Skagway Airport. This population is located along runway medians, both sides of the airport fence, and around the terminal and parking lot. Due to the status of white sweetclover as a high priority invasive plant and its concentration within the airport, the control of this species at weed pulls has been a primary focus. Infestations of white sweetclover have steadily decreased over the past several years.

The 2015 season was the first year in which bladder campion (*Silene vulgaris*) was found and recorded within the airport. The infestation was located within the runway median closest to the airport terminal. Another new plant recorded in the Skagway Airport this year was foxtail barley (*Hordeum jubatum*).



Figure 9. Kevin Hauser pulls first-ever documented bladder campion from the Skagway Airport.



Figure 10. Skagway's 7th Annual Community Weed Pull

Other species to note and that were controlled are narrowleaf hawksbeard, yellow toadflax, white clover, red clover, and pineappleweed.

For the fifth consecutive year, perennial sowthistle (*Sonchus arvensis*), originally documented in 2009 and 2010, was not found during this season's survey of the airport.

This year's community weed pull focused on controlling manageable patches of white sweetclover, yellow toadflax, and narrowleaf hawksbeard. It was decided that these species would be ideal candidates for control effort due to their high invasiveness and reduction of infestations in the past several years.

Dewey Lake Trail System

The Dewey Lake Trail system is a popular hiking destination east of the city of Skagway. Given the heavy hiker traffic during the summer, the trail is remarkably free of invasive plant species. At the trailhead of the trail system, many invasive species can be found for the first 20 feet of the trail, including common dandelion, common plantain, and white clover. From 20 feet past the beginning of the trail to the side trail leading off to the reservoir was entirely free of invasive species.

Orange hawkweed, a new invasive species to the area, was discovered, documented, and controlled at the Skagway Reservoir in the 2015 season. This species is challenging to manually remove because it contains rhizomes and has a very delicate, fibrous root system. Infestations of orange hawkweed have been a major problem in a variety of cities nearby, such as Ketchikan, Haines, Juneau, and Whitehorse. Due to the species' proximity in Southeast Alaska, it has been under close surveillance by EPMT staff this season. Orange hawkweed was found at the spillway to the



Figure 11. Orange hawkweed first found and recorded in 2015 at the Skagway Reservoir.



Figure 12. The extensive, rhizomatous roots of orange hawkweed were carefully removed from the reservoir.

reservoir in a small, but dense infestation. Altogether, 34 culms of orange hawkweed were accounted for and manually removed from the site. When first discovered, there were 5 flowering stems in total, 3 of which appeared to be already cut off or removed. This may suggest that a hiker came into the area and picked the flowering heads because of their aesthetic appeal, risking further propagation of the species along the trail. As this is an area of high ground disturbance that sees much traffic from hikers and maintenance vehicles, it does not come as a surprise that the area is infested with invasive species. However, the arrival of orange hawkweed in the area is a concern and should be closely monitored and controlled in future seasons. The spillway for the Skagway Reservoir also contained large infestations of low priority species like common dandelion, tall buttercup, and white clover.

The Lower Dewey Lake Trail was entirely free of invasive species until the southern portion of the lake where the trail opens into a small meadow. This meadow contains a plethora of invasive species including oxeye daisy, tall buttercup, white clover, common dandelion, common sheep sorrel, common plantain, and common timothy. The infestations are dense and have formed monotypic stands of invasive plants along the side of Lower Dewey Lake aligned on both sides of the trail. Despite the density of these infestations, they appear to be confined to the treeless portion of the meadow. The oxeye daisy infestation, first documented and removed in 2009, was once again recorded and removed in the 2015.



Figure 13. A dense and diverse infestation of many invasive plant species in an open meadow on the Lower Dewey Lake Trail.



Figure 14. The Skagway Native Plant Garden with non-native tall buttercup growing within it.

Skagway Native Plant Garden

In 2010, a native plant garden was established in Skagway by Skagway youth at the central location of Broadway Street between 3rd and 4th Avenues. This location is a frequently visited area by local residents and tourists to learn more about the native flora in Skagway and Dyea.

Despite showcasing the native plants of the region, several non-native, invasive species were found within the flower beds of the garden. These species primarily consisted of tall buttercup, common sheep sorrel, and common dandelion. All infestations were treated and removed in the 2015 season. If the Skagway Native Plant Garden is not maintained by EPMT staff, the public may obtain the wrong impression of plants like tall buttercup and common sheep sorrel and mistake them as native plants. This can lead to residents planting these invasive plants within their gardens, thus propagating their spread even more. To help reduce confusion and provide knowledge of native plants in the region, EPMT staff in the future should be responsible for the annual upkeep of the Native Plant Garden.

Dyea Road

Although the focus of the EPMT is to monitor the distribution of invasive species within park boundaries, monitoring and assessment of the Dyea Road remains critical to preventing the spread of invasive species. The Dyea Road is a conduit for invasive species because of its connection to Skagway and the Klondike Highway and its suitable environment for the colonization. Heavy traffic and frequent road maintenance facilitates the spread of invasive species along the road. Approximately eight miles of the Dyea Road were surveyed, from the intersection of the Dyea road and the Klondike Highway to the West Creek Bridge. The results of



Figure 15. The first portion of the Dyea Road lined with narrowleaf hawksbeard.



Figure 16. Big leaf lupine first found on the Dyea Road.

these surveys are divided into the four sections.

It is important to note that species of low priority such as common dandelion and white clover were found to be almost ubiquitous along the entire length of the Dyea Road. Additionally, infestations of red clover, alsike clover, pineapple weed, common plantain, common sheep sorrel, and shepherd's purse were found in smaller patches along the entire Dyea road.

Mile 0-2 (Skagway Overlook)

At the intersection of the Dyea Road and the Klondike, there are two large open fields that contain large infestations of tall buttercup, narrowleaf hawksbeard, yellow toadflax, smooth brome, and quackgrass. While these species were found all along the roadsides of this section, these fields stand out because of how large of an area the infestation covers compared to the sporadic patches located in the margins of the Dyea Road. Most infestations of narrowleaf hawksbeard, yellow toadflax, and tall buttercup were concentrated within the first mile of the Dyea Road. This season, four patches of oxeye daisy were found. Siberian peashrub was also located within this portion of the Dyea Road on private property. Outreach efforts to these private residences have been made in previous years but were met with strong resistance. These infestations occurred on private property north and just south of the Skagway scenic overlook. The reed canary grass infestation, first found in 2008, was found and treated again in the 2015 season. The infestation was found just across from the AB Mountain trailhead. This season, as in previous years, the flowering heads of the reed canary grass were removed.

Mile 2-4 (Nahku Bay)

Quackgrass was found along this portion of the Dyea Road in large, dense stands that covered up to 50 meter stretches along the margins of the road. Many of these infestations appeared to be spreading even further. Due to time constraints and feasibility of control, none of these infestations of quackgrass were treated. Oxeye daisy was found on two private residences at the end of the bay and at its far western extent. From both of these private properties with oxeye, the plant is spreading along the roadsides of the Dyea Road and could be a potential serious problem in the future. This portion of the Dyea Road also contained dense populations of tall buttercup sporadically concentrated along road margins. The common tansy, last recorded and controlled in 2011, was not found in the 2015 season.

A new infestation found in this section of the Dyea Road was big leaf lupine. The single plant was growing just outside of a private residence and was controlled during the 2015 season. This should be closely



Figure 17. Common eyebright found on the Dyea Road.

monitored and controlled again in future seasons.

Mile 4.6-7 (Taiya River Estuary)

Tall buttercup was more prevalent in this segment than anywhere else on the Dyea Road. Along both sides of the road, there were many separated but dense infestations of tall buttercup that appear to be spreading. Small patches of common timothy and quackgrass were also located in this section of Dyea Road. The narrowleaf hawksbeard that was identified in 2012 was found again in 2015.

Mile 6.7-8.3 (Dyea)

This section of the Dyea Road extends from the NPS Campground to the West Creek Bridge. This portion in many areas is largely free of invasive species, because of dense populations of native woody flora. Mile 6.7 to 8.3 of the road is important to survey each season because much of it is located within park boundaries. The West Creek Road was not surveyed again this season because of the negligible number of low priority species found in past years.

Common eyebright (*Euphrasia nemorosa*), was found again during the 2015 season on the east side of the road in front of the Chilkoot Outpost. The infestation appeared to be contained to the areas frequently mowed by the private land owner. Between the NPS Campground and the Taiya River Bridge, small patches of quackgrass, tall buttercup, and common timothy were all found but not treated due to time constraints. The smooth brome detected and controlled in 2012 and 2014 were not found in the 2015 season. The patch of oxeye daisy found on the east side of the Dyea Road just north of the Taiya River Bridge was found again during the 2015 season. Between miles 7.1 and 7.8, tall buttercup and common timothy were located in sporadic, low density patches. These infestations gradually taper off as the road approaches the West Creek Bridge. Additionally, species such as common dandelion, common plantain, and white clover were documented throughout this portion of the Dyea Road. Narrowleaf hawksbeard was not documented beyond mile 6.7 for the fifth consecutive year.

West Creek Trail

The West Creek Trail was formally surveyed for the first time by the KLGO EPMT in 2015 with no invasive plants found.

Dyea

Dyea continues to be a priority area for the EPMT within the park. Dyea is the most heavily used and accessible natural area within the park, making it vulnerable to the introduction of new invasive species. While there are few high priority species located within NPS-administered land in Dyea, there are several high priority species found just outside the park boundaries. Due to this, it is important to monitor and control them before they can spread into the park. Of the species that are located on park property, most are concentrated along highly disturbed sites along roads and trail systems. In the past several years, there has been an increase in the amount of invasive plants spreading into more undisturbed areas like the Nelson Slough Restoration Site and the Dyea Flats.

Dyea Townsite Road and Trail System

The Dyea Townsite Road acts as an extension of the Dyea Road and begins just north of the Taiya River Bridge. The road is important to survey because it connects to the Dyea Flats and the Lost

Lake Trailhead, acting as a vector to remote and sensitive areas. This area is frequently visited by car, bicycle, foot, and horse, making it particularly vulnerable to invasive plant species. The majority of invasive species were found in the first mile between Dyea Road and the Slide Cemetery turnoff. Many invasive species were also concentrated within the last mile between the Nelson Slough Bridge and the Dyea Flats. Both of these infestations were composed of four main species: tall buttercup, white clover, common dandelion, and common plantain. Oxeye daisy was found again in the 2015 season.

The Slide Cemetery Road that divides off of the Dyea Townsite Road into the Slide Cemetery and the Lost Lake Trailhead was almost entirely free of invasive species. A single culm of tall buttercup was identified and removed from the entire road. In the past, white clover and red clover have been found and controlled along the sides of the road but were not located for a third consecutive year. The last time control work was completed at the Slide Cemetery was in 2012. This survey removed small infestations of common timothy. However, this has also been the third consecutive year without finding the species within the area.

This season, it was decided that an extensive project, requiring potentially massive ground disturbance would occur within the Dyea Townsite Road in 2016. This plan consists of widening the Dyea Townsite Road and will result in ground disturbance in proportions that the area has never seen. This massive project is of significance because it could lead to the potential spread of new invasive plants and the propagation of already established invasive plants. Jami Belt, Biologist and Natural Resources Program Manager, plans to contain invasive species as much as possible and to not allow the introduction of new invasive species into the area during the course of the project. A contractor will be required to have gravel and fill material site certified for being weed-free. Additionally, contractors will be asked to cover all materials if they are not being used 30 days after extraction. There will be a requirement to monitor weeds within the fill importation for up to three years after the project is completed. If invasive plants are found, they will be treated as necessary. Equipment washing stations will be set up for any equipment prior to its first use at the construction site or at the construction material staging areas. Equipment washing stations will also be used again anytime they deviate from the construction site or the construction material staging areas before they return to complete the project. The top soil of the site will be removed and compiled into three separate zones based on their vegetation composition. This top soil will be replaced after the completion of the project. Jami has made efforts to collect the seeds from native plants to be used to help revegetate and restore the area post-project. The species of utmost concern of spreading from its current infestations is oxeye daisy. Oxeye daisy has been found in three occurrences within the Dyea Townsite Road.

Nelson Slough Restoration Site

In 2006, a wetland restoration project was created to establish native plants, such as Nootka lupine (*Lupinus nootkatensis*), wild-flag iris (*Iris setosa*), chocolate lily (*Fritillaria camschatcensis*), and Sitka spruce (*Picea stichensis*). The native plants that were planted in Nelson Slough in 2006 have been thriving despite the presence of invasive species. At the start of the restoration project, soil that was imported was not free from the invasive plant seeds. Therefore, this is likely the source for the

establishment of many of the invasive species present within the site. As restoration projects are anticipated for the 2016 season, the need to purchase and ensure that all material fill is weed-free. Despite the presence of common dandelion, white clover, red clover, alsike clover, and common plantain found in small patches periodically along roadsides, the Nelson Slough is largely free of any severe, high priority invasive species.

The common eyebright that was found and controlled on the edge of the restoration site south of the bridge and behind the interpretive signs was not found in the 2015 season, making it the third consecutive year without recurrence. The common timothy and meadow foxtail documented and controlled in past years was also not found or documented in the 2015 season.

As in the past several years, tall buttercup was the main focus of monitoring and control this season. This season, a 12 person volunteer group from Students Today Leaders Forever assisted in manually removing tall buttercup in small patches within the area. For continued progress in the restoration area, much effort will have to continue in future years to thoroughly remove each plant. Despite improvement, many smaller and new tall buttercup plants were located within the area that required special attention and dedication to remove.



Figure 188. The STLF service crew pose for a picture after pulling tall buttercup from the Nelson Slough Restoration Site.

Dyea Flats

The Dyea Flats is a low, flat, inter-tidal zone where the Taiya River empties into the Lynn Canal. Though there are not many invasive species located within the area, the majority of invasive species are concentrated along the road margins and are primarily of low priority. Common sheep sorrel is found throughout the entire area. Common eyebright was found again in the 2015 season and appears to be spreading. Despite this trend, common eyebright remains more concentrated along road margins than undisturbed areas. North of the Dyea Flats and east of the historic Dyea townsite, common sheep sorrel and common dandelion were found to be growing widespread at low density in a large field. Tall buttercup is also located within this area and appears to be spreading.

NPS and City Campgrounds

Both the NPS and city campgrounds in Dyea are critical places to survey because many visitors and NPS staff park their vehicles and travel from many different areas to these campsites, risking unintentional spread of invasive species. Conversely, it is important to keep these campgrounds free

of invasive species so that those staying at the campsites do not spread invasive species from Dyea to other areas.

Within the NPS Campground, small infestations of common dandelion, common plantain, common sheep sorrel, tall buttercup, and white clover were found. Most of these infestations were concentrated around NPS housing, the parking lot, and along the road to each campsite. The only campsites that contained infestations were Campsites 1 through 7, no invasive species were found past Campsite 8. While no infestations were found around the fire pits of each campsite, as documented in 2012, all infestations were located primarily along the perimeter of each campsite where infestations could potentially extend into areas of native vegetation. All infestations were recorded and controlled in the 2015 season. The European mountain ash trees documented and removed in 2012 and had not recurred for the third consecutive season. The back loops of the campground, starting at Campsite 8, were found to be entirely free of invasive species.

The City Campground and its adjacent roads were surveyed in the 2015 season. Only small patches of common sheep sorrel and white clover were found growing along the margins of the road. Tall buttercup, first found in 2014, was found again this season in a meadow southwest of the campground and appears to be spreading.

Chilkoot Trail

Due to the historical and cultural significance of the Chilkoot Trail, it was a priority area for invasive plant management in the 2015 season. Invasive plant identification guides and information on how to report invasive plants were created, laminated, and distributed to all cabins along the Chilkoot Trail for communal use. The trail was visually surveyed twice for the 13.5 mile stretch between the trailhead in Dyea and Sheep Camp. The entire trail from the trailhead to the United States/Canada border at the Chilkoot Pass were also visually surveyed. This survey was broken down into the following four sections:

Dyea Trailhead to Finnegan's Point

No invasive plant species were found between the Dyea Trailhead to the base of Saintly Hill despite frequent hiker traffic through this portion of the trail. Three tall buttercup plants and five common dandelion plants were found at the base of Saintly Hill to Finnegan's Point. All infestations were manually removed in the 2015 season. All common dandelion plants were found within the first mile of the Chilkoot Trail. One tall buttercup plant was found on the stairs going up Saintly Hill and the two other tall buttercup plants were found at the end of the boardwalk across the Beaver Ponds. A small patch of white clover was documented again at the entrance of the campground at Finnegan's Point, just west of the warming shelter. A thorough survey of the Finnegan's Point Campground revealed no other invasive plants. After noting that most infestations in prior years have commonly been associated with trail maintenance, areas near bridges and other trail maintenance activities were given special attention. However, no invasive species were found adjacent to bridges on this section of the trail.

Finnegan's Point to Sheep Camp

The tall buttercup and common timothy found and controlled in 2012 and 2014 respectively were not found in the 2015 season. No other invasive species were found between Finnegan's Point and Canyon City. Extensive surveys of the Canyon City Campground and surrounding area yielded no new infestations of invasive plants. This is the fifth year that no invasive species have been documented at Canyon City. Surveys were performed along the trails leading to the Canyon City ruins, the Canyon city helicopter pad, and Canyon City Trail Crew Cabin with no invasive species found until just south of the Sheep Camp Ranger Station, where a small patch of white clover was found again and controlled.

Sheep Camp

Sheep Camp had the largest extent and diversity of invasive species found on the Chilkoot Trail in 2015. The Sheep Camp Ranger Station, .25 miles before the Sheep Camp Campground, contained dense patches of common dandelion in the southwestern side of the cabin and was found along the trail leading to the tool shed. Common dandelion infestations were found scattered in the open field adjacent to the Taiya River and south of the cabin that has the weather station and helicopter pad. Common dandelion in this area has been increasing in density, but remains isolated to this area. Additionally, a single tall buttercup plant was found and removed. The .25 mile section between the Sheep Camp Ranger Station and the Sheep Camp Campground was entirely free of invasive species until approximately 20 feet from the southern entrance of the Sheep Camp Campground. Small infestations of white clover, common dandelion, and tall buttercup line the edges of the trail leading into the Sheep Camp Campground. According to past reports and GIS data, infestations of tall buttercup in this area appear to be growing in both density and geographic extent. Despite the aforementioned spread of tall buttercup, infestations of the species were clustered in small, manageable patches for control and were manually removed again in the 2015 season. The three loop trails leading to the tent platforms and outhouses at the Sheep Camp Campground were thoroughly surveyed and no invasive plants were found.

According to the Alaska Natural Heritage Program, reed canary grass has an invasiveness rank of 83 out of 100, making it the most invasive plant within all of the park and surrounding areas. Reed canary grass can be particularly damaging to riparian ecosystems, such as Sheep Camp.

Reed Canary grass, first found and recorded in 2011, was the highest priority of control work in the 2015 season. In past seasons, staff found that the infestations of reed canary grass proved to be much too large to dig out by hand, so all inflorescence and seed heads were cut, bagged, and burned in the incinerator at the Sheep Camp Ranger Station (Golden 2013). Shortly after these efforts, a newly developed treatment plan passed compliance in 2011 to remove the infestations. All reed canary grass plants were cut down to ground height with garden shears and were covered with two layers of material. First, a layer of black plastic sheet was cut and placed down over infestations. Next, a layer of black, non-woven, durable geotextile was placed on top of the sheets to prevent potential damage due to weather and high traffic areas from hikers. These shade covers were placed leaving at least a foot of space along the outside of each infestation to cover as much reed canary grass as possible and to shield it from sunlight. All shade covers were held in place by carefully inserting stakes into the

ground and rocks were placed on top of the shade covers to aid in restricting the covers from movement. Signs were created and placed in front of each infestation to inform incoming hikers of the project and to leave the covered areas undisturbed (Golden 2013).

Up until the 2015 season, efforts to control reed canary grass since its treatment in 2011 consisted of maintaining, repairing, and adding shade covers to the infestations. Conditions of the shade covers were thoroughly examined for any holes from falling branches and debris that could potentially allow sunlight to reach the plants. Despite efforts in 2011 to remove reed canary grass, it was found growing out and around the margins of 10 of the 12 shade covers and had managed to grow directly through the shade covers in four separate locations (Frank, 2012). Also documented were several other infestations of reed canary grass that had not previously been treated by the shade covers in 2011. In 2012, the shade covers required expansion and fortification to contain previous infestations and control new infestations. Shade covers were staked down at smaller intervals to ensure that the placement of the shade covers would not be disturbed or moved out of place. In 2012, 11 new shade covers were placed to expand the original 12 shade covers, accounting for a 44% increase in geographic area covered (Frank, 2012). In contrast to the 2012 season, 2013 EPMT staff returned to assess and monitor the conditions of the shade covers and found no major damages to the shade covers, found no new infestations of reed canary grass, and found no reed canary grass escaping the shade covers. The only maintenance completed during the 2013 season was re-aligning the rocks placed on



Figure19. Chris Overbaugh removes shade covers at Sheep Camp for the first time in 4 years.



Figure 20. Jami Belt facilitates the revegetation process by re-planting native plants found growing on top of the shade covers.

top of the shade covers to secure their positions (Golden 2013). In the 2014 season, staff found and recorded reed canary grass emerging from the sides of four of the shade covers (Mauldin 2014).

This year, a project to chemically control the reed canary grass infestations was initiated. 2015 was the first year that herbicides were used in park's back country. Efforts this season to control reed canary grass infestations at Sheep Camp were aided and not possible without Chris Overbaugh, Liaison of the Alaska Division of the Exotic Plant Management Team, and Jami Belt, Biologist and Natural Resources Manager at KLGO. This effort took more than 120 man hours to carry out.

Shade Cover Removal

The first part of the process was to remove all rocks that provided natural aesthetics and aided in holding down the shade covers. Pliers were used to pull out all stakes from the ground and nails from the trees. All stakes and nails removed were accumulated into pile so that they would not get lost and serve as a potential danger to those staying at the campsite or mistaken as artifacts. Once all stakes and nails were removed, the shade covers were then removed. Most shade covers needed to be tilted to the side or flipped over to remove excess dirt, vegetation, rocks, and/or anything else that added potential weight to the shade covers. To assist with revegetation, it was useful to pull remaining mosses and grasses that had grown into the geotextile shade covers and place them on top of the disturbed soil that was



Figure 21. Signage adjacent to plants sprayed with AquaMaster herbicide.

underneath the shade covers before they were removed. Once all excess soil and debris was removed from the shade covers, they were folded, rolled, and concentrated into a single area within the campground away from areas frequently visited from hikers, such as walkways, camping platforms, and bear lockers. After the removal of all shade covers, rocks were re-aligned to delineate the trail from the restored areas.

Herbicide Application

It was necessary to inform all incoming hikers and the Trail Center that reed canary grass was being treated via the use of herbicide, and to keep out of marked areas. Signs were cut out of wood for each area of treatment and a message was written informing hikers to keep out of all marked areas with blue dye and/or fencing. Two additional signs were created and used for both entrances to the Sheep Camp Campground informing hikers that the camp was subject to invasive plant control and to use caution because herbicides were going to be applied. It was critical to leave sufficient area around the

bear lockers and walkways to ensure hikers had enough space to place their backpacks without disrupting fencing or revegetation areas. The herbicide used for the project was AquaMaster, an approved herbicide in the State of Alaska, which was applied at the rate of 58 ounces per acre. Blue dye was used within the spray mix to indicate where the herbicide was sprayed. Areas applied with herbicides were also taped and had plenty of signage to inform and warn hikers.



Figure 22. A large area of restoration across from warming shelters and southeast of the bear boxes.

Restoration Process

To help restore the areas, seeds from five native grasses were spread: red fescue (*Festuca rubra*), blue joint reedgrass (*Calamagrostis canadensis*), polargrass (*Arctigrostis latifolia*), hairgrass (*Deschampsia caespitosa*), and annual ryegrass (*Lolium multiflorum*). All seeds with the exception of annual ryegrass were spread equally along all disturbed areas. Once the seeds were spread, layer of biodegradable, jute mesh, was laid on top. This process helps secure the seeds in place, reduces erosion, and distinguishes the area as a restoration site. Signs were put in place to inform the public to keep out of the restored areas.

Throughout the course of the project, it was critical to let the public know what was

happening in the area and to use the necessary precautions to be safe. The project included consistent and clear communication with the backcountry rangers, the Trail Center, and the public.

Sheep Camp to the Chilkoot Pass

The Chilkoot Trail after the Sheep Camp Campground remains almost entirely free of invasive species except for one stand of reed canary grass. The successful plant identification of reed canary grass by a backcountry ranger enabled EPMT staff to locate a new infestation .2 miles north of the Sheep Camp Campground. There were 12 culms of reed canary grass altogether that were manually treated. The populations of common dandelion and tall buttercup had been found and recorded in previous years but were not found in the 2015 season. Several large populations of native rock dandelion (*Taraxacum lyratum*) were found growing on Long Hill. No invasive plants were found from the Scales to the Chilkoot Pass.

Klondike Highway and White Pass Unit

Klondike Highway

The Klondike Highway and White Pass and Yukon Route Railroad, spanning from the northern end of Skagway into the Yukon Territory of Canada, serves as an excellent conduit for invasive plant dispersal between international borders. The Klondike highway and the White Pass and Yukon Route Railroad run through the White Pass Unit of KLGO into Skagway and are the main corridors connecting the Yukon Territory and British Columbia to Skagway. Frequent maintenance creates disturbed soil and facilitates the introduction, establishment and spread of invasive plant species. The USA portion of the Klondike Highway extends 14 miles, however, the area was only surveyed up to the United States Customs Station at mile 6.8. The survey was completed primarily to assess the plurality and locations of invasive species present. Overall, invasive species were found to be largely congruent with previous years, though with a few notable exceptions.

More than 100 culms of Canada thistle were located in the area at the AKDOT pull-off, about 1.5 miles north of the Dyea Road turnoff and just south of the Black Ponds. The infestation is dense. No control effort was made to control the infestation due to lack of time and man power. No other Canada thistle infestations were found along the rest of the Klondike Highway.

Tall buttercup was found in sporadic patches all along the 6.8 miles surveyed of the Klondike Highway. These infestations increase in size and density with increased proximity to Skagway. Most notably, tall buttercup grew in large thick infestations just north of the intersection of the Klondike Highway and the Dyea Road.



Figure 23. A dense stand of Canada thistle found in a single isolated infestation along the Klondike Highway.



Figure 24. Common groundsel found ubiquitously along the Klondike Highway.

Narrowleaf hawksbeard was found growing in many small patches along the Klondike highway, particularly on the east side of the highway across from the rock quarry about a mile north of the intersection with the Dyea Road. Another invasive plant species found in small proportions along the highway was yellow toadflax.

White sweetclover was documented and controlled during the 2015 season. Approximately one mile north of the intersection of the Dyea Road, several scattered but small infestations were found along the road. Most notable, was the infestation of white sweetclover at the turn-off to Liarsville. On the corner of where the Klondike Highway and the road to Liarsville, 20 different white sweetclover plants were documented and manually removed. Several low priority species exist ubiquitously along the 6.8 miles surveyed this season. These infestations consist of common dandelion, common plantain, common groundsel, red clover, white clover, alsike clover, common sheep sorrel, pineappleweed, and shepherd's purse. These species decrease in density with increased distance from Skagway. The White Pass unit was not surveyed during the 2015 season due to time constraints.

Laughton Glacier

Laughton Glacier is a popular hiking destination along the White Pass and Yukon Route Railroad, located approximately 1 mile east of the White Pass Unit of KLGO. The Laughton Glacier train stop and hiking trail were both visually surveyed during the 2015 season. The majority of invasive species found at Laughton Glacier were concentrated at the large clearing around the train stop. White clover and common dandelion accounted for most of the ground cover along with common sheep sorrel and common plantain. These infestations appear to be contained to the areas of high disturbance around the train stop.

The two mile trail leading to Laughton Glacier is largely free of invasive species. The only invasive plant found along the trail was common dandelion and seemed to be contained to an area where the trail goes through a grassy field.

After the creation and distribution of invasive plant identification charts given to NPS staff, orange hawkweed was successfully identified and reported to EPMT staff at this site by Museum Technician, Deb Boettcher.

Outreach and Education

Efforts to educate the park staff, visitors, and the general public about the presence and impacts of invasive species were emphasized during the 2015 season. Several new educational materials were created this year and distributed to park staff, visitors, and local businesses. Materials consisted of invasive plant identification charts and gardening alternatives charts. This year's focus was on early detect and how to report the presence of invasive species.

This year, walking tours were initiated to provide the public with information regarding invasive and native plants. Rather than just focusing on the invasive species found within the park and Skagway, it was important to highlight the native plants of the area. Walking tours began at the Visitor's Center with an introduction to native and exotic plants and the EPMT program. Stops were made at the Native Community Garden to display the many different native plants that the area has to offer. The

walking tour continued down Pullen Pond to help exemplify how many invasive plants are concentrated along riparian ecosystems, having a major impact on other organisms in the community. A stop was made at the White Pass and Yukon Railroad to exhibit how railroads and other transportation networks are vectors for the spread of invasive species. Walking tours were largely successful and piqued the interest of many citizens and visitors. Residents of the Skagway community learned about how they can make a difference within their own property.

This season, EPMT staff continued spreading awareness of invasive plant species by hosting presentations. EPMT staff of the 2015 season gave a presentation through a program called Monday Night at the Park, formerly known as the Guide Series. This year's presentation, "Invasive Plants in the Garden City," informed the community about invasive plants, background of the EPMT program, identification of the most common and invasive species around Skagway and KLGO, invasive species located in neighboring towns, gardening alternatives, and how the general public can report invasive plants. The event was largely successful with 24 people in attendance and community members who were eager to get started by manually removing invasive plants from their yards.

An objective of the 2015 season was to bring outreach and education to a large and diverse audience of the Skagway community. This year, the KLGO EPMT set up information tables at the Visitor's Center, Trail Center, and Junior Ranger Activities Center. Providing information and serving as a resource at these three locations in Skagway ensured that many different people would become more aware of invasive plants and learn how to reduce their



Figure 25. Kevin Hauser provides information on how to keep trails free of invasive species at the Trail Center.



Figure 26. Invasive plant display at the Skagway Public Library.

spread. Tabling at the Visitor's Center is useful because it receives a lot of traffic from tourists, visitors, and park staff. Tabling at the Trail Center brought a different crowd to learn about invasive species. While many determined hikers came into the Trail Center to learn about the weather and trail conditions of the area, they also left with a new knowledge and awareness of the invasive plants to look out for. Hikers were informed to brush their boots periodically along the trail and to place unidentified seeds with their garbage that they have to pack out. This ensures that hikers will help keep more remote and sensitive areas free of invasive plants. The Junior Ranger Activities Center was beneficial to provide information on invasive plants because children are very likely to pick flowers that could be invasive and unintentionally spread them. A main goal of tabling at the Junior Ranger Activities Center was to inform children that there are other alternatives to picking flowers, such as taking photographs.

Though EPMT staff were absent during the 2015 Junior Ranger Day on July 16th due to work on the Sheep Camp Restoration Project, education and outreach of invasive plants persisted. Deb Boettcher, Museum Technician, continued her activity for children to create bookmarks out of invasive plants. At Junior Ranger Day, Deb also handed out a variety of outreach materials, like invasive plant coloring books and plant identification charts, to children who were eager to learn more and make a difference.



Figure 27. It proved to be particularly beneficial to teach youth about invasive plant species.

A new focus for outreach and education during the 2015 season was maintaining the Skagway Native Plant Garden. Given its central location in Skagway on Broadway Street, the Skagway Native Plant Garden receives a lot of traffic and is of interest to many visitors of the park. Removing all the invasive plants within the planters and placing signs and descriptions of each native plant in the garden helped the community learn what plants were native and beneficial to plant in their gardens. A total of 9 native plants were documented with descriptions: wild flag iris, yellow rattle (*Rhinanthus minor*), beach pea (*Lathyrus japonicus*), chocolate lily, common yarrow (*Achillea millefolium*), fireweed (*Chamerion angustifolium*), Nootka lupine, wild strawberry (*Fragaria ananassa*), and silver

cinquefoil (*Argentina anserina*). This information is open to the public and is a way of encouraging planting of native flora by residents and gardeners.

This season, EPMT staff set up an invasive plant display at the Skagway Community Library. This year, the display was set up for three weeks prior to the Community Weed Pull in hopes of attracting

greater participation in the event. The display consisted of plant identification charts, the Community Weed Pull flyer, and descriptions of some of the most invasive and common invasive plants found within Skagway. Displaying information about invasive plants in the library has been found to be a successful outlet to relaying information to the public.

A partnership was created in the 2015 season with two Student Conservation Association (SCA) interns, Tony Chandonnet and Jaclyn Bernstein. Efforts with both of these interns resulted in the created of Summer Camp, a program in which children through the Skagway Recreation Center would travel to remote areas and learn about natural and cultural resources of the area. All events within Summer Camp were assisted by EPMT staff and involved learning about invasive and native flora of the region. An entire day was devoted to teaching children Leave No Trace principles and plant identification.

The 2015 season marked Skagway's 7th Annual Community Weed Pull. Eighteen people attended and learned about a variety of invasive species while hand-pulling plants. The community weed pull provides the public with knowledge of identification of some of the most common and invasive plants in the area and enables them to learn first-hand how to effectively remove invasive plants. They will be able to use these skills on their property and help the process of invasive and exotic plant management.

A very successful form of outreach and control of invasive plants was when a service crew from Students Today Leaders Forever (STLF) traveled to the Nelson Slough Restoration Site to remove tall buttercup. The experience was very beneficial because it enabled volunteers to learn first-hand how and why invasive plants are an issue. When manually removing each infestation, each volunteer learned how tedious hand pulling of invasive plants can be and how tenacious they are in terms of their dispersal and spread. 12 volunteers from the service crew went home with a great understanding and larger consideration of invasive plants. All volunteers were given invasive plant identification charts and other helpful outreach and education materials.

Another success with outreach and education in the 2015 season was the briefing of backcountry rangers on the identification, treatment methods, and reporting procedures for invasive species on remote, backcountry trails. After the restoration project at Sheep Camp this



Figure 28. The Nelson Slough Restoration Site after the STLF service crew pulled tall buttercup from the area.

season, all backcountry rangers on the Chilkoot Trail were provided with a thorough report on the process of the restoration project. Additionally, hikers along the Chilkoot Trail could also learn more about invasive species and how to successfully identify, report, and reduce their spread because laminated invasive plant identification charts for communal use were distributed at all campgrounds on the American side of the Chilkoot Trail at Finnegan's Point, Canyon City, Pleasant Camp, and Sheep Camp.

Recommendations and Discussion

Location Specific Recommendations

Recommendations for the 2016 EPMT season center on the education and outreach to prevent invasive species from establishing into the backcountry and undeveloped front country areas. Containment of invasive species within the area should be based on species with the highest priority invasiveness ranking and species that are found in small, but manageable patches.

Skagway

The best recommendation for the 2016 season is to only focus on the highest priority invasive plants for treatment. Continue providing outreach and education to those who have invasive plant species within their gardens as ornamentals located on private property. Important areas to survey within the town are places within or near park boundaries, along Pullen Creek, and at the Skagway Airport.

Removing white sweetclover should remain a high priority for future EPMT work. Since the massive removal of the plant from the Skagway Airport in 2009, efforts over the past years have been successful at greatly reducing white sweetclover on the airport's property. Community weed pulls should continue to occur at the Skagway Airport to help completely remove white sweetclover. Additionally, control work should also focus on the northern portions of Skagway, as there has been documentation of white sweetclover at Seven Pastures and in the railroad yard of the White Pass and Yukon Route Railroad. These infestations appear to be located on private property but further investigation should be done to determine if they are within the municipal right of way associated with the road. The partnership with Andrew and Joanne Beierly should continue in future seasons.

As there is only one occurrence of reed canary grass within the entire town of Skagway, it should remain a top priority for future EPMT staff. Reed canary grass is currently located along the sensitive ecosystem of Pullen Creek and poses as a major threat to spread even further and have serious impacts on the natural ecosystem.

EPMT staff should continue to monitor the seven occurrences of ornamental jewelweed within Skagway. The population located on 20th Avenue between Main and State Streets is of particular concern because of its close proximity to Pullen Creek.



Figure 29. Bird vetch in bloom at its single location in Skagway.

A plan to control the bird vetch located on 5th Avenue and Spring Street should be a high priority for the 2016 season. Discussions with the city and other organizations should be continued in future years and a plan should to use herbicides should be developed.

The common tansy found in the garden at 5th Avenue and Broadway Street should continue to be a high priority. Though the infestation is located on a lot that is maintained by NPS staff, KLGO management staff has expressed concern about the public's reaction to the removal of the common tansy. Common tansy can be removed and replaced with a native species, such as Canada goldenrod (*Solidago canadensis*). Though common tansy does not appear to be spreading past this location, it will still be important to control it before it has to the opportunity to escape out of the garden.

A consideration for future seasons should be contacting private landowners about infestations of big leaf lupine and perennial cornflower.

Other species of lesser concern, but should still be monitored, consist of yellow toadflax, narrowleaf hawksbeard, and tall buttercup. Each of these species are found extensively throughout the entire town but it will be important for EPMT staff to assess the changes in their distribution over time. A location of particular concern in Skagway that should be closely monitored is the municipal fill site at Seven Pastures. This is a point source for the spread of contaminated fill material and mulch to other locations in the area. Many species are found within the area, especially white sweetclover, and should be controlled in future seasons.

Dyea Road

The Dyea Road should be surveyed several times during the 2016 season. The collection of GPS data of low priority species is not essential as there are now several years of baseline data to support their ubiquitous presence along the Dyea Road. Instead, focus should be placed on more serious infestations of reed canary grass, yellow toadflax, oxeye daisy, smooth brome, common timothy, and quackgrass.

High priority should be established for the invasive species located within park boundaries. These infestations within park boundaries consist of the smooth brome and oxeye daisy located around the Taiya River Bridge and the common timothy, tall buttercup, and quackgrass found between the NPS Campground and the West Creek Bridge.



Figure 30. Common tansy, Icelandic poppy, Johnny jump-ups, and oxeye daisy are all located on private property at Corrington's Alaska Ivory.

Control work outside of park boundaries should begin with the reed canary grass infestation outside the Chilkoot Outpost. This infestation is located in very close proximity to park boundaries and poses a direct threat of invasion.

Lastly, controlling the narrowleaf hawksbeard found south of the NPS Campground should be treated again to help keep the infestation small and manageable.

Dyea

Yellow toadflax and oxeye daisy should be the top two species of highest priority within Dyea. These species are the most invasive within the area. Several surveys throughout the season should be conducted to control and monitor these species.

Control work on tall buttercup should continue in 2016 with emphasis on the Nelson Slough Restoration Site and the field located just north of the Dyea Flats.

It will be of high priority to monitor and remove all invasive species, especially tall buttercup, along the Dyea Townsite Road. Due to the widening of the Dyea Road in 2016, all invasive plant species should be removed early within the season before the project takes place. Many restoration and monitoring efforts of the Dyea Townsite Road will occur within the 2016 season.

Within the Nelson Slough Restoration Site, common eyebright should be controlled. Most infestations are located in small patches and are feasible to remove, especially with the assistance of volunteers.



Figure 31. Large common plantain plants grow along the side of the Dyea Road. These are located in sporadic, isolated patches and could potentially be treated in future seasons.



Figure 32. Restoration and revegetation at Sheep Camp should be monitored each year, especially around the bear boxes due to frequent foot traffic.

Chilkoot Trail

Managing the invasive plants found in the backcountry of the Chilkoot Trail is time-consuming and logistically complicated. Consolidating the number of trips needed by integrating multiple tasks into a single trip will help save a considerable amount of time and effort. Creating partnerships with the Chilkoot Trail backcountry rangers is also important, as they can monitor areas that are not as accessible to EPMT staff. Surveying the Chilkoot Trail should be done annually and Sheep Camp should be visited and monitored at least three times in the 2016 season.

EPMT staff should survey the entire length of the Chilkoot Trail early in the season to check the progress of the Sheep Camp restoration project.

Tall buttercup, white clover, and common dandelion should also be monitored and treated if the time permits.

Klondike Highway and White Pass Unit

The entire length of the Klondike Highway should be surveyed twice in the 2016 season. The species of utmost concern to control and monitor are Canada thistle, reed canary grass, and white sweetclover. Control work on the Klondike Highway should be increased in the 2016 season.

Control work should be focused on the few, small infestations of reed canary grass found along the highway and the small patches of white sweetclover. Other species to consider for control work along the Klondike Highway are yellow toadflax, oxeye daisy, narrowleaf hawksbeard, and quackgrass.

The White Pass and Yukon Route railroad was not surveyed during the 2015 season but should be a priority in future seasons. The railroad passes through park boundaries and serves as an excellent vector toward the spread of invasive species into remote areas. While surveying this area is difficult due to its sheer geographic extent and safety reasons, it is beneficial in ensuring invasive species do not spread and establish into the backcountry. To improve safety, EPMT staff should attempt to schedule surveys around a date when the trains do not run. Another option would be to coordinate with the White Pass and Yukon Route Railroad to have drop-off and pickup times for backcountry survey efforts.



Figure 33. Small infestations of yellow toadflax that can be controlled on the Klondike Highway in future years.

Survey Work

Surveys are a vital component of invasive and exotic plant management. Early detection of species will help control infestations before they become more serious threats. For example, orange hawkweed found on a survey of Lower Dewey Lake this year initiated a rapid plan of control work, addressing the issue before the infestation could spread outside of the Skagway Reservoir and along portion of the Lower Dewey Lake Trail System. The table below displays the date and amount of time invested in each survey during the 2015 season, as well as the personnel needed to conduct the surveys. These times reflect time devoted to survey work alone. Although survey work may include periodic control of small infestations, time devoted strictly to control work was not included in this table. This table does not reflect time devoted to travel to and from survey locations.

Table 2. Summary of Surveys Conducted in 2015.

Date	Location	Personnel	Time
6/25 – 8/8	Skagway	1	-
7/18	Skagway Airport	1	5 hours
6/27, 7/23	Dyea	1	-
6/29 – 7/11	Dyea Road	1	13 hours
7/13, 7/25, 7/26	Chilkoot Trail	1	11 hours
8/3	Klondike Highway	1	6 hours

Volunteers

Volunteers are an essential part of the KLGO EPMT's control strategy. The efficiency and effectiveness of manual control efforts is often directly correlated to the number of personnel working on the project. Many targeted infestations in KLGO cannot be efficiently controlled by a single staff member.

Outreach and Education

Outreach and education pay dividends well beyond the hours spent on them and should remain a high focus for future EPMT seasons. The benefits gained from these efforts outweigh the amount of time devoted to them. Education and awareness may be the most useful tool in reducing the spread and establishment of invasive species.

Connections between the park, land owners, and local or regional stakeholders are integral. In the 2015 season, partnerships were sustained with the TIWC and



Figure 34. Rachel Ford of the Taiya Inlet Watershed Council pulls white sweetclover at the community weed pull.

AKDOT. The next step for EPMT staff, however, is to form partnerships and connections with other local businesses and organizations.

The Skagway community weed pull was a success once again in the 2015 season. This is the largest community event hosted by EPMT staff and has proved to be an effective tool for controlling invasive plants and raising awareness of the issue. The event should continue to be held in future seasons and will require the assistance of the TIWC, the STC, and AKDOT. While the community weed pull was hosted in mid to late July this year, the community weed pull in future seasons needs to be conducted earlier in the season. Early to mid-June would be most beneficial to host the event. To obtain a large audience and increased participation in the event, extensive advertisement such as posting flyers on bulletin boards across town, a display at the Skagway Public Library, and announcements via many local emails will be necessary. White sweetclover, narrowleaf hawksbeard, yellow toadflax, and bladder campion should all be targets of manual treatment in future community weed pulls at the airport.

Partnership with the Skagway Public Library was a critical element of community outreach programming during the 2015 season. An invasive plant display was created three weeks before the Skagway Community Weed Pull, which was a successful means of reaching a large number of people.

Presentations proved to be a successful tool in educating a large number of park staff, volunteers, visitors, and local citizens. This year, EPMT provided a talk on invasive plants at Monday Night at the Park, formerly known as the Guide Series. Presentations, both formal and informal, should be continued in future seasons.

Audio and print media are great ways to spread the word about invasive species to the public. Radio interviews and discussions about invasive plants have been beneficial to increase awareness and should certainly be considered in future EPMT seasons. Newspaper articles would also be a positive outlet of this information.

The installation of boot brush stations should be a high priority in 2016. This is an excellent outreach opportunity for education and prevention of invasive plants.

Restoration

Restoration is a critical element of any successful large-scale invasive plant control project. With the widening of the Dyea Townsite Road in 2016, there are plans to revegetate and restore the area due to its wide ground disturbance. This will be a major priority in future EPMT seasons.

Wind Dispersal Considerations

It is recommended that when manually removing these plants in open areas, work should begin on infestations from the north end, moving south. This practice will help to contain species with wind-driven seed dispersal mechanisms to their southern limit, as north winds during the summer and early fall are rare.

Cultural Resources Integration

KLGO is located within two National Historic Landmarks, one in each river valley, and therefore is host to extensive archaeological remains. Due to the historical significance of many areas in KLGO, a meeting concerning proper cultural resource field methods should occur annually. Artifacts or archaeological sites found while conducting surveys should be photographed, mapped, and discussed with the Cultural Resources Department.

KLGO Natural Resources Exotic Plant Collection

Given the recommendations in past EPMT reports that efforts should be made, whenever possible, to collect and press voucher specimens for the exotic and invasive species found in and around KLGO, substantial progress was made during the 2015 season. Pressed plants are the best level of proof that certain species exist in the area, and also aid in species identification for other park staff. During the 2015 field season 20 new species were added to the collection. This is the greatest amount of exotic and invasive plants added to the collection in all years of the KLGO EPMT program. These species are as follows:

<i>Capsella bursa-pastoris</i>	<i>Chenopodium album</i>	<i>Elymus repens</i>
<i>Erysimum cheiranthoides</i>	<i>Euphrasia nemorosa</i>	<i>Hieracium aurantiacum</i>
<i>Hordeum jubatum</i>	<i>Papaver croceum</i>	<i>Phalaris arundinacea</i>
<i>Phleum pratense</i>	<i>Plantago major</i>	<i>Polygonum aviculare</i>
<i>Ranunculus acris</i>	<i>Rumex acetosella</i>	<i>Rumex crispus</i>
<i>Senecio vulgaris</i>	<i>Tanacetum vulgare</i>	<i>Viola tricolor</i>
<i>Trifolium repens</i>	<i>Vicia cracca</i>	

The following species, which have been documented around the Skagway area, need to be added to the collection:

<i>Anthemis arvensis</i>	<i>Bromus inermis</i>	<i>Cerastium fontanum</i>
<i>Collomia linearis</i>	<i>Galeopsis tetrahit</i>	<i>Galeopsis bifida</i>
<i>Lepidium densiflorum</i>	<i>Medicago lupulina</i>	<i>Poa pratensis</i>
<i>Polygonum convolvulus</i>	<i>Potentilla gracilis</i>	<i>Silene cucubalus</i>
<i>Stellaria media</i>	<i>Thlaspi arvense</i>	<i>Tripleurospermum inodorum</i>

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