



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

2012 Summary Report

Natural Resource Data Series NPS/KLGO/NRDS—2013/431



ON THE COVER

from top left moving clockwise: Large infestation of tall buttercup growing amongst the native iris in Dyea; Taiya Inlet Watershed Council Director Rachel Ford clips the inflorescences from reed canarygrass at Pullen Creek; Dense mats of white, red and alsike clover cover the ground at the site of the historic Pullen house; A dense stand of narrowleaf hawksbeard in the field adjacent to the White Pass & Yukon Route Railroad depot; Reed canarygrass growing along the Klondike Highway; Ornamental jewel weed inflorescence found outside of Corrington's Alaskan Ivory.

Photographs by: Peter Frank

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January 2013

U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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This report is available from the Klondike Gold Rush National Historical Park Natural Resources Department and the Natural Resource Publications Management website (<http://www.nature.nps.gov/publications/nrpm/>).

Please cite this publication as:

Frank, P. 2013. Invasive and exotic species management for Klondike Gold Rush National Historical Park: 2012 summary report. Natural Resource Data Series NPS/KLGO/NRDS—2013/431. National Park Service, Fort Collins, Colorado.

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Abbreviations

AKDOT	Alaska Department of Transportation
AKNHP	Alaska Natural Heritage Program
EPMT	Exotic Plant Management Team
GPS	Global Positioning System
KLGO	Klondike Gold Rush National Historical Park
NPS	National Park Service
SAGA	Southeast Alaska Guidance Association
TIWC	Taiya Inlet Watershed Council

Abstract

In 2012 the Exotic Plant Management Team (EPMT) at Klondike Gold Rush National Historical Park (KLGO) focused on two primary objectives; accurately documenting the distribution and abundance of invasive species in and around the park and controlling existing infestations to prevent their spread into or within the park. This summer marked the ninth consecutive year of the EPMT program at KLGO and crewmembers, park staff, and volunteers devoted approximately 1,160 hours toward managing invasive and exotic species found in and around the park. Surveys by EPMT staff during the 2012 field season totaled 185.2 acres, 31.4 of which were inside KLGO boundaries. Within the areas surveyed, a total of 106.9 acres were found to be infested, 20.9 of which were in the park. Of the areas infested, a total of 5.3 acres were treated, 0.9 acres of which were on park lands. Overall, 43 exotic species were documented, 25 of which were documented inside the park. Eight new exotic species were discovered for the first time in 2012, three of which were found in the park. One discovery of particular concern was Canada thistle (*Cirsium arvense*) outside of Skagway along the Klondike Highway. Control work in KLGO was focused in Dyea as well as on the infestation of reed canarygrass (*Phalaris arundinacea*) at Sheep Camp Campground on the Chilkoot Trail. Increasing the extent and accuracy of surveys was a priority in 2012, particularly along the Klondike Highway and in the White Pass Unit. The KLGO EPMT hosted 18 volunteers in 2012, who donated 124 hours of control work during which more than 850 pounds of invasive species were removed from in and around the park. Outreach and education remained an important component of the EPMT program in 2012 with efforts aimed at educating park staff and visitors as well as local residents about the threats posed by invasive species. Future EPMT staff should continue to monitor and contain infestations on road systems and in the town of Skagway, although priority should be given to the early detection and eradication of small, disjunct infestations of high priority species found in areas of limited disturbance.

Acknowledgments

The author would like to thank all the individuals who have dedicated their time and energy to make the 2012 Exotic Plant Management Team season at Klondike Gold Rush National Historical Park a success; Jessica Wilbarger whose hard work, support and expert guidance made this season possible; Paul Burger and Jamie Welfelt for their technical and logistical support; Tim Federal and Annie Lain for their expertise and assistance in all aspects of the program; Rachel Ford and the Taiya Inlet Watershed Council for their continued support and partnership in exotic plant management in and around Skagway; Missy Tyson and the Alaska Department of Transportation for their partnership in exotic plant management along Skagway's transportation system; as well as Backcountry Rangers Kyle Kaiser, Matt Lukas and A.J. Conley for their help in monitoring and controlling invasive plants along the Chilkoot Trail.

The author would also like to acknowledge those who have so generously volunteered their time to the benefit of the Exotic Plant Management program this summer; Joanne and Andrew Beierly for their continued dedication to the removal white sweetclover in Skagway; Aikie Kawamura, Philip Reed and the entire SAGA youth crew for controlling invasive species in Dyea; all the volunteers who participated in the community weeds pull; as well as the numerous park staff and citizens that have provided their diverse support to the program by controlling invasive plants or educating others about the threats posed by invasive plants.

Their combined diligence and dedication during the 2012 season has helped to protect and preserve the native ecosystems of Klondike Gold Rush National Historical Park and are greatly appreciated.

Introduction

Klondike Gold Rush National Historical Park (KLGO) is located in temperate Southeast Alaska at the terminus of the Lynn Canal. The park consists of three distinct units that encompass approximately 13,000 acres within the Skagway and the Taiya river valleys (Figure 1). These valleys provide a rare glacier-free interface between the maritime ecosystems along the Lynn Canal and the continental ecosystems of Northwest Canada (Hamilton 1994). As a result the park offers exceptional 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 strongly correlated to elevation and aspect which vary rapidly within the park ranging from sea level to 6000 feet at the peaks of the coastal mountains.

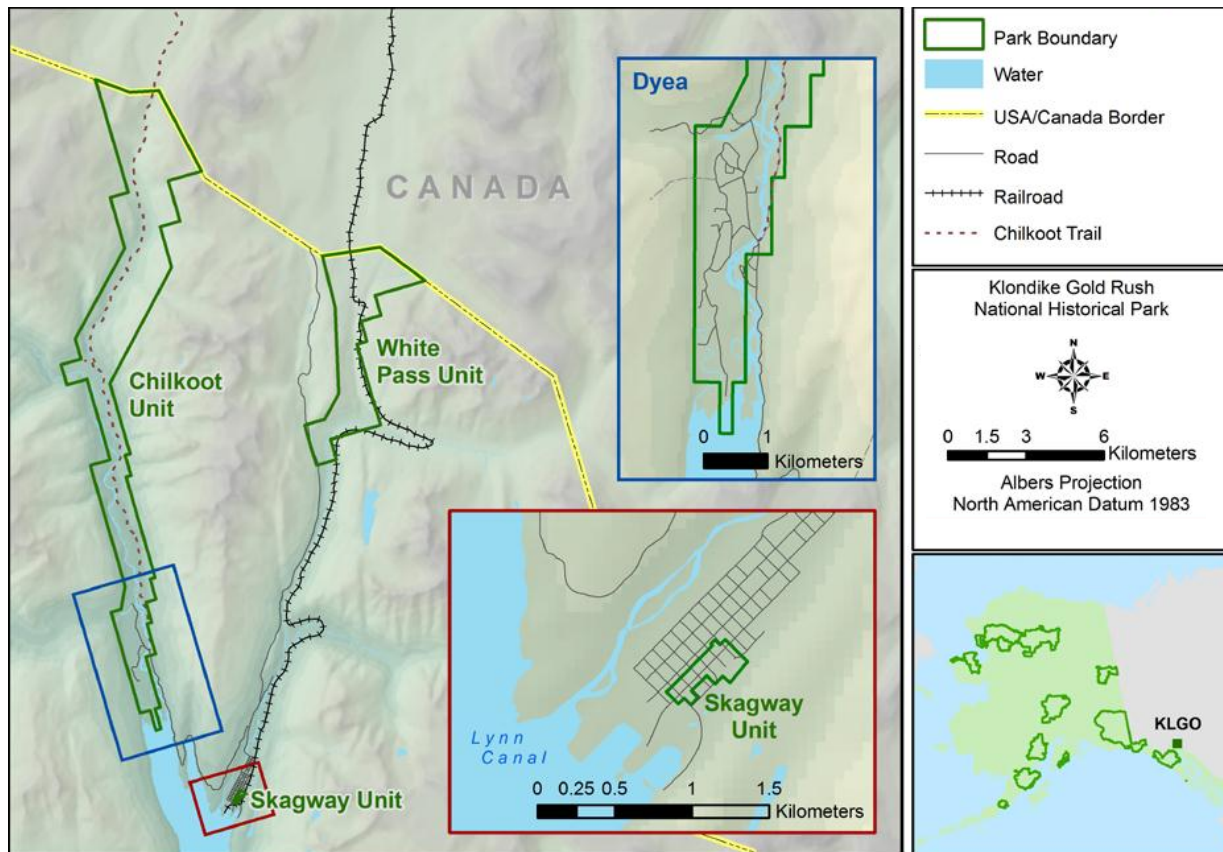


Figure 1. Boundary map of Klondike Gold Rush National Historical Park (Bernatz et al. 2011)

Several characteristics make KLGO particularly vulnerable to the introduction and spread of exotic plants. The same conditions, described above, that foster the park's enormous diversity of native plants also provide ecological niches for exotic plants to establish and spread. The threat of exotic plant introduction to KLGO is compounded by the ever-increasing anthropogenic influence in the region. Three primary characteristics are responsible for the majority of exotic plant introductions to KLGO. The first is the annual influx of park visitors who by various means intentionally or unintentionally transport exotic plant material into the park or translocate exotic plant materials within the park. The second is the local horticultural interest in Skagway; exotic plant cultivars planted in or near the park boundaries have shown the ability to escape and

invade park lands. The third is the ongoing maintenance activities associated with the infrastructure for visitation in and around the park that disturb the soil and facilitate the introduction and establishment of exotic species.

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. The three separate park units include: the Skagway Unit, the Dyea-Chilkoot Trail Unit, and the White Pass Unit (Figure 1). Each unit and its adjacent lands are distinctive in their visitor use, terrain, and ecology as well as their vectors for plant introduction, necessitating a unique exotic plant management strategy for each location. Furthermore, in each unit the majority of exotic plant infestations are found on lands adjacent to the park and thus pose a direct threat of invasion, which highlights the need to monitor and control exotic plants on non-NPS lands adjacent to park property.

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), which highlights the park's vulnerability to introduction. Despite the number of invasive species documented, KLGO and Skagway still have relatively limited and manageable populations of exotic species when compared to other areas around Southeast Alaska such as Juneau, Haines and Gustavus (Heutte 2003, Lamb & Shephard 2007). Therefore, KLGO has the opportunity to manage or eradicate many of their exotic plant infestations before they become a more serious ecological and economic problem. In order to accomplish this, monitoring efforts, prevention strategies and aggressive control have been put into effect within the park.

The Alaska Exotic Plant Management Team (EPMT) has had staff members inventorying and controlling exotic plants in KLGO since 2004. Over the past nine years, EPMT members have gathered baseline data for invasive plants in the area, conducted annual monitoring surveys, established community outreach and prevention methods and the controlled emerging infestations in and around the park. Specifically, the KLGO EPMT has focused on early detection and eradication of small, high-priority infestations in and around the park. 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.

In 2012, the KLGO EPMT continued the annual inventory and monitoring plan and collected high-quality data concerning the distribution, abundance and species composition of exotic plants in all three units of the park. Exotic plant monitoring and control activities were focused on the most aggressive species, disjunct infestations, and populations with a high potential for dispersal that threaten to expand into or within the park. Education and outreach activities targeted park staff and visitors as well as Skagway residents seeking to better inform them of the threats non-native species pose to native ecosystems. The data gathered in 2012 will be used to prioritize future work in the park and formulate long-term monitoring and control goals.

This report details the status of invasive plants in and around KLGO and draws conclusions on best management practices for the future of invasive plant management in the area.

Methods

EPMT fieldwork at KLGO occurred between the months of April and September 2012. Methods of mapping and data collection followed the protocol developed by the Alaska Region Exotic Plant Management Team (Million et al. 2012). The KLGO EPMT staff utilized existing data and recommendations from the previous years, adapted for this season's phenology and available labor, to prioritize infestations and species for control and choose appropriate control methods.



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

Given the cultural significance of many areas in KLGO, special care was taken to ensure that no cultural resources were disturbed during EPMT activities. Cultural resource protection methods followed the protocol laid out in 2010 compliance documents. 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). KLGO archaeologists Shawn Jones & Tom Thompson gave a brief training on the basic field procedure for the EPMT staff to follow when dealing with cultural resources.

Defining Work Areas

To facilitate planning control efforts, the park and its environs were divided into six work areas. Fieldwork was organized and conducted using these work areas, therefore the results, recommendations and maps in this report are divided by work area. A map of surveys conducted along with work areas can be found in appendix F.

The six work areas are:

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

Highest priority was placed on controlling and eradicating infestations from park lands in the first three work areas, while containment and prevention was emphasized in the final three work areas. While the Nelson Slough and Chilkoot Trail are both in the Dyea area of KLGO, the Nelson Slough restoration site is treated separately due to the high concentration of invasive species. The Chilkoot Trail is treated separately because of its remote location and high amount of visitor traffic. Though only small portions of the Dyea road and Klondike Highway intersect the park, they were still considered priority work areas for the KLGO EPMT since they serve as the primary conduits by which exotic species to spread into the park.

Prioritizing Treatments

Control work in KLGO was prioritized based on the geographical location, extent and invasiveness ranking of the exotic plant in question. The invasiveness rank is a 1 to 100 scale which incorporates four categories on each species: potential impacts to the ecosystem, biological attributes such as growth rate and method of reproduction, distribution, and effective control measures (Carlson et al. 2008). Species with higher invasiveness rankings and smaller extents were considered the highest priority for management. Conversely, species with low invasiveness rankings and larger extents were considered the lowest priority. Prioritization was further refined by geographic location as infestations growing in undeveloped front country and backcountry areas of the park were targeted before those infestations limited to the road systems and the town of Skagway.

In 2006 KLGO Natural Resources staff and Alaska Regional EPMT staff established the following list of 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 seven years the monitoring and eradication of these six species has been the top priority of the KLGO EPMT as these plants are all considered species of greatest concern in Alaska (Carlson et al. 2006). Three more species of high priority have since been added to the list: ornamental jewelweed (*Impatiens glandulifera*) first documented in 2007, reed canarygrass (*Phalaris arundinacea*) first documented in 2011 and Canada thistle (*Cirsium arvense*) first documented in 2012. These 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 in the park and have a very limited extent. Preventing the spread of these nine species into the park through aggressively treating any infestations found in or near the park boundaries is the KLGO EPMT's top priority.

Tall buttercup (*Ranunculus acris*), creeping buttercup (*Ranunculus repens*) and common eyebright (*Euphrasia nemorosa*) were also prioritized for control in park boundaries because these infestations are often dense enough to threaten native plant communities but have remained small enough to be manageable by EPMT staff and volunteers. The full list of exotic species identified by the park can be found in Appendix A. Graphs created for use in species prioritization in 2013 can be found in Appendices D and E.

Tools for Identification and Data Collection

The primary field guides referenced for plant identification were Flora of the Pacific Northwest (Hitchcock and Cronquist 1987) and Plants of the Pacific Northwest Coast (Pojar and Mackinnon 1994). Flora of Alaska and Neighboring Territories (Hulten 1968) was used to confirm plant identification. Illustrated Flora of British Columbia (Douglas, Meidinger, and Pojar, 2001) was also used periodically for identification. 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.

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. Each of these units is set to be accurate within zero to five meters in compliance with the 2012 Alaska Exotic Plant Management Team field protocol (Million et al. 2012). Trimble Pathfinder Office 5.20[®] was used to differentially correct positions with the CORS Gustavus, AK or CORS Skagway, AK base station data and then edit the data.

Collected data were sent to the Alaska EPMT Liaison for entry into the National Park Service's Alien Plant Control and Management (APCAM) database every two weeks. The regional EPMT staff converted the GPS data to ArcMap[®] shapefiles for use in KLGO GIS projects and the Alaska Regional invasive plant geodatabase.

Control Methods

The primary control method employed for invasive plant removal was hand pulling, combined with the utilization of hand tools such as trowels. This method allowed for selective and low-impact control. The greatest concern with this method was that the entire root system must be removed with the plant for the treatment to be effective. Plants with just a single tap root are pulled easily, but those with rhizomatous root systems require special care to remove the entire root system. Many invasive plants can regenerate from root fragments left in the soil when proper hand pulling techniques are not employed. This has been observed in previous years with common tansy, yellow toadflax and oxeye daisy.



Figure 3. Bicycle trailer full of white sweetclover from the Dyea Road.

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 exotic 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. A bicycle and trailer were used as the primary transportation method for weed waste in Skagway, freeing up vehicle use for other NPS employees (Figure 3).

Bicycles from the KLGO bicycle fleet were

also often used for conducting road surveys (Klondike highway and Dyea road), and for transportation to and from survey sites.

The discovery of reed canarygrass 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. Shade covers, which eliminate plants by depriving them of sunlight, were selected as the most feasible method of control. In 2011, KLGO EPMT covered the reed canarygrass infestations with one layer of 6mm black plastic followed by a layer of black non-woven geotextile. In 2012, after finding this method deficient at fully controlling reed canarygrass, the shade covers were expanded and fortified with one layer of 10mm opaque plastic followed by one layer of 6mm black plastic topped with black non-woven geotextile (Figure 4). Shade

covers were staked down with landscape staples and the margins were weighted down with rocks. Covers will remain in place for two full growing seasons or until the summer of 2014. The site should be monitored at least once per season to ensure the integrity of the shade covers. Sheep Camp was the only location where shade covers were used as a method for controlling exotic plants in 2012.



Figure 4. Largest of the 11 shade covers utilized at Sheep Camp to control reed canarygrass

The use of chemical herbicides for control is not widely employed by the National Park Service in Alaska at this time. The Alaska Region Invasive Plant Management Plan contains a protocol for employing the use of chemical control. This plan was utilized this year to treat large, high priority infestations at several parks across Alaska, but not at KLGO. The maintenance staff at KLGO utilized the herbicide Glyphosate to spot treat weeds, primarily common dandelion, in the lawn of the historic Moore House this summer. This was the first time that herbicides were applied on park property in KLGO. The maintenance staff was unwilling to expand their herbicide program to incorporate either front country or backcountry exotic plant control work due to the time requirements and potential compliance issues. The Taiya Inlet Watershed Council or Alaska Association of Conservation Districts in partnership with the municipality of Skagway may consider the use of herbicides for high priority infestations outside of the park during the 2013 season.

Personnel

The full-time EPMT staff member at KLGO during the 2012 season was Peter Frank, a Student Conservation Association intern. A total of 18 people volunteered for the KLGO EPMT during the 2012 season. On September 11th, a seven person SAGA (Southeast Alaska Guidance Association) crew worked with the KLGO EPMT for six hours controlling exotic plants in Dyea. On June 30th nine volunteers participated in the Skagway Community Weed Pull held at the Skagway Airport. Phil Reed, Brian Maupin, Jessica Wilbarger, Rachel Ford and Aikie Kawamura each volunteered between four and fourteen hours toward the treatment of exotic plants in Dyea and Skagway.

Results

2012 Season Overview

The 2012 KLGO EPMT staff inventoried 185.2 acres and treated 5.3 infested acres in and around the park this summer. A total of 1062.5 person-hours were logged by the EPMT staff this season while performing activities associated with the program. EPMT staff and volunteers spent a total of 475.5 hours in the field performing activities including surveying for, mapping and controlling exotic plant species. Survey work during 2012 resulted in the documentation of eight new non-native species, three of which were documented in the park. Mapping efforts in 2012 improved the resolution of data on the distribution and abundance of non-native species, particularly along the Klondike Highway, White Pass and Yukon Railroad, and in the town of Skagway. Control work in the park this summer focused on the Dyea and Chilkoot Trail Unit with specific emphases on the Nelson Slough in Dyea and the Sheep Camp campground on the Chilkoot Trail.

The park tracks control work by acreage, measuring the season's accomplishments against goals set for the exotic plant management program in accordance with the Government Performance Results Act (GPRA). The park sets goals for the acres of previous infestations found to be eradicated, the size of infestations that are being controlled, and the acreage of the plants actually pulled. The KLGO EPMT matched or exceeded all of the GPRA goals set for the park in 2012. Tables 1 and 2 summarize EPMT work conducted in 2012. Changes in gross species acres between 2009 and 2012 are summarized in appendices B and C.

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

Year	Invasive GPS Data* and GPRA Goals - NPS Lands(non-NPS lands)					
	Species Acres Surveyed	Species Acres Infested	Acres Treated		Canopy Acres Controlled	
			Actual	GPRA Goal	Actual	GPRA Goal
2004	43.531 (52.497)	7.838 (6.842)	0.792 (1.505)	-	-	-
2005	3.106 (6.450)	3.099 (2.617)	0.732 (2.436)	-	-	-
2006	63.145 (74.350)	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)	0.5	0.5	0.1
2009	11.931 (83.259)	2.453 (21.645)	0.388 (2.504)	0.5	0.6	0.6
2010	34.638 (245.513)	3.914 (56.212)	0.502 (9.362)	0.5	0.8	0.7
2011	49.720 (98.718)	11.278 (50.695)	3.045 (8.583)	0.5	0.8	0.8
2012	31.430(153.766)	20.987(86.004)	0.911 (5.282)	0.5	0.9	0.9

* All acreage was calculated using January 2012 NPS land status. Acres infested are calculated by acres mapped multiplied by the percent cover in areas greater than or equal to 0.5 acres. If under 0.5 acres, acres mapped is counted as 100%. Acres treated are calculated by taking the acres infested that were labeled as treated and applying the percent of the infestation treated.

Table 2. Summary of the 2012 infested acres in Klondike Gold Rush National Historical Park.

Species		AKEPIC ranking	Chilkoot Trail	Dyea	Dyea Road	Klondike Hwy	Skagway	White Pass
Latin Name	Common Name							
<i>Bromus inermis</i>	smooth brome	78	-	0.0001	0.075	0.008	0.17	-
<i>Capsella bursa-pastoris</i>	shepherd's purse	40	-	-	0.35	0.11	0.37	-
<i>Caragana arborescens</i>	Siberian peashrub	74	-	0.0001	-	-	0.04	-
<i>Cerastium fontanum</i>	mouse-ear chickweed	36	-	0.14	0.1	0.13	0.0006	-
<i>Cirsium arvense</i>	Canada thistle	76	-	-	-	0.03	-	-
<i>Chenopodium album</i>	lambsquarter	37	-	0.01	-	0.04	1.27	0.067
<i>Crepis tectorum</i>	narrowleaf hawksbeard	56	-	-	1.05	0.26	7.82	0.067
<i>Elymus repens</i>	quackgrass	59	-	0.004	0.68	0.04	0.89	0.067
<i>Euphrasia nemorosa</i>	common eyebright	42	-	0.37	-	-	0.0004	-
<i>Impatiens glandulifera</i>	ornamental jewelweed	82	-	-	-	-	0.17	-
<i>Leucanthemum vulgare</i>	oxeye daisy	61	-	0.03	0.086	0.23	0.28	-
<i>Linaria vulgaris</i>	yellow toadflax	69	-	0.00001	0.17	0.075	3.32	0.068
<i>Matricaria discoidea</i>	pineapple weed	32	-	0.18	0.43	0.14	0.96	0.067
<i>Melilotus alba</i>	white sweetclover	81	-	-	0.52	0.028	1.68	-
<i>Phalaris arundinacea</i>	reed canarygrass	83	0.083	-	0.01	0.014	0.47	-
<i>Phleum pratense</i>	common timothy	54	-	1.45	0.014	0.017	0.3	-
<i>Plantago major</i>	common plantain	44	0.00001	0.3	3.24	0.85	2.02	0.156
<i>Polygonum aviculare</i>	prostrate knotweed	45	-	-	0.07	0.05	0.3	-
<i>Ranunculus acris</i>	tall buttercup	54	0.0087	3.8	0.96	0.19	2.22	0.0001
<i>Ranunculus repens</i>	creeping buttercup	54	-	0.0008	-	-	0.015	-
<i>Rumex acetosella</i>	common sheep sorrel	51	-	1.4	3.1	1.4	4.4	0.33
<i>Senecio sylvaticus</i>	woodland groundsel	41	-	-	-	-	0.001	-
<i>Senecio viscosus</i>	sticky ragwort	36	-	-	0.19	0.087	1.55	-
<i>Silene noctiflora</i>	nightflowering catchflys	42	-	-	0.001	0.00005	0.002	-
<i>Sorbus aucuparia</i>	European mountain ash	59	-	0.007	0.015	-	0.68	-
<i>Stellaria media</i>	common chickweed	42	-	-	-	-	0.001	0.0001
<i>Tanacetum vulgare</i>	common tansy	60	-	-	-	0.0004	0.003	-
<i>Taraxacum officinale</i>	common dandelion	58	0.28	4.17	4.3	2.7	4.16	2.366
<i>Trifolium hybridum</i>	alsike clover	57	-	0.009	1.27	0.27	1.77	-
<i>Trifolium pratense</i>	red clover	53	-	0.004	1.23	0.019	1.72	-
<i>Trifolium repens</i>	white clover	59	0.042	3.96	4.23	1.59	5.72	0.44
<i>Tripleurospermum inodorum</i>	scentless false mayweed	48	-	-	0.003	-	0.14	-
<i>Vicia cracca</i>	bird vetch	73	-	-	-	-	0.004	-
Infested acres are calculated by acres mapped multiplied by the percent cover in areas greater than or equal to 0.5 acres. If under 0.5 acres, acres mapped is counted as 100%. Acres treated are calculated by taking the acres infested that were labeled as treated and applying the percent of the infestation treated.								

Skagway

Skagway continues to have the highest number and greatest extent of exotic species among the work areas focused on by the KLGO EPMT. A total of 43 exotic species were documented in Skagway this year, including eight new exotic species documented for the first time in 2012. Exotic plant management work within the town of Skagway focused on early detection of newly introduced species, control of the most aggressive invasive species and containment of all others in order to keep them from spreading to the more remote units of the park. The NPS unit in Skagway encompasses only 12 square blocks of the city's historic district, therefore the majority of infestations found in Skagway are not on NPS administrated land. Given this, the KLGO EPMT utilized partnerships with local and regional organizations such as the Taiya Inlet Watershed Council (TIWC), Alaska Association of Conservation Districts (AACD), Alaska Department of Transportation (AKDOT) and the Municipality of Skagway to aid in monitoring and control work throughout Skagway.

Reed canarygrass (*Phalaris arundinacea*) was documented along the southern portions of Pullen Creek, north of congress way, and south of the Dewey Lakes trailhead bridge. This infestation was found growing on both sides of Pullen creek in dense, tall stands. The extent of reed canarygrass along Pullen Creek did not appear to have expanded since it was first mapped in 2011. Surveys throughout Skagway and along Pullen Creek did not identify any other populations of reed canarygrass. This infestation appeared to be isolated to the area associated with the 2007 Pullen Creek restoration project, during which reed canarygrass was most likely introduced. Attempts at manually controlling reed canarygrass during the 2011 field season were found to be ineffective, time consuming and were ultimately determined to be an unfeasible method of control for this infestation. Therefore no manual control efforts were made on this infestation in 2012. Instead EPMT staff and two volunteers spent a total of 22 person hours over the course of two days in July and August removing the inflorescences from reed canarygrass along both sides of Pullen Creek (figure 5). All inflorescences were removed from this infestation before it could go to seed. A map of the area treated along Pullen Creek can be found in appendix L. Clipping the inflorescences has proved to be a simple and effective means for preventing the dispersal of reed canarygrass seeds, but is no substitute for removal. Several control strategies have been suggested, but the use of herbicides appears to be the most effective means of control. During the 2012 field season cooperative discussions about the use of herbicides occurred between regional parties including John Hudson of the U.S. Fish and Wildlife Service and Brian Maupin of the AACD as well as local parties including Rachel Ford of the TIWC and the Municipality of Skagway. A plan developed for an herbicide application in early fall did not occur in 2012 but may be attempted again in 2013.



Figure 5. TIWC director Rachel Ford partners with the KLGO EPMT to clip reed canarygrass inflorescences at Pullen Creek

White sweetclover (*Melilotus alba*) infestations were found to be significantly reduced in Skagway during the 2012 season. Infestations documented in 2012 were found primarily in the south western and northern portions of town. On July 10th



Figure 6. EPMT crew member Peter Frank shows off the tallest white sweetclover plant found at Seven Pastures, which was found to be over 9 feet tall.

EPMT staff with the help of Brian Maupin of the AACD removed more than 231 pounds of white sweetclover from areas around Skagway including; the petro marine services gravel lots and the corner of 16th and Main Street next to the High School Softball field. A large infestation of white sweetclover on a vacant municipal lot on the east side of State St. between 17th & 18th was discovered in early August. On August 15th EPMT staff members spent 2 hours removing all white sweetclover from the lot. Large infestations of white sweetclover were also documented at the far northern end of Skagway, at the Seven Pastures dump site as well as in the White Pass & Yukon Route Railroad Yard. EPMT staff spent 1.5 hours on August 11th removing the infestation of white sweetclover from the Seven Pastures dump site (figure 6). Unfortunately, due to the size of the infestations in the railroad yard treatment was not attempted in 2012.

Efforts to locate and pull white sweetclover in the neighborhood around the airport were undertaken by two concerned long time community residents, Joanne and Andrew Beierly, who have been keeping their eyes out for the past several years. EPMT staff provided the Beierlys with weed control bags and came on a monthly basis to retrieve and weigh what they had pulled. Over the 2012 season the Beierlys removed 124 pounds of white sweetclover from the neighborhood around the airport.

Ornamental jewelweed (*Impatiens glandulifera*) was documented in seven different locations around Skagway in 2012. All seven occurrences were on private property. The one infestation found and controlled in 2011 on Skagway municipal land, in the public park on 6th street next to Pullen Creek, was not documented in 2012. Infestations at local businesses including Corrington's Alaskan Ivory, Dedman's Photo Shop and the Skagway Outlet Store were only monitored in 2012 given the negative response by local business owners to EPMT outreach efforts in 2010 and 2011. Infestations on private land were documented on 4th street in front of Star Fire as well as on the corner of 5th and State Street. Two infestations on private land were of particular concern due to their presence in the riparian habitat of Pullen Creek (figure 7). The first was documented escaping from a planter bed in front of a private residence at the end of Broadway where it intersects with 15th. The second was documented again escaping from cultivation on a private residence on 20th street between



Figure 7. One of the largest infestations of ornamental Jewelweed documented in 2012 growing on private property along Pullen Creek.

State and Main. Both infestations were growing in dense stands along the banks of or directly in Pullen Creek. To prevent misunderstanding of authority, outreach to homeowners with ornamental jewelweed on their property should be performed by non-federal organizations like the TIWC in the future.

Bird vetch (*Vicia cracca*) was documented on municipal property on the east side of Spring Street at the intersection of 9th Street next to the fish hatchery. This infestation has been contained to the same location since it was first documented in 2006 and has only slightly increased in extent over the past seven years. The infestation is found growing over native vegetation and appears to be slowly moving back toward the fish hatchery buildings. This infestation was not controlled in 2012 given its slow rate of expansion and the documented ineffectiveness of past manual treatments.

Out of the invasive species horticulturally introduced into Skagway, yellow toadflax has shown the most aggressive tendencies. Yellow toadflax (*Linaria vulgaris*) is a common ornamental flower that is planted in many gardens around town. But unlike other ornamentals, such as oxeye daisy (*Leucanthemum vulgare*) and ornamental jewelweed which remain relatively limited in their extent, yellow toadflax has prolifically spread to the point that it is considered a common weed throughout Skagway. On NPS property only a small patch of yellow toadflax was found along the western side of the KLGO maintenance yard. NPS maintenance staff periodically mowed the infestations down before they could go to seed. At the northern end of town large infestations were found at the White Pass & Yukon Route (WP&YR) Railroad Yard as well as at the Seven Pastures dump. Yellow toadflax was documented in dense stands along the tracks, along the dirt roads and in the open gravel lots where supplies were stored. The infestation at the railroad yard was only visually noted as WP&YR denied permission to document this infestation. No control attempts were made due to the size of these infestations.

Common tansy (*Tanacetum vulgare*) was only documented in Skagway on the NPS-maintained lot located at the corner of 5th street and Broadway. This infestation was planted by Dennis Corrington of Corrington's Alaskan Ivory and is currently being maintained by NPS maintenance staff. Given that this plant is on NPS land and that it occupies such a small extent it was targeted as a potential candidate for eradication in 2012. A proposal was drafted and presented to KLGO management staff for removal and replacement of this infestation, but the proposal was denied on the grounds that the removal might cause unwanted confrontation with local business owners.

European mountain ash (*Sorbus aucuparia*) is one of the most popular ornamental trees in Skagway. This tall lush tree with its showy white flowers and vibrant red berries lines the streets at the southern end of Broadway and can be found in many yards throughout Skagway. European mountain ash has even been planted on NPS property, at the Moore House and the Peniel Mission and other NPS housing facilities in both Skagway and Dyea. Over the past years EPMT staff members have informally noted the presence of European mountain ash in Skagway but have never documented it. In 2012 EPMT staff noticed this species in early spring as it leafed out earlier than most native vegetation. Surveys in early June, discovered European mountain ash growing along the banks of Pullen Creek, infesting vacant lots and even escaping into undisturbed forest along the eastern edge of town. (Note that undisturbed, in the context of

this paper, implies only that no current ground disturbance is present, and does not account for any historical disturbance that may have occurred). This species produces copious amounts of red berries in early fall, that are readily eaten by birds and dispersed, which has resulted in the prolific spread of European mountain ash throughout Skagway and the surrounding areas. Although it is possible that *S. aucuparia* may hybridize with the native *S. sitchensis*, the mountain-ashes observed in and around Skagway display the characteristics of the non-native species, in particular the distinctive whitish hairs on new growth compared to reddish hairs of the native species. Control efforts for European mountain ash on NPS property were denied due to the negative aesthetic impacts of removal.

Several other woody invasive species were documented for the first time in Skagway this summer. European bird cherry (*Prunus padus*) was documented on private property at the



Figure 8. Rugosa rose growing through the fence in front of Jeff Smiths Parlor. This was the only infestation of rugosa rose found on NPS property in 2012.

corner of 7th and Broadway directly across from the Skagway Brewing Company. Chokecherry (*Prunus virginiana*) was documented in the Church of Latter Day Saints parking lot at the corner of 11th and State. These two cherry species were difficult to distinguish in spring but by mid July the leaves of chokecherry began to turn purple which made distinguishing the two simple. Tatarian honeysuckle (*Lonicera tartarica*) was documented growing on multiple private residences throughout Skagway. Rugosa rose (*Rosa rugosa*) is a popular shrub that has been planted throughout Skagway. Only one shrub in front of Jeff Smiths Parlor on 2nd street between Broadway and State was documented on NPS property (figure 8). Control efforts for this shrub were postponed because of the plant's potential historical significance. Siberian peashrub (*Caragana arborescens*) is another popular woody invasive found around Skagway. It was documented on NPS property in front of the Peniel Mission, where it forms a hedge along the boardwalk.

The KLGO maintenance division denied permission to control this infestation, citing the negative aesthetic impacts of removal. Of these five woody species, only Siberian peashrub was documented escaping from its horticultural confines. One small patch of Siberian peashrub was found growing along Pullen Creek on the east side of State Street between 13th and 14th Street.

Infestations of low priority exotic species such as common dandelion (*Taraxacum officinale* ssp. *officinale*), white clover (*Trifolium repens*), tall buttercup (*Ranunculus acris*) and sheep sorrel (*Rumex acetosella*) among others are so abundant in Skagway that it would be unfeasible to accurately map, concisely report or effectively control them. However, there were three infestations of primarily low priority observed in 2012 of such considerable size, density or diversity that they merit reporting. The first infestation was of narrowleaf hawksbeard (*Crepis tectorum*) and sheep sorrel and was documented covering approximately 2 acres in a field south of the White Pass & Yukon Route Railroad Depot. Within the 2-acre field narrowleaf hawksbeard accounted for approximately 75% of the vegetation cover. This was unquestionably the most visible infestation in Skagway as it was clearly recognizable from up to five blocks away as well as from the overlook on the Upper Dewey Lake trail nearly 1000 vertical feet

above. The second infestation was located in the vacant lot associated with the historic Pullen House. Almost no native vegetation was observed in the lot and the combination of white clover, red clover (*Trifolium pratense*) and alsike clover (*Trifolium hybridum*) accounted for nearly 100% of the ground cover. Yellow toadflax, tall buttercup and European mountain ash were also found covering the margins of the field. This site was logged just last year and exemplifies how rapidly invasive species can colonize a disturbed area when left unchecked. The final infestation was located at a community yard waste dump site referred to as Seven Pastures. In one dump site at the far southern end of Seven Pastures EPMT staff documented 15 different invasive species including high priority species such as white sweetclover, smooth brome (*Bromus inermis*) and quackgrass (*Elymus repens*). This infestation was of specific concern because Seven Pastures not only serves as a dump site but as a source of fill dirt and mulch for local citizens, and therefore may act as a source of invasive species.

Skagway Airport

The Skagway airport has been a focal point of the KLGO EPMT throughout the programs history due to its once large and prolific infestations of white sweetclover. The airport was surveyed twice during the 2012 season, first on June 26th and again on August 8th. White sweetclover populations along the runway medians, on both sides of the airport fence, and around the terminal and parking lot were significantly decreased for the second straight year in 2012. Due to the cold spring in 2012 much of the white sweetclover in and around the airport did not emerge until early August. Therefore no white sweetclover was pulled during the community weed pull on June 30th. During the surveys August 8th EPMT documented white sweetclover primarily along the fence line at the south eastern corner of the airport. Two smaller populations were documented on a small gravel bar at the southern end of the runway as well as in the northernmost runway median. Several small infestations were found growing in the airport parking lot. Almost all white sweetclover plants documented in and around the airport were less than one foot tall and had not yet flowered in early August. One EPMT staff member spent approximately four hours controlling all white sweetclover found in and around the airport.



Figure 9. Volunteers remove oxeye daisy along the Skagway airport runway during the fourth annual Community Weed Pull.

Narrowleaf hawksbeard was found growing in dense stands along the both the east and west edges of the runway, in the runway median as well as along the airport fence. The dense stands found in the runway median were the primary focus of the community weed pull. On June 30th six of the nine volunteers spent four hours controlling the southern portions of this infestation. After controlling approximately .85 acres the volunteers had removed more than 400 pounds of narrowleaf hawksbeard, emphasizing just how dense these infestations were. Populations of narrowleaf hawksbeard in the northern portions of the airport were not controlled during the 2012 field season.

Yellow toadflax infestations were primarily documented in the grassy strip running along the eastern edge of the airport. These infestations were the secondary focus of the community weed

pull. Three of the nine volunteers focused on controlling the yellow toadflax growing in a ditch along this first quarter-mile of the runway. Minimal infestations of yellow toadflax were also documented and treated along the southwestern edge of the airport next to the Skagway river.

A small patch of oxeye daisy was found growing along the runway margin just after the entrance to the third public hanger. This infestation was treated during the community weed pull (figure 9) and EPMT staff retreated any reemerging plants found during control work done in August.

Perennial sowthistle (*Sonchus arvensis*) was not documented in the airport for the second consecutive year in 2012. This species had been recorded in 2009 and 2010 near the north and south ends of the airport as well as in the airport medians. The two-year absence of perennial sowthistle suggests that thorough control work done in 2009 and 2010 on this species may have eradicated it from the airport entirely.

Lower Dewey Lake Trail

The Lower Dewey Lake Trail, a very popular hiking trail east of the city, was surveyed in early July while assisting KLGO natural resources staff with an amphibian monitoring project. The trail system is remarkably free of invasive species given the heavy hiker traffic the trail gets during the summer.

Common dandelion, white clover and tall buttercup were found growing in and around the spillway for the Skagway reservoir. At the southern end of the lake, where the trail opens into a small meadow, several invasive species including common timothy, sheep sorrel, common plantain (*Plantago major*), white clover, common dandelion and tall buttercup were documented. This infestation is dense and accounts for much of the vegetation present in the treeless meadow. Despite its density this infestation remains confined and has not escaped into the forested areas elsewhere along the trails. The oxeye daisy documented and removed in this meadow during surveys performed in 2009 was not detected in 2012. During informal surveys conducted in early June, EPMT staff noted that European mountain ash was escaping from Skagway and infesting the lower slopes of the Twin Dewey Peaks (figure 10). To document the European mountain ash infestation a 1.5 acre plot located approximately 100 meters up from the trailhead was surveyed in early July. A total of 37 trees, some over 8 meters tall, and 32 saplings were found within the 1.5 acre plot.

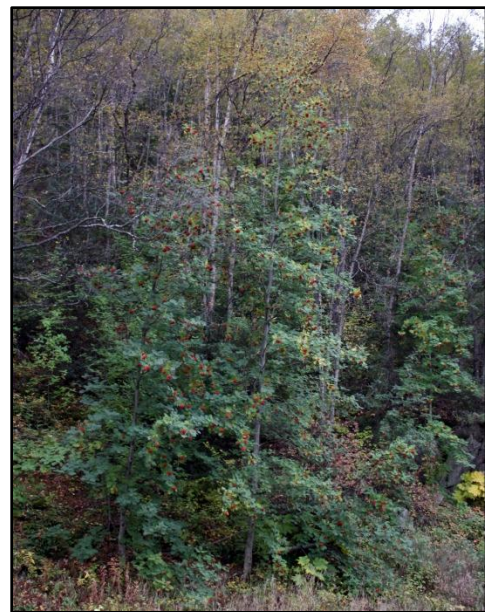


Figure 10. Large European mountain ash trees laden with bright red fruit found near the trail head to Lower Dewey Lake.

A map of the infestations in Skagway can be found in Appendix I.

Dyea Road

Exotic plant management is particularly important on the Dyea Road because the road acts as a conduit for exotic plants found in Skagway or along the Klondike Highway to spread to the heavily used park lands in Dyea. Heavy traffic as well as frequent road maintenance facilitates the spread of species along the road. The entire Dyea Road was surveyed on foot this season over

the course of multiple days, starting at the intersection of the Klondike Highway and the Dyea Road (mile 0) and proceeding to the West Creek Bridge (mile 8.3). In total approximately eight miles of road were surveyed. The results of these surveys are reported here in the five segments. Note that white clover and common dandelion were found to be almost ubiquitous along the entire length of the Dyea Road. Small infestations of: red clover, alsike clover, pineapple weed, common plantain, sheep sorrel, sticky ragwort and shepherd's purse were also documented sporadically along the Dyea Road. Given the frequency and low priority of these infestations they will not be included in the detailed results below, but it will suffice to say that these species were documented in all five segments of the Dyea Road.

Skagway Overlook (Mile 0-2)

Infestations of narrowleaf hawksbeard, tall buttercup, quackgrass and yellow toadflax were found growing in two open fields at the beginning of the Dyea Road. A third infestation



Figure 11. Infestation of yellow toadflax found in a pull off on the Dyea Road.

containing narrowleaf hawksbeard, oxeye daisy, common timothy and quackgrass was discovered at the Fire Department storage lot, located .75 miles up the road. A single white sweetclover plant was also discovered and treated at the western edge of the storage lot. This was the first documented finding of white sweetclover on the Dyea Road and surveys of the surrounding area determined that it was an isolated occurrence. Narrowleaf hawksbeard was especially dense in these infestations and was documented escaping and spreading along the gravel margins of the road. Apart from the three larger infestations found in the first two miles, small patches of yellow toadflax and quackgrass were documented growing sporadically along road margins and in pullouts. Siberian peashrub and oxeye daisy were documented on private residences approximately 1 mile up on the Dyea Road. Oxeye daisy was also found further down the road in a small ditch across from the scenic overlook parking lot. In previous years outreach efforts to these land owners has been met with strong resistance, so no control efforts were attempted this summer. European mountain ash was documented multiple times growing both

on private residences as well as escaping into the forest edges. Reed canarygrass was found and treated, for the fourth time this summer, at mile 1.8, across from the AB mountain trailhead. With continued treatment, this population does not appear to be expanding. A small group of 13 yellow toadflax plants, documented and treated in a pull-off at mile 2, was the last infestation of yellow toadflax found during these surveys (figure 11). Two small patches of smooth brome were also documented at this pull-off.

Skagway Shooting Range (Mile 2)

The Skagway shooting range is located a quarter-mile off of the Dyea Road at the end of a small paved drive. This was the first time that the Skagway shooting range was surveyed by the KLGO EPMT. The area south of the shooting range was used as a dump as recently as 1999, and has since been covered with fill dirt and revegetated leaving a large open field. This open field has since become infested with white sweetclover, yellow toadflax, quackgrass, narrowleaf

hawksbeard and numerous other invasive species. In late August the EPMT staff removed all of the white sweetclover, yellow toadflax and narrow leaf hawksbeard in and around the open field. Small patches of oxeye daisy and scentless chamomile were found in both in the field as well as along the road and were treated. Several night flowering catchfly (*Silene noctiflora*) plants were found and removed from the southeastern portion of the field. The infestations of quackgrass and common timothy in and around the field were not controlled due to their significant size and density. Low ranked invasive species including common mouse-eared chickweed, tall buttercup, and prostrate knotweed (*Polygonum aviculare*) were found in moderate densities along the margins of the road and the parking lot. None of these low priority infestations were treated during the 2012 season. This infestation is significant because it is the second and largest documentation of white sweetclover on the Dyea Road System. The infestations seem to be contained to the open field, but this area should be monitored yearly to ensure that the high priority species present are not moving down toward the main road.

Nahku Bay (Mile 2-4)

Nahku bay contained some of the largest infestations of quackgrass found along the Dyea Road. Two large infestations on the east side of the bay were found stretching between 30 and 50 meters along the road margins and expanding down into the undisturbed forest. Multiple smaller populations of quackgrass were also found spreading out from these larger infestations. One small patch of smooth brome was documented growing on a slope outside the guard rail in the southeast portion of the bay. Oxeye daisy was found on two private residences, the first at the southern end of the bay and the second at the far western extent. Oxeye daisy has been found escaping along the roadsides from both private plantings and its extent appears to have increased from previous years. Three large European mountain ash trees were documented on the western half of the bay, two of which were planted on a private residence and the third was growing approximately 15 meters from the road in undisturbed forest. Common timothy was found growing sporadically in small clumps along the Dyea Road throughout Nahku Bay. Tall buttercup was also found occasionally along the road but was at particularly high densities at the southern end of the bay. The common tansy found and treated in 2011 in a pull-off at mile 2.7, was not detected during the surveys this summer.

Taiya River Estuary (Mile 4-6.7)

Tall buttercup was more prevalent in this segment than anywhere else on the Dyea Road. Specifically, between mile 4.2 and 4.7 and between mile 5.8 and 6.2, tall buttercup was found at high densities along both sides of the road. A total of nine small isolated patches of common timothy were found along this segment of road. Two larger infestations of quackgrass were found at mile 6 and again at mile 6.5, while five smaller patches of quackgrass were also found intermittently along the road sides (Figure 12). Populations of smooth brome, quackgrass and narrowleaf hawksbeard were found in the area around the rafter's pullout as well as along the road margins, at mile 6.6. Narrowleaf hawksbeard was documented at mile 6.7, just before the entrance of the NPS campground on the east side of the road. This is the first time that narrowleaf hawksbeard has been documented in this location since 2007, a total of 46 plants were found and treated in early August.

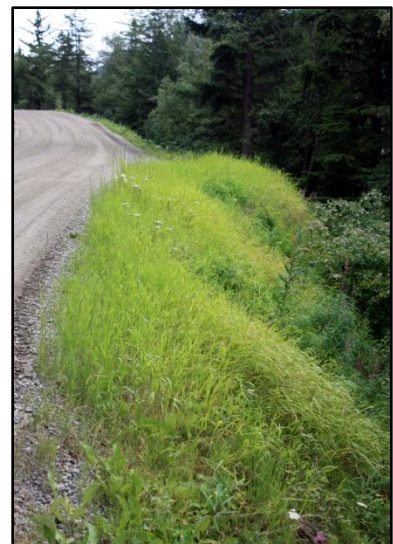


Figure 12. A large infestation of quackgrass found spreading along the Dyea Road.

Dyea (Mile 6.7-8.3)

This segment of the Dyea Road which runs from the NPS Campground to the West Creek Bridge was surveyed multiple times throughout the summer since much of it runs through park lands. The West Creek road was not surveyed this year due to the small number of low priority species found there in 2010.

On the east side of the Dyea road in front of the Chilkoot Outpost, an infestation of common eyebright was documented this year for the first time since 2008. This common eyebright infestation appeared to be contained to the areas frequently mowed by the private land owner. Directly across the road, quackgrass was found spreading along the road margins just north of the NPS campground. Several small isolated patches of tall buttercup and common timothy were also documented and controlled in segment of road between the NPS campground and the Taiya River Bridge. An infestation of reed canarygrass, originally documented in 2011, in a ditch northwest of the Chilkoot Outpost at mile 6.8, was increased in size this summer and has begun to clog a small stream that runs through the ditch. This infestation is located less than 20 meters west of the NPS boarder, but extensive surveys in the area found nothing suggesting that this infestation is relatively contained for now.

The Dyea road enters the KLGO boundary for the first time just south of the Taiya River Bridge at approximately mile 7. An infestation of quackgrass was found at the back of the Chilkoot Trail parking lot south of the Taiya River Bridge. A small patch of smooth brome was found in the pull-off on the east side of the road just before the Chilkoot Trailhead entrance. This was the



Figure 13. The inflorescence from the first documented occurrence of smooth brome in Dyea.

first time that smooth brome was documented in the park and it was treated in mid September before it went to seed (figure 13). The patch of oxeye daisy on the east side of the Dyea road north of the Taiya bridge was visited several times throughout the season, and all plants found were uprooted before they had gone to seed. The extent of oxeye daisy does not appear to have increased since 2011. Common timothy and tall buttercup were documented, at low densities, almost continuously between mile 7.1, just north of the Taiya River Bridge, and mile 7.8, after which the infestations were found to be more irregular up to the West Creek Bridge. Isolated infestations found on the northern portions of the Dyea Road were controlled but the majority of infestations in this segment of road were too extensive to be effectively treated without a volunteer crew. Narrowleaf hawksbeard, which as recently as 2010 was also found growing along this segment of the Dyea Road, was not documented beyond mile 6.7 for the second consecutive year this summer. A large European mountain ash

tree, approximately 8 meters tall, as well as a hedge of Siberian peashrub were found growing in the front yard of the NPS ranger cabin located on the east side of the road at mile 7.7. During surveys in the area a European mountain ash sapling was found escaping into the forest edge on the west side of the road and was removed. The removal of these two woody invasive plants is awaiting a compliance determination from the park.

A map of the infestations along the Dyea Road can be found in Appendix H.

Dyea

Dyea continues to be the focal point of invasive plant management in KLGO. It is the most heavily used and accessible natural area in the park which makes it particularly vulnerable to the introduction of invasive species. Several populations of high priority species are found just outside the park, but to date very few high priority species exist on park-administrated lands in Dyea. Of the species that have infested NPS land the majority are found in disturbed sites adjacent to the road and trail system, although surveys over the past two years have shown an increase in exotic plant populations in undisturbed areas such as the Dyea Flats and the Nelson Slough.

Dyea Townsite Road & Trail System

The Dyea Townsite Road, which begins north of the Taiya River Bridge, connects the Dyea Road to the Dyea flats as well as to the Lost Lake Trailhead. The entire length of the Dyea Townsite Road was surveyed in early July. The majority of invasive species along the road system were found in the first mile between the Dyea Road and the Slide Cemetery turnoff and in the last mile between the Nelson Slough Bridge and the Dyea Flats. In the first mile of road tall buttercup, white clover, common dandelion and common plantain were documented growing sporadically along the road margins. EPMT staff returned in late August and controlled the tall buttercup on this stretch of road. During end-of-year surveys in early September nine oxeye daisy plants were found and controlled approximately 150 meters in from the Dyea Road. This was the first time oxeye daisy has been documented at this location since 2009.

The Slide Cemetery Road, which splits off from the Dyea Townsite Road and leads to the Slide Cemetery trailhead and Lost Lake Trailhead, was largely free of invasive species. Three white clover plants, one red clover plant and two tall buttercup plants were found on the Slide Cemetery Road and controlled. The Slide Cemetery was free of invasive species but one patch of common timothy was found in the parking lot and removed. A small patch of common dandelion was found and controlled in the Lost Lake parking lot. The small infestation of creeping buttercup located at the Lost Lake Trailhead was found and treated again during the 2012 field season. The infestation did not appear to be reduced in size from 2011 but did not appear to have spread. Caution was taken to fully dig the rhizomes out of the ground when treating this infestation. The remainder of the Lost Lake Trail was visually surveyed in late July and no exotic species were detected.

The Historic Townsite parking lot, located approximately .25 miles south of the Slide Cemetery turnoff, had infestations of common dandelion, white clover, common plantain and sheep sorrel covering its gravel margins. A small patch of mouse-ear chickweed was found and treated at the north end of the parking lot. A total of 30 tall buttercup plants were removed from the Pullen Barn ruins located at the north end of the parking lot. The creeping buttercup found and treated at the Pullen Barn in 2011 was not detected in 2012. Aside from these infestations associated with the Historic Townsite parking lot, the half mile stretch of road between the Slide Cemetery turnoff and the Nelson Slough Bridge was free of exotic species.

The Historic Townsite trail system was surveyed in early July. During these surveys only common dandelion and white clover were found along the main trail, which leads to Vining and Wilkes Warehouse ruins, as well as in several open areas associated with old housing depressions. The False Front trail was also surveyed, and only tall buttercup was found growing at the far northern end of the trail where it connects with the Dyea Townsite Road. This infestation was dense within 25 meters of the road but became more sporadic as it spread south away from the road. All escaping tall buttercup plants found along the trail were controlled.



Figure 14. SAGA crew is all smiles after controlling tall buttercup in Dyea.

The large open meadow between the historic townsite trail and the Nelson Slough is host to a thriving native plant community but in recent years tall buttercup has begun to invade and escape into the undisturbed meadow. Since it was first mapped in 2008, this infestation has steadily spread north and increased in size each summer despite regular treatment. EPMT staff and volunteers spent multiple days throughout the summer controlling tall buttercup in the meadow. On September 11th a SAGA crew spent six hours in the meadow uprooting tall buttercup (figure 14). This meadow is also the location of the only infestation of yellow toadflax in Dyea. Located at the far southern

tip of the meadow directly adjacent to the road, this small infestation was monitored on a weekly basis throughout the summer. In late July three small yellow toadflax plants were found and treated. Extreme care was taken to remove the entire root system of the plant.

The population of large-leaf lupine (*Lupinus polyphyllus*), found just south of the Nelson Slough bridge was not detected for the third year in a row suggesting that it has been eradicated. Surveys of the fields around the Nelson Slough Bridge found no exotic species. Infestations of white clover, common dandelion, sheep sorrel and common eyebright (*Euphrasia nemorosa*) were found along the road margins between the Nelson Slough Bridge and the Alaska Excursions parking lot. The horse trail running from Alaska Excursions to the Nelson Slough Bridge has one of the densest and most diverse infestations found in Dyea. Tall buttercup, common dandelion, white clover, alsike clover, pineapple weed, mouse-ear chickweed, sheep sorrel and common eyebright accounted for the majority of the vegetation found on and around the trail. All of the species, except for tall buttercup, were contained to the highly disturbed trail margin. Tall buttercup was found escaping into the adjacent field and overtaking the native vegetation. Over the course of three days in July EPMT staff and one volunteer



Figure 15. EPMT staff and volunteers removed all tall buttercup found along this horse trail in Dyea, opening up the meadow for native plants to thrive.

treated all tall buttercup from the horse trail and the field (figure 15).

Nelson Slough

Since the 2006 wetland restoration project native plants such as, Nootka lupine (*Lupinus nootkatensis*), wild-flag iris (*Iris setosa*), northern rice root (*Fritillaria camschatcensis*) and Sitka spruce (*Picea stichensis*), have been thriving in the Nelson Slough despite the presence of invasive species. Common dandelion, common plantain, red clover and white clover were only documented growing along the edges of the restoration site this summer but were not found elsewhere in the Nelson Slough. The extent and density of these species has significantly diminished over the past five years as native species have become established. Given this trend the aforementioned invasive species have not been the focus of regular control work for the past two years and were not controlled again this summer.

Only one small patch of common eyebright was detected and controlled on the edge of the restoration site south of the bridge and behind the interpretive signs. The cover of common eyebright has been declining over the past four years and several former infestations were not detected this summer, suggesting that continued treatment has been effective and that eradication is a possibility in the coming years. One new exotic species, common timothy, was documented for the first time in the Nelson Slough in July. Only a single plant was documented growing northeast of the foot bridge and was removed. The meadow foxtail (*Alopecurus pratensis*) which was discovered in 2011 growing in the slough a few meters south of the footbridge was not documented this summer.

Tall buttercup (*Ranunculus acris*) was the focus of monitoring and control work in the Nelson Slough this summer. In the Nelson Slough restoration site the density of tall buttercup was reduced from 2011 and most of the buttercup was found as individual plants or small and manageable patches. Tall buttercup in the restoration site was treated twice in July by EPMT staff as well as in early September by a seven-person SAGA crew. Surveys both north and south of the Nelson Slough restoration site were performed on July 19th. In surveys south of the restoration site only a few small patches of tall buttercup and common dandelion were found and controlled around the base of the Nelson Slough Bridge. In surveys going north from the restoration site to the slough's intersection with the Dyea road several infestations of tall buttercup were documented and controlled. Tall buttercup infestations appear to have increased in this undisturbed area since 2011.



Figure 16. Tall buttercup found in the northern portions of the Nelson Slough.

Dyea Flats

During surveys in early July, only low priority species were documented on the Dyea Flats. Large populations of sheep sorrel were found to be widespread over much of the Dyea Flats. Infestations multiple acres in size were documented growing at low densities in and among the native vegetation. These infestations were found associated with dirt roads as well as in undisturbed areas. Smaller segments of these infestations were mapped, although many areas throughout the flats were not mapped due to time restraints. Despite the enormous size of this

infestation, it does not appear to be impacting or displacing the native vegetation as it is currently growing at relatively low densities. Two large infestations of common eyebright were also found in the south eastern end of the flats. The common eyebright infestations found were largely associated with dirt roads, and did not seem to be spreading into undisturbed areas. Foxtail barley was also found to be widespread across the Dyea Flats, but given its potential nativity, it was not mapped or treated in 2012.

In the large field located north of the Dyea Flats and east of the historic townsite, sheep sorrel and common dandelion were found to be widespread. Both species were found at low densities growing among the native vegetation. Several isolated patches of common dandelion were mapped at the north eastern extent of the field, but many areas throughout the field were not mapped due to time constraints. Tall buttercup was documented at the far northern end of this field despite being treated by a SAGA crew in 2011. Although the infestation returned it did not appear to have increased in size from last year. On July 30th, an EPMT staff member spent a full work day removing all tall buttercup found in the field.

NPS and City Campgrounds

The NPS campground was surveyed twice during the 2012 field season. Common dandelion, common plantain, sheep sorrel and white clover were found growing around the NPS housing, in



Figure 17. Small European mountain ash found in the NPS campground in Dyea.

the campground parking lot and along the road into the campground. Campsites 1 through 7 all had infestations of common dandelion and white clover most commonly growing around the fire pits. A small patch of alsike clover was found in campsite 6 and was controlled. Tall buttercup was found and controlled in campsites 2, 4, 6 and 7. Three European mountain ash trees, between 1 and 4 meters tall, were found growing in and around the campground and were uprooted (figure 17). The small patch of creeping buttercup found in the creek bed east of campsite 1 in 2011 was found and treated again this season. This infestation does not seem to have changed in size since 2011. The back loops of the campground, starting at campsite 8, were found to be free of exotic species. The trail system leading from the NPS campground to the Chilkoot Trailhead was also surveyed in late June and no exotic species were found.

The City Campground and its adjacent roads were surveyed in late August. No exotic species were found in any of the camp sites and only small patches of sheep sorrel and white clover were found growing in the margins of the gravel road. The oxeye daisy found along the road to the northwest of the campground in 2008 was not detected again this summer.

A map of the infestations found throughout Dyea can be found in Appendix G.

Chilkoot Trail

The presence of the KLGO EPMT on the Chilkoot Trail was significantly increased during the 2012 season due to the discovery of reed canary grass at Sheep Camp in 2011. The 13.5 mile stretch between the trailhead in Dyea and Sheep camp was visually surveyed a total of four times; once a month in May, June, July and August. The 16.5 mile stretch of the Chilkoot Trail

within KLGO was formally surveyed by EPMT staff this summer in late August. This was the third consecutive year that exotic plant surveys were performed on this section of the Chilkoot Trail. Data was collected from the trailhead in Dyea to the United States border at the Chilkoot Pass. This survey was broken into the following four sections:

Dyea Trailhead to Finnegan's Point

No exotic plants were found between the trailhead in Dyea and the base of Saintly Hill despite the close proximity to Dyea and frequent hiker traffic. A total of 30 tall buttercup and 24 common dandelion plants were documented and controlled between the base of Saintly Hill and Finnegan's point, the majority of which were found within the first two miles of the trail. The trail which forks off at mile 1.1 and leads to the rafting put in was surveyed and no exotic species were found. At approximately mile 3.5 at the end of the boardwalk which crosses the second beaver pond, three common plantain plants were found and controlled. An infestation of common dandelion, associated with a trail turnpike at mile 4.7, was documented but not controlled this season due to time constraints. A small patch of white clover was documented at the entrance of Finnegan's Point, mile 5, just to the west of the warming shelter (figure 18). A survey of the Finnegan's Point campground found no other exotic species. On this section of trail exotic species, specifically common dandelion, appear to be associated with trail maintenance and specifically bridge building as most common dandelions were found at the base of small bridges.



Figure 18. A small patch of white clover found at Finnegan's Point.

Finnegan's Point to Sheep Camp

A single tall buttercup plant was found approximately 100 yards beyond Finnegan's Point. No other exotic species were found between Finnegan's Point and Canyon City. Extensive surveys of the Canyon City campground and surrounding area did not locate the common dandelion and white clover infestations found at this location in 2010. This is the second 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 exotic species found. Between Canyon City and Sheep camp no exotic species were found until just south the Sheep Camp Ranger cabin, at mile 13, a small patch of white clover was found and controlled.

Sheep Camp

Sheep Camp had the largest extent of exotic species found on the Chilkoot Trail in 2012. At the Sheep Camp Ranger cabin common dandelion is found growing in dense patches along the embankment of the southwestern side of the house and along the trail leading to the tool shed. Dandelions comprise approximately five percent of the vegetation in the open field south of the cabin which contains the weather station and helicopter pad. A single tall buttercup plant was found growing next to the stairs leading down to the ranger's outhouse and controlled. The .25 mile trail between the Sheep Camp Ranger cabin and the Sheep Camp campground is free of exotic species until approximately 50 yards from the campground entrance where small patches

of white clover and common dandelion quickly turn into denser infestations, lining the edges of the trails in the southern portion of the campground around the old Ranger Cabin and the three warming shelters. Only two tall buttercup plants were found and controlled in the Sheep Camp Campground this summer, which was a significant reduction from 2011 when 21 plants were removed. The three loop trails leading to the tent platforms and outhouses were thoroughly surveyed and no exotic plants were found.



Figure 19. NPS biological technician Jamie Welfelt helps install the final layer of geotextile on the shade covers at Sheep Camp.

Two trips to Sheep Camp in late May and mid-June were made to determine the condition and assess the preliminary efficacy of the shade covers installed to control reed canarygrass during the 2011 field season. The shade covers were found in fair condition, several holes had been punched through by falling branches and debris, but no major breaches or tears were present. Reed canarygrass was found growing out around the margins of 10 of the 12 shade covers, and had managed to grow directly through the undamaged shade covers in four separate locations. Large populations of previously undocumented reed canarygrass were also found growing elsewhere around the southern end of the Sheep Camp Campground. EPMT staff removed all of the reed canarygrass culms found emerging from under the shade covers but the larger infestations were too large to be effectively controlled by hand. Expansion and fortification of the shade covers were determined to be the best methods to control these new infestations. Once supplies had been ordered and flown to Sheep Camp the EPMT returned twice during the months of July and August to complete the shade cover project (figure 19). The shade cover thickness was increased and the borders were staked down at smaller intervals and lined with rocks harvested from the Taiya River (figure 20). In total, EPMT staff plus one volunteer spent 27.25 hours installing these shade covers. Once completed the original 12 shade covers were expanded and combined to create 11 new shade covers. In total this project accounted for a 44% increase in area covered.

A map of the control work done at Sheep Camp can be found in Appendix M.



Figure 20. The edges of shade covers were weighed down with rocks to prevent reed canarygrass from pushing its way out from under the geotextile.

Sheep Camp to Chilkoot Pass

Directly outside of the Sheep Camp campground and approximately 25 yards beyond the bridge crossing the Taiya River, a large infestation of common dandelion was found lining both sides of the trail. This infestation did not extend past the disturbed trail margins but in some places grew at high densities. This infestation covered less than 0.25 miles of the trail north of Sheep Camp. This infestation was not treated due to time constraints. One tall buttercup plant was found growing among this dandelion infestation and was controlled. An isolated infestation containing a total of six common dandelions was found approximately 100 yards north of the larger infestation and was controlled. No more exotic plants were discovered beyond this infestation. The common dandelion infestations documented on Long Hill during the 2004 and 2005 surveys were not found again this summer. Several large populations of native rock dandelion (*Taraxacum lyratum*) were found growing on Long Hill. No exotic plants were found from the Scales to the Chilkoot Pass, likely due to the rocky alpine ecosystem which precludes most exotic species.

Klondike Highway & White Pass Unit

The Klondike Highway and White Pass & Yukon Route Railroad run through the White Pass Unit of KLGO into Skagway. They are the main corridors connecting the Yukon and British Columbia to Skagway and have the potential to serve as a means for exotic plant introduction and spread. Perpetual maintenance to both the road and the tracks creates disturbed soil and facilitates the introduction and establishment of exotic species. Infestations of white sweetclover, smooth brome, narrowleaf hawksbeard and alfalfa (*Medicago sativa* ssp. *sativa*) have been documented on the southern portions of the Klondike and Alaskan Highways as well as in Whitehorse and Carcross (Line 2008). These larger infestations have the potential to spread over the White Pass along either the railroad tracks or the highway into the U.S. and eventually into KLGO. The discovery and removal of a small patch Canada thistle (*Cirsium arvense*) along the Klondike Highway during the 2012 field season highlights the vulnerability of these travel corridors to invasion and emphasizes the importance of annual monitoring to allow for early detection and rapid response to new infestations.



Figure 21. Infestation of reed canarygrass found in the White Pass Unit of KLOG.

Klondike Highway

The entire 12-mile section of the Klondike Highway, between the Dyea Road Intersection (mile 0) and the U.S. –Canadian border (mile 12), was surveyed twice this summer. The first survey was done by car on August 3rd and focused on monitoring and controlling known infestations, while the second survey was done by bicycle on August 13th and focused on detailed mapping of all exotic species as well as detection of new species.

Reed canarygrass was documented and treated at three locations along the Klondike Highway in 2012. All three reed canarygrass infestations were found between mile 8 and mile 11. The first patch was found in a pullout on the east side of the road at mile

8.5, the second was found within the White Pass Unit at the southern end of the Bridal Vail Falls pull out (figure 21), and the third patch was also found in a pullout on the east side of the road at mile 11. All infestations

were fairly small, and no expansion from previous years was documented. The inflorescences were removed from all three infestations to prevent them from seeding, but no further treatment efforts were taken.

White sweetclover was recorded infesting the rock quarry, owned by Jeff Hamilton, on the Klondike Highway 1 mile north of the intersection with Dyea road. Dense stands of white sweetclover were found covering the upper tiers of the quarry (figure 22). Smaller infestations were also found escaping down an access road to the north which connects to the Klondike Highway. White sweetclover has been documented on this property since 2008. During that time the infestation does not appear to have increased in extent but appears to have increased in density. On the upper road of the quarry the percent

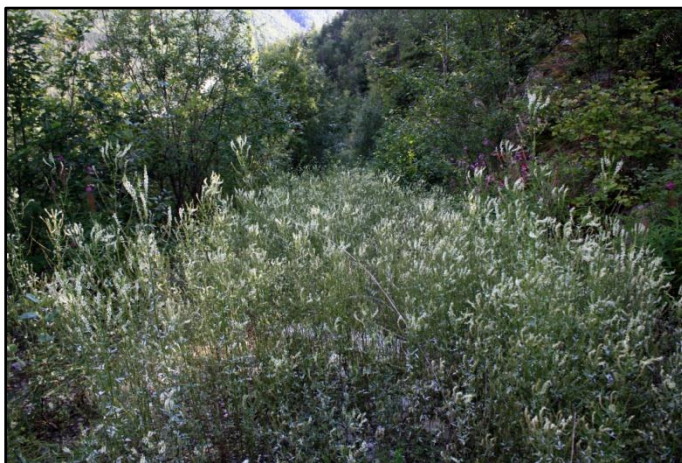


Figure 22. Dense stands of white sweetclover completely cover this old access road at the rock quarry on the Klondike Highway

cover of white sweetclover has increased from 25% in 2009 to more than 75% in 2011 and 2012. Due to the size of the infestation and the fact that it was found on private property no control efforts were made in 2012. Further down the highway at mile 1.5, three white sweetclover plants were found and treated in the AKDOT pull-off just south of the Black Ponds. A small patch of 15 white sweetclover plants was found and treated just north of the second pond. This was the first time that white sweetclover was documented at this location since 2010. No white sweetclover was found on the Klondike Highway north of this infestation, which is approximately 2 miles north of the Dyea Road turnoff. The white sweetclover documented and controlled near the summit in 2011 was not detected during surveys in 2012.



Figure 23. Canada thistle found along the Klondike highway for the first time 2012.

Canada thistle was found for the first time in or around Skagway during surveys of the Klondike Highway with Brian Maupin of the AACD on July 7th. The small infestation was found at the northern end of an AKDOT pull-off 1.5 miles up from the Dyea Road turnoff just south of the Black Ponds (figure 23). Canada thistle was found escaping into a largely undisturbed stand of grass at the edge of the gravel pull-off. The infestation was treated on July 7th and subsequently retreated on August 13th and September 10th. Despite attempts to fully remove the root system, digging the deep rhizomatous roots proved futile as many plants regenerated after each successive control effort. Thorough surveys of the surrounding area and along the entire length of the Klondike Highway detected no more Canada thistle.

Yellow toadflax was documented at six separate locations along the Klondike Highway. The largest infestation was found in the AKDOT pull-off south of the Black Ponds. A small patch of three yellow toadflax

plants was found and removed from a pull-off adjacent to the first Black Pond. Two small patches of yellow toadflax were found and removed on the west side of the road next to the Skagway incinerator building. Yellow toadflax was also found and removed along the dirt road leading to the Goat Lake hydro-electric plant. The final small infestations of yellow toadflax was found and removed from the western side of the road near mile 12 at the AKDOT maintenance station. The extent of yellow toadflax infestations along the Klondike highway does not appear to have significantly changed over the past three years.

Oxeye daisy was documented at multiple locations along the Klondike Highway. Two small patches were found and treated just south of the Skagway incinerator building and along the dirt road leading to the Goat Lake hydro-electric plant. Several large infestations of oxeye daisy were found around the U.S. custom office at mile marker 8. These infestations appeared to have significantly increased in size since they were last mapped in 2008. Another larger infestation of oxeye daisy was found mixed in with thick native vegetation in a roadside pull-off just north of mile marker 10 on the east side of the road. Neither of these larger infestations were controlled due to the time constraints for surveying the highway.

A small patch of common tansy was found on the east side of the highway between mile 8 and 9. The infestation is located just a few feet south of a patch of reed canarygrass which occupies the same pull-off. Surveys in the area found no other common tansy, suggesting that this was an isolated occurrence. The flower heads were clipped in order to prevent the plant from going to seed.

The documented extent of three exotic grasses; smooth brome, quackgrass and common timothy significantly increased during the 2012 survey. Since the first surveys, in 2008, by the KLGO EPMT on the Klondike Highway only 3 occurrences of common timothy, 5 occurrences of quackgrass and 4 occurrences of smooth brome were documented along the length of the highway. In 2012, 23 occurrences of common timothy, 18 occurrences of quackgrass and 10 occurrences of smooth brome were documented along the length of the highway. Aside from some larger populations of quackgrass north of the U.S. customs station, most of these infestations were small contained clumps of grass found along the road margins.

Fifteen separate occurrences of narrowleaf hawksbeard were documented sporadically along the entire length of the Klondike Highway. The northernmost occurrence of narrowleaf hawksbeard was documented approximately 50 meters south of the U.S. –Canadian border. All isolated patches of narrowleaf hawksbeard, such as this one, were treated. The largest infestations were found along the southern portions of the highway and in the rock quarry. Narrowleaf hawksbeard was frequently documented along the road margins from the Dyea Road turnoff to the rock quarry. In the rock quarry narrowleaf hawksbeard was documented growing along the dirt roads interspersed with white sweetclover.

Many low priority species were also documented along the Klondike Highway. Common dandelion, common plantain, sheep sorrel and white clover were found regularly along the entire length of the highway. Other species such as tall buttercup, nightflowering catchflies, shepherd's purse, pineapple weed, lambsquarters, sticky ragwort, red clover, and alsike clover were found sporadically and only within the first 10 miles of the highway. The frequency and density of

these low priority infestations decreases when moving north along the Klondike Highway suggesting that these infestations have spread from source populations in Skagway.

The Liarsville Road, which spurs off the Klondike Highway .5 miles up from the Dyea Road turnoff, was also surveyed by bicycle on August 14th. Tall buttercup, common dandelion and white clover were found regularly along the entire length of the road. Several large patches of quackgrass were found near the turnoff into Liarsville as well along the southern portions of the road. A very diverse infestation of narrowleaf hawksbeard, yellow toadflax, common timothy, nightflowering catchflies, smooth brome, red clover, alsike clover, split-lip hemp nettle (*Galeopsis bifida*), and sheep sorrel was found in an open field approximately .25 miles up the road. Because all infestation documented in Liarsville were on private land no control actions were taken.

A map of infestations found along the Klondike Highway can be found in Appendix J.

White Pass Unit

The White Pass Unit is the most remote and therefore least visited unit of KLGO. The vast majority of the White Pass Unit remains untouched and unaffected by human disturbance as most visitors who pass through the park unit never step foot out of their vehicle or train car. Despite this protective feature the White Pass Unit still contains several high priority infestations associated with the two travel corridors that run through its boundary. The one mile section of the Klondike Highway that runs through the White Pass Unit has infestations of common timothy, tall buttercup, smooth brome and reed canarygrass as well as common dandelion, sheep sorrel and white clover. The small patch of reed canarygrass was found at the southern end of the pull out for Bridal Veil Falls at mile 11.5. The infestation appeared to have decreased in size since 2010 when it was last mapped. Still the infestation remained too large to effectively treat by digging so the inflorescences were removed to prevent it from going to seed. The common timothy or smooth brome found this summer were the first documented occurrences of these species within the White Pass Unit of the park.

A survey of the White Pass Unit was conducted on August 29th. One EPMT staff member and an NPS biotechnician hiked into the unit from the Klondike highway to conduct the surveys over the course of two days. Surveys in the central and northeastern portions of the White Pass unit found no invasive species and no traces of human disturbance. All exotic plants found during the White Pass Unit survey were found along the train tracks. The entire four mile segment of the tracks within the KLGO border were surveyed for the first time this year since 2004. Common dandelion, sheep sorrel, white clover and common plantain were found intermittently along the margins of the tracks from the U.S. –Canadian border to the second tunnel at mile 16 where the tracks leave the park. A single yellow toadflax plant was found and controlled on the western end of the tunnel at mile 18.5 (figure 24). On the other end of the tunnel a small patch of common chickweed was growing

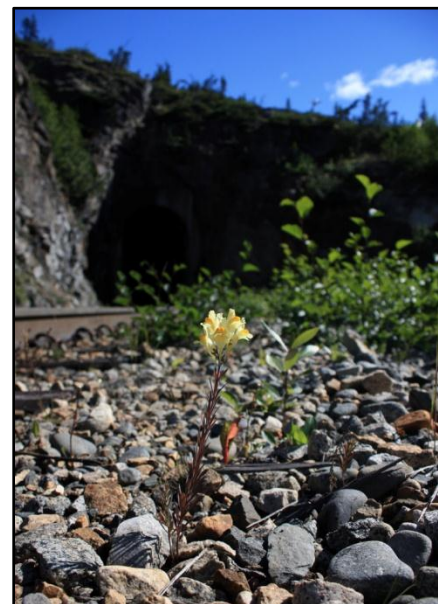


Figure 24. A single yellow toadflax plant found 18.5 miles from Skagway along the WP&YR railroad.

in the gravel amongst the railroad ties. The largest infestation along this segment of the tracks was found in an open gravel pad associated with the tunnels at mile 16. Yellow toadflax, quackgrass, narrowleaf hawksbeard, alsike clover, white clover, common dandelion, sheep sorrel, pineapple weed and lambsquarters were all infesting this gravel pad. The yellow toadflax and quackgrass were documented spreading down a steep slope away from the gravel pad into the undisturbed vegetation. All of the yellow toadflax and narrowleaf hawksbeard found in the area was removed, but lacking the proper digging tools to effectively control the large patch of quackgrass it was not treated and only the inflorescences were removed.

Laughton Glacier

Laughton Glacier is a popular hiking destination along the White Pass & Yukon Route Railroad, located approximately 1 mile east of the White Pass Unit of the park. The Laughton Glacier train



Figure 25. White clover was found covering much of the ground in a dense mat at the Laughton Glacier train stop.

stop and hiking trail were both formally surveyed by EPMT staff for the first time this summer. The area had been visually surveyed by Whitney Rapp in 2008, but no data was collected. The vegetation in the large clearing around the train stop was composed almost entirely of exotic species.

White clover and common dandelion accounted for most of the ground cover (figure 25). Common plantain, sheep sorrel and mouse-ear chickweed were also found in high densities. This infestation appears to be contained to the areas of high disturbance around the train stop. The two mile trail leading to Laughton Glacier is

surprisingly free of invasive species, given the heavy hiker traffic on the trail and the significant infestations found around the train stop. Common dandelion was only found sporadically in the first half mile of the trail and not detected anywhere else along the trail. Small patches of annual bluegrass (*Poa annua*) were found associated with the trail in several places, including on parts of the trail which ran through the glacial outwash plain. During the 2008 surveys common timothy and European mountain ash were noted in the area, but neither of these species were discovered during the 2012 surveys.

A map of infestations found in the White Pass unit can be found in Appendix K.

Outreach & Education

Efforts to educate the park staff, visitors and the general public about the presence and impacts of exotic and invasive plants in Skagway and KLGO were emphasized during the 2012 season. All new educational material, including two new pamphlets and five new signs, were created this season and distributed to park staff and visitors as well as local businesses. This educational material was designed to educate people on what exotic and invasive plants are, the impacts associated with invasive plants, and why they should be concerned about invasive plants. Other educational materials were designed to give identification tips as well as ecological and aesthetic attributes of specific exotic plants in order to help the reader recognize them.

During employee training in May EPMT staff gave a presentation on the invasive species to the KLGO seasonal staff. This presentation discussed the importance of exotic plant management in

the NPS and highlighted the invasive species that the park staff was most likely to encounter at KLGO. Three brief identification talks were given during the weekly trail meetings in the month of June. During these talks EPMT staff utilized fresh samples, photographs and botanical descriptions to teach trail staff how to recognize two of the main exotic species found on the Chilkoot Trail. The first two discussions focused on reed canarygrass identification and the third focused on tall buttercup identification. To facilitate field identification, laminated wallet sized reed canarygrass identification cards were produced and given to all NPS law enforcement, backcountry ranger and trail crew staff. A radio interview with SCA EPMT crew member Peter Frank was also conducted by KHNS radio in late June and was broadcast in both Skagway and Haines. The interview covered invasive plants in Skagway, why they are a problem to the locality, and what people can do to aid in control work. This also served as a good opportunity to promote the community weed pull over the radio. In late July KLGO EPMT staff gave an auditorium presentation, plant identification workshop and walking tour about the invasive species found in the upper Lynn Canal as part of the Alaska Geographic Guide Series program. This presentation featured edible invasive snacks and recipes as well as fresh specimens to help with an identification workshop and the walking tour covered approximately 7 blocks in Skagway and 13 different invasive species.

In an attempt to promote awareness as well as prevent the spread of invasive species in the park, the KLGO EPMT developed a proposal for the installation of boot brush stations at several strategic locations throughout the park. A boot brush station consists of an interpretative sign which directs readers to use an associated boot brush to clean their shoes before entering the park. The 2010 EPMT staff had purchased four boot brushes for this purpose, but never installed them. The 2012 EPMT staff designed and created the interpretative sign (appendix O), developed a detailed plan for construction (appendix P) and secured funding for supplies and labor from the Alaska regional EMPT. Despite this, compliance issues remain unresolved and the boot brush stations were not installed during the 2012 season.

The EPMT staff participated in the 2012 Junior Ranger Day, an event that was attended by both local and vacationing participants. Library staff set up a table where children were invited to create their own pressed native plant bookmark. Invasive species coloring pages with crayons were handed out by the EPMT staff manning the NPS natural resources booth. Another Junior Ranger project that the KLGO EPMT helped with was the First Bloom Native Plant Garden.



Figure 26. The display put up at the Skagway Public Library in 2012.

EPMT staff collected and propagated native plant seeds from Dyea which were then planted by the children in the garden beds. The EPMT staff also helped the NPS education staff to identify and remove all invasive species from the gardens.

For the third year in a row the KLGO EPMT and the TIWC set up an exotic plant display at the Skagway Public Library to highlight Alaska Invasive Weeds Awareness week and inform library goers about exotic species in the area (figure 26). In 2012 the library display

was put up on June 24th at the start of Alaska Invasive Weeds Awareness Week and remained up until August 3rd. The library display featured two new posters this year targeted at gardeners, in hopes to curb the number of horticulturally introduced invasive plants. These posters contained pictures of common horticultural invasive species and provided suggestions on native or non-invasive species to use in the garden. The library display was also an excellent venue to advertise for community weed pull.

The fourth annual Skagway Community Weed Pull was hosted by the KLGO EPMT, TIWC and AKDOT on June 30th at the Skagway Airport. A total of 9 people volunteered for four hours, and pulled 431 pounds of exotic plants, more than any previous year, despite the low turnout (figure 26). Due to a cool spring no white sweetclover was found at the airport by June 30th so the volunteers focused their attention on pulling the dense infestations of narrowleaf hawksbeard and yellow toadflax found along the runway median. All volunteers received a Skagway Community weed pull shirt as well a free lunch provided by the TIWC.



Figure 26. A small but mighty group of volunteers attended the 2012 Skagway community weed pull and removed more than 431 pounds of invasive species from the Skagway Airport.

The TIWC again proved to be an instrumental partner in exotic plant management in and around Skagway. Many local citizens and business were far more receptive to outreach and education attempts when they come from a local organization rather than an entity of the federal government. Rachel Ford, the TIWC director, was notified whenever high priority invasive species were found in the area. The EPMT staff created multiple maps for the TIWC outlining the extent of invasive species in Skagway and attended several meetings held by the TIWC to provide information about invasive species and potential control methods.

Gypsy Moth Monitoring

In accordance with the Alaska EPMT's early detection and rapid response strategy, a gypsy moth trapping program has been incorporated into the KLGO EPMT's annual monitoring efforts. The 2012 season was the second summer that EPMT staff at KLGO participated in gypsy moth monitoring. The traps lure European and Asian gypsy moths (*Lymantria dispar* & *Lymantria dispar* spp. *japonica*) with a synthetic versions of the species' pheromones. Four gypsy moth traps were set out in late June. The first two traps were placed in Skagway; one above the boat harbor and one at Yakutania point. The second two traps were placed in Dyea; one at the NPS campground and the other at the municipal campground. All four traps were checked periodically throughout the season and collected in mid September. No moths were found in the traps. A map of the trap placement can be found in Appendix N.

Recommendations & Discussion

Recommendations for the 2013 EPMT center on the prevention and proactive removal of infestations in backcountry and undeveloped front country areas and the containment of high priority invasive species found along the road systems and in the town of Skagway. Recommended prioritization strategies are in part based on gross species acres recorded in 2012 and ranking, both of which are summarized in graph form in appendices D and E.

Location Specific Recommendations

Skagway

Control work in Skagway should continue to focus on eradicating high priority species and preventing the further spread of other invasive plants to areas outside of Skagway. The continual spread of white sweetclover and yellow toadflax along the Dyea Road and Klondike Highway exemplify how challenging this can be, but should serve as a justification for the vigilance necessary to contain the spread of these invasive species. Survey work around Skagway should occur throughout the season, centering around two major surveys of the Skagway Airport and Pullen Creek.

White sweetclover remains a priority for control and monitoring in Skagway given its steadily diminishing extent since 2010. EPMT staff and volunteers have annually removed all white sweetclover found in areas in and around the airport since 2009. This practice should continue in 2013 with an emphasis on accurate mapping in order to determine how this infestation changes over time. The infestations of white sweetclover found on municipal property in the northern portions of Skagway should be controlled. These infestations are good for a single volunteer or a group of volunteers as they can easily be removed in just a few hours. EPMT staff should obtain permission to remove the infestations of white sweetclover in the White Pass and Yukon Route railroad yard. These infestations appear to be on private property but further investigation should be done to determine if they are within the municipal right of way associated with the road. Working with community members Joanne and Andrew Beierly in monitoring and controlling white sweetclover was very helpful in 2012 and should be continued in 2013.

Assisting the TIWC with monitoring and control work at Pullen Creek should continue in 2013. The TIWC has been an essential partner in community outreach and has been very responsive to learning about the exotic plants in Skagway. EPMT staff should coordinate monitoring and control efforts for the infestation of reed canarygrass at Pullen Creek with the TIWC staff. After attempts at manually digging reed canary grass were found to be unfeasible in 2011, herbicides were determined to be the most effective mean of control. Representatives from the TIWC, AACD, USFWS and the Skagway municipality all have expressed an interest in seeing this infestation treated but as of 2012 no actions have been taken. If no treatment efforts are made in 2013 EPMT staff along with the TIWC should once again remove the inflorescences from the infestation to prevent it from spreading its seed.

It will be important to monitor the seven identified occurrences of ornamental jewelweed in 2013. Monitoring of both infestations along Pullen creek should continue, but from outside private land, unless permission is obtained from the landowner. Outreach to the landowner by the

TIWC or AACD is strongly recommended in 2013. Ornamental jewelweed is a particular problem in wetland and riparian ecosystems, therefore these infestations pose a significant ecological threat to Pullen Creek and should take precedence over those found elsewhere (figure 27). The site on 4th Street across from Starfire should be monitored as well, and controlled with the property owner's permission. The infestations at Dedman's Photography and Corrington's Alaskan Ivory should be also be monitored. The owners of both establishments have refused to remove the infestations on their property after outreach attempts in previous years. The TIWC and AACD should attempt outreach efforts by offering to remove and replace these infestations rather than simply informing the owners of their presence. Monitoring for ornamental jewelweed along Pullen Creek in Molly Walsh Park should continue in 2013 despite the absences of infestations in 2012. The seed of ornamental jewelweed is viable for up to two years and this population could reemerge in 2013.



Figure 27. Ornamental jewelweed escaping from private property and growing along the banks of Pullen Creek

A plan to control the bird vetch on Spring and 9th Streets should also be a priority for the 2013 KLGO EPMT program. Coordinate with the AACD and TIWC as well as the city to apply herbicide to the infestation. This herbicide treatment has been discussed every year since 2009 but never successfully accomplished. Therefore discussions with all involved parties should start early in the season and establish a plan for treatment.

Removal of common tansy on the NPS lot located at 5th and Broadway should be a priority in Skagway during the 2013 field season. Given the small extent of this infestation, common tansy is a prime candidate for eradication on NPS land. The KLGO management staff have expressed concern about the public's reaction to this removal project. Therefore, to reduce the disturbance associated with this project, EPMT staff should clip the flower heads over the course of the summer to prevent the plant from seeding. Once fall arrives and the growing season concludes this infestation should be removed by digging or by application of herbicide. In the following spring (2014) the common tansy should be replaced with a native or non invasive plant species such as Canada goldenrod (*Solidago canadensis*). This will allow the new plants to fill in the areas previously occupied by common tansy during the 2014 summer season minimizing the aesthetic impacts of this project.

Other work on NPS property should include regular monitoring and control on the maintenance yard where yellow toadflax, narrowleaf hawksbeard and several other low priority species were found to be abundant. The focus should be put on controlling the infestations of yellow toadflax to ensure that seed will not spread from equipment and materials which travel from the maintenance yard to other areas throughout Skagway and Dyea. EPMT staff should again attempt to obtain compliance for the removal and replacement of non-native woody species found on NPS property in Skagway including Siberian peashrub, European mountain ash and



Figure 28. Large European mountain ash trees planted outside of NPS housing facilities in Skagway.

rugosa rose (figure 28). NPS maintenance staff's primary objections to removal of these species cited their relative abundance in Skagway as well as the negative aesthetic impacts that would result from their removal. Though both points may be true, the prevalence of an invasive species outside NPS property does not justify it being planted and fostered by NPS employees on NPS property, just as observing a neighbor dumping oil down a storm drain does not justify the observer doing so. Furthermore, if any of these species escape, as European mountain ash has, the long term economic and environmental implications would nullify any potential short

term impacts to the aesthetic quality of an area.

The Seven Pastures municipal fill site represents a point source for the spread of contaminated fill material and mulch to other locations around the area. The dump is host to a plethora of invasive species including smooth brome, white sweetclover and quackgrass. EPMT staff should control all white sweetclover found at Seven Pastures to prevent it's spread via fill dirt. An interpretive sign created in cooperation with the municipality of Skagway and the TIWC could be a good opportunity for education to those that use the fill site.

Invasive species observed elsewhere in southeast Alaska, such as Japanese knotweed (*Polygonum cuspidatum*), garlic mustard (*Alliaria petiolata*), Purple Loosestrife (*Lythrum salicaria*) and Orange Hawkweed (*Hieracium aurantiacum*) have not yet reached Skagway and KLGO. Other species found in southeast Alaska including spotted knapweed (*Centaurea biebersteinii*), perennial sowthistle (*Sonchus arvensis*) and large-leaf lupine (*Lupinus polyphyllus*) have previously been documented in Skagway or KLGO and are now considered eradicated. Given the multiple transit systems connecting Skagway to the rest of southeast Alaska it is only a matter of time before these invasive species arrive or are reintroduced. Therefore, EPMT staff should make a point of learning the characteristics of the species listed above in order to facilitate the early detection of these high priority species.

Dyea Road

The Dyea road should be surveyed at least once during the 2013 season. Surveys can be performed on bicycle or on foot. The 2012 EPMT staff found that surveying by foot improved the observer's ability to identify plants and thus increased the accuracy and resolution of the data collected. Surveys should be performed in July or August to ensure that exotic grass species will be in flower and identifiable. Mapping of low priority species is not essential as there are now three years of baseline data to support their ubiquitous presence along the Dyea Road. Instead focus should be put on surveying for and removing disjunct populations of reed canarygrass, white sweetclover, yellow toadflax and oxeye daisy as well as accurately mapping infestations of exotic grasses.

Control work on the Dyea Road should focus first on the high priority species found within the park including the smooth brome and oxeye daisy found around the Taiya River Bridge. If time allows and volunteers are available EPMT staff should attempt to control the larger infestations of quackgrass, common timothy and tall buttercup found between the NPS campground and the West Creek Bridge. Control efforts on non-native grasses including smooth brome, quackgrass and common timothy were performed for the first time by the KLGO EPMT in 2012. Smooth brome and quackgrass were found to have dense rhizomatous roots, similar to reed canarygrass, and were therefore difficult to successfully dig, while common timothy was found to have relatively shallow fibrous roots which could be dug and pulled with minimal effort. Controlling common timothy and tall buttercup between the Taiya River Bridge and the West Creek Bridge could be good project for a SAGA crew.

Control work outside the park should begin with the reed canarygrass infestation outside the Chilkoot Outpost. This infestation is less than 20 meters from the park boundary and poses a direct threat of invasion. Therefore it is in the park's best interest to control this population of reed canarygrass before it spreads onto park land. EPMT staff should discuss potential control methods with the municipality. Given the size and density of the infestation, manual control would not be ideal. If possible, utilize partnerships with the AACD to coordinate an herbicide treatment. If the infestation is not otherwise controlled, EPMT staff should remove the inflorescences before they go to seed. If the small patch of reed canarygrass across from the AB mountain trailhead returns in 2013 it should also be controlled as it requires a minimal input of time and effort to dig. The narrowleaf hawksbeard found south of the NPS campground should be treated in order to keep this infestation small and manageable. Surveys for the white sweetclover found at the Skagway shooting range and fire department storage lot should be performed in July and any plants found should be removed to prevent its further spread towards Dyea. All yellow toadflax found beyond the first mile of the Dyea Road closest to Skagway should also be treated.

While mapping and photographing the reed canarygrass infestation outside the Chilkoot Outpost in late June EPMT staff were accosted by a local citizen claiming they were trespassing, despite the fact that this infestation is well within the public right-of-way owned by the Municipality. This incident exemplifies the tumultuous relationship between many local citizens and the NPS and emphasizes the need for discretion when working on non-NPS lands. If new infestations are noted on private property they should not be mapped or treated until permission can be obtained from the property owner.

Dyea

Eradication of the yellow toadflax and oxeye daisy found in Dyea should be the top priority during the 2013 season. Weekly surveys of these infestations should be performed to ensure that they are fully treated before going to seed and that any subsequent regeneration is removed. Control work should then focus on creeping buttercup infestations found at the Lost Lake Trailhead and the NPS campground. Given the small extent, less than half a meter, of both infestations of creeping buttercup found in 2012 this species is a candidate for eradication over the coming years.

Control work on tall buttercup throughout Dyea takes second priority to treating the species listed above. Due to the size of infestations as well as the ease of identification and removal, tall

buttercup is the ideal candidate for treatment with volunteers or volunteer groups. Control work should again focus on the Nelson Slough and adjoining meadows, starting at the northernmost infestation and working south toward the flats. EPMT staff should also control all tall buttercup found in the large field located north of the Dyea Flats. This infestation is spread out at low densities over a very large area; therefore control work is best suited for a small volunteer group. Final priority should be given to controlling tall buttercup along the road system in Dyea Townsite Road and trail system. There are only a few dense infestations of tall buttercup along Dyea Townsite Road and trail system which would need to be controlled by volunteer groups but the majority of occurrences are small isolated populations and should be controlled during routine survey work.

Control efforts for common eyebright should be focused in the Nelson Slough Restoration Site. The common eyebright infestations south of the foot bridge and near the Nelson Slough Bridge were small and took less than two hours to control in 2012. These sites should once again be targeted for eradication in 2013. Large infestations of common eyebright on the Dyea Flats should not be controlled due to the considerable time requirements of hand-pulling this species. In the past SAGA crews have controlled these infestations but given the increased presence of tall buttercup and other exotic grasses in Dyea the priority should be shifted away from this low ranked species.

EPMT staff should attempt to obtain compliance for the removal of the European mountain and Siberian peashrub found at the Ranger Cabin in Dyea. Both species were documented growing outside of cultivation in 2012 and European mountain ash was found in several locations throughout Dyea, likely stemming from this large source tree. The hedge of Siberian peashrub could easily be removed with hand tools but the European mountain ash tree is upwards of 8 meters tall and will require a chainsaw. Therefore EPMT staff should partner with the KLGO maintenance department to develop a plan to remove and replace these two woody exotics before they spread further into Dyea.

Chilkoot Trail

Managing the exotic plants found in backcountry areas on the Chilkoot Trail is time-consuming and logistically complicated. Consolidating the number of trips needed by integrating multiple tasks into a single excursion will help save considerable time and effort. Building partnerships with the Chilkoot Trail backcountry rangers is also important, as they can monitor infestations and survey areas not readily accessible to EPMT staff. Surveying the Chilkoot Trail should now be done annually, given the discovery and subsequent treatments of reed canarygrass at Sheep Camp during the 2011 and 2012 field seasons. At least three trips should be made to Sheep Camp in 2013. The first trip should occur in the early spring, preferably in June, during which EPMT staff will check the status of the shade covers, remove any newly emerging reed canarygrass from the perimeters and patch any holes which may have developed over the winter. Intensive surveys should not be performed during this initial trip as most invasive species will not have emerged. The second trip should occur in mid to late summer, preferably in August, when reed canarygrass is in bloom and easily identifiable but has not yet gone to seed. To determine the appropriate time for this survey, EPMT staff can utilize the readily accessible infestations along Pullen Creek to estimate the phenology of reed canarygrass at Sheep Camp. Infestations in Skagway were found to be approximately one to two weeks ahead of those at Sheep Camp. An intensive exotic plant survey of the entire Chilkoot Trail should be

incorporated into the second trip to Sheep Camp as all exotic species should have emerged and become readily identifiable at this point in the summer. EPMT staff should thoroughly survey the Sheep Camp Campground to ensure that no new infestations of reed canarygrass have emerged. Any newly recorded small patches of reed canarygrass, if less than five plants, should be thoroughly dug out and bagged, provided compliance for this work has passed. If larger infestations are found EPMT staff should consider alternate control methods, such as herbicides. Perpetually expanding these shade covers is not a cost-effective strategy for control. The final trip should occur between September and October, during which EPMT staff and as many volunteers as are available will make final assessments and alterations to the shade covers then begin the initial steps toward revegetation. These include collecting and storing native plant seed and identifying candidate shrubs for local transplant.

Limiting the spread of invasive plants along the Chilkoot Trail will be a far more effective means of management than any treatment options. Therefore prevention must be a key component in the invasive plant management strategy on the Chilkoot Trail. Installing a boot brush station at the Chilkoot Trailhead will promote the active involvement and education of park staff and visitors while preventing the introduction and spread of invasive species. However, hiker traffic is not the only vector for invasive plants on the Chilkoot trail. The NPS regularly uses helicopters to transport supplies into the backcountry. Therefore EPMT crew members should coordinate with maintenance and law enforcement staff to perform inspections of all gear potentially contaminated with exotic plant material before it is flown out. This would include any tools used for vegetation management or earth work such as shovels, pick axes, weed cutters and motorized weed eaters, any unwashed tent footprints or tarps, or any larger items that may have been stored in the maintenance lot as it contains several highly invasive species. EPMT staff should check for and remove any dirt, debris or plant material found on the item which could harbor invasive plant seeds. To be effective, these inspections should occur before the 2013 field season, which means reaching out to maintenance and law enforcement should be one of the first priorities of the new EPMT manager at Klondike.

An unknown mountain ash species was discovered at the Sheep Camp campground during surveys in 2012. This species had several characteristics that set it apart from the native Sitka mountain-ash (*Sorbus sitchensis*) which is also found regularly in the area. The unknown species shared several characteristics with both the native western mountain ash (*Sorbus scopulina*) and the exotic European mountain ash. Specimens were collected and sent to the regional office for identification, but the results were not obtained before the end of the season. EPMT staff should inquire about these results in 2013. If the tree is in fact non-native, EPMT staff should perform compliance to remove the tree

Klondike Highway and White Pass Unit

The entire length of the Klondike Highway should be surveyed again during the 2013 field season. Scheduling two surveys along the highway worked well for the 2012 EPMT. An intensive survey, preferably by bicycle, should be done first. During this survey EPMT staff should be particularly vigilant for Canada thistle, white sweetclover and reed canarygrass. Furthermore EPMT should assess the size and scale of infestations prioritized for control in order to formulate a plan for treatment which includes the number of personnel and equipment needed. The second trip can be done by vehicle and should focus on control work and further monitoring of high priority infestations. If time allows, auxiliary trips should be made to do detailed surveys

of both sides of the road inside the park and to control larger infestations such as the field of oxeye daisy at mile 10.

Control work on the Klondike Highway should be increased during the 2013 field season. The infestations of reed canarygrass, in or near the White Pass Unit should be the top priority. All of these infestations are small and should be managed by either digging out the root system or removing the flower heads. The Canada thistle infestation takes second priority for control work and monitoring. This plant has deep rhizomatous roots which are difficult to remove. Attempts at digging these roots should be made if time allows but the primary focus should be on preventing the plants from going to seed. Small and isolated populations of white sweetclover, yellow toadflax, narrowleaf hawksbeard and oxeye daisy should be controlled during survey work. EPMT staff should look to partner with the TIWC and AACD to control the large infestation of white sweetclover on the private rock quarry owned by Jeff Hamilton along the Klondike Highway. Given the size of these infestations control work should only be attempted with a group of 8 to 10 volunteers or with the use of herbicides.

Surveys and control work along the section of the White Pass and Yukon Route railroad which passes through the park should be increased in 2013 given the documentation of yellow toadflax, quackgrass and narrowleaf hawksbeard in 2012. Infestations found at mile 18.5 and mile 16 should both be controlled during the 2013 field season. It is recommended that the White Pass survey and control work be conducted over a two-day backcountry trip due to the time needed to hike to the train tracks from the Klondike Highway. Surveys of the undisturbed portions of the White Pass Unit may be performed while in transit between the Klondike Highway and the railroad but additional surveys in these areas are unnecessary. The focus of the survey should be on the land adjacent to the railroad tracks. Control work may be logistically difficult due to the locations of the infestations along the railroad. To reach infestations located at the park border at mile 16 and return to a safe camping site require approximately 9 miles of hiking along steep narrow tracks usually perched on cliff ledges during which one tunnel and one trestle bridge must be crossed. To improve safety EPMT staff should attempt to schedule surveys around a date when the trains do not run. Another option would be to work with the White Pass and Yukon Route to coordinate a drop-off and pickup time for backcountry survey efforts. Once the infestations are reached EPMT staff should remove and bag all yellow toadflax, quackgrass and narrowleaf hawksbeard detected. If packing the treated plant material out, EPMT staff should double bag and tie off the bags to ensure that seeds are not dispersed.

Table 3. Summary of Surveys Conducted in 2012 (Not including travel time to get to survey sites)

Date	Survey Location	Personnel	Time
Throughout Season	Municipality of Skagway	1	-
6-26, 8-8	Skagway Airport	1	7 hours
8-9, 8-16	Dyea road (between Klondike Highway and campground)	1	12 hours
6-27, 7-20, 8-7, 9-14	Dyea road (between NPS campground and West Creek bridge)	1	14 hours
Throughout Season	Dyea	1	-
7-19	Nelson Slough Restoration Site		4 hours
6-7, 7-3, 8-31	Dyea Town Site Road and Trail System	1	16.25 hours
6-27, 7-24	NPS campground and trail system	1	6 hours
6-7, 7-3, 7-30, 8-10,	Dyea Flats	1	11.5 hours
5-31, 7-12, 8-23	Chilkoot Trail	1	18 hours
8-3, 8-13, 8-14	Klondike Highway	1	17.25 hours
7-31, 8-29, 8-30	White Pass Unit & Loughton Glacier	1	22 hours

Survey Work

Surveys are a vital component of invasive plant management. Early detection of species will help control infestations before they become more serious threats. For example, Canada thistle found during the Klondike Highway survey initiated a rapid plan for control work, addressing the issue before the infestation could spread further along the highway. [Table 3](#) ~~The table above~~ shows the date, amount of time, and personnel needed to conduct the surveys.

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. The 2011 KLGO EPMT had two full weeks with two eight-person SAGA crews during which more than 520 volunteer hours were logged. In 2012 the two weeks was cut to a single half day with an eight person SAGA which logged a total of only 54 volunteer hours. This was an approximately 90% decrease in volunteer labor in 2012. Not surprisingly, there was also a significant decline in the acres treated during the 2012 field season. If the objective of the KLGO EPMT is to effectively control and prevent the spread of invasive species in the park then volunteer groups must once again be an integral part of that effort or the EPMT must look to less resource-intensive control methods such as herbicides.

Outreach & Education

Outreach and education pay dividends well beyond the hours spent on them. In a community such as Skagway where infestations exceed the ability of EPMT staff to control them, connections between the park, landowners and local or regional stakeholders are vital. Partnering with the TIWC and AACD on outreach activities should continue in the future as they are a great resource. Efforts should also be made in 2013 to incorporate local and regional organizations, such as the TIWC, into survey and control efforts on non-NPS land in order to distribute the responsibility of exotic plant management in the more evenly among all stakeholders. This incorporation can range from simply inviting outside parties to join EPMT staff during surveys to coordinating on long-term treatment projects for high priority infestations. Developing a more communal approach to exotic plant management will benefit the NPS and the community of Skagway as a whole.

The Skagway Community Weed Pull is the largest community event put on by the EPMT and has proved to be an effective tool for controlling invasive plants as well as increasing public awareness. As a direct result of the continued treatment of white sweetclover at the Skagway airport during the Community Weed pulls in 2009, 2010 and 2011 these infestations have been significantly decreased in size and density. Therefore, EPMT staff in 2013 should once again organize the community weed pull in partnership with the TIWC and AKDOT in late June or early July. If white sweetclover is present at the airport than it should receive first priority for treatment, if white sweetclover is not present, as it wasn't in 2012, the volunteers should focus on narrowleaf hawksbeard and yellow toadflax. The refreshments, lunch and t-shirt provided for hours of hard work are great outreach tools and have proved to keep people coming back year after year.

Presentations proved to be a useful tool in educating large numbers of park staff, volunteers, visitors or local citizens. The 2013 EPMT staff should continue the presentations both during employee training in the spring as well as at the less formal trail meetings. The Alaska Geographic Guide Series presentation was also a great opportunity to reach out to an audience beyond the park service. Many local citizens, especially guides, attend these presentations and they can be an opportunity to educate active community members. Providing fresh specimens has proven to be a good teaching method as well as a way to keep the audience interested and active in the presentation. Edible invasive refreshments are easy to make, highlight other uses of invasive species and have been found to be a great addition to any event.

Audio and print media are also great ways to get the word out about invasive species. A Radio interview with KHNS conducted before the Community Weed Pull was an excellent way to get the community thinking about invasive plants and advertise for the weed pull at the same time. Setting up a radio interview to discuss invasive plants in the area and what issues they pose in Skagway would be a great way to let the community know about pertinent issues of 2013. Other media such as pamphlets, signs, newspaper articles and displays are also great ways to reach out to the community and educate people about invasive species. The 2013 EPMT staff should partner with the TIWC to create or update existing pamphlets and signs which can be distributed to park staff and visitors as well as to the local community. During the 2012 EPMT season staff members kept several invasive species brochures created specifically for Skagway and KLGO in their backpack to pass out to curious bystanders. The library display should be organized and put up again in 2013 as this is an easy and effective way to reach a high volume of people.

The installation of boot brush stations should be a priority in 2013. All of the administrative work for this project was completed in 2012, including cultural compliance, design and site approval as well as endorsement from all of the department chiefs. Therefore all that should be required to complete this project is construction and onsite installation. To ensure that this is accomplished the EPMT regional supervisor should be contacted as soon as possible to have them incorporate the cost of the boot brush stations into the budget. Costs were estimated at approximately \$400 for the construction of three stations. EPMT staff should then contact Johnnie Powell with the KLGO maintenance department and establish a definitive timeline for the construction and installation of the boot brush stations.

Restoration

Restoration is a key element in preventing the establishment and spread of invasive species. The 2006 Nelson Slough Wetland Restoration project has shown that with a minimal amount of effort from EPMT staff and volunteers, restoration projects can be incredibly effective at restoring the functionality of a degraded ecosystem and precluding invasive species establishment. Although the KLGO EPMT strives to minimize the impacts of their control efforts, the current methods applied at Sheep Camp will cause large scale disturbance to the native ecosystem that will require active restoration. When the shade covers are removed from the Sheep Camp campground, in 2014, there will be approximately 251 square meters of land completely denuded of vegetation and vegetative propagules. Given the presence of common dandelion, white clover and tall buttercup at the Sheep Camp campground it is likely that, without restoration efforts, once the shade covers are removed these invasive species or others will rapidly colonize the

disturbed areas. Therefore proactive efforts must be made in 2013 to plan and implement the early stages of this restoration project.

The revegetation plan should combine the local transplant of small shrubs with active reseeding of native plants. Sitka alder (*Alnus viridis* spp. *sinuate*) and various willow species (*Salix* spp.) can be found around the Sheep Camp campground and would make ideal candidates for transplanting. Both species, specifically willow, have been found to be very resilient to transplant (Densmore 2000). In 2013 the EPMT staff should obtain cultural resource compliance for digging and uprooting shrubs, as well as locate and flag potential transplant candidates. Efforts should be made in the fall of 2013 to collect and store seeds from native plants found in and around Sheep Camp. Blue joint grass (*Calamagrostis canadensis*), Blueberry (*Vaccinium* spp.), devil's club (*Oplopanax horridus*), clasping twisted stem (*Streptopus amplexifolius*) and goats beard (*Aruncus dioicus*) are all herbaceous plants which grow readily around the Sheep Camp campground and would be strong candidates for seed collection. For more information about the specific procedures and applications consult the Native Plant Revegetation Manual for Denali National Park and Preserve (Densmore 2000).

Wind Dispersal Considerations

The strong southerly winds that rush from the cold Pacific into the warm continental interior during the summer months have a strong effect on the dispersal of seed for many plants growing in the Skagway area. Many exotic plant species found in the Skagway area, such as narrowleaf hawksbeard, common dandelion, and tall buttercup are regularly dispersed by wind. The strong south wind in open areas such as the Skagway airport and the Dyea flats can also move larger, less mobile seeds, such as those of white sweetclover, considerable distances. Known introduction points, or high density areas, followed by decreasing densities of a species to the north are often evidence of wind dispersal.

It is recommended that when hand pulling 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

Due to the historical significance of many areas in KLGO a meeting concerning proper cultural resource field methods should occur annually. Additionally, any time control work is conducted in the Dyea Townsite or other areas of historical significance, all workers should be briefed on the procedures enacted if a cultural artifact is found. Possible 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

During field work in 2013 efforts should be made, whenever possible, to collect and press voucher specimens for the exotic species found in and around KLGO. Pressed plants are the best level of proof that certain species exists in the area, and also aid in species identification for other park staff. The KLGO Natural Resources Exotic Plant Collection was started in 2010 with a few samples collected. During the 2012 field season 10 new species were added to the collection.

The following species, which have been documented around the Skagway area, need to be added to the collection: *Anthemis arvensis*, *Bromus inermis*, *Capsella bursa-pastoris*, *Cerastium fontanum*, *Chenopodium album*, *Collomia linearis*, *Elymus repens*, *Erysimum cheiranthoides*, *Euphrasia nemorosa*, *Galeopsis tetrahit*, *Galeopsis bifida*, *Hordeum jubatum*, *Lepidium densiflorum*, *Medicago lupulina*, *Papaver nudicaule*, *Phalaris arundinacea*, *Phleum pretense*, *Plantago major*, *Poa pratensis*, *Polygonum aviculare*, *Polygonum convolvulus*, *Potentilla gracilis*, *Ranunculus acris*, *Rumex acetosella*, *Rumex crispus*, *Senecio vulgaris*, *Silene cucubalus*, *Stellaria media*, *Tanacetum vulgare*, *Viola tricolor*, *Thlaspi arvense*, *Trifolium repens*, *Tripleurospermum inodorum*, *Vicia cracca*,

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Appendix A.

Klondike Gold Rush National Historical Park Exotic Species List and Known Locations.

Latin Name	Common Name	Chilkoot Trail	Dyea	Dyea Road	Klondike Highway	Skagway	White Pass
<i>Anthemis arvensis</i>	corn chamomile					X	
<i>Anthemis arvensis</i>	stinking chamomile					X	
<i>Bromus inermis</i>	smooth brome				XO	XO	X
<i>Capsella bursa-pastoris</i>	shepherd's purse		XO	XO	XO	XO	
<i>Caragana arborescens</i>	Siberian peashrub		O*			O*	
<i>Centaurea montana</i>	perennial cornflower					O*	
<i>Cerastium fontanum</i>	mouse-ear chickweed		X	XO	XO	XO	
<i>Chenopodium album</i>	lambquarters		X	X	XO	XO	
<i>Cirsium arvense</i>	Canada thistle				O*		
<i>Collomia linearis</i>	narrow-leaved collomia				X	X	
<i>Crepis tectorum</i>	narrowleaf hawksbeard		XO	XO	XO	XO	XO
<i>Elymus repens</i>	quackgrass		XO	XO	XO	XO	
<i>Erysimum cheiranthoides</i>	wormseed mustard		X	X		X	
<i>Euphrasia nemorosa</i>	common eyebright		XO			O	
<i>Galeopsis tetrahit</i>	bristlemint		X				
<i>Galeopsis bifida</i>	splitlip hennipnettle					XO	
<i>Hesperis matronalis</i>	dames rocket					O*	
<i>Hordeum jubatum</i>	foxtail barley		X	X	X	X	X
<i>Impatiens glandulifera</i>	ornamental jewelweed					XO	
<i>Lepidium densiflorum</i>	common pepperweed					X	
<i>Leucanthemum vulgare</i>	oxeye daisy		XO	XO	XO	XO	
<i>Linaria vulgaris</i>	yellow toadflax		XO	XO	O	XO	X
<i>Lonicera tartarica</i>	Tatarian honeysuckle					O*	
<i>Lupinus polyphyllus</i>	large-leaf lupine						
<i>Matricaria discoidea</i>	pineapple weed		XO	XO	XO	XO	XO
<i>Medicago lupulina</i>	black medic					X	
<i>Melilotus alba</i>	white sweetclover			O	XO	XO	
<i>Papaver nudicaule</i>	iceland poppy					X	
<i>Phalaris arundinacea</i>	reed canarygrass	XO		XO	XO	XO	X
<i>Phleum pratense</i>	timothy grass		O	O	XO	XO	
<i>Plantago major</i>	common plantain		XO	XO	XO	XO	OX
<i>Poa pratensis</i>	Kentucky bluegrass	X	X				X
<i>Poa annua</i>	Annual bluegrass	O	O				
<i>Polygonum aviculare</i>	prostrate knotweed		X	X	XO	XO	XO
<i>Polygonum convolvulus</i>	black bindweed					X	
<i>Prunus padus</i>	European bird cherry					O*	
<i>Prunus virginiana</i>	chokecherry					O*	

Scientific Name	Common Name	Chilkoot Trail	Dyea	Dyea Road	Klondike Highway	Skagway	White Pass
<i>Potentilla gracilis</i>	slender cinquefoil		X				
<i>Ranunculus acris</i>	tall buttercup	XO	XO	XO	XO	XO	XO
<i>Ranunculus repens</i>	creeping buttercup		XO	X		XO	
<i>Rosa rugosa</i>	rugosa rose					O*	
<i>Rumex acetosella</i>	sheep sorrel	XO	XO	XO	XO	XO	XO
<i>Rumex crispus</i>	curled dock		XO	X		XO	
<i>Senecio viscosus</i>	sticky ragwort		X	XO	XO	XO	
<i>Senecio vulgaris</i>	common groundsel		X	X	XO	X	X
<i>Silene cucubalus</i>	bladder campion		X	X			
<i>Silene noctiflora</i>	nightflowering catchflys			O	O	XO	
<i>Sonchus arvensis</i>	perennial sowthistle					X	
<i>Sorbus aucuparia</i>	sorbus aucuparia		O*	O*		XO	
<i>Stellaria media</i>	common chickweed		X	X	X	XO	XO
<i>Tanacetum vulgare</i>	common tansy			X	XO	XO	
<i>Taraxacum officinale</i>	common dandelion	XO	XO	XO	XO	XO	XO
<i>Thlaspi arvense</i>	field pennycress		XO		XO		
<i>Trifolium hybridum</i>	alsike clover		XO	XO	XO	XO	
<i>Trifolium pretense</i>	red clover		XO	XO	XO	XO	
<i>Trifolium repens</i>	white clover	X	XO	XO	XO	XO	XO
<i>Tripleurospermum inodorum</i>	Scentless false mayweed			O		XO	
<i>Vicia cracca</i>	bird vetch					XO	
<i>Viola tricolor</i>	johnny-jump-up violet		XO			XO	

Notes	
X	Recorded in previous years
O	Recorded in 2011
*	Newly Documented as of 2012
	Not found in within past two years, eradicated