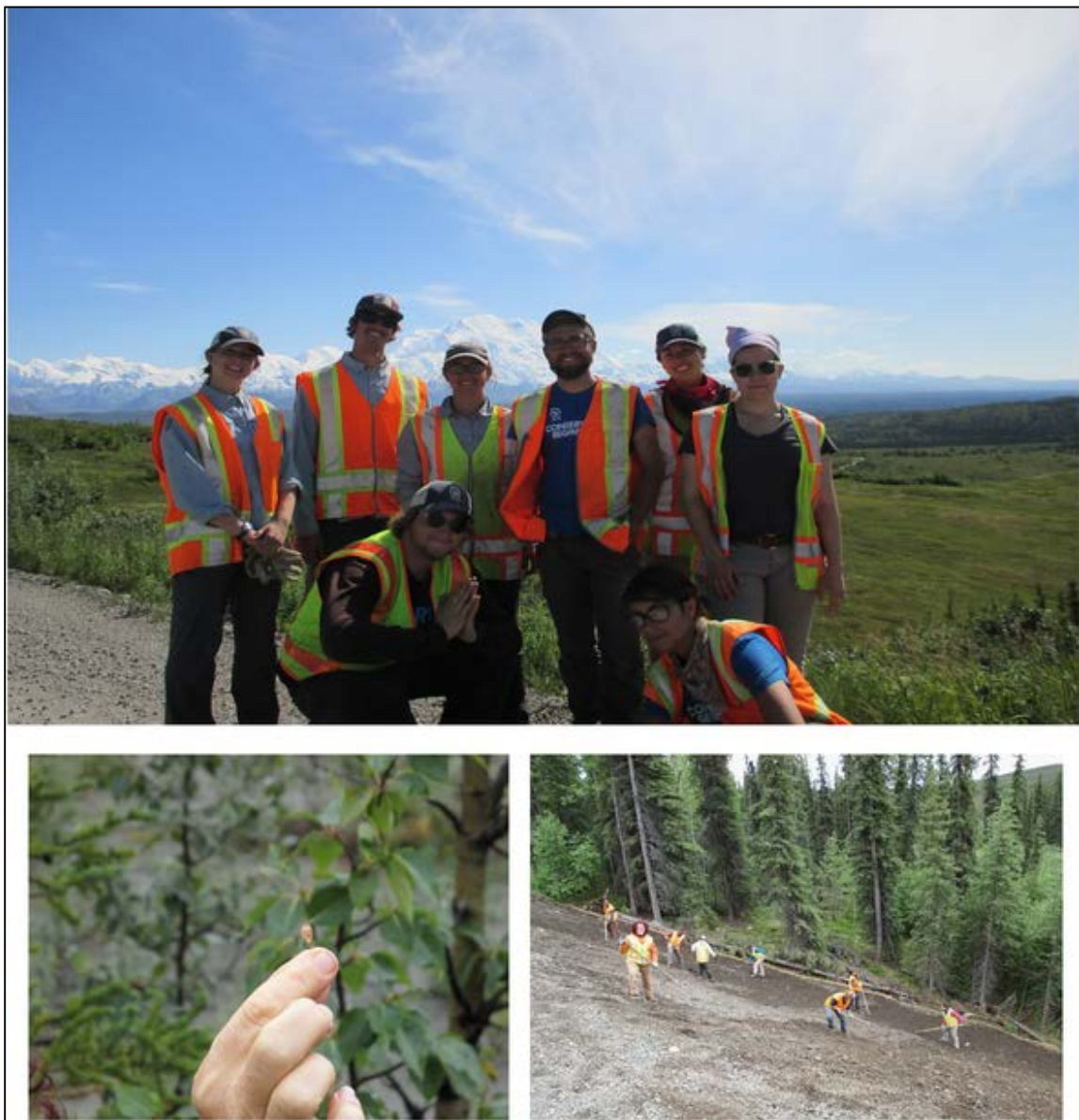




Invasive and Exotic Plant Management in Denali National Park and Preserve

2015 Summary Report

Natural Resource Report NPS/DENA/NRR—2016/1104



ON THE COVER

Top: SCA Alaska Corps Members and Interns group photo at Wonder Lake.

Bottom Left: *Hedysarum alpinum* seed. Bottom Right: Rock Creek Revegetation project.

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Abstract

Throughout the 2015 summer season, the Exotic Plant Management Team (EPMT) working in Denali National Park and Preserve (DENA) acted to prevent the encroachment of invasive/exotic/alien species into the natural tundra of the park. The species most focused on were *Taraxacum officinale*, *Hordeum jubatum*, *Crepis tectorum*, *Vicia cracca*, *Melilotus albus* and a new species *Descurainia sophia*. Invasive species typically spread in areas frequently trafficked by people and vehicles and disturbed areas such as construction zones. For this reason the team focused most of their efforts on the front country, visitor center, trails and headquarters areas of the park where there is high human traffic and construction areas. The team also focused on sections of the park road including miles 17 to 42 and miles 70 to 92, and the Kantishna airstrip. In Denali National Park and Preserve, the preferred method of invasive species management is manual treatment (hand pulling). However, herbicide was used on some areas of *Crepis tectorum*, *Vicia cracca*, and *Descurainia sophia*. During this season, the EPMT also worked on a number of revegetation projects. These areas include: both sides of the Rock Creek culvert near the park headquarters (Mile 3); a section of the park road near Eielson rest area (Eagle's Nest – Mile 68); a man-made stream bed along Moose Creek/Eldorado Creek in the Kantishna area; mile 12.5 on the Park Rd. near the large culvert; Upper Hogan Creek (mile 20); the Wonder Lake Pump House (Mile 85); and the P640 House in the Park Headquarters area. The work was completed by the Exotic Plant Management Team consisting of Wendy Mahovlic, the residing supervisor for EPMT and DENA Revegetation, Cecilia Bedard and Andy Smith, Student Conservation Association (SCA) interns, and a six person volunteer SCA core crew. The results of the 2015 work included 2225 pounds of pulled invasive plants along 47 miles of the Park Road; 65 pounds of uncleaned native seeds collected; 7 revegetation projects completed and 2390 hours of volunteer help. Spatial data was collected on a Trimble GeoXT 2008 and corrected and edited on ArcGIS and Pathfinder Office programs. This data is utilized by the Regional National Park Service (NPS) office and contributes to the database available at the Alaska Exotic Plants Information Clearinghouse (AKEPIC) from the Alaska National Heritage Program (AKNHP).

Acknowledgements

We would like to thank the following National Park Service employees for their contributions to the Exotic Plant Management Team in 2015: Wendy Mahovlic for her supervision and knowledge in restoration of native plant ecology throughout the park; Christopher Overbaugh from the Anchorage NPS office in his oversight of EPMT across the Alaskan National Parks; Peter Frank for managing field data, technical support, and experience with EPMT; and Britta Schroeder for her GIS technical support at Denali National Park. We would also like to thank the SCA Alaska Corp group that worked with our program for five weeks; this group made the summer's total amount of manual treatment of exotic plants possible. We would also like to thank our individual volunteers throughout the summer: Colleen Marinucci, Sue Salmons, Shawna Ashlock, Oliver Onufer, Natalie Onufer, and Anita Onufer. Without this vast support network, the EMPT would not have been nearly as successful as it was.

Acronyms

AKNHP Alaska's Natural Heritage Program

AKEPIC Alaska Exotic Plants Information Clearinghouse

CORS Continuously Operating Reference Stations

CLA Concession Land Assessment

DENA Denali National Park and Preserve

EDRR Early Detection Rapid Response

EPMT Exotic Plant Management Team

GIS Geographic Information System

GPS Global Positioning System

MSLC Murie Science and Learning Center

NFS Need For Seed

NPS National Park Service

SAGA Southeast Alaska Guidance Association

SCA Student Conservation Association

WWTP Waste Water Treatment Plant

Introduction

Denali National Park and Preserve is located along the George Parks Highway in the central, interior of Alaska. The park contains 6 million acres of wilderness which ranges in geography from boreal forests to alpine tundra along valleys, plains and hills leading to high mountains. Due to its high latitude, tree line is only around 2000 to 2500 ft. Denali National Park is best known for Denali, the tallest mountain in the United States. The mountain stands at 20,310 feet in elevation and its impressive sight brings half a million tourists to the park each year.

The park is also well known for its vast expanse of unspoiled wilderness. To maintain this wilderness, the park prohibits personal vehicles past mile 15 and there are very few established trails to scar the terrain. All of these tourists however, pass through the front entrance and visitor center potentially tracking invasive seeds with them, on their vehicles, clothes, packs and pets. For this reason the front country of the park is the most infested with invasive species.

The park has only one road in and out. The Park Road runs from mile 1, the entrance to the park from the George Parks Highway, to mile 92, Kantishna and the Kantishna airstrip. A large amount of effort is put into removing invasive species from the two park airstrips to prevent planes from spreading the invasive plants out into the park. To get along the park road, visitors can purchase a ride on any one of the number of busses that drive down and back each day. These busses are a huge reason for the presence of invasive species further down the park road. In future seasons perhaps more effort should be put into removing invasive species from where the busses are parked for the night, where they pick up passengers and better attention should be put into their cleaning.

Invasive species also enter the park through contaminated soils from the surrounding area or cities like Fairbanks and Anchorage. It is important to regulate and minimize the transport of soils into the park, especially tainted soils. All participating parties must remain attentive and inspect any imported soil. This could be a focus to expand educational outreach.

There are approximately 27 invasive species in Denali National Park which is considered a very small amount in comparison to the number of natural species. The most abundant invasive plant is *Taraxacum officinale*, or the common dandelion. While this plant is the most widespread, ranging from the park entrance to the end of the park road, it tends to be found only in the parking areas in the entrance of the park and along the park road itself. The park does not believe that this species poses a threat to the natural tundra of the park and is mostly treated to slow its reproduction and to maintain the most natural wilderness like appearance of the park.

The other leading invasive species *Hordeum jubatum*, *Crepis tectorum*, *Vicia cracca*, and *Melilotus albus*, have been found only in the park entrance, visitor center, park headquarters, and outside of the park. These species are less abundant than the dandelion but do pose a great threat to the rest of the park because they would most likely survive and thrive in the acidic soil of the natural tundra.

This year a new invasive species was identified within the park. Most likely entering the park in contaminated soil, *Descurainia sophia*, commonly called Flixweed, was found in last year's (2014)

mile 4 revegetation project, Sanctuary Hill revegetation project (Mile 24) and the Teklanika gravel pit at mile 28. The EMPT worked to eradicate this species from the areas it was found, yet there are concerns that it will begin to appear more in future seasons in other revegetation projects using the same soil source – the Teklanika (Tek) pit.

The EPMT, along with removing invasive species from the park, is responsible for revegetating completed reconstruction areas. Revegetation not only improves the aesthetics of the site but helps prevent invasive species from taking root. To assist with revegetation, native seeds are collected from areas within the park, cleaned and redistributed to the project sites.

This season the Exotic Plant Management Team consisted of Wendy Mahovlic, the residing supervisor for EPMT and DENA Revegetation and two Student Conservation Association Interns, Cecilia Bedard and Andy Smith. They were supported in their efforts by visiting volunteers and a six person volunteer SCA core crew. Unlike in years past with multiple alternating SCA and SAGA crews, the team worked with only one SCA crew returning five times during the season.

Volunteer help with invasive species is always appreciated and perhaps in future seasons the EMPT in Denali could work to establish an educational talk or brochure to be passed around to visitors and locals living in the park and surrounding area. There could also be a day established for people from surrounding areas to come into the park and help remove invasive species.

Methods

Site Selection

The Denali EPMT staff uses the Alaska Natural Heritage Program's (AKNHP) invasive ranking system to prioritize which invasive plants have the potential to spread throughout the park. This scale rates invasive plants 1-100 in their impacts on the local and regional ecosystem and the potential for it to spread and create disturbance. Utilizing the AKNHP ranking system as a guide and GPS data collected over the past ten years, EPMT members determine which species to monitor and where they are growing. All invasive species populations, in Denali or along the George Parks Highway, are mapped using Trimble GeoXT GPS units and processed using Microsoft Pathfinder and ArcGIS.

Denali National Park and Preserve has only one road to serve as the access point for vehicles into the Park. Referred to as the Denali Park Road, the road is 92 miles from the George Parks Highway entrance to the historic mining settlement Kantishna. Denali National Park and Preserve has a traffic bottle neck caused by the single road in the park and driving restrictions placed on visitors. The first three miles of the park road are coined the "Front Country or Entrance Area." The Front Country is the largest concentration of human impact and presence throughout the entire park. Made up of the Denali Visitor Center, Wilderness Access Center, Waste Water Treatment Plant, Riley Creek Campground, Post Office, Mercantile, Backcountry Information Center, Murie Science and Learning Center, Power Plant, Park Headquarters, Sled Dog Kennels, and structures unknown to the public like employee housing, maintenance facilities, and Bus Depot, all of which are monitored by the EPMT.

The road is paved from the entrance to the mile 15 at the bridge over Savage River. Once past mile 15, the road is unpaved and graded. The Denali Front Country is the area focused on most for monitoring and removal of invasive plant species from the park road. These 3 miles of park road are heavily monitored due to the high volume of traffic and the potential vectors that will further invasive plants to spread into the park. Past mile 15 only Park Service vehicles; shuttle buses, service vehicles, and construction equipment are permitted to drive the road. These vehicles are the largest vector for invasive species growing along the park road corridor.

To prevent additional invasive species coming into the park, EPMT members use an Early Detection Rapid Response (EDRR) approach. By using EDRR to find, treat, and monitor invasive plants in the park as well as along the Park's Highway invasive plants are kept in check. EPMT members monitor invasive plants along the George Parks Highway (Mile 230 – 239) to treat emerging infestations before they have a chance to take hold and spread into the park.

Mapping and Collecting Data

Each area of the front country is inspected or treated for invasive plants and are mapped using GPS. Data collected from years previous set the groundwork to keep an ongoing and up to date history of invasive species transmission, inside of the park. Areas surveyed are recorded as either monitored, inventoried, or treatment. Inventory is a new survey location that has no history or invasive species. Monitoring is returning to an area that as previously been surveyed. Treatment is the bulk of surveys completed, in the park.

Alaska Natural Heritage Program (AKNHP) provides information through the Alaska Exotic Plants Information Clearinghouse (AKEPIC) which makes different data available for public use. Furthermore, the AKNHP ranks each species and provides a framework for prioritizing plant treatment.

Invasive Species Surveys

Historic GPS data is the most important starting point for all surveys of invasive species. Denali National Park and Preserve has the unique opportunity to control the spread of invasive species throughout the park. This is mainly due to the remote location of the park and limited travel on the park road to park vehicles. The two main survey types are Crepis Sweeps (*Crepis tectorum*) and Dandelion pulls (*Taraxacum officinale*).

Taraxacum officinale, has always been the main focus of park EPMT activities, working to prevent rapid spread of seedlings along the park road. Currently *Taraxacum officinale* is abundant along the first three miles of the Park road and the gravel road shoulders are suitable for growth even farther.



Figure 1: SCA members performing Dandelion surveys and devegetation along Park Road

The dandelion infestation is the most widespread invasive species within the park boundaries and is treated throughout the summer. At the beginning of the season, it is the first invasive species to bloom making it the first target. Ideally, the taproots are removed before the plant goes to seed. Constant vigilance is needed to prevent the spread further into the park and along the gravel bars of Denali's braided rivers.

The second survey targets *Crepis tectorum*, or Narrowleaf hawksbeard, a highly invasive species inside the park ranking 51 on the AKEPIC invasiveness scale. Crepis sweeps start at the end of June as it begins to bloom. Historically, EPMT began removing *C. tectorum* from the park in summer 2006. Its flower spreads similarly to the common dandelion, but it grows taller and narrower, with a short taproot and a slender stalk. It is part of the aster family and consists of a 1-2 centimeter flowering head with broad yellow leaves. It is most effective to manually treat certain areas in the park in late June because it is difficult to spot when it is not in bloom. Crepis sweeps include both sides of the Park Road from the Waste Water Treatment Plant, into Riley Creek Campground Road, and into the Aramark Bus and Employee Parking Lots and between the Denali Visitor Center and Park Road.

Because this species is relatively new to Denali National Park and Preserve and has aggressively advanced up the park road, it is crucial to do the sweeps on a weekly basis to prevent spread. This

species should be sought out specifically near disturbed areas such as construction sites or areas where buses frequently stop.

Manual Treatment

Manual treatment is the preferred and primary treatment method done by Denali's EPMT. The manual treatment of invasive species is performed by hand or using a tool such as a dandelion digger. The plant must be removed with as much of the root as possible otherwise it will grow back next season. All of the invasive plants pulled are stored in heavy duty plastic bags so they do not spread seeds or organic matter after pulled. The pulled plants are burned in the winter.

Manual treatment should be done before the plant goes to seed. Manual treatment of invasive species within the park is not going to completely eradicate invasive species from the park. This treatment method serves more as a constraining process to curb the spread of invasive plants into in new areas.



Figure 2 : Wendy Mahovlic and Natalie Oberman manually treating Dandelions along the Denali Park Road

Chemical Treatment

A small number of infested areas are treated with herbicides throughout the park. Alaska requires any chemical application to be carried out by a certified applicator.

Role of EMPT

Denali's EPMT for 2015 was made up of three people, one full time NPS employee and two SCA interns. The EPMT worked to control invasive species populations of *Taraxacum officinale*, *Crepis tectorum*, *Melilotus alba*, and *Descurainia sophia*. The second duty of the EPMT is to assist with the revegetation of construction sites and other disturbed areas with native species. These projects need to be completed earlier in the summer to allow the seed time to germinate, creating enough of a root system to survive the winter and prevent erosion of the soil from spreading into the wilderness.

Results

Overview

In the 2015 season, the Denali EPMT staff inventoried 73.55 acres of the park. 5.66 acres were infested with invasive species and of those infested acres, 4.71 species acres were treated shown below in Table 1. As stated previously, the majority of Denali's infestations occur in the front country.

Table 1. Summary of Denali National Park & Preserve Exotic Plant Management Team accomplishments.

Year	EPMT Personnel		Volunteer Crews		Total Person Field Hours	Invasive GPS Data NPS Lands(non-NPS lands)		
	# pers.	Field Hours	# pers.	Field hours		Species Acres Surveyed	Species Acres Infested*	Acres Treated
2004	1	39	1	25	64	2.553 (6.557)	0.934 (6.557)	0.450 (0.035)
2005	1	224	8	544	768	16.713 (2.321)	12.877 (1.531)	3.261 (0.186)
2006	1	454	8	679	1,133	750.313 ¹ (2.958)	16.866 (0.349)	10.211 (0.121)
2007	2 ²	743	16	1,173	1,916	805.951 ¹ (7.826)	11.329 (0.301)	8.368 (0.289)
2008	2 ²	626	10	454	1,080	741.687 ¹ (11.982)	12.750 (7.968)	11.051 (0.649)
2009	2 ²	571	5	385	956	749.459 ¹ (4.210)	20.437 (0.317)	11.370 (0.317)
2010	3 ³	1,893	16	2,560	4,453	159.034 (35.245)	16.766 (2.616)	14.125 (2.586)
2011	3 ⁴	764	3	143	907	290.592 (23.395)	29.348 (7.228)	10.290 (2.010)
2012	2 ²	478	35	912	1390	61.872 (6.397)	19.108 (2.366)	10.519
2013	2 ²	500	27	980	1480	118.85 (8.3)	5.783 (1.89)	4.56 (.461)
2014	2 ²	443	14	337	780	80.33 (0.23)	6.24 (0.04)	0.84 (0.03)
2015	3 ³	1040	14	1350	2390	73.55 (0.41)	5.66 (0.03)	4.71 (0.03)

¹ Acres infested represent the area of a mapped infestation multiplied by the percent cover of invasive plants in that mapped area.

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

¹-This acreage includes the actual road surface of the Denali Park Road.

²-Includes one SCA intern

³-Includes two SCA interns

⁴-Includes one SCA intern and one international SCA intern

Species Specific accomplishments

During the 2015 season, the Denali EPMT staff treated 7 species in and out of the park. Table 2, shown below outlines the species, its invasiveness ranking and location, the acres inventoried, and acres treated

Table 2. Species specific monitoring and treatment throughout the season

Latin Name	Common Name	AKEPIC Rank	Location*	Acres Infested	Acres Treated
<i>Crepis tectorum</i>	Narrowleaf hawksbeard	56	F, HC, PH, PK, TD	1.61	1.59
<i>Descurainia sophia</i>	Flixweed	41	F, TK, PK	2.21	1.76
<i>Hordeum jubatum</i>	Foxtail barley	63	F, PH, PK, TD	0.28	0.28
<i>Melilotus alba</i>	White sweetclover	81	F, PH, TD	*.032	*.032
<i>Melilotus officinalis</i>	Yellow sweetclover	69	PK	*.0002	*.0002
<i>Taraxacum officinale</i> ssp. <i>Officinale</i>	Common dandelion	58	F, FQ, HC, PH, PK, TD	1.60	1.12
<i>Vicia cracca</i>	Bird vetch	73	F, FQ, PH, PK, TD	.004	.004

F = front country, FQ=Fannie Quigley's Cabin, HC=Kantishna horse corral, PH = George Parks Highway (AK Route 3), PK = park road, and TD = train depot, TK= Teklanika pit.

* Significant population on private property

¹ Acres infested represent the area of a mapped infestation multiplied by the percent cover of invasive plants in that mapped area.

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

Narrowleaf Hawksbeard (*Crepis tectorum*): Keeping with past management practices, *C. tectorum* was encountered and treated with herbicide in the Waste Water Treatment Facility. The infestation has been decreasing over the years but still remains a threat to the park. During 2015 the EMPT was accompanied by a 6 person SCA crew and two other volunteers and pulled 105 pounds of *C. tectorum* over a total of 40 hours. Previous herbicide treatment has been effective in this area.

Common dandelion (*Taraxacum officinale*): This is the most abundant invasive species in the park and it is most often pulled from along the park road, the visitor center, C-camp, the Shaffer Building, and the Wilderness Access Center (WAC) and the Riley Creek Mercantile. Over the course of the season, approximately 621 pounds of dandelions were pulled by the two SCA interns, the supervisor, and the six person SCA crew.

Bird Vetch (*Vicia cracca*): This is a particularly invasive species. *Vicia cracca* can be identified by its legume-like qualities and its blue-purple flowers. This plant likes to grow on top of and strangle other species. This season it was found at the Denali Education Center (Mile 231 George Parks Highway), the Historic Generator building (Mile 1.5 Park Rd.), C-Camp parking lot (a new location for this species – Mile 3 Park Rd.), the State pull out at mile 238 George Parks Highway, 2 locations

in front of the McKinley Chalet (Glitter Gulch – Mile 238 George Parks Highway), at Mile 231.75 George Parks Highway, and at Mile 240 George Parks Highway. Two-hundred pounds of Bird Vetch was pulled from the above locations, including a fair amount of soil.

Foxtail Barley (*Hordeum jubatum*): While the nativity of this species is in debate, the Denali EPMT treats the plant as invasive. The plant can be identified by its maroon and green coloring and soft look. When going to seed, the plant stiffens and the seeds themselves become very dangerous for dogs and other animal species. This season, the plant was pulled from the C-camp and Shaffer Building areas, the Waste Water Treatment Facility, and along the park road in conjunction with the Crepis sweeps. 520 pounds of Foxtail was pulled in various locations and approximately 50 hours was spent pulling it up.



Figure 3: *Hordeum jubatum* along the Meadow Vista Trail

White and Yellow Sweet Clover (*Melilotus albus*, *M. officinalis*): The *Melilotus* species are not often spotted within the park. It is a large concern for the park because of its abundance along the George Parks Highway leading towards and away from the park. This season it was specifically pulled from areas along the Canyon (Glitter Gulch) approximately mile 239 to 237 of the George Parks Highway. It was also pulled from mile 231 of the Highway at the entrance to Denali Village. In total 24 pounds of *Melilotus* was pulled by the EPMT and a 6 person SCA crew over the course of about 7 hours.



Figure 4: Yellow and white sweetclover

Flixweed (*Descurainia sophia*): This species was found for the first time this year and most likely entered through contaminated soil brought to the Teklanika Pit. It is a member of the mustard family and is recognized by its tall single stalk, blue-gray-green skinny tripinnate leaves and yellow inflorescences. This plant looks very similar to the native species, but can be differentiated by the location of the siliques. In the native mustard, the siliques grow from the inflorescence where as in the non-native, it grows below the inflorescence. This plant should be considered a high priority in future seasons due to its surprising abundance. Seven-seven hundred and fifty-five pounds of Flixweed was pulled up in the Tek Pit and various reveg projects over 81 hours.

Yellow Toadflax (*Linaria vulgaris*): While not sought out or encountered this season, *Linaria vulgaris* is a problem invasive species for the park. In seasons past it has mostly been found around the train tracks where the north bound and south bound train engines rest at the station. In the 2016 season, a survey should be done of the area to look for and manage the species.

Revegetation and Need for seed

This season, the EPMT worked on seven different revegetation projects. These projects were at the Rock Creek culvert - the north and south side (Mile 3.3 Park Rd.), the residence P-640 at mile 3.4 Park Rd., Moose Creek/Eldorado Creek (Mile 90 Park Rd.) willow stake planting, “Eagles Nest” at mile 68 Park Rd., Mile 12.5 Park Rd., and Upper Hogan Creek (Mile 20 Park Rd.) and the Wonder Lake Pump House (Mile 85). All seven revegetation projects were to help the affected areas recover after maintenance and construction.

To revegetate the areas the team used native seeds collected from within a 20 mile radius of each location. The seed mix included these species - Wheatgrass (*Elymus sp.*), Milk vetch (*Oxytropis campestris*), Eskimo potato (*Hedysarum alpinum*), *Leymus innovatus*, and *Poa alpina*. Revegetation is often used to help retain soil stability. For this purpose a non-native grass species, annual rye (*Lolium multiflorum*), is used because it grows roots immediately to stabilize the soil, but often times it does not grow back the next season so it does not crowd out the native species. A slow release fertilizer was also used on all revegetation projects.



Figure 5: SCA Alaska Corp member spreading native seeds along mile 12 of Park Road

The seeds used for revegetation are a product of the Need for Seed program implemented every year. This program takes place in a single day or over a series of days each season. The EPMT accompanied by the SCA crew and any other volunteers collect viable seeds from multiple areas along the park and the George Parks highway. These seeds are then set out to dry, cleaned, and stored for later use.



Figure 6: SCA Alaska Corps members planting willow cutting along Moose Creek

Along with spreading native seeds the EPMT worked on a revegetation project involving freshly cut willow stakes of the species *Salix alaxensis*. These stakes were cut from willows along Moose Creek



Figure 7: Natalie Onufer, Denali Park Volunteer, collecting *Hedysarum alpinum* seeds.

in Kantishna, and planted along a new, manmade stream bed (the continuation of Eldorado Creek) in the same area. This project took place the week of June 15th and involved the EPMT and the SCA volunteer crew. Willow stakes were cut approximately 25-45cm in length, and 1.0-2.5 cm in diameter. Planting included digging shallow holes at approximately 45 degree angles, allowing approximately 5-8cm of the cutting to protrude from the soil. Agriform fertilizer tablets were planted close to, but not touching, each stake. Each stake was then thoroughly watered. During the 2016 season the stakes should be checked to see if rooting and regrowth has occurred.

At the East end of the park the EPMT collected seeds from miles 241 and 231.75 on the George Parks Highway during the weeks of July 6th and 13th. These locations are great for collecting *Hedysarum alpinum* as well as *Arnica frigida*. *Hedysarum alpinum*, *Oxytropis campestris* and *Poa alpina*, were collected from the Shaffer Building and the C-Camp area during the week of July 13th.

Seed collection was conducted at the West end of the park over the week of August 17th. The EPMT, assisted by the SCA crew and three other volunteers, collected seeds from the Toklat rest area, mile 62, Eielson Visitor Center, the Eielson Bluffs, mile 72, along the road leading to the Wonder Lake Campgrounds, along the McKinley Bar, as well as along the road leading to Kantishna and the Kantishna airstrip. Mile 62, specifically, is a great source for *Arnica lessingii* seeds. At all other locations, seeds from the species *Leymus innovatus* (fat cat), *Elymus sp.* (wheat grass), *Calamagrostis canadensis*, *Aster sibericus*, *Oxytropis campestris*, and *Hedysarum alpinum* were collected.

Education and Outreach

There were no defined education or outreach programs implemented during the 2015 summer season. Any public education on invasive species within the park was done through the interns or volunteers working in the field and answering the questions of passing inquisitive visitors.

The 2015 EPMT suggests more effort be put into educating the public on what invasive plants are most prevalent within the park and how to avoid tracking them into un-infested areas. Team members are frequently asked questions while working and it would be good to keep a pictorial guide handy that identifies which species in the park are invasive.

Large concerns for the EPMT are the invasive species that could easily move from the outside area along the George Parks Highway into the park. The best way to manage invasive species outside of the park is to work in conjunction with the hotels, resorts and concessions along the highway near the

Denali Nation Park and Preserve entrance. Wendy Mahovlic, the EPMT supervisor, should discuss with each hotel, resort and concession's landscaper or maintenance crew how to identify and remove invasive species from their respective properties. It is advised that a program is developed in future seasons that facilitates this discussion.

Educating the public, the visitors and the locals, on how to identify and remove or prevent the spread of invasive species, is important in helping the EPMT in eradicating invasive species from the park.

Recommendations

Revegetation photos should be taken in the 2016 season of the four projects seeded by the team during the 2014 season. These areas include the two areas near the Shaffer Building, along Rock Creek Trail, mile four of the Park Road and the area near Sanctuary River along the Park Road.

The area on mile 68 of the park road known as "Eagles Nest" which was a previous disturbance area should be monitored for invasive species beginning in early summer as well as the success of native plant revegetation.

Continue *Crepis tectorum* sweeps along the park road from the post office to the Wilderness Access Center, the revegetation mound near the George Parks Highway and the west and east side trees. Include in future sweep the area by historic power plant building as this season *Crepis tectorum* was found there for the first time. Also look for *Vicia cracca* in this area. Along with the sweeps monitor the resurgence of *Crepis tectorum* in the waste water treatment facility across from the post office; this is the origin of the invasive species into the park. Measures including the use of herbicide sprays should be taken to help eradicate the species from the park.

Due to the high motor vehicle traffic and bus movement, herbicide should be applied to any dense *Taraxacum officinale* populations near the MSLC as well as the concessions and park bus parking and cleaning areas. This area poses a great threat of helping to spread dandelion seeds onto the rest of the park road.

Monitor the Rock Creek culvert revegetation project for introduction of invasive species especially *Descurainia sophia* (Flixweed) and success of native seed growth. Pictures of the area should be taken in the 2017 season to determine the progress of regrowth. Due to high rain washout and soil degradation while this area was revegetated consider revegetating the area again if needed.

Monitor mile four and mile 24 (Sanctuary Hill) revegetation sites as well as the Teklanika gravel and construction pit for the regrowth of *Descurainia sophia*. Re-apply herbicide spray to the Teklanika pit area if the infestation becomes extreme again. If too extreme, considerations and preparations should be taken to close down the pit or cease the removal of contaminated soil from the area for use in maintenance and revegetation areas, until *Descurainia sophia* is eradicated.

Appendix A: 2015 Volunteer Hours and Amount Treated

Dandelion Deveg and Reveg – East End – June 8 - 11, 2015

- 6 SCA (Student Conservation Association) Volunteers; 2 SCA (Student Conservation Association) interns.
- 320 hours
 - o Mile 17 – 43 Park Rd.: 115 lbs. of dandelions
 - o Mile 4 Reveg: 55 lbs. of *Descurainia sophia* (22.5 hrs.)
 - o Sanctuary Hill Reveg (Mile 24): 65 lbs. of *Descurainia sophia* (11.25 hrs.)
 - o Teklanika Pit (Mile 27): 450 lbs. of *Descurainia sophia* (32 hrs.)
 - o Mile 3 – Rock Creek Bridge – **Reveg** – planted native seeds, fertilizer, and annual rye.
 - o Mile 3.1 – P640 House – **Reveg** - planted native seeds, fertilizer, and annual rye.

Dandelion Deveg and Reveg – West End – June 15 - 18

- 6 SCA volunteer crew and 2 SCA intern
- 320 hours
 - o Mile 70-92 Park Rd.: 170 lbs. of dandelions dug
 - o Mile 68 – Eagle's Nest – **Reveg** – planted native seeds, fertilizer, and annual rye.
 - o Mile 90 – Eldorado/Moose Creek – **Reveg** – planted annual rye, fertilizer and willow stakes

Invasive Eradication and Need for Seed collection – July 13 – 16

- 5 SCA volunteers; 1 SCA intern; 1 volunteer
- 250 hours
- Removed some of the old Mile 4 silt fence
- Cleaned native seeds – 35 hours
- Collected native seeds – *Lupinus arcticus*, *Poa alpina*
- Mile 1 – 3 Park Rd. and Mile 238 – 231 Parks Highway. Pulled *Crepis tectorum*, *Melilotus albus*, *Hordeum jubatum*, *Vicia cracca*, and *Taraxacum officinalis*.
- 685 lbs.
- Teklanika Pit (Mile 27): 85 lbs. of *Descurainia sophia* (49 hours).

Need for Seed – East End – Aug. 10 – Aug. 13

- 6 SCA volunteers; 2 SCA interns; 3 volunteers
- 350 hours
- Collected 37 lbs. of *Hedysarum alpinum*, *Elymus sp.*, *Leymus innovatus*, *Oxytropis campestris*. Uncleaned seeds.
- Mile 12.5 – **Reveg** – planted native seeds, fertilizer, and annual rye (40 hrs.).
- Mile 24 (Upper Hogan Creek) – **Reveg** - planted native seeds, fertilizer, and annual rye (16 hrs.).

Need for Seed – West End – Aug. 17 – Aug. 22

- 6 SCA volunteers; 2 SCA interns; 2 volunteers; 1 NPS
- 440 hours
- 28 lbs. of *Hedysarum alpinum*, *Elymus sp.*, *Leymus innovatus*, *Arnica lessingii*, *Oxytropis campestris*, *Calamagrostis canadensis*. Uncleaned seeds.

- Mile 85 – Wonder Lake Pump House – **Reveg** - planted native seeds and fertilizer (9 hrs.).

SCA Intern – Cecilia Bedard – May 18 - Aug. 28

- 1 volunteer
- 545 hours
- Pulled many invasive plants and mapped them with a GPS. Participated and assisted with Dande Deveg East and West, Invasive Eradication in July, and Need for Seed East and West. She also cleaned many native seeds.

SCA Intern – Andy T. Smith – May 18 – Sept. 4

- 1 volunteer
- 475 hours
- Pulled many invasive plants and mapped them with a GPS. Participated and assisted with Dande Deveg East and West, Invasive Eradication in July, and Need for Seed East and West. He also cleaned many native seeds.

SCA CREW VOLUNTEERS = 6 members x 5 weeks x 40 hrs. /week = 1200 hours

SCA INTERNS = 2 interns = 1040 hours

OTHER VOLUNTEERS = 8 volunteers for 150 volunteer hours

TOTAL = 16 VOLUNTEERS FOR 2390 HOURS

INVASIVES ERADICATED - TOTALS

***Taraxacum officinale* (dandelions):** 621 lbs. – found mainly mile 1-43 Park Rd. and mile 72 - 92 Park Rd.

***Crepis tectorum* (narrowleaf hawksbeard):** 105 lbs. – found mainly in the Old Sewage Lagoon; along mile 1 of the Park Rd. and ARAMARK bus parking lot. Some also found in the recently reveged areas at Mile 237.25 Parks Hwy.

***Melilotus alba* (tall white sweetclover):** 24 lbs. – found mainly at Mile 238 and Mile 231 Parks Hwy.

***Vicia cracca* (bird vetch):** 200 lbs. (LOTS of dirt) – found Mile 240 George Parks Hwy; Mile 231.75 Parks Hwy and Denali Education Center. Sprayed herbicide on 5 small populations Mile 1 Park Rd. in 2012. Only 1 of those populations reappeared in 2014.

***Descurainia sophia* (Flixweed):** 755 lbs. – found mainly at the Teklanika Pit (Mile 28) and in the recently revegetated areas of Mile 4 and Sanctuary Hill (Mile 24).

***Tripleurospermum perforate* (scentless false mayweed):** 0 lbs. – was found at the Railroad tracks – Denali Depot and Shaffer Bldg. in 2012.

***Linaria vulgaris* (yellow toadflax):** 0 lb. – was found at the Railroad tracks - Denali Depot

***Hieracium umbellatum* (narrowleaf hawkweed):** 0 lbs. – was found at Mile 231.75

***Hordeum jubatum* (foxtail barley):** 520 lbs. – found scattered Mile 1 – 2 Park Rd.; in recently reveged areas – Shaffer Bldg., Mile 237.25 Parks Hwy., CLA Bldg., Kennels Road; Mountain Vista Rest Area – Mile 12.75 Park Rd.

***Trifolium pratense* (red clover):** 0 lbs. – was found at Mile 1 Park Rd.

***Lupinus polyphyllus* (bigleaf lupine):** 0 lbs. – was found at Mile 7 pull-out Park Rd.

***Silene noctiflora* (night-blooming cockle):** 0 lbs. – Kantishna Horse Corral in 2012.

***Galeopsis bifida* (Hempnettle):** 0 lb. – was found at Kantishna Horse Corral

TOTAL Invasives pulled = 2225 lbs.

2015 STATS –

Exotic Plant Management Team (EPMT) staff surveyed: 74.16 acres

Infested with invasive plants: 5.69 acres

EPMT staff treated: 4.74 acres

NATIVE SEEDS COLLECTED

East End:

Hedysarum alpinum: 14 lbs.

Oxytropis campestris: 12 lbs.

Elymus sp.: 9 lbs.

Leymus innovatus: 2 lbs.

TOTAL = 37 LBS.

West End:

Hedysarum alpinum: 3 lbs.

Oxytropis campestris: 3 lbs.

Elymus sp.: 12 lbs.

Leymus innovatus: 5 lbs.

Calamagrostis canadensis: 3 lbs.

Arnica lessingii: 1 lb.

Delphinium glaucum: .5 lbs.

Aster sibericus: .5 lbs.

TOTAL = 28 LBS.

Native seeds collected (uncleaned) total = 65 lbs.

Areas revegetated by planting native seeds = 2.10 acres:

- Rock Creek Bridge - Mile 3 – 6 SCA and 2 SCA interns assisted in planting and raking native seeds, fertilizer, and annual rye.
- P640 House – Mile 3.1 - 2 SCA interns assisted in planting and raking native seeds, fertilizer, and annual rye.
- Eagle's Nest – Mile 68 - 2 SCA interns assisted in planting and raking native seeds, fertilizer, and annual rye.
- Eldorado/Moose Creek - Mile 90 – 6 SCA and 2 SCA interns assisted in planting, and raking annual rye. Also planted willow stakes.
- Mile 12.5 – 6 SCA and 2 SCA interns assisted in planting and raking native seeds, fertilizer and annual rye.
- Upper Hogan Creek – Mile 24 - 6 SCA and 2 SCA interns assisted in planting and raking native seeds, fertilizer and annual rye.
- Wonder Lake Pump House – Mile 85 – 6 SCA assisted in planting native seeds and fertilizer.

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

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