

# 2016 Annual Report

## Spalding's Catchfly, *Silene spaldingii*, Wallowa Lake Key Conservation Area

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# INTRODUCTION

## Spalding's Catchfly

Spalding's catchfly (*Silene spaldingii*), is an herbaceous perennial plant in the pink family (Caryophyllaceae). It is found in bunchgrass grasslands, sagebrush-steppe, and occasionally in open pine communities in eastern Washington, northeastern Oregon, west-central Idaho, western Montana, and a very small portion of British Columbia, Canada. Henry Spalding first collected the plant around 1846 near the Clearwater River in Idaho (near the Spalding site of Nez Perce National Historical Park) (Oliphant 1934) and it was later described by Sereno Watson in 1875, based on the Spalding material (Watson 1875). Other common names besides Spalding's catchfly include Spalding's silene, and Spalding's campion. Spalding's catchfly can be confused with similar appearing members of the *Silene* genus that occur within its range. Scouler's catchfly (*Silene scouleri*) is the species most likely to be confused with Spalding's catchfly within the area considered in this report (Figure 1).

The Oregon Department of Agriculture listed Spalding's catchfly as endangered in the State of Oregon in 1995, in response to the increasing potential for extinction due to habitat loss and degradation. The plant was federally listed as threatened under the Endangered Species Act on October 10, 2001 (U.S. Fish and Wildlife Service 2001), and a recovery plan was released on October 15, 2007 with the goal of protecting and maintaining reproducing, self-sustaining populations.

Spalding's catchfly emerges in the spring and dies back to below ground level in the fall. Seedlings generally sprout in spring, form rosettes the first year, and occasionally flower the second year. The plant typically blooms from mid-July through August, sometimes September. Fruits mature from August until September and one stem may have both flowers and mature fruit capsules at the same time. The plants, ranging in height from 20 to 76 centimeters (8 to 30 inches), rise from a persistent caudex atop a long taproot. Most commonly, plants are found with only one stem but often multiple stems are present. The lanceolate leaves which are 5 to 8 centimeters (2 to 3 inches) in length are opposite and attach to the stem at swollen nodes. The approximately 1.5 centimeters (0.6 inch) corollas are greenish-white with petal blades 1-2 millimeters (~0.02 inch) that extend only past the calyx. Normally 3 to 20, though sometimes more than 100, flowers are positioned horizontally near the top of the plant in a branched inflorescence (Hitchcock and Cronquist 1973). The leaves, stems and calyx of the plant are covered in sticky glandular-pubescent hairs (Figure 2). These hairs collect foreign material including insects providing the common name "catchfly."

Spalding's catchfly plants can be undetectable in a given year during periods of dormancy when the extensive root structure does not produce above-ground shoots. Dormancy may last as long as five years and may be affected by the availability of resources and environmental variation (Lesica 1999, Lesica and Crone 2007, Taylor et al. 2012). Because of the variation in detectability

of this plant, multiple year studies are necessary to determine the strength and stability of any population of Spalding's catchfly.

Spalding's catchfly plants will be found in one of four stages throughout the year: rosettes (basal leaves), vegetative (non-flowering stems), reproductive (flowering/fruiting), or dormant (Lesica and Crone 2007). The methods described in this report are intended to track changes in individuals and the population through annual, and multiple year, studies. The current study is a continuation of efforts conducted in 2010 – 2015 (Elseth et al. 2012, Jocius 2013, Moholt 2013, 2014, 2015). For consistency and comparability of data, methods that were used in this study follow, as closely as possible, those used by Elseth et al. 2012, Jocius 2013, and Moholt 2013, 2014, 2015.



**Figure 1.** Spalding's catchfly (*Silene spaldingii*) versus Scouler's catchfly (*Silene scouleri*).

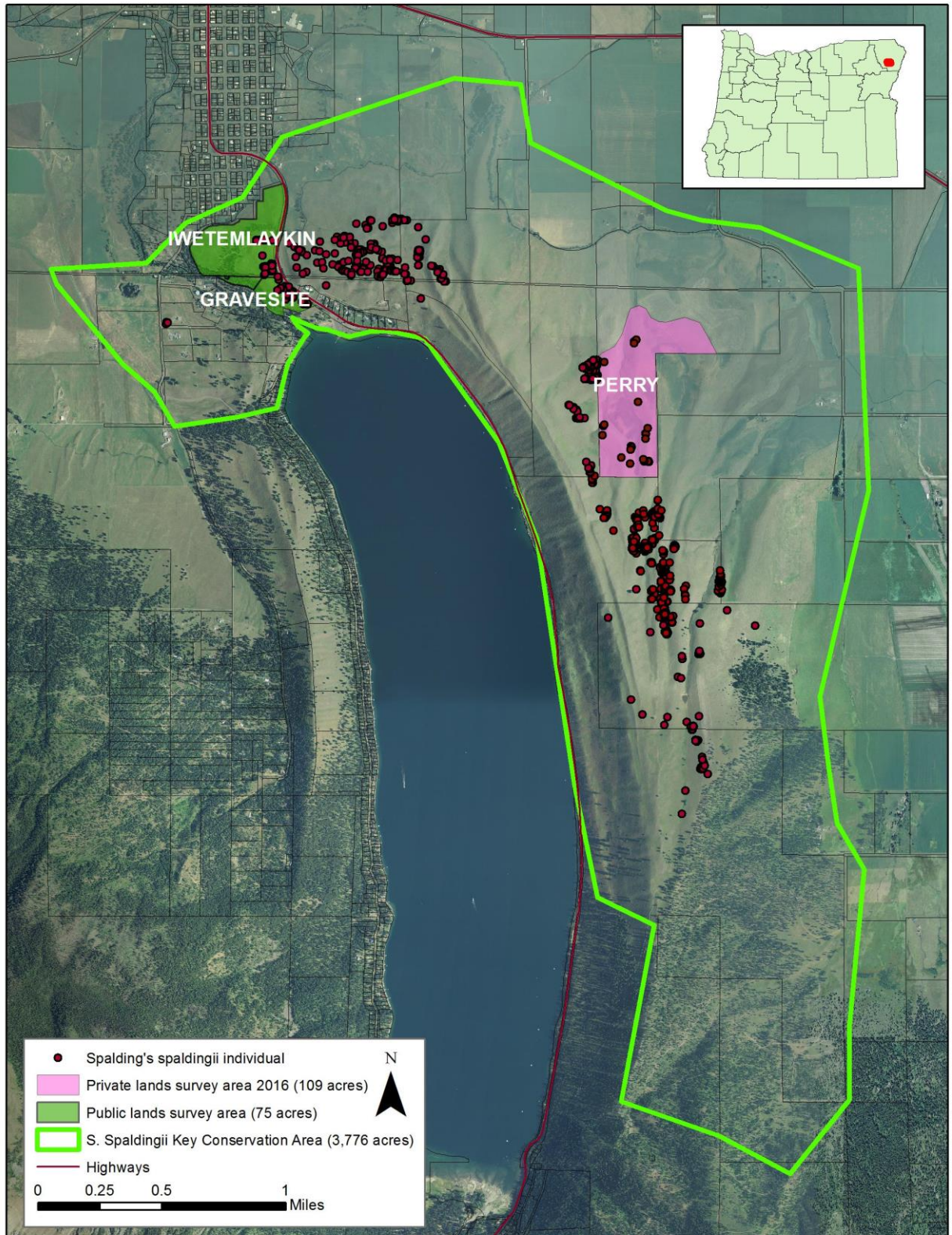


**Figure 2.** Spalding's catchfly (*Silene spaldingii*) with short petal blades and dense sticky hairs.

Photo- © Kendrick Moholt

## Site Description

The current project was conducted as part of an ongoing effort to locate and monitor Spalding's catchfly plants within the area designated as the Wallowa Lake Key Conservation Area (see Figure 3) which covers 3,375 acres. This area is located in Wallowa County, Oregon at the head of the Wallowa Valley in the glacial till soils on the terminal and east lateral moraine of Wallowa Lake. In 1898, William Cusick was the first to document *S. spaldingii* in the Wallowa Lake area (Oregon Biodiversity Information Center 2009). The Wallowa Valley is within the physiographic region designated as the Blue Mountain Basins (U.S. Fish and Wildlife Service 2007). The majority of the Wallowa Lake Key Conservation Area is located on privately owned land. In 2016, an additional survey effort was made to locate and record new occurrences of Spalding's catchfly on approximately 110 acres of private land, labeled as the Perry property in Figure 3. The long-term monitoring efforts that occur within the conservation area have been focused on 13 acres held in trust by the Department of the Interior for the Nez Perce and Umatilla Tribes, but managed by the National Park Service (Old Chief Joseph Gravesite and Cemetery) and on 62 acres purchased by a coalition of the Oregon Parks and Recreation Department, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Reservation, Confederated Tribes of the Colville Reservation and the Oregon State Parks Trust (Iwetemlaykin State Heritage Site).



**Figure 3.** The Spalding's catchfly Wallowa Lake Key Conservation Area.

## STUDY OBJECTIVES

The goal of ongoing monitoring and survey efforts within the Wallowa Lake Key Conservation Area is to obtain information that will aid management and restoration decisions critical to ensuring that the Spalding's catchfly population in the Wallowa Lake Area is protected, reproductively active and self-sustaining.

The primary objectives of the 2016 Wallowa Lake Spalding's catchfly investigation were to:

- Monitor Spalding's catchfly occurrences at Iwetemlaykin State Heritage Site & the Old Chief Joseph Gravesite and to collect reproductive output data in continuation of the ongoing monitoring program started in 2010.
- Continue the collection of information needed to implement the management plan for Spalding's catchfly in the Wallowa Lake Key Conservation Area.
- Conduct surveys to locate and map previously unknown individual Spalding's catchfly plants and subpopulations on private land in the Wallowa Lake Key Conservation Area.

## METHODS

### 2016 Plant Occurrences at Iwetemlaykin State Heritage Site & Old Chief Joseph Gravesite

As stated by Elseth et al. 2012:

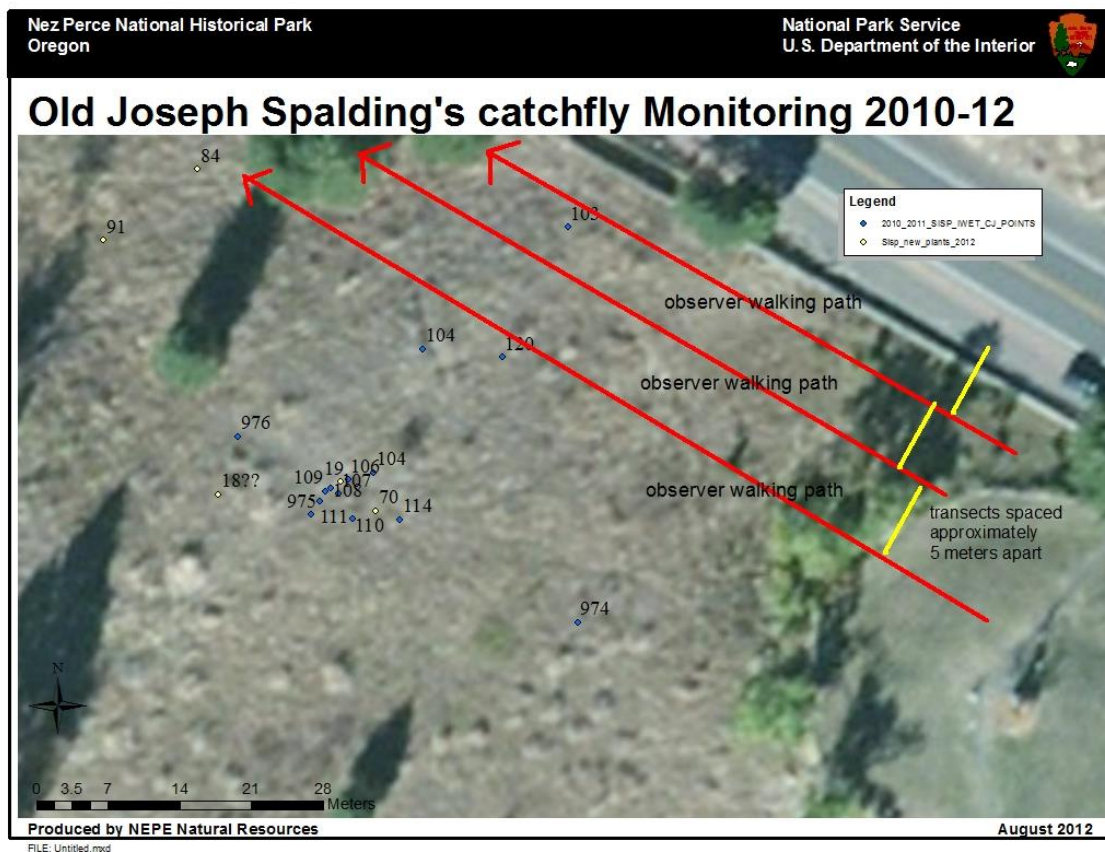
"Detailed monitoring protocols for accurately estimating the size of populations of *Silene spaldingii* in a variety of habitats have been developed (Lichthardt and Gray 2003, Hill and Gray 2005, Lesica and Crone 2007, Taylor et al. 2009). However, monitoring the population at the Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite and Cemetery site did not require a population size estimation technique, as the small number of plants present here could be censused individually."

#### *Phase 1:*

A Bio-Resources, Inc. botanist coordinated with the Wallowa Land Trust who provided experienced partner agency personnel and volunteers to assist with the inventory of Iwetemlaykin State Heritage Site and Old Chief Joseph Gravesite. On August 5, 2016, inventory participants were spaced in teams approximately five meters apart on the 13-acre Old Chief Joseph Gravesite property. The five meter-spaced transects were walked approximately parallel to the highway from southeast to northwest. Upon completing this sweep, the inventory teams moved west along the northern boundary fence and reestablished a new series of transects approximately five meters

from the western most transect on the previous run. This sweep was conducted from the northern fence to the southern fence also spaced five meters apart. This allowed the teams to cover the entire site, as the western most inventory transect on the second sweep abuts the western boundary of the property (see Figure 4).

Using the same technique, a survey was conducted on the Iwetemlaykin State Heritage Site property. Crews walked transects from south to north in the same pattern as described above, marking Spalding's catchfly sites accordingly. When Spalding's catchfly plants were encountered plants were marked with pin flags. Whenever a plant was observed at least two other observers, including one botanist, verified that the plant was Spalding's catchfly (*Silene spaldingii*) and not another *Silene* species.



**Figure 4.** Data collection methodology from 2010-2015 also used in 2016 showing observer walking paths and distance from one another (from: Jocius, 2013).

**Phase 2:**

Individual plants encountered during the inventory that were new to the project were recorded with a GPS unit and marked with permanent metal stakes and numbered tags. Previously, plants that were found very close to the Old Chief Joseph monument mound on the National Park Service site were only documented with a GPS point and not a permanent tag. However, no new



plants were found in this sensitive area in 2016.

***Phase 3:***

The team that included the Bio-Resources, Inc. botanist visited all known Spalding's catchfly sites, both new and previously recorded. Stem, browse, flower and fruit data were recorded for each plant on a data sheet (see Appendix A) and on a Trimble GPS unit. All temporary pin flags were removed.

## **Resurvey Late Season Plants at Iwetemlaykin and Old Chief Joseph Gravesite**

On September 7, 2016, a Bio-Resources, Inc. botanist revisited Iwetemlaykin State Heritage Site and Old Chief Joseph Gravesite to collect flowering, herbivory and fruiting data on all known individuals. New plants were marked and their locations were recorded with a GPS and added to the existing database with stem, browse, flower, and fruit data recorded.

## **Survey for 2016 Plant Occurrences on Private Land**

Wallowa Land Trust arranged permission to access private land owned by the Perry family on the East Wallowa Lake Moraine area (Figure 3). This area surrounds dryland farm fields and is currently not actively managed, but was grazed by livestock in the past. Areas selected for survey and data collection were those with high probability habitat where Spalding's catchfly has not previously been located. On August 4<sup>th</sup>, 2016 experienced partner agency personnel assisted a Bio-Resources, Inc. botanist with the inventory.

This inventory was conducted via an “intuitive” random meander method. With this approach, the examiner covers the entire area but focuses efforts, based on professional judgment, to habitats that appear best suited to harbor the target species. Although this method does not yield statistically interpretable results, it does provide a relatively high assurance that, if the target plant were present, it would be detected. In this study, a majority of the area surveyed contained some high-quality native bunchgrass habitat as well as areas of non-native annual grasses. In such habitat, methods entail walking parallel lines spaced approximately five meters apart and moving across the landscape visually scanning for this species. For ease of walking, these lines were generally kept on the contour of hills. Tracking on a handheld GPS was used to keep transects approximately five meters apart. When plants were located, they were recorded with the GPS and later mapped. Plants found on private lands were not marked with permanent metal rods or numbered tags.

## RESULTS

### 2016 Plant Occurrences at Iwetemlaykin State Heritage Site & Old Chief Joseph Gravesite

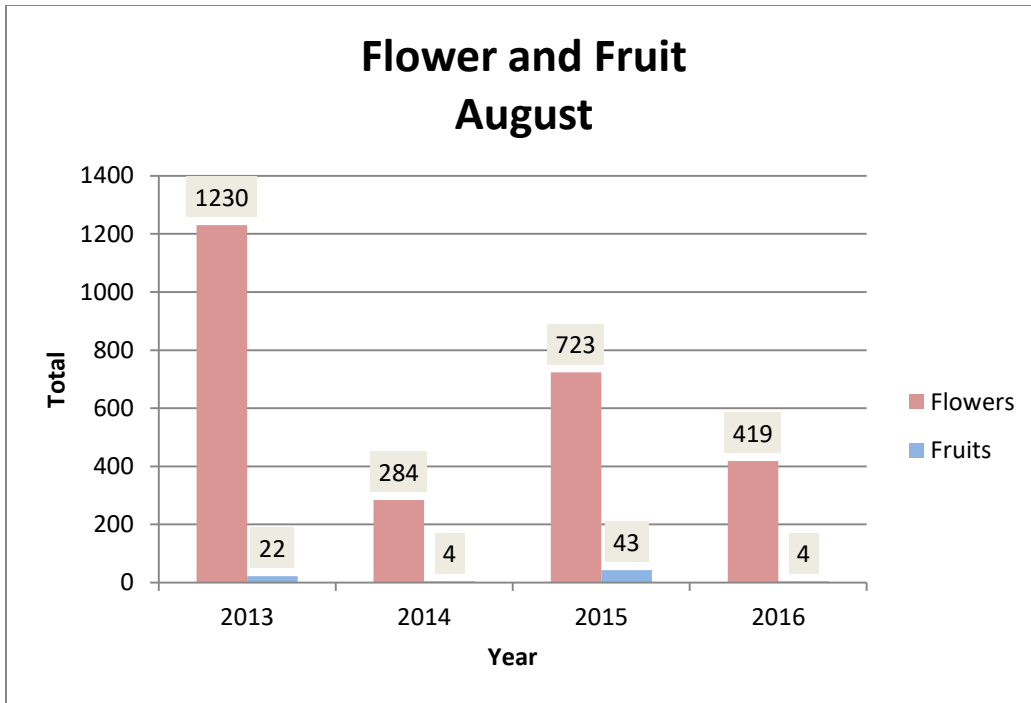
As noted above, the monitoring effort at the Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite and Cemetery site is an attempt to track all individual plants and is not based on a population estimate technique. Therefore, the data presented here are a representation of the potential reproductive output of the entire subpopulation found at the Iwetemlaykin Site and Old Chief Joseph Gravesite (Table 3).

During the August 5, 2016 survey of the Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite and Cemetery site, 43 plants were located. The plants had a mean of 1.33 stems per plant (see Table 2). At this relatively early date in the plants' breeding phenology, a majority of the plants (86%) were in flower while very few plants (4.7%) had fruits. This is a decrease in flowering and fruiting percentages compared to 2015; which were 92% and 53%, respectively (see Figures 5 and 6). Even at this early stage in the reproductive season for Spalding's catchfly, roughly a third of the stems (32%) showed signs of large mammal herbivory where at least 10% of a stem's biomass was estimated to have been removed (see Figure 9). This is an increase compared to 2015, where 24% of stems were browsed (see Figures 7 and 8). In the absence of herbivory, the number of plants in flower may have been higher. Of the 43 plants located in 2016 during the monitoring of the Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite, 3 plants were new to the study (see Appendix A).

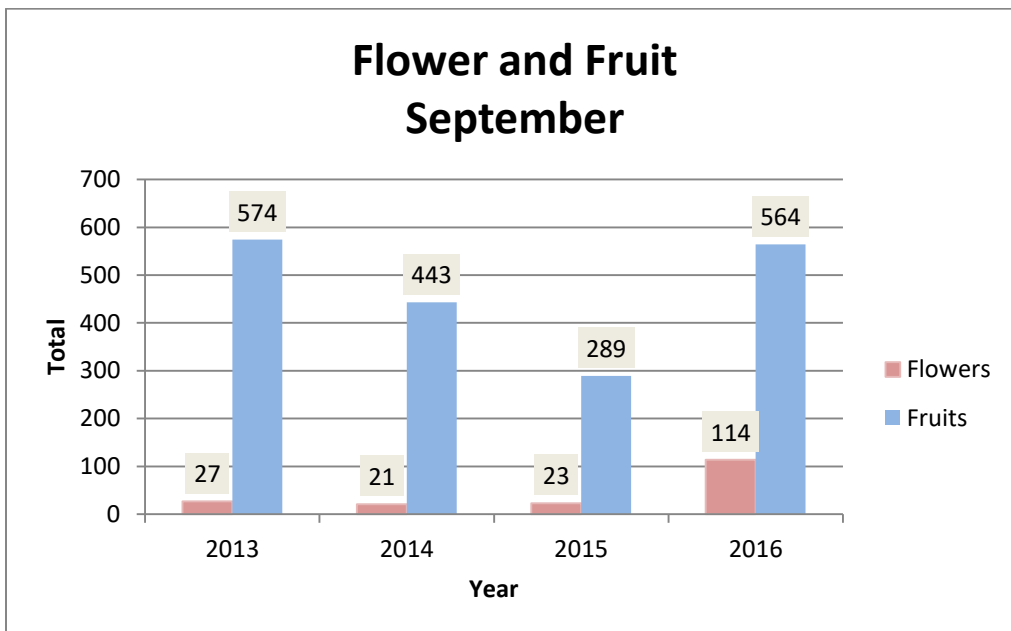
Appendix B presents reproductive output data from five years of monitoring (the first three years of data can be found in Jocius 2013). Caution should be used when comparing these data among years because plants may not have been observed during identical points in the subpopulations breeding phenology (see Discussion).

**Table 1.** Summary of August 5, 2016 Monitoring Data at Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite (number of individual plants, n=43).

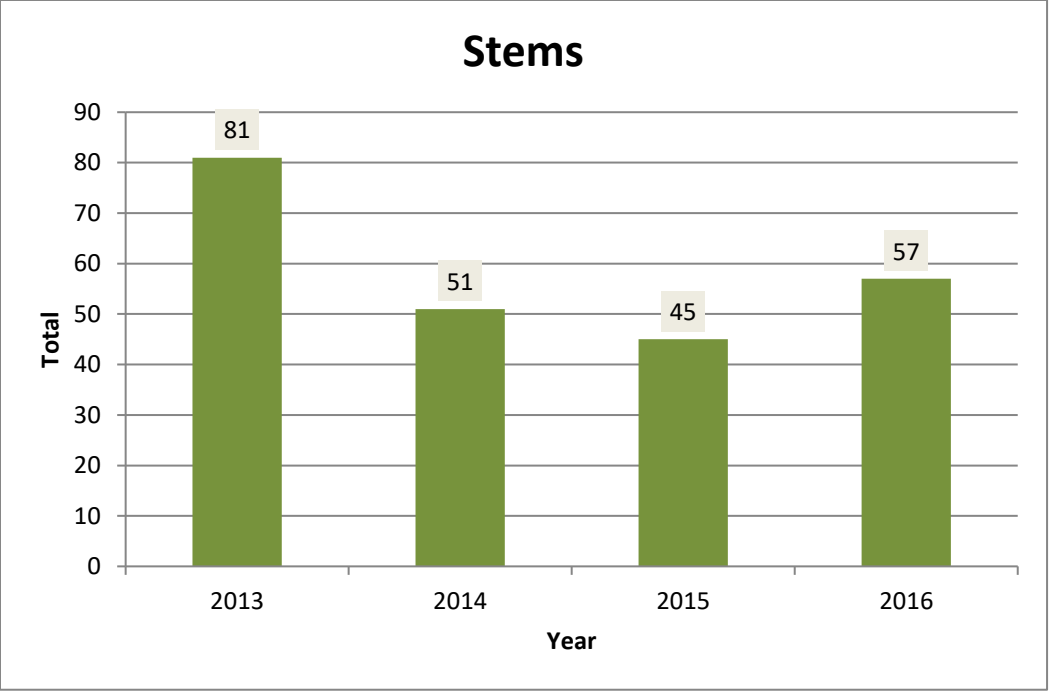
	<i>No. of stems</i>	<i>Browsed stem</i>	<i>No. of flowers</i>	<i>Fruits</i>
Total	57	18	419	4
Mean	1.33	0.42	9.74	0.09
Median	1	0	8	0
Standard Deviation	0.81	0.91	8.46	0.48
Standard Error	0.12	0.14	1.46	0.09
Minimum	1	0	0	0
Maximum	4	4	32	3



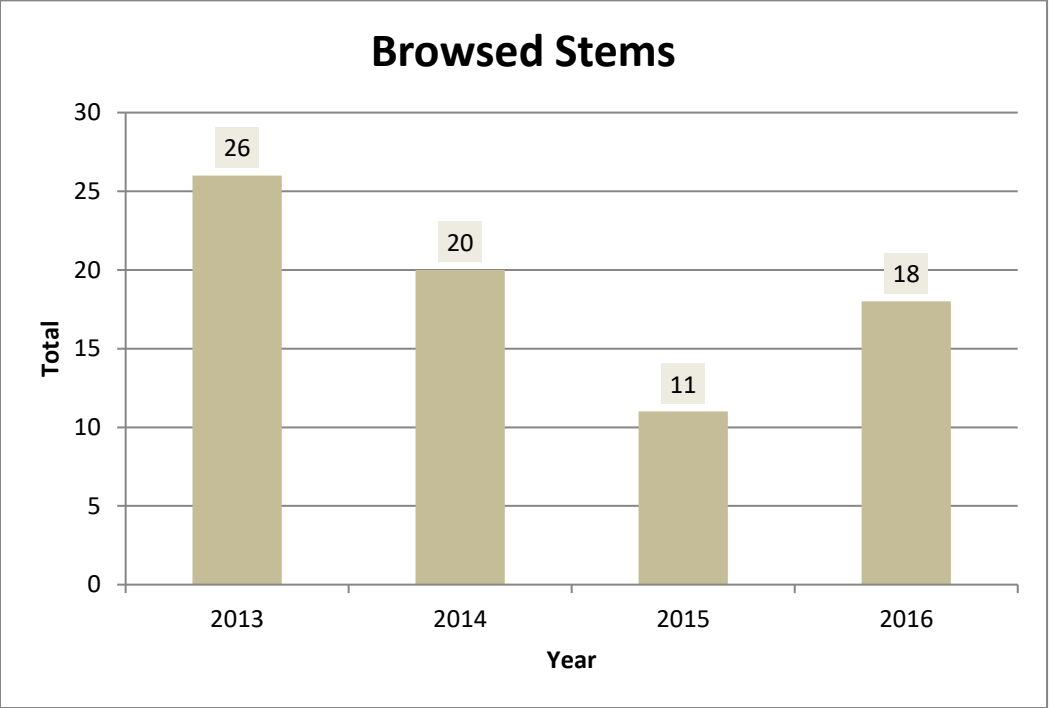
**Figure 5.** Total number of flowers and fruit counted during August surveys from 2013 to 2016.



**Figure 6.** Total number of flowers and fruit counted during the resurvey (in September) from 2013 to 2016.



**Figure 7.** Total number of stems counted during August surveys from 2013 to 2016.



**Figure 8.** Total number of browsed stems counted during August surveys from 2013 to 2016.

## Resurvey Late Season Plants at Iwetemlaykin and Old Chief Joseph Gravesite

A revisit to the Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite on September 7, 2016 located 36 detectable plants. One plant previously located on August 5, 2016 was no longer present (Tag 96). The plants had a mean 1.33 stems per plant (see Table 2). The August survey found plants primarily in flower. This September survey found plants significantly advanced in their phenology with the majority of the plants, 86%, in fruit. However, 50% of the plants were still flowering, which is much greater than the 9% flowering in September of 2015. The number of stems showing signs of herbivory had a slight decrease later in the year (22% of stems in September versus 32% of stems in August).

**Table 2.** Summary of September 7, 2016 Monitoring Data at Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite (n=36).

	<i>No. of stems</i>	<i>Browsed stem</i>	<i>No. of flowers</i>	<i>Fruits</i>
Total	50	11	114	564
Mean	1.33	0.42	9.74	0.09
Median	1	0	1	10
Standard Deviation	0.84	0.62	6.54	26.0
Standard Error	0.14	0.10	1.09	4.34
Minimum	1	0	0	0
Maximum	4	2	30	153



**Figure 9.** A Spalding's catchfly plant showing signs of heavy browsing, likely from deer.

Photo- © Kendrick Moholt

**Table 3.** September 7, 2016 End of Season Resurvey of Iwetemlaykin State Heritage Site and the Old Chief Joseph Gravesite (- = no data, no plant)

<b>Tag number</b>	<b>Total number of stems</b>	<b>Number of browsed stems</b>	<b>Number of flowers (per plant)</b>	<b>Number of fruits (per plant)</b>
1	-	-	-	-
7	Tag not located	-	-	-
9	Tag not located	-	-	-
18	Tag not located	-	-	-
19	-	-	-	-
24	Tag not located	-	-	-
28	Tag not located	-	-	-
29	Tag not located	-	-	-
38	Tag not located	-	-	-
43	-	-	-	-
45	Tag not located	-	-	-
48	1	0	21	28
51	1	0	1	10
54	1	0	5	23
55	-	-	-	-
56	-	-	-	-
57	-	-	-	-
59	-	-	-	-
60	-	-	-	-
61	2	0	1	4
62	-	-	-	-
63	-	-	-	-
63a	1	0	0	0
64	Tag not located	-	-	-
65	Tag not located	-	-	-
66	Tag not located	-	-	-
67	-	-	-	-
68	1	0	0	12
72	Tag not located	-	-	-
75	-	-	-	-
76	2	0	30	153
77	-	-	-	-
78	1	0	0	2
81	-	-	-	-
83	-	-	-	-
84	1	0	2	26
85	1	0	0	2

<b>Tag number</b>	<b>Total number of stems</b>	<b>Number of browsed stems</b>	<b>Number of flowers (per plant)</b>	<b>Number of fruits (per plant)</b>
90	Tag not located	-	-	-
91	-	-	-	-
92	1	0	0	12
95	-	-	-	-
96	0	-	-	-
98	1	0	2	12
99	-	-	-	-
100	3	0	0	10
101	1	0	3	22
102	Tag not located	-	-	-
103	-	-	-	-
104	1	1	0	0
105	1	0	1	15
106	-	-	-	-
107	-	-	-	-
108	-	-	-	-
109	1	0	0	10
110	1	0	0	6
111	-	-	-	-
112	1	0	11	54
113	1	0	0	23
114	-	-	-	-
115	1	0	2	7
116	1	0	0	9
117	1	0	0	0
118	1	0	0	10
119	1	0	1	10
120	-	-	-	-
121	-	-	-	-
122	2	1	0	0
123	Tag not located	-	-	-
124	-	-	-	-
125	-	-	-	-
126	-	-	-	-
127	Tag not located	-	-	-
128	-	-	-	-
129	-	-	-	-
130	-	-	-	-
131	-	-	-	-
132	-	-	-	-
133	-	-	-	-



<b>Tag number</b>	<b>Total number of stems</b>	<b>Number of browsed stems</b>	<b>Number of flowers (per plant)</b>	<b>Number of fruits (per plant)</b>
135	-	-	-	-
136	-	-	-	-
137	Tag not located	-	-	-
138	Tag not located	-	-	-
139	-	-	-	-
240	1	1	0	3
264	1	0	9	5
265	-	-	-	-
289	3	2	1	14
293	-	-	-	-
968	-	-	-	-
969	4	2	2	2
970	1	1	1	7
971	Tag not located	-	-	-
972	Tag not located	-	-	-
973	Tag not located	-	-	-
974	Tag not located	-	-	-
975	-	-	-	-
976	2	2	0	0
977	Tag not located	-	-	-
978	-	-	-	-
979	1	0	0	21
980	1	0	0	4
981	4	1	15	27
982	-	-	-	-
983	-	-	-	-
984	Tag not located	-	-	-
985	Tag not located	-	-	-
986	Tag not located	-	-	-
987	Tag not located	-	-	-

## Survey for 2016 Plant Occurrences on Private Land

Surveys of private land with high probability habitat for Spalding's catchfly in 2016 located 32 plants that had not previously been documented (see Appendix B). These plants were found on the East Moraine of Wallowa Lake on the Perry property. The majority of the habitat on the East Moraine appears to be managed in a way that poses minimal threat to Spalding's catchfly. The exception to this observation is the potential expansion of dryland grain farming which could eliminate habitat and subpopulations.

The total number of mature Spalding's catchfly plants now known within the Wallowa Lake Key Conservation Area is approximately 1341 individuals. However, approximately 95 percent of the plants have been found on private land. This current population estimate is significant because the U.S. Fish and Wildlife Service Spalding's catchfly Recovery Plan lists one of the objectives of its recovery program to be documenting at least "twenty-seven populations, with at least 500 reproducing *Silene spaldingii* individuals" (U.S. Fish and Wildlife Service 2007). At the time the recovery plan was written, only 10 populations with more than 500 individuals were known.

The Perry property land surveyed in 2016 had a few invasive species present, but was relatively free from infestation by noxious weeds on the Wallowa County "A" List. It appears that these invasives pose little threat to Spalding's catchfly and thus their location was not recorded.

## DISCUSSION

In 2016, Spalding's catchfly was monitored at the Wallowa Lake Key Conservation Area, within the public land portion of the population. Individual plants were monitored in this location through the reproductive season. The early August survey found most of the individual plants in bloom with roughly one in three stems browsed by mammalian herbivores, primarily deer. The monitoring in the early part of September found most plants in fruit with a little more than one in five stems browsed. The total number of fruits recorded drastically increased from four fruits in early August to 564 fruits in September. Clearly, a late season resurvey is required to determine a maximum reproductive potential based on; number of fruits, seeds produced, and the viability of these seeds as proposed by Elseth et al. 2012. Comparison of reproductive output among years should take into consideration plants' phenology when observations are made. Monitoring in 2016 was the seventh year of tracking the Wallowa Lake population on public land. When possible, comparison of reproductive output from year to year should take into consideration multiple observations within each year. A comparison of the maximum number of viable fruits produced in a year could be a more appropriate measure, as long as there are enough site visits to ensure observations are made during peak fruit phenology. However, the timing of maximum fruit production may vary from plant to plant within a given year. In addition, an estimate of actual reproductive output made too early in a given season, calculated by the number of fruits, could provide an overestimate due to early senescence, herbivory, seed predation or aborted fruit. In the future, the author recommends multiple observations of plants late in their phenology (i.e. mid-September through mid-October). An understanding of successful seed germination in the field and survivorship to fruiting age would greatly improve the assessment of the stability of this population.

Surveys in 2016 of the Perry property (private land) were successful in locating 32 previously undocumented mature Spalding's catchfly plants (see Appendix C). There are still portions of the Wallowa Lake Key Conservation Area that have yet to be surveyed. It is recommended that, if permission is granted and funding is available, that this survey effort be continued in 2017 similar to how it is conducted on The Nature Conservancy and US Forest Service Lands.

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## Appendix B

### Spalding's catchfly (*Silene spaldingii*) reproductive output data 2013-2016

Survey data for 2013 collected on August 8<sup>th</sup>

Survey data for 2014 collected on August 6<sup>th</sup>

Survey data for 2015 collected on August 5<sup>th</sup>

Survey data for 2016 collected on August 5<sup>th</sup>

Tag ID	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	3	-	-		3	-	-		1	-	-	-	0	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	2	1	1	-	2	1	0	-	6	1	25	-	0	0	2	-
24	3	3	-	-	0	0	-	-	15	3	-	-	0	0	-	-
28	-	1	-	-	-	0	-	-	-	7	-	-	-	0	-	-
29	1	-	1	-	0	-	0	-	45	-	6	-	0	-	0	-
38	-	-	1	-	-	-	0	-	-	-	9	-	-	-	0	-
43	2	-	-	-	0	-	-	-	116	-	-	-	0	-	-	-
48	1	-	1	1	0	-	1	0	20	-	2	8	0	-	0	0
51 (new plant)	-	-	-	1	-	-	-	0	-	-	-	10	-	-	-	0
54	1	-	1	1	1	-	1	0	7	-	0	12	0	-	0	0

Tag ID	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
56	1	-	-	-	0	-	-	-	4	-	-	-	0	-	-	-
57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
59	2	-	-	-	1	-	-	-	4	-	-	-	0	-	-	-
60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
61	2	-	1	1	0	-	0	0	20	-	56	19	0	-	1	0
62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
63a (new plant)	-	-	-	1	-	-	-	0	-	-	-	7	-	-	-	0
64	1	-	-	-	1	-	-	-	13	-	-	-	0	-	-	-
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
68	1	1	1	1	0	0	0	0	10	5	11	11	0	0	1	0
70	1	-	-	-	0	-	-	-	34	-	-	-	22	-	-	-
72	1	1	1	-	0	0	0	-	4	3	11	-	0	0	0	-
75	1	-	-	-	0	-	-	-	50	-	-	-	0	-	-	-
76	1	-	3	2	1	-	2	0	10	-	169	26	0	-	4	0



Tag ID	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
77	1	-	-	-	0	-	-	-	11	-	-	-	0	-	-	-
78 (new plant)	-	-	-	1	-	-	-	0	-	-	-	7	-	-	-	0
81	1	-	-	-	0	-	-	-	9	-	-	-	0	-	-	-
83	1	1	1	-	0	0	0	-	16	7	15	-	0	0	3	-
84	1	1	1	1	0	0	0	0	30	8	4	20	0	0	0	0
85	-	-	-	1	-	-	-	0	-	-	-	5	-	-	-	0
87	2	-	-	1	0	-	-	0	23	-	-	11	0	-	-	0
90	-	-	1	-	-	-	0	-	-	-	37	-	-	-	1	-
91	1	1	-	-	0	0	-	-	4	7	-	-	0	0	-	-
92	1	1	1	1	0	1	0	0	20	0	19	18	0	0	0	1
95	1	-	-	-	0	-	-	-	16	-	-	-	0	-	-	-
96	1	1	-	1	1	1	-	0	0	5	-	1	0	0	-	0
98	1	1	-	1	1	1	-	0	9	0	-	11	0	0	-	0
99	-	2	1	-	-	2	0	-	-	0	11	-	-	0	0	-
100	4	4	2	3	1	0	1	3	46	29	33	28	0	0	0	0
101	1	2	-	1	1	2	-	0	0	0	-	16	0	0	-	0
102	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
103	1	-	1	1	1	-	1	1	1	-	16	0	0	-	0	0

Tag ID	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
104	1	1	1	1	1	1	1	0	8	4	4	6	0	4	6	3
105	-	-	-	1	-	-	-	0	-	-	-	11	-	-	-	0
106	1	-	1	1	0	-	0	1	22	-	6	0	0	-	0	0
107	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
109	1	1	1	1	0	0	0	0	16	9	11	10	0	0	0	0
110	-	1	-	1	-	0	-	0	-	5	-	11	-	0	-	0
111	1	1	-	-	0	0	-	-	8	12	-	-	0	0	-	-
112	2	-	1	1	1	-	1	0	42	-	0	26	0	-	0	0
113	-	-	2	1	-	-	0	1	-	-	26	8	-	-	3	0
114	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
115	1	1	1	1	0	1	0	0	19	0	4	3	0	0	5	0
116	-	1	1	1	-	0	0	0	-	10	6	9	-	0	3	0
117	-	1	-	1	-	0	-	0	-	3	-	6	-	0	-	0
118	1	1	2	1	0	0	0	0	6	5	6	11	0	0	7	0
119	1	1	1	1	0	0	0	0	35	17	13	6	0	0	5	0
120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	3	-	-	-	1	-	-	-	10	-	-	-	0	-	-	-

Tag ID	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
122	2	2	-	1	0	0	-	0	25	17	-	8	0	0	-	0
123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
124	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
127	7	-	-	-	4	-	-	-	163	-	-	-	0	-	-	-
128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
130	2	-	-	-	0	-	-	-	35	-	-	-	0	-	-	-
131	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
132	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
134	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135	-	-	1	-	-	-	0	-	-	-	1	-	-	-	0	-
136	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
137	1	-	-	-	0	-	-	-	40	-	-	-	0	-	-	-
138	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
139	1	-	-	-	0	-	-	-	69	-	-	-	0	-	-	-

Tag ID	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
240	-	1	1	1	-	1	0	1	-	0	16	1	-	0	1	0
264	-	1	-	1	-	1	-	0	-	1	-	1	-	0	-	0
265	-	2	1	1	-	2	1	1	-	1	0	0	-	0	0	0
289	-	2	2	3	-	2	2	0	-	12	20	7	-	0	0	0
293	-	1	1	-	-	0	0	-	-	4	12	-	-	0	0	-
968	-	1	1	1	-	0	0	1	-	7	25	0	-	0	0	0
969	1	4	1	4	1	3	0	4	0	8	6	1	0	0	0	0
970	1	1	-	1	1	0	-	0	17	36	-	32	0	0	-	0
971	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
973	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
974	1	-	1	-	0	-	0	-	13	-	3	-	0	-	0	-
975	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
976	1	1	1	2	1	0	0	0	17	28	22	24	0	0	0	0
977	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
978	1	1	1	-	0	0	0	-	16	3	7	-	0	0	0	-
979	-	1	-	1	-	1	-	0	-	0	-	16	-	0	-	0
980	1	-	-	1	1	-	-	1	0	-	-	1	0	-	-	0

Tag ID	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
981	3	-	4	4	0	-	0	1	36	-	111	11	0	-	1	0
982	1	3	-	3	0	0	-	3	31	27	-	0	0	0	-	0
983	1	-	-	-	0	-	-	-	7	-	-	-	0	-	-	-
984	-	-	-	1	-	-	-	0	-	-	-	0	-	-	-	0
985	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
986	3	-	-	-	0	-	-	-	42	-	-	-	0	-	-	-
987	1	-	-	-	1	-	-	-	9	-	-	-	0	-	-	-
	Stems				Stems Browsed				Flowers				Fruits			
	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
<b>Means</b>	1.5	1.4	1.25	1.33	0.48	0.56	0.31	0.42	22.8	7.9	20.1	9.74	0.4	0.1	1.19	0.09
<b>Totals</b>	81	51	45	57	26	20	11	18	1230	284	723	419	22*	4*	43*	4*

\*See data from resurveys (2013-2016) for a more appropriate comparison

\*\*See Jocius 2013 for 2010-2012 data

## Appendix C

### New Spalding's catchfly (*Silene spaldingii*) plants found on the Iwetemlayin State Heritage Site and the Old Chief Joseph Gravesite

Tag ID	UTM Coordinates	
	Y	X
51	5020374	482480
63a	5020305	482661
78	5020572	482407

**Appendix D**  
**Spalding's catchfly (*Silene spaldingii*) plants found on private land in 2016**

Waypoint	UTM Coordinates	
	Y	X
1	5019277.88083	484864.12832
2	5019282.90793	484860.84899
3	5019281.87809	484858.99473
4	5019512.04501	484567.89832
5	5019307.35057	484684.11393
6	5019281.55199	484832.39877
7	5019281.77700	484831.22382
8	5019282.99941	484831.07002
9	5019462.94638	484841.84642
10	5019462.05574	484842.62792
11	5020064.25665	484767.75450
12	5019928.30767	484572.15757
13	5019519.58717	484573.82300
14	5019379.85295	484747.45208
15	5019379.18449	484748.23412
16	5020075.11077	484781.49307
17	5019266.22208	484739.73274
18	5019295.67614	484826.08505
19	5019670.03219	484793.21100
20	5019670.58709	484793.44742
21	5020075.11077	484781.49307
22	5019266.22208	484739.73274
23	5019295.67614	484826.08505

Waypoint	UTM Coordinates	
	Y	X
24	5019670.03219	484793.21100
25	5019670.58709	484793.44742
26	5020052.81890	484765.68962
27	5019372.96059	484749.31619
28	5019373.62754	484749.16107
29	5019498.68414	484856.27277
30	5019452.26446	484559.98864
31	5019428.10031	484840.08027
32	5019357.89669	484744.51676