

Rare Plant Monitoring in the Lakeview Resource Area



2018

Report to the Bureau of Land Management,
Lakeview District

Report prepared by Meaghan I. Petix,
Matt A. Bahm, A. Lisa Schomaker, and
Denise E. L. Giles
Institute for Applied Ecology



PREFACE

This report is the result of an agreement between the Institute for Applied Ecology (IAE) and the Bureau of Land Management (BLM). IAE is a non-profit organization dedicated to natural resource conservation, research, and education. Our aim is to provide a service to public and private agencies and individuals by developing and communicating information on ecosystems, species, and effective management strategies and by conducting research, monitoring, and experiments. IAE offers educational opportunities through 3-4 month internships. Our current activities are concentrated on rare and endangered plants and invasive species.



Questions regarding this report or IAE should be directed to:

Matt Bahm

Conservation Research Program Director

Institute for Applied Ecology

563 SW Jefferson Avenue

Corvallis, Oregon 97333

phone: 541-753-3099

email: mattab@appliedeco.org

ACKNOWLEDGMENTS

The authors thank the BLM Lakeview District for providing funding for this project. The following IAE staff and interns contributed their time and energy during the 2018 field season: Kristina Lopez, Jenn Thornhill, Michel Wiman, Nadav Moullem and Clarissa Rodriguez.

Cover photograph: Searching for *Melica stricta* at MEST_003 on June 19th, 2018. Photo: M. Petix.

Suggested Citation

Petix, M.I., M.A. Bahm, A.L. Schomaker, and D.E.L. Giles. 2018. Rare plant monitoring in the Lakeview Resource Area. Institute for Applied Ecology, Corvallis, Oregon and USDI Bureau of Land Management, Lakeview District. vi + 31 pp.

TABLE OF CONTENTS

PREFACE	II
ACKNOWLEDGMENTS	III
LIST OF TABLES	V
LIST OF FIGURES	V
EXECUTIVE SUMMARY	VI
INTRODUCTION	1
Project Objectives.....	1
METHODS	2
RESULTS	4
<i>Allium lemmonii</i> (ALLE3).....	4
<i>Astragalus tetrapterus</i> (ASTE10).....	4
<i>Botrychium crenulatum</i> (BOCR).....	5
<i>Caulanthus crassicaulis</i> (CACR11).....	6
<i>Elatine brachysperma</i> (ELBR5).....	6
<i>Ephemerum crassinervium</i> (EPCR)	6
<i>Eriogonum prociduum</i> (ERPR9)	6
<i>Galium serpenticum</i> var. <i>warnerense</i> (GASEW).....	6
<i>Heliotropium curassavicum</i> var. <i>obovatum</i> (HECUO2)	6
<i>Melica stricta</i> (MEST).....	7
<i>Mimulus latidens</i> (MILA4).....	7
<i>Orthotrichum holzingeri</i> (ORHO3).....	7
<i>Pleuropogon oregonus</i> (PLOR3).....	7
<i>Pogogyne floribunda</i> (POFL17).....	8
<i>Ranunculus andersonii</i> (RAAN).....	8
<i>Rorippa columbiae</i> (ROCO3)	8
<i>Scouleria marginata</i> (SCMA10).....	8
<i>Symphoricarpos longiflorus</i> (SYLO).....	8
CONCLUSIONS	11
LITERATURE CITED	12
APPENDIX A. SPECIES DESCRIPTIONS	13

LIST OF TABLES

Table 1. Species monitored in 2018 with their approximate bloom periods (shaded cells) and visit dates. Red text indicates no plants present. Detailed species information is included in Appendix A..... 3

Table 2. Summary of site visits by IAE staff for sensitive species in the Lakeview District in 2018. Species names in bold were not found during our surveys, and site names in bold did not contain the target species. Highlighted populations are currently being confirmed by OSU herbarium staff. 9

LIST OF FIGURES

Figure 1. Overview of areas surveyed in 2018 by IAE staff. A total of 43 existing species occurrence polygons (red) were visited, and target species were found in 29 of those. Two new polygons were added, bringing the total surveyed area to approximately 2,000 acres. Most surveyed area fell within the BLM Sagebrush Focal Area (grey). 2

Figure 2. Gravel substrate at ALLE3_325, with the target species (*Allium lemmonii*) in the open foreground and sagebrush surrounding. this polygon was extended to include an additional acre of habitat containing new plant observations..... 4

Figure 3. Polygons (left) and habitat overview photos (right) for two newly-observed *Astragalus tetrapterus* populations (NEW ASTE1 and NEW ASTE2). 5

Figure 4. Habitat (left) and close-up (right) of collected *Orthothrichum holzingeri* specimen along Deep Creek, June 26th, 2018. 7

Figure 5. Collection of *Scouleria marginata* from Deep Creek, June 26th, 2018..... 8

EXECUTIVE SUMMARY

During the spring and summer of 2018, we monitored 18 plant species (15 vascular, three non-vascular) listed as special status species (SSS) in the Bureau of Land Management's (BLM) Lakeview Resource Area. Approximately 2,000 acres were surveyed and 12 of the 18 target species were observed over the survey period stretching from April 11th to June 26th.

We observed four species that were not observed during the prior survey effort: *Allium lemmonii*, *Ranunculus andersonii*, *Orthotrichum holzingeri* (bryophyte), and *Scouleria marginata* (bryophyte). However, we did not find the following six species: *Elatine brachysperma*, *Mimulus latidens*, *Pleuropogon oreganus*, *Pogogyne floribunda*, *Rorippa columbiae*, *Ephemerum crassinervium* (bryophyte).

Three new populations of *Astragalus tetrapterus* were added to the database, and several existing polygons were expanded to incorporate new point observations. In a few cases, original occurrence polygons were moved to their current geographically-accurate population centers.

It is possible that some target species were missed due to visit timing and phenology, including *Mimulus latidens* and *Pleuropogon oreganus*, and future visits are recommended to assess populations of these species. It is recommended that future surveys be conducted for species not observed in our surveys in 2018. In order to maximize efficiency of future survey efforts, it may be advantageous to target surveys for some species in 'wet' years, as also recommended by previous surveyors.

A range of threats were observed across all sites including the presence of non-native annual grasses, as well as grazing by cattle, horses and native ungulates, impacts of manmade activities including roads and off-road vehicle use. For species more commonly found near water sources, annual hydrologic variability may impact these populations.

The lack of juniper at most of the surveyed sites, reduces the potential for impacts to rare plant populations. As long as juniper removal and habitat restoration plans take steps to minimize soil erosion, compaction, and disturbance, particularly in areas with tuffaceous soils, harm to rare plant populations will be minimal. In areas where juniper is present, disturbance should be minimized, equipment kept clean and weed free, and in areas where introduced grasses are present, species control should be considered prior to management actions.

Rare Plant Monitoring in the Lakeview Resource Area

REPORT TO THE BUREAU OF LAND MANAGEMENT, LAKEVIEW DISTRICT

INTRODUCTION

Eastern Oregon is home to nearly 15 million acres of priority and general sagebrush habitat designated for the conservation of the greater sage-grouse (*Centrocercus urophasianus*), a species that has been considered for federal listing as threatened or endangered under the Endangered Species Act (Bureau of Land Management 2015). The Lakeview District of the Bureau of Land Management (BLM) contains nearly 30% of Oregon's greater sage-grouse population (Foster 2018) and is currently implementing a landscape-scale sagebrush ecosystem restoration effort targeting juniper tree removal and invasive, annual grass reduction.

While these restoration efforts are vital to the preservation of the sage-grouse and sagebrush ecosystems, the potential impacts of restoration on Special Status Species (SSS) occurring in the region must also be considered. Many of these SSS plants occur only on small patches of specialized substrates (e.g. volcanic tuff), areas that could easily be damaged by restoration activities or invaded by non-native grasses. The most recent surveys for a subset of the SSS plants in this region were carried out in 2015 and 2016 (Grinter 2015; Petix and Bahm 2016). Continued monitoring is needed to ensure that these species are not harmed by restoration efforts and to provide accurate data for future monitoring and management of these populations.

Project Objectives

Monitor 15 SSS vascular plants and three bryophytes occurring in the Sagebrush Focal Area of the Lakeview Resource Area, Lakeview District BLM (Figure 1, Appendix A), including but not limited to the following:

- 1) Update previous monitoring efforts by revisiting documented sites and assessing and documenting abundance, reproduction, population trends, soil characteristics and potential threats.
- 2) Documentation of new sites and suitable habitat.
- 3) Collaboration with Lakeview BLM staff to develop map locations of suitable habitat for potential new survey locations (based on soils, etc.).
- 4) Compare current populations to previous monitoring data to assess current status and allow future comparison of population trends, and develop recommendations for management actions needed to ensure the long-term viability of these populations.

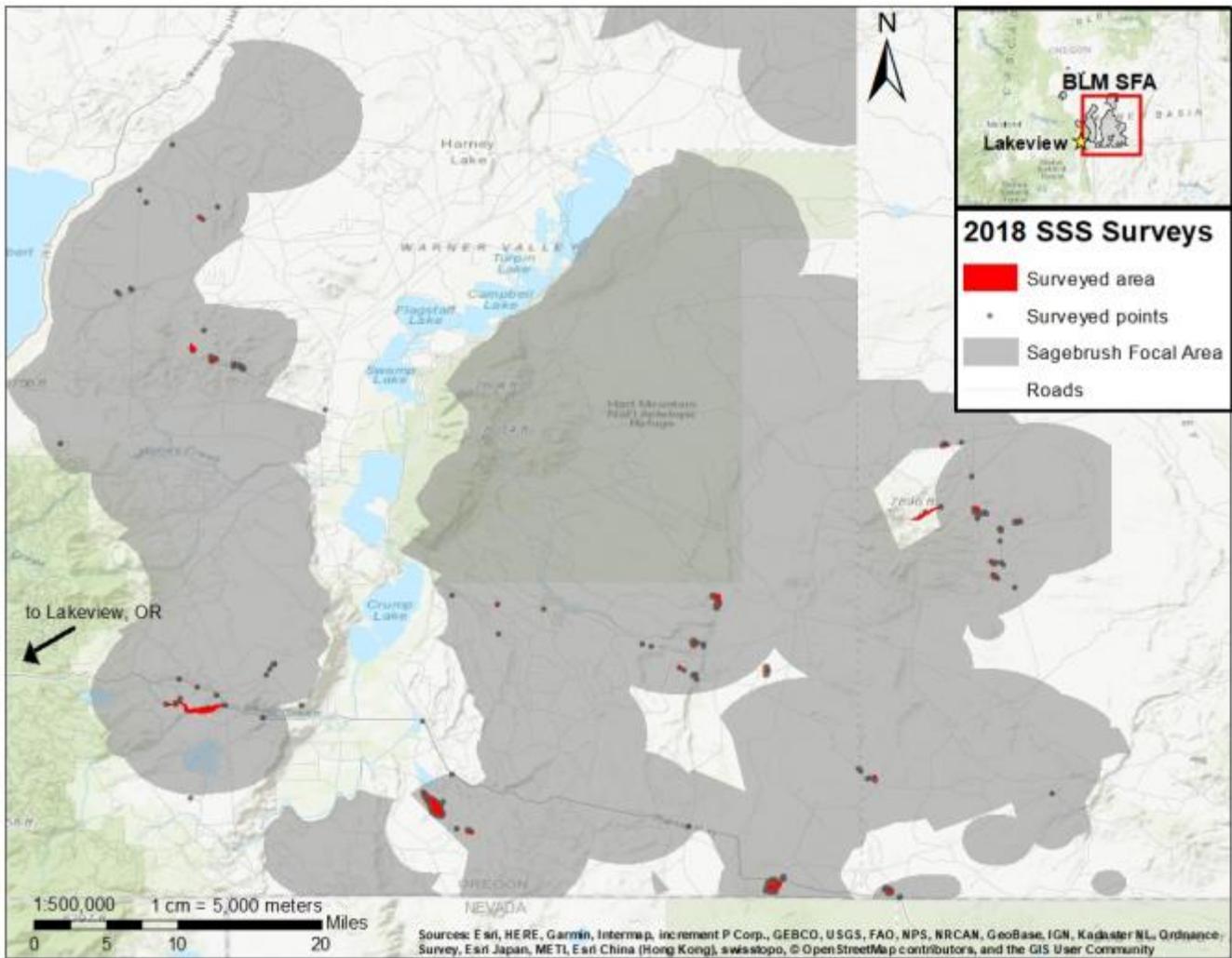


FIGURE 1. OVERVIEW OF AREAS SURVEYED IN 2018 BY IAE STAFF. A TOTAL OF 43 EXISTING SPECIES OCCURRENCE POLYGONS (RED) WERE VISITED, AND TARGET SPECIES WERE FOUND IN 29 OF THOSE. TWO NEW POLYGONS WERE ADDED, BRINGING THE TOTAL SURVEYED AREA TO APPROXIMATELY 2,000 ACRES. MOST SURVEYED AREA FELL WITHIN THE BLM SAGEBRUSH FOCAL AREA (GREY).

METHODS

In the spring and early summer of 2018, IAE staff completed surveys for the rare species listed in Table 1 (species details in Appendix A). Surveys for these rare species occurred at sites where the species had previously been documented with priority for surveys in the Sagebrush Focal Area. Surveys were conducted for 18 species (15 vascular and three non-vascular species).

At each site, a BLM site report form was completed; information on this form includes associated plant species, habitat descriptions, and threat assessments. Surveys were scheduled to coincide with flowering or fruiting of each species as possible (Table 1). For some species multiple site visits were conducted. Species identifications were confirmed by key as needed (Baldwin et al. 2012; Hitchcock and Cronquist 2018).

TABLE 1. SPECIES MONITORED IN 2018 WITH THEIR APPROXIMATE BLOOM PERIODS (SHADED CELLS) AND VISIT DATES. RED TEXT INDICATES NO PLANTS PRESENT. DETAILED SPECIES INFORMATION IS INCLUDED IN APPENDIX A.

	Species	Bloom period						
		March	April	May	June	July	August	September
Vascular plants	<i>Allium lemmonii</i>				6/6			
	<i>Astragalus tetrapterus</i>		5/1-5/30					
	<i>Botrychium crenulatum</i>				6/21			
	<i>Caulanthus crassicaulis</i>		5/1		6/4-6/5			
	<i>Elatine brachysperma</i>				6/14			
	<i>Galium serpenticum</i> ssp. <i>warnerense</i>				6/25-6/26			
	<i>Eriogonum prociduum</i>		5/15-5/29		6/5-6/12			
	<i>Heliotropium curassavicum</i> var. <i>obovatum</i>				6/13			
	<i>Melica stricta</i>				6/19			
	<i>Mimulus latidens</i>		4/17					
	<i>Pleuropogon oregonus</i>				6/19			
	<i>Pogogyne floribunda</i>			5/14	6/12			
	<i>Ranunculus andersonii</i>		4/11-4/18					
	<i>Rorippa columbiae</i>		4/19	5/14-5/16	6/12-6/14			
	<i>Symphoricarpos longiflorus</i>			5/21	6/18-6/20			
Bryophytes	<i>Ephemerum crassinervium</i>			5/8				
	<i>Orthotrichum holzingeri</i>				6/26			
	<i>Scouleria marginata</i>				6/26			

RESULTS

A total of 43 sites that had been documented previously were visited and approximately 2,000 acres were surveyed in the spring and early summer of 2018 by IAE staff. Between April 11th and June 26th, 2018, 55 site visits occurred (some of the 43 sites were visited multiple times). Seven sites in which target species were found at the time of the last survey no longer contained any individuals, while five sites were either new occurrences or had plants in 2018 when no plants were recorded during previous survey efforts (Table 2). Six of the 18 target species were not detected, but three new polygons were created for previously unknown *Astragalus tetraapterus* populations. In many cases, the original spatial extent of a species occurrence polygon was extended or moved to encompass new observations. All spatial modifications are included in the point and polygon shapefiles and briefly summarized below by species. Maps for each polygon are also included with the digital data collection. Original hard copies of BLM site report forms will be provided for soil and plant community characteristics associated with each visited



FIGURE 2. GRAVEL SUBSTRATE AT ALLE3_325, WITH THE TARGET SPECIES (*ALLIUM LEMMONII*) IN THE OPEN FOREGROUND AND SAGEBRUSH SURROUNDING. THIS POLYGON WAS EXTENDED TO INCLUDE AN ADDITIONAL ACRE OF HABITAT CONTAINING NEW PLANT OBSERVATIONS.

(NEW ASTE1-3) (Table 2). NEW ASTE3 was near ASTE10_226, and could potentially be combined, although no plants were recorded between the 2 locations. Plants were generally found in sagebrush openings on bare tuff or rocky substrates, and were not commonly found in areas with high grass (often

polygons. In 2016, IAE staff completed similar surveys for two additional SSS plants: *Eriogonum crosbyae* and *Ivesia rhypara* var. *rhypara* (Petix and Bahm 2016).

Allium lemmonii (ALLE3)

One site for *Allium lemmonii* was visited on June 6th, 2018. A total of 214 plants were found, 23 vegetative and 191 reproductive. The original 1.6-acre polygon (ALLE3_325) was expanded to a total of 2.5 acres to encompass population spread observed since the last visit to this site. Plants were found primarily in bare soil and gravel openings amongst sagebrush (Figure 2). Disturbances noted at this site included cattle grazing, trampling and soil compaction, numerous animal burrows, and damage from the close proximity to a road. Some new stalks of *A. lemmonii* were grazed to the ground and there was a cattle watering hole within 200m of the site (with an additional road to access watering hole from the main road).

Astragalus tetraapterus (ASTE10)

Twelve sites with prior observations of *Astragalus tetraapterus* were visited between May 1st and May 29th, 2018. A total of 6,565 plants were found, 4,171 vegetative and 2,394 reproductive. Three new populations were found and polygons were added to the database

Bromus tectorum) cover (Figure 3). In many sites, the loose, volcanic tuff on which *A. tetrapterus* is found is subject to erosion from cattle, wild horse, and pronghorn trampling.

Seven of the original polygons (ASTE10_002, ASTE10_168, ASTE10_218, ASTE10_226, ASTE10_227, ASTE10_302, and ASTE10_327) were expanded to encompass new observations. Two polygons (ASTE10_120 and ASTE10_301) were shifted in accordance with improved GPS location accuracy. Plants were absent from only one site (ASTE10_081). Across the twelve sites, 306 acres were surveyed.

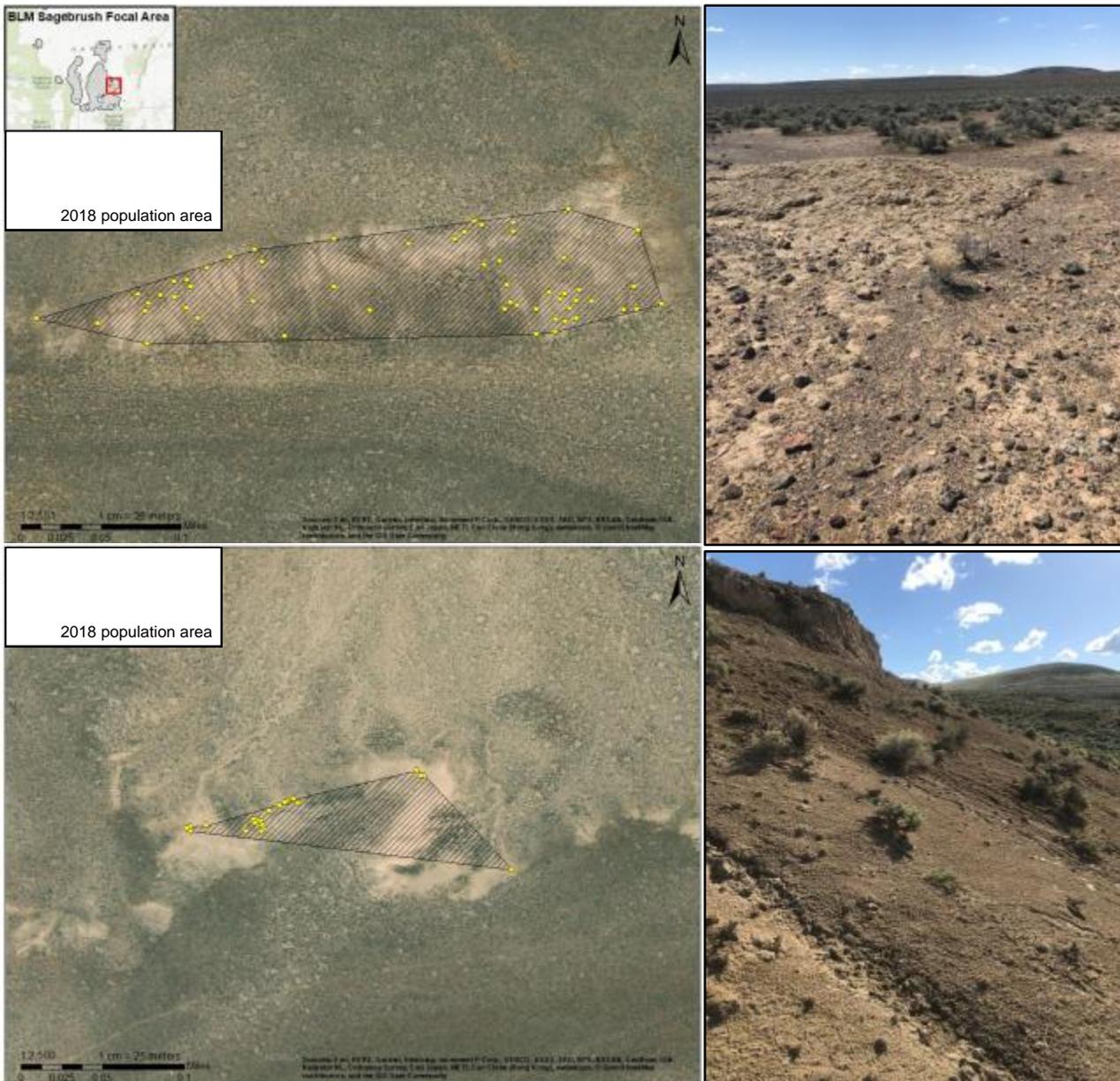


FIGURE 3. POLYGONS (LEFT) AND HABITAT OVERVIEW PHOTOS (RIGHT) FOR TWO NEWLY-OBSERVED ASTRAGALUS TETRAPTERUS POPULATIONS (NEW ASTE1 AND NEW ASTE2).

Botrychium crenulatum (BOCR)

One plant in fruit was found at the BOCR_A polygon on June 21st, 2018. The site is located within a fenced enclosure along the east side of Clover Creek and the plant itself was found in a sedge meadow

at the springhead. Several invasive plant species were observed at the site, including a *Juniperus occidentalis* sapling within the polygon.

***Caulanthus crassicaulis* (CACR11)**

Three sites covering 181 acres were surveyed for *Caulanthus crassicaulis* populations between May 1st and June 5th, 2018. A total of 892 plants were found, 560 vegetative and 332 reproductive. Plants were found at two of the three sites (CACR11_174 and CACR11_178) and both polygons were expanded to encompass new observations. Plants were found in rocky areas and even under sagebrush canopy and some new flowering stalks showed evidence of grazing. At CACR11_178, several plants were found along the roadway (HWY 140) growing in the litter/gravel shoulder.

***Elatine brachysperma* (ELBR5)**

No plants were found at this 0.5-acre site (ELBR5_A) over the course of three separate visits between April 19th and June 14th, 2018. Feather Bed Lake was still inundated at the third visit, but the edge of the polygon and the entire shoreline were surveyed, yielding no *E. brachysperma*.

***Ephemerum crassinervium* (EPCR)**

The polygon (EPCR_A) and surrounding area were surveyed on May 8th, 2018, but no plants were found and the site did not match appropriate habitat specifications for this bryophyte. The site was sagebrush-flat with no obvious water source. It is possible that the polygon location was incorrect.

***Eriogonum prociduum* (ERPR9)**

Just over 10,000 plants, 1,556 vegetative and 8,466 reproductive, were found across six sites surveyed between May 15th and June 12th, 2018. All polygons except ERPR9_L were expanded to encompass new observations. At ERPR_L and ERPR_M several *Eriogonum* spp. were present and the count for possible *E. prociduum* was estimated while specimens were collected and are being processed for further identification. Specimen identification and confirmation for the two sites (ERPR9_L and ERPR9_M) are being conducted by Oregon State University Herbarium staff.

A total of 210 acres were surveyed for *E. prociduum*. Many of these sites had obvious signs of human traffic (ATV tracks, other recreational evidence). Plants were generally found in rocky or gravelly areas on benches or plateaus within each site.

***Galium serpicum* var. *warnerense* (GASEW)**

A total of 300 plants, all reproductive, were found in the NW and NE arms of LRA07012015GASEW, but the southern extent was not surveyed, resulting in a total surveyed area of 570 acres. It is likely that the polygon should be much larger, and the number of plants higher, but we were unable to completely survey suitable habitat due to safety/access issues. For this species, each observed “clump” was counted as an individual.

***Heliotropium curassavicum* var. *obovatum* (HECUO2)**

Approximately 50,000 plants, 12,500 vegetative and 37,500 reproductive, were found along the shore of this Spanish Lake polygon (HECUO2_A) on June 13th, 2018. The original 304-acre polygon was expanded to 366 acres to encompass new observations. The original polygon encompasses the entire lake, which was full at the time of our visit. The entire shoreline was surveyed, from the water line to the foot of the dunes, and was densely populated in several areas. Plants were not found directly on the

water's edge but rather in grassy patches of drier sand. Cattle tracks and dung were observed at the site, along with ATV tracks.

Melica stricta (MEST)

Two sites were surveyed for *Melica stricta* on June 19th, 2018, totaling five acres in area. Sixty-three plants were found, all reproductive. The MEST_003 polygon was shifted from its historical position to account for the observed population extent. Plants were found exclusively in rocky outcrops, often growing out of cracks in the rock. Cattle were observed in the area.

Mimulus latidens (MILA4)

No plants were found within or near the 7.4-acre survey area (MILA4_A) on April 17th, 2018. The Wool Lake channel was mainly dry, with only a few spots of standing water less than 1 ft deep. We were unable to return to the site later in the season, so it is possible that our survey time could have potentially influenced the absence of plants recorded. Future surveys are needed to determine status of these populations.



FIGURE 4. HABITAT (LEFT) AND CLOSE-UP (RIGHT) OF COLLECTED *ORTHOTRICHUM HOLZINGERI* SPECIMEN ALONG DEEP CREEK, JUNE 26TH, 2018.

Orthotrichum holzingeri (ORHO3)

Ten patches were found in and around the occurrence polygon (LRA07012015ORHO3) on June 26th, 2018. A specimen for identification was collected off of rock along the east bank of Deep Creek (Figure 4), and has been sent for confirmation by OSU Herbarium staff.

Pleuropogon oregonus (PLOR3)

No plants were found within or near either 3-acre survey area (PLOR3_A or PLOR3_B) on June 19th, 2018. The survey may have been conducted too early according to the expected bloom period (late June through July). Future surveys are needed to determine status of these populations.

Pogogyne floribunda (POFL17)

No plants were found within or near the 3.4-acre survey area (POFL17_A) over the course of two visits, May 14th and June 12th, 2018. The lakebed/waterhole was completely dry when visited and the site was heavily grazed and trampled by cattle. This is a dramatic decline in population size from 5,000 plants observed at the last site visit (August 13th, 2015).

Ranunculus andersonii (RAAN)

A total of 324 plants, 203 vegetative and 121 reproductive, were found in the area of the historical occurrence polygon (RAAN_326) over the course of two visits, April 11th and 18th, 2018. A new polygon was formed encompassing all new observations, including the original polygon's extent; population area increased from 0.8 to 42 acres. On April 11th, many plants were just emerging and some were in flower, growing primarily on bare soil or from underneath rock edges. One week later, many flowers were senesced and the population seemed to be past peak bloom.



FIGURE 5. COLLECTION OF SCOULERIA MARGINATA FROM DEEP CREEK, JUNE 26TH, 2018.

Rorippa columbiae (ROCO3)

No plants were found across three sites covering 11.6 acres between May 16th and June 14th, 2018. The entire shorelines of Foley Lake (ROCO3_A), Feather Bed Lake (ROCO3_B), and Binkey Lake (ROCO3_C) were all surveyed. Foley Lake and Binkey Lake were both dry, suggesting poor conditions for plant growth.

Scouleria marginata (SCMA10)

Ten patches were found in and around the polygon (LRA07012015SCMA10) on June 26th, 2018. A specimen for identification was collected off of rock just above the water line along the east bank of Deep Creek (Figure 5).

Symphoricarpos longiflorus (SYLO)

A total of 184 plants, 9 vegetative and 175 reproductive, were found at one of two *Symphoricarpos longiflorus* sites (SYLO_A) on June 18th, 2018. This polygon was expanded to incorporate new observations in the northwest corner. The second site, SYLO_B, had another *Symphoricarpos* sp. present and no accurate count of *S. longiflorus* was collected.

TABLE 2. SUMMARY OF SITE VISITS BY IAE STAFF FOR SENSITIVE SPECIES IN THE LAKEVIEW DISTRICT IN 2018. SPECIES NAMES IN BOLD WERE NOT FOUND DURING OUR SURVEYS, AND SITE NAMES IN BOLD DID NOT CONTAIN THE TARGET SPECIES. HIGHLIGHTED POPULATIONS ARE CURRENTLY BEING CONFIRMED BY OSU HERBARIUM STAFF.

	Species	Site (polygon)	2018				Previous survey		
			Total	#Veg	#Repro.	Date of count	Total	Date	
Vascular Plants	<i>Allium lemmonii</i>	ALLE3_325	214	23	191	6/6/2018	0	7/17/1991	
	<i>Astragalus tetrapterus</i>	New ASTE1	849	380	469	5/2/2018	--	--	
		New ASTE2	171	33	138	5/21/2018	--	--	
		New ASTE3	33	15	18	5/29/2018	--	--	
		ASTE10_226	226	164	62	5/7/2018	15	7/12/2007	
		ASTE10_227	342	214	128	5/8/2018	100	7/31/2007	
		ASTE10_002	1205	719	486	5/9/2018	200	5/22/1985	
		ASTE10_218	1945	1005	940	5/30/2018	5000	7/31/2007	
		ASTE10_301	80	49	31	5/1/2018	400	7/19/2007	
		ASTE10_302	1294	1183	111	5/1/2018	400	7/18/2006	
		ASTE10_081	0	--	--	5/9/2018	0	8/20/2007	
		ASTE10_120	242	132	110	5/3/2018	200	7/19/2007	
		ASTE10_168	905	473	432	5/2/2018	1000	6/19/2007	
		ASTE10_327	326	232	94	5/2/2018	150	7/19/2007	
		<i>Botrychium crenulatum</i>	BOCR_A	1	--	1	6/21/2018	1	7/1/2015
		<i>Caulanthus crassicaulis</i>	CACR11_174	431	175	256	6/5/2018	255	7/11/1991
			CACR11_178	461	385	76	6/4/2018	0	4/26/2002
			CACR11_171	0	--	--	5/21/2018	0	12/17/1982
		<i>Elatine brachysperma</i>	ELBR5_A	0	--	--	6/14/2018	30	7/27/2015
		<i>Eriogonum prociduum</i>	ERPR9_I	6053	35	6018	6/5/2018	3472	6/21/2012
			ERPR9_J	479	286	193	6/11/2018	500	8/26/2014
			ERPR9_K	746	277	469	5/15/2018	120	8/26/2014
			ERPR9_L	2000	400	1600	6/12/2018	1000	6/10/2003
			ERPR9_M	200	40	160	6/11/2018	100	8/16/2007
			ERPR9_I, #2	544	518	26	5/15/2018	50	8/26/2014
		<i>Heliotropium curassavicum</i>	HECU02_A	50000	12500	37500	6/13/2018	72615	7/18/2012
	<i>Galium serpicum</i> ssp. <i>warnerense</i>	LRA07012015GASEW	300	--	300	6/26/2018	30	7/1/2015	
	<i>Melica stricta</i>	MEST_003	24	--	24	6/19/2018	25	12/27/2006	

Rare Plant Monitoring in the Lakeview Resource Area

	MEST_005	39	--	39	6/19/2018	50	6/14/1988	
<i>Mimulus latidens</i>	MILA4_A	0	--	--	4/17/2018	0	6/8/2015	
<i>Pleuropogon oregonus</i>	PLOR3_A	0	--	--	6/19/2018	10	8/2/1995	
	PLOR3_B	0	--	--	6/19/2018	25	8/2/2006	
<i>Pogogyne floribunda</i>	POFL17_A	0	--	--	6/12/2018	5000	8/13/2015	
<i>Ranunculus andersonii</i>	RAAN_326	324	203	121	4/18/2018	0	7/17/1991	
<i>Rorippa columbiae</i>	ROCO3_A	0	--	--	6/12/2018	0	6/3/2014	
	ROCO3_B	0	--	--	6/14/2018	10	7/27/2015	
	ROCO3_C	0	--	--	5/16/2018	0	4/26/2007	
<i>Symphoricarpos longiflorus</i>	SYLO_A	184	9	175	6/18/2018	126	6/12/2012	
	SYLO_B	0	--	--	6/20/2018	75	6/25/2004	
Bryophytes	<i>Ephemerum crassinervium</i>	EPCR_A	0	--	--	5/8/2018	2	7/16/2014
	<i>Orthotrichum holzingeri</i>	LRA 07012015 ORHO3	10	--	--	6/26/2018	0	7/1/2015
	<i>Scouleria marginata</i>	LRA07012015SCMA10	10	--	--	6/26/2018	0	7/2/2015

CONCLUSIONS

Twelve of the 18 target species were found in 2018 over a three-month survey period (April-June). At seven of 43 total sites we recorded no plants where plants had been recorded at the last survey date, while we documented plants at two sites that had no plants recorded during the previous survey date(s) (*Caulanthus crassicaulis* and *Ranunculus andersonii*). We also mapped three new sites for *Astragalus tetrapteris* in 2018.

In general, species that were present in 2018 occurred at a similar magnitude of abundance as was observed during the previous survey(s). In the case of species that were not present, it is possible that phenology and/or annual hydrologic variations played a role in our ability to detect presence or achieve accurate counts. Annual hydrologic variations may account for the apparent absence of four of the six species not observed including *Elatine brachysperma*, *Mimulus latidens*, *Pogogyne floribunda* and *Rorippa columbiae*. *Pleuropogon oregonus* blooms in Late June-July, thus it is possible that later site visits would have detected this species. The sixth species not observed was *Ephemerum crassinervium* (bryophyte), but the habitat in the polygon did not match suitable habitat for the species and it is likely that the polygon location is incorrect. The largest population drop observed occurred for *Pogogyne floribunda*, falling from a population of 5,000 in 2015 to zero in 2018. This population and one of the *Rorippa columbiae* populations both lie along the shore of Foley Lake, which was completely dry in 2018, suggesting that lack of water may be responsible for the current absence of these species.

A range of threats were observed across all sites including the presence of non-native annual grasses, as well as grazing by cattle, horses and native ungulates, impacts of manmade activities including roads and off-road vehicle use. Tuffaceous soils are prone to erosion, and populations of rare species found in these areas are particularly threatened by soil disturbances, including trampling and/or vehicle activity. For species more commonly found near water sources, annual hydrologic variability, as well as increased grazing pressure during dry periods may impact these populations. While these specialized habitats are not likely to host juniper trees that would be targeted for removal, they are susceptible to disturbance.

The lack of juniper at most of the surveyed sites, reduces the potential for impacts to rare plant populations. Juniper removal and habitat restoration activities for sage grouse should minimize disturbance to these habitats. As long as juniper removal and habitat restoration plans take steps to minimize soil erosion, compaction, and disturbance, particularly in areas with tuffaceous soils, harm to rare plant populations will be minimal. In areas where juniper is present, disturbance should be minimized, equipment kept clean and weed free, and in areas where introduced grasses are present, species control should be considered prior to management actions.

It is recommended that future surveys be conducted for species not observed in our surveys in 2018. In order to maximize efficiency of future survey efforts, it may be advantageous to target surveys for some species in 'wet' years, as also recommended by Grinter 2015.

LITERATURE CITED

- Baldwin, B.G., Goldman, D.H., Keil, D.J., Patterson, R., and Rosatti, T.J. 2012. The Jepson Manual: Vascular Plants of California. *In* Second Edition. University of California Press.
- Bureau of Land Management. 2015. Oregon Greater Sage-Grouse Proposed Resource Management Plan Amendment and Final Environmental Impact Statement.
- Foster, L.J. 2018. Oregon Greater Sage-Grouse Population Monitoring: 2018 Annual Report. Oregon Department of Fish and Wildlife, Hines, OR.
- Grinter, I.L. 2015. The Search for Lakeview's Obscure Taxa. 2015 ISSSP Project - Final Report, Bureau of Land Management, Lakeview District.
- Hitchcock, C.L., and Cronquist, A. 2018. Flora of the Pacific Northwest: An Illustrated Manual. *In* Second Edition. University of Washington Press, Seattle, WA.
- Oregon Biodiversity Information Center. 2016. Rare, threatened and endangered species of Oregon. Institute for Natural Resources, Portland State University, Portland, Oregon.
- Petix, M.I., and Bahm, M.A. 2016. Population monitoring of grimy mousetail (*Ivesia rhypara* var. *rhypara*) and Crosby's buckwheat (*Eriogonum crosbyae*). Institute for Applied Ecology and Bureau of Land Management, Lakeview District, Corvallis, OR.
- U.S.D.A., N.R.C.S. (n.d.). The PLANTS Database. Available from <http://plants.usda.gov> [accessed 5 December 2018].

APPENDIX A. SPECIES DESCRIPTIONS

Species information for the 15 vascular and three bryophyte species for which surveys were conducted in 2018 (U.S.D.A. n.d.; Baldwin et al. 2012; Oregon Biodiversity Information Center 2016).

Contents include:

Allium lemmonii (Lemmon's onion)

Astragalus tetrapterus (fourwing milkvetch)

Botrychium crenulatum (scalloped moonwort)

Caulanthus crassicaulis (thickstem wild cabbage)

Elatine brachysperma (shortseed waterwort)

Eriogonum prociduum (prostrate buckwheat)

Galium serpticum ssp. *warnerense* (Warner Mountains bedstraw)

Heliotropium curassavicum var. *obovatum* (seaside heliotrope)

Melica stricta (rock melicgrass)

Mimulus latidens (broadtooth monkeyflower)

Pleuropogon oregonus (Oregon semaphoregrass)

Pogogyne floribunda (profuseflower mesamint)

Ranunculus andersonii (Anderson's buttercup)

Rorippa columbiae (Columbia yellowcress)

Symphoricarpos longiflorus (desert snowberry)

Bryophytes:

Ephemerum crassinervium

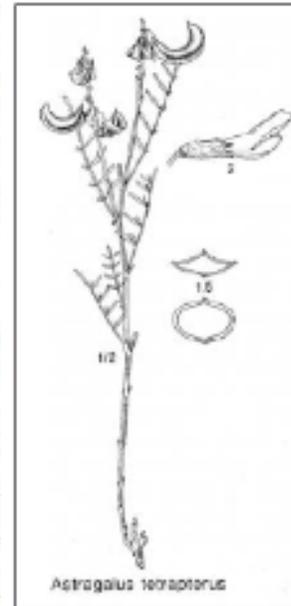
Orthotrichum holzingeri

Scouleria marginata



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Allium lemmonii</i>	Lemmon's onion	ALLE3	Monocot	Liliaceae	Perennial	Forb/herb

Allium lemmonii (Lemmon's onion) is a member of the lily (Liliaceae) family known from Oregon, California, Nevada, Idaho, and Utah. It is commonly found in drying clay soils [elevation: 1,200 – 1,900 m]. *A. lemmonii* blooms from May through June.



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Astragalus tetrapterus</i>	fourwing milkvetch	ASTE10	Dicot	Fabaceae	Perennial	Forb/herb

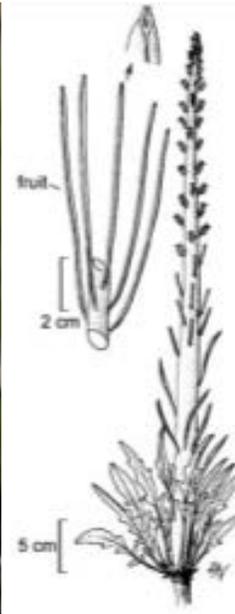
Astragalus tetrapterus (fourwing milkvetch) is a member of the pea (Fabaceae) family distributed across the Great Basin, occurring in Oregon, Nevada, Idaho, Utah, and Arizona. Its habitat includes gullied bluffs, barren knolls, stabilized dunes, and open valley floors, mostly found in loose sandy or tuffaceous soils [elevation: 1,675 – 1,970 m]. *A. tetrapterus* blooms in late April to early July; when in fruit, a key characteristic is that *A. tetrapterus* has singular pods which become 4-sided when ripe. **Heritage Rank:** G4G5



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Botrychium crenulatum</i>	scalloped moonwort	BOCR	Fern	Ophioglossaceae	Perennial	Forb/herb

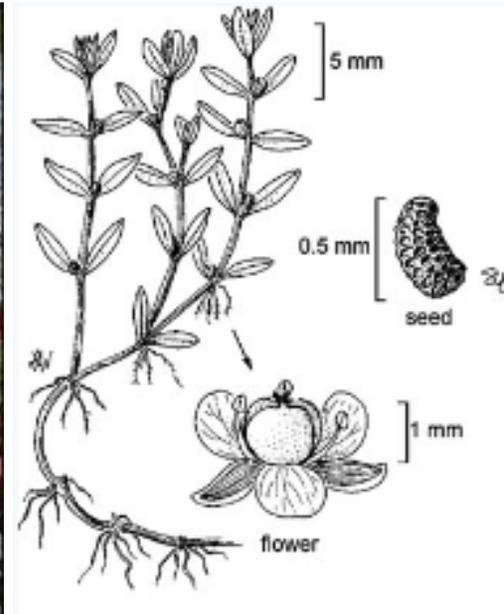
Botrychium crenulatum (scalloped moonwort) is a delicate primitive fern in the adder's tongue (Ophioglossaceae) family that is distributed in the Cascade Range and western U.S. Its habitat includes mixed-conifer forest on creek banks, clearings, and damp meadows in drier areas under sedges or on organic soil, often with mosses and on rises around trees [elevation: 1,500 – 2,500 m]. Its fertile frond is present June to July.

Heritage Rank: G3 S2 / **Federal Status:** SOC / **ODA Status:** C



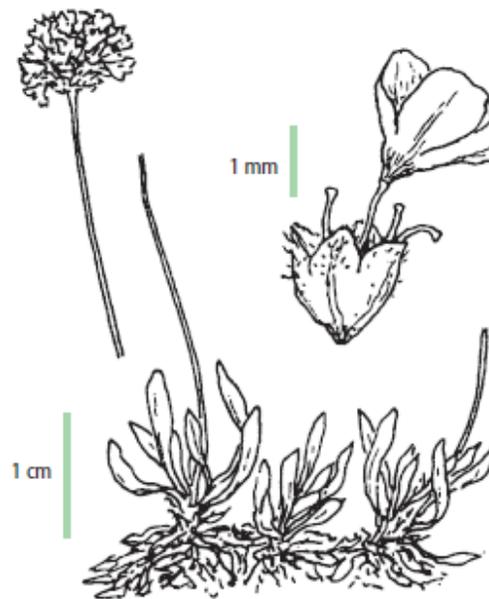
SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Caulanthus crassicaulis</i>	thickstem wild cabbage	CACR11	Dicot	Brassicaceae	Biennial; Perennial	Forb/herb

Caulanthus crassicaulis (thickstem wild cabbage) is a member of the mustard (Brassicaceae) family known from Oregon, California, Idaho, Nevada, Utah, Wyoming, and Colorado. Its habitat includes dry sagebrush scrub and pinyon/juniper woodland [elevation: 900 to 2,900 m]. *C. crassicaulis* blooms from April through July. **Heritage Rank:** G4G5T3T5 S4



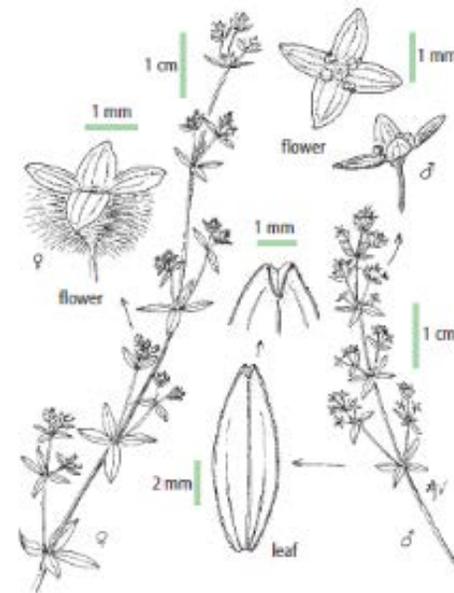
SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Elatine brachysperma</i>	shortseed waterwort	ELBR5	Dicot	Elatinaceae	Annual	Forb/herb

Elatine brachysperma (shortseed waterwort) is a member of the waterwort (Elatinaceae) family known from the western U.S. to central/southern U.S. and Mexico. Its habitat includes muddy shores and shallow pools [elevation: 50 – 500 m]. *E. brachysperma* blooms from April to September. **Heritage Rank:** G5 S1



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Eriogonum prociduum</i>	prostrate buckwheat	ERPR9	Dicot	Polygonaceae	Perennial	Forb/herb

Eriogonum prociduum (prostrate buckwheat) is a member of the buckwheat (Polygonaceae) family that is known from Oregon, California, and Nevada. Its habitat includes dry, rocky volcanic slopes, ridges, and hills mostly in yellow pine or juniper woodlands, but also found in sagebrush scrub [elevation: 1,300 to 2,500 m]. *E. prociduum* blooms from May to early August. **Heritage Rank:** G3 S1? / **Federal Status:** SOC / **ODA Status:** C



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Galium serpticum</i> ssp. <i>warnerense</i>	Warner Mountains bedstraw	GASEW	Dicot	Rubiaceae	Perennial	Forb/herb; Subshrub

Galium serpticum ssp. *warnerense* (Warner Mountains bedstraw) is a member of the madder (Rubiaceae) family that is known from Oregon, Washington, California, and Nevada. Its habitat includes steep talus slopes around the bases of rocks [elevation: 1,400 – 2,700 m]. *G. serpticum* ssp. *warnerense* blooms from late June to July. **Heritage Rank:** G4G5T2T3 S2 / **Federal Status:** SOC



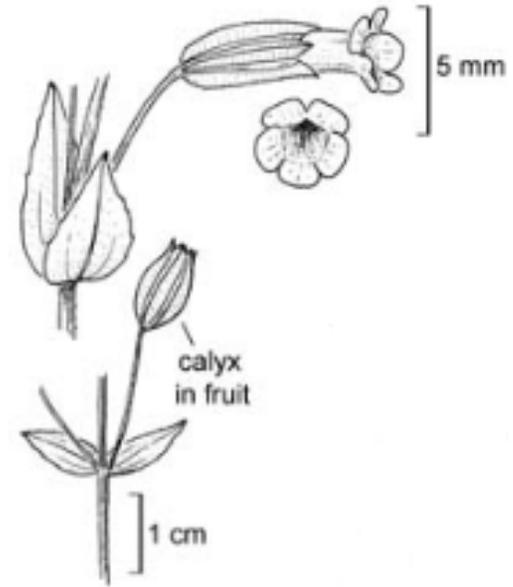
SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Heliotropium curassavicum</i> var. <i>obovatum</i>	seaside heliotrope	HECUO2	Dicot	Boraginaceae	Annual; Perennial	Forb/herb; Subshrub

Heliotropium curassavicum var. *obovatum* (seaside heliotrope) is a member of the borage (Boraginaceae) family known from the western/central U.S. up into Canada. **Heritage Rank:** G5 S2



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Melica stricta</i>	rock melicgrass	MEST	Monocot	Poaceae	Perennial	Graminoid

Melica stricta (rock melicgrass) is a member of the grass (Poaceae) family known from Oregon, California, Nevada, and Utah. Its habitat includes open sites, conifer forest, and rocky areas in alpine [elevation: 1,200 – 3,350 m]. *M. stricta* blooms from June to August. **Heritage Rank:** G4 S3



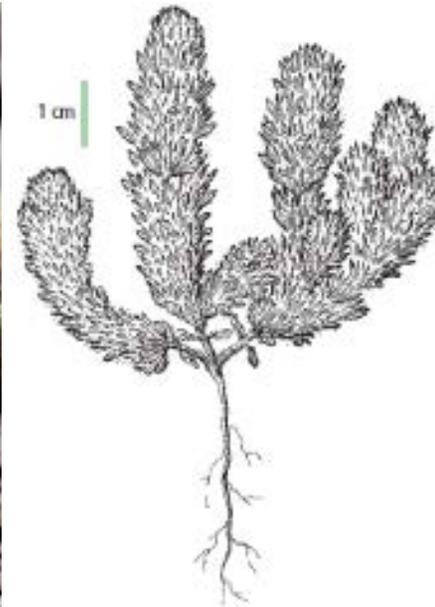
SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Mimulus latidens</i>	broadtooth monkeyflower	MILA4	Dicot	Scrophulariaceae	Annual	Forb/herb

Mimulus latidens (broadtooth monkeyflower syn. *Erythranthe latidens*) is a member of the figwort (Scrophulariaceae) family known from Oregon and California as well as down to Baja California. Its habitat includes vernal wet depressions [elevation: < 900 m]. *M. latidens* blooms from April to June. **Heritage Rank:** G4 S1



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Pleuropogon oregonus</i>	Oregon semaphoregrass	PLOR3	Monocot	Poaceae	Perennial	Graminoid

Pleuropogon oregonus (Oregon semaphoregrass) is a member of the grass (Poaceae) family known only from several small occurrences divided between two disjunct population centers in eastern Oregon – one in southern Lake County and one in southern Union County, separated by a distance of approximately 370 km (230 miles). *P. oregonus* is an obligate wetland species occurring in wet meadows and marshlands in areas of sluggish moving water [elevation: 1,000 – 1,700 m]. Surveys for *P. oregonus* should be completed when the species is in flower and/or fruit, from June through July. **Heritage Rank:** G1 S1 / **Federal Status:** SOC / **ODA Status:** LT



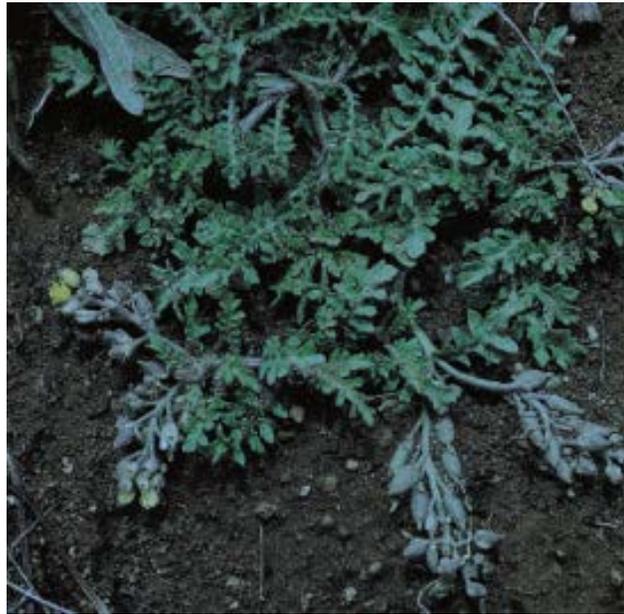
SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Pogogyne floribunda</i>	profuseflower mesamint	POFL17	Dicot	Lamiaceae	Annual	Forb/herb

Pogogyne floribunda (profuseflower mesamint) is a member of the mint (Lamiaceae) family that is known from Oregon, California, and Idaho. Its habitat includes basalt-flow vernal pools, seasonal lakes, and intermittently flooded drainages, usually in silver sage (*Artemisia cana*) flats of pine-juniper woodlands, on dark, heavy, clay loam [elevation: 1,000 – 1,500 m]. *P. floribunda* blooms from June to August. **Heritage Rank:** G4 S1 / **Federal Status:** SOC



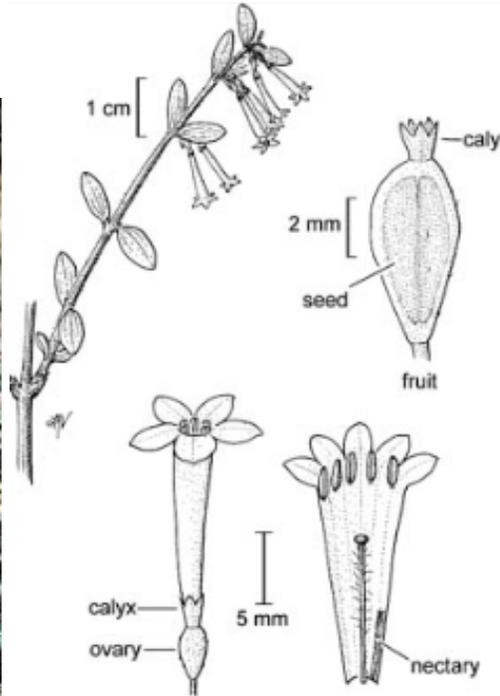
SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Ranunculus andersonii</i>	Anderson's buttercup	RAAN	Dicot	Ranunculaceae	Perennial	Forb/herb

Ranunculus andersonii (Anderson's buttercup) is a member of the buttercup (Ranunculaceae) family known from Oregon, California, Nevada, Idaho, Utah, and Arizona. Its habitat includes dry rocky slopes [elevation: 1,000 – 2,500 m]. *R. andersonii* blooms from March to May.



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Rorippa columbiae</i>	Columbia yellowcress	ROCO3	Dicot	Brassicaceae	Perennial	Forb/herb

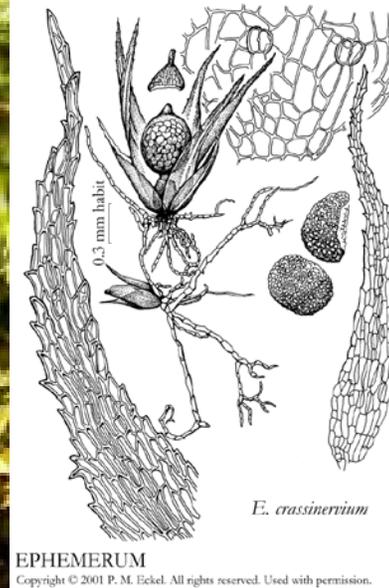
Rorippa columbiae (Columbia yellowcress) is a member of the mustard (Brassicaceae) family that is known from Oregon, California, and Washington. Its habitat includes drying lake beds (playas) and stream banks (also shores and islands of the Columbia River in Washington) in various soil textures, but seasonal saturation is required [elevation: 1,300 to 1,700 m in CA; as low as 6m in WA]. Low aerial vegetation cover by associated species. *R. columbiae* blooms from May to August (depending on moisture conditions, September on Modoc Plateau). **Heritage Rank: G3 S3 / ODA Status: C**



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Symphoricarpos longiflorus</i>	desert snowberry	SYLO	Dicot	Caprifoliaceae	Perennial	Shrub

Symphoricarpos longiflorus (desert snowberry) is a member of the honeysuckle (Caprifoliaceae) family distributed across the western U.S. Its habitat includes rocky areas [elevation: 1,350 – 1,600 m]. *S. longiflorus* blooms from May to June. **Heritage Rank:** G5 S2

BRYOPHYTES:



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Ephemeron crassinervium</i>	ephemerum moss	EPCR	Moss	Ephemeraceae	N/A	Nonvascular

Ephemeron crassinervium is a moss known from Oregon, eastern North America, Germany, Japan, and New Zealand. It occurs on damp disturbed soil, often in old fields, paths, river banks or spots of open bare ground. *E. crassinervium* is an ephemeral species that completes its entire life cycle within a very short period of time, while capsules can mature year round they usually mature between early fall to early spring. **Heritage Rank:** G4 S1



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Orthotrichum holzingeri</i>	Holzinger's orthotrichum moss	ORHO3	Moss	Orthotrichaceae	N/A	Nonvascular

Orthotrichum holzingeri is a moss endemic to Western North America. It is found on vertical calcareous rock surfaces and at the bases of *Salix* bushes just above rock that is frequently inundated by seasonally high water in dry coniferous forests. This species depends on limestone in the substratum, limiting potential survey sites. **Heritage Rank:** G3 S1



SCIENTIFIC NAME	COMMON NAME	CODE	GROUP	FAMILY	DURATION	GROWTH HABIT
<i>Scouleria marginata</i>	marginate splashzone moss	SCMA10	Moss	Scouleriaceae	N/A	Nonvascular

Scouleria marginata is a moss endemic to western North America, ranging from British Columbia to central California. It occurs on bedrock material or large boulders along perennial rivers [elevation: 0 – 1,200 m]. **Heritage Rank:** G3 S2