Relocation and Inventory of Sensitive Vascular Plants Based on Historical Herbarium Specimens

Inventory and Conservation Planning Report
Interagency Special Status / Sensitive Species Program (ISSSSP)

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INTRODUCTION

The purpose of this project was to attempt to relocate historically known populations of sensitive plant species on the Malheur National Forest. These putative populations were inferred from historical herbarium specimens of these sensitive species.

In 2009, a comprehensive review and examination of sensitive species on the Malheur NF was conducted as part of the Blue Mountain Forest Plan Revision process. This included the examination of sensitive species on neighboring National Forests and BLM Districts. As a result, numerous herbarium specimens of sensitive species were discovered to have been collected from within the present-day boundaries of the Malheur NF (Appendix A). Most of these specimens were not previously included in the Oregon Biodiversity Information Center (ORBIC) databases and were apparently unknown to local, state, and regional agency botanists.

Most of the locations provided by the herbarium labels were too general to accurately map. Thus, they were never entered into any GIS layers or the Forest Service's Natural Resource Information System for Threatened, Endangered, and Sensitive Plants (NRIS TESP), nor had any botanists visited these sites in recent history to collect data on habitats, threats, abundance, and extent of the populations. Furthermore, prior to 2009, four species (*Calyptridium roseum*, *Carex micropoda*, *Carex nardina*, and *Lupinus lepidus* var. *cusickii*) were not even listed as 'suspected' on the Malheur NF. These species have since been recommended as either 'suspected' or 'documented' for the Malheur NF, depending on the date of the original collection. *Mimulus evanescens* has previously been listed as 'documented' based on the herbarium specimen. *Eleocharis bolanderi* and *Phacelia minutissima* have previously been listed as 'documented' from three other inventoried sites on the Forest (these are entered into NRIS TESP).

The herbarium labels of these specimens provide the only information known about these sites. Sometimes this information is very sparse. Thus, there was a strong need to collect comprehensive site data for these species.

OBJECTIVES

The objectives of this project were to (1) relocate and survey locations where historical herbarium specimens of sensitive plant species were collected, (2) accurately map the sites if populations were located, and (3) complete NRIS TESP Survey and Element Occurrence forms and enter the data into the NRIS TESP database.

METHODS

The surveys occurred during the summer of 2009 and 2010 at specifically identified locations throughout the Forest, dependent upon the location and habitat information included on the herbarium labels. Prior to fieldwork, potential habitats and survey locations were determined by examining floras, species fact sheets, herbarium labels, aerial photos, and GIS layers. At each site, surveys primarily focused on the species and habitat in question. Survey intensities were either "focused", "general", or "systematic" depending on the specific characteristics of the sites. Survey and element occurrence information was entered into the NRIS TESP database.

Surveys were primarily conducted through Forest-level force accounts using funds specifically allocated by the ISSSSP selection panel and funds utilized from the Forest's Botany Program. However, a great deal of supplemental surveys were accomplished through funds that were awarded through the American Recovery and Reinvestment Act; these surveys were accomplished through both force accounts and contracts awarded to the Carex Working Group (via the Watershed Professionals Network). The supplemental surveys drastically increased the acres surveyed for *Lupinus lepidus* var. *cusickii*.

RESULTS

Surveys concluded in September, 2010. Over 520 acres were surveyed as a direct result of this project, and an additional 2100 acres were surveyed in combination with other projects (Appendix B). Most of the survey intensities were either "focused" or "systematic".

Overall, the results of the project objectives were not as successful as anticipated, however there were a number of taxonomically clarifying outcomes as a consequence of this project. In total,

one sensitive plant populations was relocated (*Phacelia minutissima*), specimens of two species were determined to be misidentified after further investigation (*Lupinus lepidus* var. *cusickii* and *Carex micropoda*), two species had habitat alteration so severe that relocation is highly improbable (*Eleocharis bolanderi* and *Carex nardina*), and two species were not relocated yet quality habitat for these species still exists (*Calyptridium roseum* and *Mimulus evanescens*). Additionally, this project resulted in the discovery of a new population of a globally rare species (*Thelypodium eucosmum*) even though this was not originally an objective of this project.

DISCUSSION

Calyptridium roseum

In total, 58 acres were surveyed in an attempt to relocate *Calyptridium roseum*. Surveys focused on areas around King Mountain on the Malheur NF in Harney Co. The last recorded specimen of *C. roseum* was collected in this area by J.W. Thompson in 1935. Location information provided on the herbarium label was vague and noted plant's habitat as "sandy yellow pine". Indeed, this species is found growing in sandy to gravelly soils within arid coniferous forests and sagebrush shrublands (WADNR et al. 2003). Thus, open ponderosa pine forests with sandy soils were the focus of the surveys.

No new populations or individuals of *C. roseum* were located. There are three primary difficulties in finding this species: (1) it is very small and difficult to see (a large individual of this species may be 2 cm high and 5 cm wide), (2) like many succulent annual members of the Portulacaceae (e.g. *Claytonia*, *Lewisia*, *Montia*, etc.) there is a short growing and flowering season which is soon followed by decomposition and/or desiccation of the plant that makes it virtually unrecognizable, and (3) contrary to many rare plants, the preferred habitat of the plant is very common across the landscape, thus it is difficult to focus on any one particular area.

There is still a high probability of relocation if a sufficient number of surveys are conducted at the right time of year. The slopes of King Mountain still support a large quantity of quality habitat, and rare plant surveys (in support of large landscape projects) are currently underway in the area.

Carex micropoda

Twenty-seven acres were surveyed in an attempt to relocate *Carex micropoda* in the North Fork Malheur River watershed. However, as the surveys were being conducted, it soon became evident that habitat was not present at the location. *Carex micropoda* is described as primarily

growing where heavy snow cover protects it from extreme cold, prevents growth of taller plants, and provides moisture during the growing season (Wilson et al. 2008). The site in question loosely fit this description, yet the elevation and competing vegetation did not appear to provide ideal habitat for this species.

Prior to the survey, there was confidence that this specimen was indeed *C. micropoda*, as it was noted by the Oregon Flora Project (OFP 2009) to have been annotated by members of the Carex Working Group (who are the definitive authority on *Carex* identification in the Pacific Northwest). Apparently, there had been an error in transcription of specimen info when this sample was entered into the OFP database. The specimen was later determined to be *Carex vallicola*.

Since the specimen was initially misidentified, survey efforts to relocate this population were abandon. Nevertheless, there is still a significant amount of habitat for this species on the Malheur NF (primarily in the Strawberry Mountain Wilderness Area).

Carex nardina

A specimen of this species was collected on or adjacent to the Malheur NF by Thomas Howell in 1885 within Bear Valley; the identification of this specimen has been confirmed by the Carex Working Group. It is typically found on dry alpine ridges and slopes, abrasion plateaus, heaths, and fellfields in Oregon, and while Bear Valley is not directly within the alpine zone, there historically has been suitable habitat for *C. nardina* in Bear Valley.

A total of 289 acres were surveyed in an attempt to relocate *Carex nardina*. During the course of the surveys in was determined that the majority of habitat that was surveyed has been probably been highly altered and/or historically impacted since the original collection of this species. Agricultural uses (including Special Use Permits on National Forest Lands), cattle and sheep grazing, and current and historical logging activities, have apparently contributed to the alteration of habitat and community composition in Bear Valley. It is unlikely that relocation of this species will ever occur in Bear Valley. Even so, there is still a significant amount of habitat for this species on the Malheur NF (primarily in the Strawberry Mountain Wilderness Area).

As a result of these surveys, a new population of *Thelypodium eucosmum*, a sensitive and globally rare species, was discovered (Site ID = 0604EO2010_RJS01).

Eleocharis bolanderi

Surveys were conducted over 76 acres on the north margin of Fox Valley. The location of the historical collection, from 1937, was known with fairly high confidence as a legal description was provided. Locally, *E. bolanderi* is most often found in seasonally wet meadows, scablands, and channel edges in sagebrush steppe and openings in juniper and ponderosa stands. The known location site probably had quality habitat at the time of the collection. However, while the surveys were being conducted, it was apparent that only marginal and highly degraded habitat is currently present. This is most likely due to habitat degradation from historical and current livestock grazing practices. No individuals of *E. bolanderi* were relocated.

Lupinus lepidus* var. *cusickii

During the summer of 2008 and 2009, the Malheur NF was beginning to find a number of *Lupinus lepidus* specimens that were keying to variety *cusickii*. This was independently corroborated by a number of botanists that were using keys in *The Intermountain Flora* (Barneby 1989), *The Flora of the Pacific Northwest* (Hitchcock & Cronquist 1973), *Vascular Plant of the Pacific Northwest* (Hitchcock et al. 1961), and S. Broich's (1989) unpublished report on the "re-examination of *Lupinus cusickii*" (1989) which had previously been noted as the appropriate key to determine variety *cusickii*. Furthermore, there were six specimens at the herbaria of Oregon State University, the University of Oregon, and the New York Botanical Gardens that were annotated by S. Broich in 2002. Broich is considered the authoritative expert on the taxonomy, nomenclature, and identification of this species and its respective varieties; thus, it was reported to ORBIC that variety *cusickii* was present on the Malheur NF.

A large portion of this entire project was to survey the sites where specimens of this species were collected. During the summer of 2009 and 2010 numerous sites were surveyed to relocate (and potentially find new populations) of *L. lepidus* var. *cusickii*. This was done concurrently with surveys for another ISSSSP project that was focused on finding new populations of *Carex idahoa* (which was found to inhabit similar areas). In total, over 2,100 acres were surveyed for *L. lepidus* var. *cusickii*. This was accomplished through force accounts and contracts, including a large sampling effort by Nick Otting of the Carex Working Group. During the survey effort, numerous new populations (>15) were being located by both the contractors and the Forest Service employees.

Since the species was previously identified as being "globally rare" and "critically imperiled", and so many new populations were being found, the Malheur NF staff, the Carex Working Group, and ORBIC, were beginning to suspect that there was either an issue with the taxonomic relations within the species or a problem with preferred taxonomic identification key that were

being used to identify the species. Either way, this still did not resolve the issue regarding the herbarium specimens that were annotated by the expert on this species, S. Broich; until this point, there was no reason to doubt that these specimens were anything other than variety *cusickii*.

After the surveys and field season of 2010 concluded, an in-depth examination of the taxonomic/identification issues of *L. lepidus* were conducted by the Carex Working Group, the Institute of Applied Ecology, and the Oregon State University Herbarium. Subsequent determinations of the putative relocated and new populations were accomplished by using keys from a more recent publication (Broich and Morrison 1995). This resulted in the identification of nine newly discovered populations as variety *utahensis* and one population as variety *aridus.* Furthermore, examination of the *L. lepidus* var. *cusickii* specimens at the herbarium of Oregon State University revealed that most of the specimens had been misidentified. The majority were keyed to variety *aridus*, a few were variety *utahensis*, and only two were variety *cusickii*. The two variety *cusickii* collections were from the Denny Flat/Unity area of Baker County. Thus, there are currently no populations of variety *cusickii* on the Malheur National Forest.

It appears that the specimens annotated by S. Broich were incorrect even though he is the author of the definitive key for this species complex. This illustrated that great caution should be exercised when attempting to identify varieties within this species. In no circumstances should any of the keys published in the standard regional floras of the area be used to identify varieties of *L. lepidus*. The table below shows the various treatments and keys available for use; the Broich and Morrison (1995) is the only key that should be used.

	Taxonomic Treatment	*Lupinus lepidus* variety							
		aridus	*confertus*	*cusickii*	*lepidus*	*lobbii*	*ramosus*	*sellulus*	*utahensis*
Inappropriate Keys and Treatments	*Vascular Plant of the Pacific Northwest* (Hitchcock et al. 1961)	X		**X**	X	X			X
	The Flora of the Pacific Northwest (Hitchcock & Cronquist 1973)	X		**X**	X	X			X
	The Intermountain Flora (Barneby 1989)	X	X	**X**	X	X	X	X	X
	Oregon Department of Agriculture (Broich 1989)	X		**X**		X		X	X
Correct Key	*Madroño* Volume 42 (Broich and Morrison 1995)	X		**X**		X		X	X

Mimulus evanescens

Fifty-three acres were surveyed in an attempt to relocate *Mimulus evanescens*. On the Malheur NF, it was last collected in 1912 by Ingram on Graylock Butte. It has not been systematically looked for at this site until this project. Across its range, the species has been observed in rocky sagebrush habitat, especially in ephemerally wet and moist areas. It primarily occupies rangeland that is used for grazing livestock. Threats to the plant include land degradation from cattle grazing, encroachment by invasive plant species, and changes in the hydrology of the plant's vernally wet habitat (Meinke 1995, 2007). Of the areas surveyed at the historical collection site, there certainly was a significant amount of acreage that met the preferred habitat criteria, however, the species was not found.

Inability to locate the species could be due to several reasons: (1) while there was a considerable amount of quality habitat; there were also numerous locations that had been highly altered due to livestock grazing and other threatening anthropogenic activities. It is possible that the historical population inhabited one of these highly disturbed sites and is now extirpated, (2) populations are characteristically scattered and patchy – they rarely exceed 10 square meters in area and range in size from a few plants to potentially several thousand individuals, depending on the seasonal precipitation (Meinke 1995, 2007); thus, surveyors could have easily missed detection of a population, especially if its extent was less than 10 square meters over a 50 acre area, (3) the species is relatively small (generally <10 cm) and its size is likely negatively correlated with the available soil moisture during its growing season (Meinke 1995, 2007); it may have been difficult to find just based on the diminutive size of the species, especially if the seasonal precipitation requirement were below its preferred levels.

Phacelia minutissima

Approximately 24 acres were surveyed for this species. It was originally collected by D. Swanson near a FS Relevé Ecology Plot in 2002. As a consequence of the surveys, the species was relocated. Site information was entered into the NRIS TESP database with Site ID = 0604EO2010_JG01. The site is described as a *Populus tremuloides* / mesic forb plant association; this is in agreement with other site descriptions for this species.

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APPENDIX A. Species, existing element occurrences, and un-inventoried herbarium collections at the time the project was initiated. Note that *Lupinus lepidus* var. *cusickii* was later determined to be incorrectly identified by S. Broich, who is the preeminent expert on this species complex.

Species	Existing mapped occurrences on Malheur N.F.	Recent and historical herbarium collections from within the Malheur N.F. boundaries (not currently relocated or mapped). Parenthetical numbers refer to Appendix 1 figure (below).
Calyptridium roseum	none	(1) J.W. Thompson, #12034 (WILLU_20593); 12 July 1935; Harney Co., King Mountain; sandy yellow pine; last annotation by K.L. Chambers, 2002.
Carex micropoda	none	(2) C.G. Johnson, *s.n.* (BAKER_7116); 28 June 1989; Grant Co., near Crane Creek; rocky scabland, T16S R35E S36, ecology plot #2004; last annotation by *Carex* Working Group, 2006 (as indicated by P. Brooks).
Carex nardina	none	(3) T. Howell, *s.n.* (OSC_1908A); 24 May 1885; Grant Co., Bear Valley; talus, mountain valley; last annotation by Dana York, 2005, and *Carex* Working Group, 1994.
Eleocharis bolanderi	1 EO	(4) Unknown collector, (BAKER_3810, BAKER_3811); 23 June 1937; Grant Co., Fox Valley, T10S R30E S30.
Lupinus lepidus var. *cusickii*	none	(5a) J. Gordon Miller, #38 (OSC_175321, NY_747238); 15 July 1991; Harney Co., near Tamarack Creek; rocky scabland; last annotation by S.L. Broich, 2002. (5b) M.E. Peck, #20961 (WILLU_23623); 29 June 1941; Harney Co., Devine Canyon, 18 miles north of Burns; moist prairie; last annotation by S.L. Broich, 2002. (5c) M.E. Peck, #20109 (WILLU_20957); 13 July 1938; Harney Co., Devine Canyon, 18 miles north of Burns; dry ground; last annotation by S.L. Broich, 2002. (5d) L.E. Detling, #4460 (OSC_188192, ORE_52608); 24 July 1940; Grant Co., Bear Valley; sagebrush formation, roadside weed association, valley floor, sandy loam soil, full sun, level exposure, moderately moist, elevation 1422m; last annotation by S.L. Broich, 2002.
Mimulus evanescens	none	(6) Ingram, *s.n.* (RM); 6 July 1912; Grant Co., Graylock Butte, Ochoco [Malheur] National Forest.
Phacelia minutissima	2 EOs	(7) D. Swanson, *s.n.* (BAKER_9555); 2002; Harney Co., approx. 250ft below (south) of FR922 in large meadow, S Burns Rd., look for witness PSME on edge of meadow, sign facing NE, 91ft @252º from 21" PSME witness, T21S R32E S10, ecology plot #MA004, elevation 5970ft.; identified by S. Markow

APPENDIX B. Species*, survey IDs, acres surveyed, survey intensities, and notes for surveys of this project.

Species	NRIS Survey ID	Acres Surveyed	Survey Type	Notes
Calyptridium roseum	0604S2009_ISSSSP-HIST_FA01	19	Focused	Not located, but habitat present
	0604S2009_ISSSSP-HIST_FA02	3	Focused	Not located, but habitat present
	0604S2009_ISSSSP-HIST_FA03	16	Focused	Not located, but habitat present
	0604S2009_ISSSSP-HIST_FA04	12	Focused	Not located, but habitat present
	0604S2009_ISSSSP-HIST_FA05	8	Focused	Not located, but habitat present
Carex micropoda	0604S2010_ISSSSP-HIST_FA03	27	Systematic	Not located and later it was discovered that the specimen was misidentified but corrected by the Carex Working Group (as *Carex vallicola*), yet was incorrectly entered into the Oregon flora project database.
Carex nardina	0604S2010_ISSSSP-SODABEAR_FA02	41	Systematic	Not located, habitat highly altered
	0604S2010_ISSSSP-SODABEAR_FA03	116	Systematic	Not located, habitat highly altered
	0604S2010_ISSSSP-SODABEAR_FA04	13	Systematic	Not located, habitat highly altered
	0604S2010_ISSSSP-SODABEAR_FA08	16	Systematic	Not located, habitat highly altered
	0604S2010_ISSSSP-SODABEAR_FA01	103	Systematic	Habitat highly altered. However, a new population of *Thelypodium eucosmum* was discovered: Site ID = **0604EO2010_RJS01**
Eleocharis bolanderi	0604S2010_ISSSSP-HIST_FA01	76	General	Habitat highly altered by livestock grazing
Lupinus lepidus var. *cusickii* *	*Surveys were conducted concurrently with* Carex idahoa *surveys, and are accounted for by Suvey ID that are have the following codes:* 0604S2009_ISSSSP-SODABEAR_FA ... 0604S2010_ISSSSP-SODABEAR_FA ... 0604S2010_ARRA-PRONG_C-CWG ...	2100	Focused	Misidentified by preeminent expert on this species and later corrected by the Carex Working Group, Insitute of Applied Ecology, ORBIC, Oregon State University Herbarium Staff, and the Oregon Department of Agriculture staff.
Mimulus evanescens	0604S2010_ISSSSP-HIST_FA04	53	Systematic	Habitat present
Phacelia minutissima	0604S2010_ISSSSP-HIST_FA02	24	General	A new population was discovered: Site ID = **0604EO2010_JG01**

* The putative specimens are no longer considered to belong to variety *cusickii*.