2015 SW Oregon Integrated Western Bumble Bee Survey Project

Summary Report of Findings

22 February 2016

Bombus occidentalis in a collection jar. Photo by Matt Trappe.

SPECIES LIST AND RANKS:

Bombus occidentalis (Western Bumble bee) G2G3, S1S2
R6 Regional Forester's Sensitive Species (USFS)
Oregon State Director's Sensitive Species (BLM)
State of Oregon – NA
ORBIC List 2

BLM/FS FIELD UNIT(S):

Umpqua National Forest.
Willamette National Forest.
Rogue River Siskiyou National Forest.
Roseburg District BLM-South River Resource Area.

PROJECT LEADS:

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South River Resource Area, Roseburg District BLM

Abstract:

In 2015, bumble bee surveys were conducted throughout federal lands in southwest Oregon with the western bumble bee (*Bombus occidentalis*) as a target species. A wide variety of habitat types, across a spectrum of elevations were surveyed, and dozens of *Bombus* species were encountered. Western bumble bees were only located on the Willamette National Forests, on the McKenzie River and Detroit Ranger Districts. Surveys on the Umpqua and Rogue River-Siskiyou National Forests, and Roseburg District BLM yielded negative results. Further investigation is recommended, especially since 2015 was a very hot, dry year in which floral phenology was significantly advanced, but this effort lends support to the hypothesis that the western bumble bee is now absent from much of it's historic range.

Introduction:

In recent decades, the western bumble bee (*Bombus occidentalis*) has seen precipitous declines throughout its range. Previously a widespread generalist, the current amount of the historic range occupied by this species is currently unknown. The declines in western bumble bee have been rapid and severe, with an estimated decline of 70-90% across much of its range since 1998 (NatureServe 2013). Populations are currently critically imperiled in Oregon, Washington, and California (NatureServe2013), are currently largely restricted to higher elevation sites within these states, and are now rarely found in the western portions of these states where they were once very common (Jepsen 2015, Hatfield et al. 2013, Cameron et al. 2011).

Western bumble bees are native, natural pollinators and as a generalist pollinator they provide pollination services to a wide variety of commercial and non-commercial botanical species which in turn provide forage and habitat to a vast array of fauna across our public and private lands (Hatfield et al. 2012).

Population declines for this species (and other closely related species) are believed to be due, in large part, to an introduced pathogen, *Nosema bombi*, which was introduced through domestic colonies of bumble bees (Hatfield et al. 2013, NatureServe 2013). Other threats identified for the western bumble bee include habitat alteration, insecticide use, invasive plants and insects, and climate change (Hatfield et al. 2012). More information regarding the current habitat use of this species could aid in the application of management and mitigation activities to support and protect extant bumble bee populations. Information gained from this survey effort can provide a baseline of presence/absence data for western bumble bee and aid in conservation project planning on the Forest Service and BLM units where they occur.

Methods/Results:

Methods and Results will be presented according to administrative unit. In general, actual in-the-field methodology was consistent across the survey area, but some units had more specific information goals or baseline information to investigate.

Willamette National Forest

Methods:

Figure 1. Searching for bumble bees is mostly hard, unrewarding work. Hunts Cove, Mt. Jefferson Wilderness, Willamette National Forest.

The focus of the work on the Willamette NF was to survey for western bumble bee (WBB) at 20 historic sites documented in the NRIS Wildlife database where WBB had been detected during the years 1907 to 1994. The elevation of these sites ranged from 1070' to 5260' with a median elevation of 3665 feet. The historic locations occurred across the Forest with 3 on the Middle Fork Ranger District, 8 on the McKenzie River Ranger District, 3 on the Sweet Home Ranger District, and 6 on the Detroit Ranger District. One additional historic site at Scott Lake on the McKenzie River Ranger District was not surveyed in 2015 because WBB had been found there and at several nearby locations from 2010-2013. The survey protocol was to locate the NRIS site in the field and conduct one hour of survey effort (e.g. 2 people each independently searching for 30 minutes or one person searching for one hour) of a suitable flowering area as close to the NRIS location as possible. The exact point was not always searched because some of the historic locations in NRIS were imprecise and not in suitable habitat. For example, a 1907 record of WBB at Pamelia Lake was located in the middle of the lake. In this case, a large flowering meadow area next to the lake was surveyed. All WBB detected in the first hour of survey were recorded. If no WBB were detected, a second hour of survey effort was conducted. During the second hour, the observers either resurveyed the same area if they thought it was likely bees were moving through the site or missed during the first survey or they went to another adjacent flowering area and conducted a second hour of searching. Thus the project protocol was for all sites to have at least two hours of survey effort in suitable habitat at or near the historic location unless WBB were detected during the first hour of survey. GPS locations of all WBB detected were recorded as well as any flowering plants used for pollen gathering and the survey information was entered into NRIS Wildlife. Voucher photos were taken of WBB and confirmed by Xerces experts until it was certain the observers could identify the species. If time permitted, other sites were surveyed for WBB and in a few cases observers surveyed for more than two hours at historic sites. WBB surveys were conducted from mid-June to early September.

Results:

Nineteen of the 20 historic surveys were surveyed to the project protocol and several sites with negative results were surveyed for more than two hours. The Toll Creek Site on the Sweet Home Ranger District was surveyed for only 60 minutes because very few flowers were present at the time of the survey in early September and no bumble bees of any species were observed. The summer of 2015 was extremely hot and dry and the observer concluded the survey should have been conducted earlier in the year when rhododendrons were in bloom.

Table 1. Results of bumble bee surveys conducted on the Willamette National Forest.

Results of 2015 Western Bumble bee Surveys (WBB) of Historic Sites on the Willamette National Forest				
Site Name	**Year of Historic Observation[1]**	**Elev. (ft.)**	**Date of Survey**	**No. WBB Detected in 2015**
Detroit RD				
Monument Peak 1	1960	4210	June 24	0
Monument Peak 2	1961	4250	June 24	0
Detroit	1907	1600	July 14	0
Pamelia Lake	1907	3880	July 15	0
Breitenbush	1934	2360	August 12	0
Hunts Cove	1907	5260	August 12	0 (1)[2]
Sweet Home RD				
Maude Creek	1970	4920	July 30	0
Iron Mountain	1941	5000	August 8	0
Toll Creek	1961	3450	September 7	0[3]
McKenzie River RD				
McKenzie Pass	1925	5110	June 30	2
Santiam Pass	1961	4760	August 17	2
Blue River	1935	1070	August 12 & 16	0
Lucky Boy Camp	1935	1070	August 19 & 20	0
Lucky Boy Camp 2	1935	1070	August 16	0
Little Dearborn Island	1994	1180	August 15	0
McKenzie Bridge	1924	1380	August 13	0
Hoodoo Ski Area	1956	4840	August 13	0 (1-2014)[4]
Middle Fork RD				
Oakridge Site 1 (Methodist Church)	1935	1100	July 9	0
Oakridge site 2 (OHS track field)	1953	1100	July 10	0
Mule Prairie	1963	4350	July 2	0

[1] For sites with more than one year of historic records, the most recent year is shown.
[2] One WBB was detected near the site in 2015 outside of the survey period.
[3] This site was only surveyed for one hour due to a lack of flowers in the vicinity of the historic location. The lack of flowers was attributed to the extremely prolonged dry weather at the time the survey was conducted in August. No bumble bees of any species were observed.
[4] One WBB was detected at this site in 2014, but not during the 2015 surveys.

Western bumble bees were detected during 2015 project surveys at 2 of the 20 historic sites (Table 1). In addition, a single WBB was detected outside the survey period while walking to one site and a WBB had been detected at one of the other sites in 2014. In total, we have recently found WBB at 5 of the 21 known historic sites on the Forest, including the Scott Lake site (Figure 2). Four of these sites are on the McKenzie River Ranger District at elevations ranging from 4760 to 5110 feet. The other site is on the Detroit Ranger District at 5260' elevation. The WBB detection on the Detroit Ranger District is the only recent sighting that the Forest Service is aware of on that district since the early 1960's. Bee surveys were also conducted at two other sites on the Detroit Ranger District and three other sites on the Sweet Home Ranger District, but no WBB were found. Eight additional sites were surveyed on the McKenzie River Ranger District, six as part of a Hummingbirds Forever Project. Western bumble bees were detected at three of these 8 sites. Also WBB were incidentally detected at 5 other sites on the McKenzie River Ranger District in 2015 in connection with various projects and WBB were detected at 10 sites in the Horse Creek drainage of the McKenzie River Ranger District as part of an ISSSP Bioblitz-In-The-Wilderness Project that will be reported on separately. The WBB distribution data and observations on selection of pollinating plants from the wilderness study are included in this report, however. Overall, we documented WBB along a 30 mile stretch west of the Cascades Crest at the headwaters of the McKenzie River drainage (Figure 3). The WBB distribution extended west up to 12 miles down the drainage from the Crest.

The elevations where WBB were detected on the McKenzie River Ranger District in 2015 ranged from about 2800 to 5900 feet. The number of WBB detected at a site ranged from 1 to more than 15 but was usually in the range of 1-4 individuals. Western bumble bees were observed collecting pollen on 11 species of plants (Table 2).

Table 2. Floral species utilized by Bombus occidentalis on the Willamette National Forest.

Flower Species Used by Western Bumble Bees to Gather Pollen by Number of Sites[1] by Month, Willamette National Forest, 2013-2015.

Flower Species	Common Name	June	July	Aug	Sept	Total
Spiraea douglasii	Douglas Spirea		3	1		4
Spiraea densiflora	Subalpine Spirea	1	1			2
Spiraea spp.	Spirea species		2			2
Mimulus lewisii	Pink Monkey Flower			1		1
Aster spp.	Asters		5	1	2	8
Solidago canadensis	Goldenrod			1		1
Ericameria greenei	Rabbitbrush			1		1
Pedicularis racemosa	Sickletop Lousewort		2			2
Senecio triangularis	Arrowleaf groundsel			1		1
Anaphalis margaritacea	Pearly Everlasting			1		1
Ligustichum grayi	Gray's Lovage		1			1
Rudbeckia occidentalis	Western Coneflower			1		1
	Total Sites	1	14	8	2	25

[1] A Site is defined as a single meadow complex or all WBB locations within 0.25 miles of each other whichever area is larger. Recorded observations of WBB gathering pollen on the Forest from 2013-2015 are included in this table.

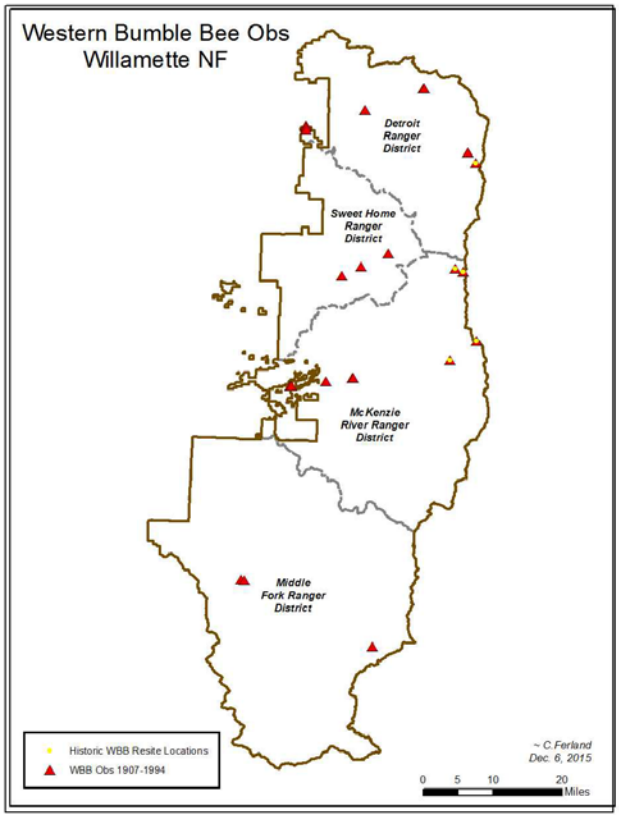

Figure 3. Location of Historic Western Bumble Bee Sites, Willamette National Forest. The sites with the yellow and red label are those where WBB have been found since 1999.

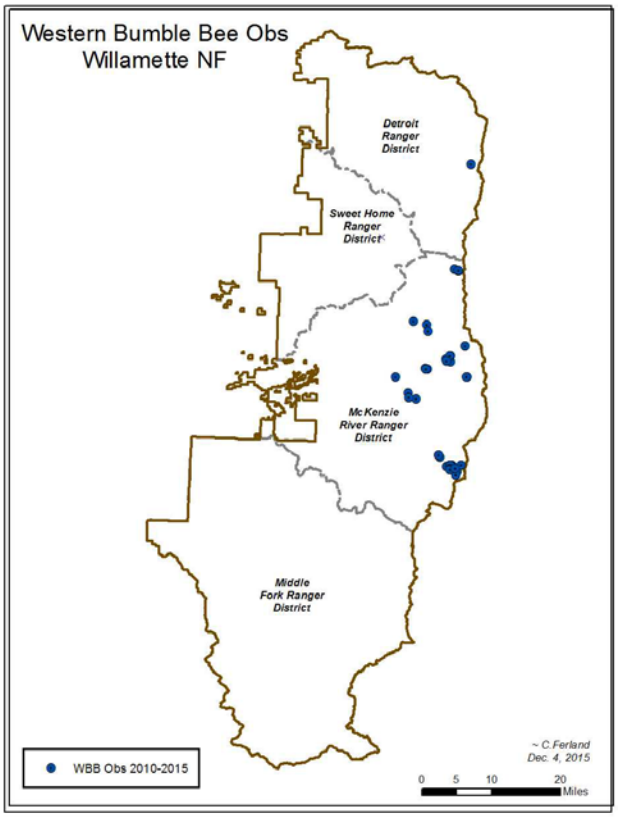

Figure 2. Location of Recent Western Bumble bee Observations, Willamette National Forest. Most of these locations were found in 2015 as a result of ISSSP funding.

The species has not been found lately on either the Sweet Home or the Middle Fork Ranger District and our working hypothesis is that it has become extinct over much of the Forest. Given that the historic data shows it once occurred across the forest, it is possible that it is now extinct on 75% or more of the Forest. There is, however, a substantial population area on the westside of the Cascades in the McKenzie River drainage that extends from crest down to at least 2800 elevation. It is not known if this population is continuing to decline. Also the abundance of WBB in high elevation areas elsewhere on the Forest is uncertain.

Umpqua National Forest

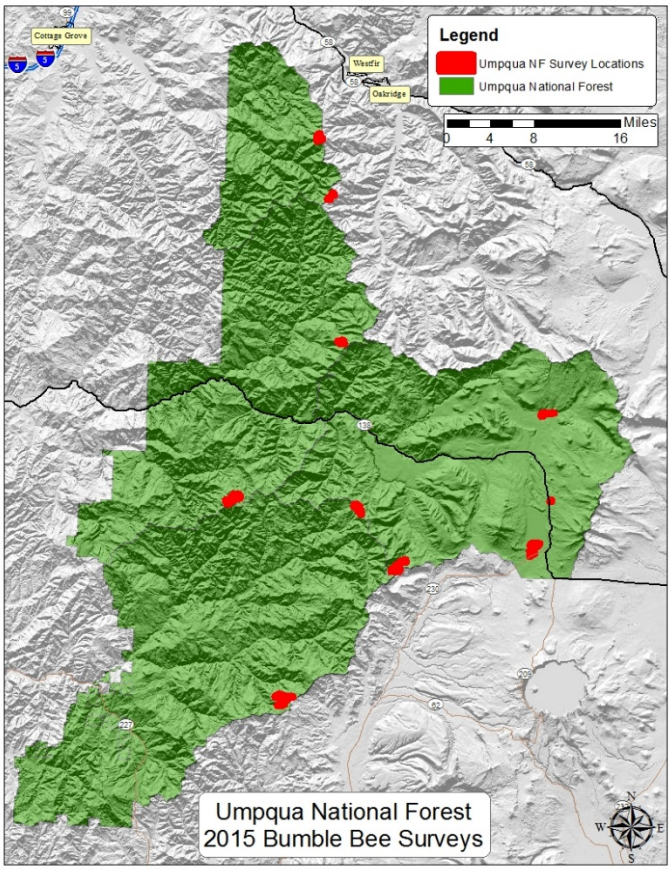

Figure 4. Survey Areas on the Umpqua National Forest.

<u>Methods:</u>

Surveys on the Umpqua National Forest concentrated on meadows with floral communities that offer pollen and nectar resources from early spring to late summer, and which include species that have been identified as being preferred by western bumble bees from previous survey efforts by The Xerces Society (Hatfield et al. 2013, Rich Hatfield personal communication).

Survey efforts consisted of walkthroughs at 10 identified survey locations that were selected by the Forest botanist as most likely to provide the characteristics identified above. Survey sites, one hectare in size each, were placed into each survey location in a manner which spread survey effort across each of the 10 survey locations. Each hectare survey site received 1 hour of walkthrough survey effort.

Figure 5. Cottage Grove District Botanist Krista Farris conducting a bee survey at Holland Meadows.

Walkthrough surveys were conducted from late July to early August. This timing was selected based on the height of colony populations for

western bumble bees in normal years (Williams et al. 2014). Field surveyors captured bumble bees using nets and/or specimen jars and identified bees to species. Specimens that could not be readily identified were either photographed or collected for later identification with the aid of Rich Hatfield of the Xerces Society. Plant species being used by pollinators were also noted by botanist and bee surveyors.

Figure 6. Bombus insularis on Rudbeckia occidentalis. Cottage Grove Ranger District.

Results:

In total, 16 *Bombus* species were documented across the Umpqua National Forest. Species composition varied from site to site and from District to District. Even though a variety of bumble bee species were identified, no *Bombus occidentalis* specimens were encountered at any of the survey locations. The species encountered, ranked by local relative abundance, can be found in Table 3.

There are only two historic *Bombus occidentalis* locations documented on the Umpqua according to records known at this time. These locations are old, dating back from the 1930's to the 1960's. The vicinity of the historic sites were included in this survey effort but no *Bombus occidentalis* were discovered.

The unusually hot and dry year likely affected the relative abundance and phenology (timing) of pollinator host plants available during the field season. In some cases only a few species were providing pollen and nectar for bumble bees at the time of survey. However, many other pollinator species were observed in the survey areas which had already finished flowering. As a part of the bumble bee surveys on the Umpqua NF, botanists conducted brief walkthroughs of the survey areas and catalogued the floral species present. There was some differentiation in floral species being used based on survey location; the northernmost sites on the Cottage Grove Ranger District observed bees utilizing very few floral species (*Rudbeckia occidentalis* was heavily favored, likely because it was one of the very few species still in bloom), while the southernmost sites on the Tiller Ranger District observed bees utilizing a wider spectrum of floral species even though surveys occurred within the same survey window. This may be because of inherent differences in floral communities at these sites (Tiller RD enjoys a greater species diversity in general), and because the southern dryer habitats contain species that are more likely adapted to drought conditions. A list of plant species encountered during surveys is included in Table 4. This is not an exhaustive list of plant communities, but rather a list of those species that were most apparent during the bumble bee survey period

Table 3. Bumble bee survey results for the Umpqua National Forest. Species are ranked by relative abundance at each survey site.

Umpqua National Forest Survey Results			
Cottage Grove Ranger District		**North Umpqua Ranger District**	
Location	**Species Found (N)**	**Location**	**Species Found (N)**
Grass Mountain 22-27 July 2015	*B. bifarius (11)* *B. flavifrons (7)* *B. vosnesenskii (5)* *B. fervidus (3)* *B. flavidus (3)* *B. mixtus (3)* *B. insularis (3)* *B. rufocinctus (1)*	**Hemlock Lake** 5 August 2015	*B. bifarius (33)* *B. vosnesenskii (7)* *B. flavifrons (3)* *B. suckleyi (2)*
Holland Meadows 21-23 July 2015	*B. flavifrons (20)* *B. mixtus (17)* *B. bifarius (10)* *B. vosnesenskii (4)* *B. flavidus (6)* *B. sitkensis (2)* *B. rufocinctus (1)*	**Reynolds Shelter** 6 August 2015	*B. bifarius (31)* *B. flavifrons (10)* *B. vosnesenskii (4)*
Diamond Lake Ranger District		**Tiller Ranger District**	
Location	**Species Found (N)**	**Location**	**Species Found (N)**
Diamond Lake Meadow 27 July 2015	*B. bifarius (17)* *B. mixtus (3)* *B. vosnesenskii (3)*	**Donegan Prairie** 16 & 21 July 2015 11 August 2015	*B. bifarius (42)* *B. flavifrons (34)* *B. mixtus (12)* *B. fervidus (7)* *B. appositus (5)* *B. vosnesenskii (5)* *B. melanopygus (4)* *B. rufocintus (3)* *B. flavidus (2)* *B. griseocollis (1)*
Fish Creek Meadow 29 July 2015	*B. bifarius (21)* *B. appositus (4)* *B. mixtus (3)* *B. vandykei (2)*		
Kelsay Valley Meadow 30 July 2015	*B. bifarius (30)* *B. vandykei (12)* *B. vosnesenskii (11)* *B. insularis (7)* *B. huntii (1)* *B. melanopygus (1)*	**French Junction** 25 June 2015 1 & 28 July 2015 3 August 2015	*B. bifarius (67)* *B. mixtus (22)* *B. flavifrons (19)* *B. vosnesenskii (18)* *B. appositus (16)* *B. griseocollis (14)* *B. fervidus (8)* *B. melanopygus (4)*
Mt. Thielsen 23 July 2015	*B. bifarius (17)* *B. mixtus (5)* *B. coliginosus (2)* *B. flavifrons (1)*		

Table 4. Floral species present in Umpqua NF survey sites. Plant species with bumble bees observed utilizing them are marked.

Umpqua National Forest Floral Survey Results			
Flora Observed	**Bee Observed**	**Flora Observed**	**Bee Observed**
Achillea millefolium	X	*Mertensia paniculata*	
Agastache spp.	X	*Mimulus guttatus*	
Aquilegia formosa		*Osmorhiza occidentalis*	
Aster foliaceus	X	*Pedicularis racemosa*	
Camassia spp.	X	*Phacelia heterophylla*	
Campanula rotundifolia	X	*Polemonium pulcherrimun*	
Castilleja hispida	X	*Prunus virginiana*	
Chamerion angustifolium		*Ribes sanguinium*	
Cirsium callilepis	X	*Rubus parviflora*	
Cornus sericea		*Rudbeckia occidentalis*	X
Delphinium spp.	X	*Salix sp.*	
Erigeron spp.	X	*Saxifraga mertensiana*	
Gilia capitata		*Senecio triangularis*	
Heracleum lanatum		*Solidago canadensis*	X
Hypericum perforatum	X	*Spireae douglasii*	
Lathyrus nevadensis		*Stachys coolei*	
Ligustichum grayi		*Trifolium*	
Lonicera involucrata		*Vaccinium membranaceae*	
Lupinus latifolius	X	*Veratrum californicum*	
Madia bolanderi			
Menyanthes trifoliata			

Rogue River-Siskiyou National Forest

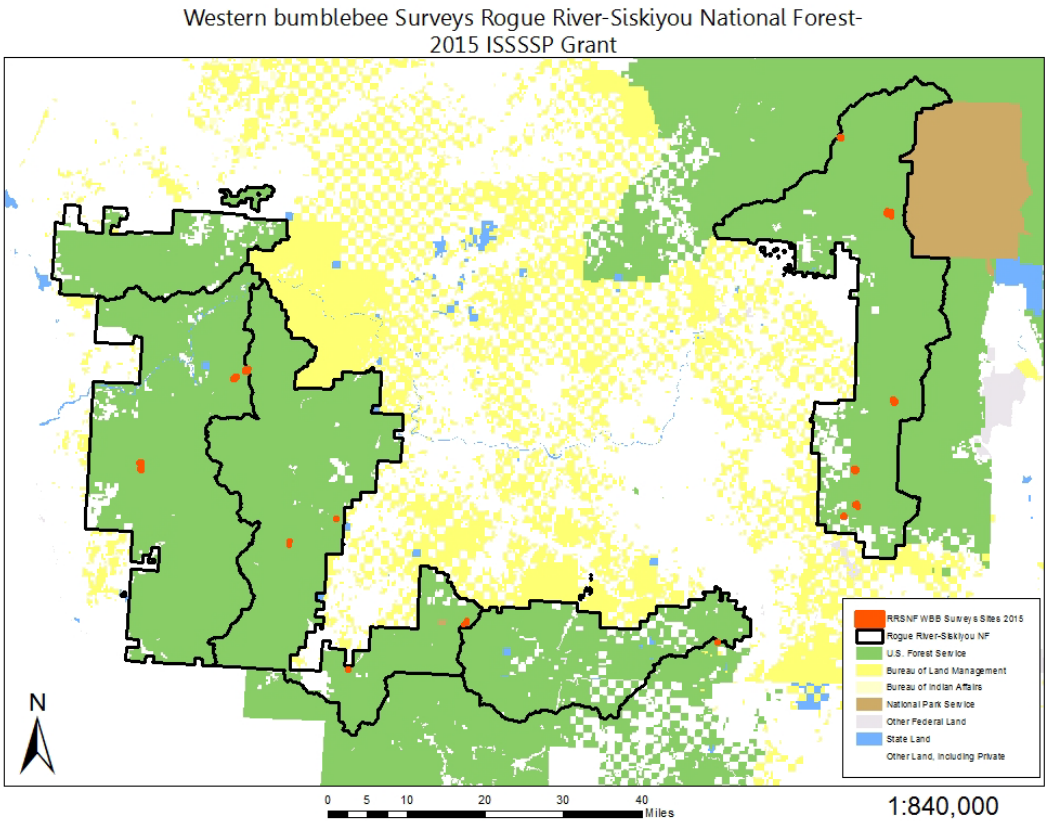

Figure 7. Survey Areas on the Rogue River-Siskiyou National Forest.

Methods:

The Rogue River-Siskiyou National Forest participated in the FY2015 multi-Forest project to survey areas for Western bumble bee. The primary purpose of the surveys was to detect Western bumble bee presence as opposed to sampling numbers of individual species. Therefore, a consistent systematic sampling method was not used for this effort.

Survey methodology included walking through the entire site and identifying *Bombus* species opportunistically. A total of 407 acres across fifteen locations on the Forest were surveyed and ranged from the southern Oregon Coast Range to the Western Cascades (Figure 7). Habitats surveyed were primarily mid to high elevation meadow complexes. The timing of surveys ranged from late July to early September. Photo vouchers of species that were not readily identified were sent to Rich Hatfield of the Xerces Society for aid in species identification.

Figure 8. Crawford Meadow in the High Cascades RD.

Results:

Western bumble bees were not detected during any of the surveys, but 11 non-target *Bombus* species were observed and documented at most of the sites (Table 5).

In total, more than 400 acres of habitat was surveyed for the Western bumble bee. There is one historic *Bombus occidentalis* location on the High Cascades Ranger District, and one survey location was near-by, approximately 1.7 miles to the southwest, but no Western bumble bees were discovered there.

Table 5. Bumble bee survey results for the Rogue River-Siskiyou National Forest by Ranger District and survey location.

Rogue River-Siskiyou National Forest Bumble Bee Survey Results				
District	**Date**	**Location Name**	**Acres**	***Bombus* species observed**
Siskiyou Mountains RD	7/20/2015	Mount Ashland	5	*B. appositus, B. vandykei, B. vosnesenskii, B. mixtus, B.nevadensis, B. flavifrons, B. bifarius, B. fervides, B. insularis*
Wild Rivers RD	7/24/2015	Elk Creek Trail	19	*B. appositus, B. vosnesenskii, B. mixtus, B. flavifrons, B. bifarius, B. fervides*
	8/4/2015	Star Flat	3	None
	8/27/2015	Hogue Meadow	5	*B. vosnesenskii*
	8/30/2015	Fiddler Mountain	5	None
High Cascades RD	8/10/2015	Short Creek Prairie	20	*B. melanopygus, B. B. flavifrons, B. mixtus*
	9/5/2015	Blue Rock Meadow	24	*B. caliginosus, B. mixtus*
	8/6/2015	Hershberger Meadow	6	*B.appositus, B. caliginosus, B. vosnesenskii, B. affinis, B. mixtus*
	8/6/2015	Willow Prairie	38	*B. vosnesenskii, B. mixtus, B. bifarius,*
	8/11/2015	Crawford Meadow	56	*B. melanopygus, B. caliginosus, B. flavifrons*
	8/10/2015	Dunlop Meadow	10	None
Gold Beach RD	9/2/2015	Snow Camp	38.5	None
	8/4/2015	Fairview	49	*B. vosnesenskii*
	07/28-29/2015	Sugarloaf	63	*B. caliginosus, B. melanopygus, B. flavifrons, B. bifaris*
	7/23/2015	Indigo Prairie	65	*B. vosnesenskii, B. fervides*
		TOTAL ACRES SURVEYED	**406.5**	

Roseburg District, BLM

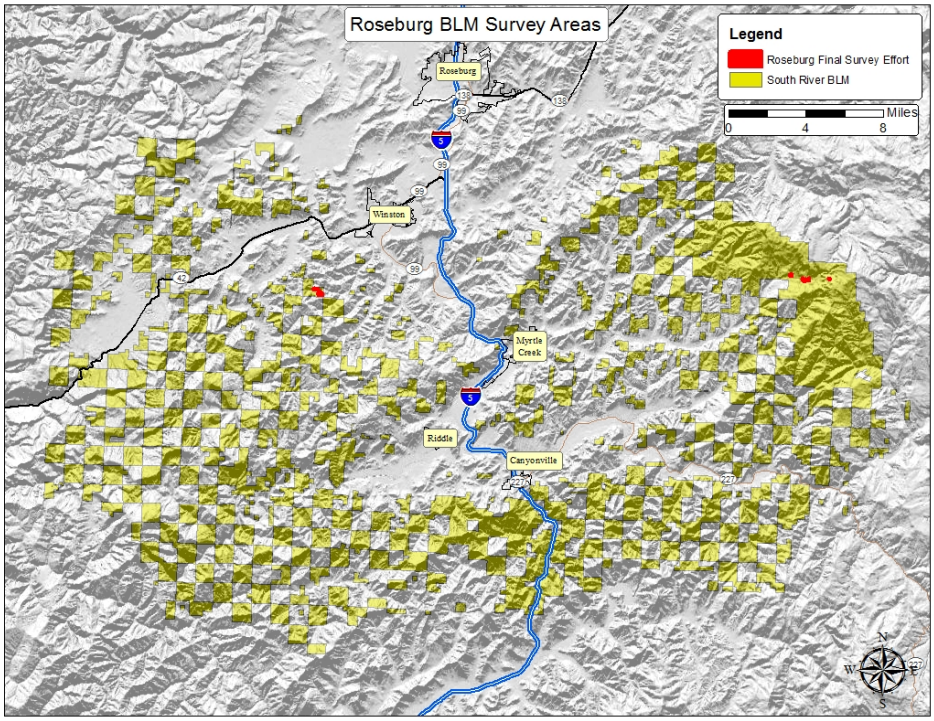

Figure 9. Areas Surveyed in South River Resource Area, Roseburg BLM.

Methods:

Surveys to detect the western bumble bee were conducted during the summer of 2015. The objective within the Roseburg District was to document bumble bee species including the western bumble bee in post-harvest areas (393 acres of thinned stands). The summer of 2015 was unusually hot and dry and shortened the longevity of the flowering season.

Methodology for this survey effort followed the general guidelines outlined by Rich Hatfield of the Xerces Society. Sites were surveyed by conducting a one hour walkthrough in one hectare survey plots. Surveys were initiated after the June 2015 bumble bee training session in Cottage Grove and continued to mid-August 2015.

Results:

Twenty six sites (393 acres) were originally planned for surveys. Seven of these sites (151 acres) were successfully surveyed during 2015 (Figure 9). Bumble bees were found in only four of the seven sites. Six species were successfully identified. All the specimens found were common species, and western bumble bees were not encountered.

Historic surveys to document bumble bee species in post-harvest areas are not available in the Roseburg District BLM. Including surveys efforts (sporadic surveys by Thorpe in the Umpqua Basin), the upland areas in the Roseburg District generally lack any survey efforts to document bumble bee species. Species encountered during surveys are displayed in Table 6.

Table 6. Roseburg BLM survey results. Survey plots were placed in areas which have recently been harvested. Numbers signify quantity of specimens identified at each site.

Roseburg District BLM 2015 Bumble Bee Survey Results							
Survey Site	**Survey Date**	*B. caliginosus*	*B. flavifrons*	*B. flavidus*	*B. mixtus*	*B. vandykei*	*B. vosnesenskii*
WBBR-01	8/24/2015						
WBBR-04	8/24/2015						
WBBR-05	8/24/2015						
WBBR-17	7/22/2015			1	1		3
WBBR-21	7/28/2015		6	1	1	1	2
WBBR-24	7/22/2015						6
WBBR-25	8/19/2015	1	5	2			

Bumble bees in Survey sites WBBR-17, WBBR-21, and WBBR-24 made use of salal (*Gaultheria shallon*) but most survey sites had a notable low presence of flowers during the summer of 2015. Non-native plant species, in particular spotted knapweed (*Centaurea maculosa*), were the only persistent flowers and the bumble bees concentrated their foraging activity on these non-native plants. Spotted knapweed was generally found in or around the periphery of the survey sites or roads in the survey sites.

Figure 10. Roseburg BLM biologists Matt Rustand and Summer Cross conducting bumble bee surveys in the South River Resource Area.

The dry condition of 2015 changed the duration of the flowering period to the point that the montane sample sites lost nectar producing flowers by July and many of the potential survey sites had poor (hot and dry) conditions for surveys. The remote locations, time involved, environmental conditions did not allow completion of surveys in the planned sites in 2015.

Although the western bumble bee was not documented, the survey effort was successful in collecting data about local bumble bee species in the Roseburg District and clearly showed that post-treated forest stands do serve as focal areas used by bumble bees. The 2015 survey effort is the first step in an attempt to document a more complete list of bumble species present in post-harvest areas. Roseburg BLM hopes to continue conducting bumble bee surveys and, in doing so, help find rare species like the western bumble bee.

Discussion

After surveying across four administrative units spread across most of southwest Oregon, the western bumble bee was found only on the Willamette National Forest where once it would have been expected to be found across that geographic range.

2015 was the first year that the Forest Service and BLM in southwest Oregon conducted focused surveys for the western bumble bee. In this study we found WBB at 20 new sites on the McKenzie River Ranger District and 1 site on the Detroit Ranger District of the Willamette National Forest.

Both the botanists and biologists thought many of the survey areas had advanced floral phenology caused by the abnormally hot and dry weather conditions. In some places there had been a complete lack of a seasonal snowpack. In such cases bumble bees were relying heavily on very few plant species, including invasive species, to support the height of their annual populations.

While western bumble bees were only found on one administrative unit, all units benefited from this project in several ways:

- A baseline bumble bee species occurrence list has been established across the varied habitats and geographic areas surveyed.
- Bumble bee survey and identification skills were learned, which were almost entirely lacking at the onset of this project.
- Biologists across a large portion of the state have been made more aware of an important part of the health of the ecosystems in their charge.
- And, very importantly, we have more information supporting the hypothesis that the western bumble bee may be experiencing extirpation from most of it's historic range, and may be absent or greatly reduced in distribution and abundance in the southwest Oregon Cascades and Siskiyou Mountains.

We believe that more survey effort would be needed to fully support such a conclusion, however, and we have a strong collective desire to implement that effort in the years to come to build on what we have learned through this project. Eventually, this information may lead to habitat restoration or conservation efforts to restore western bumble bee. In the meantime, it is possible that the populations discovered in the Willamette and Mt Hood National Forests may be the extent of the current range of the species on the west side of the Oregon Cascades, and the conservation of these populations may be very important for the future of the species.

Figure 11. A pond on Grass Mountain, the Umpqua-Willamette borderlands.

References

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