

# Surveys for the Western bumble bee (*Bombus occidentalis*) on the Wallowa-Whitman National Forest 2014-2015

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La Grande Natural Resources Crew surveying 6220 meadow site

## BACKGROUND

Pollinators play a key role in maintaining terrestrial ecosystem integrity due to their role in plant reproduction. Their role not only supports other invertebrates, birds and mammals, they provide services for the multibillion agricultural industry. This essential role, however, is increasingly at risk. There is mounting evidence that many bumble bee species have declined in recent decades, particularly in developed regions such as Western Europe and North America (Goulson 2003, Kosior et al. 2007) with habitat fragmentation, grazing, pesticide use, climate change and disease all playing part in the decline (Hatfield et al. 2012).

*Bombus occidentalis* (hereafter *B. occidentalis*), was once widespread and common throughout the Western United States and Western Canada before 1998 (Xerces Society 2008). Unfortunately, since 1998, populations of this bumble bee have declined drastically throughout parts of its former range, and it is now considered rare. It is difficult to accurately assess the magnitude of these declines since most of this bee's historic range has not been sampled systematically (Cameron et al. 2011, Thorp and Shepherd 2005). Cameron et al. 2011 compared historical records with those of current field surveys focusing on 8 North American *Bombus* species. The relative abundance of four of those species, including *B. occidentalis* has declined by up to 96%.

The conservation status of the western bumblebee is currently under consideration. NatureServe lists this species as G2G3, or Imperiled/Vulnerable, and suggests that it has declined by 70- >90% in the short term and 50-90% in the long term (Nature Serve 2011). The Oregon Biodiversity Information Center assigned the western bumble bee a rank of SI/S2, or Critically Imperiled/Imperiled, within the state. *B. occidentalis* is currently on Region 6 Foresters Sensitive Species List and has been identified as a top 10% priority species for the Wallowa-Whitman NF.

An escaped exotic fungal pathogen (*Nosema bombi*) that may have spread from commercial, domesticated bumble bees to wild bumble bees is thought to be a primary cause in the decline of the western bumble bee (Thorp and Shepherd 2005 and Evans et al. 2006). Surveys that have been conducted suggest that existing populations of the western bumblebee in Oregon are likely small and threatened by current land management practices. Zayed (2009) found that due to their unique life history, bumble bees have multiple genetic threats to population viability and because of this are highly susceptible to extinction in small and/or isolated populations. It is therefore especially important to protect the remaining populations of western bumble bees from the threats that they face. However, we know very little about the distribution of the Western bumblebee in Oregon. In order to protect and manage for the species, we need to have more information about its distribution. Surveys on the Wallowa-Whitman help provide a baseline of Western bumble bee locations as well as contributing to a list of bumble bee biodiversity on the forest.

## METHODS

Historical locations were obtained from Johnathan Koch, who gathered specimen data from natural history collections to model bumblebee distribution across the Western U.S (Lozier et al. 2011). These historical locations were used to prioritize survey locations. After the historical locations had been surveyed, district knowledge of meadow locations on the forest was used to identify appropriate habitat to survey. Survey locations were concentrated within the La Grande district, however some surveys occurred within the Baker district as part of a larger wildlife survey effort related to an up-coming timber sale.

Surveys occurred between August 4th, 2014 and August 10th, 2015. Survey protocol was conducted according to instruction from Rich Hatfield, Endangered Species Conservation Biologist for the Xerces Society. At survey locations we used 30 minute time periods to collect all bumble bees we could find within a 100 meter radius maximum. There were no experienced bumble bee observers present at these surveys and so all bumblebees observed were collected for more accurate identification. After a few surveys were complete, observers were confident enough in the identification of the most common form of *Bombus bifarius* that they could be ID'd on the wing. Captured bumblebees were placed in a cooler for up to thirty minutes to allow the bumble bees to slow down for easier identification. Photos were taken to aid in identification. After identification, bumble bees were released. Mortality was very low with this process. Over two years, four bumble bees did not recover after being removed from the cooler, but all others were able to fly away. Some bumblebees whose species identification were still in question after being observed for a long period of time were collected for further examination in the office. Floral hosts were recorded and when possible, flower identification was confirmed with the district botanist. Species abundance was taken to the best of the surveyors ability, however some meadows contained such high numbers of bumblebees that there were not enough vials to collect everything within the allotted time. In these cases the surveyors would stop collecting the most common bumblebee (in all cases this was *B. bifarius*) and instead attempt to collect any new species they saw, focusing on species diversity over species abundance.

## RESULTS

We identified 14 different species of bumble bees on 26 locations within the Wallowa-Whitman National Forest\* (Table 2, Image 1.) Western bumble bees were located at nine new sites on the forest and re-confirmed at two historic locations (Table 1, 3, Images 2-6). When floral information was collected, westerns were generally found on a different floral host at each location though twice they were found foraging on yellow coneflower (Table 3); *Lupinus sulphureus* (Lupine), *Senecio serra* (butterweed groundsel), *Chamerion augustifolium* (fireweed), *Sanguisorba sitchensis* (Canadian burnet), *Aconitum columbianum*. (monkshood), *Rudbeckia occidentalis* (yellow coneflower).

Bumble bees were located on 21 different species of plants (Table 4). The plant species that showed the highest bumble bee species richness was yellow coneflower (*Rudbeckia occidentalis*) These observations came from one unique survey location (Sand Flats), a meadow that consisted almost entirely of blooming coneflower and also had the highest species richness of all the

locations. Though species abundance was not accurately recorded in all surveys, *Bombus bifarius* was by far the most abundant species found across all surveys, as well as the most generalistic in its use of different flower species, occurring on 81% of floral hosts.

## DISCUSSION

Understanding the current distributions of sensitive species is an important part of conservation. The surveys conducted in 2014 and 2015 were not exhaustive but have helped to provide a baseline for Western bumble bee occurrence within the Wallowa-Whitman National Forest. Western bumblebees seem very well distributed on the eastern side of the La Grande district, occurring in 83% of formal surveys and discovered incidentally in two other locations. However surveys on the western side of the forest, as well as within the Wallowa district found a low distribution (Image 1). It is not clear why this would be, as a large difference in plant species composition or elevation is not markedly apparent. Western bumblebees were found at elevations ranging from 3833 ft (Catherine Creek) to 7159 ft (Anthony Lakes). It is important to note that, even in the areas of high distribution, abundance of the Western bumblebee was almost always low with only one or two individuals found during each survey. The exception to this was a survey located in a lodgepole stand that had burned in 2007. Fireweed had taken over the undergrowth and 9 western bumblebees were found in this spot (6220 switchback survey, Table 3).

It appears that the Wallowa-Whitman currently provides habitat for Western bumblebees and future surveys should endeavor to increase distribution data to provide a more complete picture of Western bumble bee distribution across the Wallowa-Whitman. More rigorous collection of habitat data at each survey site could help provide an answer as to why the Western bumblebee currently seems to be better distributed in some parts of the forest than the others.

Western bumble bee location knowledge is beneficial when considering timber and range management effects. Grazing effects from cattle and native ungulates as well as prescribed fire have a demonstrated effect on pollinator populations. Carvell 2002 found that grazing played a key role in limiting competing species from achieving dominance and maintaining species richness and abundance. Cattle are considered more beneficial for pollinator species than sheep as their grazing patterns tend to create more structurally and floristically diverse habitat. However, intensive grazing that reduces forbe availability can have negative effects to pollinators. Kimoto 2010 found that bumble bees showed reduced abundance, diversity, and richness with increased grazing intensity early in the season. Late grazing treatments tend to result in taller vegetation and increased flower abundance and higher pollinator utilization (Sjodin 2007). Prescribed fire has a proven benefit to bee species (Swengel 2000). Moretti et al. 2009 found freshly burnt sites contain the highest floral diversity and more bee species are observed at these sites compared to mature and unburnt sites. Specialized management practices tailored to enhance pollinator species can be used, especially in areas where the sensitive bumble bee has been found.

These surveys also have the benefit of providing a baseline of bumble bee species richness on the forest as well as the vegetation they are using. As pollinator species decline across the country, documentation of current species richness can be very valuable for management and

enhancement project monitoring. Maintaining this knowledge will help identify declining species before their populations reach critical levels.

## ACKNOWLEDGEMENTS

This project was made possible by funding from ISSSSP as well as knowledge and expertise from the Xerces society. Title II funds made a natural resource crew possible, which greatly added to the amount of data collected.

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Table 1. Bumble bee survey locations. (+) indicates historical records of the western bumble bee. (\*) indicates the presence of western bumble bee in the current surveys.

Location ID	Northing	Easting	Elevation	Date	Species Richness
West Eagle*	4992548	462327	5465 ft	8/4/2014	3
South Fork LimberJim	4994237	394937	4296 ft	8/5/2014	4
6220 Meadow*	5017667	445543	6860 ft	8/6/2014	6
Indian Creek Meadow	5017890	445420	6812 ft	8/6/2014	6
6220 Switchback*	5015674	444820	6359 ft	8/6/2014	4
Anthony Lakes+*	4979279	402753	7159 ft	8/7/2014	4
42 Rd site+	5001432	416234	4476 ft	8/11/2014	5

Beaver Creek +	5004318	405056	5065 ft	8/11/2014	5
220 Rd	5001653	407162	5422 ft	8/11/2014	3
High Mt Rd Junction	4989103	411858	4386 ft	8/12/2014	7
Sand Flats*	4985698	406697	5296 ft	8/12/2014	8
Limberjim 400 Rd Junction	4998436	400575	6000 ft	8/18/2014	4
Big Creek+*	4985149	455483	3842 ft	7/9/2015	5
Harl Butte Meadow	05059127	5018845	5631 ft	7/17/2015	2
Timber Pasture BSDRA	0502184	5019595	5289 ft	7/20/2015	6
Aspen Groove Spoon Spring*	0503995	5013990	5336 ft	7/21/2015	6
Tyee Creek	0499499	5003583	5744 ft	7/22/2015	4
Big Sheep Creek	0501232	5010616	4775 ft	7/23/2015	5
Grouse Creek 1	0505934	5009803	5066 ft	7/24/2015	3
Grouse Creek 2	0504910	5008597	5196 ft	7/24/2015	6
Janes Ridge	0508524	5013587	5325 ft	7/28/2015	6
4600 Rd Red Hill Lookout	0491433	5072555	4868 ft	8/5/2015	4
4600 Rd Billy Meadows	0496144	5075799	4887 ft	8/6/2015	5
Catherine Creek*	4997682	450383	3833 ft	8/6/2015	8

Two Color*	4988703	464596	5698 ft	8/6/2015	4
Mt. Howard	0486074	5011615	8059 ft	8/10/2015	5



Table 2. Bumble bee species by survey location

Survey Location	<i>B. occidentalis</i>	<i>B. bifarius</i>	<i>B. appositus</i>	<i>B. melanopygus</i>	<i>B. centralis</i>	<i>B. vagans</i>	<i>B. flavifrons</i>	<i>B. mixtus</i>	<i>B. fervidus</i>	<i>B. insularis</i>	<i>B. sylvicola</i>	<i>B. huntii</i>	<i>B. nevadensis</i>	<i>B. rufocinctus</i>
West Eagle Meadow	x	x		x										
South Fork LimberJim Creek		x		x	x	x								
6220 meadow	x	x	x	x	x			x						
Indian Creek meadow		x	x			x	x		x	x				
6220 switchback	x	x					x	x	x					
Anthony Lakes	x	x				x		x						
42Rd site		x	x				x			x	x			
Beaver creek watershed		x	x		x						x			
220 Rd		x	x							x				
High Mt Rd Junction		x	x		x	x	x	x				x		
Sand Flats	x	x		x			x	x	x	x		x		
Limberjim 400 Rd junction		x	x							x	x			
Big Creek	x	x			x			x	x					
Harl Butte Meadow		x							x					
Timber		x	x	x					x				x	x

Survey Location	<i>B. occidentalis</i>	<i>B. bifarius</i>	<i>B. appositus</i>	<i>B. melanopygus</i>	<i>B. centralis</i>	<i>B. vagans</i>	<i>B. flavifrons</i>	<i>B. mixtus</i>	<i>B. fervidus</i>	<i>B. insularis</i>	<i>B. sylvicola</i>	<i>B. huntii</i>	<i>B. nevadensis</i>	<i>B. rufocinctus</i>
Aspen Groove Spoon Spring*	x	x	x						x					x
Tyee Creek		x												x
Big Sheep Creek		x	x	x					x					x
Grouse Creek 1			x						x				x	
Grouse Creek 2		x	x		x		x		x					x
Janes Ridge		x	x		x		x		x					x
4600 Rd Red Hill Lookout		x	x		x									x
4600 Rd Billy Meadows		x	x		x			x	x					
Catherine Creek	x	x	x	x		x		x		x	x			
Two Color	x	x	x								x			
Mt. Howard					x					x		x		x

\*At least one other potential species was recorded and voucher specimen collected, however identification was not complete by report completion.

Table 3. Western bumble bee locations from 2014-2015 surveys and incidental observations

Date	Species	State	County	Location	Northing	Easting	Elevation	Floral Host	Abundance	Observer
8/4/2014	<i>Bombus occidentalis</i>	Oregon	Union	*West Eagle Meadows	4992548	462327	5465 ft	<i>Lupinus sulphureus</i>	3	A. Blumton
8/6/2014	<i>Bombus occidentalis</i>	Oregon	Union	6220 Meadow	5017667	445543	6960 ft	<i>Senecio serra</i>	1	L. Navarrete
8/6/2014	<i>Bombus occidentalis</i>	Oregon	Union	6220 Switchback	5015674	444820	6359 ft	<i>Chamerion angustifolium</i>	9	L. Navarrete
8/7/2014	<i>Bombus occidentalis</i>	Oregon	Baker	Anthony Lakes	4979279	402753	7159 ft	<i>Sanguisorba sitchensis</i>	1	J. Stearns
8/12/2014	<i>Bombus occidentalis</i>	Oregon	Baker	Sand Flats	4985698	406697	5296 ft	<i>Rudbeckia occidentalis</i>	1	L. Navarrete
4/29/2015	<i>Bombus occidentalis</i>	Oregon	Union	*Umapine Campground	4996838	377082	5087 ft		1	A. Steele
7/9/2015	<i>Bombus occidentalis</i>	Oregon	Union	Big Creek	4985149	455483	3842 ft	<i>Senecio serra</i>	1	L. Navarrete
7/13/2015	<i>Bombus occidentalis</i>	Oregon	Union	*Eagle Creek	4988733	464589	5711 ft	<i>Symphoricarpos mollis</i>	1	L. Navarrete
7/21/2015	<i>Bombus occidentalis</i>	Oregon	Wallowa	Aspen Groove Spoon Spring	0503995	5013990	5336 ft	unknown	3	P. Johnson
7/29/2015	<i>Bombus occidentalis</i>	Oregon	Wallowa	*3935-328 Road	0509566	501008		unknown	1	P. Johnson
8/6/2015	<i>Bombus occidentalis</i>	Oregon	Union	Two Color	4988703	464596	5698	<i>Rudbeckia occidentalis</i>	1	L. Navarrete
8/6/2015	<i>Bombus occidentalis</i>	Oregon	Union	Catherine Creek	4997682	450383	3833	<i>Dipsacus fullonum</i>	1	L. Navarrete

\*Incidental observation not associated with a planned survey

Table 4. Floral associations by bumble bee species

Plant Species	<i>Bombus occidentalis</i>	<i>Bombus bifarius</i>	<i>Bombus appositus</i>	<i>Bombus melanopygus</i>	<i>Bombus centralis</i>	<i>Bombus vagans</i>	<i>Bombus flavifrons</i>	<i>Bombus suckleyi</i>	<i>Bombus mixtus</i>	<i>Bombus fervidus</i>	<i>Bombus insularis</i>	<i>Bombus sylvicola</i>	<i>Bombus huntii</i>
<i>Lupinus sulphureus</i>	x	x		x							x		
<i>Senecio serra</i>	x		x	x		x			x				
<i>Chamerion angustifolium</i>	x	x					x			x			
<i>Delphinium depauperatum</i>		x	x			x			x				
<i>Rudbeckia occidentalis</i>	x	x	x	x		x	x	x	x	x		x	x
<i>Symphyotrichum puniceum</i>		x		x	x	x	x						
<i>Trifolium repens</i>		x	x							x			
<i>Penstemon pennellianus</i>		x			x		x						

<b>Plant Species</b>	<i>Bombus occidentalis</i>	<i>Bombus bifarius</i>	<i>Bombus appositus</i>	<i>Bombus melanopygus</i>	<i>Bombus centralis</i>	<i>Bombus vagans</i>	<i>Bombus flavifrons</i>	<i>Bombus suckleyi</i>	<i>Bombus mixtus</i>	<i>Bombus fervidus</i>	<i>Bombus insularis</i>	<i>Bombus sylvicola</i>	<i>Bombus huntii</i>
<i>Cirsium arvense</i>		x	x					x					
<i>Aconitum columbianum</i>		x	x			x	x		x				
<i>Achillea millefolium</i>			x										
<i>Symphoricarpos albus</i>		x			x	x			x				
<i>Cirsium vulgare</i>													
<i>Lotus corniculatus</i>		x					x						x
<i>Cirsium revifolium</i>		x	x		x			x			x	x	
<i>Grindelia nana</i>		x	x					x					
<i>Symphyotrichum puniceum</i>		x											
<i>Hypericum perforatum</i>		x											
<i>Pedicularis groenlandica</i>		x											
<i>Sanguisorba sitchensis</i>	x												
<i>Dipsacus fullonum</i>	x	x	x									x	

Image 1. Survey locations and Western bumble bee records on the Wallowa-Whitman National Forest

