Summary Report for Western Bumble Bee Surveys
Mt. Hood National Forest
2013, 2015, 2016, and 2017

Summary Report for Surveys Funded by the
Interagency Special Status/Sensitive Species Program (ISSSSP)
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Bombus occidentalis observed in Little Crater Meadow, July 21, 2015. Photo by Alan Dyck.

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ABSTRACT

In the summers of 2013, 2015, and 2016, multiple meadows and other locations[1] on the Mt. Hood National Forest (MHNF) were surveyed for presence of the western bumble bee, a species that was added to the Region 6 Regional Forester's Sensitive Species List in 2011. Western bumble bees were also documented on the MHNF in 2017. During all years, the western bumble bee was detected at 22 unique locations (29 unique sites). The surveys completed in 2015 and 2016 and the sightings in 2017 detected the western bumble bee at 15 new, previously unreported locations for this species. Across all surveyed locations, a total of 19 native bumble bee species, and some unknown species of bumble bees, were recorded. All detections of western bumble bees were east of -121.859° W longitude, and between the elevations of 2,850' and 5,980'.

INTRODUCTION

BACKGROUND

In recent decades, the western bumble bee, *Bombus occidentalis*, has experienced precipitous declines throughout much of its historic range, particularly in low elevation sites west of the Cascade and Sierra Nevada Mountains in Oregon, Washington, and California where it was once common (Cameron et al. 2011). Previously widespread across the western United States and western Canada, population declines have been rapid and severe since 1998, with an estimated decline of 70-90% across much of its historic range (NatureServe 2013), and a decline in relative abundance of 75% (Jepsen 2014). Introduction of the non-native microsporidian parasite, *Nosema bombi*, is thought to have played a major role in the sudden decline of populations. The western bumble bee subspecies *Bombus occidentalis* currently is considered critically imperiled in Oregon, Washington, and California (NatureServe 2013). Known locations of present-day populations in the Pacific Northwest are largely restricted to higher elevation sites in the Cascades and Sierra Nevada Mountain Ranges, although several low elevation populations have been discovered in the Seattle area since 2013.

Unfortunately, most of the western bumble bee's historic range has never been systematically sampled (Xerces Society 2015), so current incidence is unknown for many areas. According to Xerces Society records, the western bumble bee was historically documented at 11 locations on the Forest. In 2013, the Xerces Society conducted a survey of 14 locations on the MHNF, finding western bumble bees at eight locations - one historic location and seven new locations (using the MHNF definition of location) (Hatfield et al. 2013). All documented finds were in higher elevation meadows and east of -121.859° W longitude.

Insect populations are notoriously variable from year to year, so repeated sampling over multiple years is necessary to sufficiently ascertain the occurrence of a particular species. In 2015, Interagency Special Status and Sensitive Species Program (ISSSSP) funding supported federal inventory and monitoring efforts for the western bumble bee in western Oregon on the MHNF, Willamette National Forest, and Roseburg BLM. In 2016, the MHNF obtained further ISSSSP survey funding to increase the understanding of the extent of this species' occurrence on the MHNF. In 2017, three confirmed observations of western bumble bees were made on the east side of the MHNF.

This report summarizes results of surveys conducted in 2015 and 2016, in addition to observations made in 2017 on the MHNF. Data for all bumble bee species observed, not just western bumble bees, is presented. A summary of the occurrence of the western bumble bee on the MHNF in 2013, 2015, 2016, and 2017 is included.

[1]In this report, we use the term “location” to refer to a larger geographical vicinity such as Timberline Ski Area and “site” to refer to a more limited and distinct position on the ground where a survey or search is conducted. A location may include one or more sites. Hatfield et al. 2013 appears to use the term “locality” to indicate the geographic positions of “timed survey locations” and “point searches.”

METHODS

PROJECT AREA

The project area encompassed lands in northwest Oregon administered by the MHNF that lie in the vicinity of the Cascade Mountains Crest. Sites were selected for survey based on historical western bumble bee locations, sites surveyed in 2013 by the Xerces Society, and previously unsurveyed areas where habitat is present for the species. Surveys were conducted on all four Ranger Districts of the MHNF (Clackamas River, Zigzag, Hood River, and Barlow). The surveys concentrated on sampling wet/moist meadows with abundant floral resources, roadside areas, and other areas containing forage species preferred by bumble bees.

SURVEY METHODS

The primary method of survey was to conduct "walk-throughs" of pre-identified survey sites, focusing at each survey site on areas of bumble bee foraging habitat. Surveys took place during the months of May, June, July, August, and September when bumble bee foraging is typically at its peak in the Cascades.

Surveys were conducted by Forest Service specialists in the fields of wildlife biology and botany who had recently attended bumble bee workshops taught by Rich Hatfield of the Xerces Society. This training is satisfactory for teaching non-entomologists how to identify the western bumble bee and is an introduction into identifying other bumble bee species. A minimum of one person-hour of search time was spent slowly walking through areas with flowers preferred by bumble bees. The search was continued for an additional half hour when no western bumble bees were detected. During the walk-throughs, surveyors slowly walked through the meadows looking at areas with flowers and netted, photographed, or identified any bumble bees observed. Bees that were netted were transferred to vials with lids for species identification. When possible, photos were taken to provide additional documentation and to aid in verification of species identifications. Some of the western bumble bee photos were validated by Rich Hatfield. GPS points were recorded for each location. Elevation, timing, and flowering data were collected to provide improved habitat information for the various bumble bee species encountered.

Specialists visited as many sites as possible during the field seasons of 2015 and 2016, including sites at known western bumble bee locations and new locations where the western bumble bee had previously not been found but where suitable habitat exists. Surveys were conducted at only two sites, both on the east side of the MHNF, in 2017. In addition, specialists recorded incidental sightings of bumble bee occurrence at potential habitat sites discovered during the normal course of their work in 2015, 2016, and 2017.

RESULTS

In 2015, several of the sites surveyed in 2013 by the Xerces Society were re-surveyed and several previously-unsurveyed sites were also surveyed. The 2013 and 2015 surveys sampled 54 sites on the MHNF, ranging from 1,280 to 5,980 feet in elevation on all four Ranger Districts on the MHNF (see Tables 1, 2, and 3 below). Western bumble bees were found at 19 sites on all four Ranger Districts. Since there were no occurrences noted below 3,360 feet in elevation or west of -121.859° W longitude, the 2016 surveys prioritized surveying lower elevation sites as well as western portions of the MHNF (see Figure 1 below). New sites were also added to the 2016 western bumble bee survey list.

In the 2016 surveys, the MHNF surveyed 25 sites that ranged in elevation from 840 feet to 5,980 feet. Some of the sites were previously surveyed in 2013 and/or 2015, and some were previously-unsurveyed sites. Western bumble bees were documented in seven out of 25 surveyed sites, with the two lowest sites located at 2,850 feet and 3,450 feet in elevation. Six out of the seven sites were new sites where

western bumble bee had not been previously documented on the MHNF. All seven sites were located on the two east side Ranger Districts (Hood River and Barlow). There were no western bumble bee detections west of the -121.773° W longitude although there were ten sites targeted for survey west of this longitude in 2016. Black Wolf Meadow, the western-most site (-121.859° W) where western bumble bees were observed in 2013 was resurveyed in both 2015 and 2016, but no western bumble bees were detected.

In 2017, there was one observation made of a western bumble bee during a formal survey and two incidental sightings on the MHNF, all on the Barlow Ranger District. Western bumble bees were observed at 3,050, 3,100 and 4,500 feet elevation, and once again none of the detection sites were west of the -121.859° W longitude.

Table 1. A summary of the number of locations and sites where surveys for the WBB were conducted and where WBB were found on the Mt. Hood National Forest in 2013, 2015, 2016, and 2017. Two of the 2017 observations were incidental sightings. The dividing line for east side vs. west side locations is the Cascade Crest, which is also the eastern boundaries of the Clackamas and Zigzag Ranger Districts.

	2013	**2015**	**2016**	**2017**	**Total All Years**
Total Number of East Side Locations (Sites) Surveyed	4 (5)	10 (10)	14 (14)	4 (4)	32 (33)
East Side Number of Locations (Sites) where WBB Observed	2 (3)	4 (4)	7 (7)	3 (3)	16 (17)
Total Number of West Side Locations (Sites) Surveyed	11 (16)	20 (23)	11 (11)	0 (0)	42 (50)
West Side Number of Locations (Sites) where WBB Observed	5 (8)	4 (4)	0 (0)	0 (0)	9 (12)

Table 2. All sites surveyed in 2013, 2015, 2016, and 2017 and western bumble bee (WBB) occurrence on the west side of the Mt Hood National Forest: Clackamas and Zigzag Ranger Districts. Incidental observations are included. Sites are listed in order from highest to lowest elevation.
(Bolded sites = western bumble bee occurrence)

Historic Localities (from Xerces 2013 report)	Elevation from reports, rounded (ft)	2017 Survey by USFS (August 4 - August 9)	2016 Survey by USFS (May 4 - August 12)	2015 Survey by USFS (July 2 - Sept. 23)	2013 Survey by Xerces (July 31 - Aug 14)	WBB Floral Host 2013, 2015, 2016, 2017
	5960			North of Timberline Lodge		
	5870				Timberline 1	
	5860			Timberline Bunny Slope		
	5840			Proposed Timberline Bike Trail		
	5790				**Meadows above Timberline Lodge 1-2**	Lupinus latifolius
	5770				Timberline 2	
	5770			**Aster field just S of Timberline parking lot**		Aster, Goldenrod
	5680				**Timberline Rd (2800' S of Lodge) 1-2**	Lupinus latifolius
	5640				**Timberline 3**	
	5640				**Timberline Walt's Baby ski run 1-4, near Rd 2545-105**	Eucephalus ledophyllus
	5410			Alpine campground	**Alpine Campground 1-6**	Solidago canadensis
	5200			Sisi Butte		
	4590			High Rocks area		
	4560			Olallie Meadow	**Olallie Meadows 1-3**	Eucephalus ledophyllus, Gentiana sceptrum
	4200		Black Wolf Meadows	Black Wolf Meadows	**Black Wolf Meadow**	
	4200			Lemiti Creek		
	4120			Mirror Lake	**Mirror Lake**	
	4000		Summit Ski Area	Summit Ski Area		
	3850			Dry Meadow		
	3840			Snow Bunny Snow Park	Snow Bunny Sno Park	
	3840			**Jackpot Meadow**		marsh burnet, Saguisa officinalis
Still Creek CG (7/14/1956)	3800					
	3800			Road 6350		
	3770			**Ski Bowl East**	Ski Bowl East	Spirea
	3730			Road 4690 bridge over Clackamas River		
	3640			Summit Meadow	Summit Meadows	
	3550		Tumala Meadows (Rd 4610-043)			
	3450				Hwy 26, 2 miles S of Hwy 35	
	3360			**Little Crater Meadow**		Spirea
	2360		Pioneer Bridal Trail/Rd 34			
	2200		Rd 6310 powerline corridor			
	2000		Pint Creek meadow (old rifle range meadow on Rd 4630-018)			
	2000		Toms Meadow off Rd 6300-170			
	1950		Oak Grove meadow @ OG Work Center (rd 4631-160)			
	1800		Rd 6300-015 spur			
	1590			Ripplebrook Work Center (noted as 1870')	Ripplebrook	
Ripplebrook CG (8/3/1968)	1490		Ripplebrook Helibase	Ripplebrook Helibase		
	1280			Alder Flat Campground	Alder Flat Campground	
	840		Big Eddy day use area			

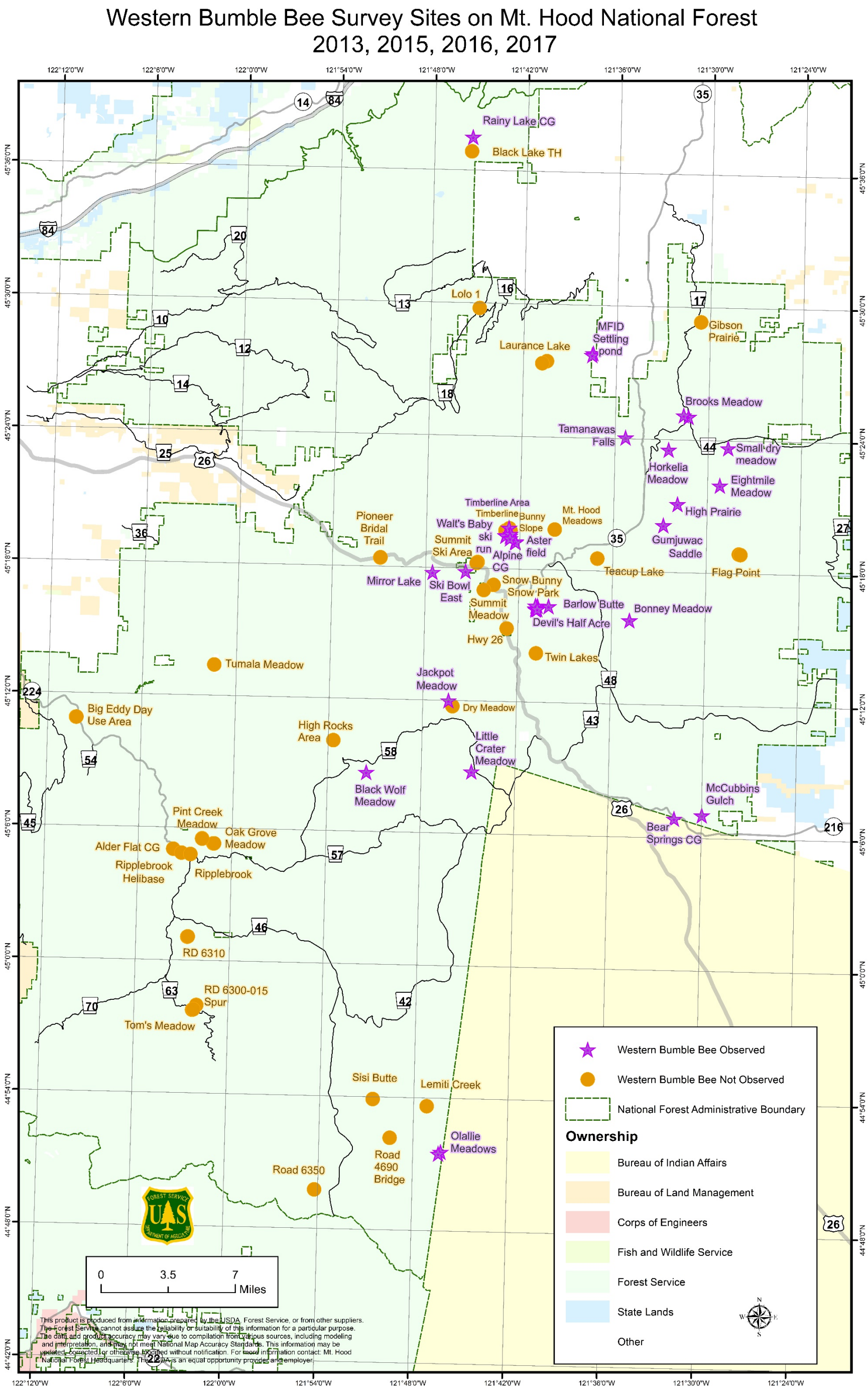
Note: All the sites listed at Timberline between 5640' and 5960' elevation are considered to be the same location (same larger geographical vicinity) in this report. Alpine Campground is considered a different location than the surveys at Timberline.

Table 3. All sites surveyed in 2013, 2015, 2016, and 2017 and western bumble bee (WBB) occurrence on the east side of the Mt Hood National Forest: Hood River and Barlow Ranger Districts. Incidental observations are included. Sites are listed in order from highest to lowest elevation.
(Bolded sites = western bumble bee occurrence)

Historic Localities (from Xerces 2013 report)	Elevation from reports, rounded (ft)	2017 Survey by USFS (August 4 - August 9)	2016 Survey by USFS (May 4 - August 12)	2015 Survey by USFS (July 2 - Sept. 23)	2013 Survey by Xerces (July 31 - Aug 14)	WBB Floral Host 2013, 2015, 2016, 2017
	5980		High Prairie	**High Prairie**		Solidago canadensis
	5650		Flag Point Lookout			
Cooper Spur/CloudCap Inn (8/19-20/1927)	5570					
	5520			**Gumjuwac Saddle** (incidental sighting)		
Ghost Ridge/Cloud Cap rd (7/30/1921)	5400			Mt Hood Meadows, near main parking lot		
	5240		**Bonney Meadows**	Bonney Meadows		Solidago canadensis, Caltha biflora, Ranunculus spp.
	5070	Eightmile Meadow	**Eightmile Meadow**			Lupinus latifolius
	4900		**Horkelia Meadow**	Horkelia Meadow, 4410 Road		Lupinus laxiflorus, Phacelia hastata
	4660			Barlow Butte	**Barlow Butte**	Lupinus latifolius
	4500	**Small dry meadow off the 4420 road, 1/2 mile from main 4400 jct.**				Saussurea americana (sawwort). Also in the meadow: goldenrod, horsemint, aster, lupine.
	4300		**Brooks Meadow (west)** (east)	**Brooks Meadow**		Lupinus latifolius, Aster, bull thistle, Penstemon euglaucus
	4200		Teacup Lake nordic trail system/Rd 3500-680			
	4030		**Rainy Lake Campground** (incidental sighting)			Arnica species
	4000			Gibson Prairie		
	3840				**Devil's Half Acre Complex**	Agastache urticifolia
Devils's 1/2 acre middle and upper meadow (8/30/2009, 7/29/2010)	3810			**Devil's Half Acre**	**Devil's Half Acre Meadow 1-3**	Solidago canadensis, Eucephalus ledophyllus
Wahtum Lake (8/28/1923)	3800					
	3770		Black Lake Trailhead			
	3600			Twin Lakes		
	3450		**Tamanawas Falls** (incidental sighting)			Solidago canadensis
	3100	**McCubbins Gulch/Clear Creek Ditch crossing off the 2110 road. Site was near the ditch.**				Senecio jacobea (tansy ragwort)
	3050	**Bear Springs Campground/Picnic Area. Dry Meadow near the picnic area and shelter.**	Bear Springs CG/ Bear Springs Meadow		Bear Springs CG	Aster foliacious (Cascade aster). Also in the meadow: goldenrod and lupine.
	3000		Decom Rd 640 @ Laurance Lake			
	2850		**MFID settling pond and pipeline**			Hypericum perforatum, (spotted) knapweed
	2260				Lolo 1 (mapped as at WFHR at FS boundary)	
	1380		Barlow Ranger District office			

Note: The sites listed as Devil's Half Acre, Devil's Half Acre Complex, and Devil's Half Acre Meadow 1-3 are all considered to be the same location (same larger geographical vicinity) in this report.

Figure 1. Sites where the western bumble bee, Bombus occidentalis occidentalis, was documented during western bumble bee surveys conducted on the Mt. Hood National Forest in 2013, 2015, 2016, and 2017.



After three years of survey efforts (2013, 2015, and 2016), and the sightings in 2017, a summary of the findings regarding the western bumble bee on the MHNF are as follows:

- Western bumble bees were found at a total of 29 sites. Of those, 17 sites were on the east side ranger districts, and 12 were on the west side districts. 17 sites were at locations that either were not surveyed during the 2013 Xerces Society surveys or where western bumble bees had not been detected during those surveys.

- Western bumble bees are found across a wide range of elevations on the east side of the MHNF (2,850 feet - 5,980 feet), but may have a slightly smaller elevation band west of the Cascade Crest (3,360 feet - 5,790 feet). Surveys were conducted from 840 to 5,980 feet elevation.

- Western bumble bees have not been found west of -121.859° W longitude. Black Wolf Meadows is the western-most site on the MHNF that has the documented presence of the western bumble bee.

- Western bumble bees have been found in seven out of the 14 primary fifth-field watersheds within the MHNF (see Table 4 below). Some of the 14 primary fifth-field watersheds are largely located in wilderness or in municipal watershed boundaries, so have had relatively few surveys completed in those watersheds due to increased access time to unroaded sites. Also, surveys were prioritized for sites that have active management nearby. Only a small portion of each of the remaining 12 fifth-field watersheds are on the MHNF. Western bumble bees were found in four of these 12 watersheds, however, and all four were east of the Cascade Crest.

- Future surveys should focus on the watersheds where very few surveys have been conducted to obtain a better understanding of how widespread the western bumble bee is across all of the MHNF's primary fifth-field watersheds.

Table 4. Western bumble bee occurrence in 2013, 2015, 2016 and 2017 by fifth-field watersheds located on the Mt. Hood National Forest.

WBB occurrence	Fifth-field watersheds on the MHNF
Yes	*Eightmile Creek
Yes	*Fifteenmile Creek
No	*Mill Creek-Columbia River
Yes	East Fork Hood River
Yes	West Fork Hood River
No	*Hood River
No	*Mosier Creek-Columbia River
No	Eagle Creek-Columbia River (almost all in Hatfield Wilderness)
No	Tygh Creek (almost all in Badger Wilderness)
Yes	White River
Yes	*White Horse Rapids-Deschutes River
Yes	*Beaver Creek
No	Upper Sandy River (large portion in Bull Run Watershed and Mt. Hood Wilderness)
Yes	Zigzag River
Yes	Salmon River
No	*Middle Sandy River
No	Bull Run River (almost all in Bull Run Watershed)
No	*Lower Sandy River
No	*City of Washougal-Columbia River
No	Upper Molalla River
No	Collawash River
Yes	Upper Clackamas River
Yes	Oak Grove Fork Clackamas River
No	Middle Clackamas River
No	*Eagle Creek
No	*Warm Springs River

* Only a small portion of these watersheds are on the MHNF

As described in the Methods section, surveyors collected data on all bumble bee species observed. A summary of all bumble bee species detected at each survey site for the years 2013, 2015, 2016, and 2017 is included in Table 5 below. Incidental observations of all bumble bee species are also included.

Table 5. Bumble bee species by survey site for the years 2013, 2015, 2016, and 2017. Data from both formal surveys and incidental observations are included. Survey sites are listed from highest to lowest elevation.

X = observation from 2013 survey

XX = observation from 2015 survey

XXX = observation from 2016 survey

XXXX = observation from 2017 survey

Survey Site (elevation in feet)	*Bombus appositus*	*Bombus bifarius*	*Bombus caliginosus*	*Bombus centralis*	*Bombus fernaldae*	*Bombus fervidus*	*Bombus flavidus*	*Bombus flavifrons*	*Bombus griseocollis*	*Bombus insularis*	*Bombus melanopygus*	*Bombus mixtus*	*Bombus nevadensis*	*Bombus occidentalis*	*Bombus rufocinctus*	*Bombus sitkensis*	*Bombus suckleyi*	*Bombus vandykei*	*Bombus vosnesenskii*	*Unknown Bombus*
Lookout Mountain (6510)																			XXXX	
High Prairie (5980)	XX	XX XXX					XX	XX		XX	XX XXX XXXX	XX XXX		XX					XX XXX	XXX
North of Timberline Lodge (5960)	XX	XX						XX												
Timberline 1 (5870)		X				X					X	X							X XX	
Timberline Bunny Slope (5860)		XX					XX			XX	XX									
Proposed Timberline Bike Trail (5840)		XX						XX			XX									
Meadows above Timberline Lodge (5790)														X						
Timberline 2 (5770)		X				X					X	X				X			X	
Aster field south of Timberline Lodge parking lot (5770)		XX						XX		XX	XX	XX		XX						
Timberline Road (2800' South of Lodge) (5680)														X						
Timberline 3 (5640)		X				X					X	X		X						

Table 5. (continued)

Survey Site (elevation in feet)	*Bombus appositus*	*Bombus bifarius*	*Bombus caliginosus*	*Bombus centralis*	*Bombus fernaldae*	*Bombus fervidus*	*Bombus flavidus*	*Bombus flavifrons*	*Bombus griseocollis*	*Bombus insularis*	*Bombus melanopygus*	*Bombus mixtus*	*Bombus nevadensis*	*Bombus occidentalis*	*Bombus rufocinctus*	*Bombus sitkensis*	*Bombus suckleyi*	*Bombus vandykei*	*Bombus vosnesenskii*	*Unknown Bombus*
Timberline Walt's Baby Ski Run, near Road 2545-105 (5640)														X						
Flag Point (5650)		XXX					XXX				XXX							XXX	XXX	
Gumjuwac Saddle (5520)		XX					XX	XX		XX				XX					XX	
Alpine Campground (5410)		XX						XX		XX	XX	XX		X		XX			XX	
Mt. Hood Meadows, near main parking lot and on main access road (5400)	XX																	XX	XX	
Bonney Meadows (5240)		XX XXX XXXX						XX						XXX						
Sisi Butte (5200)		XX						XX		XX									XX	
Cloud Cap Road (5120)		XX																	XX	
Eightmile Meadow (5070)								XXXX			XXX XXXX	XXX XXXX		XXX					XXXX	
Horkelia Meadow (4900)	XX	XXX		XXX		XX						XXX	XX	XXX				XXX	XX XXX	XXX
Barlow Butte (4660)		X XX				X	XX	XX		X	X	X		X					X	
High Rocks Area (4590)		XX					XX	XX			XX	XX							XX	
Olallie Meadows (4560)		X XX	X			X XX				XX	X XX	X XX		X					X	

Table 5. (continued)

Survey Site (elevation in feet)	*Bombus appositus*	*Bombus bifarius*	*Bombus caliginosus*	*Bombus centralis*	*Bombus fernaldae*	*Bombus fervidus*	*Bombus flavidus*	*Bombus flavifrons*	*Bombus griseocollis*	*Bombus insularis*	*Bombus melanopygus*	*Bombus mixtus*	*Bombus nevadensis*	*Bombus occidentalis*	*Bombus rufocinctus*	*Bombus sitkensis*	*Bombus suckleyi*	*Bombus vandykei*	*Bombus vosnesenskii*	*Unknown Bombus*
Small dry meadow off the 4420 road, 1/2 mile from main 4400 jct. (4500)	XXXX	XXXX						XXXX			XXXX	XXXX		XXXX					XXXX	
4420 Road, near Fifteenmile Trail (4500)												XX								
Brooks Meadow (4300)		XX XXX					XX	XXX		XX			XXXX	XX					XXX	
Brooks Meadow (West of 1700 Road) (4300)	XXX	XXX												XXX					XXX	XXX
1700 Road, near Pipeline (4220)		XXXX						XXXX					XXXX						XXXX	
Aqueduct Access Road off of 1700 Road (4200)								XX												
Black Wolf Meadows (4200)		X XX XXX				X	XXX	XX			X XX	XX		X					X	XXX*
Lemiti Creek (4200)		XX						XX												
Teacup Lake Nordic Trail System/Road 3500-680 (4200)		XXX					XXX												XXX	
1700 Road, near Dog River Pipeline (4200)		XXXX						XXXX				XX	XXXX						XX XXXX	
Mirror Lake (4120)		X XX	XX		X	X		XX		XX	XX	X XX		X				XX		

*This bumble bee was identified as *B.suckleyi* in the field, but because it was not photo vouchered or validated by Rich Hatfield it is listed here as "*Unknown Bombus*."

Table 5. (continued)

Survey Site (elevation in feet)	*Bombus appositus*	*Bombus bifarius*	*Bombus caliginosus*	*Bombus centralis*	*Bombus fernaldae*	*Bombus fervidus*	*Bombus flavidus*	*Bombus flavifrons*	*Bombus griseocollis*	*Bombus insularis*	*Bombus melanopygus*	*Bombus mixtus*	*Bombus nevadensis*	*Bombus occidentalis*	*Bombus rufocinctus*	*Bombus sitkensis*	*Bombus suckleyi*	*Bombus vandykei*	*Bombus vosnesenskii*	*Unknown Bombus*
Shooting Site Goat Mountain Area (4100)						XX		XX				XX								
Rainy Lake Campground (4030)														XXX						
Summit Ski Area (4000)		XX									XX								XXX	
Gibson Prairie area (1700 Road) (4000)		XX																		
1700-660 Road (3990)		XXXX											XXXX						XXXX	
1700 Road (3860)												XX								
Jackpot Meadow/ Dry Meadow (3840)		XX						XX		XX			XX	XX				XX		
Snow Bunny Sno Park (3840)		X XX			X	X		XX			X	X								
Devil's Half Acre (3810)	XX	X XX			X	X		XX		XX	X XX	X		X XX			X		X	XX*
Road 6350 (3800)								XX		XX	XX									
Black Lake Trailhead (3770)		XXX						XXX			XXX									
Ski Bowl East (3770)		XX				X	XX	XX		XX	XX	X		XX	XX					
Road 4690 bridge over Clackamas River (3730)								XX		XX										XX*
Summit Meadows (3640)	XX	X XX				X		XX		XX	X XX	X XX							XX	

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Table 5. (continued)

Survey Site (elevation in feet)	*Bombus appositus*	*Bombus bifarius*	*Bombus caliginosus*	*Bombus centralis*	*Bombus fernaldae*	*Bombus fervidus*	*Bombus flavidus*	*Bombus flavifrons*	*Bombus griseocollis*	*Bombus insularis*	*Bombus melanopygus*	*Bombus mixtus*	*Bombus nevadensis*	*Bombus occidentalis*	*Bombus rufocinctus*	*Bombus sitkensis*	*Bombus suckleyi*	*Bombus vandykei*	*Bombus vosnesenskii*	*Unknown Bombus*
Twin Lakes (3600)		XX						XX		XX		XX			XX					
Tumala Meadow (3550)								XXX				XXX								
1720 Road, near Super-Connector Trail (3520)																			XX	
Mill Creek Ridge, off the 1700-193 Road (3480)																			XXXX	
Highway 26, 2 miles S of Highway 35 (3470)						X					X	X								
Tamanawas Falls (3450)														XXX						
Little Crater Meadow (3360)		XX						XX		XX				XX						XX*
McCubbins Gulch/Clear Creek Ditch crossing off the 2110 road. Site was near the ditch. (3100)		XXXX												XXXX					XXXX	
Bear Springs Campground/Picnic Area. Dry Meadow near the picnic area and shelter. (3100)		X			X	X					X	X		XXXX						
Bear Springs Meadow (3050)		XXX				XXX													XXX	
Decommissioned Road 640 at Laurance Lake (3000)						XXX		XXX												

*This bumble bee was identified as *B.suckleyi* in the field, but because it was not photo vouchered or validated by Rich Hatfield it is listed here as "*Unknown Bombus*."

Table 5. (continued)

Survey Site (elevation in feet)	*Bombus appositus*	*Bombus bifarius*	*Bombus caliginosus*	*Bombus centralis*	*Bombus fernaldae*	*Bombus fervidus*	*Bombus flavidus*	*Bombus flavifrons*	*Bombus griseocollis*	*Bombus insularis*	*Bombus melanopygus*	*Bombus mixtus*	*Bombus nevadensis*	*Bombus occidentalis*	*Bombus rufocinctus*	*Bombus sitkensis*	*Bombus suckleyi*	*Bombus vandykei*	*Bombus vosnesenskii*	*Unknown Bombus*
North Fork Rock Creek Meadow (2920)																			XXXX	XXXX
Middle Fork Irrigation District Settling Pond and Pipeline (2850)		XXX												XXX					XXX	
Middle Fork Irrigation District Settling Pond (2850)														XXX						
Pioneer Bridal Trail/ Road 34 (2360)								XXX												XXX*
Lolo 1 (2260)					X	X			X		X	X								
Road 6310 Powerline Corridor (2200)		XXX						XXX												
Pint Creek Meadow (2000)								XXX												XXX*
Oak Grove Meadow (1950)								XXX				XXX								XXX*
Road 6300-015 Spur (1800)								XXX											XXX	
Ripplebrook Work Center (1590)	XX	X XX				X	XX	XX			X	X								
Ripplebrook Helibase (1490)		XX					XX	XX											XX	XX XXX*
Barlow Ranger District Office (1380)		XXXX											XXX							
Alder Flat CG (1280)						X		XX				X XX								

*This bumble bee was identified as *B.suckleyi* in the field, but because it was not photo vouchered or validated by Rich Hatfield it is listed here as "*Unknown Bombus*."

DISCUSSION

The intent of the 2015 and 2016 surveys was to resample some of the historical *Bombus occidentalis* locations and to sample new locations that had never been surveyed. A second objective was to allow specialists to become better acquainted with bumble bee identification, timing, locations, floral association and survey methods. Due to the decline in western bumble bee populations, it was important to discover if the locations identified by the Xerces Society in 2013 were the only locations where the species occurred. The western bumble bee was listed as a sensitive species on the Region 6 Regional Foresters Sensitive Species List beginning in 2011.

The 2015 and 2016 surveys and 2017 sightings of western bumble bees demonstrated several things, namely the year-to-year variability in insect survey results, and the existence of unreported western bumble bee populations in unsurveyed areas of the MHNF. There were locations where the Xerces Society located western bumble bees in 2013 but where MHNF specialists did not find the species again, and conversely, there was one location (Bear Springs Campground) where the Xerces Society and USFS surveyors found no western bumble bees in 2013 and 2016, but where a Forest Service specialist did make an incidental sighting of a western bumble bee in 2017. There were also locations where surveys were conducted for the first time in 2015 and no western bumbles were detected, but when those locations were surveyed again in 2016, western bumble bees were observed.

The majority of the locations (64%) where western bumble bees were observed were located on the east side of the Cascade Crest, even though more surveys were completed on the west side (42 surveys or 57% of all surveys were on the west side, while only 32 surveys or 43% of all surveys were conducted on the east side).

It is encouraging that 15 new locations (17 new sites) were identified. As previously stated, Hatfield et al. 2013 identified seven other new locations in 2013, bringing the total number of new locations documented since 2012 to 22. The potential exposure of western bumble bees to disease or parasites from commercial bumble bees or honeybees should be considered by the MHNF when issuing apiary special use permits, both on the east side of the forest, where most western bumble bees were observed and where most apiary permits have historically been issued, and on the west side of the forest, where western bumble bees were rarely observed.

Bumble bee species other than *B. occidentalis* that were most frequently observed during surveys include *B. bifarius*, *B. flavifrons*, *B. melanopygus, B. mixtus,* and *B. vosnesenskii (Table 5 and Figure 2).* Bumble species that were observed the least number of times during surveys include *B. nevadensis* and *B. vandykei (Table 5 and Figures 3, 4, and 5).*

B.suckleyi, a cuckoo bee that is parasitic on western bumble bee nests and that was added to the Region 6 Regional Forester's Sensitive Species List in 2019, was observed by Rich Hatfield at Devil's Half Acre in 2013 (Hatfield et al. 2013, ISSSSP 2017). He also observed western bumble bees at this site. *B.suckleyi* were also supposedly observed at three sites in 2015, including Devil's Half Acre and Little Crater Meadow, where western bumble bees were also observed. Because photo vouchers were not taken or validated, these observations have not been positively determined and future surveys in those locations are warranted. Similarly, *B.suckleyi* were listed as observed at five sites in 2016, one of which also had western bumble bees present, but again, photo vouchers were not taken.

Figure 2. Bombus bifarius observed at Cloud Cap, July 27, 2015. B. bifarius was the most frequently observed bumble bee species, documented at 46 sites during all years of surveys, and often observed more than one year at a particular site. Photo by Christina Mead.

Figures 3 and 4. Bombus nevadensis observed at Horkelia Meadow, July 9, 2015. B. nevadensis was documented at only seven sites during all years of surveys. Photos by Christina Mead.

Figure 5. Bombus vandykei observed at Mt. Hood Meadows, July 9, 2015. B. vandykei was documented at only five sites during all years of surveys. Photo by Christina Mead.

Future surveys for western bumble bees should continue to survey the lower elevations and western regions of the Forest, as recommended by Hatfield et al. 2013. Additional surveys should also sample more sites in the elevation bands on the east- and west-sides where western bumble bees have already been detected (2,850 feet - 5,980 feet and 3,360 feet - 5,790 feet, respectively) so that the extent of western bumble bee occurrence on the MHNF can continue to be determined. Monitoring known locations for persistence is also recommended, particularly given climate change and changing bloom periods as noted below. In addition, noting how much small mammal soil activity there is at survey sites would be useful information, as they are thought to provide nesting locations. Last, site management such as removing encroaching conifers to maintain meadow conditions could help maintain existing habitat at known sites.

Surveys should start as early as April and May to capture peak bloom. For example, in 2015, unseasonably warm weather conditions caused early blooming, which resulted in poor flower conditions at the time of the survey. Poor flower conditions are likely to have detrimentally affected detections of western bumble bees at many sites.

Sites where observations of *B.suckleyi* were made but not validated should be resurveyed, both because those sites may prove to also have western bumble bees present and because the Suckley cuckoo bumble bee is now also listed as a sensitive species. Photo vouchers of suspected *B.suckleyi* specimens should be validated by Xerces, as they are difficult to identify in the field. Photo vouchers of all species observed should also be sent to Xerces for verification (not all were from the 2015 and 2016 surveys).

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