

West Eugene Wetlands Habitat Sampling at Fir Butte, Oxbow West, and Vinci



2013

Report to the Bureau of Land Management,
Eugene District

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PREFACE

This report is the result of a cooperative Challenge Cost Share project between the Institute for Applied Ecology (IAE) and a federal agency. IAE is a non-profit organization whose mission is conservation of native ecosystems through restoration, research and education. Our aim is to provide a service to public and private agencies and individuals by developing and communicating information on ecosystems, species, and effective management strategies and by conducting research, monitoring, and experiments. IAE offers educational opportunities through 3-4 month internships.



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EXECUTIVE SUMMARY

This document summarizes habitat monitoring in the West Eugene Wetlands on land managed by the BLM Eugene District. In 2013, we monitored Fir Butte, Oxbow West, and Vinci to assess whether they were within the habitat targets for Threatened and Endangered species.

- Monitoring in 2013 occurred in May, which was earlier than in previous years at the sites. All sites had greater cover overall than they did previously, which could be due to timing of monitoring, but also seems to be associated with an increase in introduced species cover at most sites.
- Oxbow West and Vinci 2 were native dominated while Fir Butte and Vinci 1 had greater cover of introduced species.
- The northeast portion of Fir Butte continued to have extremely high percentages of introduced species when compared to natives.
- Cover of invasive species and litter exceeded the thresholds for management (maximum 50% cover for invasive species and 20% cover for litter) in habitat for *Lupinus oreganus* and *Erigeron decumbens*.
- Thresholds for woody vegetation were not exceeded at any of the sites.

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Habitat sampling at Fir Butte, Oxbow West, and Vinci

REPORT TO THE BUREAU OF LAND MANAGEMENT, EUGENE DISTRICT

INTRODUCTION

The West Eugene Wetlands (WEW) Project is a cooperative venture by the Bureau of Land Management (BLM), Eugene District, and others to protect and restore wetland ecosystems in the southern Willamette Valley of Oregon. This unique program involves a partnership between federal, state, and local agencies and organizations to manage lands and resources in an urban area for multiple public benefits. In 2005, the BLM developed a long term (10 year) land management implementation schedule for its parcels within the West Eugene Wetlands project area. This 10 year Environmental Assessment (EA) schedule outlines targets for habitat conditions and provides guidance on the priority of work for maintenance, enhancement, and restoration projects (BLM 2005). Within the EA, each parcel will be monitored to meet four habitat management targets. In general, these habitat targets include the following: (1) prevent woody vegetation encroachment, (2) prevent invasive plant spread, (3) prevent litter and thatch build up, and (4) maintain existing levels of native plant species diversity. When monitoring indicates that these targets are not being met based on the established thresholds, management actions may be triggered (further outlined in the EA NO. 0R090-0503, Alternative D, pages 58-61). In addition, many of these sites provide habitat for species listed in *Recovery Plan for Threatened and Endangered Species in Western Oregon and Southwest Washington* (USFWS 2010).

The purpose of this project was to conduct monitoring at several sites in the West Eugene Wetlands (Table 1) to assess



Figure 1. *Lupinus oregonus* (Kincaid's lupine)

whether they were within the habitat targets for Threatened and Endangered species (including Kincaid's lupine, Figure 1). In 2013, we monitored four sites: Oxbow West (1 plot), Fir Butte 1 (1 plot), and Vinci 1 & 2 (2 plots). Monitoring previously occurred at these sites in July 2010.

Table 1. Monitoring schedule for West Eugene Wetlands T and E sites from 2007 through 2014. If no month is listed, then the site was not monitored through this project.

Site	Plot	2007	2008	2009	2010	2011	2012	2013	Planned 2014
Balboa	1 and 3			July			May		
Fir Butte	NE and SW	July			July			May (NE only)	
Fir Butte	SE			July			May		
Greenhill	1(S) and 2 (N)				July		May		
Hansen Meadow			July			May			
Hansen Woods			July			May			
Long Tom			July			May			May
North Taylor			July			May			
Oxbow West	ERDE	July			July			May	
Oxbow West	LUOR			July					May
Speedway			July			May			
Turtle Swale			July			May			
Vinci	Upland			July			May		
Vinci	Wetland 1 and 2	July			July			May	May

Sites

Fir Butte

Fir Butte is an 18 acre prairie remnant owned by the Eugene District BLM (Appendix B). This site has been heavily invaded by many exotic weeds including *Rubus armeniacus*, *Cytisus scoparius*, *Centaurea pratensis*, and *Arrhenatherum elatius*. Despite the relatively poor habitat quality, one of the largest known extant populations of *Lupinus oreganus* (Kincaid's lupine) occurs here. This site also supports a relatively large population of the endangered Fender's blue butterfly (*Icaricia icarioides fenderi*). *Lupinus oreganus* serves as the obligate host plant for *I. icarioides fenderi*. Since 1999, BLM crews have made substantial efforts to control *C. pratensis* and *C. scoparius*, and selected areas have been repeatedly mowed to reduce the invasion of *R. armeniacus*. Since 2001, experimental treatment plots at the site have been mowed and/or burned. Restoration activities at the site have been ongoing and have included burning, mowing, and use of solarization. Monitoring in the northeast and southwest occurred in 2007 and 2010. Monitoring in the southeast occurred in 2009 and was repeated in 2012. Monitoring in the NE corner occurred in 2013.

Oxbow West

The overall habitat quality of the remnant prairie at Oxbow West is good, and ongoing management efforts have helped reduce encroachment by woody species including *Pyrus communis*, *Fraxinus latifolia*, *Populus trichocarpa*, and other shrubs. Efforts are also being made to eradicate *Phalaris arundinacea*, an invasive graminoid that is expanding into the prairie from adjacent wet areas. Oxbow West supports a number of rare species, including *Erigeron decumbens*, *Lupinus oreganus*, *Cicendia quadrangularis*, and *Sidalcea cusickii*. The habitat has also been noted as having high potential for reintroduction of *Lomatium bradshawii*. The federally endangered *E. decumbens* is the most abundant rare plant at Oxbow West, occupying approximately five acres. Maintaining and improving the prairie habitat is the main objective for management at Oxbow West. Management treatments in the wet prairie (occupied by *E. decumbens*) have included mowing (initiated in 2002) and burning (treated in September 2005). Monitoring of the wet prairie habitat occupied by *E. decumbens* occurred in 2007, 2010 and 2013. Monitoring of the upland prairie habitat occupied by *Lupinus oreganus* occurred in 2009 and is slated to occur in 2014.

Vinci

Vinci is a relatively large parcel containing both wet prairie and vernal pool habitats (Appendix B). Although the quality of the site is relatively high, it has been invaded by woody species such as *Pyrus communis*, *Fraxinus latifolia*, *Populus trichocarpa* and exotic herbaceous species including *Phalaris arundinacea* and *Dipsacus fullonum*. Vinci supports a number of rare species, including *Erigeron decumbens*, *Sericocarpus rigidus*, and *Horkelia congesta* ssp. *congesta*. Monitoring of the wet prairie habitat (Vinci 1 & 2) occurred in 2007, 2010, and 2013. Upland prairie habitat was monitored in 2009 was repeated in 2012. Vinci was burned in the fall of 2013 so monitoring of the same area is slated to occur in 2014.

METHODS

In May 2013, four plots were sampled to estimate vegetation cover in the West Eugene Wetlands. Vinci contained two plots and Oxbow West and Fir Butte each had one (Figure 2). Plot dimensions varied by site and were based on established infrastructure (e.g. conduit or other permanent markers, Table 2). The sampling scheme at each site was selected so that (1) the maximum amount of habitat would be sampled, and (2) there would be at least 200 points per plot (Table 2). The origin was placed in the southeast corner of each plot (Figure 3). For Vinci, the first transect running perpendicular to the baseline was randomly located between 0m and 4m. Subsequent transects were placed every 3m along the baseline. For Fir Butte, the first sample point along each transect was randomly located between 0m and 4m, and systematically located every 5m (Figure 5); sampling at Fir Butte avoided the area covered with solarization cloth and so more transects were added to obtain more than 200 points monitored. For Oxbow West (ERDE), the first transect running perpendicular to the baseline was randomly located between 0m and 4m (Figure 4). Subsequent transects were placed every 4m along the baseline.

The point-intercept sampling method was selected for this project because it provides an unbiased quantitative description of plant communities in an efficient manner (City of Eugene 1997). Although some species with less than 0.5% cover were likely missed, this method provides a consistent manner in which to efficiently sample a large area. We used a monopod that utilized a laser light (Synergy Resource Solutions, Inc.) to sample the vegetation at each point. We adjusted the height of the monopod so that it was above the vegetation canopy at every site. At each point, we recorded every species intercepted by the laser light and the nature of the substrate (bare ground, litter, or moss). Cover can exceed 100% due to multiple species intercepting the laser light.

Species nomenclature, growth habit, and provenance were obtained from the USDA Plants Database (<http://plants.usda.gov>). We calculated the percent cover within each plot by totaling the “hits” for each component (each species, growth habit group, and cover type), dividing by the total number of sampling points per plot, and multiplying by 100. We timed our surveys (May) early to document early-season species, including some of those that are listed threatened and endangered, however we may have missed some later-season species. In order to document all species at a site, surveys have been planned take place at multiple times throughout the growing season.

Table 2. Characteristics of habitat sampling plots

Site	Plot origin (Lat/Long, WGS 84)	Plot dimensions	# samples
Fir Butte			
Plot 1 (NE)	44.079575, -123.230085	78m x 50m	217
Oxbow West (ERDE)	44.055660, -123.190664	85m x 50m	210
Vinci (wetland)			
Plot 1	44.051923, -123.204899	65m x 50m	226
Plot 2	44.053367, -123.204644	85m x 50m	235

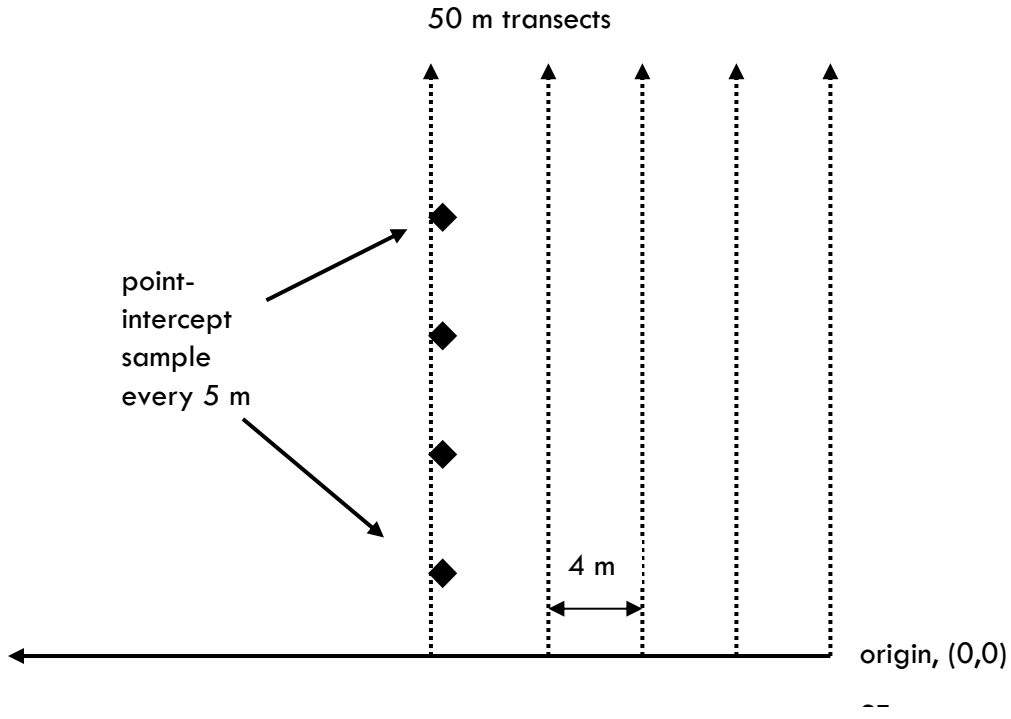


Figure 3. Example design of a sampling plot.

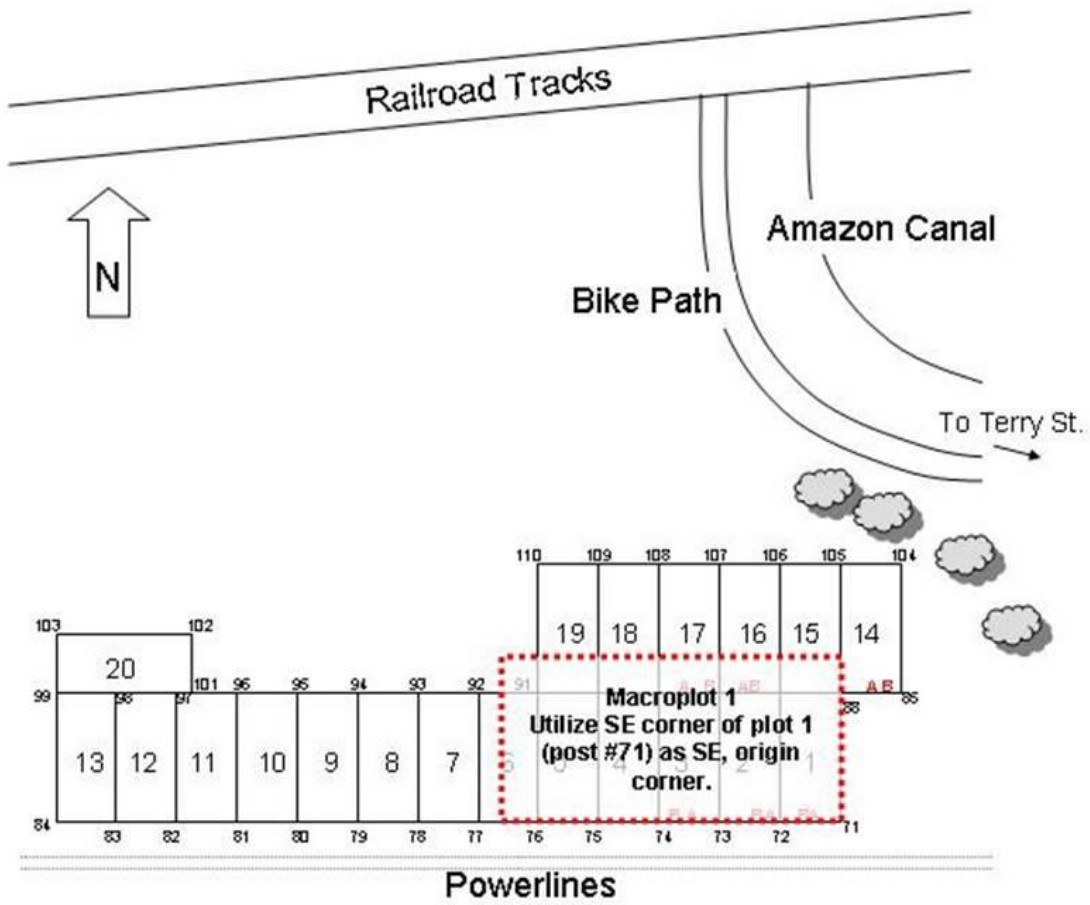


Figure 4. Location of the sampling plot at Oxbow West. Plots in the background (1-20) are for an experiment testing the effectiveness of mowing and burning treatments on *Erigeron decumbens*.

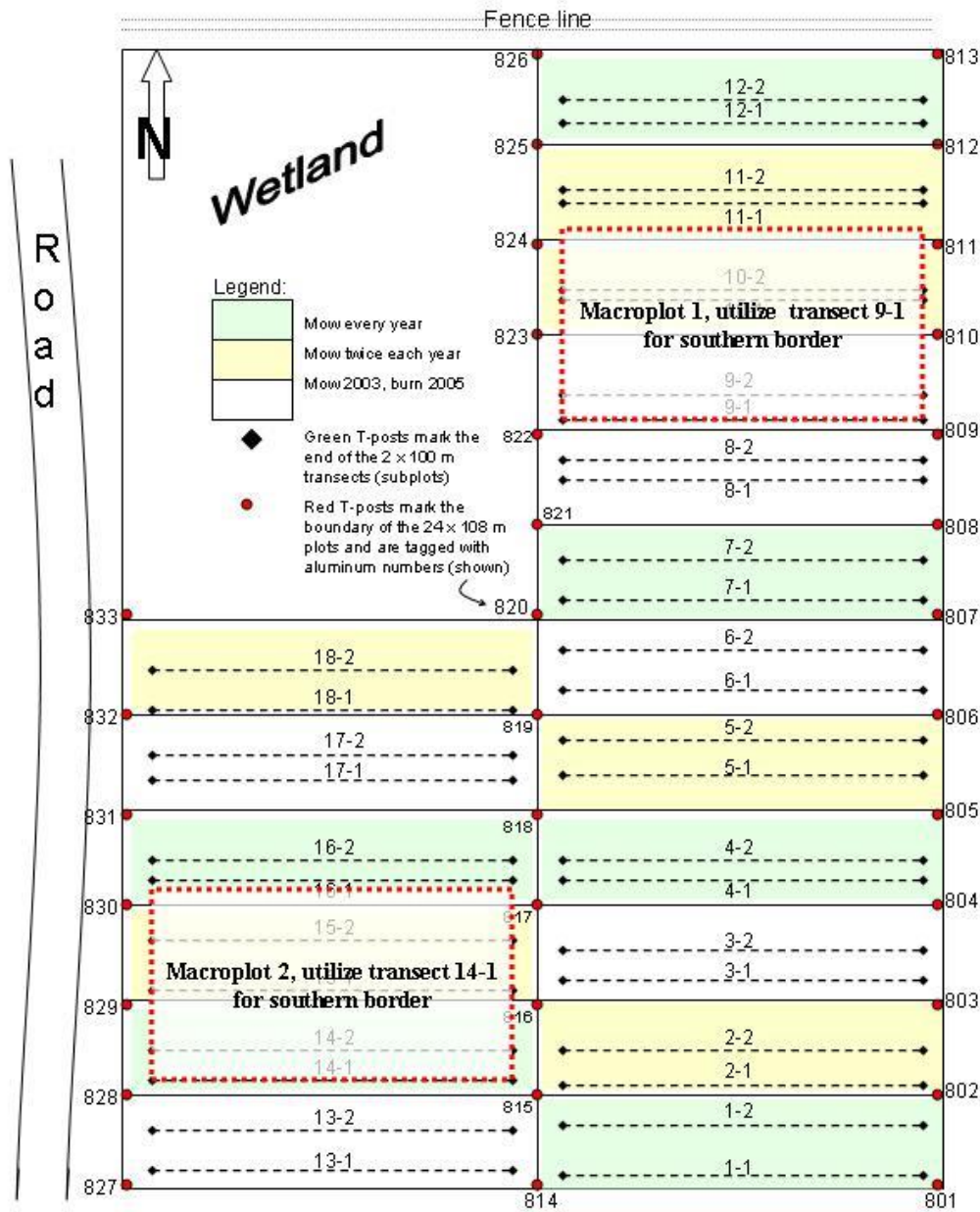


Figure 5. Location of sampling plots at Fir Butte. Plots in the background (1-18) are for an experiment testing the effectiveness of mowing and burning treatments on *Lupinus oreganus*.

RESULTS AND DISCUSSION

Sites

Fir Butte 1 (NE)

The plant community at Fir Butte 1 was dominated by introduced species; the combined total of cover of introduced species was six times that of natives (Figure 6). Of the 27 species found in this plot, five were native, and 22 were introduced. This differed from 2010 where 17 species were encountered during sampling, which occurred during July; later sampling could result in the lack of early-season species. All (5) of the native species were forbs, and the introduced species were composed of forbs (14) and graminoids (8). No trees were noted in the area. The most abundant species at Fir Butte 1 was the introduced grass *Agrostis capillaris*, which had 55% cover, this was a decrease from 2010 (82% cover). Other introduced graminoids included *Bromus hordeaceus*, *Holcus lanatus*, and *Vulpia bromoides*. The greatest change between 2010 sampling and 2013 occurred in the introduced forb category, where cover increased greatly between the two years (Figure 6). This increase could partly be an artifact of the earlier monitoring time, but also could indicate the increase of species on the site. Introduced forbs included *Daucus carota* (4.6%), and *Vicia hirsuta* (4.1%), *Vicia tetrasperma* (6.9%), *Parentucellia viscosa* (9.6%), and *Rumex acetosella* (11%); cover of all of these species increased notably. For example, cover of *R. acetosella* was 2% in 2010 as compared to 11% in 2013. *Rubus armeniacus*, the only woody invasive species found at Fir Butte increased in cover greatly from 2010 to 2013 (0.5% and 5%, respectively). Among the native species, *Galium trifidum* had relatively high cover, although this value decreased since 2010 (14.3% and 29.4%, respectively). *Lupinus oreganus* also had high native forb cover (7.8%). We found no native graminoids on the site. Establishment of *L. oreganus* and other native species may be hampered by high litter cover (91.2%; Table 3).

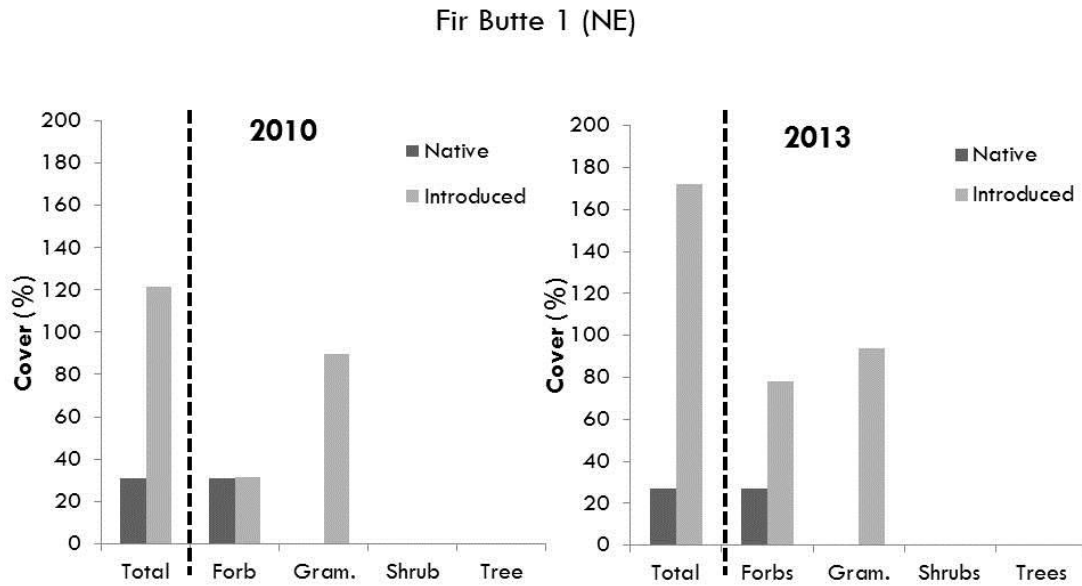


Figure 6. Percent cover of native and introduced species, by growth habit, at Fir Butte 1(NE) in 2010 and 2013. Note the y-axis range (0-200).

Oxbow West (ERDE)

Similar to past sampling, Oxbow West had more cover of native than introduced species in 2013 (Figure 7). We noted many more species in 2013 than 2010, with 9 native forbs, 4 native graminoids, and one shrub; the increase noted was primarily in native forbs. Exotic species also included forbs (7), graminoids (3), and one shrub. In 2010 the most dominant species was *Panicum capillare*, but we did encounter this species in 2013. In our monitoring, the most dominant native species included *Deschampsia cespitosa* (20%), *Danthonia californica* (8.6%), and two members of the Juncaceae (combined cover <3%; Appendix A). The lack of *P. capillare* in our 2013 monitoring could be due to timing of sampling or be the result of an increase in cover of the native *D. cespitosa*. Native forb cover was close to half of native graminoids (18.6% and 31.9%, respectively), and was composed of *Brodiaea* (sensu lato) sp., *Grindelia integrifolia*, and many others that had less than 1% cover (Appendix A). The sole native tree, *Fraxinus latifolia*, had low cover (0.5%). Oxbow West experienced an increase of introduced graminoids from 2010 to 2013 (Figure 7), including the dominant *Anthoxanthum odoratum*, which increased from 18.9% to 28.6% in three years. The other nonnative graminoids were *Holcus lanatus* (1.5%) and *Arrhenatherum elatius* (1%). Nonnative forb cover was low; *Galium parisiense* had the highest cover (3.8%), followed by *Hypochaeris radicata* (2.9%) and *Leucanthemum vulgare* (1.9%). Litter cover at this site was 93%, a slight decrease from 2010 (100%) (Table 3).

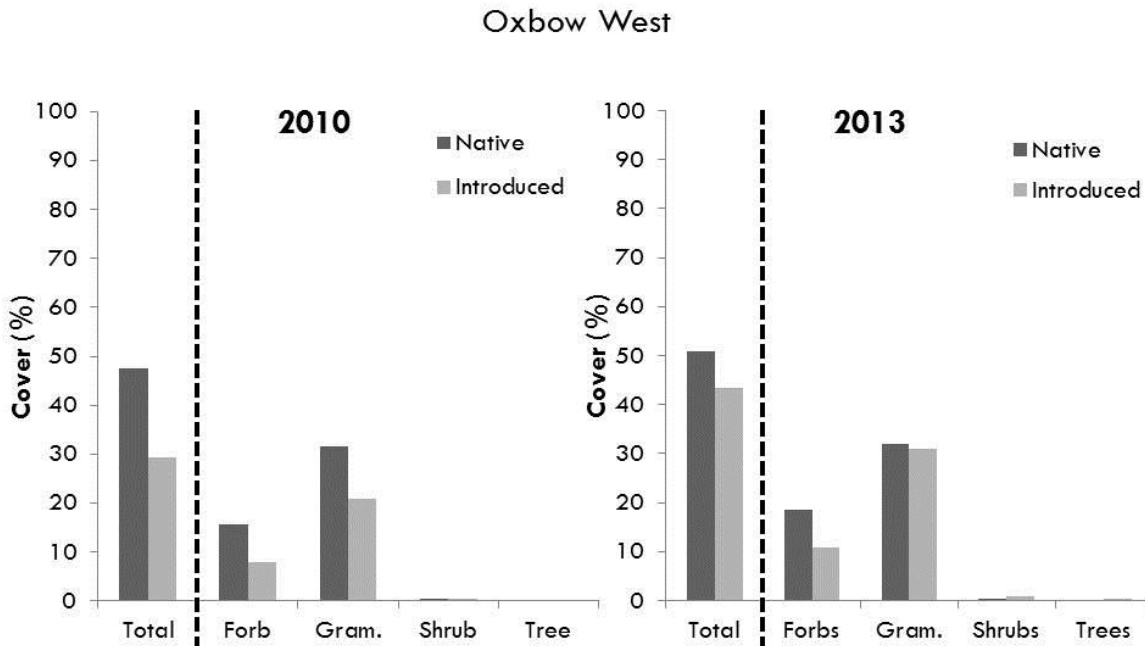


Figure 7. Percent cover of native and introduced species, by growth habit, at Fir Butte 1(NE) in 2010 and 2013. Note the y-axis range (0-200).

Vinci

Vinci 1 experienced a net increase in total cover from 2010 to 2013 (Figure 10). There were 20 exotic species at Vinci 1 in 2013, most of those composed of forbs (14), followed by graminoids (4), and two shrubs. There were 15 native species at this plot, 10 were forbs, 4 were graminoids, and one was a shrub. While in 2010 percent cover by introduced and native species was equal, cover of introduced species was greater than that of natives in 2013 (Figure 8). Native cover was dominated by graminoids, with 12.8% cover by *Deschampsia cespitosa* and 13.3% *Danthonia californica*. Among native forbs, *Brodiaea* (sensu lato) sp. had the highest cover (5.6%), followed by *Prunella vulgaris* ssp. *lanceolata* (5.3%) and *Cammisia quamash* var. *maxima* (5.3%). The 20 nonnative species were composed primarily of forbs (14), graminoids (4) and shrubs (2). *Hypochaeris radicata* had the highest cover with 11.5%, followed by *Leucanthemum vulgare* (10.2%), and *Mentha pulegium* (6.2%). Among introduced graminoids, *Anthoxanthum odoratum* had the highest cover (10.6%), followed by *Holcus lanatus* (4.0%). While in 2010 *Rubus armeniacus* was present we did not note it in 2013. The only introduced shrubs present were *Rosa eglanteria* (0.9%) and *Crataegus monogyna* x *suksdorfii* (0.9%). Litter covered 96.5% of plots.

Vinci 1

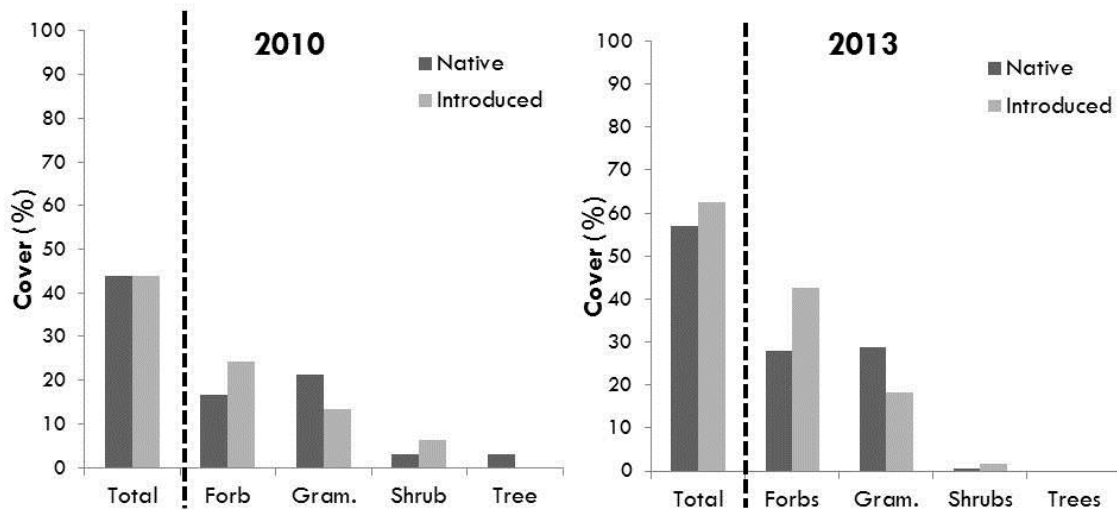


Figure 8. Percent cover of native and introduced species, by growth habit, at Vinci 1 in 2010 and 2013. Note the y-axis range (0-200).

The plant community at Vinci 2 consisted of 16 native species (10 forbs, 4 graminoids, 2 shrubs) and 15 nonnative species (11 forbs and 4 graminoids). Cover by native species was greater than that of introduced species (Figure 9). The native graminoids *Danthonia californica* and *Deschampsia cespitosa* had the highest cover of any species (22.6 and 16.7%, respectively). *Danthonia californica* had increased greatly since 2010, when it only occupied 0.9%. Native forbs included *Brodiaea* sp. (13.6%) and *Lotus micranthus* (4.7%). Among nonnative forbs, *Hypochaeris radicata* had the highest cover (16.6%), which was a great increase from the 2010 value of 0.5%. Other common non-native forbs were *Leucanthemum vulgare* (7.23%) and *Mentha pulegium* (5.1%). *Anthoxanthum odoratum* was the most abundant non-native grass (5.3%), followed by *Schedonorus phoenix* (5.1%). We noted no introduced shrubs. Litter in this plot was also very high (95.3%), perhaps influenced by high graminoid cover (Figure 9). While in 2010 native and introduced species cover was very similar (Figure 9), in 2013 native cover was greater than that of introduced species, likely a reflection of the increase in native graminoids.

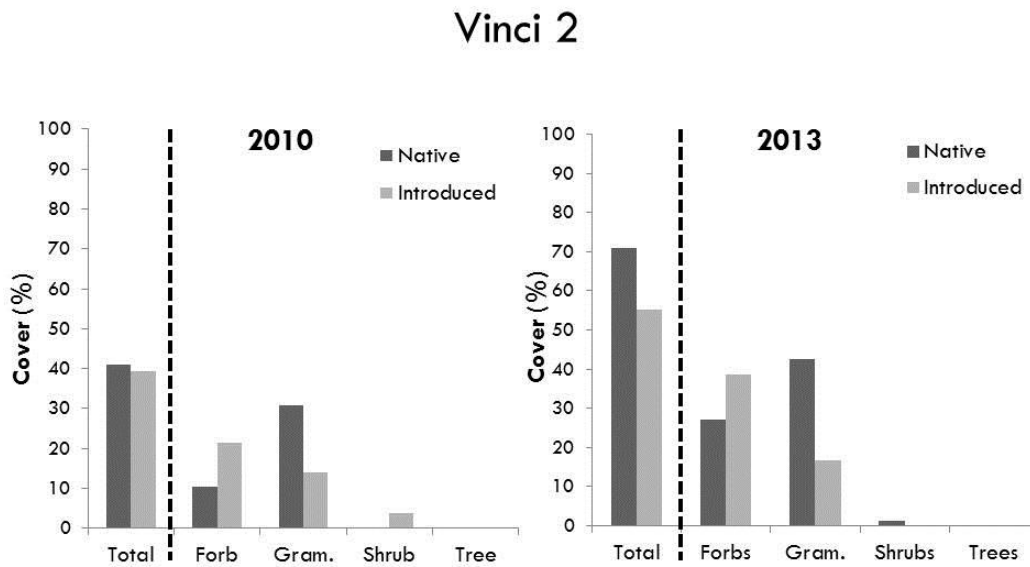


Figure 9. Percent cover of native and introduced species, by growth habit, at Vinci 2 in 2010 and 2013.

Across all sites we noticed a decrease in total plant cover which is likely due to the difference in timing of the monitoring efforts. Increases in native species found in 2013 could be due to a more-likely detection earlier in the season. Conducting monitoring at different times of the year gives a better representation of the species diversity and composition for the sites as a whole, however repeated sampling during the same time of the year would enable more concrete comparisons regarding cover of native and introduced species.

Table 3. Cover of bare ground, litter and moss at study sites in the West Eugene Wetlands in 2013

	Site			
	Fir Butte 1 (NE)	Oxbow West	Vinci 1	Vinci 2
Bare ground	23.0	90	63.3	71.0
Litter	91.2	93.3	96.5	95.3
Moss	9.7	1.4	23.5	7.2

Fender's Blue Butterfly Stepping Stone Habitat

All of the sites monitored in 2013 have the potential to serve as habitat for Fender's blue butterfly. Appropriate habitat for this species includes high quality prairie or oak savannah habitat, the presence of larval host-plants (*L. oreganus*), adult nectar sources, and stepping-stone habitat (undeveloped areas with the physical characteristics appropriate for supporting the short-stature prairie oak savannah plant community within 1.2 miles of natal lupine patches) (USFWS 2010).

In 2010, all of the sites included in this study were surveyed to meet at least one of the criteria for critical habitat for Fender's blue butterfly and were determined to be suitable stepping stone habitat (Thorpe 2010).

In 2013 monitoring, *Lupinus oreganus* was present in our plots at Fir Butte (7.8% cover), but not in the plots at the other sites (Appendix A). We identified many nectar species for Fender's blue butterfly including *Vicia* spp. at Fir Butte and Vinci 1. We also found *Cammassia quamash* and *Brodiaea* (sensu lato) sp. were present at all sites but Fir Butte. *Eriophyllum lanatum* was present at Oxbow West and Vinci 2. Though these species were present at the sites, they constitute a low percentage of total cover and we recommend efforts to increase both the diversity and cover of nectar species at these sites.

SUMMARY

The Recovery objectives from the Western Oregon and Southwestern Oregon Prairie Species Recovery Plan (USFWS 2010) specify that within habitat for *Lupinus oreganus*, *Erigeron decumbens*, and *Lomatium bradshawii*, there is to be $\geq 50\%$ relative cover of non-woody natives at 70% of local populations, $\leq 15\%$ cover of woody species, and no single non-native species with $> 50\%$ cover. Furthermore, the monitoring indicators and corresponding thresholds for management actions from the Environmental Assessment (further outlined in USDI BLM 2005, Alternative D, pages 58-61) are:

Habitat indicator	Threshold for management
Woody vegetation	When canopy cover exceeds the level appropriate for the local habitat (5-10% for wet-prairie/vernal pool and upland prairie habitats)
Invasive species	When combined encroachment reaches 10%-35% or greater of the habitat block and/or a weed population covers $> 50\%$ of a 1 m ² area, depending on site conditions and species present.
Thatch	When the litter layer exceeds 10-20% cover and litter layer is detrimentally impacting native forb plant diversity or rare plant habitat.
Native Species	When there is a loss of 5%-10% of a site's existing cover and number of native plant species.

In our surveys, we found that the thresholds for management were exceeded for the following indicators:

Table 4. Habitat indicators and levels at each site in 2013. Each of these indicators exceeded the thresholds in the 2005 Environmental Assessment.

Habitat indicator	Site	Indicator level
Invasive species	Fir Butte 1(NE)	172% introduced species cover
	Oxbow West	43% introduced species cover
	Vinci 1	62% introduced species cover
	Vinci 2	55% introduced species cover
Thatch	Fir Butte 1(NE)	91% litter cover
	Oxbow West	93% litter cover
	Vinci 1	97% litter cover
	Vinci 2	95% litter cover

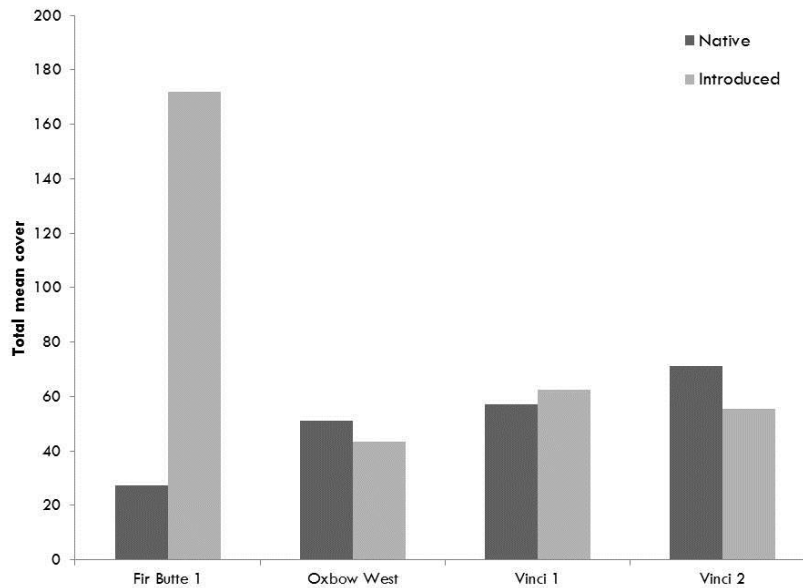


Figure 10. Total cover (%) of Introduced and native species at all sites monitored in May 2013.

Despite management efforts, the cover of invasive species and litter layer exceeded the threshold values for management at every site (Table 4, Figure 10). The threshold for woody vegetation cover was not exceeded at any site. Litter cover was greater than 90% at all sites, suggesting the potential to inhibit

germination of species, both native and exotic. Any management activities to remove litter should be followed by extensive weed control and seeding of native species.

The invasive species threshold was exceeded for all sites except for Oxbow West which had 43% cover. Invasive species were particularly abundant at Fir Butte where the total mean cover was 172% (note: cover can exceed 100% in areas with multiple layers of vegetation). This suggests that this section of Fir Butte is in need of continued habitat management, particularly in areas surrounding the *L. oregonus* population. We have noted similar trends in other areas of Fir Butte (Gray 2012). Of particular concern is the very high cover of introduced plants relative to natives at Fir Butte (Figure 10). While Vinci 1 had slightly greater introduced species cover than native cover, Vinci 2 had greater cover of natives (Figure 10). Continued habitat management to reduce invasive species and decrease litter cover would push these sites closer to the native-dominated condition that is desired.

While monitoring in different months makes it difficult to make conclusions about changes in community composition from 2010 to 2013, it does provide information that may be used for future management activities including the species that are present over the course of the growing season. At all sites total cover was greater in 2013, which was likely associated with the earlier monitoring. We still observed an increase in introduced species, particularly introduced forbs, at Fir Butte 1, and Vinci 1 and 2 in 2013. Oxbow West had slightly greater native cover than introduced species overall, and we noted a slight decrease in introduced graminoids from 2010 to 2013. These differences, despite the difference in timing of monitoring, suggest some gross changes in plant community composition, including an overall increase in introduced species.

LITERATURE CITED

- City of Eugene. 1997. West Eugene Wetland Mitigation Bank Annual Report. Prepared by the Parks and Open Spaced Division of the City of Eugene, Oregon.
- City of Eugene. 2007. West Eugene Wetland Mitigation Bank Annual Report. Prepared by the Parks and Open Spaced Division of the City of Eugene, Oregon.
- Gray, E.C. 2012. Habitat monitoring at Balboa, Fir Butte, Greenhill, and Vinci. Institute for Applied Ecology, Corvallis, Oregon; USDI Bureau of Land Management, Eugene District; and US Fish and Wildlife Service, Portland, Oregon. vi + 24 pp.
- Thorpe, A.S., and T.N. Kaye. 2007. *Erigeron decumbens* ssp. *decumbens* (Willamette daisy): Population monitoring and evaluation of mowing and burning at Oxbow West (West Eugene Wetlands). Report to the Bureau of Land Management, Eugene, District. Institute for Applied Ecology, Corvallis, Oregon. 30pp.
- Thorpe, A.S., and T.N. Kaye. 2007. *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine) and *Icaricia icarioides fenderi* (Fender's blue butterfly) in the West Eugene Wetlands: Population monitoring, reintroduction success, and an evaluation of experimental treatments. Report to the Bureau of Land Management, Eugene, District. Institute for Applied Ecology, Corvallis, Oregon. 43pp.
- Thorpe, A.S. 2010. Assessing critical habitat for Fender's blue butterfly in the West Eugene Wetlands (Brief narrative; contract number 134208M067. Institute for Applied Ecology, Corvallis, Oregon. 2 pp.
- USDI Bureau of Land Management, Eugene District [BLM]. 2005. West Eugene Wetlands Environmental Assessment No. OR090-05-03. Eugene, OR. 78 pp.
- U.S. Fish and Wildlife Service [USFWS]. 2005. Biological opinions and letter of concurrence on effects of implementation of the ten-year schedule of management activities to maintain, enhance and expand prairie habitats within West Eugene Wetlands, FY 2006 – 2016, on Fender's blue butterfly (*Icaricia icarioides fenderi*), Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*), Willamette daisy (*Erigeron decumbens* ssp. *decumbens*), and Bradshaw's lomatium (*Lomatium bradshawii*), Siuslaw Resource Area, Eugene District Bureau of Land Management. FWS Reference Number 1-7-06-F-0038.
- U.S. Fish and Wildlife Service [USFWS]. 2010. Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington. U.S. Fish and Wildlife Service, Portland, Oregon. xi + 241 pp.

APPENDIX A. SPECIES FOUND IN SAMPLED PLOTS, 2013

Nativity	Functional Group	Species	Fir Butte 1	Oxbow West	Vinci 1	Vinci 2
Exotic	Forb	<i>Alisma lanceolatum</i>	0.0	0.0	0.0	0.4
Exotic	Forb	<i>Centarium erythraeae</i>	0.0	0.0	0.4	0.0
Exotic	Forb	<i>Cerastium glomeratum</i>	0.5	0.0	0.0	0.0
Exotic	Forb	<i>Cerastium glomeratum</i>	0.0	0.5	0.0	0.0
Exotic	Forb	<i>Crepis capillaris</i>	0.0	0.0	0.4	0.0
Exotic	Forb	<i>Crepis sp</i>	1.8	0.0	0.0	0.0
Exotic	Forb	<i>Daucus carota</i>	4.6	0.0	2.2	0.4
Exotic	Forb	<i>Galium parisiense</i>	0.0	3.8	5.8	3.4
Exotic	Forb	<i>Geranium dissectum</i>	1.8	0.0	0.9	0.0
Exotic	Forb	<i>Hypericum perforatum</i>	0.5	0.0	0.0	1.7
Exotic	Forb	<i>Hypochaeris radicata</i>	0.0	2.9	11.5	16.6
Exotic	Forb	<i>Leucanthemum vulgare</i>	0.0	1.9	10.2	7.2
Exotic	Forb	<i>Lythrum hyssopifolium</i>	0.0	1.0	0.0	0.0
Exotic	Forb	<i>Mentha pulegium</i>	0.0	0.0	6.2	5.1
Exotic	Forb	<i>Myosotis discolor</i>	2.3	0.0	0.4	0.0
Exotic	Forb	<i>Parentucellia viscosa</i>	9.7	0.0	0.4	0.0
Exotic	Forb	<i>Plantago lanceolata</i>	0.5	0.0	0.0	0.0
Exotic	Forb	<i>Rubus armeniacus</i>	5.1	0.5	0.4	0.0
Exotic	Forb	<i>Rubus laciniatus</i>	0.0	0.0	0.4	0.9
Exotic	Forb	<i>Rumex acetosella</i>	11.1	0.5	0.0	0.0
Exotic	Forb	<i>Rumex crispus</i>	0.0	0.0	0.0	0.4
Exotic	Forb	<i>Senecio jacobaea</i>	0.9	0.0	0.0	0.0
Exotic	Forb	<i>Trifolium sp</i>	0.0	0.0	0.0	1.3
Exotic	Forb	<i>Vicia hirsuta</i>	4.1	0.0	0.0	0.0
Exotic	Forb	<i>Vicia sativa</i>	28.1	0.0	0.0	0.0
Exotic	Forb	<i>Vicia sp.</i>	0.0	0.0	2.2	0.0

Exotic	Forb	<i>Vicia tetrasperma</i>	6.9	0.0	0.9	1.3
Exotic	Graminoid	<i>Agrostis stolonifera/capillaris</i>	55.3	0.0	0.0	0.0
Exotic	Graminoid	<i>Aira caryophyllea</i>	0.5	0.0	0.0	0.0
Exotic	Graminoid	<i>Alopecurus pratensis</i>	0.9	0.0	0.0	0.0
Exotic	Graminoid	<i>Anthoxanthum odoratum</i>	4.6	28.6	10.6	5.5
Exotic	Graminoid	<i>Arrhenatherum elatius</i>	0.0	1.0	2.7	1.7
Exotic	Graminoid	<i>Bromus hordeaceus</i>	10.6	0.0	0.0	0.0
Exotic	Graminoid	<i>Holcus lanatus</i>	7.8	1.4	4.0	4.3
Exotic	Graminoid	<i>Panicum capillera</i>	0.0	0.0	0.9	0.0
Exotic	Graminoid	<i>Schedonorus phoenix</i>	1.4	0.0	0.0	5.1
Exotic	Graminoid	<i>Vulpia bromoides</i>	12.9	0.0	0.0	0.0
Exotic	Shrub	<i>Crataegus monogyna x suksdorfii</i>	0.0	1.0	0.9	0.0
Exotic	Shrub	<i>Rosa eglanteria</i>	0.0	0.0	0.9	0.0
Exotic	Tree	<i>Prunus avium</i>	0.0	0.5	0.0	0.0
Native	Forb	<i>Achillia millifolium</i>	0.5	0.0	0.0	0.0
Native	Forb	<i>aster curtus</i>	0.0	0.0	4.0	1.3
Native	Forb	<i>Brodeia</i> sp.	0.0	8.1	6.6	13.6
Native	Forb	<i>Camassia quamash</i> var. <i>maxima</i>	0.0	0.5	5.3	1.7
Native	Forb	<i>Epilobium</i> sp.	0.0	1.0	1.3	0.4
Native	Forb	<i>Eriophyllum lanatum</i> var. <i>lanatum</i>	0.0	1.0	0.0	0.4
Native	Forb	<i>Galium aparine</i>	1.4	0.0	0.0	0.0
Native	Forb	<i>Galium trifidum</i>	14.3	0.0	0.0	0.0
Native	Forb	<i>Grindelia integrifolia</i>	0.0	5.7	3.5	1.7
Native	Forb	<i>Lotus corniculatus</i>	0.0	0.0	0.4	0.0
Native	Forb	<i>Lotus micranthus</i>	3.2	0.0	0.0	4.7
Native	Forb	<i>Lotus</i> sp.	0.0	0.0	0.0	1.3
Native	Forb	<i>Lotus unifoliolatus</i> var. <i>unifoliolatus</i>	0.0	0.0	0.4	0.0
Native	Forb	<i>Lupinus oreganus</i>	7.8	0.0	0.0	0.0
Native	Forb	<i>Microseris laciniata</i>	0.0	0.0	0.4	0.0
Native	Forb	<i>Plagiobothrys</i> sp.	0.0	0.0	0.0	0.4

Native	Forb	<i>Potentilla gracilis</i> var. <i>gracilis</i>	0.0	0.5	0.0	0.0
Native	Forb	<i>Prunella vulgaris</i>	0.0	1.5	5.3	1.7
Native	Forb	<i>Saxifraga oregana</i>	0.0	0.5	0.0	0.0
Native	Forb	<i>Veronica scutellata</i>	0.0	0.0	0.4	0.0
Native	Graminoid	<i>Carex</i> sp.	0.0	0.0	2.2	3.4
Native	Graminoid	<i>Danthonia californica</i>	0.0	8.6	13.3	22.6
Native	Graminoid	<i>Deschampsia cespitosa</i>	0.0	20.0	12.8	16.2
Native	Graminoid	<i>Juncus</i> sp.	0.0	1.4	0.4	0.4
Native	Graminoid	<i>Luzula comosa</i>	0.0	1.9	0.0	0.0
Native	Shrub	<i>Crataegus suksdorfii</i>	0.0	0.0	0.0	0.9
Native	Shrub	<i>Fraxinus latifolia</i>	0.0	0.5	0.4	0.0
Native	Shrub	<i>Rosa nutkana</i> var. <i>nutkana</i>	0.0	0.0	0.0	0.4
	Soil	Bare	23.0	90.0	63.3	71.1
	Soil	Litter	91.2	93.3	96.5	95.3
	Soil	Moss	9.7	1.4	23.5	7.2

APPENDIX B. AERIAL PHOTOS AND IMAGES OF MONITORING SITES, 2013.

