HABITAT SAMPLING AT FIR BUTTE, OXBOW WEST, AND VINCI

2007 Report

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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 dedicated to natural resource con-servation, 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. Our current activities are concentrated on rare and endangered plants and invasive species.

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Cover photographs: (clockwise from upper left): Willamette daisy (*Erigeron decumbens* var. *decumbens*), Oxbow West, Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*), and Fir Butte. Photos by T.N. Kaye.

TABLE OF CONTENTS

LIST OF FIGURES

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 of 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 Schedule (hereafter the EA), outlines targets for habitat conditions and provides guidance on the priority of work for the maintenance, enhancement, and restoration projects (USDI 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).

The purpose of this project was to conduct monitoring within the habitat of species covered under the Western Oregon and Southwestern Oregon Prairie Species Recovery Plan (USFWS 2006) at three sites, Oxbow West, Fir Butte, and Vinci in order to provide data to assess whether these sites were within their habitat targets.

Sites

Oxbow West

The overall habitat quality of the remnant prairie at Oxbow West is good, and ongoing management efforts have helped reduce encroachment by feral *Pyrus communis* (cultivated pear trees), *Fraxinus latifolia* (Oregon ash), *Populus tricocarpa* (cottonwood), and various shrubs. Efforts are also being made to eradicate the invasive grass, *Phalaris arundinacea* (reed canary grass) that is expanding into the prairie from adjacent wet areas. Oxbow West supports a number of rare species, including *Erigeron decumbens* ssp. *decumbens*, *Aster curtus*, *Cicendia quadrangularis*, and *Sidalcea cusickii*. The habitat has also been noted as having high potential for reintroduction of *Lomatium bradshawii*. The federally endangered *E. d.* ssp. *decumbens* is the most abundant rare plant at Oxbow West, occupying approximately five acres of the site. Maintaining and improving the prairie habitat is the main objective for management at the Oxbow West site, including mowing (initiated in 2002) and burning (treated in September 2005). We sampled one plot in Oxbow West, within the mowing and burning experimental treatment area (see Thorpe and Kaye 2007).

Fir Butte

Fir Butte is an 18 acre prairie remnant owned by the Eugene District BLM. This site has been heavily invaded by many exotic weeds including *Rubus armeniacus* (blackberry), *Cytisus scoparius* (Scot's broom), *Centaurea pratensis* (meadow knapweed), and *Arrhenatherum elatius* (tall oatgrass). Despite the relatively poor habitat quality one of the largest known extant populations of the Federally threatened *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine) occurs at Fir Butte. This site also supports a relatively large population of the endangered Fender's blue butterfly (*Icaricia icarioides fenderi*). *Lupinus sulphureus ssp. kincaidii* serves as the obligate host plant for *I. I. fenderi*. Since 1999, BLM crews have made substantial efforts to pull or chop down most of the *C. pratensis* and *C. scoparius*, and selected areas have been repeatedly mowed to reduce the invasion of blackberry. Since 2001, experimental treatment plots at the site have either been mowed and/or burned.

Vinci

Vinci is a relatively large prairie containing both wet prairie and vernal pool habitat. Although the site is of relatively high quality, similar to Oxbow West, it has been invaded by woody species, including feral *Pyrus communis,Fraxinus latifolia*, *Populus tricocarpa,* and native and exotic forbs and graminoids, including *Phalaris arundinaceae*. Vinci supports a number of rare species, including *Erigeron decumbens* ssp. *decumbens*, *Aster curtus*, and *Horkelia congesta* ssp. *congesta*.

Monitoring Approach

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 species with less than 0.5% cover are likely to have been missed using this method, however, it provides a consistent manner in which to efficiently sample a large area.

METHODS

In July 2007 three sites in the West Eugene Wetlands, Vinci, Oxbow West, and Fir Butte (Figure 1) were sampled for percent vegetation estimates. We sampled two 85m x 50m plots at Fir Butte (Figure 2), one 85m x 50m and one 65m x 50m plot at Vinci (Figure 3), and one 85m x 50m plot at Oxbow West (Figure 4). In a broad sense these areas are all considered wetlands, but also contained wetland (having standing water most of the year), upland (just upslope of wetlands and dry most of the year), vernal pool (seasonal pools of water in otherwise dry habitats), and/or emergent (plant hummocks in wetlands that are above the surface of the water) microhabitats.

Plots were placed so that they would be contained within either *Lupinus sulphureus* ssp. *kincaidii* (Fir Butte) or *Erigeron decumbens* var. *decumbens* (Vinci and Oxbow West) populations. The origin for each plot was consistently placed in the south cover of each plot (Figure 5). Plot baselines were 85m long, except at one of the Vinci sites, where the baseline was 65m. In all plots, the first transect running perpendicular to the baseline was randomly located between 0m and 4m. Subsequent transects were placed every 4m along the baseline. The first sample point along each transect was randomly located between 0m and 5m in the large plots and 0m and 4m in the small plot. Sampling points were then systematically located every 5m or 4m, for the large and small plots, respectively. This ensured that at least 200 points were measured in each plot.

At each sampling point, we placed the tripod with two legs touching the tape (the leading leg at the sampling point) and the third leg to the right of the tape. After leveling the tripod, we raised the pin above the tallest vegetation, then slowly lowered it, recording each species that the pin touched. We also recorded the habitat type (wetland, upland, vernal pool or emergent) and if the substrate was bare ground, litter or moss.

Species identity, habit, and natality 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 cover type), dividing by the total number of sampling points per plot, and multiplying by 100.

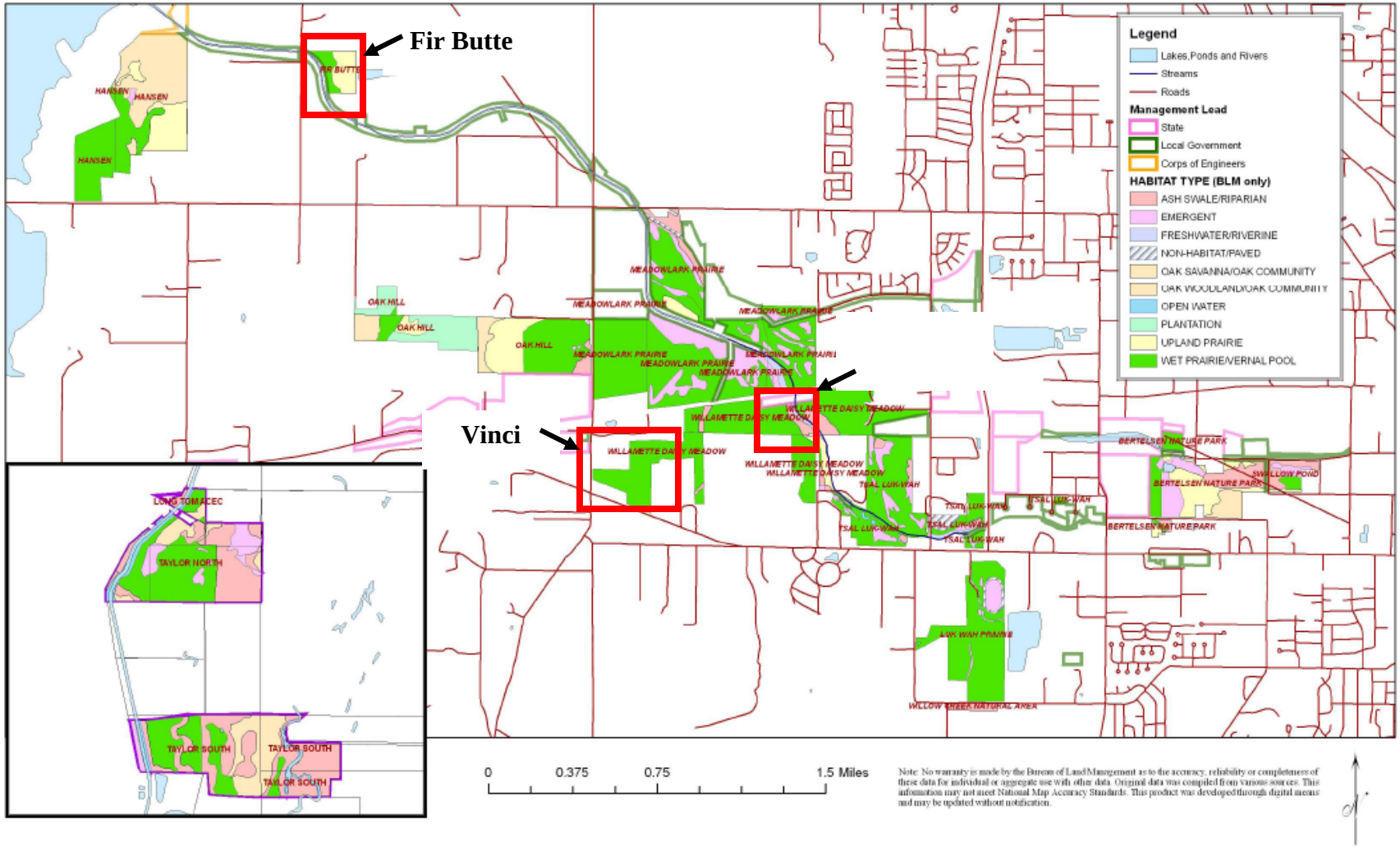

Figure 1. Monitoring sites described in this project, Fir Butte, Vinci, and Oxbow West. Sites are labeled with and outlined. Map describes plant communities at these and other sites in the West Eugene Wetlands. (Map from USDI BLM 2005)

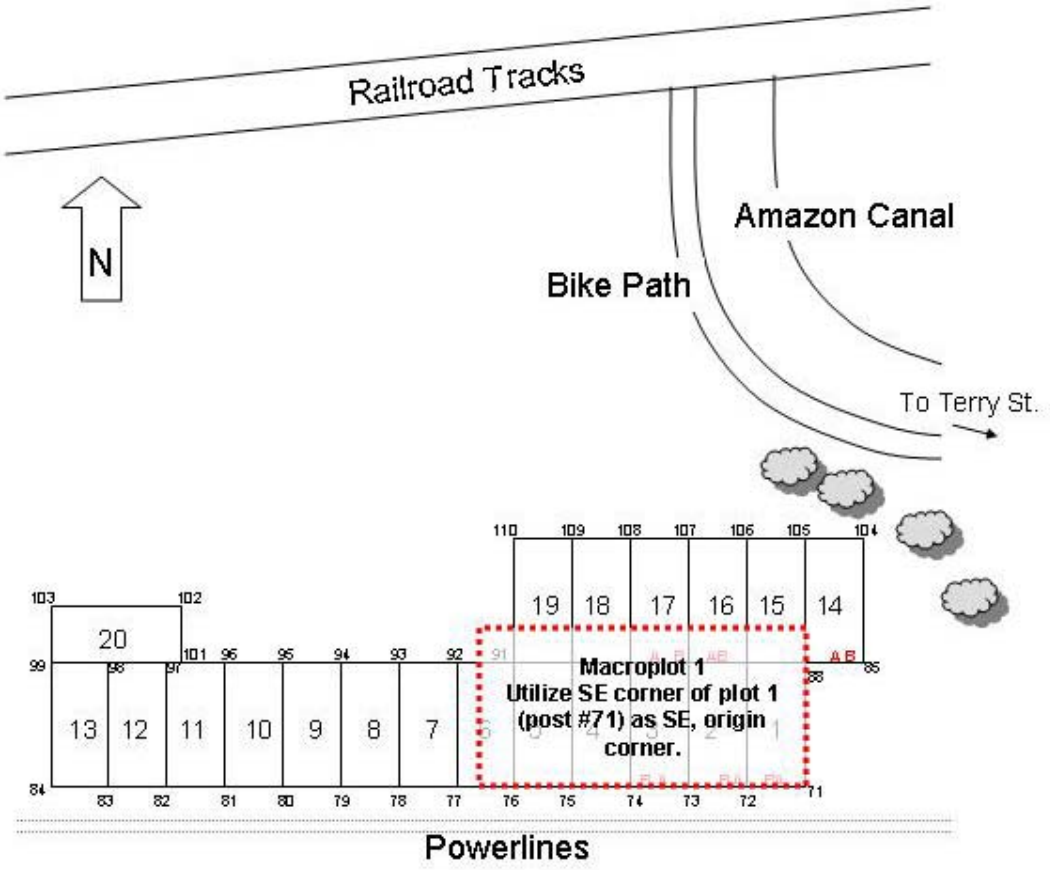

Figure 2. Location of the sample plot at Oxbow West. Plots in the background (1 – 20) are for an experiment testing the effectiveness of mowing and burning treatments on *Erigeron decumbens* ssp. *decumbens*.

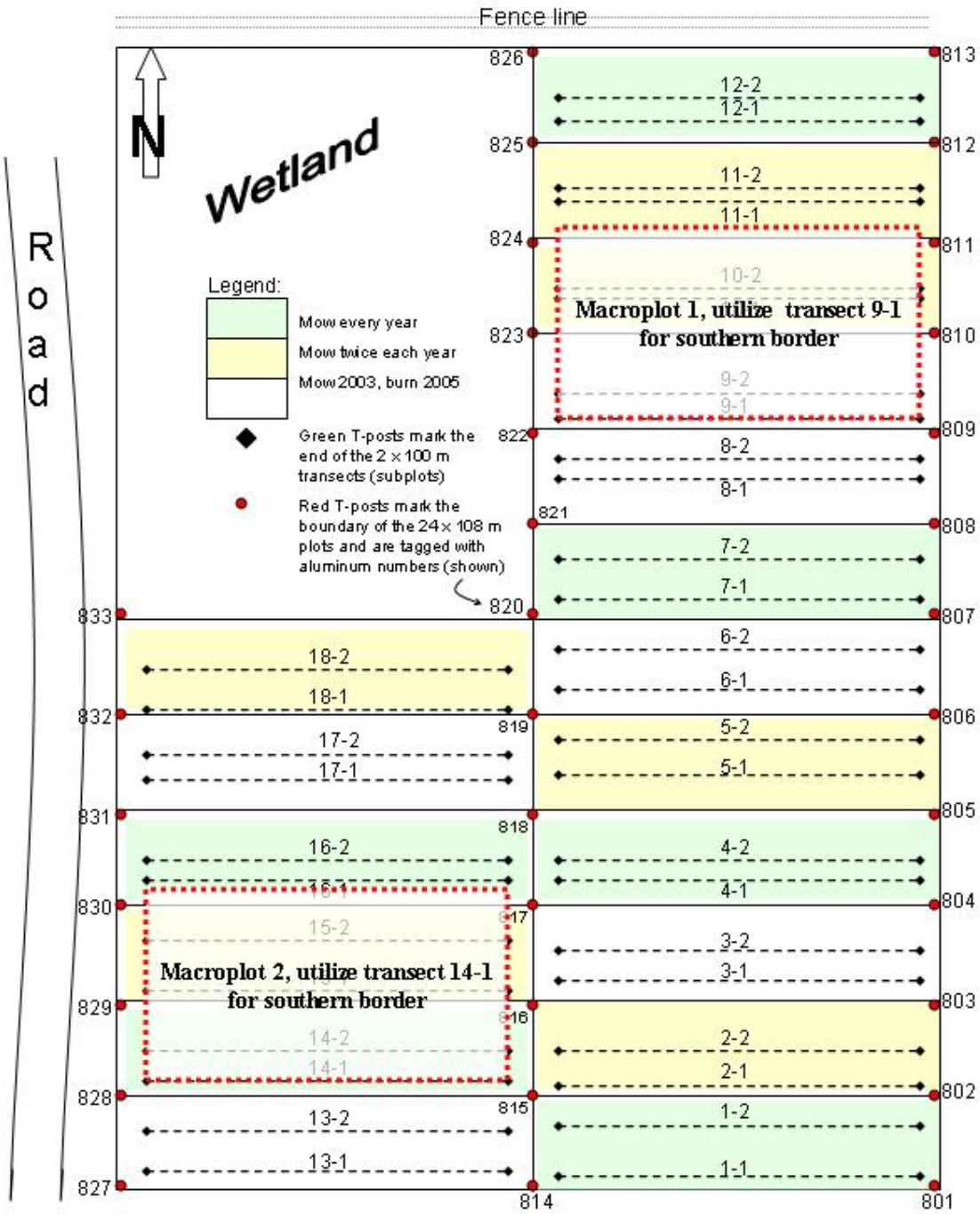

Figure 3. Location of sample plots at Fir Butte. Plots in the background (1 – 18) are for an experiment testing the effectiveness of mowing and burning treatments on *Erigeron decumbens* ssp. *decumbens*.

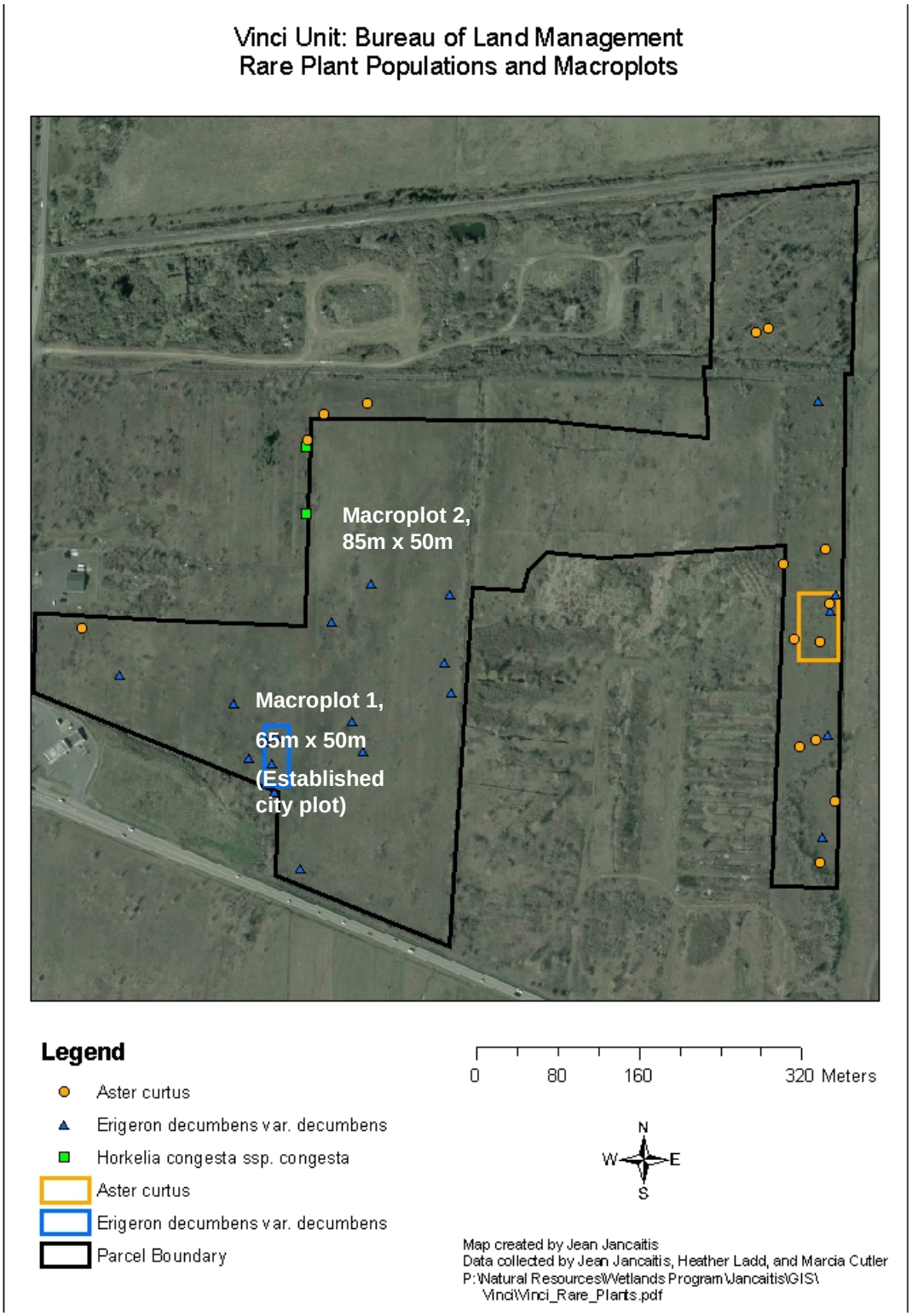

Figure 4. Location of sample plot at Vinci.

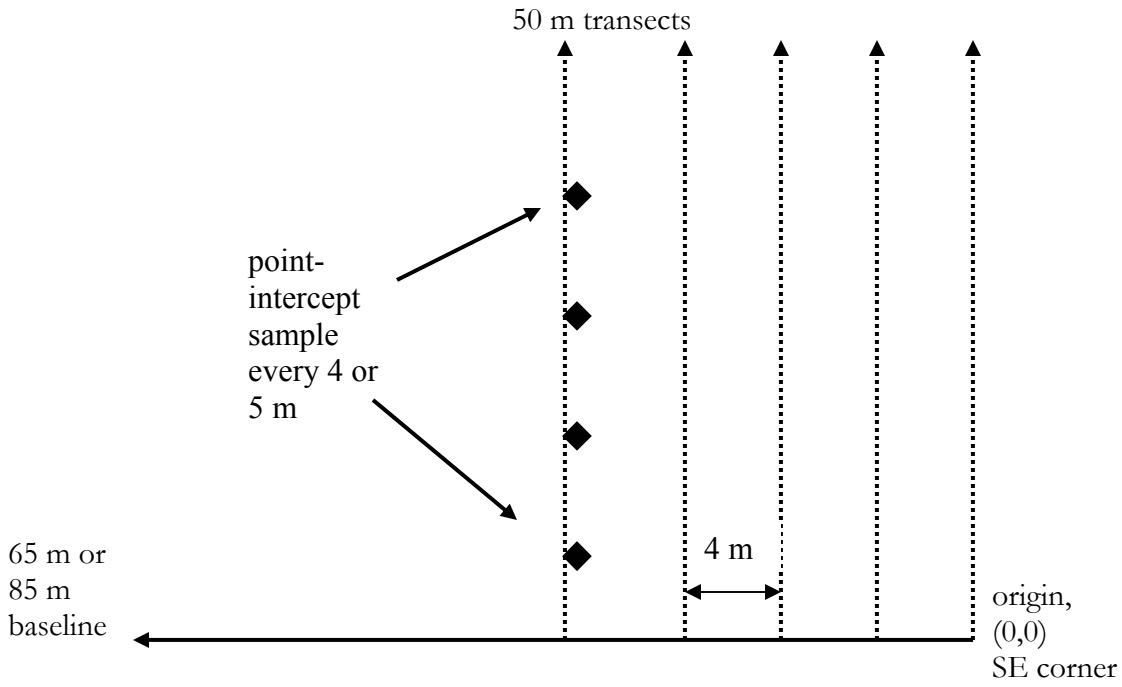

Figure 5. Example of plot sampling design.

RESULTS AND DISCUSSION

Oxbow West

Summary

There were 14 native and 12 introduced species in the two plots at Oxbow West (Appendix B, C). Total cover was greater than 100%, suggesting multiple canopy levels (Figure 6). In all growth habit types, cover of native species was higher than cover of introduced species. The two most abundant species were the native grasses, *Deschampsia caespitosa* (34%) and *Danthonia californica* (33%). Other common native species were the forb, *Grindelia integrifolia* (17%) and the grass, *Dicanthelium acuminatum* (8%). The two most abundance invasive species were the grasses, *Anthoxanthum odoratum* and *Aira caryophylla*, with 31% and 15% cover, respectively. Mowing and burning in these plots appear to be minimizing litter accumulation; there was approximately 2% cover of thatch.

Management Issues

While the plant community at Oxbow West remains dominated by native species, the introduced species, particularly *Anthoxantum odoratum*, have the potential to become community dominants without significant management actions. Two woody species that compromise the quality of the wet prairie habitat were also present at the site, the native tree *Crataegus suksdorfii*, and the invasive tree *Prunus avium*.

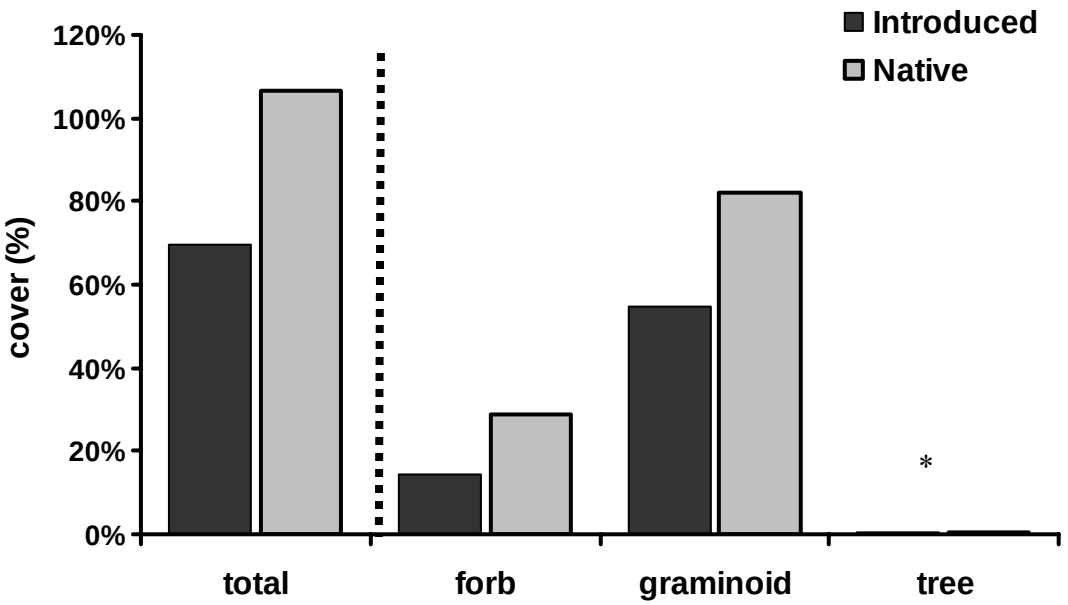

Figure 6. Cover (%) of native and introduced species divided into growth habits at **Oxbow West** in the West Eugene Wetlands. *Both native and introduced trees were present, but cover was so low (0.39%), that the bars do not appear on the graph.

Fir Butte

Summary

At Fir Butte, invasive species were more abundant than native species both in terms of richness and cover (Appendix B, C, Figure 7). There were 27 invasive species and the average cover of invasive species was 240%. In contrast, there were 6 native species and on average, the cover of natives was 6%. The most abundant species were the introduced grasses *Agrostis stolonifera* (84%), *Vulpia bromoides* (18%), and *Arrhenatherum elatis* (12%); forbs *Vicia sativa* (37%) and *Vicia hirsuta* (17%), and shrub, *Rubus laciniatus* (23%). The most abundant native species were the threatened forb, *Lupinus sulphureus* ssp. *kincaidii* (3.3%) and the fern, *Pteridium aquilinum* (1.5%). Mowing and burning in these plots appear to be minimizing litter accumulation; there was approximately 1% cover of thatch.

Management Issues

The most pressing management issue at Fir Butte is the high cover of introduced species, particularly the shrub, *Rubus laciniatus*, which has the potential to form near-monocultures. We also observed that the two *Vicia* species frequently grew within patches of *Lupinus sulphureus* ssp. *kincaidii*. As *Vicia* is also leguminous, these species may be particularly strong competitors against the threatened native. Finally, although *Pteridium aquilinum* is a native species and is still relative low in average cover, it also tended to occur within patches of *Lupinus sulphureus* ssp. *kincaidii*. Its larger size and taller stature may also make it a strong competitor against the threatened native.

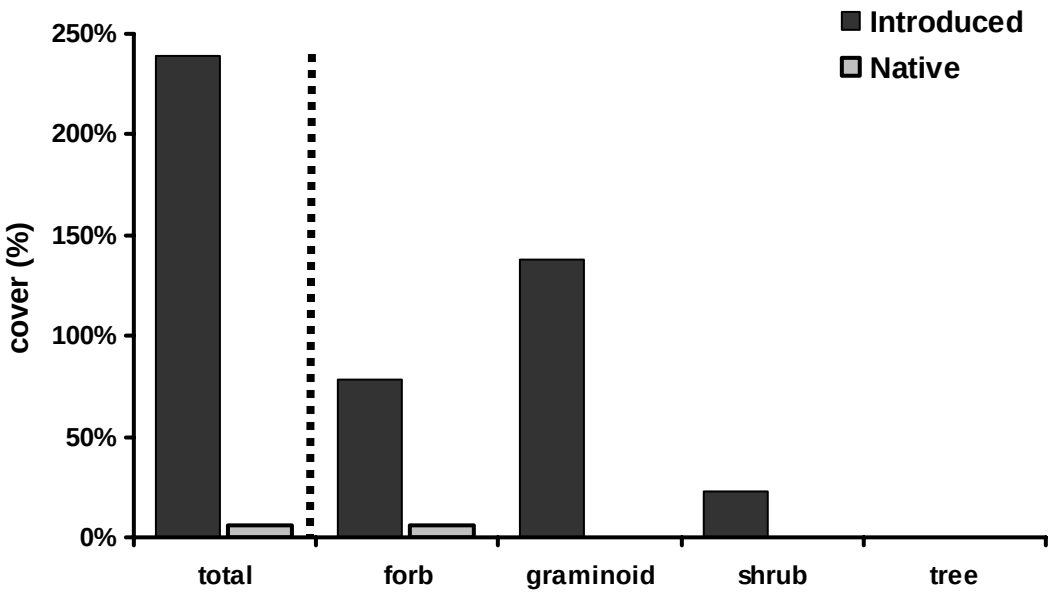

Figure 7. Cover (%) of native and introduced species divided into growth habits at **Fir Butte** in the West Eugene Wetlands. Bars are averages between two sample plots.

Vinci

Summary

Vinci had the highest richness of both native (23) and introduced (32) species of the three sites we surveyed (Appendix B, C; figure 8). Cover of native forbs, graminoids, and all groups together was higher than that of introduced species in those categories. The most abundant invasive species at Vinci were the graminoids *Anthoxanthum odoratum* (16%), and *Holcus lanatus* (7%), the forb, *Leucanthemum vulgare* (11%), and the shrub, *Rubus armeniacus* (7%). There was less than 4% cover by thatch.

Management Issues

While the cover and richness of native species at Vinci was relatively high, so was the cover and richness of exotic species. Several of the exotic species we documented are known to aggressively spread at sites with similar habitat. Vinci also had the highest cover of woody vegetation (1.6% native shrubs, 2.4% native trees, 7.6% introduced shrubs, and 0.4% introduced trees; 12% total).

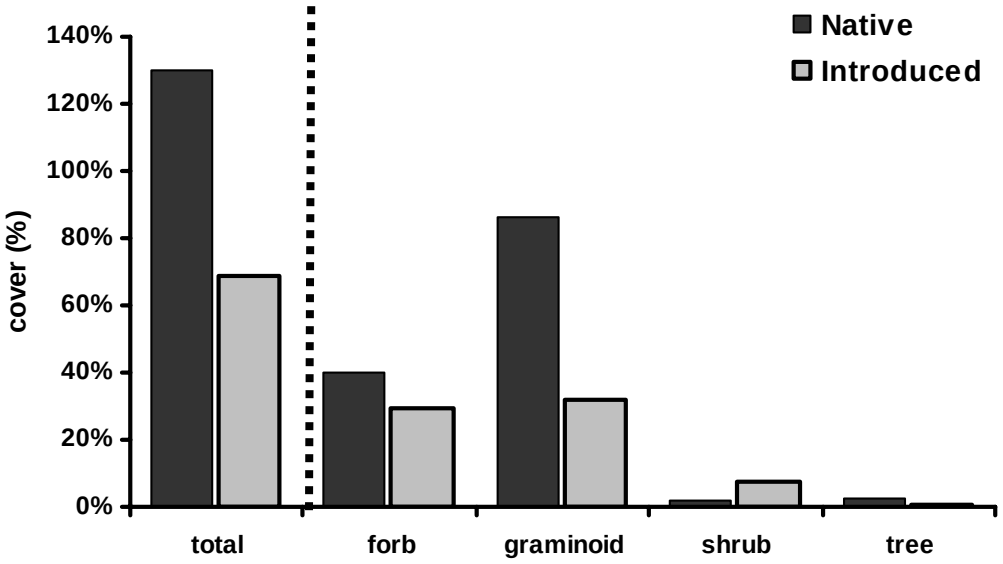

Figure 8. Cover (%) of native and introduced species divided into growth habits at **Vinci** in the West Eugene Wetlands. Bars are averages between two sample plots.

SUMMARY

The Draft Recovery objectives form the Western Oregon and Southwestern Oregon Prairie Species Recovery Plan (USFWS 2006) specify that that within habitat for *L. s.* ssp. *kincaidii* and *E. d.* var. *decumbens*, there is to be ≥50% relative cover of nonwoody natives at 70% of local populations, ≤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 the EA, 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 $1m^2$ 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:

Habitat indicator	Site	Indicator level
Woody vegetation	Vinci	12% cover of woody species
Invasive species	Oxbow West	70% cover of introduced species
	Fir Butte	239% cover of introduced species
	Vinci	68% cover of introduced species

The threshold for management of thatch was not exceeded at any site. Our sampling methods were not sufficient to determine if there had been a loss in the cover of number of native plant species.

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APPENDIX A. USEFUL FIELD HINTS

- Previous to arriving in the field data sheets with transect and point locations randomly assigned were made and uploaded onto hand held computers.
- Although it could have been done with 2 people it was ideal to have three people working together. One person recorded the numbers on paper or a hand held computer, the second person moved the tripod and dropped the pin while the third person watched the pin and called out which species were hit. To avoid trampling do not walk on the right side of the transect tape as that was the side of the transect that the tripod is placed and the data points are collected.
- On average, each site took 1.5 days to survey.

APPENDIX B. ALL SPECIES FOUND IN FIVE PLOTS SAMPLED IN THE WEST EUGENE WETLANDS IN 2007.

Species	Family	US Nativity	Growth Habit	Fir Butte 1	Fir Butte 2	Oxbow	Vinci 1	Vinci 2
				Cover % (lower-upper 90% C.I.)				
Achillia millifolium	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Agrostis exarata	Poaceae	Native	Graminoid	91 (88-94)	77 (72-81)	2 (0-4)	9 (6-12)	15 (11-19)
Agrostis stolonifera/capillaris	Poaceae	Introduced	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	1 (0-3)	0 (0-1)
Aira caryophyllea	Poaceae	Introduced	Graminoid	5 (3-7)	5 (3-7)	15 (11-20)	0 (0-2)	2 (1-4)
Alisma lanceolatum	Alismataceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Alisma triviale	Alismataceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Allium amplectens	Liliaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-2)	0 (0-1)
Alopecurus geniculatus	Poaceae	Introduced	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Alopecurus pratensis	Poaceae	Introduced	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Amelanchier alnifolia	Rosaceae	Native	Tree, Shrub	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Anagallis arvensis	Primulaceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Anthemis cotula	Asteraceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)
Anthoxanthum odoratum	Poaceae	Introduced	Graminoid	1 (0-2)	1 (0-2)	31 (26-37)	21 (17-25)	12 (9-16)
Anthriscus caucalis	Apiaceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Arrhenatherum elatius	Poaceae	Introduced	Graminoid	0 (0-1)	25 (20-29)	0 (0-1)	0 (0-1)	0 (0-1)
Avena fatua	Poaceae	Introduced	Graminoid	0 (0-2)	3 (2-6)	0 (0-1)	0 (0-1)	0 (0-1)
Beckmannia syzigachne	Poaceae	Native	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Bidens cernua	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Bidens frondosa	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Briza minor	Poaceae	Introduced	Graminoid	0 (0-1)	0 (0-1)	4 (2-7)	2 (1-4)	2 (1-5)
Brodiaea coronaria	Liliaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Bromus hordeaceous	Poaceae	Introduced	Graminoid	1 (0-3)	4 (2-7)	0 (0-1)	1 (0-3)	0 (0-1)
Bromus sterilis	Poaceae	Introduced	Graminoid	0 (0-1)	8 (6-12)	0 (0-1)	0 (0-1)	0 (0-1)

Appendix B, cont. All species found in five plots sampled in the West Eugene Wetlands in 2007.

Species	Family	US Nativity	Growth Habit	Fir Butte 1	Fir Butte 2	Oxbow	Vinci 1	Vinci 2
				Cover % (lower-upper 90% C.I.)				
Camassia leichtlinii var. *suksdorfii*	Liliaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-2)	6 (4-9)	0 (0-1)
Camassia quamash var. *maxima*	Liliaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	2 (1-4)
Carex spp.	Cyperaceae	Native	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	1 (1-3)	0 (0-1)
Carex ovalis	Cyperaceae	Native	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)
Carex unilateralus	Cyperaceae	Native	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)
Castilleja tenuis	Scrophulariaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)	0 (0-2)
Centarium erythraeae	Gentianaceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)
Cerastium glomeratum	Caryophyllaceae	Introduced	Forb/herb	1 (0-2)	0 (0-2)	0 (0-1)	0 (0-1)	1 (0-2)
Collomia grandiflora	Polemoniaceae	Native	Forb/herb	1 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Crataegus suksdorfii	Rosaceae	Native	Tree, Shrub	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-2)	1 (0-3)
Crepis capillaris	Asteraceae	Introduced	Forb/herb	2 (1-5)	0 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)
Dactylis glomerata	Poaceae	Introduced	Graminoid	0 (0-1)	1 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)
Danthonia californica	Poaceae	Native	Graminoid	0 (0-1)	0 (0-1)	33 (28-39)	20 (16-25)	35 (30-40)
Daucus carota	Apiaceae	Introduced	Forb/herb	5 (3-7)	5 (3-8)	0 (0-1)	4 (3-7)	4 (2-7)
Deschampsia cespitosa	Poaceae	Native	Graminoid	0 (0-1)	0 (0-1)	34 (29-40)	41 (36-46)	37 (32-43)
Dicanthelium acuminatum	Poaceae	Native	Graminoid	0 (0-1)	0 (0-1)	8 (5-12)	2 (1-4)	0 (0-2)
Dichelostemma congestum	Liliaceae	Native	Forb/herb	0 (0-1)	0 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)
Epilobium brachycarpum	Onagraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	1 (0-2)
Epilobium ciliatum	Onagraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	2 (1-4)	0 (0-2)
Erigeron decumbens var. *decumbens*	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)
Eriophyllum lanatum var. *lanatum*	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	2 (0-4)	0 (0-1)	1 (0-3)
Festuca arundinacea	Poaceae	Introduced	Graminoid	0 (0-2)	4 (2-6)	3 (2-6)	3 (2-6)	5 (3-7)

Appendix B, cont. All species found in five plots sampled in the West Eugene Wetlands in 2007.

Species	Family	US Nativity	Growth Habit	Fir Butte 1	Fir Butte 2	Oxbow	Vinci 1	Vinci 2
				Cover % (lower-upper 90% C.I.)				
Fraxinus latifolia	Oleaceae	Native	Tree	0 (0-1)	0 (0-1)	0 (0-1)	2 (1-4)	1 (0-2)
Galium aparine	Rubiaceae	Native	Forb/herb	0 (0-2)	1 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)
Galium parisiense	Rubiaceae	Introduced	Forb/herb	4 (2-7)	7 (5-11)	0 (0-1)	0 (0-2)	1 (0-3)
Geranium dissectum	Geraniaceae	Introduced	Forb/herb	1 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Grindelia integrifolia	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	17 (13-22)	12 (9-16)	5 (3-7)
Holcus lanatus	Poaceae	Introduced	Graminoid	7 (5-10)	6 (4-9)	1 (0-3)	5 (3-8)	8 (5-11)
Hypericum perforatum	Clusiaceae	Introduced	Forb/herb	0 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)
Hypochaeris radicata	Asteraceae	Introduced	Forb/herb	5 (3-7)	3 (2-6)	3 (1-6)	4 (2-6)	8 (6-12)
Juncus bufonius	Juncaceae	Native	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)
Juncus ensifolius	Juncaceae	Native	Graminoid	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)
Juncus tenuis	Juncaceae	Native	Graminoid	0 (0-1)	0 (0-1)	5 (2-8)	6 (4-9)	3 (2-5)
Lathyrus latifolius	Fabaceae	Introduced	Forb/herb	0 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Leontodon taraxacoides	Asteraceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	8 (5-12)	1 (0-3)	3 (2-5)
Leucanthemum vulgare	Asteraceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	2 (0-4)	13 (10-17)	8 (6-12)
Linum bienne	Linaceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	1 (0-3)	0 (0-1)	0 (0-1)
Lotus unifoliolatus var. unifoliolatus	Fabaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	1 (0-3)	3 (2-5)
Lupinus sulphureus ssp. *kincaidii*	Fabaceae	Native	Forb/herb	4 (2-6)	3 (2-5)	0 (0-1)	0 (0-1)	0 (0-1)
Madia spp.	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	6 (4-10)	17 (14-22)
Madia glomerata	Asteraceae			0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)
Malus fusca	Rosaceae	Native	Tree, Shrub	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)
Mentha spicata	Lamiaceae	Introduced	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	3 (2-6)	2 (1-5)
Microseris laciniata	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	3 (1-5)	3 (2-6)	2 (1-4)

Appendix B, cont. All species found in five plots sampled in the West Eugene Wetlands in 2007.

Species	Family	US Nativity	Growth Habit	Fir Butte 1	Fir Butte 2	Oxbow	Vinci 1	Vinci 2
				Cover % (lower-upper 90% C.I.)				
Myosotis discolor	Boraginaceae	Introduced	Forb/herb	2 (1-4)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Navarretia squarrosa	Polemoniaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)
Parentucellia viscosa	Scrophulariaceae	Introduced	Forb/herb	1 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Plantago lanceolata	Plantaginaceae	Introduced	Forb/herb	1 (0-2)	0 (0-1)	0 (0-2)	0 (0-2)	0 (0-2)
Potentilla gracilis var. *gracilis*	Rosaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	1 (0-3)	0 (0-1)	0 (0-1)
Prunella vulgaris var. *lanceolata*	Lamiaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	1 (1-3)	3 (2-5)
Prunella vulgaris var. *vulgaris*	Lamiaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	2 (1-4)	0 (0-1)	0 (0-1)
Prunus avium	Rosaceae	Introduced	Tree	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)	0 (0-1)
Pteridium aquilinum	Dennstaedtiaceae	Native	Forb/herb	3 (2-6)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Pyrus communis	Rosaceae	Introduced	Tree	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	1 (0-2)
Rosa nutkana var. *nutkana*	Rosaceae	Native	Subshrub	0 (0-1)	0 (0-1)	0 (0-1)	2 (1-5)	1 (0-2)
Rubus armeniacus	Rosaceae	Introduced	Subshrub	20 (16-24)	26 (21-31)	0 (0-1)	7 (5-10)	7 (4-10)
Rubus laciniatus	Rosaceae	Introduced	Subshrub	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)	1 (0-3)
Rumex acetosella	Polygonaceae	Introduced	Forb/herb	8 (5-11)	3 (2-6)	0 (0-1)	0 (0-1)	1 (0-2)
Rumex salicifolius var. *salicifolius*	Polygonaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-2)	0 (0-1)	0 (0-1)
Senecio jacobaea	Asteraceae	Introduced	Forb/herb	0 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)
Spiraea douglasii	Rosaceae	Native	Shrub	0 (0-2)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)
Symphyotrichum hallii	Asteraceae	Native	Forb/herb	0 (0-1)	0 (0-1)	3 (2-6)	8 (5-11)	2 (1-5)
Triteleia hyacinthina	Liliaceae	Native	Forb/herb	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-1)	0 (0-2)
Vicia hirsuta	Fabaceae	Introduced	Forb/herb	13 (9-16)	21 (17-26)	0 (0-1)	0 (0-2)	1 (0-2)
Vicia sativa	Fabaceae	Introduced	Forb/herb	36 (31-41)	39 (34-44)	0 (0-1)	0 (0-1)	0 (0-1)
Vulpia bromoides	Poaceae	Introduced	Graminoid	18 (14-22)	18 (15-23)	0 (0-2)	0 (0-1)	0 (0-1)

APPENDIX C. SPECIES WITH >1% COVER IN EACH SAMPLING PLOT.

Species with >1% cover at Fir Butte sample plot 2. Cover values are % (lower-upper 90% C.I.)

Species	Cover
Agrostis stolonifera/capillaris	91 (88-94)
Vicia sativa	36 (31-41)
Rubus armeniacus	20 (16-24)
Vulpia bromoides	18 (14-22)
Vicia hirsuta	13 (9-16)
Rumex acetosella	8 (5-11)
Holcus lanatus	7 (5-10)
Aira caryophyllea	5 (3-7)
Daucus carota	5 (3-7)
Hypochaeris radicata	5 (3-7)
Galium parisiense	4 (2-7)
Lupinus sulphureus ssp. *kincaidii*	4 (2-6)
Pteridium aquilinum	3 (2-6)
Crepis capillaris	2 (1-5)
Myosotis discolor	2 (1-4)
Anthoxanthum odoratum	1 (0-2)
Bromus hordeaceous	1 (0-3)
Cerastium glomeratum	1 (0-2)
Collomia grandiflora	1 (0-2)
Geranium dissectum	1 (0-2)
Parentucellia viscosa	1 (0-2)
Plantago lanceolata	1 (0-2)

Species with >1% cover at Fir Butte sample plot #2. Cover values are % (lower-upper 90% C.I.)

Species	**Cover**
Agrostis stolonifera/capillaris	77 (72-81)
Vicia sativa	39 (34-44)
Rubus armeniacus	26 (21-31)
Arrhenatherum elatius	25 (20-29)
Vicia hirsuta	21 (17-26)
Vulpia bromoides	18 (15-23)
Bromus sterilis	8 (6-12)
Galium parisiense	7 (5-11)
Holcus lanatus	6 (4-9)
Aira caryophyllea	5 (3-7)
Daucus carota	5 (3-8)
Bromus hordeaceous	4 (2-7)
Festuca arundinacea	4 (2-6)
Avena fatua	3 (2-6)
Hypochaeris radicata	3 (2-6)
Lupinus sulphureus ssp. *kincaidii*	3 (2-5)
Rumex acetosella	3 (2-6)
Anthoxanthum odoratum	1 (0-2)
Dactylis glomerata	1 (0-2)
Galium aparine	1 (0-2)

Species with >1% cover at the Oxbow West sample plot. Cover values are % (lower-upper 90% C.I.)

Species	**Cover**
Deschampsia cespitosa	34 (29-40)
Danthonia californica	33 (28-39)
Anthoxanthum odoratum	31 (26-37)
Grindelia integrifolia	17 (13-22)
Aira caryophyllea	15 (11-20)
Dicanthelium acuminatum	8 (5-12)
Leontodon taraxacoides	8 (5-12)
Juncus tenuis	5 (2-8)
Briza minor	4 (2-7)
Festuca arundinacea	3 (2-6)
Hypochaeris radicata	3 (1-6)
Microseris laciniata	3 (1-5)
Symphyotrichum hallii	3 (2-6)
Agrostis exarata	2 (0-4)
Eriophyllum lanatum var. *lanatum*	2 (0-4)
Leucanthemum vulgare	2 (0-4)
Prunella vulgaris var. *vulgaris*	2 (1-4)
Holcus lanatus	1 (0-3)
Linum bienne	1 (0-3)
Potentilla gracilis var. *gracilis*	1 (0-3)

Species with >1% cover at Vinci sample plot #1.
Cover values are % (lower-upper 90% C.I.)

Species	**Cover**
Deschampsia cespitosa	41 (36-46)
Anthoxanthum odoratum	21 (17-25)
Danthonia californica	20 (16-25)
Leucanthemum vulgare	13 (10-17)
Grindelia integrifolia	12 (9-16)
Agrostis exarata	9 (6-12)
Symphyotrichum hallii	8 (5-11)
Rubus armeniacus	7 (5-10)
Camassia leichtlinii var. *suksdorfii*	6 (4-9)
Juncus tenuis	6 (4-9)
Madia species	6 (4-10)
Holcus lanatus	5 (3-8)
Daucus carota	4 (3-7)
Hypochaeris radicata	4 (2-6)
Festuca arundinacea	3 (2-6)
Mentha spicata	3 (2-6)
Microseris laciniata	3 (2-6)
Briza minor	2 (1-4)
Dicanthelium acuminatum	2 (1-4)
Epilobium ciliatum	2 (1-4)
Fraxinus latifolia	2 (1-4)
Rosa nutkana var. *nutkana*	2 (1-5)
Agrostis stolonifera/capillaris	1 (0-3)
Bromus hordeaceous	1 (0-3)
Carex spp.	1 (1-3)
Leontodon taraxacoides	1 (0-3)
Lotus unifoliolatus var. *unifoliolatus*	1 (0-3)
Prunella vulgaris var. *lanceolata*	1 (1-3)

Species with >1% cover at Vinci sample plot #2.
Cover values are % (lower-upper 90% C.I.)

Species	**Cover**
Deschampsia cespitosa	37 (32-43)
Danthonia californica	35 (30-40)
Madia spp.	17 (14-22)
Agrostis exarata	15 (11-19)
Anthoxanthum odoratum	12 (9-16)
Holcus lanatus	8 (5-11)
Hypochaeris radicata	8 (6-12)
Leucanthemum vulgare	8 (6-12)
Rubus armeniacus	7 (4-10)
Festuca arundinacea	5 (3-7)
Grindelia integrifolia	5 (3-7)
Daucus carota	4 (2-7)
Juncus tenuis	3 (2-5)
Leontodon taraxacoides	3 (2-5)
Lotus unifoliolatus var. *unifoliolatus*	3 (2-5)
Prunella vulgaris var. *lanceolata*	3 (2-5)
Aira caryophyllea	2 (1-4)
Briza minor	2 (1-5)
Camassia quamash var. *maxima*	2 (1-4)
Mentha spicata	2 (1-5)
Microseris laciniata	2 (1-4)
Symphyotrichum hallii	2 (1-5)
Cerastium glomeratum	1 (0-2)
Crataegus suksdorfii	1 (0-3)
Epilobium brachycarpum	1 (0-2)
Eriophyllum lanatum var. lanatum	1 (0-3)
Fraxinus latifolia	1 (0-2)
Galium parisiense	1 (0-3)
Pyrus communis	1 (0-2)
Rosa nutkana var. *nutkana*	1 (0-2)
Rubus laciniatus	1 (0-3)
Rumex acetosella	1 (0-2)
Vicia hirsuta	1 (0-2)