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# Habitat sampling at Hansen, Long Tom, North Taylor, Speedway, and Turtle Swale

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2011 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 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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**Cover photographs:** Oak savannah habitat at Long Tom and Kincaid's lupine (*Lupinus oreganus* var. *kincaidii*) at Turtle Swale.

## REFERENCE

Gray, E.C. and A.S. Thorpe. 2011. Habitat monitoring at Hansen, Long Tom, North Taylor, Speedway, and Turtle Swale. 2011 Report. Prepared by Institute for Applied Ecology for the Eugene District BLM. iv + 26 pp.

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## 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 is to monitor habitat quality at several sites in the West Eugene Wetlands (Table 1) in order to assess whether these sites are within the habitat targets for Threatened and Endangered species. In 2011 we monitored five sites, Hansen, Long Tom, North Taylor, Speedway, and Turtle Swale.**

Table 1. Monitoring schedule for West Eugene Wetlands T and E sites from 2007 through 2011. If no month is listed, then the site was not monitored through this project.

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

## Sites<sup>1</sup>

### *Hansen*

Hansen is 143.37 acre site with a small population of the threatened plant, *Lupinus oreganus* A. Heller var. *kincaidii* (Kincaid's lupine). *Lupinus oreganus* var. *kincaidii* is the primary host plant for larvae of the endangered *Icaricia icarioides fenderi* (Fender's blue butterfly). Invasive forage grasses dominate this site. *Lupinus oreganus* var. *kincaidii* research plots were accidentally seeded with *Festuca rubra* (red fescue), which was mistaken for the native *Festuca roemerii* (Roemer's fescue) when seed was collected for the project. *Festuca rubra* has taken over most of the native species in plots where it was originally seeded and has spread outside of the plots. This site has also been invaded by *Cirsium arvense* (Canada thistle) and *Rubus* spp. (blackberry). In 2007, a portion of Hansen was treated for encroachment. Hereafter, we will call the treated area Hansen Meadows and the untreated Hansen Woods.

### *Long Tom and North Taylor*

Combined, the Long Tom and North Taylor sites are eight acres in size. These high quality prairies host a population of the endangered *Lomatium bradshawii* (Bradshaw's desert-parsley). Threats to these the prairies include invasion by *Cirsium vulgare*, encroachment by *Fraxinus latifolia* (Oregon ash), *Quercus garryana* var. *garryana* (Oregon white oak), and *Quercus kelloggii* (California black oak), and build-up of thatch.

### *Speedway*

Speedway is a 50 acre site with populations of the *Erigeron decumbens* ssp. *decumbens* (Willamette daisy) and *Lomatium bradshawii*, both federally endangered species. This site has been impacted intensively, having previously served as a racing drag strip. Remnant wet prairie is in poor to good condition depending of level of disturbance. There is severe erosion along channelized portions of Willow Creek and associated swales. Threats to this site include the invasive species *Cytisus scoparius* (Scots broom), *Cirsium arvense*, *Cirsium vulgare* (bull thistle), and *Rubus* spp.; encroachment by woody native species, including *Fraxinus latifolia* and *Crataegus douglasii* (Douglas' hawthorn); and impacts by dog walkers and transient campers.

### *Turtle Swale*

Turtle Swale is 60.5 acre, high quality prairie remnant. Both *Lupinus oreganus* and *Icaricia icarioides fenderi* are present at this site. Threats to Turtle Swale include invasion by *Rubus* spp. and non-native grasses.

## 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

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<sup>1</sup> All site descriptions are from *USDA FWS 2005*.

been missed using this method, it provides a consistent manner in which to efficiently sample a large area.

## METHODS

In May 2011, we monitored vegetation composition and cover at five sites in the West Eugene Wetlands, Hansen (meadows and woods), Long Tom, North Taylor, Speedway, and Turtle Swale (Figure 1). Plot dimensions varied by site and were selected so that (1) the maximum amount of habitat would be sampled, and (2) for most sites, there would be at least 200 points per plot (Table 1). The origin for each plot was placed in the south corner of each plot (Figure 2). In all plots, the first transect running perpendicular to the baseline was randomly located between 0m and 2m. Subsequent transects were placed every 2m (Long Tom, North Taylor), 3m (Hansen), or 4m (Speedway, Turtle Swale) along the baseline. The first sample point along each transect was randomly located between 0m and 2m. Sampling points were then systematically located every 1m (North Taylor), 2m (Hansen, Long Tom), or 3m (Speedway, Turtle Swale). Due to the small size of the meadow, only 100 points were sampled at North Taylor.

These sites were previously monitored using the same method in July 2008. Most macroplots were marked with rebar or tall conduit. At Long Tom, we could not locate the origin rebar. Our sampling macroplot was set-up to capture the habitat occupied by *Lomatium bradshawii*. At North Taylor we used maps to estimate the original location of the plot as there were many rebar in area and we could not determine which had been used for monitoring in 2008. Similarly, the origin rebar was not found at Speedway, but was relocated based on GPS and aerial photos.

We used a laser point sampler (Synergy Resource Solutions, Inc.) to sample each point. At most sites, we were able to adjust the height of the monopod so that it was above the canopy of the vegetation. In 2011, most trees and shrubs had not yet fully leafed-out at the time of our monitoring, so we could only roughly estimate canopy cover. At each point, we recorded every species intercepted by the laser, the habitat type (wetland, upland, vernal pool or emergent), and if the substrate was bare ground, litter or moss.

Species nomenclature, habit, and nativity were obtained from the USDA Plants Database (<http://plants.usda.gov>) and *Plants of western Oregon, Washington, and British Columbia* (Kozloff 2005). We calculated the percent cover within each plot by totaling the “hits” for each component (each species, growth habit group, and substrate cover type), dividing by the total number of sampling points per plot, and multiplying by 100.

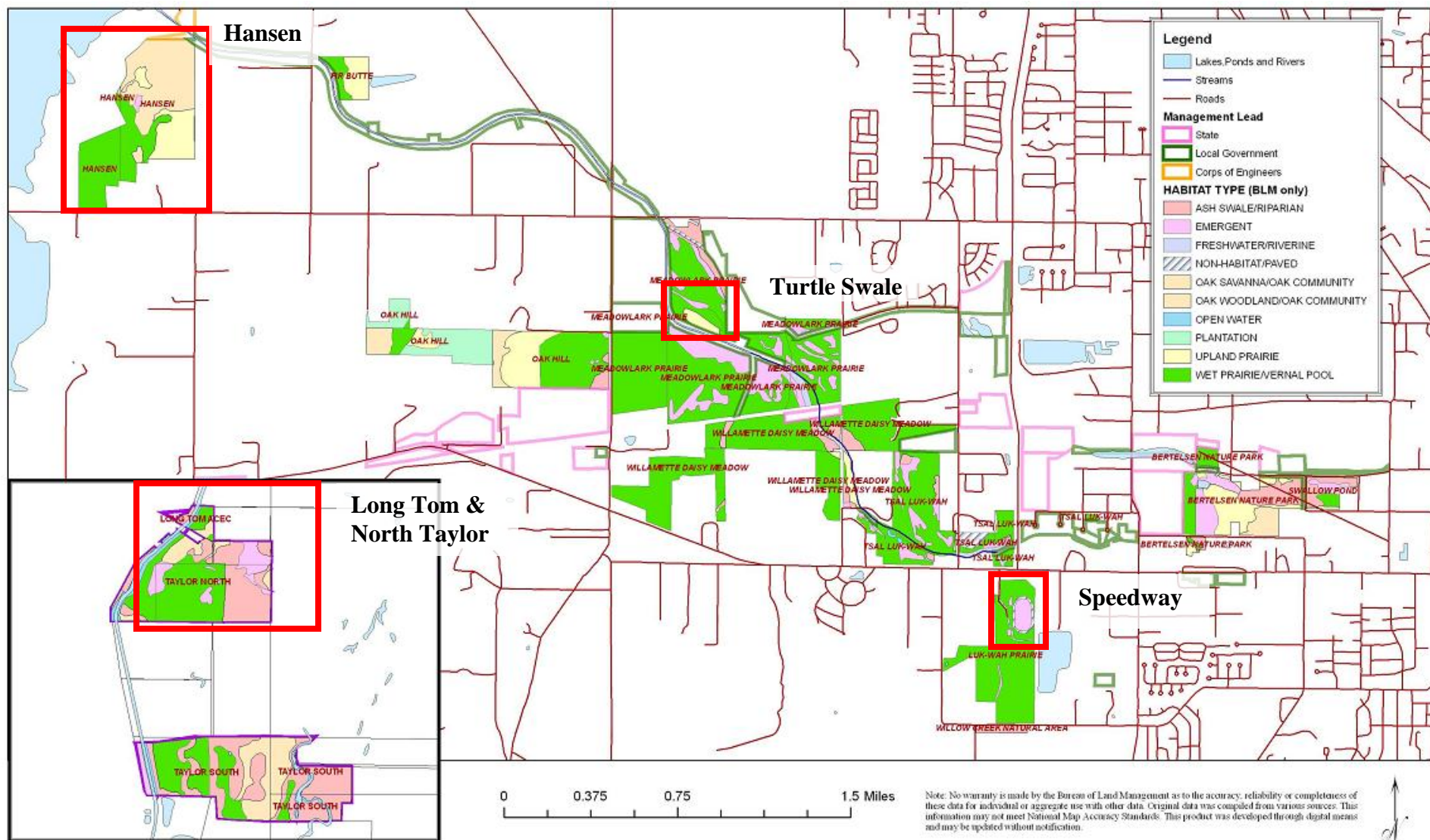


Figure 1. Monitoring sites described in this project, Hansen, Long Tom, North Taylor, Speedway, and Turtle Swale. Sites are labeled and outlined. Map describes plant communities at these and other sites in the West Eugene Wetlands. (Map from USDI BLM 2005)



Table 2. Habitat sampling plot characteristics.

Site	Plot origin (UTM)	Plot dimensions	# samples
Hansen			
Meadow (treated 2007)	10T 0480167, 4880232	40m x 30m	200
Woods (untreated)	10T 0476265, 4887315	40m x 30m	200
Long Tom	10T 0476412, 4887473	40m x 20m	208
North Taylor	10T 0476315, 4887383	20m x 10m	100
Speedway	10T 0486220, 4876905	50m x 50m	204
Turtle Swale	10T 0483998, 4878754	50m x 50m	204

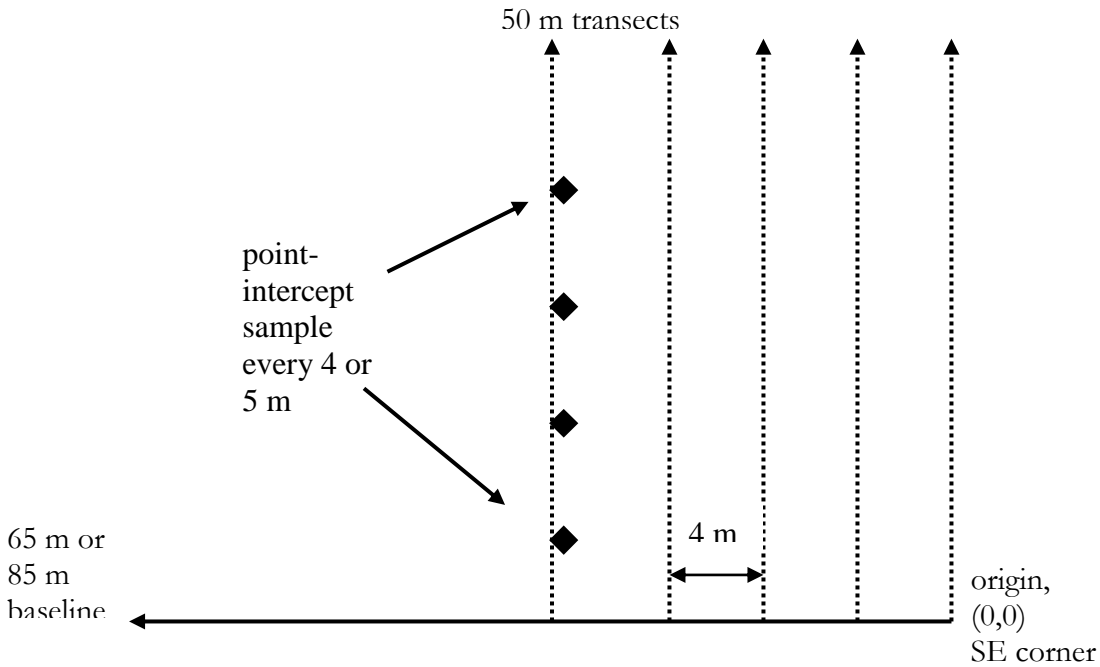


Figure 2. Example of plot sampling design

## RESULTS AND DISCUSSION

### Sites

#### *Hansen*

In the treated area at Hansen (Hansen Meadow), there were 23 native and 18 introduced species; this differs from 2008 where introduced species were more abundant than natives (27 and 17, respectively). In 2011, introduced species composed 64% of total cover and were more abundant than native species in all vegetation classes except forbs (Figure 3). The most abundant introduced species were graminoids, which collectively made up 41% of the total cover; these species included graminoids *Anthoxanthum odoratum* (18%) and *Holcus lanatus* (10%). There was also relatively high cover of the invasive shrub *Rubus armeniacus* (11%).

The untreated area at Hansen (Hansen Woods) was dominated by native species, with 20 native and 5 introduced species. Native species composed 76% of total cover, with forbs comprising 44% of total cover. The most abundant native forbs in 2011 consisted of *Polystichum munitum* (24%) and *Osmorhiza pupurea* (8%). No native or invasive graminoids were present in 2011. The most dominant introduced species were the shrub *Rubus armeniacus* (9%) and tree *Prunus avium* (9%).

At the time of sampling in 2011 (May), the majority of tree species had not yet leafed-out, resulting in rough estimates of canopy cover. At Hansen meadows in 2008, tree cover was over 50%, in 2011 canopy cover was estimated at approximately 35%, with many large *Quercus* spp (25-40 cm dbh) present. Hansen woods had a more dense canopy, and it was estimated that when leafed-out, canopy cover of *Quercus* spp. and other woody species would be roughly 80%. This indicates that the lack of canopy cover in 2011 may not be attributed to a decline in woody species, but a reflection of the timing of sampling.

The treated area at Hansen had a heavy cover of litter (94%; Table 3). This litter could inhibit germination and/or establishment of seedlings. While litter was very low in the untreated area in 2008, in 2011 it had increased greatly (from 10% to 64%, respectively). Moss cover was approximately 6% at both sites.

Although treating the meadow in 2007 released native graminoids, it also appeared to release introduced forbs and graminoids. Cover of introduced graminoids doubled between 2008 and 2011 in the treated area. Native graminoids increased slightly in the treated area between 2008 and 2011. As native species were not very abundant at this site, it is likely that there is little native seed bank present to respond to management treatments. If more shrubs and trees are removed from the area, we recommend an aggressive seeding and weed control program.

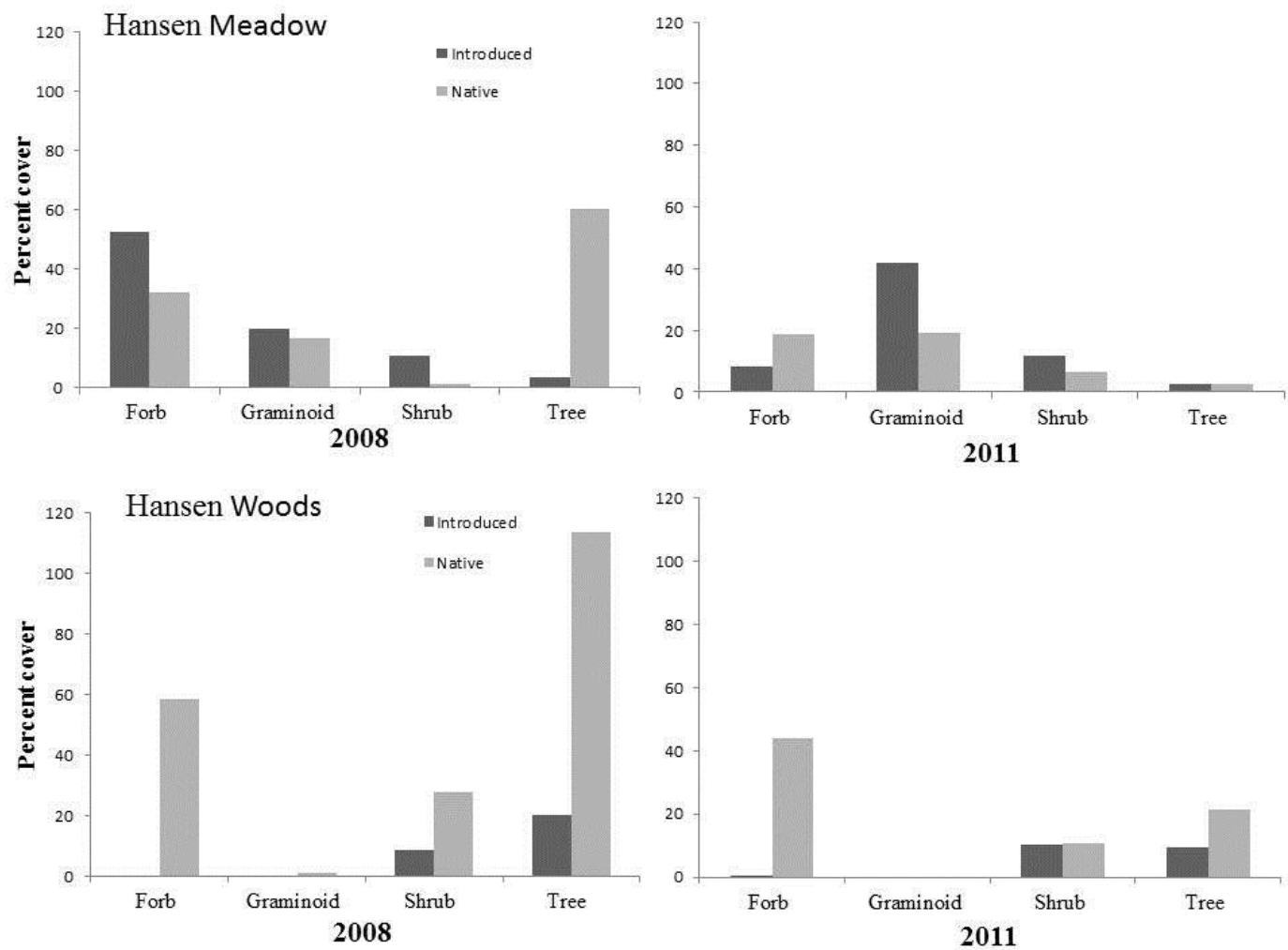


Figure 3. Percent cover of native and introduced species, by growth habit, at Hansen meadow (treated in 2007) and Hansen woods (untreated) in 2008 and 2011. Note, 2011 values for tree cover are likely underestimates as trees were not leafed-out at time of sampling.

Table 3. Cover of bare ground, litter, and moss at study sites in the West Eugene Wetlands in July 2008 and May 2011.

	Site											
	Hansen meadow (treated)		Hansen woods (untreated)		Long Tom		North Taylor		Speedway		Turtle Swale	
	2008	2011	2008	2011	2008	2011	2008	2011	2008	2011	2008	2011
<b>Bare</b>	7	1	86	24	18	10	6	5	12	55	2	8
<b>Litter</b>	87	94	10	69	81	90	93	83	87	70	97	90
<b>Moss</b>	7	13	6	21	1	6	1	11	1	12	1	37

### Long Tom and North Taylor

In the meadow habitat at Long Tom, there were equal numbers of native and introduced species, but the total cover of introduced species was greater than that of natives (55% and 44%, respectively; Figure 4). This differs from 2008, where introduced species composed nearly three times the amount of cover as native species. The most abundant native species were the forbs *Prunella vulgaris* ssp. *lanceolata* (5%) and *Ranunculus orthorhynchus* (5%) and graminoids *Carex densa* (5%), and *Danthonia californica* (5%). The most abundant introduced species were the forbs, *Trifolium dubium* (5%) and *Vicia sativa* (5%), while *Anthoxanthum odoratum* dominated the graminoids (15%). Prominent species in 2011 differed from those in 2008, likely reflecting the difference in timing of sampling.

Despite their proximity, there were few similarities between Long Tom and North Taylor. At North Taylor in 2011, there were nearly twice the number of native species compared to introduced species (21 and 11, respectively) and total cover of native species was almost double that of the introduced species (76% and 43%, respectively). We observed similar trends in 2008. The most abundant native species at North Taylor were the forbs *Symphyotrichum hallii* (14%), and *Brodiaea* spp. (13%), and the native tree *Quercus garryana* (7%), which had not fully leafed-out at the time of sampling. The most abundant introduced species were the forb *Hypochaeris radicata* (9%) and graminoid *Anthoxanthum odoratum* (19%).

Both Long Tom and North Taylor exceeded the woody species threshold for upland prairie habitats. While in 2008 there was 17% cover of woody species at Long Tom and 68% cover of woody species at North Taylor, in 2011 there was 9% cover of woody species and 19% cover at North Taylor. This discrepancy between years suggests that timing of sampling may be affecting this difference. At the time of sampling in 2011, dense cover of *Quercus garryana* was noted, yet the trees had not yet leafed out. While the majority of the shrubs or trees at Long Tom were in the mid- to overstory, the majority of the *Fraxinus latifolia* at North Taylor were seedlings. If these seedlings are not controlled, they will quickly overgrow the meadow.

Litter cover was greater than 80% at both Long Tom and North Taylor (Table 3). Moss cover was 1% at both sites. The thick layer of litter may inhibit seed germination and establishment.

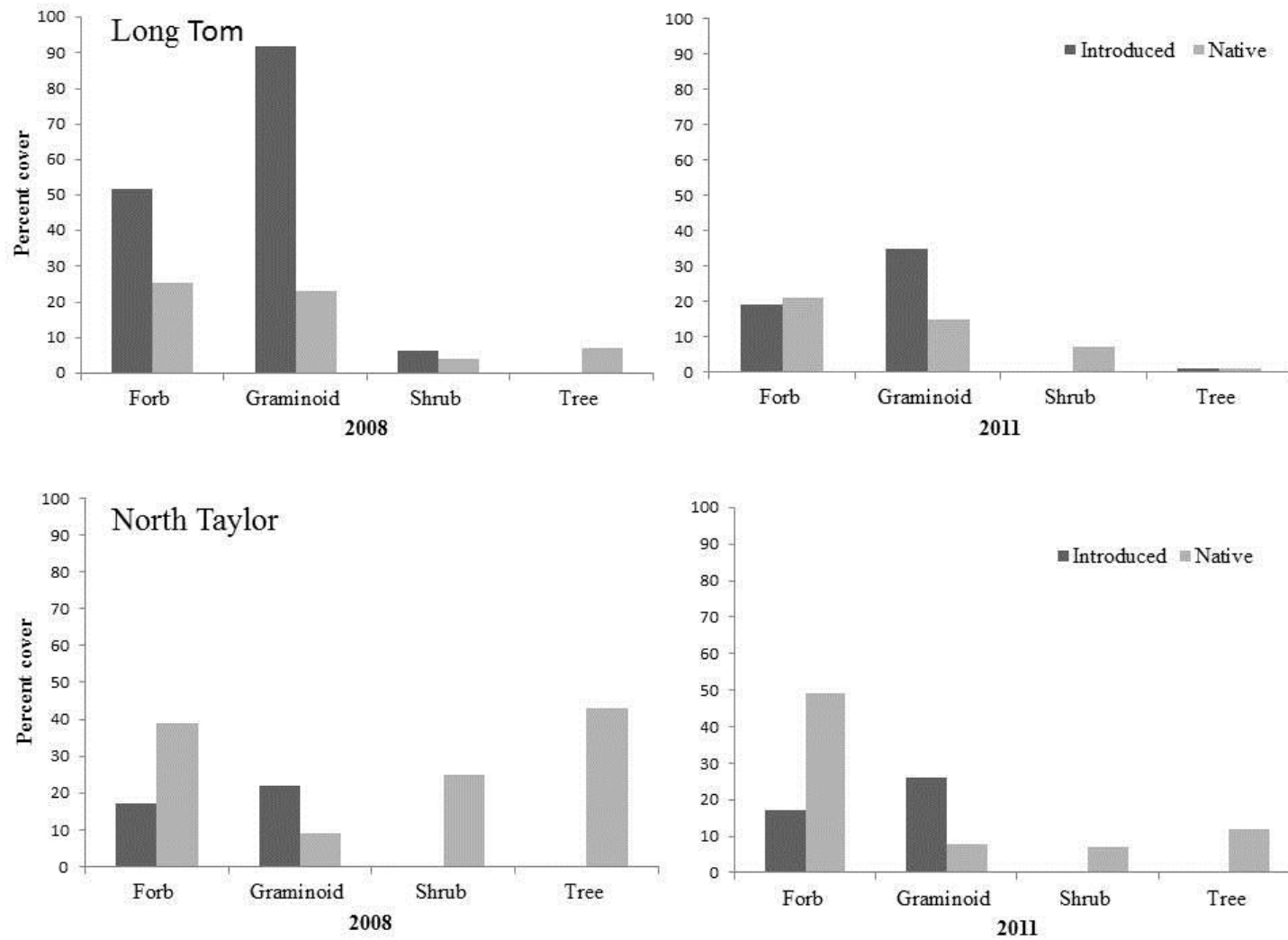


Figure 4. Percent cover of native and introduced species, by growth habit, at Long Tom and North Taylor in 2008 and 2011.

### *Speedway*

Native and introduced species were approximately equal in numbers at Speedway (13 and 14, respectively), however the cover of introduced species was 130% that of native species (Figure 5). The most abundant introduced species were the forb *Hypochaeris radicata* (12%), and graminoids *Agrostis stolonifera* (8%) and *Anthoxanthum odoratum* (11%). The most abundant native species were the graminoids *Danthonia californica* (9%) and *Deschampsia cespitosa* (6%). The cover of the most abundant native forb, *Camassia quamash* ssp. *maxima*, was 4 %.

Total cover by woody species was 1%, which was made up of only shrubs. There was 70% cover of litter at Speedway, with 55% cover of bare ground (Table 3).

### *Turtle Swale*

Introduced species dominated Turtle Swale. Cover of introduced species was 91%, while that of natives was 21%. There were 19 invasive species as compared to 14 natives (Figure 5). The most abundant introduced species were the forb *Leucanthemum vulgare* (10%), and graminoids *Agrostis stolonifera* (6%), *Anthoxanthum odoratum* (28%), and *Festuca arundinaceae* (24%). The most prominent native species included *Camassia quamash* ssp. *maxima* (9%) and *Danthonia californica* (7%). There were no trees observed at this site. Litter cover was high at Turtle Swale (90%); moss cover was 32% (Table 3).

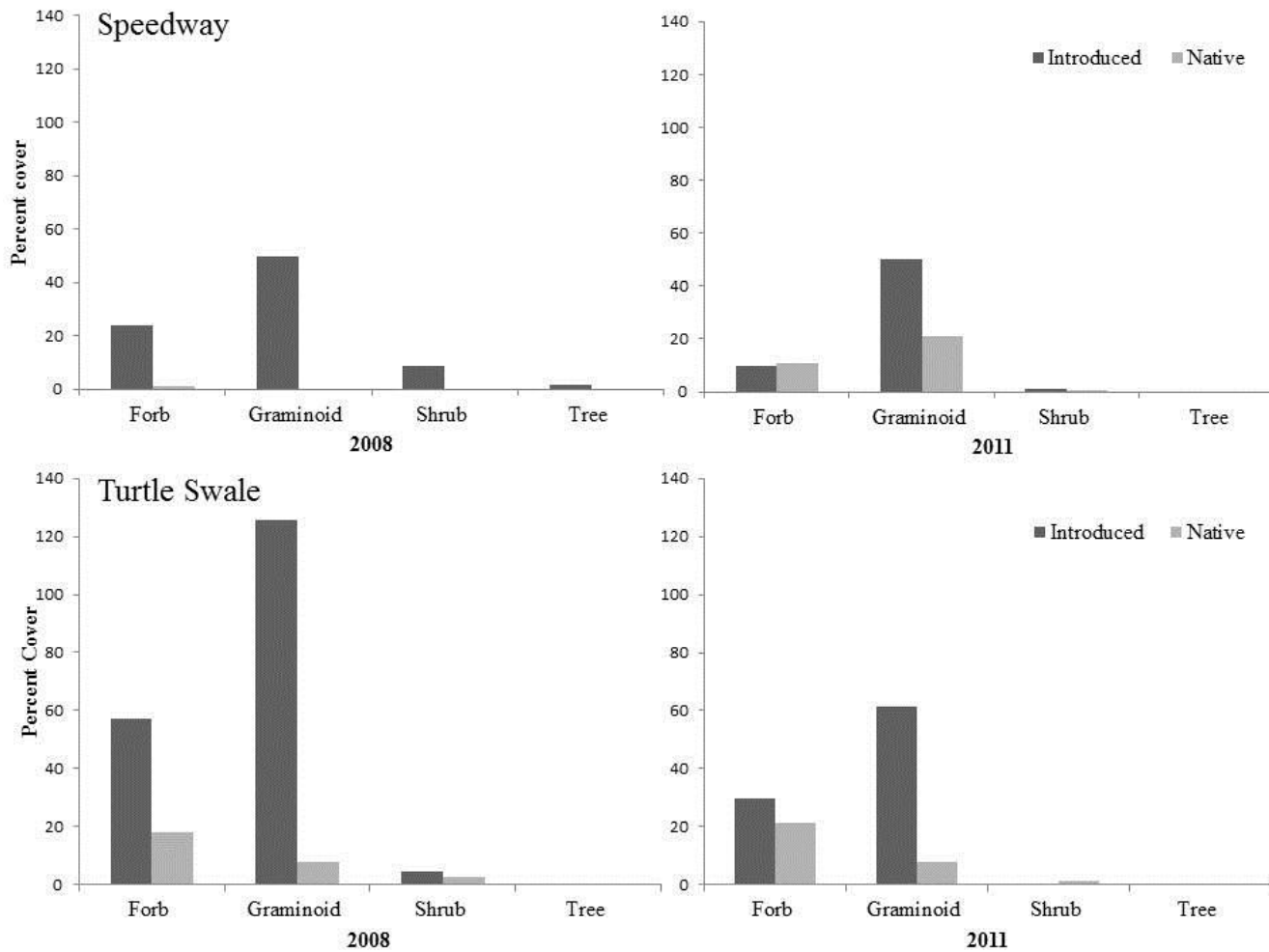


Figure 5. Percent cover of native and introduced species, by growth habit, at Speedway and Turtle Swale in 2008 and 2011.

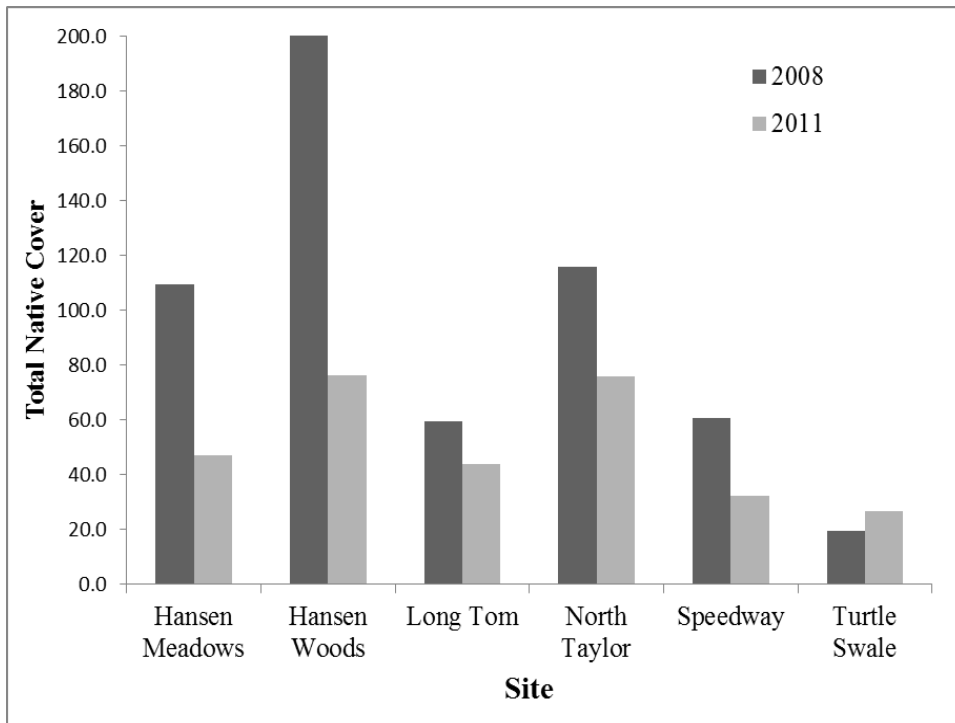


Figure 6. Total cover of native species at each site surveyed in July 2008 and May 2011.

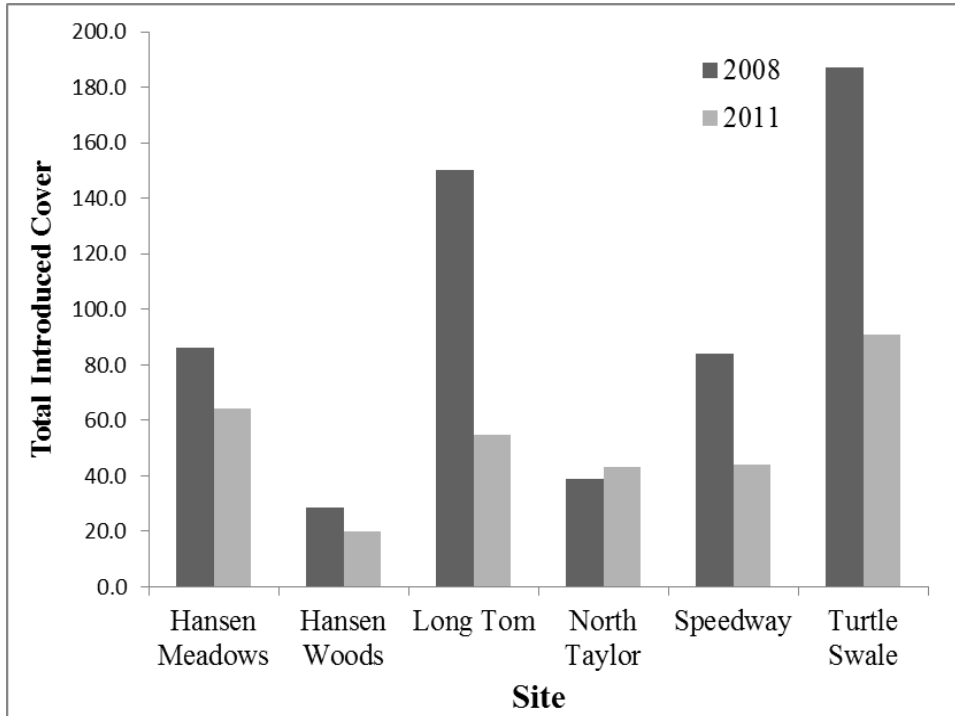


Figure 7. Total cover of introduced species at each site surveyed in July 2008 and May 2011.



## Monitoring Approach

In order to document all species at a site, we surveyed both early and mid- to late in the growing season (July 2008 and May 2011). This enabled us to assemble a more-complete species list, however with point intercept, it is likely that some rare species will not be represented in the sample. Between both years, very different species assemblages were noted (Appendix B). While species richness was similar between sampling in 2008 and 2011 (103 and 107, respectively), the majority of total cover (across both years; 65%) was observed in July 2008, while sampling in May 2011 captured 35% of total cover across both years. Both native and introduced species had greater cover at the time of the July 2008 sampling than in May 2011 (Figure 6, Figure 7). This is likely a reflection of more species having germinated by the time sampling occurred. In our May 2011 sampling, it is likely that some early-germinating species were noted that may have been missed in the later-spring sampling. Though the discrepancies between years seem to indicate a decrease in native species from 2008 to 2011, this difference is likely a reflection of the timing of sampling rather than native species abundances. Continued monitoring at similar points in the growing season would enable us to make further comparisons.

## SUMMARY

The recovery objectives from the western Oregon and southwestern Washington Prairie Species Recovery Plan (USFWS 2010) specify that within habitat for *Lupinus oreganus*, *Erigeron decumbens* var. *decumbens*, and *Lomatium bradshawii*, there is to be  $\geq 50\%$  relative cover of nonwoody 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:

<b>Habitat indicator</b>	<b>Threshold for management</b>
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 $1\text{m}^2$ 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:

<b>Habitat indicator</b>	<b>Site</b>	<b>Indicator level</b>
Woody vegetation	Hansen Meadow	23% cover of woody species
	Hansen Woods	52% cover of woody species
	Long Tom	9% cover of woody species
	North Taylor	19% cover of woody species
Invasive species	Hansen Meadow	64% cover of introduced species
	Long Tom	55% cover of introduced species
	Turtle Swale	91% cover of introduced species
Thatch	Hansen Meadow	94% cover of litter
	Hansen Woods	69% cover of litter
	Long Tom	90% cover of litter
	North Taylor	83% cover of litter
	Speedway	70% cover of litter
	Turtle Swale	90% cover of litter

While at the time of our 2011 sampling many trees had not yet leafed-out and our cover estimates are underestimates, we still found that Hansen Meadows, Hansen Woods, Long Tom, and North Taylor all exceeded thresholds for woody cover in prairie habitats. Encroachment by woody species has the potential to shade out native prairie forbs, including the rare species noted in this report. Weed treatments and seeding of native species should be included with plans to treat encroachment by woody species. Weed control is also needed at the three sites (Hansen Meadows, Long tom, and Turtle Swale) where cover by invasive species exceeded the threshold for management.

The cover of the litter layer exceeded the threshold for management at every site. It is likely that the litter is inhibiting germination and establishment of native species. However, this litter layer may also inhibit weed seed germination and establishment. Therefore, any management activities to remove litter should be followed by extensive weed control and seeding of native species.

While sampling in different months makes it difficult to make conclusions about changes in community composition from 2008 to 2011, it does provide information that may be used for future management activities. Weed control efforts can be timed so that they are implemented when particular species are most abundant.

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## **Appendix A. Useful field hints**

- Previous to arriving in the field upload data sheets with randomly assigned transect and point locations 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 (or monopod) and dropped the pin (or operated the laser pointer) while the third person watched the pin (or light) and called out which species were hit. To avoid trampling monitor on the right side of the transect tape and walk on the left side.
- On average, each plot took 1 day to survey.

Appendix B. Species list and cover values for each site in 2008 and 2011, sorted by growth form.

**Hansen Meadows**

Nativity	Growth Form	Species	2008	2011
Introduced	Forb	<i>Anthriscus caucalis</i>	1.0	
		<i>Cerastium glomeratum</i>	4.5	
		<i>Cirsium vulgare</i>	1.0	1.5
		<i>Daucus carota</i>	0.5	0.5
		<i>Galium parisiense</i>		0.5
		<i>Geranium dissectum</i>	5.0	
		<i>Hypericum perforatum</i>	0.5	1.0
		<i>Hypochaeris radicata</i>	2.5	3.0
		<i>Lathyrus angulatus</i>	0.5	
		<i>Myosotis discolor</i>	1.5	0.5
		<i>Sherardia arvensis</i>	0.5	
		<i>Trifolium dubium</i>	7.5	
		<i>Trifolium subterraneum</i>	2.5	
		<i>Vicia hirsuta</i>	22.0	
		<i>Vicia sativa</i>	3.0	1.0
	Graminoid	<i>Agrostis stolonifera</i>	5.0	
		<i>Anthoxanthum odoratum</i>	5.5	18.2
		<i>Briza minor</i>	1.0	
		<i>Bromus</i> sp.		1.5
		<i>Bromus diandrus</i>	1.0	
		<i>Cynosurus echinatus</i>	1.5	0.5
		<i>Dactylis glomerata</i>	0.5	
		<i>Festuca</i> sp.	1.5	
		<i>Festuca rubra</i>		7.1
		<i>Holcus lanatus</i>	0.5	9.6
		<i>Poa</i> sp.	2.0	
		<i>Poa compressa</i>		1.5
		<i>Poa pratensis</i>		1.0
		<i>Schedonorus phoenix</i>	1.0	2.5
		Shrub	<i>Rubus armeniacus</i>	10.5
	Tree	<i>Ilex aquifolium</i>	0.5	1.0
		<i>Prunus avium</i>	3.0	1.5

**Hansen Meadows cont.**

Nativity	Growth Form	Species	2008	2011
Native	Forb	<i>Achillea millefolium</i>		0.5
		<i>Agoseris</i> sp.		0.5
		<i>Claytonia parviflora</i>	1.5	
		<i>Epilobium densiflorum</i>	0.5	
		<i>Galium aparine</i>	19.5	1.0
		<i>Heuchera micrantha</i>		1.0
		<i>Lonicera hispidula</i>	3.0	1.5
		<i>Marah oreganus</i>		0.5
		<i>Osmorhiza berteroi</i>		1.0
		<i>Osmorhiza purpurea</i>	3.0	4.0
		<i>Polystichum munitum</i>	1.5	2.0
		<i>Potentilla gracilis</i>		0.5
		<i>Prunella vulgaris</i> ssp. <i>lanceolata</i>	1.5	3.5
		<i>Ranunculus occidentalis</i> var. <i>occidentalis</i>	0.5	0.5
		<i>Ranunculus orthorhynchus</i>		1.0
		<i>Sanicula crassicaulis</i>	0.5	1.0
		<i>Vicia americana</i>	0.5	
	Graminoid	<i>Bromus carinatus</i>	0.5	0.5
		<i>Bromus vulgaris</i>		0.5
		<i>Elymus glaucus</i>	12.0	17.7
		<i>Festuca roemerii</i>		0.5
		<i>Juncus bufonius</i>	4.0	
	Shrub	<i>Amelanchier alnifolia</i>	0.5	
		<i>Crataegus douglasii</i>		1.0
		<i>Rubus ursinus</i>		0.5
		<i>Symphoricarpos albus</i>		4.5
		<i>Toxicodendron diversilobum</i>	0.5	0.5
	Tree	<i>Corylus cornuta</i>		2.0
		<i>Pseudotsuga menziesii</i>	1.5	
		<i>Quercus garryana</i>		0.5
		<i>Quercus kelloggii</i>	58.5	

## Hansen Woods

Nativity	Growth Form	Species	2008	2011
Introduced	Forb	<i>Cirsium vulgare</i>		0.5
	Shrub	<i>Crataegus monogyna</i>	0.5	1.5
		<i>Rubus armeniacus</i>	8.5	8.8
	Tree	<i>Ilex aquifolium</i>	0.5	1.0
<i>Prunus avium</i>		19.5	8.3	
Native	Forb	<i>Adenocaulon bicolor</i>	5.5	4.4
		<i>Clinopodium douglasii</i>	1	
		<i>Fragaria vesca</i>		1
		<i>Fritillaria affinis</i> var. <i>affinis</i>		0.5
		<i>Galium aparine</i>	0.5	1.5
		<i>Lonicera hispidula</i>	7.5	1
		<i>Nemophila parviflora</i>		0.5
		<i>Nemophila pedunculata</i>		0.5
		<i>Osmorhiza berteroi</i>	3.5	
		<i>Osmorhiza purpurea</i>		8.3
		<i>Polystichum munitum</i>	40	23.5
		<i>Sanicula crassicaulis</i>		1.5
	<i>Tellima grandiflora</i>	0.5	1.5	
	Graminoid	<i>Carex</i> sp.	0.5	
		<i>Carex rossii</i>	0.5	
	Shrub	<i>Amelanchier alnifolia</i>	16.5	5.4
		<i>Rubus ursinus</i>	2.5	
		<i>Symphoricarpos albus</i>	3.5	1
		<i>Toxicodendron diversilobum</i>	5	4.4
	Tree	<i>Arbutus menziesii</i>	6.5	0.5
		<i>Cornus nuttallii</i>	19	2.5
		<i>Corylus cornuta</i>	27	14.2
		<i>Frangula purshiana</i>		1
<i>Pseudotsuga menziesii</i>		2.5		
<i>Quercus garryana</i> var. <i>garryana</i>		12	2	
<i>Quercus kelloggii</i>		46.5	1.5	

**Long Tom**

Nativity	Growth Form	Species	2008	2011	
Introduced	Forb	<i>Centaureum erythraea</i>		2	
		<i>Cerastium glomeratum</i>	3.9		
		<i>Cirsium vulgare</i>	0.5		
		<i>Draba verna</i>		1	
		<i>Galium parisiense</i>	6.7		
		<i>Geranium dissectum</i>		1	
		<i>Hypericum perforatum</i>	0.5		
		<i>Lactuca saligna</i>		1	
		<i>Myosotis discolor</i>	1.4	2	
		<i>Parentucellia viscosa</i>	1.9		
		<i>Rumex acetosella</i>		1	
		<i>Trifolium dubium</i>	7.7	5	
		<i>Vicia</i> sp.		1	
		<i>Vicia hirsuta</i>	8.2		
		<i>Vicia sativa</i>	1.9	5	
	<i>Vicia tetrasperma</i>	19.2			
	Graminoid	<i>Agrostis</i> sp.			2
		<i>Agrostis stolonifera</i>	26	6	
		<i>Aira caryophyllea</i>	15.9		
		<i>Anthoxanthum odoratum</i>	6.7	15	
		<i>Briza minor</i>	19.2		
		<i>Bromus</i> sp.	0.5		
		<i>Bromus hordeaceus</i>	1		
		<i>Cynosurus echinatus</i>	0.5	2	
		<i>Holcus lanatus</i>		3	
		<i>Poa pratensis</i>		2	
		<i>Schedonorus phoenix</i>	22.	5	
	Shrub	<i>Rosa eglanteria</i>	6.3		
	Tree	<i>Prunus</i> sp.			1
	Native	Forb	<i>Brodiaea</i> sp.		3
			<i>Brodiaea coronaria</i>	1.4	
			<i>Camassia quamash</i> ssp. <i>maxima</i>	2.9	3
			<i>Claytonia sibirica</i>		1
			<i>Eriophyllum lanatum</i>	3.9	3
<i>Isoetes</i> sp.				1	
<i>Madia sativa</i>			8.2		
<i>Microseris laciniata</i>			0.5		
<i>Perideridia oregana</i>			3.9	1	



**Long Tom cont.**

Nativity	Growth Form	Species	2008	2011	
Native	Forb	<i>Potentilla gracilis</i>	1.4		
		<i>Prunella vulgaris ssp. lanceolata</i>	1	5	
		<i>Ranunculus orthorhynchus</i>		4	
		<i>Sisyrinchium idahoense</i>	2.4		
	Graminoid	<i>Carex sp.</i>			1
		<i>Carex densa</i>			5
		<i>Carex obnupta</i>	11.1		
		<i>Danthonia californica</i>	4.3	5	
		<i>Deschampsia cespitosa</i>	3.9	3	
		<i>Elymus glaucus</i>	0.5		
		<i>Iris tenax</i>			1
		<i>Juncus bufonius</i>	1.9		
		<i>Juncus tenuis</i>	1.4		
	Shrub	<i>Amelanchier alnifolia</i>			1
		<i>Rosa nutkana var. nutkana</i>			2
		<i>Spiraea douglasii</i>	3.4		
		<i>Symphoricarpos albus</i>			4
		<i>Toxicodendron diversilobum</i>	0.5		
	Tree	<i>Fraxinus latifolia</i>	4.3	1	
		<i>Quercus garryana var. garryana</i>	2.9		

**North Taylor**

Nativity	Growth Form	Species	2008	2011
Introduced	Forb	<i>Centaurium erythraea</i>	1	1
		<i>Galium parisiense</i>	1	1
		<i>Hypochaeris radicata</i>	10	9
		<i>Plantago lanceolata</i>	3	1
		<i>Rumex acetosella</i>		1
		<i>Trifolium dubium</i>		2
		<i>Vicia sativa</i>	2	2
	Graminoid	<i>Agrostis stolonifera</i>	4	
		<i>Anthoxanthum odoratum</i>	17	19
		<i>Briza minor</i>	0	
		<i>Bromus diandrus</i>		1
		<i>Bromus hordeaceus</i>	1	
		<i>Cynosurus echinatus</i>		2
		<i>Schedonorus phoenix</i>		4
Native	Forb	<i>Brodiaea</i> sp.		13
		<i>Brodiaea coronaria</i>	3	1
		<i>Camassia quamash</i>	0	
		<i>Camassia quamash</i> ssp. <i>maxima</i>		3
		<i>Claytonia sibirica</i>		2
		<i>Fragaria virginiana</i>	10	4
		<i>Galium aparine</i>	1	2
		<i>Lomatium bradshawii</i>		1
		<i>Montia linearis</i>		3
		<i>Perideridia oregana</i>	2	3
		<i>Ranunculus orthorhynchus</i>		2
		<i>Sanicula crassicaulis</i>		1
		<i>Symphotrichum hallii</i>	22	14
		<i>Trientalis borealis</i> ssp. <i>latifolia</i>	1	
	Graminoid	<i>Danthonia californica</i>	5	2
		<i>Festuca roemerii</i>		1
		<i>Juncus bufonius</i>	2	
		<i>Koeleria macrantha</i>		4
		<i>Luzula comosa</i>	2	1
	Shrub	<i>Amelanchier alnifolia</i>		1
		<i>Rubus ursinus</i>	4	2
		<i>Spiraea douglasii</i>	1	
		<i>Symphoricarpos albus</i>		4
<i>Toxicodendron diversilobum</i>		1		

**North Taylor cont.**

Nativity	Growth Form	Species	2008	2011
Native	Shrub	<i>Vaccinium ovalifolium</i>	19	
	Tree	<i>Fraxinus latifolia</i>	30	5
		<i>Quercus garryana</i> var. <i>garryana</i>	13	7

## Speedway

Nativity	Growth Form	Species	2008	2011
Introduced	Forb	<i>Centaureum erythraea</i>		0.5
		<i>Cerastium glomeratum</i>		0.5
		<i>Crepis capillaris</i>		0.5
		<i>Hypericum perforatum</i>		0.5
		<i>Hypochaeris radicata</i>	15.7	11.7
		<i>Leucanthemum vulgare</i>	2.9	1.4
		<i>Mentha ×piperita</i>	2.5	
		<i>Mentha pulegium</i>		6.7
		<i>Plantago lanceolata</i>	1.9	1.8
		<i>Rumex acetosella</i>	1.0	
	Graminoid	<i>Agrostis stolonifera</i>	23	8.1
		<i>Anthoxanthum odoratum</i>	18.1	10.8
		<i>Arrhenatherum elatius</i>		0.5
		<i>Holcus lanatus</i>	0.5	0.5
		<i>Schedonorus phoenix</i>	7.8	0.5
	Shrub	<i>Rosa eglanteria</i>	3.9	
		<i>Rubus armeniacus</i>	4.9	0.5
	Tree	<i>Pyrus communis</i>	1.5	
	Native	Forb	<i>Brodiaea coronaria</i>	2.5
<i>Camassia quamash ssp. maxima</i>			1.0	4.0
<i>Fragaria virginiana</i>				0.5
<i>Grindelia integrifolia</i>			2.9	
<i>Microseris laciniata</i>				0.5
<i>Microsteris gracilis</i>				0.9
<i>Prunella vulgaris ssp. lanceolata</i>			1.5	1.4
<i>Sisyrinchium idahoense</i>			0.5	
<i>Symphotrichum hallii</i>			1.0	2.7
<i>Triteleia hyacinthina</i>			0.5	
Graminoid		<i>Danthonia californica</i>	8.8	9.0
		<i>Deschampsia cespitosa</i>	23	6.3
		<i>Juncus tenuis</i>	0.5	
		<i>Luzula comosa</i>	0.5	0.5
		<i>Panicum capillare</i>	16.2	3.1
		<i>Deschampsia danthonioides</i>	1.0	
		<i>Juncus nevadensis</i>		2.2
Shrub		<i>Crataegus douglasii</i>	0.5	
		<i>Rosa nutkana var. nutkana</i>	0.5	0.5

**Turtle Swale**

Nativity	Growth Form	Species	2008	2011	
Introduced	Forb	<i>Centaureum erythraea</i>		0.5	
		<i>Cerastium glomeratum</i>	1.0	3.2	
		<i>Crepis capillaris</i>		0.5	
		<i>Daucus carota</i>	6.9	3.6	
		<i>Galium parisiense</i>	15.2	0.5	
		<i>Geranium dissectum</i>	0.5	1.8	
		<i>Hypericum perforatum</i>		0.9	
		<i>Hypochaeris radicata</i>	2.5	1.8	
		<i>Lactuca serriola</i>	0.5		
		<i>Leucanthemum vulgare</i>	13.2	9.9	
		<i>Myosotis discolor</i>	0.5		
		<i>Parentucellia viscosa</i>	1.5	0.5	
		<i>Plantago lanceolata</i>	6.9	2.3	
		<i>Rumex acetosella</i>	1.5	1.4	
		<i>Senecio jacobaea</i>	0.5	0.5	
		<i>Vicia hirsuta</i>	5.4	2.7	
		<i>Vicia sativa</i>	1.5		
	Graminoid	<i>Agrostis capillaris</i>			3.2
		<i>Agrostis stolonifera</i>	16.7		5.4
		<i>Aira caryophyllea</i>	37.3		
		<i>Anthoxanthum odoratum</i>	11.3		27.5
		<i>Holcus lanatus</i>	2.9		1.4
		<i>Schedonorus phoenix</i>	56.9		23.9
		<i>Vulpia bromoides</i>	0.5		
	Shrub	<i>Rubus armeniacus</i>		4.4	
	Native	Forb	<i>Allium amplexans</i>	0.5	
			<i>Brodiaea</i>		2.7
			<i>Brodiaea coronaria</i>	0.5	
<i>Calystegia atriplicifolia</i>				0.5	
<i>Camassia quamash ssp. maxima</i>			2.5	8.6	
<i>Eriophyllum lanatum</i>			0.5		
<i>Galium aparine</i>				0.5	
<i>Heracleum maximum</i>				0.5	
<i>Lupinus oreganus</i>			1.0	1.4	
<i>Madia sativa</i>			0.5		
<i>Prunella vulgaris ssp. lanceolata</i>			2.0	2.7	
<i>Sidalcea malviflora ssp. virgata</i>			2.0	0.9	
<i>Symphotrichum hallii</i>			8.8	3.6	

**Turtle Swale cont.**

Nativity	Growth Form	Species	2008	2011
Native	Graminoid	<i>Danthonia californica</i>	3.9	7.2
		<i>Deschampsia cespitosa</i>	1.5	
		<i>Deschampsia danthonioides</i>	0.5	
		<i>Luzula comosa</i>	2.0	0.5
	Shrub	<i>Crataegus douglasii</i>		0.5
		<i>Rosa gymnocarpa</i>		0.9
		<i>Rosa nutkana var. nutkana</i>	2.5	