

# West Eugene Wetlands Augmentation of Threatened and Endangered Plant Species: 2016 Annual Report WEB VERSION



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Report to the Bureau of Land Management  
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## PREFACE

IAE is a non-profit organization whose mission is conservation of native ecosystems through restoration, research and education. IAE provides services to public and private agencies and individuals through development and communication of information on ecosystems, species, and effective management strategies. Restoration of habitats, with a concentration on rare and invasive species, is a primary focus. IAE conducts its work through partnerships with a diverse group of agencies, organizations and the private sector. IAE aims to link its community with native habitats through education and outreach.



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**Special Note:**

This report has been modified from its original format by removing maps and/or appendices that include information on the location of rare and sensitive species.

## ACKNOWLEDGMENTS

Funding for this project was provided by the Bureau of Land Management. We thank Sally Villegas-Moore of the BLM for her guidance and Christine Calhoun for sharing her knowledge of the sites and her aid in coordinating and implementing project activities, especially monitoring. Thanks also to the Looking Glass youth crew for help with outplanting Kincaid's lupine and Willamette daisy and bagging Kincaid's lupine plants for seed collection. We also thank Amy Bartow and the staff at the U.S. Department of Agriculture's Natural Resources Conservation Service, Corvallis Plant Materials Center, for producing seed and growing plugs of the rare species to be reintroduced in this project. Thanks to Matt Benotsch at the Nature Conservancy for allowing collection of Kincaid's lupine at Willow Creek sites. We are also grateful to the team at the U.S. Army Corps of Engineers Fern Ridge office for their donation of Kincaid's lupine seed. Thanks also to Linda Boyer at Heritage Seedlings, Inc. for allowing us to salvage Kincaid's lupine seed.

**Cover photograph:** IAE Restoration Technician Anna Ramthun and Looking Glass Youth Crew members outplanting Willamette daisy plugs at Greenhill in spring 2016. *Photo by Matt Schultz.*

## SUGGESTED CITATION

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# West Eugene Wetlands Augmentation of Threatened and Endangered Plant Species: 2016 Annual Report WEB VERSION

## SUMMARY OF 2016 ACCOMPLISHMENTS

- IAE outplanted 1599 Kincaid's lupine plugs at the Bureau of Land Management's West Eugene Wetland sites, Hansen and Isabelle, and 1559 Willamette daisy plugs at Greenhill (see Appendix A for site maps).
- Outplanting macroplots at Balboa, Hansen, Isabelle and Turtle Swale, established in 2012-2016, were maintained, weeded, and monitored for threatened and endangered plant survival and reproduction.
- Kincaid's lupine seed was collected from five sites to establish new seed production beds with two partner growers.
- Seed production for four rare plant species continued.
- Plugs of shaggy horkelia, Kincaid's lupine, and Willamette daisy were begun for outplanting in 2017.

## INTRODUCTION

The Institute for Applied Ecology has been working with the BLM to introduce and augment threatened, endangered, and bureau-sensitive plant populations in BLM-managed sites within the West Eugene Wetlands in Eugene, Oregon, since 2011. This multi-year project is expected to continue through 2017 and beyond.

The goal of this project is to contribute to the recovery of listed prairie species and prevent the need for listing of rare prairie species through seed and plug production, population augmentation and introduction, adaptive management and maintenance of prairie habitat, and population status and trend assessment.

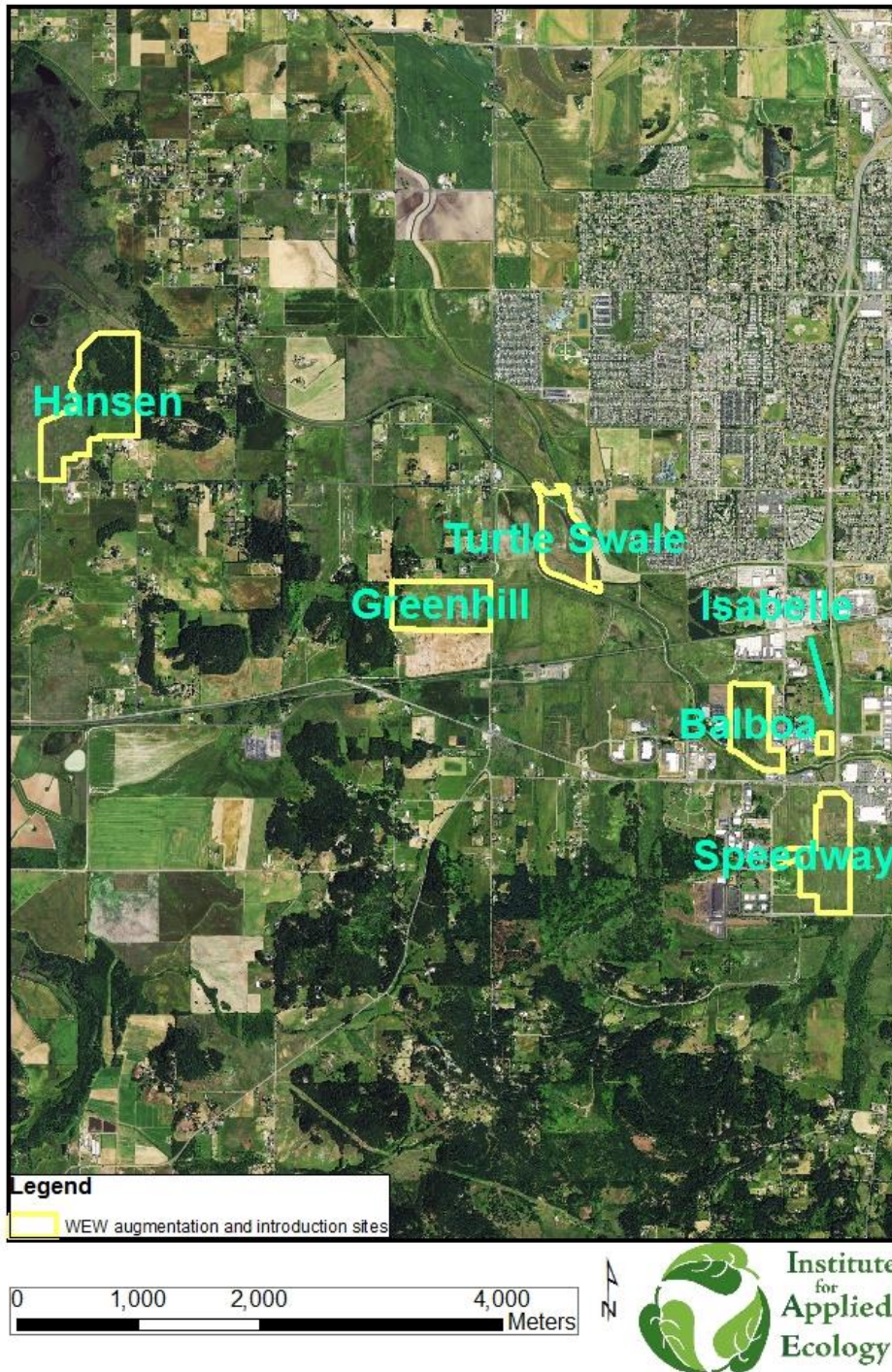


Figure 1. Sites in the BLM-administered West Eugene Wetlands that have received introduction or augmentation of rare species under this project from 2012-2016 include Hansen, Greenhill, Turtle Swale, Isabelle, Balboa and Speedway.

This project focuses on the following four species: Bradshaw's lomatium (*Lomatium bradshawii*, endangered), Kincaid's lupine (*Lupinus oregonus*, threatened), Willamette daisy (*Erigeron decumbens*, endangered), and shaggy horkelia (*Horkelia congesta* ssp. *congesta*) (Figure 2).



Figure 2. Four rare species have been the focus of introduction and augmentation efforts under this project from 2011 to the present. From upper-left in clockwise fashion: Bradshaw's lomatium (*Lomatium bradshawii*, endangered), Kincaid's lupine (*Lupinus oregonus*, threatened), Willamette daisy (*Erigeron decumbens*, endangered), and shaggy horkelia (*Horkelia congesta* ssp. *congesta*, Bureau sensitive).

## 2016 ACTIVITIES

The following recovery activities were implemented in 2016: seed collection, seed and plug production, outplanting, plot maintenance, and monitoring.

## Seed Collection

### Kincaid's Lupine

In 2015, Heritage Seedlings, Inc. (Heritage) informed IAE that they did not have the staffing resources to continue managing the Eugene West recovery zone Kincaid's lupine field that was re-established in 2012. In December 2015, approximately 500 mature Kincaid's lupine plants were salvaged from Heritage and transplanted to a field at the Natural Resources Conservation Service's Plant Materials Center (PMC). Unfortunately, this salvage effort was unsuccessful, and all but two of the transplants died.

In the spring of 2016, IAE learned that many mature Kincaid's lupine plants remained at the Heritage field. In June of 2016, IAE staff bagged the inflorescences of these plants and returned in July to collect the bags, yielding about 1.5 lbs of seed. This seed will be used to grow Kincaid's lupine plugs for outplanting in the spring of 2017. Heritage has no plans to plow their Eugene West lupine field in the upcoming year, and IAE expects to be able to collect seed from the Heritage field in 2017 as well.

IAE collected wild Kincaid's lupine seed from BLM's Fir Butte site and four Nature Conservancy (TNC) sites (Figure 3). This seed was collected for the purpose of establishing a new Eugene West seed production field. The Army Corps of Engineers (ACE) Fern Ridge Reservoir staff also collected and donated Fern Ridge Kincaid's lupine seed for the establishment of the new seed production beds.



Figure 3. Looking glass crew member bagging Kincaid's lupine at Willow Creek (Bailey Hill), a preserve owned by The Nature Conservancy.

Table 1 summarizes the Kincaid's lupine seed collection sites and amounts of wild seed collected. Approximately 150 g of the wild-collected seed was provided to growers for the establishment of new

seed production beds. The remainder of the seed is stored at Finley National Wildlife Refuge’s seed cooler until needed for future recovery efforts.

**TABLE 1. KINCAID’S LUPINE SEED COLLECTED IN 2016 FOR SEED PRODUCTION BED**

Site name	Owner	Amount
Fir Butte	BLM	154 g
Willow Creek North	TNC	20 g
Willow Creek Main	TNC	0.2 g
Willow Creek Bailey Hill	TNC	11 g
Willow Creek Fir Grove	TNC	2 g
South Eaton	ACE	45 g
Big Spires	ACE	20 g
East Spires	ACE	20 g
<b>Total available</b>		<b>272.2 g</b>

In addition to the seed from Heritage, Kincaid’s lupine seed was collected from introduced populations at three BLM West Eugene Wetlands sites: Isabelle, Turtle Swale, and Hansen. This seed will only be used for plug production or direct seeding in the West Eugene Wetlands. A summary of this seed is provided in Table 2.

**TABLE 2. KINCAID’S LUPINE SEED COLLECTED IN 2016 FROM INTRODUCED POPULATIONS OR AGRICULTURAL PRODUCTION**

Site name	Owner	Amount
Hansen	BLM	10.5 g
Isabelle	BLM	4.3 g
Turtle Swale	BLM	52.7 g
Heritage Seedlings, Inc.	Heritage	614 g
<b>Total available</b>		<b>681.5 g (1.5 lb)</b>

**Willamette daisy**

In 2016, 1403 g of Willamette daisy seed was collected from the introduced population at Vinci, a BLM-owned West Eugene Wetlands site. Seed was collected in June and July, either by hand collecting directly from inflorescences or vacuuming up with a handheld vacuum once mature seed had fallen on the shade cloth.

**Seed Production**

**Kincaid’s lupine**

In 2016, IAE broke ground at its new native plant farm, located near Independence, Oregon. Due to the loss of first the Heritage Eugene West Kincaid’s lupine seed production field, and then the failure of the transplants at the PMC, IAE decided to re-establish the Eugene West Kincaid’s lupine seed production in



raised beds at the new IAE farm. In the fall of 2016, approximately 90 g of wild-collected seed was put into cold stratification at 4°C for four weeks. Once seeds germinated, approximately 600 seedlings were transplanted to plug containers and moved to the OSU nursery yard and later to the IAE greenhouse. These plugs will be transplanted to raised beds at the IAE Farm in the spring of 2017. We expect to harvest our first seed yields from these beds in 2019.

In the fall of 2016, 60 g of wild-collected seed was provided to the U.S. Forest Service Dorena Genetic Resource Center for the purpose of establishing an additional Eugene West Kincaid's lupine seed production bed at that facility.

### **Willamette Daisy**

2016 was the last year of Eugene West Willamette daisy seed production at the PMC. The 0.02 acre field was established in 2011 with seed collected from the Eugene West Recovery Zone. Since direct sowing of Willamette daisy seed is generally not successful, all seed produced from this field will be used for growing plugs. In late 2013, this field produced its first harvest of 29 grams of seed (enough to grow over 50,000 plugs). In 2016 the field produced one pound of seed, enough to supply West Eugene partners with seed for plug growout for many years. Seed will be stored at Finley National Wildlife Refuge's seed cooler until used to grow plugs for future introduction efforts in the West Eugene Wetlands. Stored seed will be tested periodically for viability.

### **Shaggy Horkelia**

A seed production field of shaggy horkelia was established at the Corvallis PMC in the fall of 2014, and started producing seed in 2015. This field has been very successful, and in 2016, it produced 14 pounds of seed.

As a result of a shift in priorities within the NRCS, the PMC is phasing out its production of native seed for federal and other partners. The PMC shaggy horkelia seed production field was discontinued at the end of 2016.

IAE will need to collect shaggy horkelia seed from various wild populations throughout the Eugene West recovery zone in fall 2017. This seed can be used to create plugs that will be used to establish a new seed production field at the IAE Farm in spring 2018. If the production field is established in spring 2018, we would expect to harvest the first substantial seed yield for this species in 2019.

### **Bradshaw's Lomatium**

A seed production field of Bradshaw's lomatium was established at the Corvallis PMC in the fall of 2014. The first harvest was expected in 2017. However, due to the changes at the PMC, this field was discontinued at the end of 2016.

IAE will need to collect Bradshaw's lomatium seed from various wild populations throughout the Eugene West recovery zone in summer 2017. This seed can be used to create plugs that will be used to establish a new seed production field at the IAE Farm in fall 2017. We expect this field to produce its first significant harvest in 2020.

## Plug Production

Plugs destined for 2016 outplanting were grown at the Plant Materials Center in Corvallis according to their protocol.

### Kincaid's lupine

First, Kincaid's lupine seed was scarified by running the seeds through a sandpaper drum on a brush machine. After scarification, three to four seeds were planted per container containing a sterilized peat-based media (Pro-Mix HP Biofungicide + Mycorrhizae). Racks of containers were placed into a cooler for 7-10 days until the onset of germination. After stratification in the cooler, the racks of Kincaid's lupine plugs were grown in an unheated, partially ventilated greenhouse. During germination, watering was light and frequent. During plug growth, watering was thorough and less frequent.

These Kincaid's lupine plugs were grown from IAE seed archives dating back to 1999. Amy Bartow of the PMC collected germination data from each cohort, which is summarized in Table 3. These data show that seed from 2004 was about as viable as seed from collected in 2015. Seed collected in 1999 and 2000 had markedly lower germination rates than seed collected from 2004-2015.

**TABLE 3. KINCAID'S LUPINE SEED GERMINATED BY COHORT**

Population	Year	Percent germination	Number of germinants	Number of seeds planted	Abnormals
Oxbow west	1999	26%	34	132	3
s. green oaks	1999	0%	0	10	0
s. green oaks	1999	13%	22	176	7
Fir Butte	2000	11%	21	196	5
Fir Butte	2004	59%	109	186	9
Fir Butte	2004	44%	75	170	3
Fir Butte	2004	54%	105	196	7
Fir Butte	2004	50%	98	196	8
Fir Butte	2004	50%	98	196	15
Fir Butte	2004	58%	113	196	9
Fir Butte	2004	55%	107	196	13
Fir Butte	2004	47%	93	196	12
Fir Butte	2005	65%	128	196	4
Fir Butte	2005	75%	48	64	1
Fir Butte	2005	67%	132	196	4
Fir Butte	2005	72%	142	196	14
Fir Butte	2005	60%	12	20	1
Fir Butte	2005	63%	33	52	2
Fir Butte	2009	67%	8	12	0
Fir Butte	2011	49%	92	189	12
Heritage	2015	64%	126	196	8
Heritage	2015	62%	121	196	7
Heritage	2015	66%	130	196	3
Heritage	2015	52%	44	84	8

### **Willamette daisy**

Three to five Willamette daisy seeds were sown per container containing a sterilized peat-based media (Pro-Mix HP Biofungicide + Mycorrhizae). After sowing, racks of containers were wrapped in plastic bags and placed into a stratification cooler (4 degrees C) for 12-15 weeks.

After stratification, the racks were placed in a lighted and heated greenhouse. The temperature of the greenhouse was set to 18-24 degrees C during the day and no lower than 10 degrees C at night.

Plugs were lightly watered and fertilized with a general purpose (20-20-20) fertilizer. Plugs required about 3 months of growth in the heated greenhouse, a week in an unheated greenhouse and then a few days in a shadehouse prior to outplanting.

## **Reintroduction: Direct Sowing**

### **Willamette daisy**

In December 2015, 389 g of uncleaned Willamette daisy seed was sown in a 5 m x 5 m test plot at Greenhill to reassess the possibility of direct seeding as an option for this species. Unfortunately, no seedlings were detected in 2016, thus confirming the decision to reintroduce this species solely with plugs.

### **Shaggy horkelia**

In December 2016, about 35 g and 45 g of shaggy horkelia seed were seeded into plots at Speedway and Greenhill, respectively, to test the efficacy of direct seeding as an introduction method. Prior to direct seeding, both of these sites were prepared with a prescribed burn conducted in October 2016.

## **Reintroduction: Plug Outplanting**

### **Kincaid's lupine**

Plugs of Kincaid's lupine were outplanted at two BLM West Eugene Wetlands sites (Hansen and Isabelle) in the spring of 2016. A summary of threatened and endangered plant plug introduction can be found in Table 4.

Previously laid geotextile cloth (installed in fall 2013 and winter 2014) was left in place as site preparation. A monitoring grid was established with plugs placed approximately a half-meter apart, and a propane torch used to burn holes in the geotextile cloth prior to planting. Plugs were transplanted into the holes at Hansen on March 29<sup>th</sup>-31<sup>st</sup> (1549 plugs) and Isabelle on March 31<sup>st</sup> (50 plugs) and watered in afterwards. Later in the spring, holes where previously planted lupine plugs had died were plugged with shade cloth patches at Hansen.

### **Willamette daisy**

Willamette daisy plugs were also outplanted in the spring of 2016 (Table 3). Shade cloth has generally not been necessary as a weed suppression tool for this species because Willamette daisy is outplanted to relatively high-quality wet prairie with only moderate weed pressure. Additionally, a prescribed burn

conducted in fall 2015 served as site preparation for the outplanting effort. Plugs (1559 total) were outplanted with meter spacing on April 5<sup>th</sup> and 6<sup>th</sup>. Low-lying areas that were saturated at planting time did not receive plants. Plants were not watered in as the soil was quite damp at planting time.

**TABLE 4. SUMMARY OF 2016 THREATENED AND ENDANGERED PLANT PLUG INTRODUCTION IN WEST EUGENE WETLANDS**

<b>Species</b>	<b>Site</b>	<b># plugs</b>
Kincaid's lupine	Hansen	1549
Kincaid's lupine	Isabelle	50
Willamette daisy	Greenhill	1559

## Restoration Activities

A complete list of restoration activities conducted for this project is listed in Table 5.

**TABLE 5. 2016 RESTORATION ACTIVITIES IN THREATENED AND ENDANGERED PLANT AUGMENTATION SITES IN WEST EUGENE WETLANDS IN 2016.**

Date	Site	Activity
4/5/16- 4/6/16	Greenhill	Outplanted 1559 Willamette daisy plugs
3/29- 3/31/16	Hansen	Outplanted 1549 Kincaid's lupine plugs (in monitoring grid)
3/31/16	Isabelle	Outplanted 50 Kincaid's lupine plugs (in monitoring grid)
4/1/16	Isabelle	Watered in Kincaid's lupine plugs, weeded plugs planted in previous years
5/12/16	Isabelle	Weeded Kincaid's lupine shadecloth patch
5/20/16, 7/12/16, 10/7/16	Hansen	Weeded Kincaid lupine plots; plugged shadecloth holes
6/6/16- 6/9/16	TNC sites	Bagged Kincaid's lupine plants
6/7/16	Vinci	Weeded ERDE plot
6/14/16	Vinci	Collected ERDE seed
6/24/16	Fir Butte	Bagged Kincaid's lupine plants & hand-collected seed
7/12/16 - 7/14/16	Fir Butte & TNC sites	Collected bagged Kincaid's lupine seed
7/18/16- 7/19/16		Processed Kincaid's lupine seed
7/18/16	Vinci	Collected Willamette daisy seed
11/15/16, 11/18/16	Hansen	Weeded plot, fixed shade cloth

## Monitoring

All BLM West Eugene Wetland threatened and endangered plant reintroduction sites are monitored annually for transplant survival. Table 6 summarizes the results of 2016 monitoring efforts for all sites except Hansen's 2016 Kincaid's lupine transplants. In 2016, the Kincaid's lupine plugs outplanted at Hansen were monitored 5 times between April 11th and June 16th in order to determine the timing of

transplant failure (previously outplanted plugs at this site have had very low survival rates). Table 6 summarizes the monitoring results for the Kincaid's lupine plugs outplanted at Hansen in 2016. Appendix A summarizes monitoring data collected from 2012-2016.

**TABLE 5. 2016 MONITORING RESULTS OF WEST EUGENE WETLANDS AUGMENTATION**

WEW Augmentation Summary 2012-2016				2016	
Site	Year	Species	total planted	# alive	% survival
Balboa	2013	Willamette daisy	550	221	40.2
Balboa	2014	Willamette daisy	529	177	33.5
Balboa	2015	Willamette daisy	1807	429	23.7
Greenhill	2016	Willamette daisy	1559	1458	93.5%
Vinci	2014	Willamette daisy	1398	1116	93.5%
Hansen	2014	Kincaid's lupine	599	25	4.2%
Hansen	2015	Kincaid's lupine	952	144	15.1%
Hansen	2016	Kincaid's lupine	1549	1413	91.2%
Isabelle	2014	Kincaid's lupine	200	51*	20.4%
Isabelle	2016	Kincaid's lupine	50		
Turtle Swale	2012	Kincaid's lupine	500	73	14.6%
Turtle Swale	2013	Kincaid's lupine	190	24	12.6%
Turtle Swale	2015	Kincaid's lupine	160	13	8.1%

\*In 2016, Kincaid's lupine plugs were comingled with the existing 2014 cohort at Isabelle. It is difficult to assign a particular cohort to each surviving plant.

**TABLE 6. KINCAID'S LUPINE SURVIVAL AT HANSEN, APRIL – JUNE 2016**

Dates	Total Present	% survival
4/6	1549	100%
4/11	1528	98.6
4/25	1508	97.4
5/9	1495	96.5
5/23	1467	94.7
6/16	1413	91.2

## DISCUSSION

In 2016 all outplanted Kincaid's lupine plugs were planted into geotextile cloth. The cloth will be removed when the Kincaid's lupine plants are well established and herbicide is available as a tool to control competing weeds. This use of shade cloth has introduced another level of maintenance to this project. The cloth needs to be monitored and repaired during the winter and the planting holes should be hand-weeded a few times during the growing season.

The geotextile fabric is a temporary measure used to prepare the site while waiting for herbicides to be approved for use. More planning needs to be done to decide the best way to move forward with the removal of the fabric, considering what weed treatments and seeding should be applied to the spaces created between the plants. The geotextile fabric is good for blocking/killing the living undesired vegetation, but the seed bank in the soil remains intact, and once the cloth is removed we expect additional weed seeds to germinate.

Another factor to consider is the treatment of the areas where the geotextile fabric has been applied. One of the negative factors of using this fabric in natural areas is that the fabric tends to funnel large quantities of wind-blown weed seed into the openings in the fabric. One way to help mitigate against this weed seed invasion is to keep the weeds along the edge of the fabric from producing seed by mowing during the growing season.

Survival of the 2016 Kincaid's lupine plugs at Hansen was excellent, probably due to a warm and relatively wet spring. Plants were planted at virtually the same time as in 2015, using the same methodology, but in 2016 rains continued through mid-July as opposed to early June in 2015. The 2016 outplanted Kincaid's lupine plugs were monitored every two weeks from April through June of that year, but no supplemental watering was necessary as survival remained over 90%. In addition, three of the transplants flowered and produced seed (Figure 4). In order to increase transplant survival in the future, we recommend monitoring introduced Kincaid's lupine plugs bi-weekly for the first four months after outplanting, and to supplement rainfall with additional watering if the weather is hot and dry.

For Willamette daisy plugs outplanted at Greenhill in 2016, first year survival was greater than 90% (Appendix A). Longer-termed survival rates remain to be seen, but there will most likely be some additional attrition, since two to four year post-planting survival rates for Willamette daisy at Balboa have been much lower (ranging from 23-40%, see Appendix A). However, first year survival rates at Balboa have not exceeded 67% in previous years (Appendix A), so we hope to see higher long-term survival rates in future years at Greenhill as well.



Figure 4. A Kincaid's lupine plant in June 2016, two and half months after transplanting. This plant successfully produced seed.

## NEXT STEPS

The following activities are recommended for 2017:

- Outplant Kincaid's lupine, Willamette daisy, and shaggy horkelia plugs in March-April 2017: Approximately 800 plugs of Kincaid's lupine, 1500 plugs of Willamette daisy, and 300 plugs of shaggy horkelia are currently being grown by IAE to be outplanted at Hansen, Greenhill, and Speedway, respectively. We recommend that Kincaid's lupine plants continue to be planted into shade cloth at Hansen. These plants will provide some of the seed for future seeding of a prairie restoration at Hansen. A prescribed burn was conducted in fall 2016 at Speedway, and that will serve as the site preparation for the shaggy horkelia plugs to be planted there.
- Monitor all BLM threatened and endangered plant reintroduction sites in the West Eugene Wetlands. Monitoring should occur at the appropriate time to capture survival and reproduction data for all outplanted plants (typically in April-May for Bradshaw's lomatium, and in May-June for Kincaid's lupine and Willamette daisy).
- Monitor 2017 Kincaid's lupine transplants at Hansen on a bi-weekly schedule from April-June of that year, and provide supplemental water to the transplants if the year is hot and dry.



- Maintain threatened and endangered plant reintroduction sites by hand-weeding around plants and mowing buffers around edges of geotextile shadedcloth areas before surrounding weeds set seed.
- Maintain seed production beds for Eugene West Kincaid's lupine at Arklay Farm(IAE managed).
- In the fall of 2017, start Kincaid's lupine, Willamette daisy, and shaggy horkelia plugs for introduction in the spring of 2018.
- Begin focused habitat restoration at Oak Hill in preparation for future introduction of golden paintbrush (*Castilleja levisecta*) once herbicide use is permitted at the site. Oak Hill needs a minimum of three years of site preparation before considering introduction of golden paintbrush.

APPENDIX A. MONITORING RESULTS FOR WEST EUGENE WETLAND THREATENED AND ENDANGERED PLANT AUGMENTATION SITES, 2012-2016

WEW Augmentation Summary 2012-2016					Monitoring year									
					2012		2013		2014		2015		2016	
Site	Planting year	Species	Total # planted	# Planted in macroplot	# alive	% Survival	# alive	% Survival	# alive	% Survival	# alive	% Survival	# alive	% Survival
Balboa	2013	ERDE	1100	550			521	94.7%	334	60.7%	268	48.7%	221	40.2%
Balboa	2014	ERDE	1644	529					351	66.4%	181	34.2%	177	33.5%
Balboa	2015	ERDE	1807	1807							892	49.4%	429	23.7%
Vinci	2014	ERDE	1398	1398					1304	93.3%	1197	85.6%	1116	79.8%
Greenhill	2016	ERDE	1559	1559									1458	93.5%
Hansen	2012	LUOR	724	496	301	60.7%	24	4.8%	13	2.6%	N/A	N/A	N/A	N/A
Hansen	2013	LUOR	600	544			297	54.6%	3	0.6%	N/A	N/A	N/A	N/A
Hansen	2014	LUOR	599	599					134	22.4%	39	6.5%	25	4.2%
Hansen	2015	LUOR	952	952							341	35.8%	144	15.1%
Hansen	2016	LUOR	1549	1549									1413	91.2%
Isabelle	2014	LUOR	200	200					62	31.0%	27	13.5%	51	20.4%
Isabelle	2016	LUOR	50	50										
Turtle Swale	2012	LUOR	500	500	322	64.4%	158	31.6%	125	25.0%	108	21.6%	73	14.6%
Turtle Swale	2013	LUOR	190	190			156	82.1%	57	30.0%	41	21.6%	24	12.6%
Turtle Swale	2014	LUOR	70	70					0	0.0%				
Turtle Swale	2015	LUOR	160	160							44	27.5%	13	8.1%

Table created by Christine Calhoun. Monitoring conducted by Christine Calhoun and Danica Malone

