
**Reintroduction of *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine) to Dragonfly Bend in the West Eugene Wetlands
*2009 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 conservation, 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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REFERENCE

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TABLE OF CONTENTS

Preface.....	ii
Acknowledgements.....	ii
Reference	ii
Table of Contents	iii
List of tables.....	iv
List of figures	iv
Introduction.....	1
Methods.....	1
Study site.....	1
Reproduction and population biology.....	2
Reintroduction.....	2
Monitoring	3
Results and discussion	3
Transplants	3
Seeding.....	3
Management recommendations	4
Literature cited.....	5
Literature cited	6
Appendix A. Dragonfly Bend Gear List and Directions.....	7
Gear List.....	7
Directions	8

LIST OF TABLES

Table 1. Kincaid's lupine reintroduction events at Dragonfly Bend.

Table 2. Establishment, cover, and reproduction of Kincaid's lupine seeds sown at Dragonfly Bend.

LIST OF FIGURES

Figure 1. Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*).

Figure 2. Eggs of Fender's blue butterfly are identifiable as white dots on the undersides of *Lupinus sulphureus* ssp. *kincaidii* leaves.

Figure 3. Herbivory of Kincaid's lupine by larvae of Fender's blue butterfly results in clusters of damaged stems, leaves, and growing points (left) because the larvae (right) typically feed on young leaves and apical meristems.

Figure 4. Cover (m²) of Kincaid's lupine at Dragonfly Bend in the north and south introduction areas in 2009.

Figure 5. Dragonfly Bend north lupine introduction site. Note the dense, tall cover of native species.

INTRODUCTION

Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*; Figure 1), a rare member of the legume family (Fabaceae), is listed by the U.S. Fish and Wildlife Service and Oregon Department of Agriculture as a threatened and endangered by the Washington Department of Natural Resources. This species is found in native prairie remnants in the Willamette Valley, southwestern Washington, and forest openings in Douglas County, Oregon. In the Willamette Valley, Kincaid's lupine serves as the primary larval host plant for the endangered Fender's blue butterfly, making conservation of the lupine a common strategy for the success of both species.

Only 57 sites are known to support Kincaid's lupine and fewer than 20 of these are larger than 1 hectare (Wilson et al. 2003). Additionally, the majority of the sites are on privately held land, which is exempt from protections provided by state and federal listing, increasing the importance of management by state and federal agencies on public land.

The objective of this project was to introduce Kincaid's lupine to Dragonfly Bend, a wetland mitigation site located in the West Eugene Wetlands, and managed by the City of Eugene and Eugene District Bureau of Land Management. This report summarizes the results of three years of reintroduction efforts at this site.



Figure 1. Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*).
photo by T.N. Kaye

METHODS

Study site

The 76.8 acre Dragonfly Bend wetland mitigation site is located in the Amazon Creek drainage to the northeast of the intersection of Royal Avenue and Green Hill Road in west Eugene. The BLM purchased a conservation easement on 23.44 acres located in the southern portion of the site (Lane Council of Governments 2004). The southern half of the site is identified in the *West Eugene Wetland Plan* (1992) as B8 and designated as "wetlands to be enhanced for mitigation credit" (Lane Council of Governments 2004). Since 2004, the site has undergone restoration to convert the former annual ryegrass (*Lolium multiflorum*) field back to native vegetation.

Three patches of native plant species typical of upland prairies are located in the drier portions of the field and total approximately 4.4 acres. Additional soil was graded onto these areas to raise the elevation by 6 to 18 inches (Lane Council of Governments 2004). The soil that was graded onto the upland prairie was taken from adjacent areas

that were designated for vernal pool restoration. Within the two largest upland patches, 0.7 acres were designated as areas for the reintroduction of Kincaid's lupine and were augmented with an additional 3" of soil/compost mix and 1" of compost.

Reproduction and population biology

Kincaid's lupine is an herbaceous perennial that reproduces by seed. Plants form clumps of basal leaves and eventually produce one or more flowering stems. This species also appears to spread vegetatively, though it is unknown to what extent vegetative growth might result in the formation of physiologically distinct clones. Kincaid's lupine requires insects for successful fertilization and seed formation (Kaye 1999). Fender's blue butterfly oviposits small white eggs on the undersides of Kincaid's lupine leaves (Figure 2). After eggs hatch, the larvae emerge and feed on lupine leaves (Figure 3) before overwintering in the soil near the base of plants.

Reintroduction

Seeding and transplanting of Kincaid's lupine occurred five times since the fall of 2006 (Table 1). The 2006 and 2007 events were on relatively fresh soil. In preparation for the January 2008 seeding, plots were cleared of vegetation using a drip torch on 17 December, 2007, and again in January before the seeding. Plots were burned again in

Table 1. Kincaid's lupine reintroduction events at Dragonfly Bend.

Date	# plots or plants	propagule type	notes
12/11/2006	10 plots in each area (20 total)	Unscarified seeds (50 per plot)	½ of plots covered with netting
02/19/2007	10 plots in each area (20 total)	Scarified seeds (50 per plot)	½ of plots covered with netting
03/27/2007	South site: 80 plants on two transects. North site: 29 plants on one transect.	plugs	Plants 1m apart. North: Every third plant caged to reduce deer and vole grazing. South: Every other plant caged.
01/10/2008	14 plots in each area (28 total)	Scarified seeds (50 per plot)	Plots 3m apart.
01/10/2009	14 plots in each area (28 total)	Scarified seeds (50 per plot)	Plots 3m apart, adjacent to 2008 plots. ½ of plots covered with netting.

October 2008 and January 2009, prior to the 2009 seeding. Plots containing lupine were weeded in the late spring 2007, 2008, and 2009.

Monitoring

We monitored seeded and transplanted plots in May or June 2007, 2008, and 2009. In each seeding plot, we counted the number of seedlings, leaves per plant (first year seedlings only), measured lupine cover, and searched for butterfly eggs.

Kincaid's lupine cover is measured by visually creating a rectangle from each lupine patch, then measuring the longest and perpendicular-to-longest lengths to the nearest centimeter. For each transplant, we noted whether it was alive or dead and counted the number of leaves on each live plant.



Figure 3. Herbivory of Kincaid's lupine by larvae of Fender's blue butterfly results in clusters of damaged stems, leaves, and growing points (left) because the larvae (right) typically feed on young leaves and apical meristems. *photo by T.N. Kaye*

RESULTS AND DISCUSSION

Transplants

In 2007 there was low survival of the transplanted lupines. In the north area, 3 of 29 (10.3%) individuals survived. In the south area, 2 of 80 (2.5%) individuals survived. By 2008 no transplanted individuals could be located. When the seedlings were planted in March 2007, we observed that below approximately 3 inches from the soil surface, the soil turned into heavy clay that had mottling and gleying typical of wetland soils. Kincaid's lupine typically grows very poorly in this type of soil and it is likely that this condition had a negative effect on the survival and growth of the transplanted individuals.

Seeding

There was significant variation in establishment success between the seeding efforts. In 2007, 22% of the sown seeds sown in fall 2006 and spring 2007 germinated and became established. By May 2009, 9.7% of these individuals remained.

Table 2. Establishment, cover, and reproduction of Kincaid’s lupine seeds sown at Dragonfly Bend.

Seeding effort	Individuals in 2009	establishment in 2009 (%)	Total cover (m ²)	Mature racemes	Aborted racemes
fall 06	97	9.7	0.3	6	2
winter 07	12	1.2	0	0	0
winter 08	0	0	0.003	0	0
winter 09	6	0.6	0.005	0	0

Establishment of seeds from winter 2007 and 2009 was relatively low, 1.2 and 0.6%, respectively. In spring 2008, we did not detect any seedlings from the winter 2008 seeding. However, in 2009, we found four individuals in these plots. Seedling survival was approximately the same in the south and north seeding areas (3.1% and 3.7%, respectively). The total cover of Kincaid’s lupine at Dragonfly Bend in 2008 was 0.33 m². The majority of this cover is from the fall 2006 seedlings (Figure 4). Netting to minimize granivory had no effect on the number or cover of Kincaid’s lupine plants ($P_{1,88} = 0.33$). There are likely two main causes of the low germination and establishment of seeds in the later seedings. First, as discussed above, the fill dirt beneath the compost appeared to be heavy clay, which typically is not suitable for Kincaid’s lupine. In 2006, the germinating seeds had several inches of compost to grow through before reaching clay soil. In later seeding efforts, most of the compost had either been compacted or blown away, reducing the amount of hospitable soil. Second, after 2007, the cover of seeded native species, including *Madia*, *Gilia*, *Achillea*, and *Clarkia* was near 100%. Although the plots with visible lupine had been weeded by the City of Eugene, the plants were likely affected by strong below ground competition.

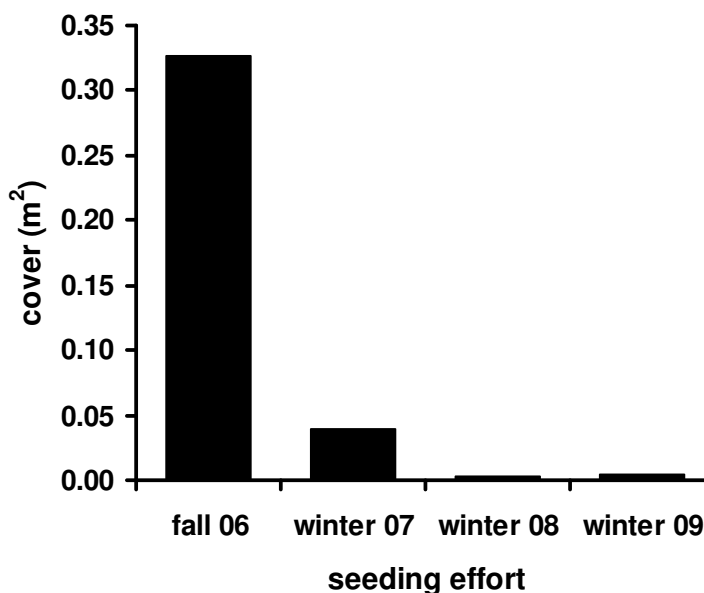


Figure 4. Cover (m²) of Kincaid’s lupine at Dragonfly Bend in the north and south introduction areas in 2009.

Management recommendations

There are two primary issues that may affect the long-term success of Kincaid’s lupine reintroduction at Dragonfly

Bend. The first is the heavy clay that is present below the compost in the mounded habitat. Due to their long taproots, lupine plugs must be planted relatively deep in the soil. It is possible that the roots of the plugs planted in 2007 were damaged as the clay dried, causing high mortality. In contrast, it is possible that as the roots of seeded plants grew, they were able to find more habitable cracks and pockets as they reached the clay layer. We recommend that all future reintroduction efforts use seeds instead of transplants. The second management issue at this site is competition by other seeded native plants. Although areas around lupine plants were weeded in spring 2009, there was still significant shading by neighboring plants. The level of underground competition is unknown, but based on the high amount of aboveground biomass, we expect that it is high. Continued weeding will be necessary for the survival of lupine at this site.



Figure 5. Dragonfly Bend north lupine introduction site. Note the dense, tall cover of native species.

LITERATURE CITED

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APPENDIX A. DRAGONFLY BEND GEAR LIST AND DIRECTIONS

Gear List

copy of gear list and directions
last year's report
last year's datasheets
new datasheets, some rite-in-the-rain
clipboards (4)/pencils
maps/gazetteer
5 tapes: 3-100m, 2 shorter
8 candy canes
rulers- one per person
meter poles- one per person
flagging
~20 pin flags
5 pieces rebar (for replacement)
mallet
compass
Health and Safety Kit
Extra water

Directions

From Corvallis, drive south on HWY 99. Go west on the Beltline Highway. Exit at Barger Dr. and go west. Turn onto Terry St. (south), then turn right (west) onto Royal Avenue. Signs indicated site.

