INTRODUCTION OF THE THIN-LEAVED PEAVINE (LATHYRUS HOLOCHLORUS): 2016 ANNUAL REPORT

3/31/2017

Report to the Bureau of Land Management
Agreements # L13AC00098-33 and L16AC00256-0001

Report prepared by Ian Silvernail

Institute for Applied Ecology

Institute for Applied Ecology

PREFACE

This report is the result of agreements # L13AC00098-0033 and L16AC00256-0001 between the Institute for Applied Ecology (IAE) and the Bureau of Land Management, Northwest Oregon District. Projects under both agreements provided funds for the activities describe herein. IAE is a non-profit organization whose mission is the 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.

Questions regarding this report or IAE should be directed to:

Tom Kaye, Executive Director

Institute for Applied Ecology

563 SW Jefferson St.

Corvallis, Oregon 97333

phone: 541-753-3099 ext 111

fax: 541-753-3098

email: tom@appliedeco.org

ACKNOWLEDGMENTS

Funding for this project was provided by the Northwest Oregon District of the Bureau of Land Management (BLM). We thank Cheshire Mayrsohn of the BLM for the opportunity to assist in the conservation of this rare species. We also thank Sally Villegas-Moore, also of the BLM and Wes Messinger, of U.S. Army Corps of Engineers, for supporting plant introductions in the West Eugene Wetlands and around Dorena Reservoir.

Cover photograph: *Lathyrus holochlorus* flowers. *Photo by Ian Silvernail.*

SUGGESTED CITATION

Silvernail, I. 2017. Population Introduction of the Thin-leaved Peavine (Lathyrus holochlorus): 2016 Annual Report. Institute for Applied Ecology, Corvallis, Oregon. 28 pages.

TABLE OF CONTENTS

INTRODUCTION OF THE THIN-LEAVED PEAVINE (LATHYRUS HOLOCHLORUS): 2016 ANNUAL REPORT

REPORT TO THE BUREAU OF LAND MANAGEMENT

EXECUTIVE SUMMARY

In 2016, several activities that support to population introductions of a Bureau of Land Management (BLM) Sensitive Species, *Lathyrus holochlorus* (thin-leaved peavine), were completed by the Institute for Applied Ecology (IAE). A seed increase bed was established from container plants started from a diverse accession of wild-collected seed. This bed was maintained via watering, fertilizing, and weeding, and is intended to produce seed in the future to support other introduction efforts. Six introduction locations across four separate sites managed for conservation purposes were identified, managed in preparation for planting, and planted with 1000 nursery-grown plugs in total. Reintroduction plots were monitored for survival, number of stems, and vigor of *L. holochlorus*, and associated plant community characteristics were assessed. Sites differed significantly in percent survival and in number of stems, but not in vigor of *L. holochlorus* plants. Habitat management recommendations were made based on the results of plant community monitoring. 2017 will see more monitoring and habitat maintenance in these introduced populations.

INTRODUCTION

The thin-leaved peavine (*Lathyrus holochlorus)* is a rare member of the pea family (Fabaceae). It is a Bureau of Land Management (BLM) Sensitive Species, a U.S. Fish and Wildlife (USFWS) Species of Concern, and an Oregon Biodiversity Information Center (ORBIC) List 1 species. It is found throughout the Willamette Valley and south toward Roseburg in northwestern Oregon. A few small populations are also found in Lewis County, Washington. The thin-leaved peavine is most commonly found along roadsides, fencerows, or scattered in deciduous woodlands. Most of the remaining populations are along roadsides and unmowed fencerows, where it is commonly associated with Oregon white oak (*Quercus garryana*), common snowberry (*Symphoricarpos albus*), various species of rose (*Rosa* sp.), and poison oak (*Toxicodendron diversilobum*). Many populations are threatened by incompatible mowing practices and herbicide use.

The thin-leaved peavine is a rhizomatous perennial, and many populations are likely composed of a single, self-incompatible genetic clone. Most small populations consistently do not produce any viable seed; very few large populations remain. In a 2012-2014 range-wide inventory performed by the Institute for Applied Ecology (IAE), 32% of extant populations had 10 or less stems, and 75% of populations had 100 or less stems.

This report includes information about Phases 3 and 4 of a four phase project. Phases 1 and 2 of the project included field surveys of historic populations, seed collection, germination testing, and limited plug production. Phase 3 involved further seed collection, plug grow out, site preparation at selected locations, and population increase by outplanting thin-leaved peavine plugs. Phase 4 objectives are to maintain thin-leaved peavine seed increase beds, monitor establishment of outplanted plugs, and improve habitat quality at reintroduction sites to enhance outplanting and establishment success.

2016 ACTIONS

In 2016, activities included maintenance of seed increase beds, outplanting of nursery-grown plugs, monitoring, and site maintenance.

Seed increase bed maintenance

A single 5' x 48' (240 ft^2) raised bed located at the Forest Sciences Laboratory at Oregon State University was direct seeded in late 2014 with *L. holochlorus* seed collected from 20 different wild populations of this species. Germination was poor and the bed failed to establish. In response, two raised beds (480 ft^2 total) were planted with greenhouse-grown plugs in March 2016. Both beds were weeded and fertilized twice in 2016 and irrigated regularly in early summer. None of the transplants flowered or set seed in 2016.

Outplanting

In 2015, four sites were chosen for introduction of *L. holochlorus* based on soils, habitat, and geographic location. One of the sites, Bake Stewart Park, had two introduction plots installed. Figure 1 shows all of the introduction sites. Bake Stewart Park is owned by the U.S. Army Corps of Engineers; all other sites are owned by the BLM.

A total of 1000 plants were grown at the Corvallis Plant Materials Center in 2015. A mixture of seeds collected from 20 different wild populations was used to produce the 1000 plants. Additionally, 100 second-year plants were grown at IAE. All second-year plants were produced from seed collected from the largest-known wild population of *L. holochlorus* at Cutler Lane. All plants were transplanted to introduction sites in March 2016. Plots at Bake Stewart were planted on March 1st and 2nd. Plots at Dorena were planted on March 14th. Plots at Hansen and South Taylor were planted on March 22nd. Plot corners were marked with a piece of rebar pounded into the ground and a ½" PVC pipe placed over the rebar. The PVC is about 8" tall and the origin corner has a metal tag on it. See Appendix 1 for more information on plot location and layout. All introduction plots are 5.5m x 10.5m. At all sites except Dorena, *L. holochlorus* plants were planted every 0.5 meters, from 0.5 to 10, along transects spaced 0.5 meters apart and running lengthwise within the plots, for a total of 200 plants per plot. At Dorena,

plants were planted along transects spaced 0.5 meters apart and running lengthwise within the plots, but spaced every 1 meter from 1 to 10 for a total of 100 plants per plot.

Observations of natural populations by the author showed that *L. holochlorus* is commonly found associated with shrubs. As a result, in choosing outplanting locations, an attempt was made to choose plot locations that could be used to assess the efficacy of planting *L. holochlorus* with existing shrubs. At Dorena, the west plot was virtually shrub free, while the east plot was significantly colonized with snowberry. At Bake Stewart Park, the east plot was virtually shrub free, while the west plot was also significantly colonized by snowberry, as well as poison oak. All plots were mowed prior to planting (including the shrubs within the plots). See Silvernail (2016) for more information about pre-planting site preparation.

FIGURE 1. *LATHYRUS HOLOCHLORUS* INTRODUCTION SITES (INDICATED BY A YELLOW DIAMOND)

Monitoring

Lathyrus holochlorus reintroductions

In 2016, introduction plots at Bake Stewart were monitored on June 7, Dorena on June 8, and Hansen and South Taylor on June 16. At each site, survival, number of stems per surviving plant, and vigor of all surviving plants was assessed. Plants were rated on a vigor scale of 0-4. Zero indicated a plant that was dead or likely dead; four indicated a plant that was vigorous and healthy. Scores of one to three represented intermediate stages of vigor. Factors impacting the vigor rating of a plant included color, stature, turgidity, height, and stem thickness. Photopoints were also taken from each plot corner (see Appendix 3).

Mean percent survival across all six introduction plots was significantly different (one-way ANOVA, $F(4,995)=10.15$, $P<0.0000001$). Table 1 lists percent survival at each site. Bake Stewart West had the highest percent survival at 73%. This differed significantly from survival at Dorena West and South Taylor. Survival rate at Dorena West, 36%, was significantly lower than at all other sites.

Mean number of stems on surviving plants differed significantly across introduction plots (one-way ANOVA, $F(5,618)=2.63$, $P=0.02$). Table 1 lists the mean number of stems for surviving plants at each introduction site. Dorena East had the highest mean number of stems per surviving plant, and this differed significantly from Bake Stewart East and Hansen, who had the lowest number of stems per per surviving plant.

Mean vigor of surviving plants did not differ significantly across introduction plots (one-way ANOVA, $F(5,618)=1.31$, $P=0.26$).

TABLE 1. PERCENT SURVIVAL, MEAN NUMBER OF STEMS PER SURVIVING PLANT, AND MEAN VIGOR OF SURVIVING LATHYRUS HOLOCHLORUS PLANTS AT ALL SIX INTRODUCTION PLOTS. AN ASTERISK (*) REPRESENTS A SIGNIFICANT DIFFERENCE ACROSS ALL SITES. PAIR-WISE DIFFFERENCES AS SUGGESTED BY A TUKEY-KRAMER MULTIPLE COMPARISON TEST ARE REPRESENTED BY THE SUPERSCRIPT LETTERS NEXT TO THE VALUES. IF A SITE SHARES THE SAME LETTER, THERE IS NO SIGNIFICANT DIFFERENCE BETWEEN THOSE TWO SITES. CONVERSELY, IF SITES DO NOT SHARE A LETTER, THERE IS A SIGNIFICANT DIFFERENCE BETWEEN THOSE SITES FOR THE FACTOR IN QUESTION.

Introduction site	Percent survival*	Mean number of stems for surviving plants*	Mean vigor of surviving plants
Bake Stewart West	73%^{C}	1.6^{AB}	2.3^{A}
Bake Stewart East	71%^{C}	1.5^{A}	2.2^{A}
Dorena East	61%^{BC}	1.9^{B}	2.2^{A}
Dorena West	36%^{A}	1.6^{AB}	1.9^{A}
Hansen	65.5%^{BC}	1.5^{A}	2.2^{A}
South Taylor	54%^{B}	1.6^{AB}	2.3^{A}

It is possible that some of the results related to survival, mean number of stems, and mean vigor of surviving plants can be explained by differences in dates of planting and monitoring. Bake Stewart Park plots were planted 12-21 days earlier than plots at other sites. Differences in monitoring dates were less pronounced, with Bake Stewart sites being monitored 1-9 days earlier than other sites. Additionally, upon outplanting, the vigor of the container plants was not assessed. Attempts to evenly distribute plants of varying vigor levels across sites were made, but it is possible that some sites received lower quality transplants than others. Future years of monitoring will help to better elucidate reasons for differences between sites.

Associated plant community

The associated plant community in each of the reintroduction plots was assessed by randomly placing five 1m x 1m plots in each plot. In each of these smaller plots, the ocular percent cover of all vascular plant species present was recorded. Ocular percent cover of other ground cover characteristics, including bare ground, thatch, lichens/bryophytes, and rocks was also assessed. All vascular plant species present in the overall reintroduction plot (but not assigned to a smaller monitoring plot) were also noted. Qualitative notes were also made on suggested management actions.

Results of plant community assessments are presented in Tables 2-7. Each table lists the mean relative cover ("mean rel cov") of all vascular plant species in the monitoring plots as well as the standard error (SE) associated with the mean. Other ground cover variables are presented as absolute cover values ("mean absol cover"). Future years of assessment after habitat maintenance activities are performed will help to evaluate the effectiveness of those actions.

TABLE 2. BAKE STEWART EAST PLANT COMMUNITY ASSESSMENTS. "MEAN REL COV" = MEAN RELATIVE COVER OF EACH SPECIES. SE = STANDARD ERROR. "MEAN ABSOL COV" = MEAN ABSOLUTE COVER.

Forbs	mean rel cov	SE		Trees/Shrubs/Sub-shrubs	mean rel cov	SE
Vicia sativa	6.6	1.8		*Oemleria cerasiformis*	3.5	3.0
Moehringia macrophylla	3.7	1.2		*Quercus garryana*	0.3	0.3
Lathyrus holochlorus	3.6	1.0		*Prunus avium*		
Lapsana communis	2.5	0.7		*Toxicodendron diversilobum*		
Fragaria vesca	1.6	1.0				
Torilis arvensis	1.4	0.5				
Stellaria media	0.2	0.2		**Ground cover**	**mean absol cov**	**SE**
Vicia hirsute	0.2	0.2		Bare	0.4	0.4
Geranium molle	0.1	0.1		Thatch	39	4
Achillea millefolium				Lichen/bryophyte	0.0	0.0
Aquilegia formosa				Rock	0.0	0.0
Nemophila menziesii var. *atomaria*						
Sidalcea malviflora ssp. *virgata*						
Graminoids	**mean rel cov**	**SE**				
Dactylis glomerata	36.0	9.2				
Arrhenatherum elatius	31.0	11.5				
Bromus diandrus	7.8	4.6				
Elymus glaucus	1.0	1.0				
Bromus vulgaris	0.5	0.5				
Bromus carinatus	0.2	0.2				

TABLE 3. BAKE STEWART WEST PLANT COMMUNITY ASSESSMENTS. "MEAN REL COV" = MEAN RELATIVE COVER OF EACH SPECIES. SE = STANDARD ERROR. "MEAN ABSOL COV" = MEAN ABSOLUTE COVER.

Forbs	mean rel cov	SE		Graminoids	mean rel	SE
Montia perfoliata	7.0	2.8		*Elymus glaucus*	2.5	0.8
Lathyrus holochlorus	4.4	2.4		*Bromus vulgaris*		
Nemophila menziesii var. *atomaria*	3.6	0.9				
Vicia hirsute	3.3	0.7		**Trees/Shrubs/Sub-shrubs**	**mean rel**	**SE**
Galium sp.	2.1	1.2		*Symphoricarpos albus*	52.7	3.5
Lapsana communis	1.1	0.8		*Toxicodendron diversilobum*	15.1	8.2
Lamium purpureum	1.1	0.4		*Quercus garryana*	2.6	2.6
Geranium dissectum	0.7	0.7		*Oemleria cerasiformis*	0.1	0.1
Vicia sativa	0.7	0.7		*Rosa* sp.		
Torilis arvensis	0.4	0.2				
Stellaria media	0.3	0.3		**Ground cover**	**mean absol cov**	**SE**
Hyppericum perforatum	0.2	0.2		Bare	16	4
Galium aparine	0.1	0.1		Thatch	29	6
Centaurea cyanus				Lichen/bryophyte	1.2	0.7
Marah oregana				Rock	0.8	0.4
Senecio sylvaticus						
Ferns and allies	**mean rel cov**	**SE**				
Polystichum munitum	2.1	2.1				

TABLE 4. DORENA EAST PLANT COMMUNITY ASSESSMENTS. "MEAN REL COV" = MEAN RELATIVE COVER OF EACH SPECIES. SE = STANDARD ERROR. "MEAN ABSOL COV" = MEAN ABSOLUTE COVER.

Forbs	mean rel cov	SE		Graminoids	mean rel	SE
Sidalcea malviflora ssp. *virgata*	11.2	8.4		*Schedonorus arundinaceus*	3.0	1.8
Galium aparine	2.8	1.3		*Arrhenatherum elatius*	2.7	1.8
Nemophilia sp.	2.4	1.9		*Elymus glaucus*	2.7	1.8
Hyppericum perforatum	2.4	2.0		*Anthoxanthum odoratum*		
Achillea millefolium	1.2	0.8		*Festuca* sp.		
Rumex acetosella	0.9	0.7				
Calystegia atriplicifolia	0.9	0.9		**Trees/Shrubs/Sub-shrubs**	**mean rel cov**	**SE**
Plantago lanceolata	0.9	0.9		*Symphoricarpos albus*	34.4	17.8
Lathyrus holochlorus	0.9	0.5		*Rubus ursinus*	14.5	8.9
Torilis arvensis	0.8	0.5		*Lonicera ciliosa*	6.8	6.8
Geranium dissectum	0.7	0.3		*Quercus garryana*	6.7	4.8
Vicia sativa	0.5	0.2		*Rosa* sp.	1.5	0.9
Leucanthemum vulgare	0.4	0.3		*Toxicodendron diversilobum*	0.6	0.6
Sanguisorba officinale	0.3	0.3		*Crataegus monogyna*		
Fragaria virginiana	0.3	0.3		*Prunus avium*		
Vicia hirsute	0.2	0.2		*Rosa eglanteria*		
Lupinus rivularis	0.2	0.2				
Hypochaeris radicata	0.1	0.1		**Ground cover**	**mean absol cov**	**SE**
Dichelostemma congestum				Bare	6.8	4.5
Epilobium ciliatum				Thatch	22.5	3.2
				Lichen/bryophyte	1.5	0.6
				Rock	0.1	0.1

TABLE 5. DORENA WEST PLANT COMMUNITY ASSESSMENTS. "MEAN REL COV" = MEAN RELATIVE COVER OF EACH SPECIES. SE = STANDARD ERROR. "MEAN ABSOL COV" = MEAN ABSOLUTE COVER.

Forbs	mean rel cov	SE		Graminoids	mean rel cov	SE
Leucanthemum vulgare	10.0	6.6		*Arrhenatherum elatius*	38.8	6.9
Fragaria virginiana	4.0	1.1		*Festuca* sp.	11.2	8.3
Rumex acetosella	2.8	1.1		*Schedonorus arundinaceus*	2.2	1.4
Plantago lanceolata	1.5	1.0		*Anthoxanthum odoratum*	1.0	0.3
Galium sp.	1.3	0.6		*Bromus carinatus*	0.6	0.5
Geranium dissectum	1.0	0.5		*Bromus diandrus*	0.3	0.2
Lathyrus holochlorus	0.8	0.5		*Bromus vulgaris*	0.3	0.3
Hyppericum perforatum	0.6	0.2		*Elymus glaucus*	0.3	0.3
Torilis arvensis	0.6	0.1		*Poa pratensis*	0.2	0.2
Sanguisorba officinalis	0.5	0.5		*Dactylis glomerata*		
Galium aparine	0.4	0.3				
Sanicula crassicaulis	0.4	0.4		**Trees/Shrubs/Sub-shrubs**	**mean rel cov**	**SE**
Vicia sativa	0.3	0.2		*Symphoricarpos albus*	7.4	4.5
Vicia hirsute	0.3	0.2		*Rosa* sp.	7.1	3.9
Achillea millefolium	0.2	0.2		*Quercus garryana*	3.2	1.2
Epilobium ciliatum	0.1	0.1		*Rubus bifrons*	2.7	1.8
Taraxacum officinale	0.1	0.1		*Rubus ursinus*		
Calystegia atriplicifolia				*Toxicodendron diversilobum*		
Camassia leichtlinii ssp. *suksdorfii*						
Dichelostemma congestum				**Ground cover**	**mean absol cov**	**SE**
Potentilla gracilis				Bare	6.1	4.6
Sidalcea malviflora ssp. *virgata*				Thatch	26.3	6.3
Vicia cracca				Lichen/bryophyte	0.5	0.0
				Rock	0.1	0.1

TABLE 6. HANSEN PLANT COMMUNITY ASSESSMENTS. "MEAN REL COV" = MEAN RELATIVE COVER OF EACH SPECIES. SE = STANDARD ERROR. "MEAN ABSOL COV" = MEAN ABSOLUTE COVER.

Forbs	mean rel	SE		Graminoids	mean rel	SE
Hypochaeris radicata	7.2	1.8		*Dactylis glomerata*	14.7	6.3
Leucanthemum vulgare	3.6	0.6		*Anthoxanthum odoratum*	10.0	3.7
Osmorhiza chilensis	1.8	0.5		*Cynosurus echinatus*	9.7	5.6
Lathyrus holochlorus	1.6	0.4		*Elymus glaucus*	2.9	1.0
Geranium dissectum	1.5	0.4		*Bromus carinatus*	1.4	1.2
Daucus carota	1.3	0.9		*Poa pratensis*	0.8	0.2
Vicia sativa	1.2	0.4		*Bromus commutatus*	0.7	0.6
Hyppericum perforatum	0.7	0.2		*Bromus vulgaris*	0.5	0.3
Trifolium dubium	0.6	0.3		*Holcus lanatus*	0.4	0.4
Taraxacum officinale	0.5	0.5		*Arrhenatherum elatius*		
Satureja douglasii	0.4	0.4		*Schedonorus arundinaceus*		
Sidalcea malviflora ssp. *virgata*	0.4	0.4				
Sanicula crassicaulis	0.2	0.2		**Trees/Shrubs/Sub-shrubs**	**mean rel**	**SE**
Trifolium repens	0.2	0.2		*Rubus bifrons*	22.6	3.4
Vicia hirsute	0.2	0.2		*Toxicodendron diversilobum*	11.1	4.5
Cirsium vulgare	0.1	0.1		*Corylus cornuta* var. *californica*	1.5	1.5
Crepis capillaris	0.1	0.1		*Lonicera ciliosa*	1.4	1.2
Acmispon americanus				*Rubus laciniata*	0.3	0.3
Cerastium viscosum				*Amelanchier alnifolia*	0.2	0.2
Fragaria virginiana				*Arbutus menziesii*		
Prunella vulgaris var. *lanceolata*				*Quercus garryana*		
Ranunculus occidentalis				*Quercus kellogii*		
Senecio jacobaea				*Rhamnus purshiana*		
				Rosa sp.		
Ferns and allies	**mean rel**	**SE**				
Polystichum munitum	0.1	0.1		**Ground cover**	**mean absol cov**	**SE**
				Bare	5.2	0.8
				Thatch	25.0	2.2
				Lichen/bryophyte	0.8	0.3
				Rock	0.0	0.0

TABLE 7. SOUTH TAYLOR PLANT COMMUNITY ASSESSMENTS. "MEAN REL COV" = MEAN RELATIVE COVER OF EACH SPECIES. SE = STANDARD ERROR. "MEAN ABSOL COV" = MEAN ABSOLUTE COVER.

Forbs	mean rel cov	SE		Trees/Shrubs/Sub-shrubs	mean rel	SE
Vicia sativa	3.8	1.6		*Rubus ursinus*	39.7	6.4
Galium aparine	2.7	0.7		*Corylus cornuta* var. *californica*	7.9	5.6
Osmorhiza chilensis	1.9	1.3		*Symphoricarpos albus*	7.6	2.1
Lathyrus holochlorus	0.5	0.3		*Viburnum ellipticum*	2.0	1.2
Vicia hirsute	0.2	0.2		*Toxicodendron diversilobum*	1.9	1.2
Hypochaeris radicata	0.1	0.1		*Rubus bifrons*	1.8	1.8
				Berberis aquifolium	1.8	1.8
Graminoids	**mean rel cov**	**SE**		*Oemleria cerasiformis*	1.1	1.1
Dactylis glomerata	23.4	8.9		*Amelanchier alnifolia*	0.5	0.5
Elymus glaucus	1.5	1.0		*Prunus avium*		
Alopecurus pratensis	1.5	0.9		*Quercus garryana*		
Arrhenatherum elatius	0.2	0.2		*Rhamnus purshiana*		
Schedonorus arundinaceus	0.1	0.1		*Rubus parviflorus*		
Bromus carinatus						
				Ground Cover	**mean absol cov**	**SE**
				Bare	10.8	5.3
				Thatch	48.0	13.7
				Lichen/bryophyte	1.5	0.9
				Rock	0.0	0.0

Habitat maintenance

Pre-introduction habitat maintenance activities are detailed in Silvernail (2016). In 2016, no post-introduction habitat maintenance was performed.

Based on 2016 habitat monitoring data, several maintenance tasks are recommended for 2017. See Table 8 below for recommendations. These recommendations should be revised annually based on monitoring results. In order to more broadly improve the habitat, it may be appropriate to perform maintenance tasks outside of the reintroduction plots on a site-by-site basis.

TABLE 8. HABITAT MAINTENANCE ACTIVITIES AT *LATHYRUS HOLOCHLORUS* INTRODUCTION SITES.

Site	Habitat Maintenance Activities
Bake Stewart West	1. Monitor regrowth of shrubs and consider mowing if their growth is significantly outpacing that of *L. holochlorus* and appears detrimental to *L. holochlorus* establishment. 2. There is an overall low cover of non-natives in this plot.
Bake Stewart East	1. Manage *Arrhenantherum elatius* inside and outside of plot. 2. Monitor *Dactylus glomerata* for any increases in cover and manage if necessary.
Dorena East	1. Remove scattered *Hypericum perforatum* plants. 2. Manage *A. elatius* (only found on south side of plot)
Dorena West	1. Grub out roots of *Rubus bifrons*. 2. Remove *Leucanthemum vulgare.* 3. Mow *A. elatius* prior to seed set and after monitoring.
Hansen	1. Grub out roots of *R. bifrons*.
South Taylor	1. Grub out *D. glomerata* and *R. bifrons*. There is significant *R. bifrons* outside of the plot that could be grubbed as well. 2. Consider mowing/cutting to reduce height of *Corylus cornuta* var. *calfornica* if interfering with establishement of *L. holochlorus*.

BUDGET

Table 9 is a summary of all costs associated with the 2016 activities described in this report.

TABLE 9. SUMMARY OF 2016 PROJECT EXPENSES.

Activity	Cost
Project Coordination	$2721
Introduction site management	$567
Outplanting	$1545
Monitoring	$1167
Seed increase	$280
Equipment and Materials	$108
Transportation	$1103
Admin	$1648
Total	$9139

DISCUSSION

It is recommended that monitoring of reintroduction plots occur earlier in early to mid-May, as opposed to the first half of June, as was done in 2016. In the wild, *L. holochlorus* plants senesce over a long period of multiple months, and it is not uncommon to visit a population for seed collection in July to fine

some stems completely brown and withered, while others are green, robust, and appear to be actively growing. It is possible that monitoring of reintroduced plots in June led to an inaccurate picture of survival due to this variability in timing of senescence. An earlier monitoring date will reduce this potential, as well as increase the potential to observe introduced plants in flower.

Additionally, earlier monitoring of the surrounding plant community (late May instead of mid-June) provides a longer window for adaptive management actions that should take place in the late spring and early summer. By not monitoring until as late as mid-June, some habitat management actions no longer had a window of opportunity for success. For example, tall oatgrass (*Arrhenatherum elatius*) may have already set seed by mid-June., Monitoring *L. holochlorus* sites in May would allow for identification of the problem and implementation of management actions before seed set, increasing treatment effectiveness.

It is important not to perform habitat management actions in the spring prior to monitoring because of the potential damage to introduced *L. holochlorus* plants and the resulting impact on monitoring data. Management actions that must occur after monitoring in May and before *L. holochlorus* senescence should be executed with care so as to minimize damage to *L. holochlorus*. By August, most *L. holochlorus* plants will have senesced, opening a window for habitat management that will last through January, when L. holochlorus plants begin to resprout.

NEXT STEPS

The following actions are proposed for 2017:

- Monitor reintroduction plots in May 2017.
- Implement habitat management actions as needed (see Table 8 for a list of recommended actions) immediately following monitoring of *L. holochlorus* and surrounding vegetation and throughout the fall and winter as appropriate.
- Maintain *L. holochlorus* seed increase beds throughout the year. The first seed harvest from these beds is expected 2018 or 2019.

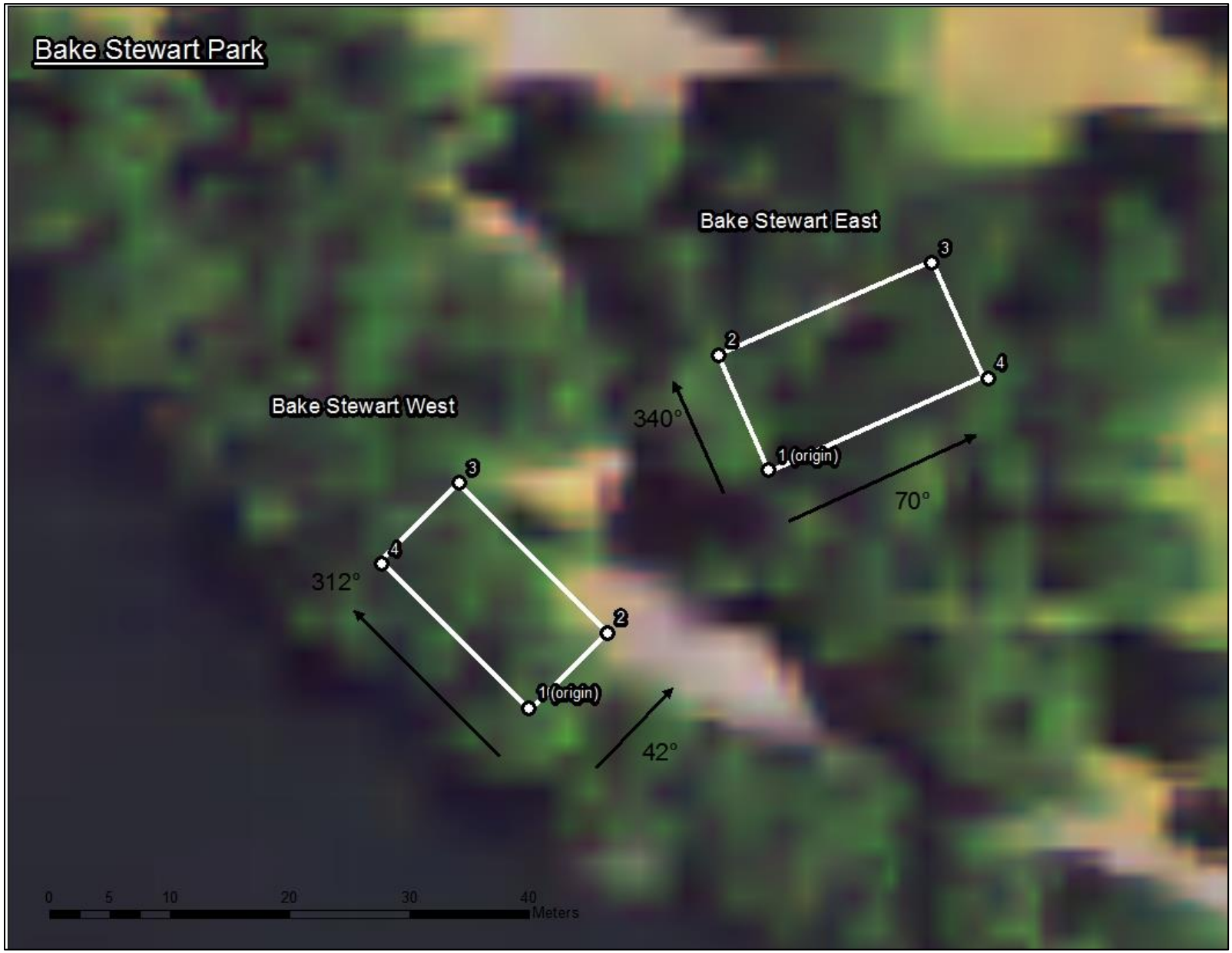
LITERATURE CITED

Silvernail, I. 2016. Population Introduction of the Thin-leaved Peavine: 2015 Annual Report. Institute for Applied Ecology, Corvallis, Oregon. 8 pages.

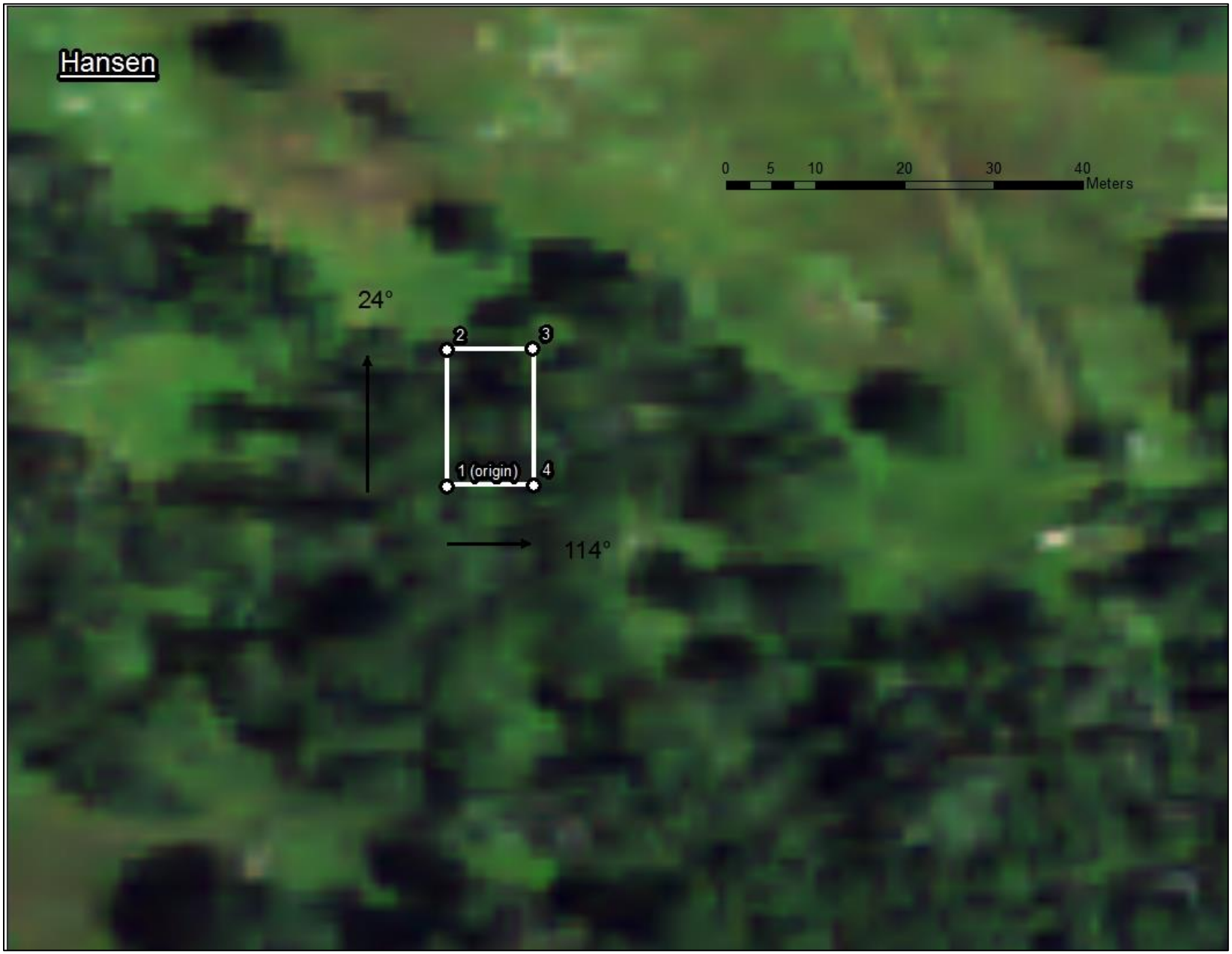
APPENDIX 1: INTRODUCTION PLOT LOCATIONS

Site	Latitude	Longitude
Bake Stewart West	43.74453	-122.89176
Bake Stewart East	43.74471	-122.89158
Dorena East	43.78648	-122.96553
Dorena West	43.78647	-122.96584
Hansen	44.07804	-123.24926
South Taylor	44.12699	-123.29788

APPENDIX 2: INTRODUCTION PLOT LAYOUTS




Dorena
Dorena West
Dorena East
28°
298°
282°
12°
1 (origin)
2
3
4
0 5 10 20 30 40
Meters


Hansen
0 5 10 20 30 40
Meters
24°
2
3
1 (origin)
4
114°


South Taylor
3
2
4
1 (origin)
327°
57°
0 5 10 20 30 40
Meters

APPENDIX 3: INTRODUCTION PLOT PHOTOPOINTS

Photopoints were taken from the corner of each introduction plot looking into the plot. Plot corner numbers listed in the captions below correspond to the plot corner numbers in Appendix 2.

Bake Stewart East. Clockwise from upper left: corner 1(origin), corner 2, corner 3, and corner 4.

Bake Stewart West. Clockwise from upper left: corner 1(origin), corner 2, corner 3, and corner 4.

Dorena East. Clockwise from upper left: corner 1(origin), corner 2, corner 3, and corner 4.

Dorena West. Clockwise from upper left: corner 1(origin), corner 2, corner 3, and corner 4.

Hansen. Clockwise from upper left: corner 1(origin), corner 2, corner 3, and corner 4.

South Taylor. Clockwise from upper left: corner 1(origin), corner 2, corner 3, and corner 4.