

Population status of Kincaid's lupine (*Lupinus oreganus*) in the BLM Roseburg District



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PREFACE

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Cover photographs: Flowering Kincaid's lupine (*Lupinus oreganus*) plant at Dickerson Heights. All photographs by J. Christina Mitchell unless documented otherwise.

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Population status of Kincaid's lupine (*Lupinus oreganus*) in the BLM Roseburg District

EXECUTIVE SUMMARY

Only a few remnant populations of Kincaid's lupine (*Lupinus oreganus*) exist in Douglas County, forming the southern edge of this threatened species' range. In 2021 and 2022, the Institute for Applied Ecology (IAE) monitored the status of Kincaid's lupine populations by assessing foliar (leaf) cover and raceme count at multiple sites in the Bureau of Land Management (BLM) Roseburg District. We assessed populations at the Callahan Meadows, China Ditch, Letitia Creek, and Stout's Creek sites in 2021 and at the Callahan Meadows, China Ditch, Dickerson Heights, Letitia Creek, and Stout's Creek sites in 2022. Vegetation surveying methods were updated between the 2021 and 2022 field season. Results from a comparison experiment confirm high correlation between the two different methods and verify our decision to use the updated, more efficient sampling method in 2022 and subsequent surveys. Foliar cover in 2022 was less than 2020 cover at all sites monitored by IAE. Over the last three years, Kincaid's lupine cover at Callahan Meadows, China Ditch, and Dickerson Heights have declined the most. The number of mature racemes was less in 2022 than in 2020 at four out of five monitored sites. The number of aborted racemes was less in 2022 than in 2020 at all monitored sites.

1. INTRODUCTION

Kincaid's lupine (*Lupinus oreganus*), a member of the legume family (Fabaceae), is an herbaceous perennial that forms clumps of basal leaves which subsequently produce one or more flowering stems. Kincaid's lupine is listed as a threatened species by the Oregon Department of Agriculture and the U.S. Fish and Wildlife Service. This species is a host plant for larvae of the Fender's blue butterfly (*Icaricia icarioides fenderi*; Figure 1), also listed as a threatened species (recently downgraded from endangered; U.S. Fish and Wildlife Service 2023). Kincaid's lupine reproduces by seed, a process dependent on insects for successful fertilization and seed formation (Kaye 1999), and spreads vegetatively, though it is unknown to what extent genetic diversity occurs with vegetative growth. To date, Fender's blue does not occur in Douglas County and there are no historical records of Fender's and Kincaid's lupine co-occurring in this area.

Kincaid's lupine is found in native prairie remnants in the Willamette Valley and forest openings in Douglas County, Oregon, and southwestern Washington. Few remnant populations of Kincaid's lupine exist in Douglas County; seven extant populations are located on BLM land, four are found on private land, and one population is managed by the U.S. Forest Service (Mouallem and Giles 2020).

Previous work by IAE in the BLM Roseburg District consisted of population surveys beginning in 2003 at six sites (Giles-Johnson et al.

2011) and population augmentation efforts from 2016 to 2017 using Kincaid's lupine collected from BLM populations (Giles and Bahm 2017, Mouallem and Giles 2020). The BLM Roseburg District partnered with IAE in 2021 to conduct a three-year long project to continue long-term monitoring of Kincaid's lupine populations and the effects of management on five known populations within areas managed by the BLM Roseburg District. Populations of Kincaid's lupine are censused at Callahan Meadows, Dickerson Heights, and Letitia Creek, while populations at China Ditch and Stout's Creek are too large for censusing and therefore sub-sampled. In 2023, we will visit areas of Kincaid's lupine, outplanted in 2017 and last monitored in 2020, at Callahan Meadows and Stout's Creek to assess survival and reproductive status.



Figure 1. Fender's blue butterfly (*Icaricia icarioides fenderi*) on Kincaid's lupine (*Lupinus oreganus*) at Baskett Slough National Wildlife Refuge. Photograph by Soledad Diaz.

2. GOALS AND OBJECTIVES

The goal of this project is to continue long-term monitoring of Kincaid's lupine populations within areas managed by the BLM Roseburg District (the southernmost portion of this species' range). These efforts help conserve genetic diversity to benefit the long-term survival of this species.

Specific objectives include:

- 1) Continue long-term monitoring of Kincaid's lupine populations at Callahan Meadows, China Ditch, Dickerson Heights, Letitia Creek, and Stout's Creek;
- 2) Assess survival and reproductive status of outplanted Kincaid's lupine at Callahan Meadows and Stout's Creek; and
- 3) Determine potential threats to Kincaid's lupine populations at all sites and suggest management actions for population enhancement.

3. METHODS

3.1. Site Description

Layouts of monitoring plots varied based on the different characteristics of the population or subpopulations at each site. Brief site descriptions are included below; please refer to previous reports for further details (Mouallem and Giles 2020). Monitoring plots were designated by relocatable units or transect segments to facilitate long-term detection and consistently track Kincaid's lupine population densities. Kincaid's lupine populations at Callahan Meadows, Dickerson Heights, and Letitia Creek were censused, and populations at China Ditch and Stout's Creek were sub-sampled. Foliar cover was estimated, mature racemes were counted, and aborted racemes were counted within monitoring areas at each site.

Callahan Meadows – Census; two subpopulations

Callahan Meadows is located near Tiller, OR, about 26 miles east of Canyonville and I-5, and monitoring began in 2003. Subpopulations occur adjacent to a privately-owned meadow and a fence was erected in 2004 to exclude grazing livestock. The larger and southern Subpopulation 1 was monitored with a 12-m² plot and the smaller and northern Subpopulation 2 was monitored with a 6-m long transect. This is the only known Kincaid's lupine site in the Roseburg District that could potentially support Fender's blue butterfly because the surrounding plant communities provide adequate nectar resources, and the site is not alongside a road. This Kincaid's lupine population is also polyploidy, suggesting it is genetically distinct from other Kincaid's lupine populations (Severns 2008).

China Ditch – Sub-sample; three subpopulations

China Ditch is located near the China Ditch Historic Site northeast of Myrtle Creek, OR, and monitoring began in 2004. Vegetation thinning occurred in 2009 and revealed the full extent of the population. Monitoring occurs at three main subpopulations, in Patch A, Patch C, and Patch D. Within each patch,

there are transects of different lengths along the roadside and varying distances away from the roadside. As a subsample, these transects are intended to represent variability in Kincaid's lupine cover across the site and represent a portion of the China Ditch population.

Dickerson Heights – Census; one population



Dickerson Heights is located about nine miles southwest of Winston, OR, on a ridgeline adjacent to BLM road 29-7-3.0, and monitoring began in 2005. Thinning of small trees and shrubs occurred on site in 2009 and 2010. Over time, these monitoring plots have expanded to accommodate the growing Kincaid's lupine population (Figure 2). To accommodate population growth in 2022, one triangular segment (established in 2014) was doubled in size to create a rectangle that extending west from the plot towards the road.

Figure 2. Plot set up at Dickerson Heights, looking southward.

Letitia Creek – Census; two subpopulations

Letitia Creek is located about 11 miles east of Myrtle Creek, OR, along a ridge dividing Letitia Creek and Long Wiley Creek at about 530 m elevation, and monitoring began in 2003. The surrounding area, including the ridgetop, has been subjected to extensive logging. Thinning of small trees and shrubs occurred on site in 2009 and 2010. There are two populations on public land, but most plants in this area are on private property and not monitored by IAE. The smaller population is located on the border between public and private land and monitored with one transect; the larger population along the ridgetop is monitored with multiple transects.

Stout's Creek – Sub-sample; two subpopulations

Stout's Creek is located about three miles south of Milo, OR, and monitoring began in 2005. Thinning of small trees and shrubs occurred on site in 2009 and 2010. Extensive logging and road maintenance occurred between 2014 and 2017 and resulted in the loss of some Kincaid's lupine along the roadside. This Kincaid's lupine population extends across BLM and private land; two subpopulations on public land are monitored. One subpopulation contains four transects and the other contains one transect and three plots. As a subsample, these transects and plots represent a portion of Stout's Creek's population. Similar to Callahan Meadows, Stout's Creek populations also have evidence of polyploidy genes and may be distinct from other Kincaid's lupine populations (Severns 2008).

Loose Laces – No longer monitored by IAE; four subpopulations

Monitoring at this site was initiated in 2003 and transferred to the Bureau of Indian Affairs, Cow Creek Band of Umpqua Tribe of Indians and not monitored by IAE in 2021 or 2022. In 2022, IAE trained Cow Creek staff in Kincaid's lupine sampling techniques (detailed in Section 3.2) and used this site to assess the change in foliar cover protocol. At 30 randomly selected locations, we assessed foliar cover with both 2021-and-prior and proposed-2022 protocols to assess if results from the two techniques were sufficiently correlated to justify the protocol change.

3.2. Population Estimates: Vegetation Sampling

In 2022, we modified the vegetation sampling protocol to be more consistent with methodology from range-wide surveys that have been conducted in recent years (Ottobrino-Haworth et al. 2016). In BLM Roseburg sites prior to 2022, foliar cover was estimated by measuring length and width of Kincaid's lupine patches (or individual plants) with a ruler and then calculating patch area and total area (m²). The updated 2022 protocol estimated percent foliar cover of Kincaid's lupine within 1-m² quadrats and calculated total area (m²). To ensure that 2022 and future Roseburg data are comparable to prior surveys, we estimated foliar cover using both described methods in Spring 2022 and assessed any differences.

Reproductive status was quantified using a protocol that has remained unaltered since the inception of surveys. In all samples, either for censuses or subsamples, Kincaid's lupine racemes were counted and determined as mature (Figure 3a) or aborted (Figure 3b). Mature racemes had a typically developed flowering stem with flowers or developing seed. Aborted racemes often had stunted flowering stems or stems ending in what looked like a grey tassel, and were without flowers or flower scars.



Figure 3. Examples of Kincaid's lupine plants with (a) mature racemes, indicated with red ovals encircling developing seeds, and an (b) aborted raceme, indicated with a red rectangle.

3.3 Data Analyses

We used the 2022 subset data from Loose Laces to calculate a correlation coefficient and assess whether the sampling protocol used in 2022 quantified foliar cover in a comparable way to the previous protocol used in 2021. Correlation coefficients indicate the relationship between two variables and range from -1, indicating a perfect negative relationship, to 1, indicating a perfect positive relationship.

For each site monitored in 2021 and 2022, we compared the most recent surveys (foliar cover, mature racemes, aborted racemes) to a 5-year average of prior surveys (2015 to 2020, as no data were collected in 2018). The 5-year average represented a simple estimate of recent Kincaid's lupine populations and provided a relevant comparison to our current data, allowing us to detect potential trends.

4. RESULTS

In recent years, Kincaid's lupine foliar cover at Callahan Meadows, China Ditch, and Dickerson Heights has declined. There is high variability in the number of mature racemes throughout the years, but there may be some indication of decline at China Ditch. Trends in the number of aborted racemes seem consistent with historical data.

4.1. Protocol Change Assessment

We analyzed the estimates of foliar cover made following protocols used in 2021 and 2022, and the correlation coefficient was 0.92. This correlation coefficient is very close to 1 and considered highly correlated, therefore we present all data collected between 2003 and 2022 together. These results justify the change in protocol and make ongoing surveys more consistent with range-wide Kincaid's lupine assessment methods.

4.2. Callahan Meadows

The previous five-year averages at Callahan Meadows were 16.2 m² foliar cover, 318 mature racemes, and 27 aborted racemes. Foliar cover was 32.0 m² in 2021, then dropped to 6.1 m² in 2022 (Figure 4, Table A1). However, the variation in total number of mature racemes, 598 in 2021 and 332 in 2022, is consistent with trends going back to about 2007 (Figure 5, Table A2). There were 6 aborted racemes in 2021 and 27 in 2022 (Figure 6, Table A3); these numbers represent a slight increase from the last ten years but are similar to numbers around 2007.

An estimated 1900 Kincaid's lupine plants were outplanted in 2017. Outplanted areas were last monitored in 2020 and no plants were found (Giles and Bahm 2017). We plan to monitor outplanted areas in 2023 and confirm the population's status.

4.3. China Ditch

The previous five-year averages at China Ditch were 47.4 m² foliar cover, 510 mature racemes, and 231 aborted racemes. Foliar cover was 24.6 m² in 2021 and decreased in 2022 to 12.5 m² (Figure 4, Table A1). The total number of mature racemes was 202 in 2021 and 212 in 2022, about half of the previous 5-year average (Figure 5, Table A2). The number of aborted racemes was lower than the 5-year average; 24 in 2021 and 17 in 2022 (Figure 6, Table A3).

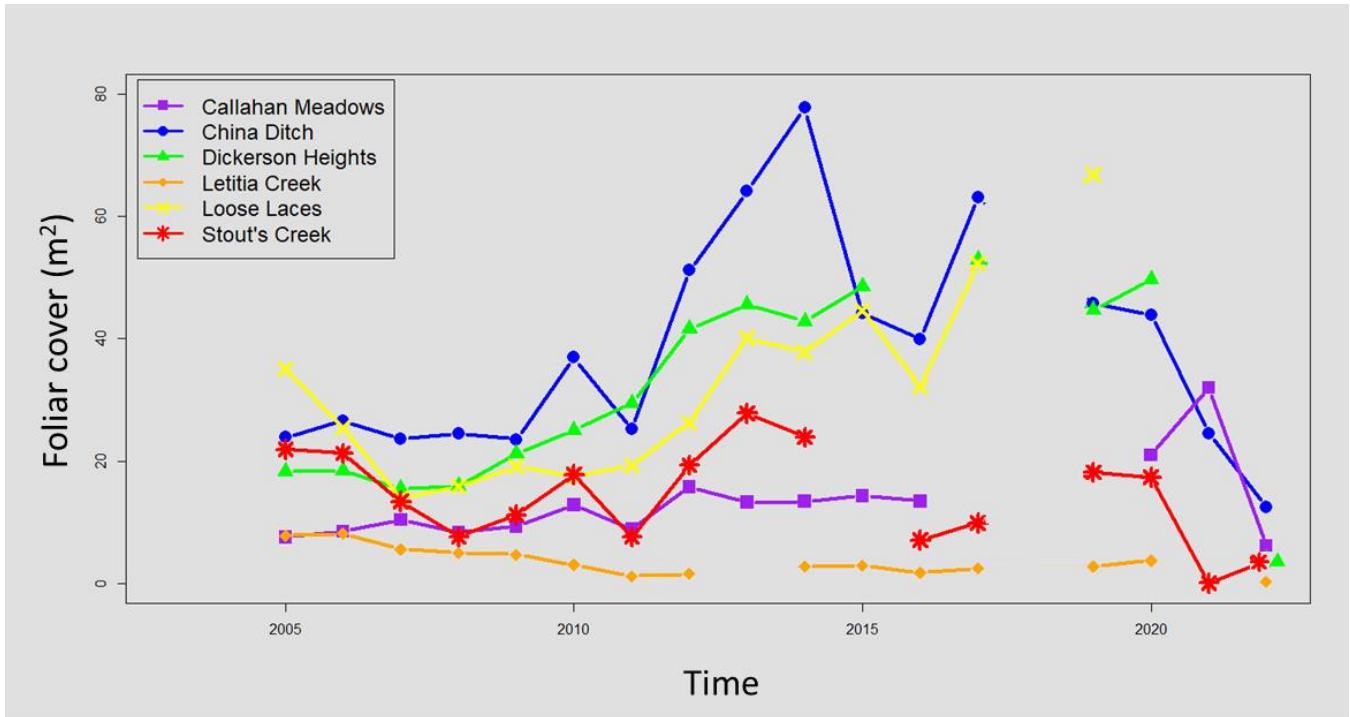


Figure 4. Trends in total number of Kincaid's lupine mature racemes from 2003 to 2022; gaps indicate years without monitoring data. Sites are color coded: Callahan Meadows (purple), China Ditch (blue), Dickerson Heights (green), Letitia Creek (orange), Loose Laces (yellow), and Stout's Creek (red).

4.4. Dickerson Heights

The previous five-year averages at Dickerson Heights were 49.0 m² foliar cover, 456 mature racemes, and 246 aborted racemes. Foliar cover was not monitored in 2021, but the 4.0 m² measured in 2022 was far below the previous 5-year average (Figure 4, Table A1). The number of mature racemes, 696, was greater in 2022 compared to the 5-year average (Figure 5, Table A2) and the number of aborted racemes, 114, was less in 2022 compared to the (Figure 6, Table A3).

4.5. Letitia Creek

The previous five-year averages at Letitia Creek were 2.7 m² foliar cover, 13 mature racemes, and 11 aborted racemes. Foliar cover was not monitored in 2021, but the 0.2 m² measured in 2022 was below the previous 5-year average (Figure 4, Table A1). The total number of mature racemes was 8 in 2022 (Figure 5, Table A2) and the total number of aborted racemes was 0 in 2022 (Figure 6, Table A3).

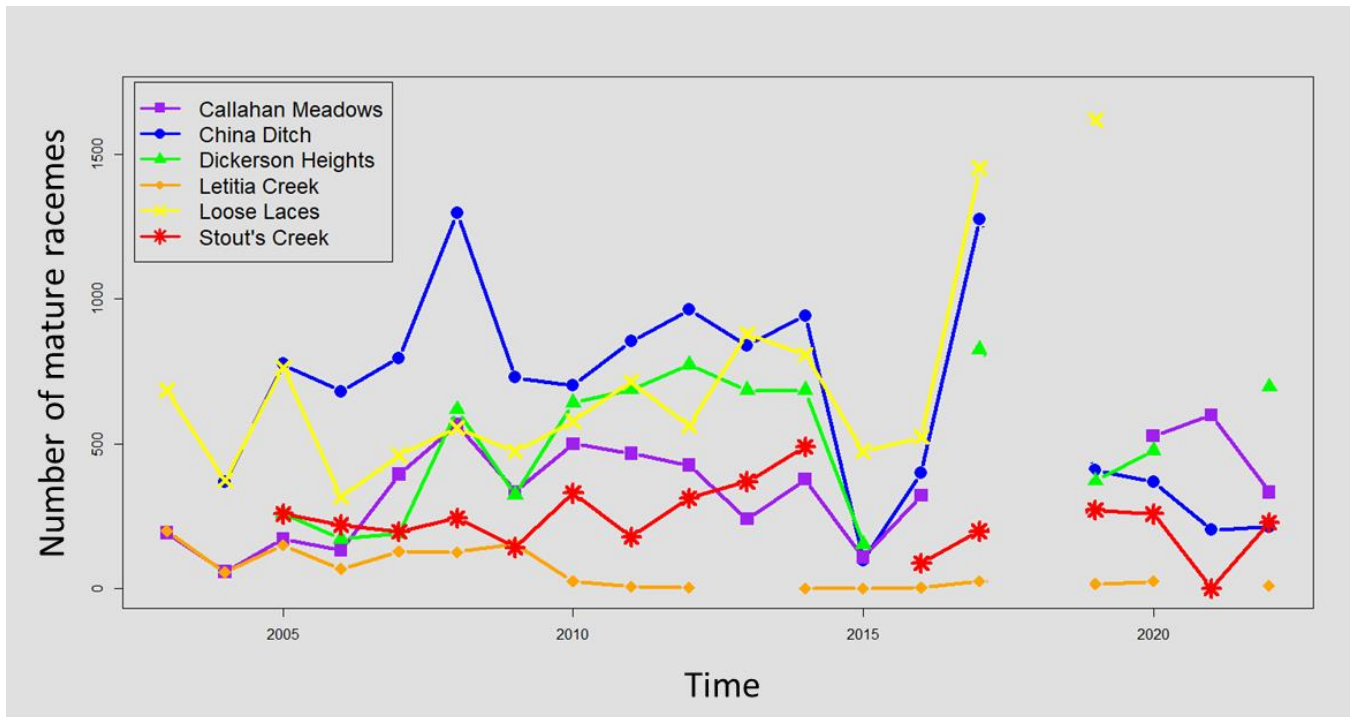


Figure 5. Trends in total number of Kincaid's lupine mature racemes from 2003 to 2022; gaps indicate years without monitoring data. Sites are color coded: Callahan Meadows (purple), China Ditch (blue), Dickerson Heights (green), Letitia Creek (orange), Loose Laces (yellow), and Stout's Creek (red).

4.6. Stout's Creek

The previous five-year averages at Stout's Creek were 13.1 m² foliar cover, 203 mature racemes, and 23 aborted racemes. Foliar cover was 0.7 m² in 2021 (larger populations not sampled) and 3.7 m² in 2022 (smaller populations not sampled; Figure 4, Table A1). The total number of mature racemes was 0 in 2021 when the small population was monitored, and 228 in 2022 when the larger population was monitored (Figure 5, Table A2). Under similar circumstances, the total number of aborted racemes was 0 in 2021 and 17 in 2022 (Figure 6, Table A3).

An estimated 750 Kincaid's lupine plants were outplanted in 2017. Outplanted areas were last monitored in 2020, though due to limited field abilities caused by the pandemic, we were only able to determine the presence of plants and estimated at least 60 surviving Kincaid's lupine plugs (Giles and Bahm 2017). We plan to monitor outplanted areas in 2023 and confirm the population's status.

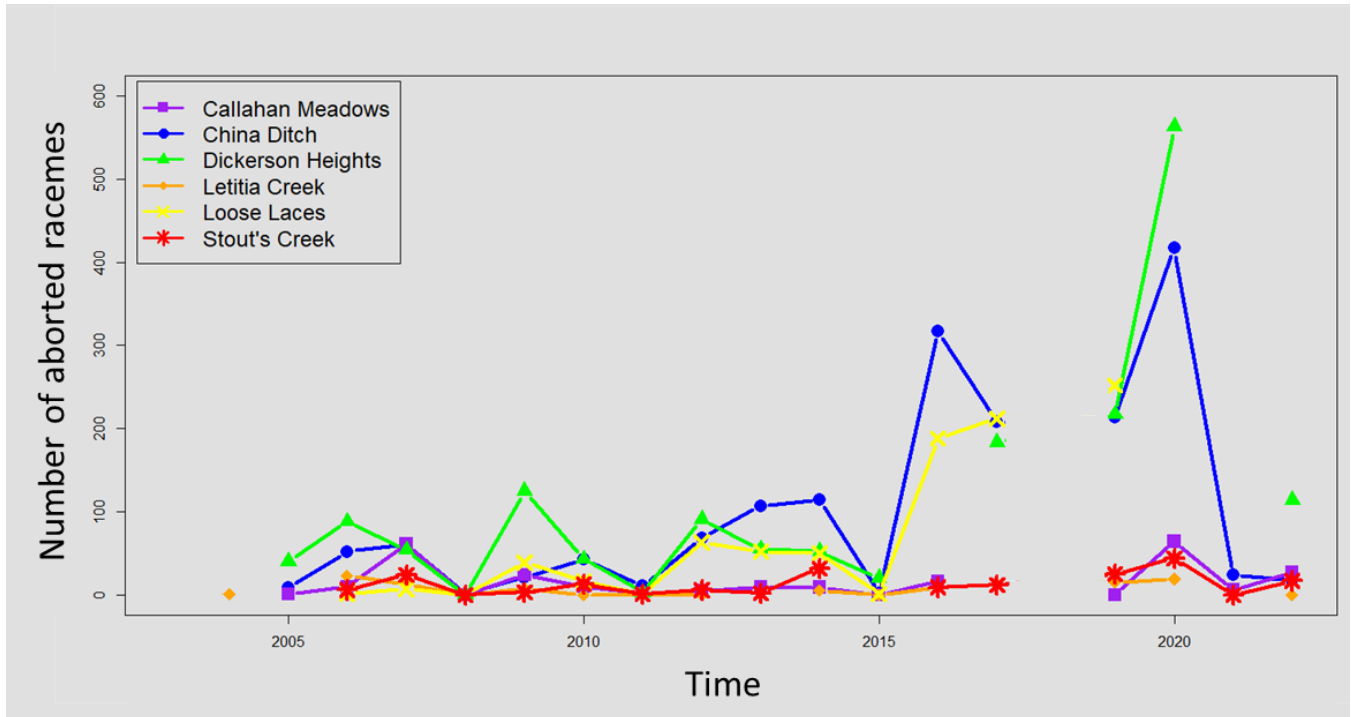


Figure 6. Trends in total number of Kincaid's lupine aborted racemes from 2003 to 2022; gaps indicate years without monitoring data. Sites are color coded: Callahan Meadows (purple), China Ditch (blue), Dickerson Heights (green), Letitia Creek (orange), Loose Laces (yellow), and Stout's Creek (red).

5. DISCUSSION

The percentage of Kincaid's lupine foliar cover and the number of mature and aborted racemes was less in 2022 compared to 2020 at almost every site. There were some subpopulations that were not monitored in 2021 or 2022 due to funding and access issues, but the overall decline is concerning. Foliar cover at Callahan Meadows, China Ditch, and Dickerson Heights declined by approximately half or more, and were lower than 2005 population levels (when monitoring began). The Management and Recovery Plan proposes a goal of 5,000 m² of occupied habitat consisting of at least two meta-populations in Douglas County in order to reach recovery goals (U.S. Fish and Wildlife Service 2010). The Douglas County recovery zone does not meet these goals at this time, and continued monitoring and management are recommended.

Some sites are dense with encroaching native and nonnative woody and herbaceous vegetation, including poison oak (*Toxicodendron diversilobum*) and Himalayan blackberry (*Rubus armeniacus*). This can make navigation and finding 10-20-year-old plot markers more difficult, which contributes to increased time in field. Additionally, competition from other plants can contribute to declines in Kincaid's lupine foliar cover. Trees at China Ditch, Dickerson Heights, Letitia Creek, and Stout's Creek were thinned between 2009 and 2010, and Kincaid's lupine cover exceeded pre-treatment levels for the following three years. Woody debris from vegetation removals was piled and burned on site, and germinated Kincaid's lupine

seedlings were observed in 2011 and 2012. Select vegetation removals should occur every 5-10 years for ideal population management, so we recommend that the BLM Roseburg sites be considered for understory vegetation and canopy thinning. If possible, burning debris on site, in areas absent of Kincaid's lupine, should also be considered.

6. CONCLUSIONS

The following general conclusions can be made from this report:

- The Douglas Recovery Zone for Kincaid's lupine does not meet recovery goals at this time.
- Additional years of monitoring will help to determine whether the declines seen in 2022 are a consistent trend, or merely a result of interannual fluctuation.
- Vegetation removal, understory clearing and canopy thinning, should be considered to release Kincaid's lupine from competition.
- Documentation for reports and future surveys would benefit from remapping all Kincaid's lupine populations and monitoring plots. Additionally, plot markers are 10 to 20 years old and should be replaced.

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APPENDIX A. KINCAID'S LUPINE SUBPOPULATION DATA, 2003-2022

Table A1. Estimated Kincaid's lupine (*Lupinus oreganus*) foliar cover, in m², for each site between the years of 2003 and 2022. NA indicates that subpopulation was not monitored that year.

Foliar Cover (m ²): 2003 - 2022																				
Site	Sub-plots	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019	2020	2021	2022
Callahan Meadows	1	NA	NA	6.85	8.20	10.22	8.21	9.10	12.54	8.68	15.49	12.97	13.12	14.12	13.40	NA	NA	20.98	31.98	6.11
	2	NA	NA	0.69	0.30	0.17	0.15	0.20	0.30	0.16	0.24	0.27	0.26	0.16	0.03	NA	NA	0.03	NA	0
China Ditch	Patch A	NA	NA	5.82	5.34	5.40	6.57	4.35	9.25	9.81	13.67	19.95	21.05	12.37	8.53	13.30	10.15	13.55	NA	2.99
	Patch B	NA	NA	9.36	10.12	9.59	9.77	8.90	16.65	9.89	25.11	27.38	36.59	17.03	20.84	32.26	22.42	16.19	14.64	3.73
	Patch C	NA	NA	8.67	11.10	8.69	8.20	10.28	11.04	5.50	12.40	16.83	20.11	14.79	10.60	17.53	13.19	14.17	9.92	5.79
Dickerson Heights	1	NA	NA	18.24	18.43	15.45	15.89	21.20	25.02	29.44	41.63	45.60	42.82	48.50	NA	52.96	44.66	49.71	NA	4.02
Letitia Creek	Public	NA	NA	0.42	0.60	0.54	0.51	0.54	0.34	0.16	0.38	NA	0.34	0.30	0.14	0	0.31	0.80	NA	0
	Road	NA	NA	7.40	7.52	5.03	4.49	4.17	2.64	1.01	1.16	NA	2.39	2.63	1.60	2.50	2.45	2.94	NA	0.23
Stout's Creek	Below	NA	NA	10.00	10.19	5.08	3.11	4.21	4.76	4.58	6.74	8.01	8.38	NA	7.08	6.44	9.36	7.77	NA	1.31
	Roadside	NA	NA	7.05	8.21	6.37	3.79	6.48	12.50	2.88	12.40	19.73	15.54	NA	0	3.43	8.75	9.59	NA	2.35
	Transect A	NA	NA	0.50	0.31	0.20	0.13	0.08	0.07	0.01	0	0	0	NA	0	0	0	0	0	NA
	Transect B	NA	NA	1.28	0.66	0.44	0.17	0.12	0.15	0	0.08	0.02	0.02	NA	0	0	0.02	0	0.07	NA
	Transect C	NA	NA	1.04	0.88	0.34	0.13	0.13	0.05	0	0.02	0	0	NA	0	0	0	0	0	NA
	Transect D	NA	NA	2.04	1.00	0.95	0.29	0.18	0.26	0.11	0.09	0.05	0	NA	0	0	0	0	0	0

Loose Laces – refer to the monitoring report for data from the last survey of this site (Giles and Gray 2019)

Table A2. Total number of Kincaid's lupine (*Lupinus oreganus*) mature racemes for each site between the years of 2003 and 2022. NA indicates that subpopulation was not monitored that year.

Number of Mature Racemes: 2003 - 2022																				
Site	Sub-plots	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019	2020	2021	2022
Callahan Meadows	1	191	57	168	131	394	565	330	498	464	425	239	376	107	321	NA	NA	526	598	332
	2	NA	0	1	NA	0	1	4	1	2	0	0	0	0	0	NA	NA	0	NA	0
China Ditch	Patch A	NA	95	180	95	171	305	108	183	366	211	298	369	60	57	263	147	128	NA	84
	Patch B	NA	147	257	302	364	546	312	292	388	499	377	373	3	231	706	197	153	115	69
	Patch C	NA	127	338	284	261	446	308	227	100	253	165	200	34	110	307	65	88	87	59
Dickerson Heights	1	NA	NA	259	171	189	618	322	641	688	773	684	684	151	NA	826	371	476	NA	696
Letitia Creek	Public	0	0	4	3	6	3	3	2	0	0	NA	0	0	1	NA	0	0	NA	0
	Road	198	54	145	64	122	122	151	22	5	2	NA	0	0	2	24	15	24	NA	8
Stout's Creek	Below	NA	NA	126	89	55	127	54	41	64	55	56	91	NA	87	128	89	68	NA	127
	Roadside	NA	NA	96	110	118	88	84	288	114	257	131	399	NA	NA	69	181	189	NA	101
	Transect A	NA	NA	5	4	2	8	0	0	0	0	0	0	NA	NA	0	0	0	0	NA
	Transect B	NA	NA	10	0	1	6	0	0	0	NA	0	0	NA	NA	0	0	0	0	NA
	Transect C	NA	NA	5	5	1	2	0	0	0	NA	0	0	NA	NA	0	0	0	0	NA
	Transect D	NA	NA	15	11	19	12	3	0	0	NA	0	0	NA	NA	0	0	0	0	NA

Loose Laces – refer to the monitoring report for data from the last survey of this site (Giles and Gray 2019)

Table A3. Total number of Kincaid's lupine (*Lupinus oreganus*) aborted racemes for each site between the years of 2003 and 2022. NA indicates that subpopulation was not monitored that year.

Number of Aborted Racemes: 2003 - 2022																					
Site	Sub-plots	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2019	2020	2021	2022	
Callahan Meadows	1	NA	NA	1	10	61	0	24	10	2	5	9	9	0	16	NA	NA	64	6	27	
	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	0	0	NA	0	0	NA	0	
China Ditch	Patch A	NA	NA	3	9	7	0	3	11	4	13	33	40	0	83	54	73	121	NA	5	
	Patch B	NA	NA	3	18	24	0	13	21	7	29	37	50	0	141	73	78	160	21	7	
	Patch C	NA	NA	3	25	30	1	5	11	0	26	37	24	2	93	81	62	136	3	5	
Dickerson Heights	1	NA	NA	40	88	54	0	125	43	3	91	55	52	20	NA	183	217	565	NA	114	
Letitia Creek	Public	NA	1	NA	1	0	0	0	0	0	0	NA	0	0	0	NA	2	14	NA	0	
	Road	NA	NA	NA	22	13	0	8	0	0	0	NA	5	0	9	13	13	5	NA	0	
Stout's Creek	Below	NA	NA	NA	3	15	0	3	7	1	5	2	2	NA	9	12	11	15	NA	10	
	Roadside	NA	NA	NA	1	5	0	0	6	0	1	0	30	NA	NA	0	13	29	NA	7	
	Transect A	NA	NA	NA	0	0	0	0	0	0	0	0	0	NA	NA	0	0	0	0	NA	
	Transect B	NA	NA	NA	0	3	0	0	0	0	0	NA	0	0	NA	NA	0	1	0	0	NA
	Transect C	NA	NA	NA	1	0	0	0	0	0	0	NA	0	0	NA	NA	0	0	0	0	NA
	Transect D	NA	NA	NA	1	1	0	0	0	0	0	NA	0	0	NA	NA	0	0	0	0	NA

Loose Laces – refer to the monitoring report for data from the last survey of this site (Giles and Gray 2019)

