

5-YEAR REVIEW

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

GENERAL INFORMATION:

Species: *Lupinus sulphureus* ssp. *kincaidii* [syns. *Lupinus oregonus*, *Lupinus oregonus* var. *kincaidii*]

Date listed: January 25, 2000

FR citation(s): 65 FR 3875

Classification: Threatened

BACKGROUND:

Most recent status review: 5-Year Review completed September 29, 2010. Available at https://ecos.fws.gov/docs/five_year_review/doc3355.pdf, and attached here as Appendix C.

FR Notice citation announcing this status review: 81 FR 7571. [Endangered and Threatened Wildlife and Plants; Initiation of 5-Year Status Reviews of 76 Species in Hawaii, Oregon, Washington, Montana, and Idaho](#). February 12, 2016.

Critical habitat: 71 FR 63862. [Designation of Critical Habitat for the Fender's blue butterfly \(*Icaricia icarioides fenderi*\), *Lupinus sulphureus* ssp. *kincaidii* \(Kincaid's lupine\), and *Erigeron decumbens* var. *decumbens* \(Willamette daisy\)](#). October 31, 2006.

Recovery Plan: 75 FR 37460. [Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington](#). June 29, 2010.

ASSESSMENT:

Information acquired since the last status review: This 5-year review was conducted by the U.S. Fish and Wildlife Service's (USFWS or Service) Oregon Fish and Wildlife Office. Data for this review were solicited from interested parties through a *Federal Register* notice announcing this review on February 12, 2016. We also contacted other Federal agencies (e.g., NRCS, BLM), the Oregon Department of Agriculture, and species experts at nongovernmental organizations (Institute for Applied Ecology, Oregon Flora Project) to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files.

Overview of Assessment: There is no new information available to indicate that a change in the current listing status of the species is warranted. Threats identified and discussed in the most recent 5-year review completed in 2010 generally remain the same. Although a recent rangewide assessment indicates that some new populations have been discovered or established and some populations have increased in abundance since the species was last evaluated in 2010, others have declined over that same time period. The species remains rare over its distribution and most populations are small in size, therefore exhibiting a relatively low level of resiliency over its representative range. Collection of seed and propagation of plugs for population

augmentation or reintroduction is challenging and remains an impediment to recovery. Overall, we conclude the species remains appropriately classified as threatened under the Endangered Species Act of 1973, as amended (Act; 16 U.S.C. 1531 *et seq.*).

New Information: Some new data are available to us with regard to the status of *Lupinus sulphureus* ssp. *kincaidii* from a recent rangewide survey for the species, conducted in the years 2014 through 2016 (Ottombrino-Haworth *et al.* 2017, entire). The results of this survey are discussed in the sections Abundance and Distribution, below. In addition, we have some new information available to us that suggests it would be appropriate to recognize a taxonomic change for *Lupinus sulphureus* ssp. *kincaidii*, most likely elevating the subspecies to full species status as *Lupinus oregonus* (see Taxonomy, below). Finally, there are some research publications regarding *Lupinus sulphureus* ssp. *kincaidii* that have become available since the last status review. We present a summary of those new publications here, noting that while the findings regarding the genetics and management recommendations for the species are useful and informative for recovery actions moving forward, the nature of the studies are such that they do not affect our evaluation of the appropriate status of the species under the Act.

Taxonomy. In our 2010 5-year review for the species, we recommended an evaluation of the taxonomy of *Lupinus sulphureus* ssp. *kincaidii* as multiple names were in use for the species, and there were a number of unresolved issues regarding the naming conventions and genetics of the species at that time. Since 2010 these issues have been addressed, most prominently by the publication of a paper in 2012 titled “Taxonomic Clarification of *Lupinus oregonus* and *Lupinus biddlei* in the Pacific Northwest, USA” (Severns *et al.* 2012, entire). This study examines the history of the taxonomy of Kincaid’s lupine and its classification as *L. sulphureus* ssp. *kincaidii*, the scientific name currently recognized by the Service. The researchers evaluated the putative diagnostic characters in question that resulted in the historical recognition of Kincaid’s lupine as a sister taxon of *L. sulphureus*, and also constructed a phylogeny based on DNA sequencing of various species of *Lupinus*. The conclusion of the study is that the resulting phylogeny does not support the past systematic relationships that led to the recognition of Kincaid’s lupine as *L. sulphureus* ssp. *kincaidii*, and that there are no morphological, geographical, or nomenclatural reasons to rationalize the assignment of Kincaid’s lupine to *L. sulphureus* ssp. *kincaidii*. Based on these findings, the authors recommend “ ‘Kincaid’s lupine’ should be re-elevated to its original specific status as *L. oregonus* Heller, a taxon restricted to western Oregon, southwest Washington, and western British Columbia (historically)” (Severns *et al.* 2012, p. 410).

This taxonomic change for Kincaid’s lupine, from the subspecies *Lupinus sulphureus* ssp. *kincaidii* to the full species *Lupinus oregonus*, has now been recognized by the Oregon Department of Agriculture (Oregon Department of Agriculture, 2019) and by botanical authorities such as the Oregon Flora Project’s Vascular Plant Checklist (Jaster *et al.* 2019) and the Flora of Oregon (S. Meyers pers. comm. 2019). Other authorities, such as the Natural Resources Conservation Service’s USDA PLANTS database (USDA PLANTS 2019), the Integrated Taxonomic Information System (ITIS.GOV 2019), the Flora of the Pacific Northwest (Hitchcock and Cronquist 2018), and Washington Department of Natural Resources (Washington Natural Heritage Program 2019, p. 19) now recognize Kincaid’s lupine as a variety, *Lupinus oregonus* var. *kincaidii* C.P. Sm. (the other variety being *L. oregonus* var. *oregonus*, formerly *L. biddlei*). Whether a full species or an infraspecies, all authorities now agree that at a

minimum, Kincaid's lupine should be recognized under the specific epithet "*oreganus*" instead of "*sulphureus*."

Abundance. As noted in our 2010 5-year review, at the time of listing the Service recognized 54 sites of *Lupinus sulphureus* ssp. *kincaidii*, which had grown to a total of 154 extant sites by 2010. However, as also recognized at that time, determining the number of "sites" in a manner that allows for comparison over time is difficult because there are no standard naming conventions, and sites occurring on different properties, although in close proximity and likely functioning as a single biological population, often had separate names due to past naming conventions or differences in ownership or management practices. The 2010 5-year review recommended the development of a standardized naming convention that reflects "populations" as functional biological units, in conjunction with a clear, consistent method for aggregating sites into populations as defined by the recovery plan for the species. The 2010 5-year review additionally recommended a complete survey effort to assess the status of all presumed extant populations of *L. sulphureus* ssp. *kincaidii* throughout its range, and to gather accurate and up-to-date population estimates in the form of foliar cover (the accepted method for determining population size for this species) for a number of sites.

Both of these recommendations have now been carried out. As part of the construction of a Threatened and Endangered Plants Geodatabase (U.S. Fish and Wildlife Service 2018; developed for the Service by the Institute for Applied Ecology), we now have an established protocol for consolidating *Lupinus sulphureus* ssp. *kincaidii* sites into populations and standardized names for those populations (Ottombrino-Haworth *et al.* 2017, p. 16). In addition, a rangewide survey of *L. sulphureus* ssp. *kincaidii* was completed over the years 2014 through 2016 (Ottombrino-Haworth *et al.* 2017, entire). However, because these new conventions utilized in the geodatabase differ from those relied upon in the 2010 5-year review, the results are not directly comparable between the two reviews, thus any apparent changes in numbers of sites, populations, foliar cover or mapped extent over time should be interpreted with caution. From this point forward, however, all sites and population names will be consistently identified in the geodatabase and should provide the basis for more direct and accurate comparisons of changes in abundance and or distribution over time.

The rangewide survey for *Lupinus sulphureus* ssp. *kincaidii* did not census every known occurrence of the species, but concentrated on those populations with the potential to contribute to the recovery goals for the species. Sites were selected for survey based on a priority system considering population size, connectivity with other populations, landownership, co-occurrence with Fender's blue butterfly, and date of most recent monitoring efforts. Small, isolated populations, especially those on private lands, were not prioritized for surveys. If sites had been monitored within the last 5 years, these sites were not resurveyed, but instead the most recent data were utilized in the report. As a result, the rangewide survey and monitoring report provides data from 84 populations of *L. sulphureus* ssp. *kincaidii* across its range (Ottombrino-Haworth *et al.* 2017, pp. 16, 23, 72–582). These 84 populations are distributed across six recovery zones for *L. sulphureus* ssp. *kincaidii* as follows: 27 in Salem West, 26 in Corvallis West, 14 in Eugene West, 8 in Douglas County, 5 in SW Washington, and 4 in Eugene East. There are no known extant populations in the Corvallis East and Salem East recovery zones.

Table 1 presents a comparison of the estimated extent of foliar cover and mapped polygon extent in each recovery zone for *Lupinus sulphureus* ssp. *kincaidii* at the time of listing (2000), at the time of the 2010 5-year review, and at present. The 2010 5-year review reported a total of 154 extant sites; as of 2019, we have a record of 238 extant sites; however, as noted earlier, due to past inconsistencies in naming conventions not all of these sites are necessarily comparable to the sites that were identified in past analyses. To avoid the inconsistencies with site identification over time, we used measures of foliar cover totaled by recovery zone as the most directly comparable metric by which to assess changes in populations of *L. sulphureus* ssp. *kincaidii* across its range over time.

Overall foliar cover has increased from an estimated range of 14,070 to 19,118 square meters (m²) (1.4 to 1.9 hectares (ha); 3.5 to 4.7 acres (ac)) at the time of listing to approximately 22,785 m² (2.3 ha; 5.6 ac) today (Table 1). A few recovery zones have seen increases in foliar cover of *L. sulphureus* ssp. *kincaidii* since the 2010 5-year review, and in some cases those increases are quite large; these increases are primarily in the Corvallis West and Salem West recovery zones, where recovery efforts, including augmentation and outplanting of *L. sulphureus* ssp. *kincaidii*, have been concentrated in recent years. These zones have benefitted from the availability of seed specific to these areas (the lack of genetically appropriate seed sources is a continuing problem in many of the recovery zones), as well as the incidental advantage gained by *L. sulphureus* ssp. *kincaidii* from being cultivated as the host plant for the endangered Fender's blue butterfly (*Icaricia icarioides fenderi*), which also occurs in those recovery zones. In contrast the foliar cover of *L. sulphureus* ssp. *kincaidii* has declined in the Douglas County and Southwest Washington recovery zones, and has remained roughly the same in Eugene West. However, as this most recent survey was the first rangewide effort using a standardized approach, at this point in time it is difficult to make any truly definitive assessments regarding population trend (Ottombrino-Haworth *et al.* 2017, p. 45). Recovery criteria have not been met for *L. sulphureus* ssp. *kincaidii* in any recovery zone (Ottombrino-Haworth *et al.* 2017, p. 45; see also Appendix A).

In sum, although the overall abundance of *L. sulphureus* ssp. *kincaidii* appears to have increased in foliar cover from a range of roughly 1.6 to 1.9 ha (3.8 to 4.5 ac) in 2010 to 2.3 ha (5.6 ha) today, the magnitude of the change is not so great as to alter our understanding of the status of the species as evaluated in our 2010 5-year review (U.S. Fish and Wildlife Service 2010). Furthermore, inconsistencies in past data collection and site naming conventions make it difficult to draw any real conclusion regarding population trend over time. We have no new information to suggest that there has been any change in the distribution of the species across its historical range since our 2010 5-year review, nor do we have information to suggest that the nature, magnitude, or severity of threats to the species have changed over this time period (see Threats, below).

Conservation and Research

In 2017, the Institute for Applied Ecology submitted a report to the Service detailing the results of a comprehensive rangewide survey of *Lupinus sulphureus* ssp. *kincaidii* (Ottombrino-Haworth *et al.* 2017, entire). As described above, a total of 84 sites were the subject of rigorous assessment in this effort (Ottombrino-Haworth *et al.* 2017, pp. 23, 72–582). In addition to the population metrics of foliar cover and mapped polygon extent previously mentioned, the survey

Table 1. Population estimates for *Lupinus sulphureus* ssp. *kincaidii* over time, by recovery zone. The most recent rangewide survey reported foliar cover only in terms of a single point estimate; however, estimates from the time of listing (denoted as “historic”) and at the time of the 2010 5-year review were presented in terms of both a lower and upper estimate, thus we present those values here as a range (a single value in that column indicates the lower and upper foliar cover estimates were the same).

Recovery Zone	Year	Foliar Cover Estimate (m ²)			Mapped Polygon Extent (m ²)		
		2000 ^a	2010 ^a	2019 ^b	2000 ^a	2010 ^a	2019 ^b
Corvallis West		4,330.0-6,330.0	1,236.4	4,787.7	372,961.1	404,708.0	158,000
Douglas County		1,226.0 – 2,274.0	4,734.2 – 4,865.3	2,447.5	47,799.9	76,851.8	50,745
Eugene East		11.0	446.7	819.7	7,811.6	33,374.9	39,900
Eugene West		7,898.0 – 9,898.0	4,026.7 – 5,948.2	5,898.3	283,346.0	139,493.4	146,400
Salem West		605.0	3,586.7 – 3,995.3	7,540.8	612,283.6	912,452.1	1,150,500
SW Washington		0.0	1,471.6 – 1,801.3	1,291.3	1,084,481.3	24,974.5	35,500
Grand Total (m²)		14,070.0 – 19,118.0	15,502.4 – 18,293.4	22,785.3	2,408,683.4	1,591,854.5	1,581,045
Grand Total (hectares)		1.4 - 1.9	1.6 – 1.8	2.3	240.9	159.2	158.1
Grand Total (acres)		3.5 – 4.7	3.8 – 4.5	5.6	594.9	393.1	391.0

^a data from 2010 5-year review (U.S. Fish and Wildlife Service 2010, p. viii)

^b data derived from Threatened and Endangered Plants Geodatabase (U.S. Fish and Wildlife Service, version 9/18/2018)

additionally recorded measures of prairie quality and diversity to allow evaluation of each site in accordance with the guidelines provided in the recovery plan, as well as nectar abundance at all sites known to be occupied by Fender's blue butterfly. This report presents a wealth of baseline information and, in conjunction with the recently developed Threatened and Endangered Plants Geodatabase (U.S. Fish and Wildlife Service 2018), lays the groundwork for a more accurate and standardized assessment of the status of the species in our next 5-year review.

An active prairie plant working group, composed of representatives from Federal, State, and local agencies and nongovernmental organizations, continues to work toward the conservation and recovery of *Lupinus sulphureus* ssp. *kincaidii* as well as other Willamette Valley prairie plant species of concern. There are multiple ongoing efforts to augment or reintroduce *L. sulphureus* ssp. *kincaidii* on various public and private lands in the Willamette Valley; examples include public lands at the Baskett Butte National Wildlife Refuge and West Eugene Wetlands, and numerous private landowners enrolled in Partners for Fish and Wildlife Agreements or Safe Harbor Agreements (the latter is focused primarily on the conservation of Fender's blue butterfly, but incorporates the conservation of *L. sulphureus* ssp. *kincaidii* as a key component). These efforts are making progress, as represented by the increases in population numbers and foliar cover discussed above, but recovery of the species remains hampered by the dearth of genetically appropriate seed and the challenges of propagating *L. sulphureus* ssp. *kincaidii*. Seed collection and growout efforts are ongoing, but *L. sulphureus* ssp. *kincaidii* has proven to be a high maintenance species in propagation, and several attempts at cultivating the species for seed collection or outplanting have resulted in failure (see, e.g., Institute for Applied Ecology 2018, results of plant production efforts for Kincaid's lupine).

Several new scientific publications have become available since our 2010 5-year review of *Lupinus sulphureus* ssp. *kincaidii*; a list of these new publications is provided in Appendix B. As noted earlier in this document, we have reviewed these publications and although we find them to be helpful and informative for management of the species moving forward, the subject matter of the research does not affect our review of the status of the species under the Act.

The Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington set recovery criteria for *Lupinus sulphureus* ssp. *kincaidii* to serve as a benchmark for the point at which a status review would be likely to result in a potential delisting. The recovery plan set specific goals for the abundance, distribution, protection and management of *L. sulphureus* ssp. *kincaidii*, as well as habitat quality measures, across eight recovery zones within the historical range of the species. Appendix A summarizes the current status of the species relative to the delisting criteria described in the recovery plan; at present, none of the recovery criteria have been fully achieved within any recovery zone for *L. sulphureus* ssp. *kincaidii*.

Threats

The primary threats at the time of listing and at the time of our most recent status review were identified as loss or degradation of habitat due to development, encroachment by woody species, and invasion by aggressive, nonnative plants. Due to the loss of natural disturbance regimes that historically maintained prairie ecosystems in the Willamette Valley (flooding, fire), active management by methods such as burning or mowing is now needed to maintain the early seral conditions required by native prairie species such as *Lupinus sulphureus* ssp. *kincaidii*. New potential threats identified since listing include the potential for hybridization with co-occurring

lupine species (e.g., *Lupinus arbustus*) and the potential effects of climate change (see, e.g., Gray *et al.* 2012, entire). Overall, however, since our 2010 5-year review, the threats have remained generally the same and no new significant threats and no significant new information regarding the species' biological status are known to warrant a change in the Federal listing status of *Lupinus sulphureus* ssp. *kincaidii*.

Conclusion:

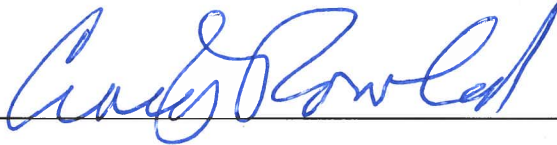
After reviewing the best available scientific information, we conclude that *Lupinus sulphureus* ssp. *kincaidii* remains a threatened species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Act and analysis of the status of the species in our 2010 5-year review remains an accurate reflection of the species' current status.

RECOMMENDATIONS FOR FUTURE ACTIONS:

- Integrate newly standardized site and population naming system into future 5-year reviews to ensure accurate comparisons of population measures over time, and to allow assessment of population trend
- Research more effective and efficient plant propagation techniques for *Lupinus sulphureus* ssp. *kincaidii* to increase likelihood of success in augmentation and reintroduction efforts
- Reassess importance of currently designated seed zones for *Lupinus sulphureus* ssp. *kincaidii*, and consider potential flexibility to allow for the augmentation or establishment of populations in recovery zones where seed or plugs are scarce
- Increase production of *Lupinus sulphureus* ssp. *kincaidii* seed to meet the plant material needs of partnership-driven restoration projects in the Salem West and Corvallis West recovery zones.
- In the absence of natural disturbance, management is imperative for prairie species to maintain the habitat conditions they require. Removal of woody species, control of invasive weeds, and, in some cases, reintroduction of the once common native prairie matrix species may be necessary to maintain suitable habitat for *Lupinus sulphureus* ssp. *kincaidii*
- The majority of the habitat for *Lupinus sulphureus* ssp. *kincaidii* is on private lands, thus partnering with private landowners by working with nongovernmental organizations (e.g., land trusts), local governments such as soil and water conservation districts, and the Service's Partners for Fish and Wildlife program is essential to achieve recovery.
- Work with partner organizations in Douglas County recovery zone to identify additional habitats suitable for establishing populations of *Lupinus sulphureus* ssp. *kincaidii*. The limited extent of currently known available habitat is likely insufficient to support the goal of 5000 m² foliar cover in the Douglas County recovery zone as established in the Recovery Plan (Service 2010, p. IV-36).

- Assess recent taxonomic changes accepted by botanical authorities regarding the scientific name of “Kincaid’s lupine.” If deemed appropriate, develop a formal proposal to update the listed name of the species in 50 CFR 17.12 to reflect the best available scientific data.

State Supervisor, U.S. Fish and Wildlife Service, Oregon Fish and Wildlife Office

Approve  Date 7/29/19

Appendices:

- Appendix A – Recovery criteria for Kincaid’s lupine
- Appendix B – New research publications available since 2010
- Appendix C – Kincaid’s lupine 5-Year Review, 2010

Literature Cited

- Gray, E.C., A.S. Thorpe, and T.N. Kaye. 2012. Abating climate change impacts on Kincaid's lupine. 2012 Interim Report. Prepared by Institute for Applied Ecology for the USDI Bureau of Land Management, Eugene District. Corvallis, Oregon. iii + 13 pp.
- Hitchcock, C.L. and A. Cronquist. 2018. Flora of the Pacific Northwest: An Illustrated Manual, 2nd Edition. Edited by D.E. Giblin, B.S. Legler, P.F. Zika, and R.G. Olmstead. University of Washington Press, Seattle, WA. 936 pp. Checklist for the 2nd Edition, Flora of the Pacific Northwest. <http://www.pnwherberia.org/florapnw/checklist.php>. Accessed July 26, 2019.
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- U.S. Fish and Wildlife Service. 2018. Threatened and Endangered Plants Geodatabase, version 9/18/2018. Unpublished data maintained by U.S. Fish and Wildlife Service, Portland, Oregon. Accessed July 25, 2019.

Washington Natural Heritage Program. 2019. 2019 Washington Vascular Plant Species of Special Concern. Washington Natural Heritage Program Report Number: 2019-04. Washington Department of Natural Resources, Olympia, Washington. , July 15, 2019. 29 pp.

Personal Communications

Dr. Stephen Meyers. 2019. Telephone conversation with Michele Zwartjes, U.S. Fish and Wildlife Service, confirming Oregon Flora Project's treatment of Kincaid's lupine as the full species *Lupinus oregonus* [Volume 2 of the Flora of Oregon is in press and due to come out Summer 2019]. July 26, 2019.

Appendix A. Recovery criteria for Kincaid’s lupine

The Recovery Plan for Prairie Species of Western Oregon and Southwestern Washington set distribution and abundance goals for Kincaid’s lupine to be considered for delisting (U.S. Fish and Wildlife Service 2010, Table IV-5; see Table A-1, below). Additional recovery criteria for the species were set in terms of population trend and evidence of reproduction, habit quality and management (including prairie quality, security of habitat, and management, monitoring, and control of threats), and storage of genetic material (U.S. Fish and Wildlife Service 2010, p. IV-35).

Here we present a brief summary of the most recent data for Kincaid’s lupine based on the results of the 2014-2016 rangewide survey, with respect to the delisting criteria for distribution and abundance, as well as the recovery plan guidelines for prairie quality and diversity (Table A-2). In addition, we provide a summary of the current protection status of the sites, based on the information in our most recent update of the Threatened and Endangered Plants Geodatabase (U.S. Fish and Wildlife Service 2018, accessed July 25, 2019). The recovery plan set goals for a minimum number of populations and foliar cover for eight recovery zones throughout the historical range of the species. Foliar cover goals ranged from one population with a total of 2,500 m² foliar cover in the Salem East recovery zone to three populations with a total of 7,500 m² foliar cover in the Salem West, Corvallis West, and Eugene West recovery zones (U.S. Fish and Wildlife Service 2010, Table IV-5). At the present time, only one recovery zone, Eugene West, meets the recovery target for foliar cover. All recovery zones are lacking in meeting recovery plan guidelines for prairie quality and diversity, and the Salem East and Corvallis East recovery zones still do not have any Kincaid’s lupine populations.

Table A-1. Distribution and abundance goals for *Lupinus sulphureus* ssp. *kincaidii*, adapted from Table IV-5 in the Recovery Plan for Prairie Species of Western Oregon and Southwestern Washington (U.S. Fish and Wildlife Service 2010, p. IV-36); recovery zones that did not include distribution or abundance goals are not included in this version of the table.

Table IV-5. Distribution and Abundance Goals for <i>Lupinus sulphureus</i> ssp. <i>kincaidii</i>		
Status: Threatened		
Recovery Zone	Delisting Goals	
	Minimum # of Populations / Zone	Target Foliar Cover / Zone
SW Washington	2	5,000 m ²
Salem East	1	2,500 m ²
Salem West	3	7,500 m ²
Corvallis East	2	5,000 m ²
Corvallis West	3	7,500 m ²
Eugene East	2	5,000 m ²
Eugene West	3	7,500 m ²
Douglas County	2	5,000 m ²
+ additional populations (may occur in any zone within species’ range)	2	5,000 m ²
Total	20	50,000 m ²

Table A-2. Evaluation of all populations of *Lupinus sulphureus* ssp. *kincaidii* inventoried in 2014-2016 against recovery plan guidelines for prairie quality and diversity and abundance criteria for delisting (from Ottobrino-Haworth *et al.* 2017, pp. 31-34)

Recovery Zone	Total number of populations evaluated in each recovery zone	Number of populations that meet prairie quality and diversity guidelines	Number of populations with abundance meeting (foliar cover > 1000 m ²) or contributing to (foliar cover >100 m ²) recovery guidelines
SW Washington	7	0	3 total 3 (> 100 m ²)
Salem East	0	0	0
Salem West	29	3	7 total 5 (> 100m ²) 2 (>1,000 m ²)
Corvallis East	0	0	0
Corvallis West	26	6	9 total 8 (>100 m ²) 1 (>1,000 m ²)
Eugene East	7	0	0
Eugene West	14	0	5 total 3 (> 1,000 m ²) 2 (> 100 m ²)
Douglas County	7	0	0

Table A-3. Number of extant populations for each recovery zone, and protection status of sites comprising those populations, based on Threatened and Endangered Plants Geodatabase (U.S. Fish and Wildlife Service 2018m accessed July 25, 2019).

Recovery Zone	# of populations	# of sites	Provenance of sites			Protection status of sites					
			Augmented	Introduced	Wild	Unknown	CE/other*	Public	Public ROW	SHA	None
SW Washington	2	6	-	-	-	2		1			3
Salem East	0	-	-	-	-						
Salem West	26	86	2	3	81	1	9	15	21	4	36
Corvallis East	0	-	-	-	-						
Corvallis West	14	85	2	8	75		8	20	21	3	33
Eugene East	6	12			12	1	3	4			4
Eugene West	4	33	3	4	26	1	7	17	2		5

*CE/Other = conservation easement or Partners for Fish and Wildlife landowner agreement

Appendix B. New research publications available since 2010

Giles-Johnson, D.E.L., A.S. Thorpe, R.E. Newton, T.N. Kaye. 2010. *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine) and *Icaricia icarioides fender* (Fender's blue butterfly) in the West Eugene Wetlands: Population monitoring, reintroduction success, and an evaluation of experimental treatments. 2010 Report. Prepared by Institute for Applied Ecology for Eugene District BLM. 26 pp.

Summary: Kincaid's lupine cover at monitored sites increased from the previous year. Burning and mowing both benefit lupine cover; burning is more effective. Estimating foliar cover is a suitable alternative to leaf counting to track trends in Kincaid's lupine within a site. The method is not suitable for comparison between sites, because leaf density is dependent on the light environment.

Gray, E.C., A.S. Thorpe, T.N. Kaye. 2012. Abating climate change impacts on Kincaid's lupine. 2012 Interim Report. Prepared by Institute for Applied Ecology for the USDI Bureau of Land Management, Eugene District. Corvallis, Oregon. iii + 13 pp.

Summary: Interim report on experiment to determine effects of microclimate on Kincaid's lupine establishment. Reports variable germination rates at study sites, but does not include final microclimate effects results.

Severns, P.M., M.V. Wilson. 2011. Resolving conflicts between butterfly host resource abundance and genet population size estimates for a vegetatively spreading, threatened grassland legume. *Biological Conservation*. 144: 1152-1158.

Summary: If properly calibrated, percent cover can be used to estimate genet number of Kincaid's lupine.

Severns, P.M., A. Liston, M.V. Wilson. 2011. Habitat fragmentation, genetic diversity, and inbreeding depression in a threatened grassland legume: is genetic rescue necessary? *Conservation Genetics* 12: 881-893.

Summary: Analysis of simple sequence repeat (SSR) loci in nuclear and chloroplast DNA suggest that a century of habitat fragmentation has not caused a loss in genetic diversity. Kincaid's lupine likely to retain high levels of genetic diversity within populations.

Severns, P.M., A. Liston, M.V. Wilson. 2011. Implications of nonadventitious rhizome spread on reproduction, inbreeding, and conservation for a rare grassland legume. *Journal of Heredity* 102 (4): 371-379.

Summary: Individual genets in study had a maximum average spread distance of 5.5 meters and integrated with intervening genets. Genotype diversity was high, and no evidence was seen indicating a recent genetic bottleneck. Typical *Bombus* sp. foraging flight has approximately 80% chance of crossing between genets.

Severns, P.M., E. Bradford, A. Liston. 2012. Whole genome duplication in a threatened grassland plant and the efficacy of seed transfer zones. *Diversity and Distributions* (2012): 1-10.

Summary: Existing seed zones may not be sufficient to prevent mixing of plants with incompatible ploidy levels, which could undermine conservation efforts. Recommends screening populations for ploidy variations prior to introducing seed from off-site.

Severns, P.M. S.C. Meyers, T. Tran. 2012. Taxonomic clarification of *Lupinus oreganus* and *Lupinus biddlei* in the Pacific Northwest, USA. *Western North American Naturalist* 72(3): 407-411.

Summary: Reviews botanical literature and conducts phylogenetic analysis to suggest that Kincaid's lupine be reclassified as *Lupinus oreganus* (its original name) from *Lupinus sulphureus* ssp. *kincaidii*. Also asserts evidence of hybridization between Kincaid's lupine and *L. arbustus* and *L. albicaulis*.

Thorpe, A.S., S. Perakis, C. Catricala, T.N. Kaye. 2013. Nutrient limitation of native and invasive N₂-fixing plants in northwest prairies. *PLoS ONE* 8(12): e84593.

Summary: Non-nitrogen fertilization (phosphorous or other macro- and micro-nutrients) can boost performance of Kincaid's lupine and may present a strategy to aid populations, but may also boost non-native legumes.

5-YEAR REVIEW

Short Form Summary

Species Reviewed: Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii* [syns. *Lupinus oreganus* var. *kincaidii*, *Lupinus oreganus*])

Current Classification: Threatened

FR Notice announcing initiation of this review: Federal Register: July 6, 2005, Volume 70, Number 128, Pages 38972-38975.

Lead Region/Field Office:

Region 1/Oregon Fish and Wildlife Office, Portland, Oregon

Name of Reviewer(s):

Kate Norman, Oregon Fish and Wildlife Office, Botanist

Jeffrey Dillon, Oregon Fish and Wildlife Office, Supervisory Biologist

Methodology used to complete this 5-year review:

The review was conducted by staff of the Oregon Fish and Wildlife Office of the U.S. Fish and Wildlife Service (Service) beginning on January 1, 2010. The review was based on the final critical habitat designation for *Lupinus sulphureus* ssp. *kincaidii* and two other species found predominantly in the Willamette Valley, Oregon (Service 2006), the final Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington (Service 2010a), and review of current, available information. The evaluation of the status of the species was prepared by our lead *Lupinus sulphureus* ssp. *kincaidii* biologist and reviewed by the Recovery Coordinator for the Oregon Fish and Wildlife Office. The document was then reviewed by the acting assistant project leader before submission to the acting State Supervisor for approval.

Background:

Kincaid's lupine was listed as threatened under the Endangered Species Act (Act) of 1973, as amended (16 U.S. C. 1531 et seq.) in 2000. For more information regarding the species' listing history and other facts, refer to the Fish and Wildlife Service's Environmental Conservation On-line System (ECOS) database for threatened and endangered species (http://ecos.fws.gov/tess_public).

Application of the 1996 Distinct Population Segment (DPS) Policy:

This policy does not apply to plants.

Review Analysis:

Refer to the final critical habitat designation for *Lupinus sulphureus* ssp. *kincaidii* published in the Federal Register on October 31, 2006, and the Final Recovery Plan for Prairie Species of Western Oregon and Southwestern Washington (recovery plan) completed on June 29, 2010, for a complete discussion of the

species status (including biology and habitat), threats, and management efforts. A summary of this information is provided below.

Kincaid's lupine is primarily a prairie plant, although, in Douglas County, it also grows in forests and along forest edges; it is endemic to Western Oregon and Southwestern Washington. Kincaid's lupine is known to occur in eight counties in Oregon and one county in Washington, with the majority of populations located in the Willamette Valley, Oregon. At the time of listing, the Service recognized 54 sites (Service 2000). The number of sites is difficult to estimate as there are no standard naming conventions and sites occurring on different properties, although close in proximity, are often given separate names due to historic naming conventions, landownership, or management practices. The Service currently uses names that are associated with monitoring reports and management agreements. This convention does not reflect "population" as a functional unit, but "site" as a management unit. In order to compare the changes in sites between the time of listing and present conditions, we have analyzed the data using current, Service site naming conventions.

This analysis of historic data resulted in 60 site names that were known at time of listing (Service 2010b). Of these 60 sites, 48 are believed extant at this time. The remaining 12 sites are extirpated, have not been found during recent surveys, or their status is unknown. Since 2000, when Kincaid's lupine was listed, an additional 106 sites have been located; a total of 154 sites are currently believed extant. All recovery zones have shown increases in the number of extant Kincaid's lupine sites. Overall, the estimates of populations indicate an increase from conservative estimate of 14,070 square meters (m²) (3.5 acres) of cover range wide at the time of listing to 15,502 m² (3.8 acres) of cover at present. However, the data is incomplete and statistics relating to increases or decreases in mapped area and low or high population estimates should be interpreted with caution. All site population estimates used in this analysis are presented in Tables 1 and 2 in the appendix.

At the time of listing, Kincaid's lupine was described with the scientific name *Lupinus sulphureus* ssp. *kincaidii*. Historically, it has also been described as a variety, *Lupinus sulphureus* var. *kincaidii* (Stephen Meyers, Oregon Flora Project, pers. comm., 2010). Currently the Service still uses *Lupinus sulphureus* ssp. *kincaidii*. However, several recognized plant authorities in Oregon use different scientific names to describe this species. For example, the Natural Resource Conservation Service in the Plant Database lists Kincaid's lupine as *Lupinus oregonus* var. *kincaidii* (NRCS 2010); the Oregon Flora Project refers to it as *Lupinus sulphureus* ssp. *kincaidii* (Stephen Meyers, Oregon Flora Project, pers. comm., 2010). Dr. Paul Severns, an authority on the species, uses the name *Lupinus oregonus* (Severns 2009). Kincaid's lupine is also listed as *Lupinus oregonus* in Plants of Western Oregon, Washington, and British Columbia (Kozloff 2005). The Service will continue to use *Lupinus sulphureus* ssp.

kincaidii for the present, but is aware that upcoming publications may elevate Kincaid's lupine to full species (*L. oregonus*) status.

Threats to this plant include development, encroachment by woody species, and invasion by aggressive, non-native plants. These threats to habitat have not changed since Kincaid's lupine was listed. Other potential threats include over-use for scientific or educational purposes. Kincaid's lupine has been collected for scientific study under permits from the Service; therefore the threat associated with this activity has been substantially minimized. Kincaid's lupine is currently not used for recreation or commercial purposes; therefore no threats are associated with this type of activity.

Fender's blue butterfly (*Icaricia icariodes fenderii*) uses Kincaid's lupine as its primary larval host plant but occasionally uses *Lupinus arbustus* (spur lupine) and *L. albicaulis* (sicklekeel lupine) when available (Schultz et al. 2003). This relationship was well documented at the time of listing and has not changed. No additional disease or predation issues have been reported. Regulatory mechanisms for Kincaid's lupine are limited to Federal lands and actions (under the Act) or state lands (under state laws). Kincaid's lupine serves as host plant for Fender's blue butterfly and may benefit from the regulations associated with this species when the two are found together. However, the plant itself, when it occurs alone on private lands where no federal agency is involved, is not protected. Voluntary conservation by private landowners has been of great assistance, but no regulatory mechanism exists to protect Kincaid's lupine on private property.

One concern that was not addressed at the time this species was listed was the possibility for Kincaid's lupine to hybridize with co-occurring lupine species. Hybridization, the result of cross breeding between two species, can be detrimental if the offspring that result are maladapted, but compete for the same resources as the co-occurring lupine plants that are capable of sexual reproduction. Hybridization may also be detrimental if continued intermixing results in back crossing to the more common parent plant and, ultimately, swamping of the rare parent genes (Tom Kaye, Institute for Applied Ecology, pers. comm., 2010; Rebecca Currin, Oregon Department of Agriculture, pers. comm., 2010). Kincaid's lupine and spur lupine (*Lupinus arbustus*) are known to hybridize at Baskett Slough National Wildlife Refuge (Liston et al., 1995). In order to determine the role of hybridization and any risk it may pose to this species, additional genetic information is needed for Kincaid's lupine populations throughout its range.

Hybrids, first generation crosses between two species, are generally not regulated by the Act. However, the tendency for plants to share some traits and characteristics based on historic interbreeding is a subject which has not been fully addressed by a Service Policy and is open to interpretation. Because broadly sympatric occurring lupine species (including Kincaid's lupine) appear to

frequently interbreed (Hitchcock and Cronquist 1961), we recommend that plants showing the dominant traits of Kincaid's lupine be regarded as Kincaid's lupine until such time as they are conclusively shown to be the result of direct hybridization, not historic introgression, through genetic studies. This topic will be reviewed as additional information becomes available.

The recovery criteria as described in the recovery plan for this species (Service 2010a) call for a minimum of 20 populations totaling at least 50,000 m² of foliar cover distributed across eight recovery zones. At present, there are 166 named sites distributed between the recovery zones and 154 are believed to be extant at this time (Table 1). Of the extant named sites, only six have a reported foliar cover of at least 500 m² and the majority of sites with data support less than 50 m² of foliar cover. A large number of sites, 68 of the 154 extant sites, do not have reliable population data associated with the location information. Based on the currently available data, none of the recovery zones have met the abundance goals outlined in the recovery plan (Service 2010a, 2010b). In addition to abundance goals, the recovery plan also stipulates that populations should show evidence of reproduction and stable or increasing populations (an attribute that cannot be determined with current foliar cover estimates) and the habitat should be managed to maintain or improve prairie quality and control threats. The recovery plan also recommends that a substantial portion of the populations be secured either by a government agency or a private conservation organization (Service 2010a).

Although the number of populations and the rough population estimate of foliar cover have increased since the time of listing, many of the populations are still unsecured and/or unmanaged. The recovery goals for Kincaid's lupine have not been reached as none of the recovery zones have met the abundance criteria established for this species and the threats of habitat degradation and habitat loss identified at the time of listing have not been removed. Therefore, Kincaid's lupine meets the definition of threatened as it is likely to become endangered within the foreseeable future throughout its range.

Recommendations for Future Actions:

Site naming conventions remain inconsistent and do not reflect "populations" as functional units. We recommend that a standard procedure for aggregating sites into populations be developed so that the Service and our partners can describe the number of populations in a more meaningful way.

We recommend that the taxonomy of this species be reviewed as multiple names are currently being used for the same species. Naming conventions and genetics issues surrounding Kincaid's lupine remain unresolved.

Management is imperative for prairie species to survive. Removal of woody species, control of invasive weeds and, in some cases, reintroduction of the once common native prairie matrix species may be necessary to maintain suitable habitat for Kincaid's lupine.

Recovery of Kincaid's lupine will require voluntary conservation by private landowners. The majority of this species' habitat is privately owned and, due to the regulatory limitations, the Service is not able to prevent privately owned populations from being destroyed. Working with private landowners, conservation organizations, and local governments to conserve and protect Kincaid's lupine is essential to achieving recovery.

We recommend that the issue of hybridization be addressed through genetic analysis or crossing studies of Kincaid's lupine. Current publications are limited to one known instance of hybridization between Kincaid's lupine and spur lupine at Baskett Slough National Wildlife Refuge (Liston et al. 1995). In order to determine the role of hybridization and the risk it poses to this species, additional genetic information is needed for Kincaid's lupine populations throughout its range.

The gaps in data evident in this analysis also indicate the need for accurate and up-to-date population (foliar cover) estimates for a number of sites. We recommend a complete survey effort to assess the status of all presumed extant populations of Kincaid's lupine throughout its range.

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- Liston, A., K. St. Hilaire, and M. V. Wilson. 1995. Genetic diversity in populations of Kincaid's lupine, host plant of Fender's blue butterfly. *Madroño* 42:309-322
- Natural Resource Conservation Service. 2010. PLANTS Database. <<http://plants.usda.gov/index.html>> Accessed July 9, 2010.
- Schultz, C.B., P.C. Hammond and M.V. Wilson. 2003. The biology of the Fender's blue butterfly, an endangered species of western Oregon native prairies. *Natural Areas Journal*. 23:61-71

Severns, P.M. 2009. Conservation genetics of Kincaid's lupine: a threatened plant of Western Oregon and Southwest Washington grasslands. Doctoral thesis, Oregon State University Department of Botany and Plant Pathology. 115 pp.

U.S. Fish and Wildlife Service. 2006. Designation of Critical Habitat for the Fender's blue butterfly (*Icaricia icarioides fenderi*), *Lupinus sulphureus* ssp. *kincaidii* (Kincaid's lupine), and *Erigeron decumbens* var. *decumbens* (Willamette daisy); Final Rule. AGENCY: Fish and Wildlife Service. Federal Register 71: 63862-63977.

U.S. Fish and Wildlife Service. 2010a. Recovery Plan for the Prairie Species of Western Oregon and Southwestern Washington. U.S. Fish and Wildlife Service, Portland, Oregon. xi + 241 pp.

U.S. Fish and Wildlife Service. 2010b. Kincaid's lupine GIS data and corresponding notes to file detailing processes and analyses used for the Kincaid's lupine 5-Year Review. Unpublished data on file at the Oregon Fish and Wildlife Office, Portland, Oregon.

Personal Communications:

Rebecca Currin. 2010. Oregon Department of Agriculture. Email to Kate Norman, U.S. Fish and Wildlife Service, Portland, Oregon on 11 August 2010. Peer Review comments.

Tom Kaye. 2010. Institute for Applied Ecology. Email to Kate Norman, U.S. Fish and Wildlife Service, Portland, Oregon on 3 August 2010. Peer Review comments

Stephen Meyers. 2010. The Oregon Flora Project. Email to Kate Norman, U.S. Fish and Wildlife Service, Portland, Oregon on 6 July 2010. Kincaid's lupine nomenclature.

U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW on *Lupinus sulphureus* ssp. *kincaidii*

Pre-1996 DPS listing still considered a listable entity? NA

Recommendation resulting from the 5-year review:

- Delisting
- Reclassify from Endangered to Threatened status
- Reclassify from Threatened to Endangered status
- No Change in listing status


Field Supervisor, Oregon Fish and Wildlife Office



Date 9/29/10

Appendix

Table 1: Kincaid's lupine current and historic population estimates by site number. For the privacy of our partners, site names have been replaced with unique numeric codes.

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
Corvallis West	1236.4	1236.4	404708.0	4330.0	6330.0	372961.1
1	52.0	52.0	816.2			
2	0.0	0.0	614.5			
3	3.5	3.5	132.5			
4	2.0	2.0	74.5			
5	271.0	271.0	2670.4	1.0	1.0	15159.9
6	0.3	0.3	97.8	100.0	100.0	7811.7
7	0.0	0.0	89573.7	0.0	0.0	192549.9
8	4.5	4.5	114401.9	21.0	21.0	10304.0
9	0.0	0.0	44.9	0.0	0.0	7811.5
10	1.5	1.5	14.1			
11	0.3	0.3	4.4	5.0	5.0	7811.7
12	0.0	0.0	44889.9			
13	32.1	32.1	347.0			
14	0.0	0.0	59556.2			
15	4.0	4.0	37.0			
16	0.0	0.0	13045.8			
17	30.0	30.0	205.4			
18	0.0	0.0	87.5			
19	5.0	5.0	721.4			
20	0.0	0.0	2327.8	200.0	200.0	16827.0
21	15.5	15.5	125.5			
22	4.8	4.8	56.0			
23	0.0	0.0	106.2			

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
24	52.8	52.8	1414.7	0.0	0.0	7811.7
25	4.0	4.0	98.0			
26	22.8	22.8	904.5			
27	0.0	0.0	91.0			
28	2.0	2.0	98.8			
29	0.8	0.8	14.3			
30	5.0	5.0	268.1			
31	5.0	5.0	141.8			
32	0.0	0.0	12038.9	0.0	0.0	7811.4
33	0.0	0.0	7.1	0.0	0.0	7811.5
34	5.0	5.0	151.5			
35	3.0	3.0	184.7			
36	12.0	12.0	49.9			
37	6.0	6.0	268.4			
38	0.3	0.3	42.3			
39	281.0	281.0	21522.5	4000.0	6000.0	21825.9
40	2.8	2.8	71.6			
41	2.0	2.0	23.6			
42	0.0	0.0	187.0			
43	0.0	0.0	13.4			
44	5.0	5.0	162.6			
45	50.0	50.0	1314.2			
46	12.5	12.5	508.2	1.0	1.0	8503.9
47	10.5	10.5	189.2			
48	7.0	7.0	18.1			
49	0.0	0.0	279.8			
50	0.0	0.0	164.4			
51	4.5	4.5	34.5			
52	2.0	2.0	7.8			
53	296.3	296.3	6781.7			

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
54	1.3	1.3	1.3			
55	4.0	4.0	139.9			
56	10.0	10.0	261.3	1.0	1.0	60921.0
57	0.8	0.8	11.0			
58	1.0	1.0	88.3			
59	0.0	0.0	17302.0			
60	0.0	0.0	2089.6			
2009	1.0	1.0	7811.4	1.0	1.0	
Douglas County¹	4734.2	4865.3	76851.8	1226.0	2274.0	47799.9
61	50.0	50.0	1718.7	360.0	360.0	8255.0
62	573.1	573.1	573.1	100.0	200.0	7807.3
63	0.0	0.0	20886.5			
64	0.0	0.0	3747.1			
65	30.0	30.0	714.0			
66	0.0	0.0	250.7			
67	60.0	60.0	501.4			
68	70.0	175.1	3115.0	3.0	3.0	7807.8
69			27.7	0.0	0.0	55.4
70	0.0	0.0	643.5			
71	30.0	40.0	1643.7	500.0	500.0	8756.4
72	30.0	40.0	1643.7			
73	12.0	18.0	1534.6			
74	0.0	0.0	54.3	101.0	1000.0	6360.7
75	2377.7	2377.7	2377.7			
76	1.5	1.5	1531.2			
77	100.0	100.0	11357.5	51.0	100.0	7807.5

¹ Discrepancies were found during peer review of Douglas County data. Service estimates are represented here, however, additional information from the Institute for Applied Ecology reports population estimates as follows: #61 = 9.43 m², #63 = 23.53 m², #67 = 20.65 m², #71 and #72 (combined) = 3.94 m², #74 and #77 (combined) = 19.11 m², #78 = 11 m².

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
78	400.0	400.0	16592.4			
79	0.0	0.0	131.0	10.0	10.0	949.8
2022	1000.0	1000.0	7808.2	101.0	101.0	
Eugene East	446.7	446.7	33374.9	11.0	11.0	7811.6
81	0.0	0.0	463.1			
82	0.0	0.0	9978.1			
83	0.0	0.0	932.5			
84	0.0	0.0	3059.6			
111	444.7	444.7	444.7			
112	0.0	0.0	2873.8			
113	1.0	1.0	7811.6	10.0	10.0	7811.6
2034	1.0	1.0	7811.6	1.0	1.0	
Eugene West	4026.7	5948.2	139493.4	7898.0	9898.0	283346.0
80	0.0	0.0	836.6			
85	0.0	0.0	204.3	3.0	3.0	3442.1
86	0.0	0.0	153.6			
87	300.0	300.0	31769.1	300.0	300.0	68461.4
88	27.4	52.9	235.6	3120.0	3120.0	35784.8
89	0.0	0.0	51.1			
90	0.0	0.0	234.5			
91	166.6	166.6	166.6			
92	0.0	0.0	1194.9	6.0	6.0	9035.0
93	0.0	0.0	65.8			
94	0.0	0.0	4326.7	2.0	2.0	30185.0
95	0.0	0.0	154.2			
96	0.0	0.0	349.6			
97	3160.1	5056.1	12640.3	3000.0	5000.0	30220.0
98	0.0	0.0	233.2			
99	0.0	0.0	4799.9			
100	0.0	0.0	8470.7			

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
101	0.0	0.0	737.7	6.0	6.0	9158.0
102	0.0	0.0	787.4	2.0	2.0	21504.5
103	0.0	0.0	723.0	200.0	200.0	4551.3
104	319.7	319.7	1065.6			
105	0.0	0.0	465.8	3.0	3.0	3583.7
106	0.0	0.0	3465.6	3.0	3.0	3954.2
107	0.0	0.0	8836.0	600.0	600.0	19950.6
108	0.0	0.0	5425.3	200.0	200.0	4166.4
109	0.0	0.0	24214.4	200.0	200.0	33795.6
110	0.0	0.0	73.7	200.0	200.0	5553.3
2027	3.0	3.0	4208.8	3.0	3.0	
2029	12.0	12.0	8090.0	12.0	12.0	
2031	4.0	4.0	7702.1	4.0	4.0	
2032	34.0	34.0	7811.6	34.0	34.0	
Salem West	3586.7	3995.3	912452.1	605.0	605.0	612283.6
114	0.0	0.0	251944.5			
115	6.0	9.0	79.3			
116	28.8	72.1	288.4	1.0	1.0	499884.0
117	0.0	0.0	1814.4	0.0	0.0	7810.9
118	0.0	0.0	12.5	1.0	1.0	7810.8
119	200.0	200.0	3140.8			
120	1.0	3.0	10.5			
121	0.0	0.0	964.0			
122	106.5	133.1	266.3			
123	0.0	0.0	28826.3			
124	0.0	0.0	404.8			
125	0.0	0.0	65.3			
126	0.0	0.0	1247.7			
127	154.4	154.4	474.5			
128	7.8	15.5	118.4	0.0	0.0	13515.5

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
129	0.9	0.9	344.4			
130	83.5	170.9	1847.9	300.0	300.0	11285.1
131	7.0	15.0	102.3	2.0	2.0	7809.7
132	0.9	0.9	164.3			
133	15.3	40.0	1335.7			
134	47.3	47.3	315.0			
135	0.0	0.0	155.5			
136	0.0	0.0	1726.2	0.0	0.0	7809.7
137	875.0	950.0	5939.0			
138	25.0	30.0	1514.9			
139	30.0	30.0	721.8			
140	0.0	0.0	409.7	0.0	0.0	24252.4
141	0.0	0.0	2.9			
142	0.2	0.2	292.1			
143	2.0	5.0	144.4			
144	24.8	24.8	51.7			
145	966.2	966.2	3476.8			
146	0.0	0.0	151.7			
147	0.0	0.0	11968.4	0.0	0.0	32105.4
148	608.2	731.1	2851.3			
154	65.0	65.0	65.0			
155	30.0	30.0	65.0			
2051	1.0	1.0	528710.6	1.0	1.0	
2055	0.0	0.0	24250.8	0.0	0.0	
2058	0.0	0.0	7808.6	0.0	0.0	
2062	300.0	300.0	20569.3	300.0	300.0	
2065	0.0	0.0	7809.0	0.0	0.0	
SW Washington	1471.6	1801.3	24974.5	0.0	0.0	1084481.3
149	0.0	0.0	684.6	0.0	0.0	542240.6
150	1456.6	1779.3	2373.4			

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
151	0.0	0.0	3.0			
152	0.0	0.0	21592.7	0.0	0.0	542240.7
153	15.0	22.0	320.8			
Grand Total	15502.4	18293.4	1591854.5	14070.0	19118.0	2408683.4

Table 2: Current and historic population estimates for Kincaid's lupine by Recovery Zone.

Recovery Zone and Numeric Site ID	CURRENT			HISTORIC		
	Lower Foliar Cover Estimate (m2)	Upper Foliar Cover Estimate (m2)	Mapped Polygon Extent (m2)	Lower Foliar Cover Estimate (m2), historic	Upper Foliar Cover Estimate (m2), historic	Mapped Polygon Extent (m2), historic
Corvallis West	1236.4	1236.4	404708.0	4330.0	6330.0	372961.1
Douglas County	4734.2	4865.3	76851.8	1226.0	2274.0	47799.9
Eugene East	446.7	446.7	33374.9	11.0	11.0	7811.6
Eugene West	4026.7	5948.2	139493.4	7898.0	9898.0	283346.0
Salem West	3586.7	3995.3	912452.1	605.0	605.0	612283.6
SW Washington	1471.6	1801.3	24974.5	0.0	0.0	1084481.3
Grand Total	15502.4	18293.4	1591854.5	14070.0	19118.0	2408683.4