

*Reintroduction of Cook's desert parsley (*Lomatium cookii*) at Waldo-Takilma ACEC and French Flat, 2022 Annual Report*



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PREFACE

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



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COVER PHOTO:

Photo by Tom Kaye of Denise Giles seeding in January of 2022 at Waldo-Takilma ACEC.

SUGGESTED CITATION

Giles, D. 2022. Reintroduction of Cook's desert parsley (*Lomatium cookii*) at Waldo-Takilma ACEC and French Flat, 2022 Annual report. Unpublished report for BLM, Medford District. Institute for Applied Ecology. Corvallis, Oregon.

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EXECUTIVE SUMMARY

This report summarizes the activities conducted by IAE from 2019-2022 at Waldo-Takilma ACEC and French Flat to augment existing populations of Cook's desert parsley (*Lomatium cookii*). Seeding of Cook's desert parsley occurred in November of 2019 and January 2022. Monitoring was conducted in April or May in 2020-2022.

In the fall of 2019, 21,500 seeds were spread over 23 0.5m x 40m plots at the Waldo-Takilma ACEC. In January of 2022, an additional 8 0.5m x 40m plots were seeded at Waldo-Takilma. In addition, in 2022, two larger, 900m² blocks were seeded at both Waldo-Takilma and at French Flat. In each block 2lbs of seed were spread using a belly seeder (equivalent to a seeding rate of 9lbs/acre).

Seeds were provided by BLM partners and were grown at the J. Herbert Stone Nursery. Seeds for this production field were sourced from sites with serpentine-influenced substrates throughout the Illinois Valley.

Germination in the 0.5m x 40m plots seeded in 2022 was 0.05%, with only six seedlings observed in seven monitored plots. A total of 860 plants established from plots seeded in 2019 (4.2% establishment). The larger blocks seeded in 2022 had higher establishment. French Flat had an estimated 3,400 seedlings (95% CI: 1,585-5,215) or 1.7% establishment (95% CI: 1.0%-3.4%). Waldo-Takilma had an estimated 2,693 seedlings (95% CI: 1,864 – 3,523) or 2.2% establishment (95% CI: 1.2%-4.3%).

Reintroduction of Cook's desert parsley (*Lomatium cookii*) at Waldo-Takilma ACEC and French Flat, 2022 Annual Report

INTRODUCTION

Cook's desert parsley (*Lomatium cookii*) is endemic to southwestern Oregon and is listed as endangered by the State of Oregon, and by USFWS (Oregon Biodiversity Information Center 2016). This project contributes to ongoing efforts to increase these species throughout its range. This report summarizes seeding and monitoring activities conducted by Institute for Applied Ecology in cooperation with Medford BLM from 2019-2022.

The 2019 Reintroduction Plan for the species recommends seeding and habitat management in order to reach recovery goals for the species (Kaye et al. 2019). Augmentation of existing Cook's desert parsley were conducted at two sites managed by the BLM, the Waldo-Takilma ACEC and French Flat ACEC both located in the Illinois Valley, Josephine County, Oregon.

Threats to the species include habitat disturbance, introduced species, encroachment by woody species and climate change. The primary constituent elements of habitat identified in the USFWS Recovery Plan (U.S. Fish and Wildlife Service 2012) for *L. cookii* include "vernal pools, seasonally wet meadows within oak and pine forests, sloped mixed-conifer openings, and shrubby plant habitats" dominated by native plant associations, along with intact hydrology and soils that provide for adequate soil moisture.

GOALS AND OBJECTIVES

The goals of this project are to 1) support the recovery of the species by increasing knowledge regarding the success of seeding projects in suitable habitat for the species, 2) augment populations of Cook's desert parsley on BLM lands. Various seeding rates have been employed in this project and will inform appropriate seeding rates as more seed and propagules become available for seeding and augmentation activities.

SPECIES DESCRIPTION AND LIFE HISTORY

The endangered *L. cookii*, Cook's desert-parsley, is a member of the Apiaceae (parsley family). The species is endemic to southwestern Oregon. The plants are usually less than 3 dm tall and inconspicuous except when in flower. Ternately divided leaves feature many narrow leaflets and creamy yellow flowers are produced in compound umbels on leafless stems generally in (Late March) April to May. Density of plants of natural populations, in occupied portions of habitat, can

range from 1.2-2.8 plants/m² at Indian Hill to 7-42 plants/m² at French Flat, both sites managed by the BLM (Pfingsten et al. 2019).

L. cookii is a perennial forb, reproducing exclusively by seed. Individuals tracked over time have been observed to live over 10 years. Observations by IAE have tracked individuals in both natural and introduced populations and found that it takes at least two years, usually 3-4, before plants become reproductive (Kaye et al. 2018). It is not uncommon for reproductive plants to return to a vegetative state in the subsequent year, although some individuals flower multiple consecutive years. Plants may remain vegetative for multiple years before becoming reproductive again.

In natural populations monitored by IAE, ~30% of plants are reproductive in any one year. Annual mortality of individuals ranges from 15-30%; smaller, vegetative individuals are more likely to be absent in subsequent years than large vegetative or reproductive individuals (Kaye et al. 2018). Plants in introduced populations at Reeves Creek and French Flat took longer to transition from seedling (or transplant) to reproductive phase than their natural cohorts (Kaye et al. 2018). Because stable or increasing populations are required in order to meet recovery requirements, it is vital that introduced propagules reach reproductive phases, and that monitoring includes assessments of population structure in at least a sub-sample of the population.

METHODS

2019 Outplantings

Seeded Strips

In November of 2019, in the Waldo-Takilma ACEC, IAE established 23, 40m x 0.5m plots and seeded each strip with 1,140 Cook's desert parsley seeds (equivalent to 1,000 live seeds.) Each plot is marked with two PVC markers 40m apart, with the origin tagged with a numbered, round aluminum tag. A tape was laid between the PVC, and seeds were spread in the 0.5m 'uphill' (generally the north side) of the tape (Figure 1). Seeds were spread by hand and evenly distributed in each plot. No ground preparation treatments occurred. Roughly ~21,500 live seeds were planted across 23 plots for a total seeded area of 450 m² (Appendix A). Three plots are only 20m in length due to habitat constraints, and thus received 500 seeds each; plots 349, 350, and 368 (**Table 3**).

Plant materials for seeding efforts were from a production field at J. Herbert Stone Nursery; this field was established from seeds collected from sites with serpentine-influenced substrate in the Illinois Valley. Each seeded strip received 1,000 live seeds ~ 6g (1,140 total seeds); equivalent to a seeding rate of 25 live seeds/m², and approximately 2.6lbs/acre. Though Cook's desert parsley is present in the vicinity of the plots, plot locations were selected in areas where Cook's desert parsley was not observed to be present within the plot.

Forb species present in seeded blocks at the time of monitoring include yampah (*Perideridia* sp.), quillwort (*Isoetes* sp.), and western buttercup (*Ranunculus occidentalis*). Native graminoids present included California oatgrass (*Danthonia* spp.), tufted hairgrass (*Deschampsia* spp.), and pine bluegrass (*Poa scabrella*); the non-native rat-tail fescue (*Vulpia myuros*) was also noted throughout the site.

2022 Outplantings

Large Blocks

In January of 2022, two larger blocks were seeded using belly seeders at the Waldo-Takilma and French Flat South. Each block was a total of 900m². At Waldo-Takilma the seeded block is 15m x 60m with the long-axis running North to South. At French Flat, the seeded block is 30m x 30m. Each block is marked with PVC markers at each corner. Seeds were spread using a belly seeder by Tom Kaye. Seeds were grown at the J. Herbert Stone Nursery, with a serpentine influenced seed source used for the production field. Seeds for all 2019 and 2022 outplantings were from J. Herbert Stone Nursery and provided by BLM partners (accession numbers S0655-19, 0.984 lbs and S0655-20, 3.015lbs). For all calculations throughout this report, we assumed 77,000 seeds/lb as provided by J. Herbert Stone Nursery for the 2019 accession. A total of 4lbs of seed was spread over the two blocks (2lbs/900m² block); at an equivalent rate of 9lbs/acre, or 171 seeds/m².

Seeded strips

In January 2022 at Waldo-Takilma, we utilized the existing plot structure to seed an additional 8 plots on the 'downhill' (generally south) side of the PVC posts which mark one edge of 0.5m x 40m plots. Seeding rate was double the seeding rate of seeding efforts of 2019, using 2000 live seeds per transect; (12 grams of seed, approximately 5.2lbs/acre, or 50 live seeds/m²). (Plot 360 received only 1000 live seeds in 2022.) Plots seeded in 2022 are listed in **Table 4**.



Figure 1. BLM and IAE staff contribute to seeding efforts in the fall of 2019. Note the PVC marker and tape which delineate the plot edges. Plots are 40m x 0.5m. Seeding efforts in 2022 utilized the same plot infrastructure but were seeded on the 'downhill' (generally southern) side of the plot.

Monitoring

Blocks Seeded in 2022

In May of 2022, IAE monitored for seedling emergence in plots seeded in January of 2022. At Waldo-Takilma the established plot is 60m x 15m (Appendix A. Figure 1). A baseline transect was established along the long axis of the plot and 10cm wide belt transects were monitored for seedlings along these East-West running transects, a total of 9 belt transects were monitored at Waldo-Takilma. Transect placement was determined using a random number generator. At French Flat South, the seeded area is 30m x 30m and a similar monitoring strategy was employed with 15 randomly generated transects running East to West, and monitoring transects with a width of 30 cm (Appendix A. Figure 5).

Seeded Strips Established and Seeded in 2019 and 2022

In late April of 2020, 2021 and May of 2022, IAE revisited the seeded plots to monitor seedling emergence and establishment. Seeded strips at Waldo-Takilma were monitored in 2m long

sections. In 2020 and 2021 every other section was monitored such that one half of each plot was surveyed; in 2022 the entire length of each transect was monitored. In addition to emergence success; life stage, evidence of grazing, and basic characteristics of the substrate and plant community were recorded. Habitat classes were divided into three ground cover classes bareground dominant, grass litter dominant, or pine duff litter dominant (Table 3).

RESULTS

Seeded Blocks

At French Flat the 900m² seeded block which received 2lbs of seed had an estimated 2,693 Cook's desert parsley seedlings (95% CI: 1,864-3,523); this is equivalent to 3.0 plants/m² (95% CI: 2.1-3.9 plants/m²) and an establishment rate of 1.7% (95% CI: 1.2-2.3%) (**Table 1**). The seeded block at Waldo-Takilma (with the same size and seeding rate) had an estimated 3,400 seedlings (95% CI: 1,585 – 5,215). At Waldo-Takilma, there were an estimated 3.8 plants/m² (95% CI: 1.8-5.8 plants/m²) and an establishment rate of 2.2% (95% CI: 1.0-3.4%) (**Table 1**).

Table 1. Population estimates and establishment of plants in 900m² blocks seeded at French Flat and Waldo-Takilma in 2022.

Site	Estimated Number of Plants	95% C.I. (range)	Average Plants/m ²	95% C.I. (range)	% Establishment	95% C.I. (range)
French Flat	2,693	(1,864 - 3,523)	3.0	(2.1-3.9)	1.7%	(1.2- 2.3%)
Waldo-Takilma	3,400	(1,585 - 5,215)	3.8	(1.8-5.8)	2.2%	(1.0- 3.4%)

Seeded Strips

In April of 2020, 1,699 individual seedlings were observed in the 23 seeded plots (15.4% emergence; 95% CI: 11.6-19.1%, Figure 2. Seedlings emerged in all plots and counts conducted in half of each seeded plot ranged from 13 (2.6% emergence rate) to 164 (32.8% emergence rate) per plot (Table 3).

All plants observed in 2020 were categorized in the seedling class. Grazing was observed on 9 of the 1,699 germinants. In 2021, a total of 592 vegetative plants were observed in the monitored portions of each seeded plot (5.1% germination success and survivorship). Seedlings (plants with cotyledons continued to be noted in 2021 with 24 of the 592 plants classified as seedlings. The entirety of each plot was monitored in 2022 and 860 vegetative plants were observed (4.2% survival of germinants). In 2022 19 of the plants observed were classified as seedlings (Table 2).

Table 2. Count (and %) of plants in each size class in the monitored portion of each seeded strip in 2021 and 2022. In 2020 all plants were classed as seedlings. In 2021 only a portion of each plot was monitored. In 2022 the entirety of each seeded strip was monitored. *Plots 348, 349 and 369 are only 20 m long.

Plot #	2021			2022		
	Seedlings	V1-V2	V3	Seedlings	V1-V2	V3
344	0(0%)	5(56%)	4(44%)	1(5%)	15(75%)	4(20%)
347	0(0%)	40(100%)	0(0%)	0(0%)	73(74%)	26(26%)
348*	4(25%)	12(75%)	0(0%)	0(0%)	18(86%)	3(14%)
349*	0(0%)	55(82%)	12(18%)	0(0%)	22(63%)	13(37%)
350	0(0%)	58(88%)	8(12%)	2(9%)	16(70%)	5(22%)
351	2(29%)	5(71%)	0(0%)	0(0%)	0(0%)	0(0%)
352	0(0%)	18(100%)	0(0%)	0(0%)	16(100%)	0(0%)
353	2(2%)	85(92%)	5(5%)	0(0%)	98(64%)	55(36%)
354	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
355	0(0%)	18(100%)	0(0%)	5(6%)	60(68%)	23(26%)
356	0(0%)	8(100%)	0(0%)	0(0%)	3(100%)	0(0%)
357	2(5%)	28(65%)	13(30%)	3(2%)	118(75%)	37(23%)
358	2(3%)	44(71%)	16(26%)	1(1%)	54(71%)	21(28%)
359	0(0%)	0(0%)	0(0%)	1(17%)	3(50%)	2(33%)
360	0(0%)	2(67%)	1(33%)	1(11%)	5(56%)	3(33%)
361	0(0%)	1(100%)	0(0%)	0(0%)	1(100%)	0(0%)
362	1(17%)	5(83%)	0(0%)	0(0%)	3(100%)	0(0%)
363	6(15%)	34(83%)	1(2%)	0(0%)	67(76%)	21(24%)
364	0(0%)	2(67%)	1(33%)	0(0%)	15(94%)	1(6%)
365	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
366	5(7%)	69(91%)	2(3%)	0(0%)	35(78%)	10(22%)
367	0(0%)	14(100%)	0(0%)		no data	
368*	0(0%)	2(100%)	0(0%)	0(0%)	0(0%)	0(0%)
Total	24(4%)	505(85%)	63(11%)	14(2%)	622(72%)	224(26%)

Table 3. Count of plants in 0.5m x 40m strips seeded in November 2019 and monitored in the spring of 2020-200. Plot 367 was not monitored in 2022. *Plots 348, 349 and 368 are only 20m long due to habitat constraints.

Plot #	Dominant Substrate Type	# Lives Seeds	Count of plants			Establishment (%)			Area Surveyed (m ²)			2022 Plants/m ²
			2020	2021	2022	2020	2021	2022	2020	2021	2022	
344	Pine litter	1000	26	9	20	5.2%	1.8%	2.0%	10	10	20	1
347	Grass litter	1000	53	40	99	10.6%	8.0%	9.9%	10	10	20	5.0
350	Pine litter	1000	82	66	23	16.4%	13.2%	2.3%	10	10	20	1.2
351	Grass litter	1000	148	7	0	29.6%	1.4%	0.0%	10	10	20	0.0
352	Pine litter	1000	126	18	16	25.2%	3.6%	1.6%	10	10	20	0.8
353	Grass litter	1000	106	92	153	21.2%	18.4%	15.3%	10	10	20	7.7
354	Grass litter	1000	19	0	0	3.8%	0.0%	0.0%	10	10	20	0.0
355	Grass litter	1000	68	18	88	13.6%	3.6%	8.8%	10	10	20	4.4
356	Grass litter	1000	76	8	3	15.2%	1.6%	0.3%	10	10	20	0.2
357	Bareground	1000	164	43	158	32.8%	8.6%	15.8%	10	10	20	7.9
358	Grass litter	1000	129	62	76	25.8%	12.4%	7.6%	10	10	20	3.8
359	Bareground	1000	46	0	6	9.2%	0.0%	0.6%	10	10	20	0.3
360	Bareground	1000	53	3	9	10.6%	0.6%	0.9%	10	10	20	0.5
361	Bareground	1000	80	1	1	16.0%	0.2%	0.1%	10	10	20	0.1
362	Grass litter	1000	106	6	3	21.2%	1.2%	0.3%	10	10	20	0.2
363	Grass litter	1000	100	41	88	20.0%	8.2%	8.8%	10	10	20	4.4
364	Grass litter	1000	74	3	16	14.8%	0.6%	1.6%	10	10	20	0.8
365	Bareground	1000	14	0	0	2.8%	0.0%	0.0%	10	10	20	0.0
366	Grass litter	1000	13	76	45	2.6%	15.2%	4.5%	10	10	20	2.3
367	Pine litter	1000	18	14	no data	3.6%	2.8%	no data	10	10	no data	no data
348*	Grass litter	500	30	16	21	6.0%	3.2%	4.2%	10	10	10	2.1
349*	Pine litter	500	100	67	35	20.0%	13.4%	7.0%	10	10	10	3.5
368*	Pine litter	500	68	2	0	27.2%	0.4%	0.0%	5	10	10	0.0
TOTAL			21,500	1,699	860	15.4% (±3.7%)	5.1% (±2.3%)	4.2% (±2.1%)	225	230	410	2.1 (±1.1)

Table 4. Seeded strips in 2022. Plots were seeded at a rate of 2,000 live seeds per plot 0.5m x 40m plot. Plot 367_b was not monitored in 2022. *Plot 360_b was only seeded with 1,000 live seeds.

Plot #	Initial establishment rate (%)	# of live seeds seeded in 2022	Seedlings in 2022
352_b	0%	2000	0
356_b	0%	2000	0
359_b	0.3%	2000	5
360_b*	0%	1000	0
361_b	0%	2000	0
364_b	0%	2000	0
365_b	0.1%	2000	1
367_b	Not monitored 2022	2000	Not monitored 2022
Total	0.05%	15,000	6



Figure 2. Seedlings observed in 2020 at Wald-Takilma ACEC.

DISCUSSION AND RECOMMENDATIONS

In 2020, 15.4% ($\pm 3.7\%$) of seeds established as germinants in the first year. In 2015, first year seedling emergence from direct seeding at nearby French Flat ACEC ranged from 12.5% to 61.7% (Giles et al. 2017). In 2022, 4.2% (860) of the 21,500 seeds planted in 2019 had established. Survivorship was highest in the central area, and in plots without pine litter as the dominant substrate. It is possible that if litter had been removed at the time of seeding that establishment would have been higher in the plots with high cover of pine duff.

At the time of monitoring in 2022, no plants had become reproductive, however 224 of the 860 plants observed were vegetative plants with 3 or more leaves. Other work by IAE has shown that plants classified as "V3" (plants with 3 or more vegetative leaves) in natural populations have a 12-15% probability of becoming a reproductive plant in the following year (Pfingsten et al. 2019). Thus, we would expect that in 2023 reproductive plants may be observed in some of the seeded plots.

Seedlings (plants with visible cotyledons) continued to be observed in the plots in 2021 and 2022 indicating that some seeds continued to germinate in the years post-seeding. However, the plots seeded in 2019 which are adjacent to those seeded in 2022 include some of the plots with the lowest germination and survival rates across the site. However, despite the poor germination of the plots seeded in 2022, it is possible that more seedlings will be observed in the coming years.

We recommend continued monitoring of the seedling establishment plots at the Waldo Takilma ACEC and French Flat to evaluate the number of germinants that persist at Waldo-Takilma ACEC, and to assess if these plants become reproductive. Understanding germination and establishment at this seeding rate, across multiple sites will allow land managers to target seeding rates that align with the desired number of Cook's desert parsley at any given site, and provide information to establish timelines for how long it will take to establish reproductive (and potentially self-sustaining) populations of this endangered species. This information will also inform the scale of growout or seed increase projects appropriate for this species.

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APPENDIX A. MAPS OF SEEDED PLOTS

Waldo-Takilma Seeded Areas

Appendix A. Figure 1. Overview of seeded plots in 2019 and 2022 at Waldo-Takilma ACEC. Plots with #_b were seeded in 2022. The block seeded in 2022 15m x 60m. A total of 23 0.5m x 40m plots were seeded in 2019 and 8 0.5m x 40m plots were seeded in 2022.

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Waldo-Takilma: Central Section

Appendix A. Figure 2. Map of center of area seeded at Waldo-Takilma ACEC in 2019. Seeded plots are 0.5m x 40m and seeded on the 'uphill' (generally north) side of the plot.

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Southern Section

Appendix A. Figure 3. Map of southern area seeded in 2019 at Waldo-Takilma ACEC. Seeded plots are 0.5 m x 40m and seeded on the 'uphill' (generally northern) side of the plot.

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Northern Section

Appendix A. Figure 4. Areas seeded in 2019 and 2022 at Waldo-Takilma ACEC. Plots are 0.5m x 40 and seeded on the uphill (northern) side of the plot. Plots with #-b were seeded in 2022 on the southern ('downhill') side of the plot using the same plot infrastructure. The block seeded in 2022 is 15m x 60m.

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French Flat Seeded Block

Appendix A. Figure 5. Block seeded at French Flat in 2022. Seeded area is 30m x 30m.

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