

Columbia yellowcress (*Rorippa columbiae*) population monitoring and conservation: 2022-2025 final project report



March 2025

Report to the Bureau of Land Management,
Lakeview District

Report prepared by J. Christina Mitchell and Scott
Harris

Institute for Applied Ecology



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.



Questions regarding this report or IAE should be directed to:

Keith Norris (Executive Director)
Institute for Applied Ecology
4950 SW Hout St.
Corvallis, OR 97333

phone: 541-753-3099
fax: 541-753-3098
email: info@appliedeco.org

ACKNOWLEDGEMENTS

The authors greatly acknowledge the cooperation and funding provided by the Bureau of Land Management (BLM). Kerry Johnston, John Owens, and other members of the BLM Lakeview District, along with Sandra Klepadlo-Girdner and Erin Rentz of the USDA Forest Service Klamath Ranger District were particularly helpful. We thank Dani Marshall and Jordan Brown of the Oregon Department of Agriculture and Kris Freitag from Portland State University for their coordination with permits and seeds. Field work was supported by Laura Estrada, Ben Stephenson, and Cierra Dawson, and plant propagation was supported by Mara Friddle, Kate Wellons, and other IAE staff. We are grateful to the BLM staff and local volunteers who helped outplant Columbia yellowcress in 2023 and 2024. This project was funded by BLM Assistance Agreement L22AC00087. We thank ESRI for their support of our GIS program. Maps were created using ArcGIS® software by Esri. ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved. For more information about Esri® software, please visit www.esri.com.

Cover photographs: Columbia yellowcress (*Rorippa columbiae*) plant at Featherbed Lake in 2023. Photograph, and all others unless documented otherwise, by J. Christina Mitchell.

SUGGESTED CITATION

Mitchell, J.C. and S. Harris. 2025. Columbia yellowcress (*Rorippa columbiae*) population monitoring and conservation: 2022-2025 final project report. Institute for Applied Ecology. Corvallis, Oregon.

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Columbia yellowcress (*Rorippa columbiae*) population monitoring and conservation: 2022-2025 final project report

EXECUTIVE SUMMARY

Between 2022 and 2025, the Institute for Applied Ecology (IAE) partnered with the Bureau of Land Management (BLM) Lakeview District to research how to maintain and restore a BLM sensitive plant, Columbia yellowcress (*Rorippa columbiae*), and its habitat. On May 3rd 2024, Columbia yellowcress was listed as endangered in Oregon, highlighting the importance of conservation efforts for this species. During this project, we censused or sampled populations at four sites across southern Oregon, and collected vegetation community data from Columbia yellowcress habitat and established demography plots to track growth and survival of individual plants over time on Stukel Mountain. We collected seed from five sites across southern Oregon, and grew hundreds of plugs for outplanting efforts and banked seed to the Rae Selling Berry Seed Bank for long term storage. IAE and our BLM partners are committed to the conservation of this species and would like to continue project efforts. Conservation of this species will preserve the native diversity of plants on Stukel Mountain and in eastern Oregon, and contribute to a better understanding of the trends, demography, and specific ecology of this endangered species in other areas of its range.

1. INTRODUCTION

Columbia yellowcress, *Rorippa columbiae*, is a low-growing perennial forb in the mustard (Brassicaceae) family (USDA NRCS 2016). Columbia yellowcress inhabits shoreline areas with seasonal inundations of water, including along lakes, playas, rivers, streams, and human-made ditches (Kentnesse 2017b). It is unknown exactly how long Columbia yellowcress individuals live. It is considered a perennial species even though individuals may behave as annuals. Plants are capable of reproduction by both seed (sexually) and rhizomes (vegetatively; Kaye 1996, Kentnesse 2017b). Previous surveys of Columbia yellowcress populations across southern Oregon suggested plant survival was threatened by human-, livestock-, and vehicle-related trampling, alteration of hydrologic regimes, and the invasion of and encroachment by nonnative plant species (Kaye 1996, Kentnesse 2017a, Kentnesse 2017b). Columbia yellowcress is a USFS-BLM special status species. It is not federally listed under the Endangered Species Act but was Oregon state listed as endangered on May 3rd, 2024 (Oregon Department of Agriculture 2024). Columbia yellowcress is state listed as threatened in Washington (Washington Natural Heritage Program 1997) and considered rare or endangered in California (California Native Plant Society 2023).

It is expected that water availability and hydrology regimes, together with availability of bare ground and thatch, are the primary drivers of Columbia yellowcress distribution. We observed Columbia yellowcress growing in bare ground, in thatch under and near sagebrush (*Artemisia tridentata*), amongst dense plants (including reed canary grass, *Phalaris arundinacea*), or in dried lake beds with dispersed plants (including tansyleaf evening primrose, *Taraxia tanacetifolia*). We also observed Columbia yellowcress occurring in low, but not typically the lowest, lying swales among other plants and thatch, at mid-elevation areas along “shorelines”, and in bare ground both with and without evidence of trampling. Over multiple visits, we saw evidence of insect and mammal herbivory and other insect interactions (Figure 1). We installed a camera trap to gather more information about the species that interact with Columbia yellowcress habitat on Stukel Mountain. The camera took over 12,000 pictures of 31 different species (11 mammals including cattle, 12 birds, 7 insects, and 1 reptile), providing insight into the variety of species that visit the site and may consume Columbia yellowcress (Mitchell and Harris 2024).



Figure 1. Examples of insects associating with Columbia yellowcress on Stukel Mountain, including a a) thread-waisted wasp (Sphecidae), b) Brassicaceae-dependent caterpillar (Pieridae: *Pontia*), c) native sweat bee (Halictidae: *Lasioglossum*), and d) hoverfly (Syrphidae). The wasp, bee (with visible pollen on the legs), and fly are likely contributing to pollination services for Columbia yellowcress.

The BLM Klamath Falls Field Office, as part of the National Seed Strategy for Rehabilitation and Restoration within the Klamath Falls Resource Area, partnered with IAE in 2022 to conduct a three-year project to monitor, conserve, and augment populations of Columbia yellowcress on Stukel Mountain and other populations in Klamath and Lake counties. The status of Columbia yellowcress populations across its range is relatively unknown, as most data are outdated. In 2022, we censused two populations of Columbia yellowcress and collected community data from Stukel Mountain. We also collected seed from Sprague River populations, grew plugs over the winter, and outplanted ~500 plugs on Stukel Mountain in Spring 2023. In 2023, we surveyed Columbia yellowcress populations and surrounding plant communities, and collected seed from five sites (Stukel Mountain, Sprague River, Foley Lake, Featherbed Lake, and Paulina Marsh). We sowed seed into plugs over the winter and outplanted 523 plugs across four sites in Spring 2024. In 2024, we again surveyed Columbia yellowcress populations and surrounding plant communities, and collected seed from five sites. We banked 60-200 Columbia yellowcress seeds per site to the Rae Selling Berry Seed Bank and sowed remaining seed for seed amplification efforts. In March 2024, we hosted the first Columbia yellowcress working group meeting in coordination with the Oregon Department of Agriculture. This meeting gathered 23 people from 11 agencies who are working or interested in Columbia yellowcress monitoring and conservation. On March 13, 2025, we hosted the second annual working group meeting with 16 people from 11 agencies in attendance. Attendees were thankful for our dissemination of Columbia yellowcress information and expressed interest in collaboration and ongoing meetings related to this species.

2. GOALS AND OBJECTIVES

The goals of this project are to develop methods for effective Columbia yellowcress population establishment and to inform management strategies for conserving this species and its habitat.

Specific objectives are:

- 1) Track demography of the naturally occurring Columbia yellowcress populations and outplanted plugs at Stukel Mountain, Foley Lake, Featherbed Lake, and Paulina Marsh;
- 2) Census or sample Columbia yellowcress and quantify associated vegetation communities at Stukel Mountain, Foley Lake, Featherbed Lake, and Paulina Marsh;
- 3) Collect and grow Columbia yellowcress seeds from Stukel Mountain, Sprague River, Foley Lake, Featherbed Lake, and Paulina Marsh populations; and
- 4) Share knowledge of Columbia yellowcress research and conservation by convening an annual working group.

3. METHODS

3.1. Site Descriptions

Since 2022, IAE has conducted work related to Columbia yellowcress at five different sites across Klamath and Lake Counties: Stukel Mountain, Sprague River, Foley Lake, Featherbed Lake, and Paulina Marsh (Figure 2). Previous to these efforts, these sites had last been surveyed in 2016 (Kentnesse 2017a).

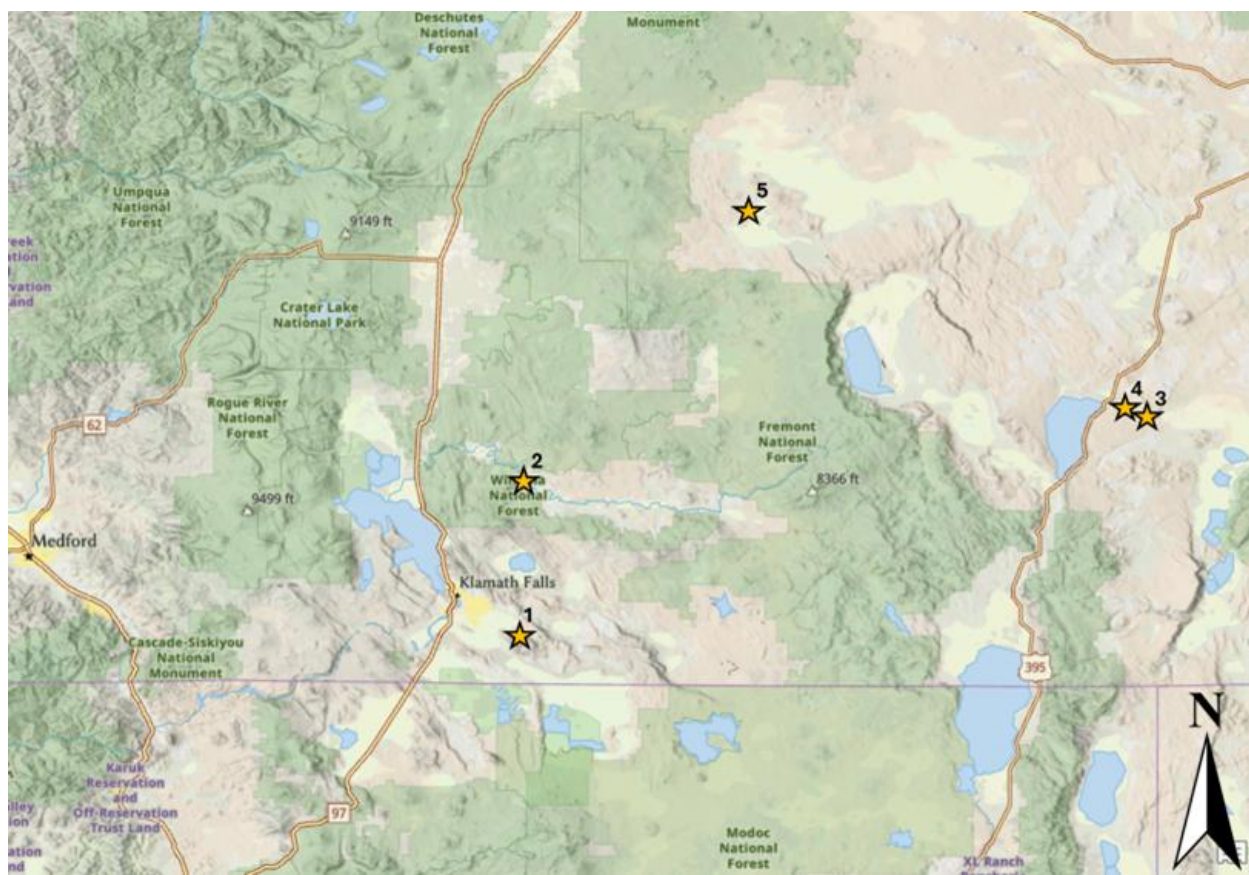


Figure 2. Columbia yellowcress (*Rorippa columbiae*) populations in southeastern Oregon where IAE has conducted work since 2022: 1) Stukel Mountain, 2) Sprague River, 3) Foley Lake, 4) Featherbed Lake, and 5) Paulina Marsh.

Stukel Mountain

This site is located southeast of Klamath Falls in Klamath County, OR and managed by the Bureau of Land Management (BLM; Appendix A). During this project, we censused two naturally occurring populations of Columbia yellowcress on Stukel Mountain, one around a seasonal pond at 4990 ft elevation on BLM land (Stukel 1 ‘pond’) and one at 5070 ft elevation on private land (Stukel 2 ‘private’). Through outplanting efforts, we introduced Columbia yellowcress to two new locations on Stukel Mountain, the Stukel 3 ‘exclosure’ site and the Stukel 4 ‘van meter’ site. We chose these locations for introductions because the Stukel 3 ‘exclosure’ area has seasonal inundations of water and a fence that separates the site, allowing us to compare effects of grazing on Columbia yellowcress establishment, while the Stukel 4 ‘van meter’ site occurs on either side of a reservoir and allows us to understand Columbia yellowcress establishment in an area with different characteristics.

Sprague River

This site is located northeast of Klamath Falls in Klamath County, OR and managed by the United States Forest Service (Appendix A). The Sprague River area is an example of Columbia yellowcress in a streambank habitat that exhibits metapopulation dynamics and is the largest population in Oregon (Kentnesse 2017a). We collected seed from Sprague River Main (around 4285 ft elevation) in 2022, 2023, and 2024 for seed banking and testing, and outplanting efforts at Stukel Mountain. Columbia

yellowcress occurs on both banks of the river and on the in-river island, often growing in swales in the open or around sagebrush plants and thatch.

Foley Lake

This site is located east of Lake Abert and east of Featherbed Lake, in Lake County, OR and managed by the BLM (Appendix A). In 2023, IAE surveyed and collected seed from this Columbia yellowcress population (around 5060 ft elevation), and in 2024 we outplanted plugs, surveyed, and collected seed. At this site Columbia yellowcress occurs within the 'bathtub ring' around the edge of the seasonal lake, in association with sagebrush and tansyleaf evening primrose plants (Figure 3). There is a fenced off section of the lake and vegetation conditions vary between the areas (we only surveyed for Columbia yellowcress outside of the fence). We found numerous healthy Columbia yellowcress in 2023 but only found desiccated Columbia yellowcress plants during our visit in August 2022.

Featherbed Lake

This site is located east of Lake Abert and west of Foley Lake, in Lake County, OR and managed by the BLM (Appendix A). In 2023, IAE surveyed and collected seed from this Columbia yellowcress population (5320 ft elevation), and in 2024 we outplanted plugs, surveyed, and collected seed. This site has a smaller reservoir dug into the middle of the lake, and we found Columbia yellowcress occurring around the edge of this water source and not around the visible edge of the lake. We saw standing water within this reservoir in August 2023, but not in May or August 2024. The landscape is mostly open, with tansyleaf evening primrose plants throughout.

Paulina Marsh

This site is located north of Silver Lake in Lake County, OR alongside County Rd 5-13 (also called Pitcher or Picture Rd, depending on the map) in the public right of way and is managed by the Oregon Department of Transportation (Appendix A). In 2023, IAE surveyed and collected seed from this Columbia yellowcress population (4320 ft elevation), and in 2024 we outplanted plugs, surveyed, and collected seed. Columbia yellowcress plants occur in the lower lying areas of the ditch that runs along the road, including at culvert junctions. The public right of way is surrounded by private property, most with grazing cattle, that looks similar to Columbia yellowcress habitat.



Figure 3. Examples of Columbia yellowcress plants (circled in black) growing amongst similar looking plants, including *Rorippa curvisiliqua* (top picture, to the right) and *Taraxia tanacetifolia* (bottom picture, to the left).

3.2. Population Census, Outplanting Survival, and Demography Plots

Depending on the year, we surveyed Columbia yellowcress populations in July during data collection or in August during data and seed collection. While surveying, Columbia yellowcress plants were marked with pin flags then georeferenced using Field Maps software on a Samsung tablet and a Bad Elf GNSS surveyor with GPS accuracy of 1–3 meters.

Stukel Mountain

In July 2022, we censused the Stukel 1 ‘pond’ and Stukel 2 ‘private’ Columbia yellowcress populations. In July 2023, we censused the naturally occurring plants at the Stukel 1 and Stukel 2 sites, counted the surviving outplanted plants at the Stukel 1 and Stukel 3 ‘exclosure’ sites (methods based on Kaye 1996, Mitchell and Harris 2023), and established demography plots at the Stukel 1 and Stukel 3 sites (Mitchell and Harris 2024). Between July and August 2024, we censused naturally occurring plants at the Stukel 1 and Stukel 2 sites, counted surviving outplanted plants at the Stukel 1, Stukel 3, and Stukel 4 ‘van meter’ sites, and monitored demography plots at the Stukel 1 and Stukel 3 sites.

Other Sites

In July 2023, we counted Columbia yellowcress plants and collected data from a sample of the population at Featherbed Lake. In August 2024, we counted Columbia yellowcress plants and collected data from a sample of the population at Foley Lake, Featherbed Lake, and Paulina Marsh. Due to time constraints, we were unable to survey the entire possible Columbia yellowcress habitat at these three sites, but we collected data from a subsample of plants.

3.3. Surrounding Vegetation Community

We quantified the vegetation community associated with Columbia yellowcress on Stukel Mountain in 2022, 2023, and 2024. We established two transects across the microelevation gradient of the Stukel 1 ‘pond’ site and quantified the vegetation community within 1x1-m quadrats (Mitchell and Harris 2023) in July of 2022, 2023, and 2024. We collected vegetation community data from quadrats spanning the microelevation gradient at the Stukel 2 ‘private’ site in 2022, but did not collect data in subsequent years because we found no Columbia yellowcress plants in 2023 or 2024. We collected quadrat-based vegetation community data from areas where Columbia yellowcress plants were outplanted around the Stukel 3 ‘exclosure’ site in July 2023 and August 2024. Within each quadrat, percent cover was estimated for each plant species and seven types of ground cover: bare ground, rocks, moss and lichen, standing water, fecal matter (e.g. cattle, ungulate, rodent), woody litter (e.g. sage branches, pine cones), and non-woody litter (e.g. grasses or other herbaceous material; Mitchell and Harris 2023).

Columbia yellowcress conservation can benefit from understanding long-term associations among vegetation communities, to inform which species and conditions may be beneficial or antagonistic to Columbia yellowcress survival. Long-term monitoring is critical to track how well natural and augmented populations establish, and to evaluate how populations respond to infrequent events (e.g., drought) or changes that may take several years to express (e.g. inbreeding depression, soil seedbank replenishment, hydrology regimes; Maschinski and Haskins 2012).

3.4. Seed Collection and Plant Propagation

In August 2022, we collected Columbia yellowcress seed from the populations at Sprague River Main and grew about 500 plugs between winter and spring (Mitchell and Harris 2023). On May 1st 2023, we outplanted plugs around the Stukel 1 ‘pond’ and Stukel 3 ‘exclosure’ sites. In August 2023, we collected Columbia yellowcress seed from populations at Stukel Mountain (Stukel 1), Sprague River (Main), Foley Lake, Featherbed Lake, and Paulina Marsh. These seeds were grown in the early spring (Mitchell and Harris 2024) and we outplanted 523 plugs across Stukel Mountain, Foley Lake, Featherbed Lake, and Paulina Marsh between April 29th and May 2nd 2023. In August 2024, we again collected Columbia yellowcress seed from populations at Stukel Mountain, Sprague River, Foley Lake, Featherbed Lake, and Paulina Marsh. There was a noticeable difference in the moisture level of the soil and plants at these sites between August 2023 and 2024; all Columbia yellowcress plants were desiccated at Foley Lake and after 14 weeks in the greenhouse under optimal conditions, only two seeds have germinated.

Propagation knowledge of Columbia yellowcress is limited but work by Kaye (1996) and Kentnesse (2017a, 2017b) provided details and guidance for our process. In 2022, we trialed two methods of seed propagation (about 50% of plugs sown produced plants) and in 2024 we followed the more successful methods, ensuring seeds were surface sown and fully exposed to light (about 89% of plugs sown produced plants; Mitchell and Harris 2023). Instead of growing plugs over the winter for a spring outplanting, we decided to prepare plants for a fall outplanting. To account for Columbia yellowcress seed collected in August not being ready to plant via plugs by fall in the same year, we are trialing a method of seed amplification that could produce plant material for a fall outplanting. On December 3rd 2024, we sowed seed collected from five sites into separate bulb trays (14.5 x 14.5 x 6.0 inches), with the intention that Columbia yellowcress plants could grow from these seeds and go through their growth and maturation process, at which point we could collect seed produced by them in summer 2025, which in turn could be sown into plugs for a fall 2025 outplanting. We sowed about 60 seeds from Stukel Mountain, 250 seeds collected in 2023 and 250 seeds collected in 2024 from Sprague River, 30 seeds from Foley Lake, 50 seeds from Featherbed Lake, and 200-300 seeds from Paulina Marsh into separate trays. We gave seed from each site to the Oregon Department of Agriculture for banking to the Rae Selling Berry Seed Bank. Additionally, we conducted germination trials on 100 seed each from collections of 2015, 2023, and 2024 Sprague River seed (collected by IAE and Laura Kentnesse), 2015 Paulina Marsh seed (collected by Laura Kentnesse), and 1983 Featherbed Lake seed (pulled from storage at the Rae Selling Berry Seed Bank).

4. RESULTS

4.1. Population Census, Outplanting Survival, and Demography Plots

We monitored Columbia yellowcress populations and survival of outplanted plugs at Stukel Mountain, Foley Lake, Featherbed Lake, and Paulina Marsh, and assessed demography plots at Stukel Mountain. In 2024, we censused (Stukel Mountain) or subsampled (Foley Lake, Featherbed Lake, and Paulina Marsh) each population depending on the size of the population or site.

Stukel Mountain

On April 29th and 30th 2024, we outplanted 264 Columbia yellowcress plugs on Stukel Mountain from seed sourced from Stukel Mountain and Sprague River (Figure 4). We planted 89 Columbia yellowcress plugs at the Stukel 1 ‘pond’ site, 96 plugs at the Stukel 3 ‘exclosure’ site, 79 at the Stukel 4 ‘van meter’

site, and none at the Stukel 2 ‘private’ site. Between July and August 2024, we censused 250 Columbia yellowcress plants at Stukel 1 (naturally occurring and outplanted plants), no plants at Stukel 2 (naturally occurring plants), eight plants at Stukel 3 (outplanted plants), and 22 plants at Stukel 4 (outplanted plants). We could not be entirely sure which plants were naturally occurring, and which were outplanted across years, or the proportion of each category that survived between visits.

Therefore, we added the 202 plants censused in 2023 to the 89 plants outplanted in 2024 for an estimated total of 291 plants, and a combined 85.9% estimated survival rate for Stukel 1 (Table 1). For the second year in a row, we found no Columbia yellowcress plants on the private property (Stukel 2). Stukel 3 had an estimated 3.9% survival by August 2024, with only eight plants found from an estimated population of 206 plants. Stukel 4 had an estimated 27.8% survival by July 2024, with 22 plants found from 79 outplanted plants.



Figure 4. BLM and IAE staff outplanting Columbia yellowcress plugs on Stukel Mountain, at Stukel 3 (top) and Stukel 1 (bottom) in 2024. Photographs taken by IAE staff.

At Stukel 1 there was an average of five stems per plant measured ($N=20$), the longest stem was an average 6.2 cm long, and there was an average of 24 buds or flowers, four seed capsules, and 37 leaves per longest stem. Compared to 2023, the average Columbia yellowcress at Stukel 1 was smaller in size but with more buds, flowers, and leaves per longest stem. At Stukel 3 there was an average of three stems per plant found ($N=8$), the longest stem was an average 3.6 cm long, and there was an average of 26 leaves per longest stem; none of the found plants had reproductive structures (buds, flowers, or seed capsules). Compared to 2023, the average Columbia yellowcress at Stukel 3 was smaller in size with more leaves per longest stem. Due to time constraints, we were not able to measure plants metrics at Stukel 4; none of the found plants had reproductive structures. Across all subsites, we saw signs of herbivory on Columbia yellowcress plants.

We established demography plots on Stukel Mountain in July 2023 (Mitchell and Harris 2024) and monitored them again in August 2024. We had two 1x1-m demography plots at the Stukel 1 ‘pond’ site

and two plots at the Stukel 3 'exclosure' site. In 2024 at Stukel 1, we found 20 of the 24 plants measured in 2023 and measured two new plants in the demography plot surrounding the naturally occurring Columbia yellowcress. In the demography plot surrounding the outplanted Columbia yellowcress at Stukel 1, we found all 22 plants measured in 2023 and measured one new plant. In 2024, we found no living plants (from outplanted plugs) in the two demography plots at Stukel 3. In 2023, there were nine plants in the demography plot inside the exclosure and seven plants in the demography plot outside the exclosure at Stukel 3.

Foley Lake

On May 1st 2024, we outplanted 44 Columbia yellowcress plugs at Foley Lake from seed sourced from Foley Lake. We only planted 44 plugs at this site because the reservoir had no standing water following the winter and we wanted to minimize loss of plant material due to inadequate moisture. This site was visibly drier in August 2024 compared to August 2023. In 2024, all of the plants we found (N=101; 31 vegetative and 70 reproductive plants) were completely dried out and brittle (Table 1). None of the outplanted Columbia yellowcress plants survived. Many found plants were broken, including at the base (N=8), and it was difficult to determine whether the plant damage was caused by herbivory or because the plants were so brittle. We did not measure plant metrics from this population because the plants were brittle.

Featherbed Lake

On May 1st 2024, we outplanted 152 Columbia yellowcress plugs at Featherbed Lake from seed sourced from Featherbed Lake and Foley Lake. In 2024, we found 43 vegetative and four reproductive plants that were completely dried out and brittle (Table 1 only reports live plants). There was an estimated 12.6% survival in August 2024, with 21 plants found from 167 outplanted and previously found Columbia yellowcress plants. Many found plants were broken, including at the base (N=18), and it was difficult to determine whether the plant damage was caused by herbivory or because the plants were so brittle. We did not measure plant metrics from this population because the plants were brittle.

Paulina Marsh

On May 2nd 2024, we outplanted 63 Columbia yellowcress plugs at Paulina Marsh from seed sourced from Paulina Marsh and Foley Lake. We did not have time to properly subsample Paulina Marsh in 2023, but we found an estimated 70 plants. In August 2024, we found 138 plants, more than the sum of what we found in 2023 and what we outplanted in spring 2024 (Table 1). This indicates there are more plants than we have surveyed on site. There was an average of four stems per plant measured (N=21), the longest stem was an average 8.1 cm long, and there was an average of four buds or flowers, 14 seed capsules, and 34 leaves per longest stem. We saw signs of herbivory on some Columbia yellowcress plants.

Table 1. Summary of Columbia yellowcress populations at each site (census or subsample, denoted C or S respectively in ‘site’ column) in 2024. Stukel 1 data represent naturally occurring and outplanted plants, Stukel 2 data represent naturally occurring plants, and Stukel 3 and Stukel 4 data represent outplanted plants. Foley Lake, Featherbed Lake, and Paulina Marsh data represent naturally occurring and outplanted plants. We counted all plants found but only measured a subset of plants per site: Stukel 1 = 20 plants, Stukel 3 = 8 plants, and Paulina Marsh = 21 plants.

Columbia yellowcress (<i>Rorippa columbiae</i>) 2024 population summary								
Site	Total living plants	Total vegetative plants	Total flowering plants	Counted plant stems	Average length of longest stem	Avg. # buds & flowers per longest stem	Average # fruits per longest stem	Average # leaves per longest stem
Stukel 1 “pond” (C)	250	81	169	107	6.2 cm	24	4	37
Stukel 2 “private” (C)	0	0	0	0	NA	NA	NA	NA
Stukel 3 “exclosure” (C)	8	8	0	27	3.6 cm	0	0	26
Stukel 4 “van meter” (C)	22	22	0	NA	NA	NA	NA	NA
Foley Lake (S)	0	0	0	0	NA	NA	NA	NA
Featherbed Lake (S)	21	15	6	NA	NA	NA	NA	NA
Paulina Marsh (S)	138	67	71	75	8.1 cm	4	14	34

4.2. Surrounding Vegetation Community

To quantify the plant community surrounding Columbia yellowcress populations on Stukel Mountain, in 2022, 2023, and 2024, we identified plant species and estimated cover within 18 quadrats at the Stukel 1 ‘pond’ site, and 13 quadrats at the Stukel 3 ‘exclosure’ site. We collected data from 18 quadrats at the Stukel 2 ‘private’ site in 2022 but not since, because we found no Columbia yellowcress plants at the Stukel 2 ‘private’ site in 2023 or 2024 and management practices are uncertain.

In 2023, Stukel 1 and Stukel 3 had similar amounts of bare ground and non-woody litter; there were more of both categories at Stukel 3 compared to Stukel 1 (Mitchell and Harris 2024). In 2024, there was less bare ground and more non-woody litter at both sites; there was about 12% more non-woody litter at Stukel 1 and 20% more at Stukel 3 in 2024 (Table 2). There was more vegetation material within the plots at Stukel 1 (33.0% average basal area in 2024, 39.7% in 2023) compared to Stukel 3 (11.9% average basal area in 2024, 25.4% in 2023).

The Stukel 1 ‘pond’ site had a plant species richness of 32 in 2022, 33 in 2023, and 28 in 2024. The Stukel 3 ‘exclosure’ site had a plant species richness of 36 in 2023, and 20 in 2024. There were 51 unique species identified in the community plots in 2023 and 39 in 2024. The amount of nonnative plant cover, and the amount of graminoid cover, both decreased since monitoring began at Stukel 1 (2022-2024) and Stukel 3 (2023-2024). The amount of native plant cover increased since monitoring began at Stukel 1 and Stukel 3. The amount of forb cover increased at Stukel 1 (from 23% in 2022 to 31.7% in 2024) and decreased at Stukel 3 (from 18% in 2023 to 4.2% in 2024) since monitoring began.

Table 2. Mean percent cover for each ground cover type and summarized plant categories from two locations on Stukel Mountain; standard error is included in parenthesis.

2024: all quadrats combined for each Stukel Mountain subsite		
	Stukel 1 “pond”	Stukel 3 “exclosure”
Bare ground	16.3 (5.3)	29.7 (6.6)
Rocks	9.2 (2.4)	2.0 (0.9)
Moss and lichen	1.0 (0.5)	0.7 (0.4)
Standing water	0.0 (0.0)	0.0 (0.0)
Fecal matter (e.g. cow, ungulate, rodent)	0.5 (0.1)	2.1 (0.8)
Woody litter (e.g. sage branches, pine cones)	0.4 (0.2)	0.2 (0.2)
Non-woody litter (e.g. grasses or other herbaceous material)	39.7 (5.2)	53.4 (6.0)
Total grass	26.1 (5.8)	15.2 (2.9)
Total forb	31.7 (7.0)	4.2 (1.0)
Total woody	1.7 (1.7)	0.0 (0.0)
Total native	47.7 (7.6)	89.7 (3.9)
Total nonnative	52.3 (7.6)	7.5 (3.7)
Overall species richness (N = 39)	28	20

4.3. Plant Propagation

As of March 12, 2025, 16 plants germinated from 2024 Stukel Mountain seed, two plants germinated from 2024 Foley Lake seed, eight plants germinated from 2024 Featherbed Lake seed, and ten plants germinated from 2024 Paulina Marsh seed. After three and a half months in the greenhouse, some of these plants look like they are newly germinated and have none or only one set of true leaves. We did not count the number of individual plants in the 2023 and 2024 Sprague River seed trays; we had more seed to sow in these trays and they are dense with plants (Figure 5).

Between October 2024 and February 2025, we conducted seven different germination trials of Columbia yellowcress seed; each trial involved 100 seeds. We tested Columbia yellowcress seed collected in 2015, 2023, and 2024 at Sprague River, 2015 at Paulina Marsh, and 1983 at Featherbed Lake. We used two different germination regimens; one where seeds were kept at a lower temperature (10°C – 20°C) and the other where seeds were kept in a germination chamber at a higher temperature (15°C – 25°C), both with light and dark periods.

Using the lower temperature methods, one out of 100 seeds germinated from 1983 Featherbed Lake, 11 out of 100 seeds germinated from 2023 Sprague River, and 21 out of 100 seeds germinated from 2024 Sprague River. Using the higher temperature methods, six out of 100 seeds germinated from 2015 Paulina Marsh, four out of 100 seeds germinated from 2015 Sprague River, 70 out of 100 germinated from 2023 Sprague River, and 84 out of 100 seeds germinated from 2024 Sprague River. We were able to germinate seed from every year and population we had access to. Columbia yellowcress germinated better in optimal (higher temperature) conditions compared to conditions a little closer to

natural climate conditions after plants drop their seed (lower temperatures). Seed collected from Sprague River in 2024 had a higher germination rate than seed collected from Sprague River in 2023.

After the germination trials were complete, we transferred germinated seed from the 2015 Sprague River and Paulina Marsh trials to pots in the greenhouse. As of March 12, 2025, three of the four Sprague River plants are alive and one of the six Paulina Marsh plants are alive.



Figure 5. Examples of Columbia yellowcress growing in bulb trays in the greenhouse, emerged as a new seedling, and germinated seeds from the germination trial.

5. DISCUSSION

During the three years of this project, we saw clear evidence of the variability in Columbia yellowcress populations in southern Oregon. We saw reduced survival of naturally occurring and outplanted plants in 2024 compared to 2023. Only the Stukel Mountain 1 ‘pond’ site and Paulina Marsh had greater than 50% survival, and four sites had less than 20% survival. We noticed a visual decline in moisture at these sites in 2024 compared to 2023, including completely desiccated Columbia yellowcress plants at Foley Lake, dry and brittle vegetation across sites, and lack of standing water in May 2024 that was seen in August 2023 at Featherbed Lake. This increased dryness likely contributed to the observed decline in population numbers and outplanting survival, including at the Stukel 3 site (Figure 6), however grazing damage may also be a factor. Columbia yellowcress plants have taproots that may go quite deep in the soil. There is a chance that plants may be able to survive a dry year by relying on energy stored in their

taproots, but only repeated surveys can determine this. We established demography plots on Stukel Mountain (Stukel 1 and Stukel 3 sites) to track the survival and growth of individual plants over time, and continued funding of this project would allow us to determine how resilient these plants may be.



Figure 6. Example of difference between July 2023 (top picture) and August 2024 (bottom picture) at the Stukel 3 'exclosure' site. Photographs taken by Laura Estrada.

We are still understanding what determines Columbia yellowcress habitat, as many factors contribute to favorable conditions for this species. We chose introduction sites on Stukel Mountain (Stukel 3 and Stukel 4) based on similar water availability and plant communities to areas where Columbia yellowcress naturally occurred (Stukel 1 and Stukel 2), but we have yet to determine which variables drive Columbia yellowcress habitat availability. 2024 seemed drier than 2023, but the density of surrounding plants may also outcompete Columbia yellowcress and contribute to poor outplanting survival. At the Stukel 4 site, we planted Columbia yellowcress in seemingly open areas near the water's edge in the Spring, but these locations were dominated with reed canary and other dense plants during our census in Summer.

Data gathered from Stukel Mountain indicate plants were on average smaller in 2024 compared to 2023, but there were more leaves per longest stem. Additionally, we only found reproductive plants at the Stukel 1 'pond' site. This may indicate that plants are stressed by climatic conditions and putting energy into maintaining vegetative tissues as opposed to reproductive structures. Demography plots at Stukel 1 suggest plants are propagating, but no plants were found in demography plots at Stukel 3 suggesting inadequate conditions. Results from our plant community data showed a transition from bare ground and plant occupancy in 2023 to nonwoody thatch in 2024, possibly due to the drier conditions. We also documented a decrease in plant species richness at the Stukel 1 and Stukel 3 sites between 2023 and 2024, and an overall decrease in the number of plant species identified in plots on Stukel Mountain.

We have plant materials in preparation for a fall outplanting to see if planting prior to winter would increase survival, and this would be ideal work for a follow up project. Additionally, we have plans to start a raised bed for Columbia yellowcress seed production, to alleviate limitations by wild-collected plant materials. If we were to get additional funding for this project, we would also like to use knowledge gained from our germination trials to pull more 1983 Featherbed Lake seed from storage at the Rae Selling Berry Seed Bank to grow out any germinated plants and contribute those genetics into population amplification efforts. Our germination trials demonstrated a reduction in seed viability over time, but we were still able to germinate over 40 year old seed, indicating seed longevity in cold storage.

6. CONCLUSIONS

In summary:

- We hosted the second annual Columbia yellowcress working group meeting on March 13, 2025 and discussed current and future work conducted by folks in CA, OR, and WA across numerous agencies.
- Our work with this species highlights the high variability in populations between years, likely influenced by weather, hydrology, and disturbances caused by humans and other mammals.
- Further experimental approaches and population monitoring are needed to continue efforts to conserve this endangered species.
- We would like to determine how to fund an expansion of this project so we can assess population statuses across the state and better conserve Columbia yellowcress across its range.

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APPENDIX A. SITE PICTURES



Figure A1. Stukel Mountain: the a) Stukel 1 ‘pond’ site, b) growing Columbia yellowcress (*Rorippa columbiae*) near the pond, c) Stukel 3 ‘exclosure’ site, and d) Stukel 4 ‘van meter’ site.



Figure A2. Sprague River: a) view of the island at Sprague River Main on the left and eastern bank on the right, b) example of swale with Columbia yellowcress growing in the open area surrounded by sagebrush, and c) Columbia yellowcress growing in sagebrush thatch.



Figure A3. Foley Lake: examples a) and b) of Foley Lake in August 2023, flags indicating Columbia yellowcress plants, and c) close up of a desiccated Columbia yellowcress plant (in black circle) and other desiccated plants in August 2024.



Figure A4. Featherbed Lake: examples of the reservoir within Featherbed Lake a) with water in August 2023, and b) no water in August 2024.



Figure A5. Paulina Marsh: example of a) Columbia yellowcress habitat along the ditch in the roadside right of way, b) ditch depth while surveying for Columbia yellowcress (picture by Laura Estrada), and c) Columbia yellowcress plants growing near the junction between the ditch and a culvert.