

Columbia yellowcress (*Rorippa columbiana*) in the BLM Lakeview District: Population monitoring and conservation 2023 annual report



February
2024

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:

Thomas Kaye (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, and Sandra Klepadlo-Girdner of USDA Forest Service Klamath Ranger District were particularly helpful. Field work was supported by Laura Estrada and plant propagation was supported by Mara Friddle and farm staff. 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 photograph: May 1st, 2023 view of the pond site on Stukel Mountain, home of a Columbia yellowcress (*Rorippa columbiae*) population. Photograph, and all others unless documented otherwise, by J. Christina Mitchell.

SUGGESTED CITATION

Mitchell, J.C. and S. Harris. 2024. Columbia yellowcress (*Rorippa columbiae*) in the BLM Lakeview District: Population monitoring and conservation 2023 annual report. Institute for Applied Ecology. Corvallis, Oregon.

TABLE OF CONTENTS

EXECUTIVE SUMMARY..... 1

1. INTRODUCTION..... 2

2. GOALS AND OBJECTIVES 3

3. METHODS..... 3

 3.1. Site Descriptions 3

 3.2. Population Census, Outplanting Survival, and Demography Plots 5

 3.3. Surrounding Vegetation Community 5

 3.4. Seed Collection and Plant Propagation 6

4. RESULTS 6

 4.1. Population Census, Outplanting Survival, and Demography Plots 6

 4.2. Surrounding Vegetation Community 8

5. DISCUSSION..... 9

6. CONCLUSIONS..... 10

7. REFERENCES..... 10

APPENDIX A. SUMMARY OF STUKEL MOUNTAIN CAMERA TRAP PHOTOS..... 11

LIST OF FIGURES

Figure 1. Lepidopteran pupae in netted case and leaf damage on a Stukel Mountain *Rorippa columbiae* plant..... 2

Figure 2. *Rorippa columbiae* populations (indicated with gold star) visited in southeastern Oregon. 4

Figure 3. Examples of site conditions at each population visited in 2023; a) Paulina Marsh, b) Sprague River, c) Stukel Mountain, d) Featherbed Lake, e) Foley Lake. 5

Figure 4. Examples of Columbia yellowcress (*Rorippa columbiae*) germinants, seeds, and seed surface. ... 6

Figure 5. Four demography plots established in 2023 on Stukel Mountain; a) Stukel 1 original plants, b) Stukel 1 outplanted, c) Stukel 3 outplanted inside exclosure, d) Stukel 3 outplanted outside exclosure..... 7

LIST OF TABLES

Table 1. Summary of Columbia yellowcress (*Rorippa columbiae*) populations at three locations on Stukel Mountain and one at Featherbed Lake. All plants on Stukel Mountain were counted, but only a sample of plants were measured in each area: Stukel 1 = 20 plants, Stukel 3 = 20 plants, Featherbed = 15 plants. 8

Table 2. Mean percent cover for each ground cover type and summarized plant categories fro two locations on Stukel Mountain; standard error is included in parenthesis. 9

Columbia yellowcress (*Rorippa columbiae*) in the BLM Lakeview District: Population monitoring and conservation 2023 annual report

EXECUTIVE SUMMARY

In 2023, the Institute for Applied Ecology (IAE) continued a partnership 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. We outplanted 490 Columbia yellowcress plugs and monitored survival, censused Columbia yellowcress, and collected vegetation community data at the Stukel Mountain site. We counted 202 plants at the Stukel Mountain 'pond' site, which included plants from the original and outplanted population, and 0 plants at the Stukel Mountain 'private' site. We counted 84 plants at the Stukel Mountain 'exclosure' site, all of which were outplanted. We scouted three additional sites (Featherbed Lake, Foley Lake, and Paulina Marsh) and found Columbia yellowcress populations. We collected seed from five sites (Stukel Mountain, Featherbed Lake, Foley Lake, Paulina Marsh, and Sprague River) for propagation and outplanting efforts in 2024. 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 uncommon species in other areas of its range.

1. INTRODUCTION

Rorippa columbiae, or Columbia yellowcress, 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 not federally listed under the Endangered Species Act but is a state-listed threatened species in Washington (Washington Natural Heritage Program 1997), considered rare or endangered in California by the California Native Plant Society (California Native Plant Society 2023), and is a candidate species in Oregon (Oregon Department of Agriculture 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 dried lake beds with dispersed plants (including *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 herbivory and other insect presence (Figure 1) and what we presumed to be mammals. To gather more information about the species that interact with Columbia yellowcress on Stukel Mountain, we installed a camera trap by the pond site. The camera took over 12,000 pictures of 31 different species (11 mammals including cows, 12 birds, 7 insects, and 1 reptile), providing insight into the variety of species that visit the site and may consume Columbia yellowcress (Appendix A. Summary of Stukel Mountain camera trap Photos).



Figure 1. Lepidopteran pupae in netted case and leaf damage on a Stukel Mountain *Rorippa columbiae* plant.

The status of Columbia yellowcress populations across its range is relatively unknown, as most data are outdated. In 2023, we visited three sites (in addition to two previously visited sites) to get updated information on the populations' statuses. In July, we collected Columbia yellowcress population, survival, demography, and vegetation community data from the five visited sites (Stukel Mountain, Sprague River, Foley Lake, Featherbed Lake, and Paulina Marsh). In August, we collected mature Columbia yellowcress seeds from each site, and sowed these seeds in the greenhouse on February 1st, 2024. We plan to outplant plugs in April or May 2024 and hope that augmenting populations will foster stable populations.

In February 2023, we contacted known and expected stakeholders in Columbia yellowcress conservation and management about scheduling the inaugural Columbia yellowcress working group meeting.

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 population and outplanted plugs on Stukel Mountain to determine traits of survival and inform conservation management protocols;
- 2) Census or sample Columbia yellowcress and quantify associated vegetation communities on 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 conservation by convening a stakeholder working group.

3. METHODS

3.1. Site Descriptions

In 2023, we visited five known locations of Columbia yellowcress populations in southern Oregon (**Figure 2**). Columbia yellowcress was known to historically occur at these sites, but populations (aside from Stukel Mountain and Sprague River) had not been monitored since 2016 (Kentness 2017a). Columbia yellowcress populations and surrounding plant communities were quantified on Stukel Mountain, and the other four sites were visited to confirm Columbia yellowcress presence, with plans to collect data later.

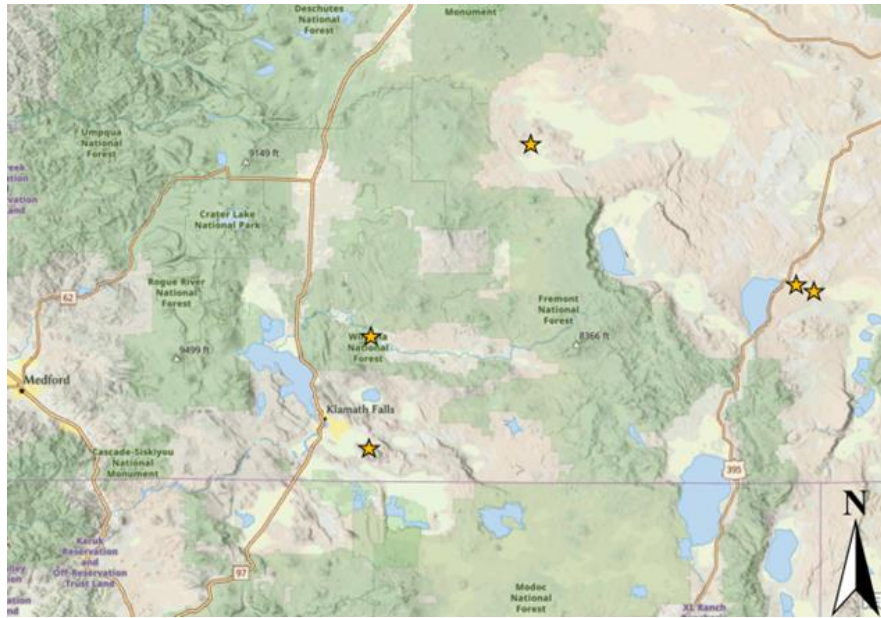


Figure 2. *Rorippa columbiae* populations (indicated with gold star) visited in southeastern Oregon.

Stukel Mountain populations occur on BLM and private land, near areas that are seasonally inundated with water (Figure 3c). On May 1st, 2023, we outplanted almost 500 plugs near the original population by a vernal pond (Stukel 1 ‘pond’ site) and by a previously unoccupied reservoir and accompanying vernal pond (Stukel 3 ‘exclosure’ site). The Sprague River population (Figure 3b) occupies both riverbanks and an ‘island’ in the middle of the river. This population is unique among the sites visited because the river provides year-round moisture to the soil in which Columbia yellowcress grows. The Foley Lake population occurs around most of the lake’s perimeter, likely caused by the pattern of seasonal water inundation (Figure 3e, seen dry in August). The Featherbed Lake population occurs near a small, internal, and water-holding reservoir (Figure 3d, as seen in August), as opposed to the perimeter of the larger, dried up reservoir. The Paulina Marsh population (Figure 3a) occurs within a ditch running alongside county road 5-13. All Columbia yellowcress populations observed in 2023 were on public land, and evidence of cattle were seen at all sites.

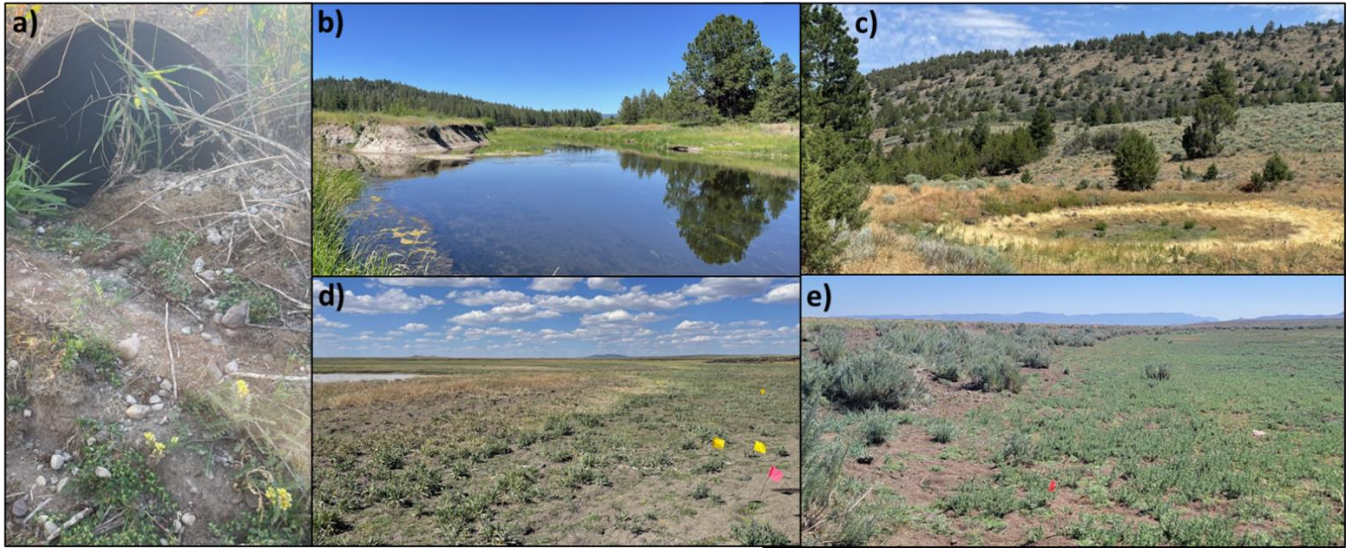


Figure 3. Examples of site conditions at each population visited in 2023; a) Paulina Marsh, b) Sprague River, c) Stukel Mountain, d) Featherbed Lake, e) Foley Lake.

3.2. Population Census, Outplanting Survival, and Demography Plots

On July 11th and 12th 2023, we collected Columbia yellowcress data from the Stukel 1 ‘pond’ (BLM; 42.120398, -121.631561), Stukel 2 ‘private’ (private; 42.112344, -121.627529), and Stukel 3 ‘exclosure’ (BLM, 42.108114, -121.614836) populations. We conducted a complete census of naturally occurring plants at the Stukel 1 and Stukel 2 sites, and conducted a count of surviving outplanted plants at the Stukel 1 and Stukel 3 sites (methods based on Kaye 1996, Mitchell and Harris 2023). We installed demography plots consisting of labeled markers to physically mark the northwest corner of a 1-m x 1-m area, so we can return annually and document plant growth, propagation, and mortality. On July 13th, 2023 we collected Columbia yellowcress data from the population at Featherbed Lake. Locations of Columbia yellowcress were georeferenced using Field Maps software on a Samsung tablet and a Bad Elf GNSS surveyor with GPS accuracy of 1–3 meters. Censusing will continue for the duration of this project to determine how Columbia yellowcress populations naturally fluctuate over time and in response to management actions.

3.3. Surrounding Vegetation Community

On Stukel Mountain, transects ran across the microelevation gradient of the Stukel 1 ‘pond’ site and quadrats were placed to quantify the vegetation community associated with Columbia yellowcress (Mitchell and Harris 2023). Around the Stukel 3 ‘exclosure’ site, quadrats were placed around where Columbia yellowcress plants were outplanted to quantify the surrounding plant community. 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. cow, 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

Between August 21st and August 31st, 2023 we collected and separately stored mature Columbia yellowcress seeds from five sites: Stukel Mountain, Sprague River, Foley Lake, Featherbed Lake, and Paulina Marsh. We collected seed by handpicking mature-looking fruit capsules, usually darker in color or starting to dehisce, from Columbia yellowcress inflorescences. No more than 5% of seeds were taken from a plant or within a given area to avoid overharvesting and to maximize genetic diversity. Fruit capsules were sieved to separate seeds from plant material, and seeds were stored at room temperature (~68°F) until sowing.

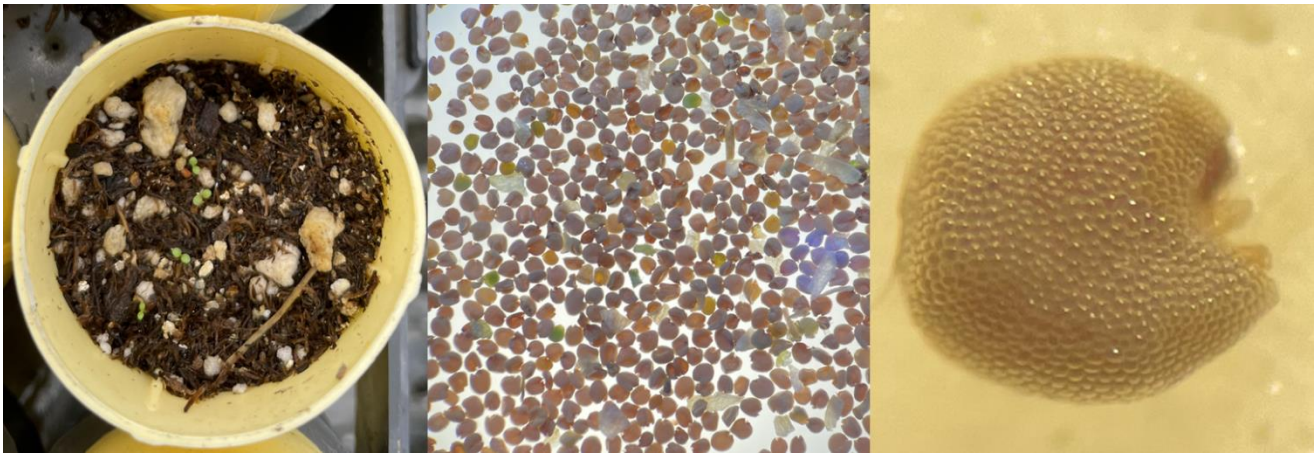


Figure 4. Examples of Columbia yellowcress (*Rorippa columbiae*) germinants, seeds, and seed surface.

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 and in 2024 we followed the more successful methods (Mitchell and Harris 2023). On February 1st, 2024, we surface-sowed seeds from the five sites into 588 conetainer plugs, and germinants were first observed on February 8th (Figure 4). Seeded plugs will continue to be monitored and hardened off to outside temperatures beginning in March, for a targeted outplanting once southeastern Oregon sites are accessible, likely late April or May 2024.

4. RESULTS

4.1. Population Census, Outplanting Survival, and Demography Plots

On May 1st, 2023, we outplanted 294 plugs around the Stukel 1 ‘pond’ site and 196 plugs in multiple areas around the Stukel 3 ‘exclosure’ site. At Stukel 1, plugs were planted as close to the waterline as possible, along the northern, western, and southern edges of the pond. We chose these areas because the Columbia yellowcress plants found in 2022 grew mostly along the northwest edge of the pond. When we returned on July 11th, 2023, we counted a total of 202 Columbia yellowcress plants at the Stukel 1 ‘pond’ site (

Table 1). We were not entirely sure which plants were counted in 2022 and which were outplanted in 2023, or the proportion of each category that survived between visits. Therefore, we added the 22 plants censused in 2022 to the 294 plants planted in 2023 for an estimated total of 316 plants, and a combined 63.9% estimated survival rate for Stukel 1. There was an average of five stems per plant, the longest stem was an average 7.8 cm long, and there was an average of five buds or flowers, four seed capsules, and 11 leaves per longest stem. We established two demography plots in 2023, one around 24 plants in the original Columbia yellowcress population (Figure 5a) and one around 22 outplanted Columbia yellowcress (Figure 5b).

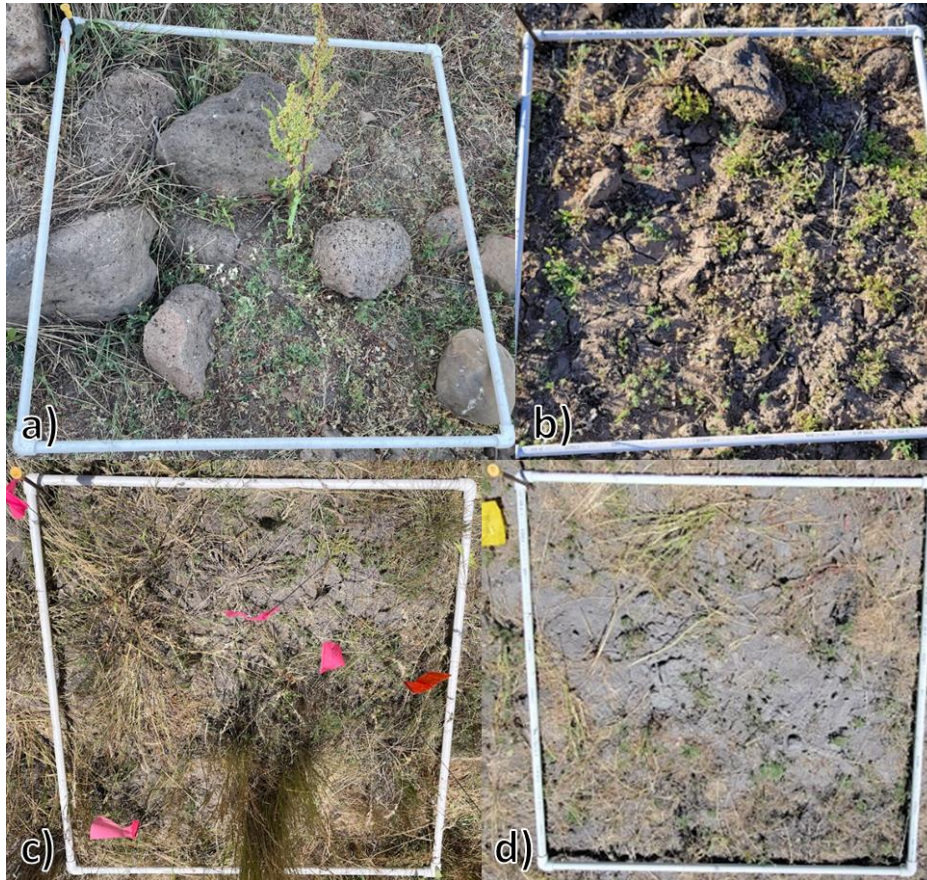


Figure 5. Four demography plots established in 2023 on Stukel Mountain; a) Stukel 1 original plants, b) Stukel 1 outplanted, c) Stukel 3 outplanted inside enclosure, d) Stukel 3 outplanted outside enclosure.

At the Stukel 2 ‘private’ site, we searched for plants in July and August 2023 but found no Columbia yellowcress plants. We did find, as we did in 2022, similar looking curvepod yellowcress (*Rorippa curvisiliqua*) plants, which can grow in similar conditions.

At the Stukel 3 ‘enclosure’ site, we planted 184 plugs in four separated areas: 12 plants along the shoreline to the reservoir, 70 plants outside the enclosure and near the mouth of the reservoir, 70 plants inside the enclosure and near the mouth of the reservoir, and 30 plants around a small pond. When we returned on July 12th, 2023, we counted a total of 110 plants across all areas, for a combined 59.8% estimated survival rate for Stukel 3 (

Table 1). There was an average of seven stems per plant, the longest stem was an average 7.3 cm long, and there was an average of two buds or flowers, three seed capsules, and 11 leaves per longest stem. We established two demography plots in 2023, one around nine plants inside the exclosure (Figure 5c) and one around seven plants outside the exclosure (Figure 5d). BLM partners planted the remaining 12 Columbia yellowcress plants around Van Meter reservoir and IAE staff were unable to find them when visiting the area in July 2023.

We only had time to survey about a quarter of Featherbed Lake, but we found 15 Columbia yellowcress plants. There was an average of 2 stems per plant, the longest stem was an average 5.5 cm long, and there was an average 21 buds or flowers, six seed capsules, and 14 leaves per longest stem (

Table 1).

Table 1. Summary of Columbia yellowcress (*Rorippa columbiae*) populations at three locations on Stukel Mountain and one at Featherbed Lake. All plants on Stukel Mountain were counted, but only a sample of plants were measured in each area: Stukel 1 = 20 plants, Stukel 3 = 20 plants, Featherbed = 15 plants.

Columbia yellowcress (<i>Rorippa columbiae</i>) 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"	202	89	113	95	7.8 cm	5	4	11
Stukel 2 "private"	0	0	0	0	NA	NA	NA	NA
Stukel 3 "exclosure"	110	43	67	144	7.3 cm	2	3	11
Featherbed Lake	15	4	11	28	5.5 cm	21	6	14

4.2. Surrounding Vegetation Community

To quantify the plant community surrounding Columbia yellowcress populations on Stukel Mountain, 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. Since there were no Columbia yellowcress plants at the Stukel 2 'private' site in 2023, and management practices are uncertain, we chose not to collect vegetation community data.

Averages by ground cover and vegetation type were mostly similar between Stukel 1, where natural and outplanted plants occur, and Stukel 3, where we planted Columbia yellowcress in an area it did not previously occur. There was more bare ground in the sampled area at Stukel 3, and there were more rocks in the sampled area at Stukel 1. There were no woody species sampled at Stukel 3, while there were two sampled at Stukel 1.

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.

All quadrats summed per site		
	Stukel 1 “pond”	Stukel 3 “exclosure”
Bare ground	21.5 (5.4)	33.9 (5.7)
Rocks	8.9 (2.5)	2.6 (1.6)
Moss and lichen	0.8 (0.3)	0.3 (0.2)
Standing water	0.0 (0.0)	0.0 (0.0)
Fecal matter (e.g. cow, ungulate, rodent)	1.2 (0.3)	2.0 (0.8)
Woody litter (e.g. sage branches, pine cones)	0.8 (0.4)	2.7 (2.5)
Non-woody litter (e.g. grasses or other herbaceous material)	27.1 (5.0)	33.1 (5.1)
Total grass	21.7 (5.7)	20.5 (5.8)
Total forb	27.0 (5.4)	18.0 (3.9)
Total woody	2.5 (2.0)	0.0 (0.0)
Total native	53.7 (7.3)	63.9 (8.0)
Total nonnative	45.5 (7.3)	35.8 (8.0)

5. DISCUSSION

By observing the same populations over two years, we saw clear evidence of the variability in Columbia yellowcress populations. We outplanted 294 plants at the Stukel 1 ‘pond’ site, so fluctuations in the original population were obscured between 2022 and 2023. However, the Columbia yellowcress population at the Stukel 2 ‘private’ site decreased from 6 plants in 2022 to 0 plants in 2023. While we did not observe any obvious changes in site conditions, hydrology could have changed between years and gone unnoticed.

Both areas where we outplanted Columbia yellowcress plants, Stukel 1 and Stukel 3, had survival rates over 50%. We are optimistic that we are on track for determining practical propagation and restoration methods to better conserve this at-risk species. We collected and are growing seed from five different population sources, so we can outplant individuals back to their source populations and hopefully maintain population resiliency in the near-term. Low seed supply is a limitation for effective conservation of this species. Therefore, in the long-term, we hope to establish a seed production bed at a nursery or farm facility, which will greatly augment seed supply.

In 2024, we plan to outplant, continue monitoring Stukel Mountain and outplantings, and scout and census as many sites as possible to gain updated range-wide population data. As part of our experiments to better understand Columbia yellowcress, we plan to deploy one or two devices to measure changes in soil moisture and temperature (CITE HOBOS). It would also be informative to collect soil samples. We are currently planning the inaugural meeting for the Columbia yellowcress working group, which we anticipate occurring in mid to late March. We anticipate this event will result in a network of managers

and practitioners familiar with Columbia yellowcress to inform conservation and management of the species, including determining sites for future augmentation. In future efforts, it would also be worth investigating which insect species visit or potentially pollinate Columbia yellowcress, expanded from Kentnesse (2017a). This may elucidate whether pollination is a limiting factor in natural Columbia yellowcress propagation.

6. CONCLUSIONS

In summary,

- We are planning the inaugural Columbia yellowcress working group meeting for March 2024, to help determine which sites and populations should receive future augmentation.
- We continue to learn more about Columbia yellowcress ecology and will add to this knowledge in 2024 with more experimental and observational approaches.
- Columbia yellowcress from five sources is growing in the IAE greenhouse and will be outplanted in April or May 2024.
- 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.

7. REFERENCES

- California Native Plant Society, Rare Plant Program. 2023. Rare Plant Inventory (online edition, v9.5). Website <https://www.rareplants.cnps.org>.
- Kaye, T. N. 1996. Conservation Strategy for *Rorippa columbiae* (Columbia cress). Prepared for Bureau of Land Management, US Dept. of Agriculture, and US Fish and Wildlife Service. Oregon Department of Agriculture; Plant Conservation Biology Program, Salem, Oregon.
- Kentnesse, L. 2017a. Species Conservation Strategy for *Rorippa columbiae* (Columbia yellowcress). Oregon Department of Agriculture; Native Plant Conservation Program.
- Kentnesse, L. 2017b. Conservation of *Rorippa columbiae*: An Evaluation of Reintroduction Potential through the Study of Germination Ecology, Propagation Methods, and Habitat Requirements. Master's Thesis; Oregon State University.
- Maschinski, J., and K. E. Haskins. 2012. Plant Reintroduction in a Changing Climate. The Science and Practice of Ecological Restoration. Island Press, Washington, DC.
- Mitchell, J. C., and S. Harris. 2023. Columbia yellowcress (*Rorippa columbiae*) in the BLM Lakeview District: Population monitoring and conservation. Institute for Applied Ecology, Corvallis, OR.
- Oregon Department of Agriculture. 2023. Oregon's threatened, endangered, and candidate plants. <https://www.oregon.gov/oda/programs/PlantConservation/Pages/AboutPlants.aspx>
- US Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2016. The PLANTS Database. <http://plants.usda.gov>.
- Washington Natural Heritage Program. 1997. Endangered, threatened, and sensitive plants of Washington with working lists of rare non-vascular species. Department of Natural Resources, Olympia, Washington.

APPENDIX A. SUMMARY OF STUKEL MOUNTAIN CAMERA TRAP PHOTOS



Figure A1. Example photographs from the pond-side camera trap, including: quail, chipmunk, cattle, rabbit, deer, flicker, coyote, woodrat, squirrel, and cougar.