Twin Prairie restoration: 2024 annual report

February 2025

Report for Bureau of Land Management, Agreement #L23AC00272

Report prepared by Rolando Beorchia and Andrew Esterson

Institute for Applied Ecology

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PREFACE

Institute for Applied Ecology (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 photographs: Oregon sunshine (*Eriophyllum lanatum*) at Twin Prairie, June 8th, 2023. Photo by Rolando Beorchia.

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EXECUTIVE SUMMARY

The Institute for Applied Ecology has partnered with the Bureau of Land Management Upper Willamette Field Office, Northwest Oregon District, to restore Twin Prairie since 2013. In 2024, restoration activities focused on invasive plant removal, native seed collecting, and monitoring both the remnant shaggy horkelia (*Horkelia congesta* spp. *congesta*) population and the experimental plots testing efficacy of seeding and planting Willamette Valley and mid-elevation seed sources.

During the shaggy horkelia census we counted 624 individuals. Of those, 66% were flowering, 34% were vegetative, and 103 seedlings were recorded. In experimental plots with Willamette Valley seed, no plants were observed. In the Willamette Valley plug plots there were 33, 20, and 10 plants observed in the West, Central and East plots, respectively. In the mid-elevation seed plots there were 11, 0, and 0 plants observed in the West, Central and East plots, respectively. In the mid-elevation plug plots there were 33, 20, and 10 plants observed in the West, Central and East plots, respectively.

1. INTRODUCTION

Twin Prairie is a mid-elevation (1600-1800ft) prairie owned and managed by the Bureau of Land Management, Northwest Oregon District (BLM), and located in southern Lane County, Oregon, south of Cottage Grove (Figure 1). The meadow supports a population of the Oregon endemic and BLM Sensitive species, and State of Oregon Candidate Species (Oregon Department of Agriculture, 2025) shaggy horkelia (*Horkelia congesta* ssp. *congesta*). The Oregon Biodiversity Information Center (ORBIC) designates shaggy horkelia as a "List 1" species that "contains taxa which are endangered or threatened throughout their range or which are presumed extinct" (ORBIC, 2016). Management that protects or bolsters shaggy horkelia is necessary to prevent the listing of this species under the Endangered Species Act.

The Institute for Applied Ecology (IAE) and the BLM have partnered since 2013 to perform restoration work at Twin Prairie. This report describes restoration activities performed in 2024.

2. GOALS AND OBJECTIVES

The purpose of this project is to assist the BLM in maintaining and improving the regionally rare mid-elevation prairie habitat to support the native plant community and shaggy horkelia population at Twin Prairie.

There are five primary objectives of this project:

1. Increase the shaggy horkelia population through augmentation.
2. Eradicate low abundance invasive plants from within the ACEC, specifically Italian thistle (*Carduus pycnocephalus*), Scotch broom (*Cytisus scoparius*), and false brome (*Brachypodium sylvaticum*).
3. Reduce the abundance of invasive grasses in open prairie by implementing regular hand pulling and herbicide applications.
4. Increase native plant abundance and diversity in the meadows by augmenting species occurring in low abundance and introducing native mid-elevation species observed at reference meadows.
5. Release Oregon white oaks (*Quercus garryana*) from conifer encroachment.

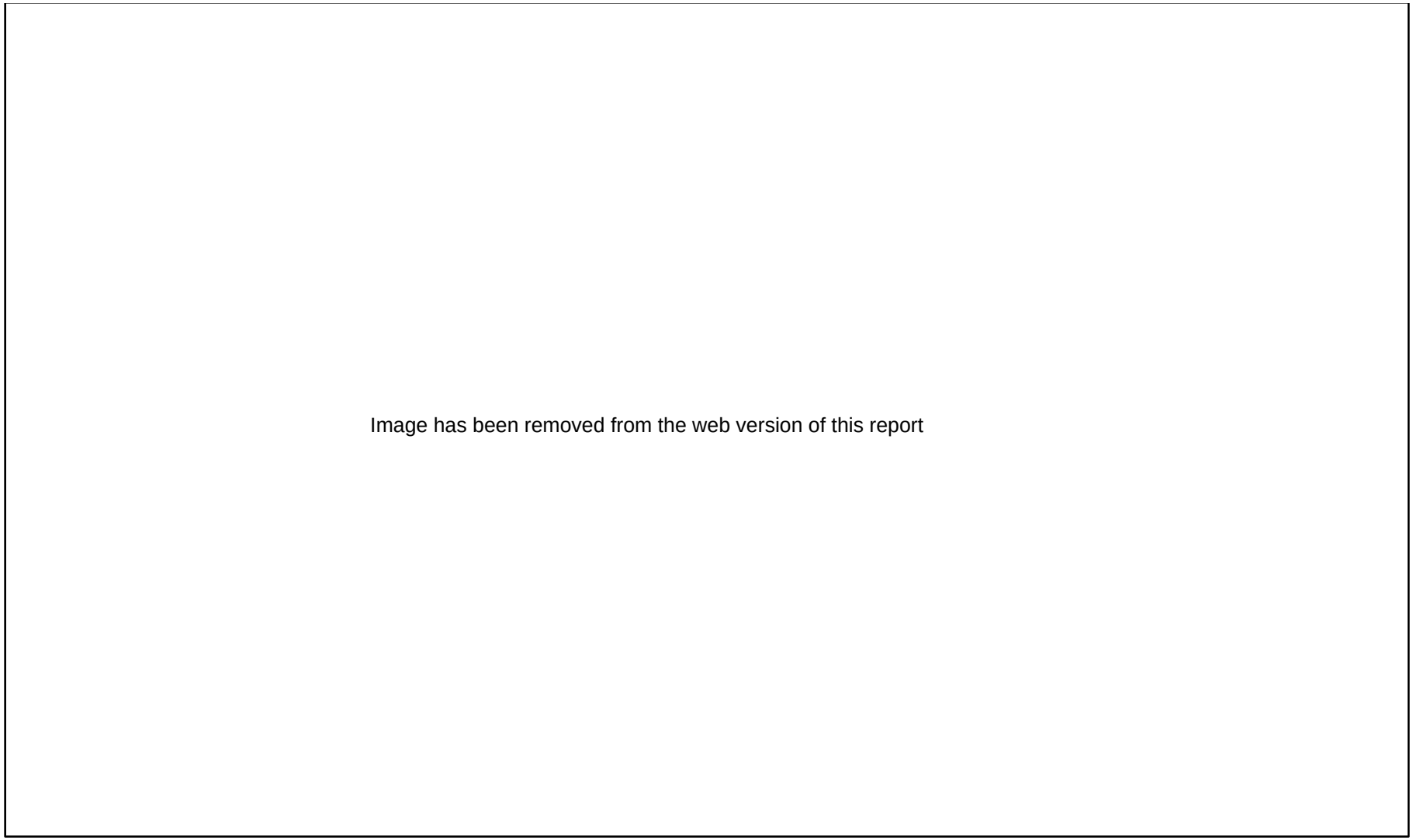

Figure 1. Twin Prairie ACEC boundary, management units, and location within the Willamette Valley.

3. 2024 RESTORATION ACTIONS

In 2024, restoration actions consisted of hand pulling invasive forbs and shrubs, monitoring shaggy horkelia, and collecting shaggy horkelia seed for plug production. A detailed summary of actions is listed in Table 1. The BLM's pesticide use permit was expired most of 2024 and therefore weed treatments were completed by manual actions.

Table 1. 2024 management actions at Twin Prairie.

Date	Unit(s)	Management Action*
19-Apr	1, 2, 3, 4, 5, 7	Manual weed removal targeting oxeye daisy (*Leucanthemum vulgare*) and site assessments
30-May	2, 3, 5	Manual weed removal targeting oxeye daisy in units 2, 3, and 5. Manual weed removal targeting Scotch broom (*Cytisus scoparius*) in unit 5. Cut seed heads from annual grasses in unit 2 and 3. Scythe mowed Italian thistle (*Carduus pycnocephalus*) in unit 5.
7-Jun	1, 2, 3	Monitored shaggy horkelia population (*Horkelia congesta*) with BLM staff: Jessica Celis.
23-Jul	2, 3	Collected native seeds from multiple species including California fescue (*Festuca californica*), American wild carrot (*Daucus pusillus*), and shaggy horkelia.

*Institute for Applied Ecology (IAE) performed all listed activities.
Bureau of Land Management (BLM).

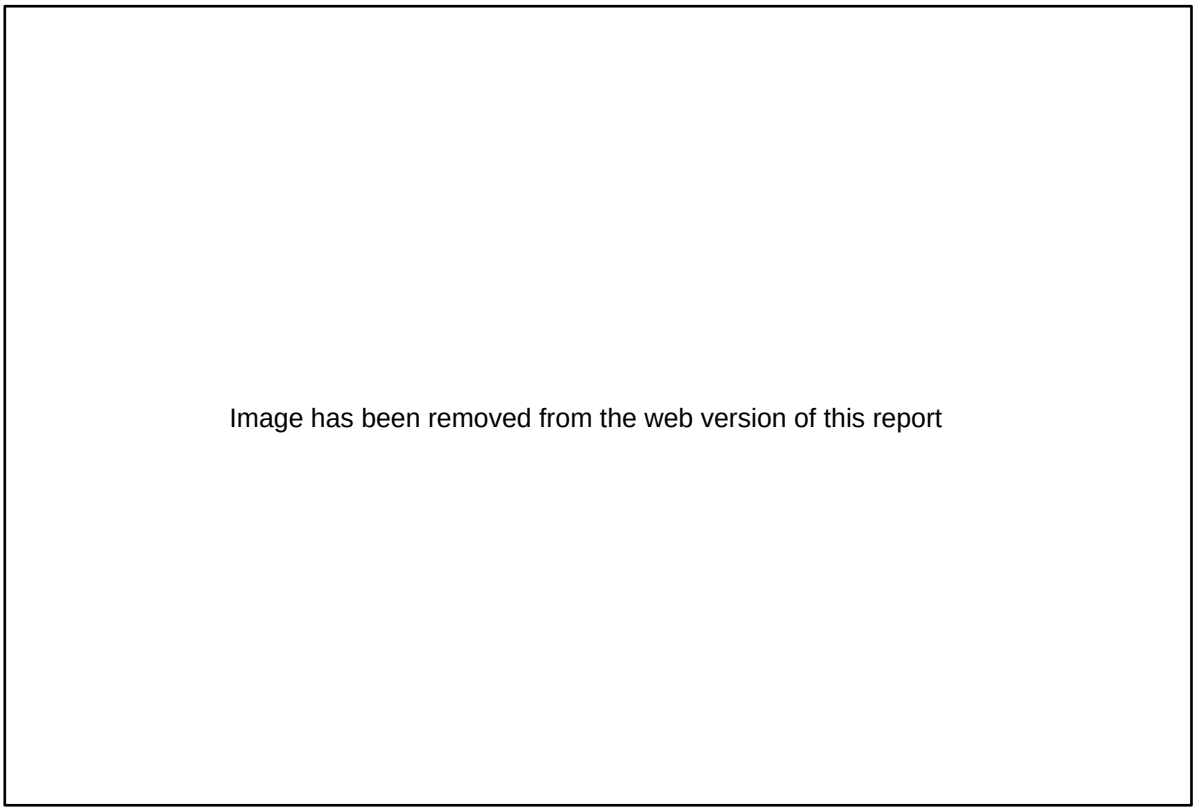

Figure 2. 2024 restoration activities at Twin Prairie. Shaggy horkelia (*Horkelia congesta* ssp. *congesta*) monitoring

Shaggy horkelia monitoring

In June 2024, we monitored the naturally occurring shaggy horkelia population and the experimental augmentation plots. We counted 624 individuals in the naturally occurring population, with 66% flowering and 34% vegetative; we also recorded 103 seedlings. Monitoring protocols can be found in Appendix B and census data is available in Appendix E. The number of individuals at Twin Prairie in 2024 was the lowest to date. This marks a 24.5% decrease from 2023 (828) and is 34% lower than the ten-year average of 947 (Figure 3).

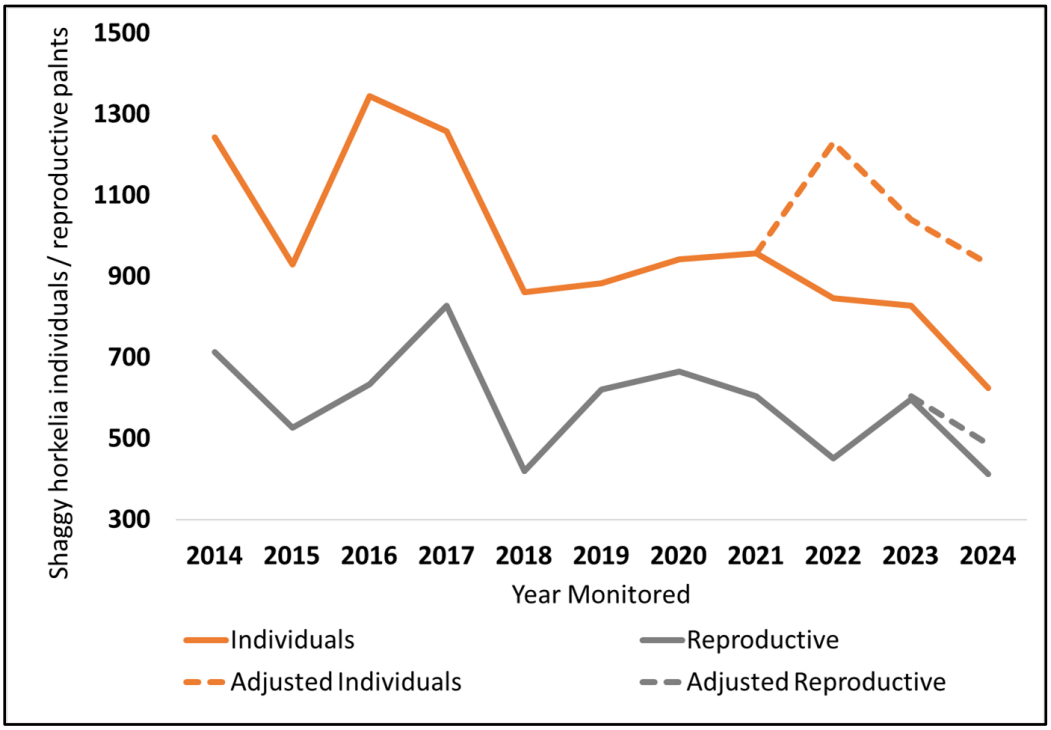

Figure 3. Shaggy horkelia (*Horkelia congesta* ssp. *congesta*) individuals and reproductive plants (2013-2024). Adjusted values include plants counted in experimental plots.

Seed source survivorship experiment

As described in the 2020 annual report (Celis et al. 2021), three experimental plots were established at Twin Prairie to test the efficacy of planting shaggy horkelia plugs versus sowing seeds and to determine if seed origin (Willamette Valley and mid-elevation meadow) affects survival (Celis et al. 2021). Experimental plots are referenced as east, central, and west based on their geographic location across the meadow. Each plot has concrete monuments with reference tag numbers (Appendix D). Plots are divided into subplots based on the seed source (Willamette Valley (WV) or mid-elevation (ME)) and the type of plant material used (seed or plugs). The subplot names have been updated from the original naming system (Celis et al. 2021) as follows: 'west subplot' and 'east subplot' have now become 'WV plug' and 'WV seed,' respectively. In 2020, the WV seed subplots were each seeded with 113.4g or about 110,111 seeds (971seeds/gram). In 2021, the WV plug subplots were each planted with 212 plugs and the ME seed subplots were each seeded with 8.65g or about 8,399 seeds (971 seeds/gram). To prepare the subplots for seeding, each ME seed subplot was thermally treated before hand-dispersal seeding of shaggy horkelia. In fall 2023, ME plug subplots were established and planted with

approximately 120 shaggy horkelia plugs using the same wild-collected mid-elevation seed from Douglas County.

In 2024, zero plants were observed in the three subplots where WV seed was sown. The three WV plug subplots had a total of 63 plants, a 67% decrease from 2023 (190), however, ten plants were observed flowering. The ME seed subplots had a total of eleven plants, one of which was flowering. The three ME plug subplots had a total of 232 plants, and 63 plants were observed flowering. Data for this experiment can be found in Appendix E.

Preliminary results suggest planting plugs is a superior strategy over broadcasting seed for shaggy horkelia augmentation at Twin Prairie. Seed source does not appear to impact plug establishment. Interestingly, we did observe more flowering plants in year one from plugs sourced from ME seed, but since ME and WV plugs were planted in different years it is difficult to say if seed source was the primary factor leading to more flowers. Climate and soil conditions may have influenced flowering; however, those factors were not evaluated. Data collected in 2025 will help determine if long term establishment rates differ between WV and ME plugs, and between ME seeding and ME plugs.

4. MANAGEMENT RECOMMENDATIONS

The overarching goal of this project is to maintain and improve mid-elevation prairie habitat and increase the shaggy horkelia population at Twin Prairie. The following restoration actions are recommended for 2025 and beyond:

- Pull, cut, and/or apply herbicide to treat false brome and Himalayan blackberry along the ACEC access road and Scotch broom within unit 5.
- Seed native species throughout the meadow complex. Emphasize increasing annual forb abundance and perennial forb and graminoid diversity. Consider adding fruiting shrubs to the south meadow edge to increase abundance of wildlife forage.
- Scythe mow, weed-wacker mow, and/or apply herbicide (sponge dauber or spot spray) to treat non-native grasses, particularly around the shaggy horkelia flagged polygons in preparation for fall planting.
- Buck and pile logs for natural decay within unit 2 corridor.
- Monitor shaggy horkelia when in peak bloom, likely between June 10th and 20th.
- Collect seed from shaggy horkelia for plug production if funding is expected to continue for the 2025-2030 planting plan.
- Plant 10,000 shaggy horkelia plugs over six years to augment and expand remnant population. If 10% of plugs survive after two years, as we saw with the WV plugs data from the recent experiment, this six-year planting strategy will create a population two and half times the current size. Additionally, if 2025 data show mid-elevation plugs have a higher survival rate this strategy may well exceed that projected growth goal. The first-year planting will give a significant boost to all current patches. Years two and three will enhance population continuity and create new patches within the meadow complex. Years four through six will expand all known patches a second time. Planting will occur around remnant patch perimeters and in radiating clumps to promote expansion.
    - 2025: 2000 plugs: ~200 to each of ten existing patches “A” through “J”
    - 2026: 1500 plugs: ~500 to each of three new patches: west of patch “E”, in center corridor of unit 2, east of patch “F”

- 2027: 1500 plugs: ~250 to each of six new patches: three in unit 4, three in unit 5
- 2028: 1500 plugs: ~150 to each of ten existing patches "A" through "J"
- 2029: 1500 plugs: ~500 to each successful new patch: west of patch "E", in center corridor of unit 2, east of patch "F", OR create new patches if previous planting patch had 100% mortality.
- 2030: 2000 plugs: ~250 to each successful patch in unit 4 and unit 5 OR create new patches if previous planting had 100% mortality.

5. REFERENCES

Celis, J., A. Esterson, and R. Currin. 2021. Habitat restoration and monitoring of shaggy horkelia at Twin Prairie: 2020 annual report. Unpublished report prepared for the Bureau of Land Management, Northwest Oregon District. Institute for Applied Ecology, Corvallis, Oregon.

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APPENDIX A. COMPLETED AND PROPOSED MANAGEMENT ACTIONS: 2013-2030

2013

- Seeds of Success collection: common yarrow (*Achillea millefolium*), winecup (*Clarkia purpurea*), American wild carrot (*Daucus pusillus*), Roemer's fescue (*Festuca roemeri*), prairie June grass (*Koeleria macrantha*), nineleaf biscuitroot (*Lomatium triternatum*), showy tarweed (*Madia elegans*), grassy tarweed (*Madia gracilis*), woodland tarweed (*Madia madioides*), and short spurred seablush (*Plectritis congesta*).
- Mapped shaggy horkelia (*Horkelia congesta ssp. congesta*), Himalayan blackberry (*Rubus bifrons*) and Scotch broom (*Cytisus scoparius*).
- Removed ~1.17 acres of Himalayan blackberry and ~0.4 acres of Scotch broom
- Monitored shaggy horkelia (only stems counted).

2014

- Mapped shaggy horkelia, Himalayan blackberry and Scotch broom populations.
- Removed ~1.2 acres of Himalayan blackberry, and ~0.5 acres of Scotch broom.
- Broadcast native seed mix on disturbed areas: common selfheal (*Prunella vulgaris*), blue wildrye (*Elymus glaucus*), Roemer's fescue and California oatgrass (*Danthonia californica*).
- Monitored shaggy horkelia (vegetative and reproductive individuals, browsed and unbrowsed stems).

2015

- Removed Scotch broom
- Limbed or felled shrubs and trees around shaggy horkelia populations.
- Girdled large trees near shaggy horkelia plots.
- Monitored shaggy horkelia (vegetative and reproductive individuals, browsed and unbrowsed stems).
- Planted 220 shaggy horkelia plugs in two locations (110 plugs in each).

2016

- Mapped shaggy horkelia population.
- Removed Himalayan blackberry and Scotch broom.
- Limbed or felled shrubs and trees around shaggy horkelia populations.
- Girdled large trees near shaggy horkelia plots.
- Monitored shaggy horkelia (vegetative and reproductive individuals, browsed and unbrowsed stems).
- Monitored augmented shaggy horkelia population.
- Broadcast native seed mix on disturbed areas: blue wildrye, Roemer's fescue, woolly sunflower (*Eriophyllum lanatum*), and California oatgrass.

2017

- Removed Scotch broom.
- Monitored shaggy horkelia (vegetative and reproductive individuals, browsed and unbrowsed stems).
- Limbed or felled shrubs and trees around shaggy horkelia populations.

2018

- Removed Scotch broom.
- Monitored shaggy horkelia (vegetative and reproductive individuals, browsed and unbrowsed stems).

2019

- Removed Scotch broom.
- Monitored shaggy horkelia (vegetative and reproductive individuals, browsed and unbrowsed stems).
- Approximately 12, 14–18-inch diameter Douglas-fir (*Pseudotsuga menziesii*) were cut to open space near shaggy horkelia.

2020

- Felled numerous Douglas-fir to release Oregon white oak (*Quercus garryana*)
- Monitored shaggy horkelia.
- Hand pulled Scotch broom in western meadow.
- Setup three experimental plots to test efficacy of seeding and planting shaggy horkelia plugs.
- Applied glyphosate to approximately one acre of non-native grasses.
- Flame weeded Willamette Valley (WV) seed and WV plugs experimental subplots.
- Seeded WV seed subplots with shaggy horkelia.

2021

- Monitored shaggy horkelia.
- Removed Douglas-fir for meadow connectivity enhancement.
- Planted 600 shaggy horkelia plugs in WV plug experimental subplots.
- Flame torch treatment of mid-elevation (ME) seed experimental subplots.
- Seeded shaggy horkelia in ME seed experimental subplots.
- Seeded native mix of mid-elevation origin to disturbed areas: winecup clarkia, blue wildrye, woolly sunflower, California fescue (*Festuca californica*), Roemer's fescue, prairie June grass, showy tarweed, grassy tarweed, woodland tarweed, short spurred seablush.

2022

- Removed Douglas-fir to improve meadow connectivity.
- Monitored shaggy horkelia.
- Seeded native mix of mid-elevation origin to disturbed areas (Appendix F).

2023

- Hand pulled oxeye daisy (Leucanthemum vulgare), Scotch broom in unit 5, and many non-native grass, forb, and shrub species along the access road within the ACEC, with LMYC.
- Monitored remnant shaggy Horkelia and experimental plots with BLM staff.
- Broadcast 78.1 pounds native seed mix (Appendix F).
- Planted 360 shaggy Horkelia plugs. Created one new subplot (ME plugs) at each of the three experimental plots with 120 plugs each.

2024

- Manual weed removal of oxeye daisy, annual grasses, Italian thistle, and Scotch broom.
- Monitored remnant shaggy Horkelia and experimental plots with BLM staff.
- Collected native seed of shaggy Horkelia for plug production and select other native species for hand dispersal.

2025

- May-July: Pull and/or apply herbicide to treat false brome and Himalayan blackberry along ACEC access road and Scotch broom within unit 5.
- May/June: Hand pull or apply herbicide to treat non-native grasses (sponge dauber or spot spray).
- June 5-20: Monitor shaggy horkelia when in flower, likely between June 5th and 20th.
- Oct/Nov: Seed native species throughout the meadow complex. Emphasize increasing annual forb abundance and perennial forb and graminoid diversity. Consider adding fruiting shrubs to the south meadow edge to increase abundance of wildlife forage.
- Sept-Dec: Buck and pile logs for natural decay within unit 2 corridor.
- Oct-Dec: Plant shaggy horkelia plugs.

2025-2030

- Plant shaggy horkelia plugs annually to augment and expand remnant population. Planting should occur around remnant patch perimeters and in radiating clumps to promote expansion.
    - 2025: 2000 plugs: ~200 to each of ten existing patches "A" through "J"
    - 2026: 1500 plugs: ~500 to each of three new patches: west of patch "E", in center corridor of unit 2, east of patch "F"
    - 2027: 1500 plugs: ~250 to each of six new patches: three in unit 4, three in unit 5
    - 2028: 1500 plugs: ~150 to each of ten existing patches "A" through "J"
    - 2029: 1500 plugs: ~500 to each successful new patch: west of patch "E", in center corridor of unit 2, east of patch "F", OR create new patches if previous planting patch had 100% mortality.
    - 2030: 2000 plugs: ~250 to each successful patch in unit 4 and unit 5 OR create new patches if previous planting had 100% mortality.

APPENDIX B. SHAGGY HORKELIA MONITORING PROTOCOL

1. Designate field crew members as either plant counter (counter) or data recorder (recorder). Generally, there are multiple counters and only one recorder.
2. Divide each shaggy horkelia patch into sections using transect tapes.
3. Count all individual shaggy horkelia encountered within each patch.
    a. Individual plants are defined as basal rosettes not obviously connected to a single crown, usually a minimum of 1-2 inches apart (Alverson, 2013).
    b. In 2020, the monitoring crew defined a seedling as any plant less two inches in diameter; however, the crew encountered many plants that were much smaller than this (**Figure 3**).
    c. When a counter sees a shaggy horkelia plant they will shout whether the plant is a seedling, vegetative or reproductive. If the plant is a seedling or vegetative then no other information is needed. For example, "I have three vegetative." The recorder will then write three tally marks under the column "vegetative" in the row indicating the patch number. However, if the counter sees a plant with any number of stems, even if browsed, they will tell the recorder that they have a "reproductive" and provide the number of browsed and unbrowsed stems present on that individual. For example, "one reproductive, four unbrowsed and three browsed stems." The recorder will then add one tally mark to the column "flowering," four tallies to the column "unbrowsed," and three tallies to the column "browsed."
    d. In 2024, IAE and BLM staff decided to no longer count stems and only count individuals: vegetative, flowering, or seedling.

Figure 4. Average size of shaggy horkelia (*Horkelia congesta ssp. congesta*) seedlings found during monitoring. Photo taken by Jessica Celis on June 4, 2020.

APPENDIX C. SHAGGY HORKELIA PATCH LABELING 2013 TO 2022

The shaggy horkelia (*Horkelia congesta* spp. *congesta*) population at Twin Prairie was first mapped in 2013 by BLM staff. In the original map individual patches were labeled by number. Over the past ten years new patches have been created as offshoots of the original patch (e.g., 7 and 7a), and at other times patches were merged due to low numbers and ease of monitoring. In 2022, multiple patches were combined and the need to revise the overall number system became necessary. To avoid confusion with the previous labeling system, the patch numbers have been replaced by letters A through J (Table 2, Figure 3).

Table 2. Shaggy horkelia (*Horkelia congesta* spp. *congesta*) patch mergers

Patch	Merger Notes
A	Patches 1 and 2 combined 2022.
B	Patches 3, 4, 5 combined 2015; plot 6 combined 2022.
C	Patches 7 and 7a combined 2021.
D	Patches 8 and 8a combined 2021
E	Patches 9, 10, 10a, and 11 combined 2022.
F	Patches 12, 12a, 12b combined 2022
G	Patches 13, 14, and15 combined 2022.
H	Patch 16
I	Patch 18
J	Patches 17 and 19 combined 2022.

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Figure 5. Twin Prairie shaggy horkelia (*Horkelia congesta* spp. *congesta*) patches with old labeling system (numbers) and new labeling system (letters).

APPENDIX D. EXPERIMENTAL PLOT LAYOUT

Table 3. Tag numbers for shaggy horkelia (*Horkelia congesta ssp. congesta*) experimental plots.

Plot Location	W.V. NE Label	W.V. NW Label
East	278	279
Central	284	291
West	289	288

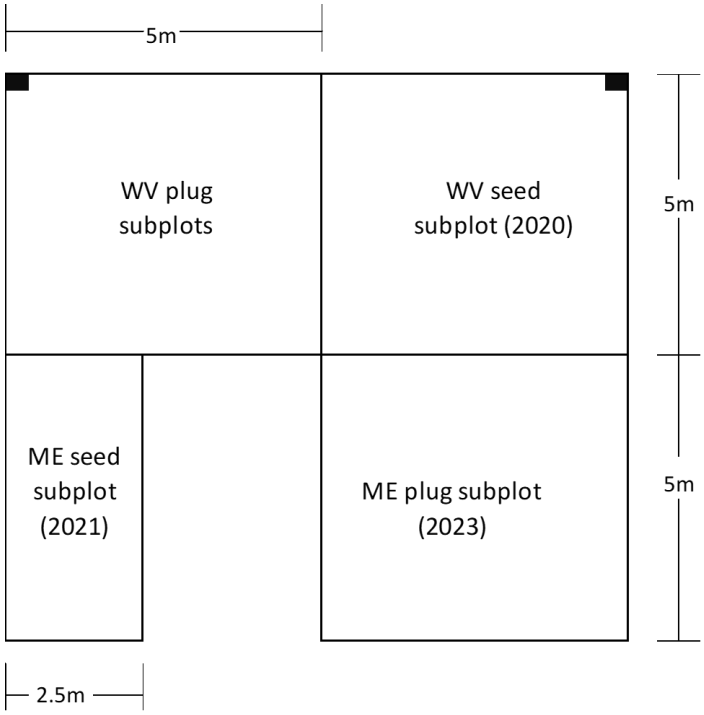

Figure 6. Experimental East plot layout with label locations marked in black.

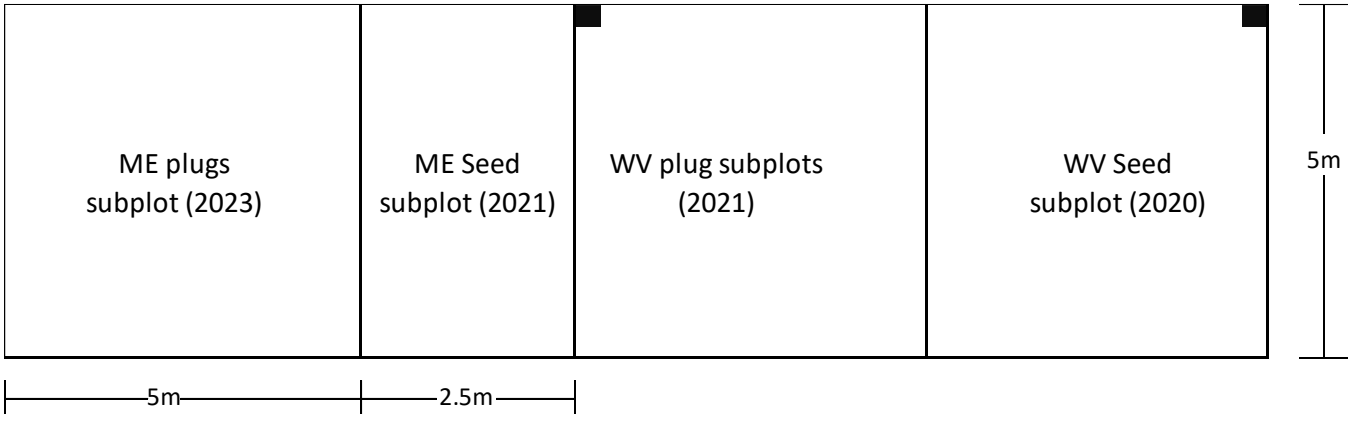

Figure 7. Experimental Central and West plot layout with label locations marked in black.

APPENDIX E. SHAGGY HORKELIA MONITORING DATA 2014-2024

Shaggy horkelia abundance (total individuals) from 2014-2024.

Patch*	# of total plants (# of additional seedling plants)										
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
A	19	16	18	29 (4)	8	15	22 (1)	32 (19)	14	19	19 (38)
B	427	422	521	723 (124)	484 (45)	528 (27)	588 (60)	511 (261)	431 (2)	472 (9)	333 (9)
C	63	35	42	46	41 (15)	39	27 (1)	28 (0)	5 (0)	24	15
D	68	13	58	54	68 (14)	40	30 (3)	21 (9)	49 (0)	38 (2)	43 (10)
E	5	9	13	30	8	6	6 (0)	5 (4)	1	12	5 (1)
F	104	69	119 (5)	51	31	46 (1)	26 (202)	66 (101)	80 (10)	71	67 (36)
G	96	87	108	94	50 (1)	42	62 (76)	76 (47)	68 (5)	47	29 (9)
H	355	216	303 (81)	211	122 (12)	111 (3)	130 (131)	128 (114)	123 (6)	83 (13)	52
I	76	44	104 (60)	31	31 (7)	31	26 (79)	37 (17)	19 (1)	20	23
J	17	16	59 (50)	8	17 (1)	20 (3)	25 (109)	53 (42)	57 (5)	42	38
Total Remnant	**1242**	**929**	**1345 (196)**	**1257 (128)**	**860 (95)**	**883 (34)**	**942 (661)**	**957 (614)**	**847 (29)**	**828 (24)**	**624 (103)**
Total Experiment								**0 (471)**	**383 (314)**	**212 (3)**	**306**
Adjusted Total								**957 (1085)**	**1230 (343)**	**1040 (27)**	**930 (103)**

*Patch mergers notes available in Appendix C.

Shaggy horkelia abundance (reproductive individuals) from 2014-2024.

Patch	# of reproductive plants										
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
A	19	14	6	20	8	13	19	25	13	14	14
B	245	225	276	424	188	358	416	334	273	327	224
C	51	30	30	33	19	20	20	21	5	19	11
D	35	13	37	43	31	36	29	19	25	36	39
E	8	10	8	9	6	6	6	5	1	11	4
F	64	39	58	40	26	38	21	18	13	59	40
G	49	43	50	65	39	35	44	57	34	37	16
H	184	116	125	159	78	82	74	79	56	56	31
I	46	24	36	27	18	25	18	26	13	14	14
J	12	13	7	8	7	8	18	20	18	23	19
Total	**713**	**527**	**633**	**828**	**420**	**621**	**665**	**604**	**451**	**596**	**412**
Percent Flowering:	57.4%	56.7%	47.1%	65.9%	48.8%	70.3%	70.6%	63.1%	53.3%	72.1%	66.0%
Total Experiment										**8**	**74**
Adjusted Total										**604**	**486**

*Patch mergers notes available in Appendix C.

Flowering stems (browsed) of shaggy horkelia at Twin Prairie, 2013-2023

Patch	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
A	25	22 (30)	35 (3)	7 (1)	70	21	45 (3)	37 (25)	65	24 (17)	42
B	516	217 (340)	345 (168)	99 (426)	464(634)	417 (158)	530 (288)	733 (178)	306 (294)	564 (31)	615 (69)
C	77	53 (63)	51 (11)	30 (38)	84(7)	39	38	37 (3)	28 (19)	12	40
D	61	39 (54)	26	44 (39)	102(23)	62 (18)	57 (30)	69 (46)	34 (26)	42 (34)	102 (50)
E	14	17 (1)	9 (16)	4 (9)	12 (16)	17 (16)	10 (3)	13 (6)	1 (12)	3 (0)	22 (7)
F	17	113 (79)	59 (23)	39 (88)	81(23)	52(6)	109	68 (5)	45 (7)	24 (8)	157
G	29	48 (72)	55 (29)	47 (47)	98	70	52	80 (5)	81 (14)	49 (16)	62 (16)
H	229	205 (287)	111 (98)	83 (185)	239(136)	167 (9)	149 (37)	118 (93)	104 (61)	74 (50)	48 (115)
I	102	66 (68)	48 (4)	10 (85)	57(35)	40 (6)	76	29 (14)	59 (9)	24 (25)	13 (51)
J	11	10 (29)	37	3 (17)	15(14)	18 (5)	33	23 (36)	30 (23)	18 (35)	23 (82)
TOTAL Unbrowsed + (browsed)	**N/A**	**790 + (1023)**	**776 + (352)**	**359 + (935)**	**1222 + (907)**	**903 + (218)**	**1098 + (362)**	**1,207 + (411)**	**753 + (465)**	**834 + (216)**	**1,124 + (390)**
TOTAL Combined	**1081**	**1813**	**1128**	**1294**	**2129**	**1121**	**1,460**	**1,618**	**1,218**	**1,050**	**1,514**
Proportion of browsed stems	**N/A**	**56%**	**31%**	**72%**	**43%**	**19%**	**25%**	**25%**	**38%**	**21%**	**26%**

***2024 monitoring did not include counting browsed or intact flowering stems.**

Table 4. Shaggy horkelia (*Horkelia congesta* ssp. *congesta*) seed source survivorship experiment data

		# of plants (# of seedlings)			
	Plot	**2021**	**2022**	**2023**	**2024**
WV seed	West	0 (123)	0	0	0
	Central	0 (33)	2	0	0
	East	0 (315)	0 (25)	0	0
ME seed	West	x	0 (115)	17 (3)	11
	Central	x	0 (90)	5	0
	East	x	0 (84)	0	0
WV plug	West	x	122	94	33
	Central	x	124	57	20
	East	x	135	39	10
ME plug	West	x	x	x	54
	Central	x	x	x	77
	East	x	x	x	101

	Total # plants by subplot type (# of seedlings)			
	2021	**2022**	**2023**	**2024**
WV Seed	0 (471)	2 (25)	0	0
ME Seed	x	0 (289)	22 (3)	11
WV plugs	x	381	190	63
ME plugs	x	x	x	232

	Total # <u>flowering plants</u> by subplot type			
	2021	**2022**	**2023**	**2024**
WV Seed	0	0	0	0
ME Seed	X	0	0	1
WV plugs	X	0	8	10
ME plugs	X	x	x	63

APPENDIX F. COMPREHENSIVE PLANTING AND SEEDING RECORD 2014-2024

Scientific name	Common name	Amount seed (lb.) and number of plugs or shrubs {quantity}.						
		2014	2015	2016	2020	2021	2022	2023
Achnatherum lemmonii ssp. lemmonii	Lemon's needlegrass						0.117	
Amsinckia menziesii var. intermedia	Menzies' fiddleneck							2.51*
Clarkia amoena ssp. lindleyi	farewell-to-spring							6.19*
Clarkia purpurea	winecup clarkia					Seed	0.121	5.65*
Collinsia grandiflora	large-flowered blue-eyed Mary							2.23*
Collomia grandiflora	large-flowered collomia							6.18*
Danthonia californica	California danthonia	5		2			2	10
Elymus glaucus	blue wildrye	7		1		Seed		
Epilobium densiflorum	denseflower willowherb							0.44*
Eriophyllum lanatum	Oregon sunshine			1		Seed	2	8.3
Festuca californica	California fescue					Seed	0.68	
Festuca roemeri	Roemer's fescue	5		2		Seed	2	5.71
Gilia capitata	globe gilia						0.7	1.71*
Horkelia congesta spp. *congesta*	shaggy horkelia		{220}		0.75	Seed {600}		{360}
Iris tenax	toughleaf iris							0.047
Koeleria macrantha	prairie Junegrass					Seed	1	10
Lomatium dissectum	fern-leaved biscuitroot							0.165
Lomatium utriculatum	spring gold					Seed	0.02	
Madia citriodora	lemon-scented tarweed							0.0548
Madia elegans	showy tarweed					Seed		1.05*
Madia gracillis	grassy tarweed					Seed		0.68*
Madia madioides	woodland tarweed					Seed		
Phacelia nemoralis var. oregonensis	Oregon woods phacelia							1.01*
Plagiobothrys figuratus	fragrant popcornflower							1.07*
Plectritis congesta	shortspur seablush							3.003*
Poa secunda	pine bluegrass					Seed		
Prunella vulgaris var. lanceolata	common selfheal	3					0.026	6.1

Scientific name	Common name	Amount seed (lb.) and number of plugs or shrubs {quantity}.						
		2014	2015	2016	2020	2021	2022	2023
Sidalcea malviflora spp. virgata	rose checkermallow						0.1	
Wyethia angustifolia	narrowleaf mule's ear						2	6.0035
	Totals:	**20 lb.**	**220 plugs**	**6 lb.**	**0.75 lb.**	**Unknown seed total, 600 plugs**	**10.76 lb.**	**78.10 lb. 360 plugs**
	Seed source notes: Willamette Valley (WV) or mid-elevation (ME) genetic origin.				**All WV sourced.**	**All ME sourced, but unknown quantities (see 2021 report). H. congesta from WV (Douglas).**	**All ME sourced.**	**ME and WV sourced. *Annual Color Mix: WV sourced.**

No plant materials were added to the site in 2024.