

Habitat Restoration and Monitoring of Shaggy Horkelia at Twin Prairie: 2021 Annual Report



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PREFACE

IAE is a non-profit organization whose mission is 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: Shaggy Horkelia (*Horkelia congesta* ssp. *congesta*) flower. Photo taken on June 7, 2021 by IAE staff.

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Habitat Restoration and Monitoring of Shaggy Horkelia at Twin Prairie: 2021 Annual Report

1. EXECUTIVE SUMMARY

Twin Prairie is a mid-elevation meadow owned and managed by the Bureau of Land Management, Northwest Oregon District (BLM), and located in southern Lane County, Oregon, south of Cottage Grove. The meadow supports a population of shaggy horkelia (*Horkelia congesta* ssp. *congesta*), a rare species endemic to Oregon. The goals of restoration actions at Twin Prairie are to maintain and improve rare upland prairie habitat in support of the shaggy horkelia population. In 2021, restoration actions consisted of monitoring the shaggy horkelia population, removing encroaching trees, seeding disturbed areas and maintaining experimental plots to determine the efficacy of seeding and planting shaggy horkelia.

During the shaggy horkelia census we counted 957 individuals, of those 63% were flowering and 37% were vegetative; 614 seedlings were also counted. 1,218 reproductive stems were counted, and of those 38% were browsed. In the experimental plots 123, 38, and 315 seedlings were observed in the West, Central and East plots, respectively.

2. INTRODUCTION

Twin Prairie is a mid-elevation 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 prairie supports a population of the Oregon endemic, BLM Sensitive and State of Oregon Candidate (Department of Agriculture 2017) species shaggy horkelia (*Horkelia congesta* ssp. *congesta*). The Oregon Biodiversity Information Center (ORBIC 2016) 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 populations is necessary to prevent the listing of this species under the Federal 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 2021.

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Figure 1. Location of Twin Prairie in the context of the greater Willamette Valley. Map inset shows the boundaries of Twin Prairie (yellow) and part of the Willamette Valley Prairie Oak and Pine Area of Critical Environmental Concern (orange; ACEC).

3. GOALS AND OBJECTIVES

The goals of habitat restoration at Twin Prairie are to maintain and improve rare upland prairie habitat that supports shaggy horkelia and to release Oregon white oaks (*Quercus garryana*) from conifer encroachment. The five primary objectives of this project are to:

1. Decrease the abundance of non-native invasive plant populations;
2. Prevent encroachment of woody species into the prairie;
3. Release Oregon white oaks from conifer encroachment;
4. Increase diversity and abundance of the native plant community; and
5. Improve connectivity between meadows at Twin Prairie.

4. 2021 RESTORATION ACTIONS

In 2021, restoration actions consisted of monitoring the shaggy horkelia population including experimental plots (Celis et al. 2021), removing conifers that are encroaching into the meadow and around Oregon white oaks, maintaining experimental plots that test the efficacy of augmenting shaggy horkelia with seeds and plugs (Table 1, Figure 2) from different ecoregions (Willamette Valley and Mid-Elevation prairies) and seeding native species in disturbed areas. See Appendix A for a list of all restoration activities conducted at Twin Prairie from 2013 to 2021.

Table 1. Summary of 2021 restoration actions at Twin Prairie

Date	Personnel*	Task
March	IAE and BLM staff	2021 site assessment and planning meeting; flagged trees for fall cutting
June	IAE and BLM Staff	2021 shaggy horkelia population census
October	Northwest Youth Corps, IAE and BLM staff	Cut down flagged Douglas-fir (<i>Pseudotsuga menziesii</i>), bucked and remove from meadow; delineated thermal treatment area and new shaggy horkelia seeding subplots
October	Northwest Youth Corps, IAE and BLM staff	Cut down flagged Douglas-fir, bucked and removed from meadow
November	AmeriCorps, IAE and BLM staff	Planted 600 shaggy horkelia in experimental plots (ME Plug subplots)
November	IAE and BLM staff	Thermal treatment of non-native grasses within experimental plots (ME seed subplots) and followed with seeding shaggy horkelia. Seeded native seed in disturbed areas from tree removal.

*Institute for Applied Ecology (IAE); 10 person AmeriCorps Red 8 Team (AmeriCorps)

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Figure 2. Polygons delineating management actions at Twin Prairie in 2021. Shaggy horkelia (*Horkelia congesta* ssp. *congesta*) experimental plots (west (W), central (C), and east (E)) were thermally treated, seeded, and planted with plugs according to their subplots.

5. Shaggy horkelia monitoring

5.1. Background and methods

Shaggy horkelia monitoring began in 2013. Geographically unique clusters of shaggy horkelia were designated as “patches” and mapped (Figure 2). Since then, patches have either been added or consolidated as new patches were found or as patches grew together and became indistinguishable from one another. Initially, every reproductive stem in each patch was counted. Since 2014, additional data has been collected, including the total number of individuals, reproductive status (vegetative or flowering) and the number of browsed stems. Beginning in 2016, mature individuals were distinguished from seedlings to document evidence of reproduction. A description of the monitoring protocol can be found in Appendix B.

5.2. Results

In 2021, 20 patches of shaggy horkelia were monitored and 957 shaggy horkelia individuals were counted; of those, 64% were flowering, 36% were vegetative (seedlings not included). 1,218 reproductive stems were counted and of those 38% were browsed. 614 seedlings were counted in 2022; which is a 7% decrease from 2020, but a 1700% increase from 2019. In the West, Central and East experimental plots, 123, 38, and 315 seedlings were counted, respectively. (Figure 3, Table 2, Table 3, Table 4)

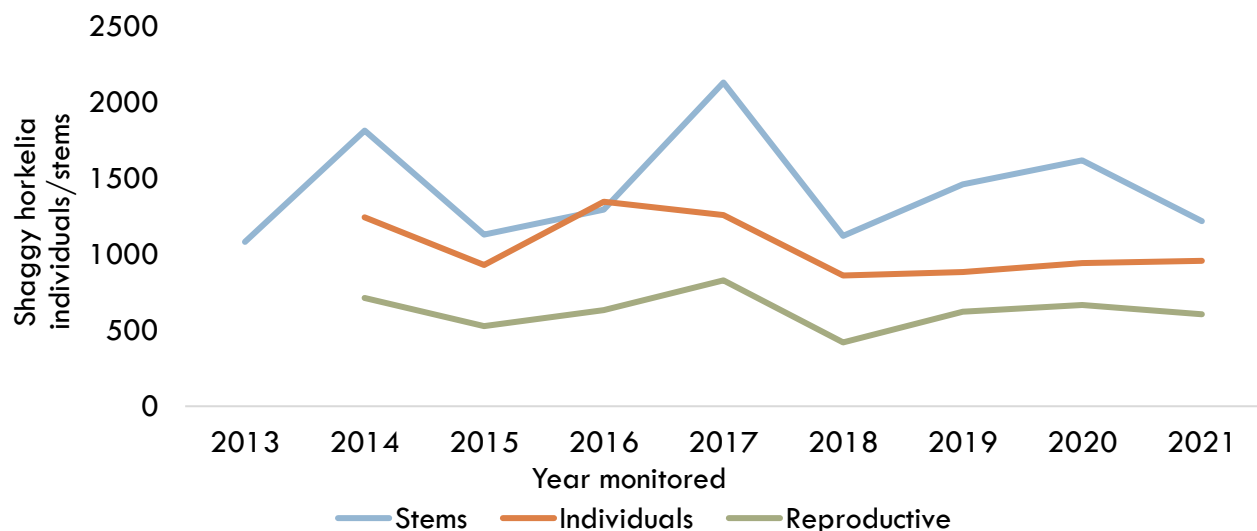


Figure 3. Shaggy horkelia (*Horkelia congesta* ssp. *congesta*) population trends from 2013 – 2021. Data show total number of stems (browsed and unbrowsed), individuals (vegetative and reproductive, does not include seedlings) and reproductive individuals.

6. DISCUSSION

6.1. Habitat management

A variety of trees, including Douglas-fir, western red cedar (*Thuja plicata*), grand fir (*Abies grandis*) and Oregon ash (*Fraxinus latifolia*), along with shrubs such as Himalayan blackberry (*Rubus bifrons*) and Scotch broom (*Cytisus scoparius*), are the primary woody species establishing in the prairie. Limbing and/or removal of the species that encroach into shaggy horkelia habitat is a priority for restoration. In 2021, with the help of a Northwest Youth Corps team, we were able to remove Douglas-fir trees and saplings from around many Oregon white oaks (Figure 2), but did not have time to remove trees along the northern edge where the shaggy horkelia exist. Tree removal work planned for 2022 will focus on the northern edge of the meadow closer to the shaggy horkelia population.

The Scotch broom population in the east prairie has been pulled for many years and has declined as a result, however, there is still a need to continue managing this species. In 2021, IAE planned to remove Scotch broom from the eastern meadow with help from an AmeriCorps team. Unfortunately, the AmeriCorps team was sent on another assignment and was not able to support this task. IAE will continue managing the Scotch broom in 2022. Once the Scotch broom is under control, efforts to remove Himalayan blackberry should be prioritized. Historically herbicides have not been permitted but with recent BLM policy changes some herbicides are permitted and may be a good tool for management of some species. All applications will be pre-approved by BLM staff and follow BLM herbicide protocols. Priority species for herbicide application includes Scotch broom and Himalayan blackberry.

6.2. Shaggy horkelia monitoring

2021 monitoring show the shaggy horkelia population increasing for the third consecutive year. Between 2020 and 2021 the number of reproductive plants and the overall number of stems decreased. It is unclear what factors have contributed to the recent population growth, but it may be a result of management practices and more refined monitoring methods. IAE has limbed and/or felled conifers and removed shrubs around some shaggy horkelia patches, providing increased light and less competition for below-ground resources.

In 2020, there was a 1,844% increase in seedlings from 2019 (34) to 2020 (661). A high number of seedlings continued in 2021 (614), meaning for two years in a row, seedling observations have been three times higher than any year prior to 2020. This appears to be a positive new population trend but we believe it is more likely attributed to more accurate surveying. The tiny seedlings can easily be overlooked and heightened awareness of them in 2020 and 2021 could explain these higher numbers. Shaggy horkelia has been monitored annually since 2013 and we recommend that the annual census continue in 2022 and subsequent years.

6.3. Shaggy horkelia augmentation

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) effects 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 on the corners with reference tag numbers on the NE and NW corners (Appendix C). Plots are divided into subplots based on the seed source, Willamette Valley (WV) or mid-elevation (ME), and also the plant material type used (seed or plugs). Subplot names have been updated from (Celis et al. 2021) in the following ways: west subplot and east subplot have now become WV plugs and WV seed, respectively. In 2021, the WV plugs subplots were each planted with 212 plugs. Additionally, ME seed subplots were added to the western edge of each plot to compare plant establishment and vigor between seed source locations (Appendix C). Steep, rocky terrain at the east plot made establishment of the ME seed subplot difficult so the ME seed subplot was setup below the WV plugs subplot.

To prepare subplots for seeding, each ME seed subplot was thermally treated before hand-dispersed seeding with 8.65g of shaggy horkelia. An additional round of subplots will be added in fall 2022 (ME plugs) and will be planted with approximately 200 shaggy horkelia plugs using the same wild collected mid-elevation seed. Thin, rocky soils made planting 5.5 inch plugs challenging. Numerous times we were not able to dig holes deep enough for the plugs. An alternative approach we plan to try in 2022 may be growing shorter plugs that require shallower holes for planting.

6.4. Plant materials

In 2021, IAE collected shaggy horkelia seed from two locations in the Roseburg BLM district (Lower Berry Creek and Ben Irving) and Twin Prairie. In total, 27grams of shaggy horkelia seed was collected. Collected seed was used to augment new experimental subplots created in 2021 (Appendix C). Each subplot received 8.65g of shaggy horkelia seed. An additional 500 plugs will be grown in 2022 using this seed and plugs will be planted in fall 2022.

Ideally, if using source seed from sites other than Twin Prairie, we recommend collecting from sites with similar thin-soiled, mid-elevation habitat. Population information collected by Kaye and Gisler in 1993 reported 20 known populations of shaggy horkelia within the Willamette Valley, Oregon (Kaye1993). Permission should be sought to collect seed from public and private mid-elevation sites. However, if mid-elevation seed is not available, we still recommend broadening the Twin Prairie shaggy horkelia population's genetic diversity with seed sourced from the Willamette Valley.

While removing conifer trees in 2021, muddy conditions led to visible ground disturbance. To mitigate the disturbance a native seed mix was broadcast in disturbed areas. All seed was sourced from mid-elevation sites and was provided by IAE at no cost to the project. Unfortunately, most of the seed was collected between five and ten years ago and was not weighed out, thus pure live seed (PLS) and seed weight was unknown.

Table 2. Native seed mix used in 2021

Species	Common name
<i>Clarkia purpurea</i>	winecup clarkia
<i>Elymus glaucus</i>	blue wildrye
<i>Eriophyllum lanatum</i>	Oregon sunshine
<i>Festuca roemerii</i>	Roemer's fescue
<i>Festuca californica</i>	California fescue
<i>Koeleria macrantha</i>	june grass
<i>Lomatium utriculatum</i>	common lomatium
<i>Madia elegans</i>	common madia
<i>Madia gracilis</i>	grassy tarweed
<i>Madia madioides</i>	woodland madia
<i>Plectritis congesta</i>	shortspur seablush

7. MANAGEMENT RECOMMENDATIONS

- **Monitor shaggy horkelia:** Monitoring in 2022 and 2023 should include a census of shaggy horkelia establishment within the seed versus plug experimental plots as well as the regular known population sites. Consider a change in the monitoring cycle of shaggy horkelia from annually to biennially after establishment and initial monitoring of the experimental plots has finished (2024).
- **Shaggy horkelia augmentation experimentation:** In the fall of 2022, plant shaggy horkelia plugs into the west subplot in each of the seed versus plug experimental plots. Each subplot should be chemically treated to remove invasive weeds and thermally treated to reduce thatch prior to seeding or plug planting.
- **Wild-collect shaggy horkelia seed:** To increase the size and genetic diversity of the shaggy horkelia population at Twin Prairie, seed should be collected for augmentation from other wild populations. If data from the seeding experiment show there is a benefit to using mid-elevation sourced seed, then we recommend collecting shaggy horkelia seed from Twin Prairie and other mid-elevation wild populations in 2023 and beyond for augmentation. If the experiment shows benefit to using Willamette Valley sourced seed we recommend considering wild seed collection from locations below 750ft elevation.
- **Remove encroaching vegetation:** Tree clearing should continue along prairie edges, especially near shaggy horkelia patches and surrounding Oregon white oaks.
- **Manage non-native shrubs:** Remove Scotch broom and Himalayan blackberry. Spot spray regrowth with herbicide following manual removal.
- **Locate and remove non-native grass and forb species:** Surveys should be conducted in spring to determine where large patches of non-native herbaceous species occur. The most aggressive species should be targeted for spot spraying with herbicide using a backpack sprayer. False brome (*Brachypodium sylvaticum*) has been observed along the access road and should be treated annually.

- **Collect mid-elevation native seed:** Native seed should be collected from Twin Prairie and other mid-elevation sites and stored until used for future direct seeding (especially in areas where woody material has been removed), plug production and/or seed amplification. We recommend wild-collecting native species in 2022 to use for restoration at Twin Prairie and other mid-elevation meadows. Specific species to target include, but are not limited to, blue wildrye (*Elymus glaucus*), California oatgrass, California fescue (*Festuca californica*), Roemer's fescue, junegrass (*Koeleria macrantha*), and Oregon sunshine. Collected seed will be used in disturbed areas following conifer removal or prescribed fire treatment.

8. REFERENCES

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APPENDICES

Appendix A Restoration actions at Twin Prairie (2013-2021)

2013

- Seeds of Success collection (common yarrow (*Achillea millefolium*), winecup (*Clarkia purpurea*), American wild carrot (*Daucus pusilis*), Roemer's fescue (*Festuca roemerii*), prairie Junegrass (*Koeleria macrantha*), nineleaf biscuitroot (*Lomatium triternatum*), common madia (*Madia elegans*), grassy tarweed (*Madia gracilis*), woodland madia (*Madia madioides*), and short spurred seablush (*Plectritis congesta*))
- Shaggy horkelia, Himalayan blackberry and Scotch broom populations were mapped
- ~1.17 acres of Himalayan blackberry was removed
- ~0.4 acres of Scotch broom was removed
- Shaggy horkelia was monitored (only stems counted)

2014

- Shaggy horkelia, Himalayan blackberry and Scotch broom populations were mapped
- ~1.2 acres of Himalayan blackberry were removed
- ~0.5 acres of Scotch broom was removed
- A native seed mix was broadcast over disturbed areas (common selfheal (*Prunella vulgaris*), blue wildrye (*Elymus glaucus*), Roemer's fescue and California oatgrass (*Danthonia californica*))
- Shaggy horkelia was monitored (vegetative and reproductive individuals, browsed and unbrowsed stems)

2015

- Scotch broom was removed
- Shrubs and trees around shaggy horkelia populations were limbed or felled
- Large trees near shaggy horkelia plots were girdled
- Shaggy horkelia was monitored (vegetative and reproductive individuals, browsed and unbrowsed stems)
- 220 shaggy horkelia plugs were planted in two locations (110 plugs in each)

2016

- Shaggy horkelia population was mapped
- Himalayan blackberry and Scotch broom was removed
- Shrubs and trees around shaggy horkelia populations were limbed or felled
- Large trees near shaggy horkelia plots were girdled
- Shaggy horkelia was monitored (vegetative and reproductive individuals, browsed and unbrowsed stems)

- Augmented shaggy horkelia population was monitored
- A native seed mix was broadcast over disturbed areas (blue wildrye, Roemer's fescue, common woolly sunflower, and California oatgrass)

2017

- Scotch broom was removed
- Shaggy horkelia was monitored (vegetative and reproductive individuals, browsed and unbrowsed stems)
- Shrubs and trees around shaggy horkelia populations were limbed or felled
- Management plan was reviewed by IAE staff

2018

- Scotch broom was removed
- Shaggy horkelia was monitored (vegetative and reproductive individuals, browsed and unbrowsed stems)

2019

- Scotch broom was removed
- Shaggy horkelia was monitored (vegetative and reproductive individuals, browsed and unbrowsed stems)
- Approximately 12, 14–18-inch DBH Douglas-fir (*Pseudotsuga menziesii*) trees were cut from the northern edge of the large meadow and countless saplings were cut from along the north and west edges of the meadow.

2020

- Felled numerous Douglas-fir to release Oregon white oaks
- 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
- Tree removal of Douglas-fir (*Pseudotsuga menziesii*)
- Planted 600 shaggy horkelia plugs in WV plug experimental subplots
- Thermal treatment of mid-elevation (ME) seed experimental subplots
- Seeded shaggy horkelia in ME seed experimental subplots

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 4).
 - 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.”



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 Experimental plot layout

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

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

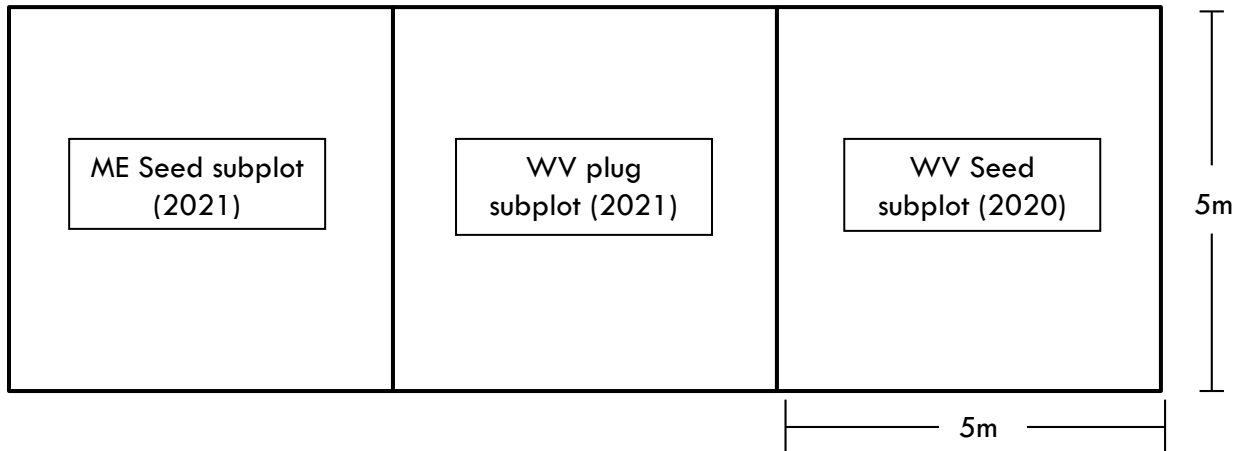


Figure 5. Experimental design of shaggy horkelia (*Horkelia congesta* ssp. *congesta*) seed versus plug experiment; Willamette Valley (WV) and mid-elevation (ME) seed sources.

Appendix D Shaggy horkelia monitoring data

Table 4. Results of the shaggy horkelia (*Horkelia congesta* ssp. *congesta*) monitoring of total population and individual size from 2014 to 2021.

Patch	# of total plants (# of additional seedling plants)							
	2014	2015	2016	2017	2018	2019	2020	2021
1	12	11	17	20	0	0	0	0
2	7	5	1	9 (4)	8	15	22 (1)	32 (19)
3,4,5	407	406	503	700 (124)	484 (45)	528 (27)	588 (60)	511 (261)
6	20	16	18	23	0	0	0	0
7, 7a	63	35	42	46	41 (15)	39	27 (1)	28 (0)
8, 8a	68	13	58	54	68 (14)	40	30 (3)	21 (9)
9	3	1	1	2	0	0	3 (0)	2 (0)
10	1	0		20	0	0	0	0
10a	0	1	1	1	0	0	0	0
11	5	9	11	7	8	6	3 (0)	3 (4)
12	104	67	117 (5)	50	27	42 (1)	21 (153)	61 (86)
12a	0	2	2	1	1	4	4 (39)	4 (15)
12b	0	0	0	0	3	0	1 (10)	1 (0)
13	3	6	7	2	0	2	0	1 (0)
14	1	1	2	8	2	0	0	0
15	92	80	99	84	48 (1)	40	62 (76)	75 (47)
16	355	216	303 (81)	211	122 (12)	111 (3)	130 (131)	128 (114)
17	2	2	0	0	0	0	0	0
18	76	44	104 (60)	31	31 (7)	31	26 (79)	37 (17)
19	15	14	59 (50)	8	17 (1)	20 (3)	25 (109)	53 (42)
Total	1242	929	1345 (196)	1257 (128)	860 (95)	883 (34)	942 (661)	957 (614)

* Initially, patches 3, 4 and 5 were distinct, but over time they have expanded and merged into a contiguous patch and are now counted one patch. Patches 7 and 7a were combined in 2021 and 8 and 8a were combined in 2021. Counts from 2016 to 2021 included seedlings which are shown in parenthesis.

Table 5. Results of the shaggy horkelia (*Horkelia congesta* ssp. *congesta*) monitoring of total reproductive plants from 2014 to 2021.

	# of reproductive plants							
Patch	2014	2015	2016	2017	2018	2019	2020	2021
1	12	9	5	15	0	0	0	0
2	7	5	1	5	8	13	19	25
3,4,5	235	216	263	408	188	358	416	334
6	10	9	13	16	0	0	0	0
7, 7a	51	30	30	33	19	20	20	21
8, 8a	35	13	37	43	31	36	29	19
9	3	1	1	2	0	0	3	2
10	1	0	0	0	0	0	0	0
10a	0	1	1	1	0	0	0	0
11	4	8	6	6	6	6	3	3
12	64	37	56	39	22	34	18	14
12a	0	2	2	1	1	4	2	3
12b					3	0	1	1
13	3	5	5	1	0	1	0	1
14	1	1	2	6	1	0	0	0
15	45	37	43	58	38	34	44	56
16	184	116	125	159	78	82	74	79
17	2	2	0	0	0	0	0	0
18	46	24	36	27	18	25	18	26
19	10	11	7	8	7	8	18	20
Total	713	527	633	828	420	621	665	604

* Initially, patches 3, 4 and 5 were distinct, but over time they have expanded and merged, and are now counted as one patch. Patches 7 and 7a were also combined in 2021. 8 and 8a were also combined in 2021.

Table 6. Results of shaggy horkelia (*Horkelia congesta* ssp. *congesta*) stem counts from 2013 to 2021.

Patch	# reproductive stems (#browsed stems)								2021
	2013	2014	2015	2016	2017	2018	2019	2020	
1	12	12 (24)	27	6	56	0	0	0	0
2	13	10 (6)	8 (3)	1 (1)	14	21	45 (3)	37 (25)	65 (0)
3-5, summed	489	212 (315)	325 (168)	88 (409)	423(634)	417 (158)	530 (288)	733 (178)	306 (294)
6	27	5 (25)	20	11 (17)	41	0	0	0	0
7	77	53 (63)	51 (11)	30 (38)	84(7)	39	38	37 (3)	28 (19)
8	61	39 (54)	26	44 (39)	102(23)	62 (18)	57 (30)	69 (46)	34 (26)
9	3	3 (1)	2	2	5	0	0	6 (6)	0 (5)
10	9	6	0	0	0	0	0	0	0
10a	0	0	1	1	1(1)	0	0	0	0
11	2	8	6 (16)	1 (9)	6(15)	17(16)	10 (3)	7 (0)	1 (7)
12	17	113 (79)	54 (23)	33 (86)	80(23)	38(5)	93	57 (5)	28 (7)
12a	0	0	5	6 (2)	1	5	16	5 (0)	9 (0)
12b	0	0	0	0	0	9(1)	0	6 (0)	8 (0)
13	19	2 (12)	11	2 (9)	1	0	2	0	3 (0)
14	6	3 (4)	1 (2)	3	14	11	0	0	0
15	4	43 (56)	43 (27)	42 (38)	83	59	50	80 (5)	78 (14)
16	229	205 (287)	111 (98)	83 (185)	239(136)	167 (9)	149 (37)	118 (93)	104 (61)
17	4	2	2	0	0	0	0	0	0
18	102	66 (68)	48 (4)	10 (85)	57(35)	40 (6)	76	29 (14)	59 (9)
19	7	8 (29)	35	3 (17)	15(14)	18 (5)	33	23 (36)	30 (23)
TOTAL: Unbrowsed + (browsed)	N/A	790 + (1023)	776 + (352)	359 + (935)	1222 + (907)	903 + (218)	1098 + (362)	1,207 + (411)	753 + (465)
TOTAL: Combined	1081	1813	1128	1294	2129	1121	1,460	1,618	1,218
Proportion of browsed stems	N/A	56%	31%	72%	42%	19%	25%	25%	38%

* Initially, patches 3, 4 and 5 were distinct, but over time they have expanded and merged, and are now counted as one patch. Patches 7 and 7a were combined in 2021 and 8 and 8a were combined in 2021