

Old Peak Meadow habitat enhancement project: 2023 annual report



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#PW 2019-066-250741

Report prepared by Rolando Beorchia and Andrew
Esterson

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

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Cover photograph: Flowering chocolate lily (*Fritillaria affinis*) at Old Peak Meadow. Photo taken by Rolando Beorchia on April 27, 2023.

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EXECUTIVE SUMMARY

In 2023, the Institute for Applied Ecology (IAE) continued to improve habitat conditions at Old Peak Meadow (Old Peak) through weed abatement and revegetation. To support a targeted restoration approach, Old Peak is divided into three management units: North, Central, and South. In the North unit, IAE hand weeded oxeye daisy (*Leucanthemum vulgare*) and planted shrubs and strawberry within the roadside shrub enclosure. In the Central unit, IAE maintained chemical fallow, broadcast a native seed mix, and planted native bulbs and bareroot plants. In the South unit, IAE selectively treated invasive weeds while maintaining desirable native plant. Throughout all units, IAE treated non-native species including false brome (*Brachypodium sylvaticum*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), fox glove (*Digitalis purpurea*), oxeye daisy, and rattail fescue (*Vulpia myuros*). The combination of these restoration methods and specific treatment timings should continue to improve habitat across the meadow.

1. INTRODUCTION

Old Peak Meadow (Old Peak) is a mid-elevation, remnant meadow located in the Corvallis Watershed and owned by the City of Corvallis (City) (Figure 1). Historically, Old Peak was part of a 160-acre homestead with open habitat (Esterson 2018). Due to decades of conifer encroachment, the open habitat was reduced to an approximately one-acre meadow. Between 2009 and 2013, the City removed 100 Douglas-fir (*Pseudotsuga menziesii*) trees, increasing the size of the meadow to approximately three acres. Songbird surveys completed between 2011 and 2013 indicated Old Peak was attracting fewer songbirds than expected, most likely a result of minimal floristic diversity and structure (Vesely 2013). In 2014, the City, along with three other partners including Institute for Applied Ecology (IAE), received a \$43,000 grant from the Coast Range Stewardship Fund to improve wildlife habitat at Old Peak by diversifying plant species composition and vegetation structure of the meadow. Since 2014, restoration actions by IAE have included:

- Controlling invasive species with herbicide and mowing.
- Increasing native species diversity and abundance via seeding and planting.
- Creating structural diversity within the meadow and along the meadow/forest ecotone:
 - Seeding with a variety of native forbs and grasses.
 - Planting shrubs on the east edge of the meadow.
- Conducting plant community surveys.

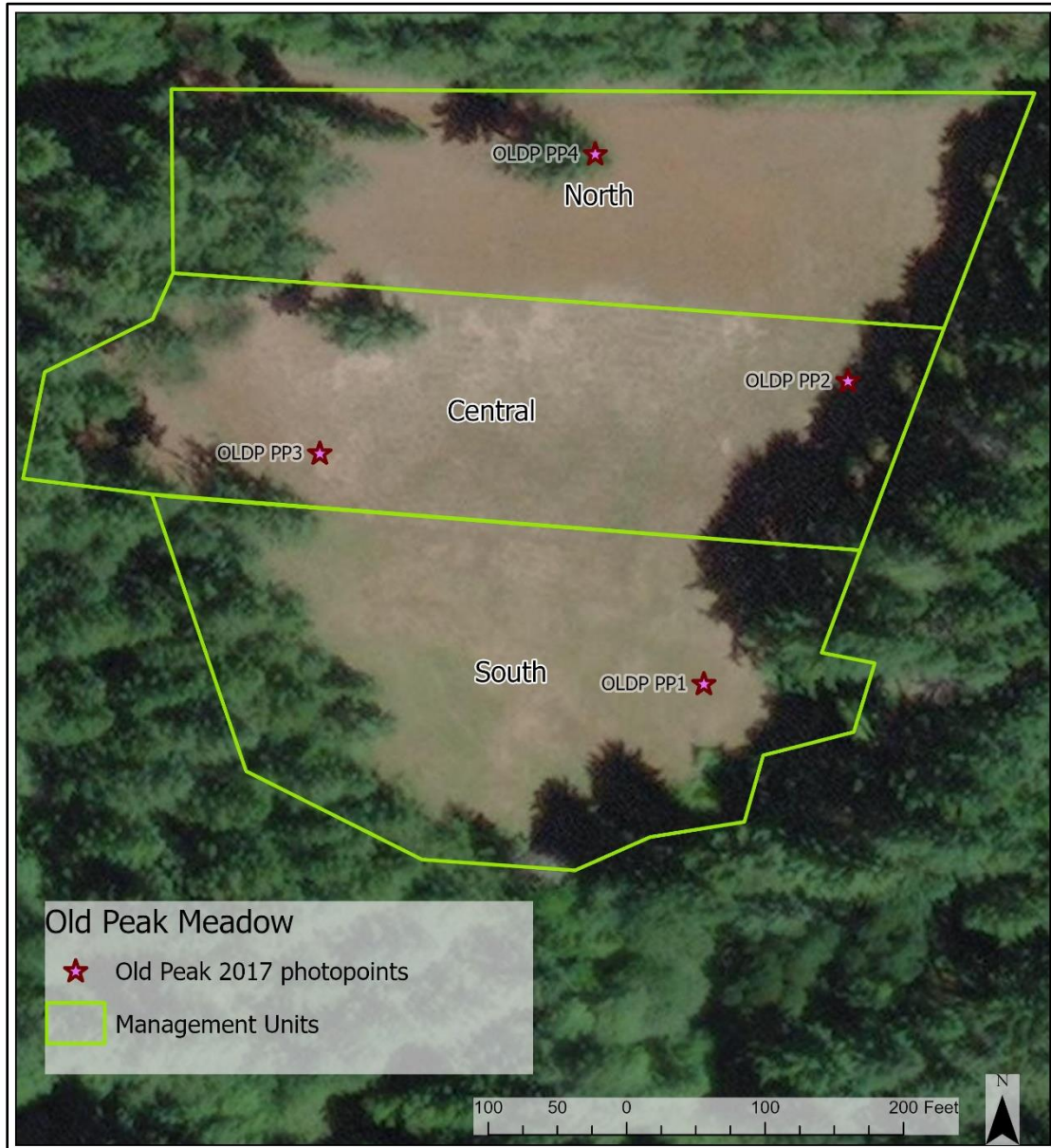


Figure 1. Old Peak Meadow management units and photo point locations.

2. RESTORATION ACTIVITIES

Old Peak is divided into three management units, North, Central, and South, to delineate areas for a targeted restoration approach and units differ in the actions needed to meet restoration goals (Figure 1). Restoration efforts in all units consisted of herbicide applications, hand weeding oxeye daisy (*Leucanthemum vulgare*), and planting native species (Table 1). Spot spray application of Rodeo (glyphosate) herbicide occurred in all units targeting false brome (*Brachypodium sylvaticum*), Canada thistle (*Cirsium arvense*), Bull thistle (*Cirsium vulgare*), foxglove (*Digitalis purpurea*), and oxeye daisy. Additionally, a local wild seed wholesaler, Jonny Native Seed, donated one pound of great camas (*Camassia leichtlinii*) seed that was broadcast over the eastern third of all the units (Figure 2). A summary of management actions from 2009-2023 are in Appendix A. Appendix C contains a comprehensive

record of species planted and seeded at Old Peak Meadow. Appendix D contains plant community composition data from 2017.

Table 1. 2023 management actions at Old Peak Meadow.

Date	Personnel*	Unit Location	Management Action
April 27	IAE	All 3	Applied Rodeo (glyphosate) targeting thistles (<i>Cirsium</i> sp.), foxglove (<i>Digitalis purpurea</i>), false brome (<i>Brachypodium sylvaticum</i>), and oxeye daisy (<i>Leucanthemum vulgare</i>).
		North	Applied Select Max (clethodim) targeting rattail fescue (<i>Vulpia myuros</i>).
		Central	Broadcast applied Rodeo (glyphosate) to continue fallow.
May 12	IAE	North	Hand weeded oxeye daisy.
May 31			
June 5		Central	Broadcast applied Rodeo (glyphosate).
June 16	IAE, volunteers	North	Hand weeded oxeye daisy.
June 23	IAE, City	All 3	Evaluated revegetation progress and discussed options for combatting oxeye daisy and rattail fescue presence. Planned future weed management and revegetation.
July 14	IAE, volunteers	North, South	Hand weeded oxeye daisy, foxglove, and bull thistle (<i>Cirsium vulgare</i>).
October 2	IAE	All 3	Broadcast one pound of great camas (<i>Camassia leichtlinii</i>) to the eastern third of all units.
October 28	IAE, volunteers, Grange #685	North	Planted 58 shrubs in roadside living fence: crab apple (<i>Malus fusca</i>), osoberry (<i>Oemleria cerasiformis</i>), Lewis' mock-orange (<i>Philadelphus lewisii</i>), Oregon white oak (<i>Quercus garryana</i>), salmon berry (<i>Rubus spectabilis</i>), red elderberry (<i>Sambucus racemosa</i>), beaked hazelnut (<i>Corylus cornuta</i>), and golden chinquapin (<i>Chrysolepis chrysophylla</i>).
		North, Central	Planted 200 bareroot wild strawberry (<i>Fragaria virginiana</i>).
		Central	Broadcast 21.4 pounds of native seed mix.
			Planted 1720 bulbs in central unit: narrow leaved onion (<i>Allium amplexans</i>), crown brodiaea (<i>Brodiaea coronaria</i>) harvest brodiaea (<i>Brodiaea elegans</i>), Tolmie star-tulip (<i>Calochortus tolmiei</i>), ookow (<i>Dichelostemma congestum</i>), Henderson's shooting star (<i>Dodecatheon hendersonii</i>), chocolate lily (<i>Fritillaria affinis</i>), tiger lily (<i>Lilium columbianum</i>), Gardner's yampah (<i>Perideridia gairdneri</i>).
December 5	IAE, NCCC	North	Hand weeded oxeye daisy with AmeriCorps NCCC.
*City of Corvallis (City), Institute for Applied Ecology (IAE), AmeriCorps (NCCC), community volunteers (Volunteers), Marys River Grange #685 (Grange #685)			

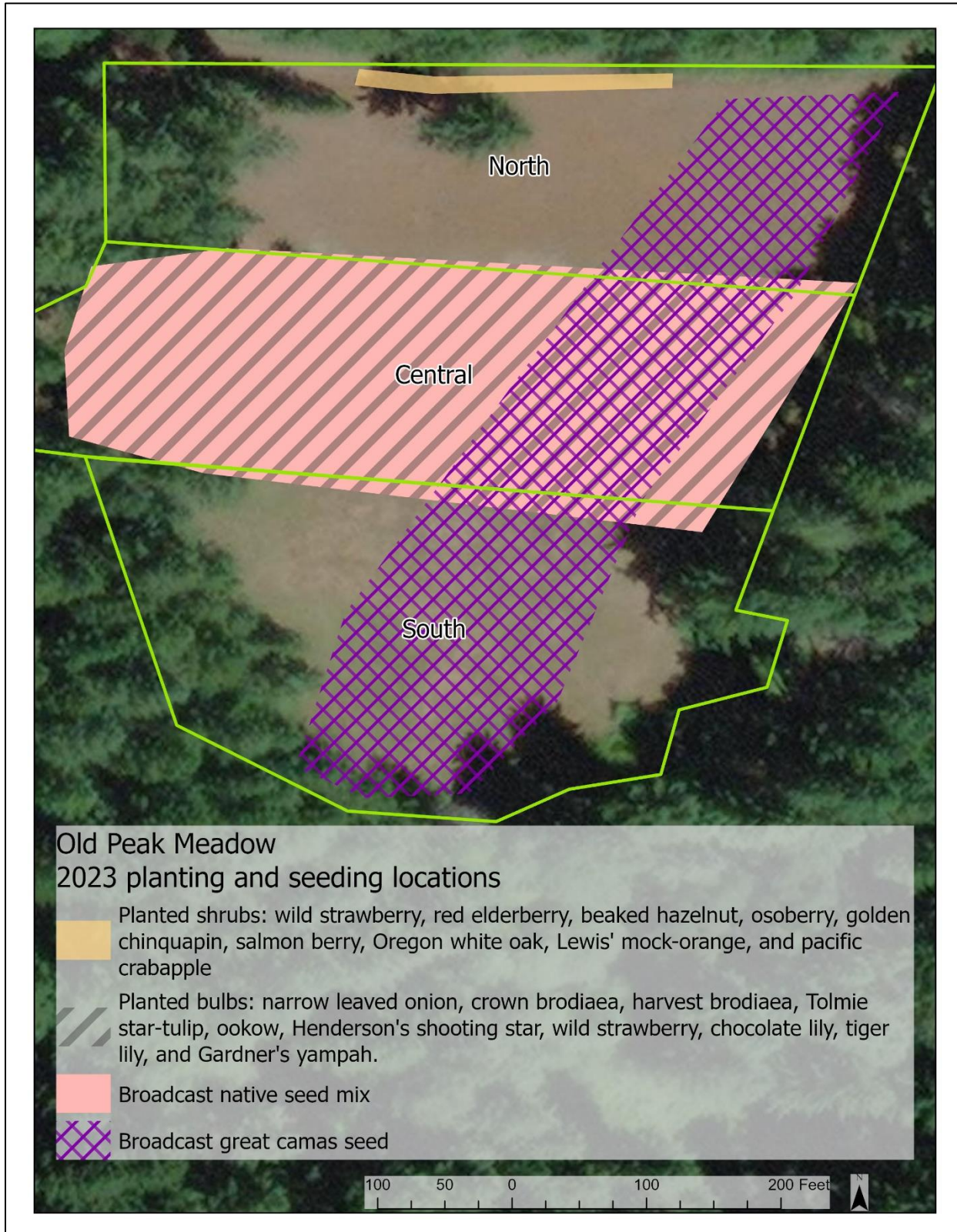


Figure 2. Old Peak Meadow planting and seeding locations.

North unit

In 2023, IAE staff continued to see successful establishment of native species seeded in 2021 and 2022 (Figure 3). We anticipate native composition to increase as plants get larger, mature to flowering stages, and disperse seed.

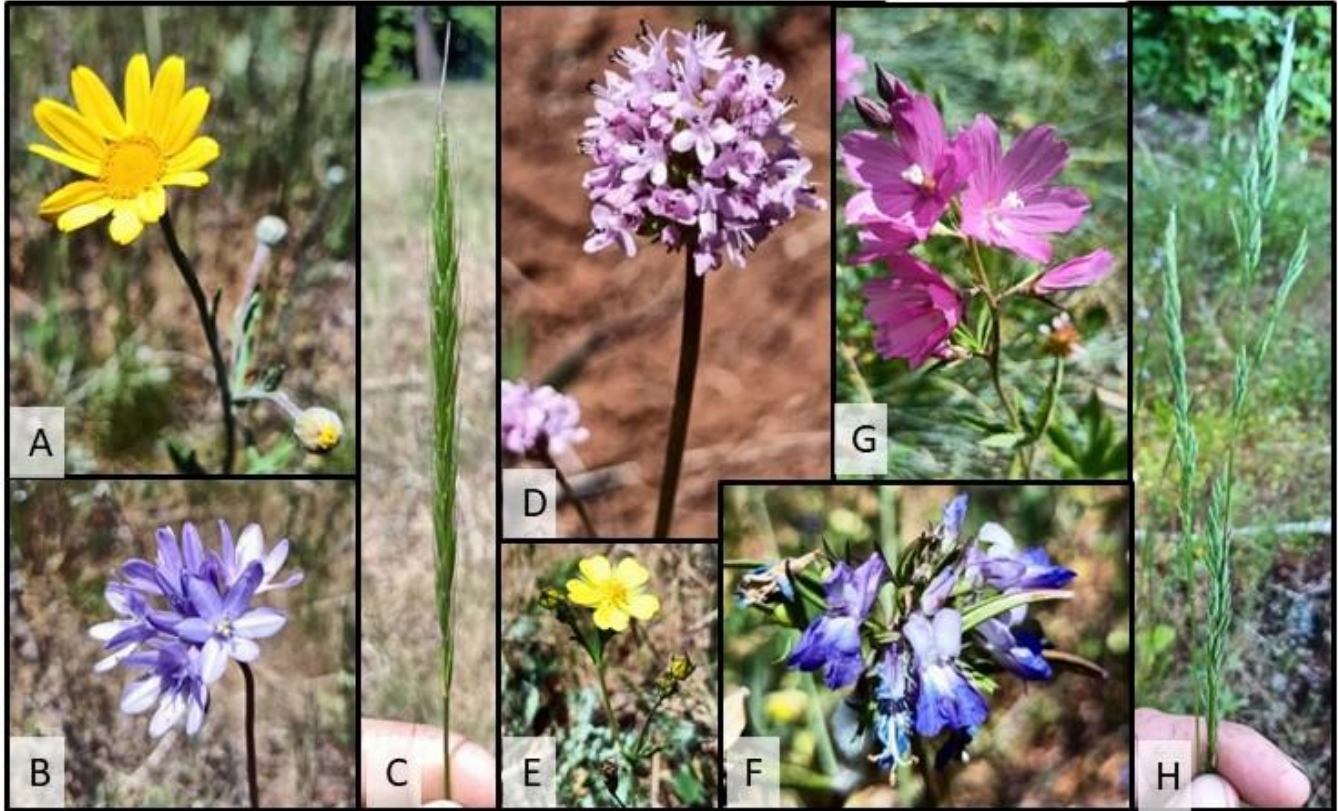


Figure 3. Native plant establishment in North meadow resulting from 2021 and 2022 seeding and planting. (A) Oregon sunshine (*Eriophyllum lanatum*), (B) ookow (*Dichelostemma congestum*), (C) blue wild rye (*Elymus glaucus*), (D) shortspur seablush (*Plectritis congesta*), (E) slender cinquefoil (*Potentilla gracilis*), (F) large-flowered blue-eyed Mary (*Collinsia grandiflora*), (G) dwarf checkermallow (*Sidalcea malviflora* ssp. *Virgata*), (H) Roemer's fescue (*Festuca roemerii*), June 05, 2023.

Oxeye daisy and rattail fescue (*Vulpia myuros*) continue to be problematic and are the most abundant weeds in the North unit. A combination of herbicide and hand-pulling were used to remove these species. In spring, spot spray applications using glyphosate and clethodim (separate applications) were completed and targeted oxeye daisy and rattail fescue, respectively. To minimize unintended damage from herbicides, hand pulling rather than herbicide application was used during peak growing season (May- August). On two occasions in May, IAE staff donated time to the project and hand pulled weeds before they bloomed (Figure 4). Through community outreach, IAE organized volunteers to pull oxeye daisy in June and July (Figure 4). In December, with the help of an eight-person AmeriCorps National Civilian Community Corps (NCCC), we pulled more oxeye daisy. There was a noticeable decrease in oxeye daisy because of these efforts, however, oxeye daisy will still be present and problematic for the next few years. A mixed treatment plan including hand weeding, herbicide treatment, mowing, and seed head removal are scheduled for 2024.



Figure 4. Oxeye daisy (*Leucanthemum vulgare*) removal by IAE staff and community volunteers in May (left) and June (right).

In the fall, shrubs and small deciduous trees were added to the living fence along the road. Once fully grown the living fence will provide structural shelter and forage to birds and mammals frequenting the meadow and will help limit the introduction of non-native seed from the road. To make an effective weed barrier, multiple vegetative layers are required. The upper layer (one to eight feet tall) is composed of a two-meter-wide shrub row that was started in 2022 with fifty-four shrubs including eight species (Beorchia & Esterson 2023). In 2023, fifty-eight shrubs were added including crab apple (*Malus fusca*), osoberry (*Oemleria cerasiformis*), Lewis' mock-orange (*Philadelphus lewisii*), Oregon white oak (*Quercus garryana*), salmon berry (*Rubus spectabilis*), red elderberry (*Sambucus racemosa*), beaked hazelnut (*Corylus cornuta*), and golden chinquapin (*Chrysolepis chrysophylla*) (Table 2, Figure 2). The ground layer (under one foot tall) was planted with 100 wild strawberry (*Fragaria virginiana*) to build upon the 2022 planting and seeding (Beorchia & Esterson 2023, Table 3, Figure 2).

Due to summer drought stress, about one third of the shrubs planted in 2022 did not set bud in fall 2023, even though summer watering did occur (Figure 5). It is possible shrubs will sprout new shoots from living root stock in 2024, but a portion have likely died. In spring 2024, IAE staff will evaluate the mortality rate of the 2022 plantings. Beaked hazelnut and golden chinquapin seeds are highly attractive to squirrels, and we suspect 100% predation of the seed sown in fall 2022. We also suspect gopher predation occurred on bulbs planted in 2022.



Figure 5. Hand watering (left) and planting (right) shrubs establishing a roadside living fence.

Central unit

In 2023, the Central unit was in its third year of chemical fallow. IAE applied multiple broadcast glyphosate treatments in the spring and summer. In November, IAE staff planted 1720 bulbs and 200 bareroot plants to increase meadow diversity with species selected to add bulb and fruit forage for small and medium sized mammals (Table 2, Figure 2). In addition, IAE and volunteers broadcast 21.4 pounds of native seed, composed of 46 species (Table 3). This native mix included 9.6 pounds of seed previously purchased for this project and 11.8 pounds of seed from five Heritage Seedlings and Liners Inc. seed mixes: Tough and Tenacious Mix (3lb), High Diversity Upland Flower Mix (3lb), Diverse Prairie Mix (3lb), Disturbed Ground Mix (1lb), Burn Pile Mix (1.8lb). IAE retains in our seed cooler 13.55 pounds seed for 2024 seeding at Old Peak (Table 3).

Table 2. Bulbs and potted shrubs planted in 2023.

Species/Variety	Common Name	Bulbs (bareroot)	Rooted shrubs
<i>Allium amplexans</i>	narrow leaved onion	100	
<i>Brodiaea coronaria</i>	crown brodiaea	300	
<i>Brodiaea elegans</i>	harvest brodiaea	100	
<i>Calochortus tolmiei</i>	Tolmie star-tulip	200	
<i>Dichelostemma congestum</i>	ookow	320	
<i>Dodecatheon hendersonii</i>	Henderson's shooting star	50	
<i>Fragaria virginiana</i>	wild strawberry	(200)	
<i>Fritillaria affinis</i>	chocolate lily	50	
<i>Lilium columbianum</i>	tiger lily	200	
<i>Perideridia gairdneri</i>	Gardner's yampah	400	
<i>Chrysolepis chrysophylla</i>	golden chinquapin		4
<i>Corylus cornuta</i>	beaked hazelnut		5
<i>Malus fusca</i>	Pacific crabapple		5
<i>Oemleria cerasiformis</i>	osoberry		15
<i>Philadelphus lewisii</i>	Lewis' mock-orange		5
<i>Quercus garryana</i>	Oregon white oak		2
<i>Rubus spectabilis</i>	salmon berry		5
<i>Sambucus racemosa</i>	red elderberry		20
	Totals	1720 bulbs (200 bareroot)	58 shrubs

Table 3. 2023 seed mix and remaining seed inventory.

Species/Variety	Common Name	Central unit mix (lb)	2024 mix (lb)
<i>Achillea millefolium</i>	common yarrow	0.03	1.1
<i>Acmispon americanus</i>	American bird's-foot trefoil	0.87	0.8
<i>Amsinckia menziesii</i> var. <i>intermedia</i>	Menzies' fiddleneck	0.10	
<i>Aquilegia formosa</i>	red columbine	1.16	1.95
<i>Barbarea orthoceras</i>	American yellowrocket	0.03	
<i>Camassia leichtlinii</i>	great camas	1.34	
<i>Carex tumulicola</i>	splitawn sedge	0.93	
<i>Clarkia amoena</i> ssp. <i>lindleyi</i>	farewell-to-spring	0.07	
<i>Clarkia purpurea</i>	winecup clarkia	0.03	
<i>Collinsia grandiflora</i>	large-flowered blue-eyed Mary	0.11	
<i>Collomia grandiflora</i>	large-flowered collomia	0.34	
<i>Danthonia californica</i>	California oatgrass	2.38	2.5
<i>Elymus glaucus</i>	blue wildrye	3.19	3
<i>Epilobium densiflorum</i>	denseflower willowherb	0.07	2.6
<i>Eriophyllum lanatum</i>	woolly sunflower	0.63	0.6
<i>Festuca roemerii</i>	Roemer's fescue	0.42	
<i>Gilia capitata</i>	bluehead gilia	0.04	1
<i>Iris tenax</i>	toughleaf iris	0.48	
<i>Koeleria macrantha</i>	prairie Junegrass	0.32	
<i>Lomatium dissectum</i>	fern-leaved biscuitroot	0.04	
<i>Lomatium nudicaule</i>	barestem biscuitroot	0.42	
<i>Lomatium utriculatum</i>	spring gold	1.47	
<i>Lotus purshianus</i>	Spanish clover	1.06	
<i>Lupinus latifolius</i>	broadleaf lupine	0.20	
<i>Lupinus rivularis</i>	river lupine	0.30	
<i>Luzula comosa</i>	woodrush	0.58	
<i>Madia elegans</i>	showy tarweed	0.69	
<i>Madia gracilis</i>	grassy tarweed	0.02	
<i>Microseris laciniata</i>	cutleaf silverpuffs	0.21	
<i>Perideridia oregana</i>	Oregon yampah	0.09	
<i>Phacelia nemoralis</i> var. <i>oregonensis</i>	Oregon phacelia	0.05	
<i>Plectritis congesta</i>	shortspur seablush	0.03	
<i>Poa secunda</i>	pine bluegrass	0.11	
<i>Potentilla glandulosa</i>	sticky cinquefoil	0.01	
<i>Potentilla gracilis</i>	slender cinquefoil	0.08	
<i>Prunella vulgaris</i> var. <i>lanceolata</i>	common selfheal	0.05	
<i>Ranunculus occidentalis</i>	western buttercup	0.04	
<i>Rudbeckia occidentalis</i>	western coneflower	0.87	
<i>Rumex salicifolius</i>	willow dock	0.83	
<i>Sanguisorba occidentalis</i>	western burnet	0.08	
<i>Sanicula bipinnatifida</i>	purple sanicle	0.15	
<i>Sidalcea campestris</i>	meadow checkermallow	0.16	
<i>Sidalcea malviflora</i> ssp. <i>virgata</i>	dwarf checkermallow	0.42	
<i>Solidago elongata</i>	Canada Goldenrod	1.00	
<i>Symphyotrichum hallii</i>	Hall's aster	0.74	
<i>Viola praemorsa</i>	prairie violet	0.01	
	Total (lb)	22.4	13.55

South unit

The South unit is a matrix of native and non-native species. To minimize impacts to desirable, native species, IAE used targeted spot spraying and hand weeding to treat non-native species. Spot spray glyphosate treatments targeted oxeye daisy, Canada thistle, bull thistle, and false brome. Oxeye daisy, fox glove, and bull thistle were hand pulled throughout the unit. In October, great camas seed was broadcast in the eastern third of the unit (Figure 2, Table 3).

3. 2024 MANAGEMENT RECOMMENDATIONS

The overarching goal of this project is to restore meadow habitat at Old Peak by controlling priority invasive species and revegetating with native species. To meet project goals the following restoration actions are recommended in 2024:

- Hand removal treatments:
 - Organize volunteer oxeye daisy weed pulling events before the petals drop off flowers from March through July (indicating pollination has occurred and seeds will develop). We suggest collaboration with Benton County Soil and Water Conservation District, who organize annual “Let’s Pull Together” events for community weed management. The Marys River Grange #685 and the Oregon Hunters Association could be other opportunities to engage people in meadow stewardship.
- Herbicide treatments:
 - Spot spray glyphosate on invasive weeds underneath and around shrubs on the eastern edge and in the North and South units as needed April through October.
 - Spot spray false brome with glyphosate around the edges of the meadow April through October.
- Take photo points in May or early June.
- Mowing treatments:
 - Mow oxeye daisy in late June or early July to reduce seed set.
- Purchase annual forbs and previously seeded perennials which are not present in the current seed inventory.
- Broadcast native seed mix to Central unit and ground disturbed by weed treatments in fall 2023.
- Purchase and plant additional bulbs from the 2023 species list (Table 2)
- City of Corvallis purchases of plant materials to increase meadow diversity could be made using resources listed in Appendix B.

4. REFERENCES

- Beorchia, R. and E. Esterson. 2023. Old Peak Meadow habitat enhancement project: 2022 annual report. Unpublished report prepared for the City of Corvallis. Institute for Applied Ecology, Corvallis, OR. 8 pages plus appendices.
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APPENDIX A. OLD PEAK MANAGEMENT HISTORY (2009-2023)

Year	Date	Personnel*	Management Action
2009-2013	Unknown	City/Contractor	Removed over 100 Douglas-fir (<i>Pseudotsuga menziesii</i>) from meadow
			Removed lower conifers limbs along east edge
			Placed some of the felled Douglas-fir along the eastern edge for wildlife habitat
		City	Mowed meadow to reduce tall oatgrass (<i>Arrhenatherum elatius</i>) seed production
			Spot sprayed false brome (<i>Brachypodium sylvaticum</i>)
			Snag creation around heritage trees in the surrounding conifer stand
			Planted 120 trees and shrubs along eastern edge (2011, 2012)
		IAE	Plastic weed barrier put around planted shrubs (2012)
			Seedlings watered 2-3 times (2012)
		OWI	Songbird surveys completed (2011, 2012, 2013)
2014	Unknown	City	Snag creation
		ODF	Prescribed burn
		IAE	Plant community survey
			Grass-specific herbicide application to control non-native grasses
			Native seeding
			Spot spray glyphosate to control thistles (<i>Cirsium</i> sp.), false brome, rattail fescue (<i>Vulpia myuros</i>) and false dandelion (<i>Hypochaeris radicata</i>)
2015	Unknown	IAE	Planted 500 shrubs and 20 oak trees
			Planted bulbs, runners, and plugs: narrow leaf onion (<i>Allium amplexans</i>), tapertip onion (<i>Allium acuminatum</i>), wild strawberry (<i>Fragaria virginiana</i>), and Oregon iris (<i>Iris tenax</i>)
			Seeded meadow with native seed mix
			Spot sprayed glyphosate to control thistles, false brome, rattail fescue and false dandelion
		IAE/City	Built enclosures around shrubs

*City of Corvallis (City), Institute for Applied Ecology (IAE), Oregon Hunter's Association (OHA), Oregon Department of Forestry (ODF)

Year	Date	Personnel*	Management Action
2016	Apr	IAE	Spot sprayed Poast to control non-native grasses
	Summer	IAE	Watered planted shrubs
	Unknown	OHA	Spot sprayed glyphosate to control thistles, false brome, rattail fescue and false dandelion
2017	Mar	IAE	Established four photo points; take photo point pictures
	May	IAE	Spot sprayed oxeye daisy (<i>Leucanthemum vulgare</i>) and foxglove (<i>Digitalis purpurea</i>) using clopyralid and glyphosate, respectively
			Took photo point pictures
			Community data survey
			Treated portions of meadow to control oxeye daisy with clopyralid
			Spot sprayed glyphosate to control rattail fescue
	Jun	OHA	Spot sprayed false brome using glyphosate
		IAE	Watered planted shrubs
			Took photo point pictures
	Jul	IAE	Watered planted shrubs
		OHA	Mowed entire site
	Aug	City	Watered planted shrubs
	Oct	OHA	Spot sprayed oxeye daisy with clopyralid
	Dec	IAE	Planted chocolate lily (<i>Fritillaria affinis</i>) bulbs
2018	Mar	IAE	Broadcast Fusilade across entire meadow with a boom sprayer mounted on an ATV
	May	IAE	Broadcast Fusilade across entire meadow using a backpack sprayer mounted on an ATV
			Spot sprayed a 1.5% solution of glyphosate to target oxeye daisy, Canada thistle (<i>Cirsium arvense</i>), foxglove, and dove's foot geranium (<i>Geranium molle</i>)
			Mowed tall oatgrass and oxeye daisy with string trimmer

*City of Corvallis (City), Institute for Applied Ecology (IAE), Oregon Hunter's Association (OHA)

Year	Date	Personnel*	Management Action
2018	Jun	IAE	Mowed tall oxeye daisy with string trimmer
			Spot sprayed a 1.5% solution of glyphosate to target false brome, oxeye daisy and Canada thistle
			Mowed entire site
	Jul	IAE	Mowed around shrub enclosures with string trimmer
	Sep	City	Mowed North unit for imazapyr preparation
	Oct	IAE	Imazapyr broadcast application on North unit
	Nov	IAE	Broadcast Poast over entire site
			Spot sprayed glyphosate to oxeye daisy
2019	Apr	IAE	Fusilade application across entire site with boom sprayer
			Glyphosate application targeting rattail fescue, thistles and oxeye daisy in North unit
	May	IRM	Fusilade application using a boom sprayer mounted on an ATV in Central and South units targeting non-native grasses; Glyphosate spot treatment targeting rattail fescue and thistles
	Jun	IRM	Plant community survey
		IAE, IRM	Mowed meadow
2020	Mar	City	Glyphosate application with ATV wand sprayer in North unit; Treated foxglove, bull thistle (<i>Cirsium vulgare</i>) and oxeye daisy.
		IAE	Glyphosate application with ATV wand sprayer in North unit; Treated foxglove, bull thistle and oxeye daisy.
	Jun	IAE	Glyphosate and clopyralid spot treatment for bull thistle and oxeye daisy.
		IAE	Mowed meadow
	Jul	IAE	Photo points taken
		IAE	Glyphosate spot treatment in North unit targeting false brome along eastern edge; clopyralid spot treated thistles along southern and western edge.
		City	Partner site visit
	Oct	IAE	Repair shrub enclosures

*City of Corvallis (CITY), Institute for Applied Ecology (IAE), Oregon Hunter's Association (OHA), Integrated Resource Management (IRM)

Year	Date	Personnel*	Management Action
2020	Nov	IAE	Site visit to flag units prior to broadcast spray
	Dec	IAE, City	Imazapyr treatment in North and Central units; triclopyr applied to edges by enclosures and under tree drip lines
2021	Jan	OHA	Project partner site visit and Imazapyr treatment efficacy check
	Apr	IAE	Broadcast glyphosate application to North and Central units. Spot treated with sponge dapper in South unit.
		IRM	Spot sprayed glyphosate on non-native plants in entire meadow.
	May	IAE, City, T Mt.	Spot sprayed perennial weeds in all units. Mowed half of South unit with string trimmer. Bucked and removed one wind fallen oak from the meadow.
	Jun	IAE	Broadcast clopyralid in South unit. Spot sprayed glyphosate in North and Central units and false brome on western edge of meadow.
			Mowed South unit to control oxeye daisy
			Broadcast glyphosate on North and Central units
	Oct	IAE	Broadcast glyphosate to North and Central units
			Seeded 16 lb of native seed mix in the North unit using a dew drop drill pulled behind an ATV
2022	Mar	IAE	Assessed seedlings growing in North unit from fall 2021 seeding; Identified 19 of 23 species seeded
			Broadcast Fusilade DX (fluazifop-p-butyl) in South unit; Broadcast Round-Up Custom (glyphosate) in Central unit; Spot sprayed Rodeo (glyphosate) in South unit and meadow edges
	May	IAE	Broadcast Fusilade DX in Central and South units. Took photopoints.
	Jun	IAE	Broadcast Rodeo in Central unit and upper quarter acre of South unit; Spot sprayed Rodeo in North and South units and meadow edges
	Jul	IAE, City	Site evaluation and planning; Mowed oxeye daisy in North and South units
		OHA	Removed shrub enclosure fence from eastern edge of meadow
	Aug	IAE	Mowed stinking chamomile (<i>Anthemis cotula</i>) in North unit; Hand pulled oxeye daisy
	Sep	IAE	Built enclosure fence along the road in North unit to protect shrubs

*City of Corvallis (CITY), Institute for Applied Ecology (IAE), Oregon Hunter's Association (OHA), Integrated Resource Management (IRM), Trout Mountain (T Mt.)

Year	Date	Personnel*	Management Action
2022	Oct	IAE	Finished building enclosure fence; planted 200 bare-root wild strawberry, 10 osoberry (<i>Oemleria cerasiformis</i>), 10 chokecherry (<i>Prunus virginiana</i>), 30 red-flowering currant (<i>Ribes sanguineum</i>), and 4 blue elderberry (<i>Sambucus caerulea</i>) along road; planted 50 narrow leaved onion, 100 harvest brodiaea (<i>Brodiaea elegans</i>), 50 Tolmie star-tulip (<i>Calochortus tolmiei</i>), 100 ookow (<i>Dichelostemma congestum</i>), 100 chocolate lily, 100 tiger lily (<i>Lilium columbianum</i>), 50 common camas (<i>Camassia quamash</i>) bulbs in North unit, and planted 50 common camas in the South unit.
	Nov	IAE	Repaired enclosure fence; Seeded North unit, eastern shrub area, and roadside shrub enclosure with native seed mix; Seeded 1 lb beaked hazelnut (<i>Corylus cornuta</i>) and 2 oz golden chinquapin (<i>Chrysolepis chrysophylla</i>) in eastern shrub area and roadside shrub enclosure.
		IAE	Planted 100 nodding onion (<i>Allium cernuum</i>), and 100 Henderson's shooting star (<i>Dodecatheon hendersonii</i>) bulbs in the North unit.
2023	Apr	IAE	Applied Rodeo (glyphosate) targeting thistles, foxglove, false brome, and oxeye daisy in all units. Applied Select Max (clethodim) targeting rattail fescue in North unit. Broadcast applied Rodeo (glyphosate) to continue fallow in Central unit.
	May	IAE	Hand weeded oxeye daisy in North unit.
	Jun	IAE	Broadcast applied Rodeo (glyphosate) in Central unit.
		IAE, volunteers	Hand weeded oxeye daisy in North unit.
		IAE, City	Evaluated revegetation progress and discussed options for combatting oxeye daisy and rattail fescue presence. Planned future weed management and revegetation.
	Jul	IAE, volunteers	Hand weeded oxeye daisy, foxglove, and bull thistle.
	Oct	IAE, volunteers, Grange #685	Planted 58 shrubs in North unit living fence: 5 crab apple (<i>Malus fusca</i>), 15 osoberry, 5 Lewis' mock-orange (<i>Philadelphus lewisii</i>), 2 Oregon white oak (<i>Quercus garryana</i>), 5 salmon berry (<i>Rubus spectabilis</i>), 20 red elderberry (<i>Sambucus racemosa</i>), 5 beaked hazelnut, and 4 golden chinquapin. Planted 1720 bulbs in Central unit: narrow leaved onion, crown brodiaea (<i>Brodiaea coronaria</i>), harvest brodiaea, Tolmie star-tulip, ookow, Henderson's shooting star, chocolate lily, tiger lily, and Gardner's yampah (<i>Perideridia gairdneri</i>). Planted 200 bareroot wild strawberry in Central unit and North unit living fence, and broadcast 22.4 pounds of native seed mix.
	Dec	IAE, NCCC	Hand weeded oxeye daisy with AmeriCorps in North unit.

*City of Corvallis (City), Institute for Applied Ecology (IAE), AmeriCorps (NCCC), community volunteers (Volunteers), Marys River Grange #685 (Grange #685)

APPENDIX B. PLANT AUGMENTATION MATERIALS SOURCES

Heritage Seedling and Liners Inc. sells premixed Willamette Valley-sourced seed mixes that could be utilized in future years. We recommend the “Burn-Pile” or “Disturbed Ground” mixes for disturbed areas and the “Diverse Prairie,” “Tough and Tenacious” or one of the three “Upland Prairie” mixes to add diversity to patches of meadow where previous seeding was less successful. Mixes ranged from \$90-\$200 per pound in 2023. Mix lists and prices are available on their website.

Seven Oaks Native Nursery is a wholesaler of native shrubs, bulbs, and other plant materials. Native shrubs could enhance meadow edges at Old Peak, increasing wildlife habitat and forage, while bulb species could add diversity into the meadow. Bulbs range from \$0.40-\$1.50 per bulb in 2023 while shrubs range from \$3-\$25 depending on container size and species. You can sign up through their website to see a full price list.

Jonny Native Seed specializes in wild collecting native species. If there is desire to increase diversity in the meadow and also maintain Coast Range-specific genetics, these collectors could fill that niche and gather seed otherwise not commercially available. 2023 prices varied quite widely between species, about \$60-\$400 per pound, but a periodic inventory and price sheet is sent out through email newsletter that can be subscribed to through the website.

APPENDIX C. COMPREHENSIVE SEEDING AND PLANTING RECORD 2011-2023

Scientific name	Common name	Amount seed (lb.) and number of plugs or shrubs {quantity}.					
		2023	2022	2021	2017	2015	2011/2012
<i>Acer circinatum</i>	Pacific vine maple					{50}	
<i>Achillea millefolium</i>	common yarrow	0.03	0.836	0.17			
<i>Acmispon americanus</i>	American bird's-foot trefoil	0.87	0.44	2.91			
<i>Allium amplexans</i>	narrow leaved onion	{100}	{50}			{300}	
<i>Allium acuminatum</i>	tapertip onion					{150}	
<i>Allium cernuum</i>	nodding onion		{100}				
<i>Amelanchier alnifolia</i>	Pacific serviceberry					{50}	
<i>Amsinckia menziesii</i>	Menzies' fiddleneck	0.10					
<i>Aquilegia formosa</i>	red columbine	1.16	1.436	0.564			
<i>Barbarea orthoceras</i>	American yellowrocket	0.03					
<i>Berberis aquifolium</i>	tall Oregon grape					{50}	
<i>Brodiaea coronaria</i>	crown brodiaea	{300}					
<i>Brodiaea elegans</i>	harvest brodiaea	{100}	{100}				
<i>Calochortus tolmiei</i>	Tolmie's star-tulip	{200}	0.32 {50}	0.389		{300}	
<i>Camassia leichtlinii</i>	great camas	1.34					
<i>Camassia quamash</i> var. <i>azurea</i>	common camas		{100}				
<i>Carex pachystachya</i>	chamisso sedge		0.195	0.085			
<i>Carex tumulicola</i>	splitawn sedge	0.93		0.26			
<i>Chrysolepis chrysophylla</i>	golden chinquapin	{4}	0.125				
<i>Cirsium edule</i>	edible thistle		0.1				
<i>Clarkia amoena</i> ssp. <i>lindleyi</i>	farewell-to-spring	0.07	0.16	0.24			
<i>Clarkia purpurea</i>	winecup clarkia	0.03	0.7	0.372			
<i>Collinsia grandiflora</i>	large-flowered blue-eyed Mary	0.11	0.728				
<i>Collomia grandiflora</i>	large-flowered collomia	0.34					
<i>Corylus cornuta</i>	beaked hazelnut	{5}	1			{40}	
<i>Danthonia californica</i>	California danthonia	2.38	2.52	1			
<i>Dichelostemma congestum</i>	ookow	{320}	{100}			{300}	
<i>Dodecatheon hendersonii</i>	Henderson's shooting star	{50}	{100}				
<i>Elymus glaucus</i>	blue wildrye	3.19	3.03	0.96			
<i>Epilobium densiflorum</i>	denseflower willowherb	0.07	2.68	0.2			

<i>Eriophyllum lanatum</i>	Oregon sunshine	0.63	0.373	0.227			
<i>Festuca roemerii</i>	Roemer's fescue	0.42	7.36	0.509			
<i>Fragaria virginiana</i>	wild strawberry	{200}	{200}			{300}	
<i>Fritillaria affinis</i>	chocolate lily	{50}	{100}		{100}	{292}	
<i>Gilia capitata</i>	globe gilia	0.04	0.41	0.187			
<i>Holodiscus discolor</i>	ocean spray					{50}	
<i>Iris tenax</i>	toughleaf iris	0.48	1.5	3		{300}	
<i>Koeleria macrantha</i>	prairie Junegrass	0.32					
<i>Lilium columbianum</i>	tiger lily	{200}	{100}				
<i>Lomatium dissectum</i>	fern-leaved biscuitroot	0.04					
<i>Lomatium nudicaule</i>	barestem biscuitroot	0.42					
<i>Lomatium utriculatum</i>	spring gold	1.47				{150}	
<i>Lotus purshianus</i>	Spanish clover	1.06					
<i>Lupinus latifolius</i>	broadleaf lupine	0.20		0.69			
<i>Lupinus polyphyllus</i>	small-flowered lupine			1.74			
<i>Lupinus rivularis</i>	river lupine	0.3					
<i>Luzula comosa</i>	woodrush	0.58					
<i>Madia elegans</i>	showy tarweed	0.69	0.43	0.78			
<i>Madia gracilis</i>	grassy tarweed	0.02					
<i>Malus fusca</i>	Pacific crabapple	{5}					
<i>Microseris laciniata</i>	cutleaf silverpuffs	0.21					
<i>Oemleria cerasiformis</i>	osoberry	{15}	{10}			{50}	
<i>Perideridia gairdneri</i>	Gardner's yampah	{400}					
<i>Perideridia oregana</i>	Oregon yampah	0.09					
<i>Phacelia nemoralis</i> var. <i>oregonensis</i>	Oregon woods phacelia	0.05					
<i>Plectritis congesta</i>	shortspur seablush	0.03	0.56	0.19			
<i>Poa secunda</i>	pine bluegrass	0.11					
<i>Potentilla glandulosa</i>	sticky cinquefoil	0.01					
<i>Potentilla gracilis</i>	slender cinquefoil	0.08	0.81	0.178			
<i>Prunella vulgaris</i> var. <i>lanceolata</i>	common selfheal	0.05	0.56	0.57			
<i>Prunus virginiana</i>	chokecherry		{10}				
<i>Quercus garryana</i>	Oregon white oak	{2}				{20}	
<i>Ranunculus occidentalis</i>	western buttercup	0.04	0.72	0.871			
<i>Ribes bracteosum</i>	stink currant						
<i>Ribes sanguineum</i>	red-flowering currant		{30}				
<i>Rosa nutkana</i>	Nootka rose					{50}	
<i>Rubus leucodermis</i>	whitebark raspberry					{50}	
<i>Rubus parviflorus</i>	thimbleberry					{50}	

<i>Rubus spectabilis</i>	salmon berry	{5}					
<i>Rudbeckia occidentalis</i>	western coneflower	0.87					
<i>Rumex salicifolius</i>	willow dock	0.83					
<i>Sambucus cerulea</i>	blue elderberry		{4}				
<i>Sambucus racemosa</i>	red elderberry	{20}					
<i>Sanguisorba occidentalis</i>	western burnet	0.08					
<i>Sanicula bipinnatifida</i>	purple sanicle	0.15					
<i>Sidalcea campestris</i>	meadow checkermallow	0.16					
<i>Sidalcea malviflora</i> spp. <i>virgata</i>	rose checkermallow	0.42		0.3			
<i>Solidago elongata</i>	Canada goldenrod	1					
<i>Symphoricarpos albus</i>	snowberry					{60}	
<i>Symphyotrichum hallii</i>	Hall's aster	0.74					
<i>Viola praemorsa</i>	prairie violet	0.01					
	Totals:	22.4 lb, 1920 bulbs, 58 shrubs	27.09 lb, 1000 bulbs, 54 shrubs	16.39 lb	100 bulbs	520 shrubs, 2092 bulbs	120 shrubs, unknown species

APPENDIX D. 2017 PLANT COMMUNITY COMPOSITION

Table 4. 2017 community composition at Old Peak meadow.

Scientific Name	Common Name	Native Status	Growth Habit	Average percent cover
<i>Arrhenatherum elatius</i>	tall oatgrass	Introduced	Graminoid	12.7
<i>Vulpia bromoides</i>	squirreltail fescue	Introduced	Graminoid	12.5
<i>Leucanthemum vulgare</i>	oxeye daisy	Introduced	Forb	9.3
<i>Rubus ursinus</i>	California blackberry	Native	Shrub	6.1
<i>Luzula campestris</i>	field woodrush	Native	Graminoid	5.9
<i>Carex tumulicola</i>	splitawn sedge	Native	Graminoid	5.5
<i>Fragaria virginiana</i>	Virginia strawberry	Native	Forb	3.6
<i>Trifolium dubium</i>	suckling clover	Introduced	Forb	3.0
<i>Cerastium glomeratum</i>	sticky chickweed	Introduced	Forb	2.8
<i>Festuca roemerii</i>	Roemer's fescue	Native	Graminoid	2.7
<i>Agrostis capillaris</i>	colonial bentgrass	Introduced	Graminoid	2.7
<i>Myosotis discolor</i>	changing forget-me-not	Introduced	Forb	2.1
<i>Geranium dissectum</i>	cutleaf geranium	Introduced	Forb	1.6
<i>Rumex acetosella</i>	common sheep sorrel	Introduced	Forb	1.4
<i>Elymus glaucus</i>	blue wildrye	Native	Graminoid	1.2
<i>Plectritis congesta</i>	shortspur seablush	Native	Forb	1.2
<i>Sherardia arvensis</i>	blue fieldmadder	Introduced	Forb	1.2
<i>Grindelia integrifolia</i>	Puget Sound gumweed	Native	Forb	1.0
<i>Hypochaeris radicata</i>	hairy cat's ear	Introduced	Forb	0.8
<i>Poa pratensis</i>	Kentucky bluegrass	Introduced	Graminoid	0.7
<i>Festuca arundinacea</i>	tall fescue	Introduced	Graminoid	0.5
<i>Achillea millefolium</i>	common yarrow	Native	Forb	0.4
<i>Acmispon micranthus</i>	small flowered lotus	Native	Forb	0.4
<i>Prunella vulgaris</i>	common selfheal	Native	Forb	0.4
<i>Ranunculus occidentalis</i>	western buttercup	Native	Forb	0.3
<i>Cardamine hirsute</i>	hairy bittercress	Introduced	Forb	0.3
<i>Cirsium arvense</i>	Canada thistle	Introduced	Forb	0.3
<i>Taraxacum officinale</i>	common dandelion	Introduced	Forb	0.3
<i>Eriophyllum lanatum</i>	common woolly sunflower	Native	Forb	0.2
<i>Sidalcea malviflora</i> ssp. <i>Virgata</i>	dwarf checkerbloom	Native	Forb	0.2
<i>Brachypodium sylvaticum</i>	false brome	Introduced	Graminoid	0.1
<i>Vicia sativa</i>	garden vetch	Introduced	Forb	0.1

* Average percent cover was calculated by summing individual species cover from each plot and dividing by the number of plots (10).