

HCP Effectiveness Monitoring Report



2018

Prepared for the Benton County Natural Areas
and Parks Department

Report prepared by
Institute for Applied Ecology



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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Acknowledgments

We thank Benton County for their assistance in project coordination. Marisa Mancillas, Jillian Demus, Chelsea Osbron, Amy Zimmer, and Ashley Ottombrino-Haworth assisted with fieldwork, and Lisa Schomaker helped with data compilation. We thank ESRI for their support of our GIS program.

Cover photograph: Crisp Property in Cardwell Hill. *All photos by IAE.*

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Introduction

Institute for Applied Ecology (IAE) completed effectiveness monitoring at five sites owned or managed by Benton County in spring and summer of 2018 as specified in the Benton County Prairie Species Habitat Conservation Plan (HCP) (Benton County 2010a) and direction from the Natural Areas and Parks Department. The HCP specifies that effectiveness monitoring is to be completed every three years. Baseline monitoring at these sites was completed in 2011 (Benton County 2011). Repeat monitoring was completed at a subset of three sites in 2014 (Bezell Memorial Forest, Fitton Green Natural Area, Jackson-Frazier Wetland), and an additional two sites in 2015 (Crisp-Liddell, Percy). All five sites were monitored in 2018.

The following species and habitats were monitored (Table 1):

- Bradshaw’s lomatium (*Lomatium bradshawii*)
- Nelson’s checkermallow (*Sidalcea nelsoniana*)
- Kincaid’s lupine (*Lupinus oregonus*)
- Willamette daisy (*Erigeron decumbens*)
- Fender’s blue butterfly (*Icaricia icarioides fenderi*) habitat- Host and nectar species (Table 3)
- Taylor’s checkerspot butterfly (*Euphydryas editha taylori*) habitat- Host and nectar species (Table 4).

Table 1. Effectiveness monitoring data collected in 2018 at Benton County Natural Areas and Parks sites.

Site	Fender’s blue butterfly	Taylor’s checkerspot butterfly	Kincaid’s lupine	Bradshaw’s lomatium	Nelson’s checkermallow	Willamette daisy
Bezell Memorial Forest	n/a	Host and Nectar estimated in plots	Census	n/a	n/a	Census
Fitton Green Natural Area	n/a	Host and Nectar estimated in plots	Census	n/a	n/a	n/a
Jackson-Frazier Wetland	n/a	n/a	Census	Census	Census	n/a
Crisp-Liddell	Host and Nectar	n/a	Census	n/a	n/a	n/a
Percy	Host and Nectar	n/a	Census	n/a	n/a	n/a

Census= Complete count/cover measurement.

Methods

Monitoring at each site was completed as described in the HCP (Benton County 2010a) or as assigned/modified in consultation with the Benton County Natural Areas and Parks Department. Field work was completed between April 19 and July 8, 2018 (Table 2).

Table 2. Effectiveness monitoring 2018 field work schedule.

Site	HCP Census Dates	Vegetation Sampling Dates	Weed Mapping Dates
Bezell Memorial Forest	<u>Kincaid's lupine</u> June 6 <u>Willamette daisy</u> June 27	June 6, 26	June 6, 26
Fitton Green Natural Area	<u>Kincaid's lupine</u> May 3	May 3	June 26, July 6
Jackson-Frazier Wetland	<u>Bradshaw's lomatium</u> April 19 <u>Kincaid's lupine</u> July 8 <u>Nelson's checkermallow</u> June 27	June 27	June 27
Crisp-Liddell	<u>Kincaid's lupine and FBB Nectar: June 16-18</u>	May 10	May 8-10, June 26
Pearcy	<u>Kincaid's lupine and FBB Nectar: June 21-23</u>	May 10	May 16, June 26

HCP Species and Habitat Abundance

At each site, we assessed the abundance of HCP species and/or habitat present. Metrics for each species follow those described in the HCP (Benton County 2010a), and are included in Table 5. Complete census counts of individual plants were made for Bradshaw's lomatium and Nelson's checkermallow. The Kincaid's lupine census consisted of estimating total leaf cover in square meters of all plants encountered. Patches of plants were mapped as polygons. Note that the reported leaf area of Kincaid's lupine is smaller than the total area mapped within the polygons because the plants are scattered and do not form continuous cover. HCP species polygons and individuals were field mapped using ArcPad software on a Nautiz x7 or Juno SB handheld computer with GPS accuracy of 1-3 meters.

In 2018, Fender's blue butterfly nectar species (Table 3) were censused through counts of floral units at the Cardwell Hill sites (Crisp and Percy). This methodology differs from what was prescribed in the HCP in 2010, but aligns with methods currently used by USFWS to quantify nectar resources (calculations of nectar sugar availability per square meter).

We estimated the abundance of Taylor’s checkerspot host and nectar species (Table 4) at Bezell Memorial Forest and Fitton Green Natural Area using cover data from vegetation sampling plots (see Vegetation sampling section below). We calculated a 95% confidence interval to describe the uncertainty associated with these estimates of abundance.

Table 3. Nectar species for Fender’s blue butterfly, flowering units for nectar assessment, and estimated sugar per flowering unit (based on Schultz & Dlugosch 1999, Crone & Kallioniemi 2009, and Thomas and Schultz 2010).

Species	Common name	Flowering unit	Sugar Constant (mg/flowering unit)
<i>Allium amplexans</i>	Taper tip onion	Head	18.04
<i>Calochortus tolmiei</i>	Tolmie’s star tulip	Flower	1.52
<i>Camassia quamash</i>	Common camas	Stalk	4.79
<i>Cryptantha intermedia</i>	Popcorn flower	Flower	0.74
<i>Eriophyllum lanatum</i>	Oregon sunshine	Head	3.19
<i>Geranium oregonum</i>	Oregon geranium	Flower	0.99
<i>Iris tenax</i>	Toughleaf iris	Flower	2.17
<i>Lupinus spp.</i>	Lupine host	Stalk	1.61
<i>Sidalcea virgata</i>	Dwarf checkermallow	Stalk	21.94
<i>Vicia americana</i>	American vetch	Stalk	1.85

Table 4. Host and native nectar species for Taylor’s checkerspot butterfly (Benton County 2010a).

	Scientific Name	Common Name
Host Plants	<i>Castilleja levisecta</i>	golden paintbrush
	<i>Plantago lanceolata</i>	English plantain
Native Nectar Plants	<i>Calochortus tolmiei</i>	Tolmie’s mariposa
	<i>Fragaria virginiana</i>	broadpetal strawberry
	<i>Linanthus bicolor</i>	bicolored linanthus
	<i>Lomatium utriculatum</i>	spring gold
	<i>Plectritis congesta</i>	seablush

Table 5. Metrics for measuring abundance of HCP species and habitat (Benton County 2010a).

Species	Units of measurement
Bradshaw’s lomatium	Individual plants. Plants ≥ 10 cm apart are considered separate individuals.
Nelson’s checkermallow	Individual plants, separated by ≥ 30 cm, or occupied square meters, when plants are in large patches.
Kincaid’s lupine	Square meters of leaf cover.

Taylor’s checkerspot host and nectar species	Square meters of leaf cover of host plants (golden paintbrush, English plantain) and native nectar plants.
Fender’s blue butterfly host and nectar species	Square meters of leaf cover of host plants (Kincaid’s lupine) and native nectar species.

Noxious Weeds

Noxious weed populations were mapped in the prairie habitat areas. Mapped species (Table 6) included species on the Oregon Department of Agriculture A and B lists (ODA 2014) and tall oatgrass which is not currently listed by ODA. Unlike in 2011, noxious weeds were mapped throughout the prairie habitat areas in 2014. For example, in 2011, at Jackson-Frazier Wetland reed canarygrass was only mapped when it was near HCP species populations. In 2014, we mapped reed canarygrass throughout the mapped prairie habitat area boundary.

Noxious weed populations were field mapped using ArcPad software on a Nautiz x7 or Juno SB handheld computer. Clusters of multiple plants were mapped as polygons, while patches of 1-2 individuals were mapped as points. Total abundance of noxious weed species by site was estimated as the area (square meters) of established polygons of the species, calculated in GIS. No evidence of invasive animals was observed.

Table 6. Noxious weeds inventoried and mapped.

Common name	Scientific name	Description
Armenian blackberry	<i>Rubus armeniacus</i>	Shrub
Bull thistle	<i>Cirsium vulgare</i>	Biennial forb
Canada thistle	<i>Cirsium arvense</i>	Perennial forb
False brome	<i>Brachypodium sylvaticum</i>	Perennial grass
Meadow knapweed	<i>Centaurea pratensis</i>	Perennial forb
Medusahead rye	<i>Taeniatherum caput-medusae</i>	Annual grass
Perennial pea	<i>Lathyrus latifolius</i>	Perennial forb
Reed Canarygrass	<i>Phalaris arundinacea</i>	Perennial grass
St. Johnswort^a	<i>Hypericum perforatum</i>	Perennial forb
Tall oatgrass^b	<i>Arrhenatherum elatius</i>	Perennial grass
Tansy ragwort	<i>Senecio jacobaea</i>	Biennial forb

^aOnly patches of 3 or more plants were mapped

^bNot on the 2014 ODA Noxious Weeds List.

Vegetation Sampling

A total of 31 plots (5 meter x 5 meter) were sampled: 13 at Beazell Memorial Forest, four each at Fitton Green Natural Area, Crisp, and Percy, and six at Jackson-Frazier Wetland. Plots were not permanently marked, as new randomly selected locations are to be sampled in each monitoring session in the future. Within each plot, we estimated percent cover of each vascular plant species, moss, plant litter/thatch, bare ground and rock. At Crisp-Liddell, half of the plots were in an area burned the prior year, and half were in unburned areas.

Woody Vegetation Mapping

The boundary between prairie and forest was delineated in 2011 to allow tracking of tree and shrub encroachment into openings (Benton County 2011). In 2014 and 2018 we mapped scattered individuals and significant patches of encroaching woody vegetation that were not present in 2011. Woody vegetation patches were field mapped using ArcPad software on a Nautiz x7 handheld computer. We used GIS to calculate the current acreages of meadow/prairie areas after subtracting areas with woody vegetation encroachment (summed from the area of polygons mapped and estimating 0.25 square meters per scattered individual shrub) for comparison to baseline and 2014 acreages.

Assessment of Human and Natural Disturbance

Signs of human and natural disturbances were evaluated at all sites. We used a GPS to map any unauthorized trails, trampling or disturbance caused by horses, ATVs, mountain bikes, or hikers. Erosion related to roads or malfunctioning culverts was also mapped.

Mapping and GIS

Field mapping files were imported to GIS and all mapping was displayed using the most current ESRI imagery. All data will be submitted in addition to this report.

Results

Results are reported on the Benton County Prairie Species HCP Effectiveness Monitoring Summary Forms in Appendix A and the following section.

HCP Species and Habitat Abundance

Maps of HCP species locations are included in Appendix B. Total abundance of each HCP species is shown for each site in Table 7 and abundance of Fender's blue and Taylor's checkerspot habitat as indicated by host and nectar species is shown in Table 8 and Table 9. Both tables show the 2011, 2014/2015, and 2018 data for comparison between the baseline and the subsequent effectiveness monitoring events. For Fender's blue butterfly nectar quantity/quality, comparison is not possible due to the update in methods, but comparison to USFWS standards is included with each site below.

Bezell Memorial Forest

At Bezell Memorial Forest, Kincaid's lupine abundance continued to increase, expanding from 19.6 square meters in 2011 to 67.3 square meters in 2018, across the Bird loop, North meadow and Middle meadow. No Kincaid's lupine was found in Summit Meadow or South Meadow. Ten flowering Willamette daisy plants were found and mapped in Middle Meadow, an increase from the three observed in 2014. Additional vegetative plants may be present but are not detectable unless flowering. Estimates of host and nectar species abundance for Taylor's checkerspot decreased slightly at Bezell (by roughly 10%) in 2018 relative to 2014, but has increased relative to baseline.

Table 7. HCP plant species abundance in 2011, 2014, and 2018.

Site	Kincaid's lupine (Leaf Area in m ²)				
	2011	2014/15	2018	Change from Prior	Change from Baseline
Bezell Memorial Forest	4.35	19.6	67.3	47.7 243%	62.95 1447%
Fittton Green Natural Area	0.5	0.46	0.4	-0.06 0%	-0.1 -20%
Jackson-Frazier Wetland	1.1	0.5	0	-0.5 -100%	-1.1 -100%
Crisp-Liddell	576.2	645	398.1	-246.9 -38%	-178.1 -31%
Pearcy	297.1	269	234.8	-34.2 -13%	-62.3 -21%

Site	Bradshaw's lomatium (# of plants)				
	2011	2014	2018	Change from Prior	Change from Baseline
Jackson-Frazier Wetland	213	66	87	21 32%	-126 -59%

Site	Nelson's checkermallow (# of plants)				
	2011	2014	2018	Change from Prior	Change from Baseline
Jackson-Frazier Wetland	224	212	289	77 36%	65 29%

Site	Willamette daisy (# of plants)				
	2011	2014	2018	Change from Prior	Change from Baseline
Bezell Memorial Forest	n/a	3	10	7 233%	n/a n/a

^a Willamette daisy not censused in 2011.

^b Leaf area in 2011 assumed to be 0.5 m²

Table 8. Abundance of HCP butterfly host and nectar species 2011, 2014/2015, and 2018. Native nectar sugar for Fender’s blue in 2018 is described in Table 9.

Site	Fender’s blue Native Nectar Species (Leaf Area in m ²)			
	2011	2014/15	2018	Change
Bezell Memorial Forest	15.7 m ²	18.8 m ²	Not assessed	n/a
Crisp-Liddell	45.3 m ²	38.1 m ²	change to nectar sugar	n/a
Pearcy	130 m ²	135.4 m ²		

Site	Taylor’s checkerspot Host Species (Leaf Area in m ²)				
	2011	2014	2018	Change from Prior	Change from Baseline
Bezell Memorial Forest	401.6	1001	901 ^a	-100 -10%	499.4 124%
Fittton Green Natural Area	5759	1562	2465 ^b	903 58%	-3294 -57%

Site	Taylor’s checkerspot Nectar Species (Leaf Area in m ²)				
	2011	2014	2018	Change from Prior	Change from Baseline
Bezell Memorial Forest	3028	8416	7631.4 ^c	-784.6 -9%	4603.4 152%
Fittton Green Natural Area	10,620	2557	4173 ^d	1616 63%	-6447 -61%

^a Estimated from vegetation plot data: 95% confidence interval from 429 m²–1,373 m².

^b Estimated from vegetation plot data: 95% confidence interval from 1215 m²–3714 m².

^c Estimated from vegetation plot data: 95% confidence interval from 4086 m²–11,176 m².

^d Estimated from vegetation plot data: 95% confidence interval from 2917 m²–5429 m².

Table 9. HCP plant species abundance by meadow at Bezell Memorial Forest. Note that the areas where these species were introduced (plots) at Bezell are mapped in Appendix B regardless of whether the introductions were successful.

Meadow	Kincaid’s lupine (Leaf Area in m ²)				Willamette Valley daisy (Number of plants)			
	2011	2014	2018	Change	2011	2014	2018	Change
Bird Loop	4.35	16.9	40.5	23.6	0	0	0	n/a
Middle	0	2.7	23.55	20.85	0	3	10	7
North	0	0.1	3.25	3.15	0	0	0	n/a
Summit	0	0	0	n/a	0	0	0	n/a
South	0	0	0	n/a	0	0	0	n/a
Total	4.35	19.6	67.3	47.6	0	3	10	7

Fitton Green Natural Area

At Fitton Green Natural Area Kincaid’s lupine leaf area remained stable at a small cover of roughly 0.4 square meters.

Estimates of Taylor’s checkerspot host plant abundance and nectar species abundance both increased from 2014 levels, by 58% and 63%, respectively, but are lower than baseline abundance at the site in 2011.

Jackson-Frazier Wetland

At Jackson-Frazier Wetland no Kincaid’s lupine was observed in 2018. In 2014, leaf area of Kincaid’s lupine had decreased from 1.1 m² to 0.5 m². The area was highly dominated by invasive species in 2018. The Bradshaw’s lomatium population increased from 66 plants in 2014 to 87 plants in 2018, and the Nelson’s checkermallow population increased from 212 plants in 2014 to 289 plants in 2018, benefitting from the establishment of introduced plants on the south side of the site.

Crisp-Liddell

In 2018, Kincaid’s lupine abundance at Crisp-Liddell decreased by roughly 38% from 2015, and decreased by 31% from baseline abundance. Native nectar plant sugar availability, calculated with methods from USFWS, is included in Table 10. The site has excellent native nectar species richness across the different flight periods for the butterfly, but does not meet the target levels of sugar availability. Sugar availability at the site is highest in the early flight period, then lower in peak and late flight periods. Overall, the site total for nectar sugar is roughly 25% of the target of 20 mg/square meter, summed over the entire season.

Table 10. Native nectar plant nectar sugar availability for Fender's blue butterfly across the butterfly flight season (early, peak, late) and overall sugar availability relative to target amounts at Crisp-Liddell and Pearcy in 2018.

Phenology-Weighted Nectar - Crisp-Liddell 2018					
Early		Peak		Late	
Species	mg/m ²	Species	mg/m ²	Species	mg/m ²
<i>Camassia quamash</i>	0.00	<i>Allium amplexans</i>	0.00	<i>Allium amplexans</i>	0.00
<i>Calochortus tolmiei</i>	0.00	<i>Calochortus tolmiei</i>	0.00	<i>Cryptantha intermedia</i>	0.00
<i>Geranium oreganum</i>	0.00	<i>Iris tenax</i>	1.12	<i>Eriophyllum lanatum</i>	1.28
<i>Iris tenax</i>	2.62	<i>Lupinus spp</i>	0.07	<i>Lupinus spp</i>	0.07
<i>Sidalcea virgata</i>	0.06	<i>Sidalcea virgata</i>	0.47	<i>Sidalcea virgata</i>	0.06
		<i>Vicia americana</i>	0.00	<i>Vicia americana</i>	0.00

Overall Nectar Availability -Crisp-Liddell 2018				
	Early Spp. mg/m ²	Peak Spp. mg/m ²	Late Spp. mg/m ²	Site Total
Nectar Aim (mg/sq m)	4	12	4	20
Current mg/sq m	2.6823	1.6637	1.4147	5.76
NECTAR QUALITY	low	low	low	
Richness	5	6	5	9
Species Needed (Aim = 2/period, 5/site)	0	0	0	0

Phenology-Weighted Nectar - Pearcy 2018					
Early		Peak		Late	
Species	mg/m ²	Species	mg/m ²	Species	mg/m ²
<i>Camassia quamash</i>	0.00	<i>Allium amplexans</i>	0.00	<i>Allium amplexans</i>	0.00
<i>Calochortus tolmiei</i>	0.07	<i>Calochortus tolmiei</i>	0.16	<i>Cryptantha intermedia</i>	0.00
<i>Geranium oreganum</i>	0.00	<i>Iris tenax</i>	0.24	<i>Eriophyllum lanatum</i>	0.44
<i>Iris tenax</i>	0.55	<i>Lupinus spp</i>	0.09	<i>Lupinus spp</i>	0.09
<i>Sidalcea virgata</i>	0.03	<i>Sidalcea virgata</i>	0.23	<i>Sidalcea virgata</i>	0.03
		<i>Vicia americana</i>	0.00	<i>Vicia americana</i>	0.00

Site Quality - Pearcy 2018				
	Early Spp. mg/m ²	Peak Spp. mg/m ²	Late Spp. mg/m ²	Site Total
Nectar Aim (mg/sq m)	4	12	4	20
Current mg/sq m	0.6494	0.7105	0.5566	1.92
NECTAR QUALITY	low	low	low	
Richness	4	4	3	6
Species Needed (Aim = 2/period, 5/site)	0	0	0	0

Pearcy

In 2018, Kincaid's lupine abundance at Pearcy decreased roughly 13% from 2014 abundance, and decreased by 21% from baseline abundance. Native nectar plant sugar availability is included in Table 10. The site has excellent native nectar species richness across the different flight periods for the butterfly, but does not meet the target levels of sugar availability. Sugar availability is highest in the peak flight period, and lower in early and late flight periods. Overall, the site total for nectar sugar is roughly 10% of the target of 20 mg/square meter, summed over the entire season.

Noxious Weeds

Maps showing noxious weed and tall oatgrass locations at each site are included in Appendix C. A summary of noxious weed abundance at each site is included and in Table 10. Because of its invasive qualities, tall oatgrass was added in 2014 to the list of noxious weeds mapped on the HCP sites. We do not have 2011 baseline data that would show how its abundance may have changed since that time, but

Bezell Memorial Forest

Evidence of targeted weed removal (e.g., thistle, scotch broom) was seen in 2018 (Table 10), with some areas of infestation removed. However, tall oatgrass infests all or most of all of the meadows. Scotch broom is frequent, particularly near meadow margins. False brome is also encroaching into meadows from the perimeter forest, which is typically dominated by false brome.

Fitton Green Natural Area

Tall oatgrass is prevalent throughout most of the meadow although uninfested areas still occur. False brome is invading from the meadow margins and forms numerous patches at the perimeters, and many individuals are scattered throughout other parts of the meadow. Patches of medusahead rye are concentrated in the northern portion of the meadow as are a patches of thistles. Hawthorn and Douglas-fir encroachment are discussed in the woody vegetation section.

Jackson-Frazier Wetland

In 2011 and 2018, the area of the wetland with HCP species was the focus for mapping. We clipped the GIS data from 2014 monitoring to include an equivalent area for comparison. The 2018 abundance of reed canarygrass in the HCP species area has increased from 2011 and 2014, with patches scattered on both sides of the bisecting hedgerow. Within the wetland area there was little other change in prevalence of noxious weeds.

False brome and Armenian blackberry were not mapped in the historical location of the northwest Kincaid's lupine population, but dominate the area, and there is significant tree overstory of big leaf maple over the site.

Crisp-Liddell

Spatial weed mapping data from 2015 were not available, therefore we will compare 2018 data to 2011 conditions. A significant increase in blackberry, thistles, false brome, Scotch broom, and tall oatgrass is apparent at this site. Areas of blackberry are reaching height and density so as to limit growth of understory species. Evidence of work to control Scotch broom and blackberry was seen as burned or

dead canes/stems. Hawthorn and Douglas-fir encroachment are discussed in the woody vegetation section.

Pearcy

In comparison to conditions in 2011, blackberry, false brome, medusahead rye and tall oatgrass have increased since 2011. Scotch broom patches have declined with management. A new aggressive species at the site is bachelor button (*Centaurea cyanus*), an escaped cultivated species related to starthistle and knapweed – this species has been steadily expanding and dominating habitat at the northwest side of the property, and appears to be replacing and excluding native species. Hawthorn and Douglas-fir encroachment are discussed in the woody vegetation section.

Table 11. Weed species mapping data describing weed patch (polyon) area and abundance of scattered individuals (points) in 2011, 2014 and 2018. Note that the Cardwell hill sites (Crisp, Pearcy), did not have weed mapping data available for comparison from 2015 monitoring. At Beazell and Jackson-Frazier Wetland, a larger extent of the site was mapped for weeds in 2015. That mapping has been clipped to an extent that is comparable to what was monitored in 2011 and 2018, for the purposes of comparison.

Site	Species	Polygon area (m ²)				Scattered Individuals (#)			
		2011	2014	2018	Change	2011	2014	2018	Change
Beazell Memorial Forest	Armenian blackberry	130	582	107	-475	8	34	12	-22
	Bull thistle	10	8757	91	-8667	95	185	30	-155
	Canada thistle	13480	7934	527	-7407	30	39	6	-33
	False brome	222	2745	1510	-1235	18	173	36	-137
	Meadow knapweed	0	0		0	0	3		-3
	Medusahead rye	7360	1009	1959	951	0	0		0
	Perennial pea	0	101		-101	1	0		0
	Scotch broom	21	9483	4184	-5299	36	118	60	-58
	St Johnswort	0	162		-162	0	4	2	-2
	Tall oatgrass ^a	n/a	142100	141739	-361	n/a	0		0
Tansy ragwort	0	334	16	-318	49	60	22	-38	
Fitton Green Natural Area	Armenian blackberry	0	55	591	536	5	10	15	5
	Bull thistle	11	0	7	7	45	31	4	-27
	Canada thistle	516	242	167	-75	6	2	4	2
	False brome	178	7253	5888	-1365	54	96	20	-76
	Italian thistle	0	0		0	0	1		-1

Site	Species	Polygon area (m ²)				Scattered Individuals (#)			
		2011	2014	2018	Change	2011	2014	2018	Change
	Meadow knapweed	0	0		0	0	1		-1
	Medusahead rye	1690	2617	1525	-1091	2	15	2	-13
	St Johnswort			8	8			4	4
	Tall oatgrass ^a	n/a	61673	68246	6573	n/a	8	2	-6
	Tansy ragwort	0	40	20	-19	10	18	9	-9
Jackson-Frazier Wetland	Armenian blackberry	0	0		0	0	6	1	-5
	Bull thistle	0	0		0	0	3	4	1
	Canada thistle	0	0		0	2	1	4	3
	False brome	0	238		-238	6	0		0
	Purple loosestrife	0	0		0	0	1		-1
	Reed canarygrass ^b	47	288	298	10	0	46	5	-41
	Tansy ragwort	0	0		0	1	3	1	-2
Crisp-Liddell	Armenian blackberry	1600	0	23105	21505	17		15	-2
	Bull thistle	0	0	243	243	28		87	59
	Canada thistle	0	0	775	775	3		18	15
	False brome	0	0	3076	3076	7		65	58
	Medusahead rye	300	0		-300				0
	Scotch broom	3094	0	8484	5391	50		73	23
	St Johnswort	0	0		0			30	30
	Tall oatgrass ^a	0	0	6411	6411			4	4
	Tansy ragwort	0	0	17	17	5		25	20
Pearcy	Armenian blackberry			1112	1112	6		13	7
	Bachelor button			6327	6327				0
	Bull thistle				0	4		3	-1
	Canada thistle	391			-391	1			-1
	False brome	714		963	249	18		12	-6
	Italian thistle				0				0
	Meadow knapweed				0	1			-1

Site	Species	Polygon area (m ²)				Scattered Individuals (#)			
		2011	2014	2018	Change	2011	2014	2018	Change
	Medusahead rye	3809		5946	2137	3			-3
	Scotch broom	250		102	-148	26		20	-6
	St Johnswort				0	4			-4
	Tall oatgrass ^a			5409	5409				0
	Tansy ragwort				0			1	1

Vegetation Composition

Maps of 2018 vegetation plot locations are included in Appendix B. A comparison of the average percent cover of native species, exotic species, shrubs and plant litter/thatch found within the plots at each site is summarized in Table 12, along with standard error values, which represent the variability within the set of samples at a site in a given year. When mean (average) values for a given parameter differ by more than the standard error between years, we note a change has occurred. Otherwise, the change detected is within the variability in the site, and indicates more samples (plots) are needed to be able to detect differences.

Relative to 2014/2015, native species cover in 2018 increased at Beazell Memorial Forest and Fitton Green, and decreased at Jackson-Frazier Wetland, Crisp, and Percy. Introduced species cover decreased at Beazell, but appears fairly constant at Fitton Green and Crisp, and increased at Jackson-Frazier and somewhat at Percy. Shrub cover increased at all sites except Fitton Green. Plant litter cover was lower at all sites in 2018 relative to 2014/2015.

Woody Vegetation Encroachment

Minor declines in overall meadow size as a result of woody encroachment were detected in 2018. However, mapping of small and scattered individuals of woody species reveals the need for proactive management action to prevent future increases. For example, young hawthorn stems were abundant throughout the entire Crisp-Liddell site, to the extent that they were only mapped in the western third of the Property.

Assessment of Human and Natural Disturbance

No significant areas of human or natural disturbance were observed within the HCP habitat areas in 2018. Surrounding land uses do not appear to have changed since 2011.

Table 12. Summary of vegetation plot data in 2011, 2014/15, and 2018.

		2011		2014/15		2018	
		Mean	+SE	Mean	+SE	Mean	+SE
Native Species Cover (%)	Bezell	28.1	5.9	32	5.7	46.7	7.7
	Fitton Green	47.1	13	20.1	11.2	35.7	9.3
	Jackson-Frazier	65.7	10.8	109.2	10.8	78.2	8.5
	Crisp-Liddell	36.4	8.1	50.6		37.2	3.5
	Pearcy	32.5	17.6	44.0		30.5	12.2
		Mean	+SE	Mean	+SE	Mean	+SE
Introduced Species Cover (%)	Bezell	51.7	3.8	58.3	5.7	46.8	5.8
	Fitton Green	39.4	8.3	85.7	20.8	59.8	7.3
	Jackson-Frazier	10.7	6.4	5.2	2.5	29.4	8.9
	Crisp-Liddell	45.6	5.9	61.6		57.4	8.9
	Pearcy	55.2	10.7	53.8		62.5	9.0
		Mean	+SE	Mean	+SE	Mean	+SE
Shrub Cover (%)	Bezell	6.3	2.7	6.2	2.4	14.1	3.7
	Fitton Green	17.1	10.4	9.2	7	0.3	0.2
	Jackson-Frazier	16.4	9.4	13.2	10.8	33.2	16.1
	Crisp-Liddell	5.6	2.8	0.0		17.8	12.6
	Pearcy	0.5	0.4	0.0		1.7	1.1
		Mean	+SE	Mean	+SE	Mean	+SE
Plant Litter Cover (%)	Bezell	30.7	5.2	70.3	4.9	26.7	3.9
	Fitton Green	24.6	6.3	53	10.2	7	3.4
	Jackson-Frazier	16.8	3.9	42.2	13.5	8.9	3.4
	Crisp-Liddell	32.5	1.8	12.6		9.3	5.4
	Pearcy	22.8	0.1	5.0		12.0	4.7

Table 13. Prairie or meadow acreages not occupied by woody vegetation in 2011, 2014, and 2018. Scattered individuals were estimated to cover 0.25 square meters each.

	2011 Acreage	2014/2015 Acreage	2018 Acreage	Change from baseline
Bezell Memorial Forest	36.65	36.10	35.51	-3.1%
Fitton Green Natural Area	24.12	24.12	23.92	-0.8%
Jackson-Frazier Wetland	35.62*	13.52	35.62*	0%
Crisp-Liddell	22.50	22.50	22.47	-0.1%
Pearcy	18.13	18.13	18.11	-0.1%

*Estimated as approximate extent of site with HCP species.

Discussion

In 2018, increases in Kincaid's lupine relative to baseline and 2014 abundance were observed in the meadows at Beazell Memorial Forest, primarily in the Bird Loop Meadow and Middle Meadow, where planted lupine has expanded despite dense tall oatgrass. Planted Kincaid's lupine at North Meadow is still increasing slightly in cover, and may continue to expand over time. Host and nectar species for Taylor's checkerspot butterflies decreased slightly, which may relate to competition from tall oatgrass. False brome, Scotch broom, and tall oatgrass remain threats to the HCP species habitats at Beazell. Woody species increase across the site triggers the adaptive management threshold. Control of Douglas-fir saplings in the Summit Meadow, in particular, is encouraged while they are still small.

At Fitton Green Natural Area, the Kincaid's lupine population is still quite small in extent and leaf area. The population at this site is small and scattered, and does not seem to be prone to increase. Estimates of Taylor's checkerspot host and nectar species increased from their levels in 2014, and may be supporting the Taylor's checkerspot population which was augmented at the site by USFWS in recent years. False brome, Scotch broom, and tall oatgrass remain threats to the prairie quality at Fitton Green. Control of Douglas-fir saplings, particularly in the eastern edge of the meadow, is encouraged while they are still small.

The Bradshaw's lomatium population recovered somewhat at Jackson-Frazier Wetland (increasing from 66 plants up to 87 plants) but still remains below the 213 plants seen in 2011. The Nelson's checkermallow population increased relative to the baseline and 2014 abundance. The rare species at the site co-exist with native shrub species, mainly Nootka rose, and would benefit from regular prescribed burning and/or mowing to control woody vegetation. The woody species adaptive management threshold was triggered for the site. The Kincaid's lupine population at Jackson-Frazier has historically been very small and impacted both by the forest overstory and by understory invasives, mainly false brome and Armenian blackberry. The lupine plants were not located this year, though flags marking their past position were observed, in dense false brome and blackberry.

Increase in abundance by blackberry, tall oatgrass, hawthorn and false brome, plus the expansion of woody species (e.g., hawthorn) at Crisp-Liddell and Percy may be responsible for the decline in Kincaid's lupine cover at both sites. The decline in lupine triggers the adaptive management threshold for Crisp, and the native species decline triggers the adaptive management threshold at Percy. The woody vegetation increase at Crisp also triggers the adaptive management threshold. Mowing, in addition to prescribed fire and herbicide control, within parameters for Fender's blue protection, is needed to reduce the dominance of all these species, especially hawthorn, blackberry, and false brome, and to preserve the remaining native species and key nectar resources for Fender's blue butterfly. Removal of the large Douglas-Fir at Crisp has been successful, and regular control of the smaller Douglas- fir at the site encouraged while the trees are still a manageable size.

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- Schultz, C., R. Thomas and K. Cummings. 2012. Assessing nectar resources for Fender's blue butterfly within upland prairies in Willamette Valley, Oregon. Report to USFWS and Oregon Department of State Lands. Washington State University, Vancouver, WA. 28 p.
- Thomas, R. and C. B. Schultz. 2010. Response of Fender's blue butterfly to large scale habitat restoration in critical habitat: I. Distribution of Fender's blue eggs in The Nature Conservancy's Hayfield site, 2008 and 2009, and, II. Assessing nectar resource phenology for Fender's blue butterfly, 2009. Report to the Bureau of Land Management 31 pages.

Appendix A. HCP Effectiveness Monitoring Summary Forms



**BENTON COUNTY PRAIRIE SPECIES HCP
Effectiveness Monitoring Summary**

SUBMIT TO: BENTON COUNTY NATURAL AREAS & PARKS
DEPARTMENT, 360 SW Avery Avenue, Corvallis, OR 97333

Complete this form using effectiveness monitoring data from a single site, and **SUBMIT BY DECEMBER 31 OF THE YEAR IN WHICH MONITORING WAS COMPLETED.** For Baseline Monitoring, complete the shaded fields only. For continuing monitoring, if an adaptive management threshold has been triggered (e.g., if YES is checked in any box below), it is the responsibility of the landowner/manager to take and document the designated corrective action (see HCP Section 7.3.2).

CHECK ONE: WORK FOR MITIGATION VOLUNTARY WORK FOR CONSERVATION

Cooperator Name: _____

Site: Beazell Memorial Forest Dates of Effectiveness Monitoring: May-June 2018

HCP SPECIES STATUS/ABUNDANCE

Species	Abundance (note units)			% Change		THRESHOLD CHECK: >30 % Decrease from Prior?
	Baseline Date: (6/24/11)	Prior Monitoring Date: (6/3/14)	Current Monitoring	From Baseline =100x (Current # - Baseline #) /Baseline #	From Prior =100x (Current # - Prior #) /Prior #	
<i>Lupinus oregonus</i>	4.35 m ²	19.6 m ²	67.3 m ²	+1447%	+243%	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
<i>Erigeron decumbens</i> *	N/A	3 plants	10 plants	N/A	+233%	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO

**Erigeron decumbens* was not documented in the baseline monitoring

TREE AND SHRUB ENCROACHMENT

THRESHOLD CHECK

36.64 acres Estimated baseline meadow size.
3.1 % Estimated decrease in meadow size from baseline

Decrease >30%? YES NO

INVASIVE SPECIES: GROUP A

New population(s) discovered of N/A
New population(s) discovered of _____

New occurrence? YES NO
New occurrence? YES NO

Existing population of N/A increased by _____ %
Existing population of _____ increased by _____ %

Increase >30%? YES NO
Increase >30%? YES NO

Existing population of _____ increased by _____% Increase >30%? YES NO

INVASIVE SPECIES: GROUP B (relative to baseline)

New population(s) discovered of meadow knapweed New population? YES NO
 New population(s) discovered of St. Johnswort New population? YES NO
 New population(s) discovered of Robert geranium New population? YES NO

Existing population of bull thistle increased by +780 % Increase >30%? YES NO
 Existing population of Canada thistle increased by - 96 % Increase >30%? YES NO
 Existing population of false brome increased by +580 % Increase >30%? YES NO
 Existing population of Arm. blackberry increased by -18 % Increase >30%? YES NO
 Existing population of medusahead rye increased by -73 % Increase >30%? YES NO
 Existing population of perennial pea increased by n/a % Increase >30%? YES NO
 Existing population of Scotch broom increased by +20309 % Increase >30%? YES NO
 Existing population of tansy ragwort increased by -318 % Increase >30%? YES NO
 Existing population of Tall oatgrass increased by >>100% % Increase >30%? YES NO

INVASIVE SPECIES: OTHER

New population(s) discovered of _____ New population? YES NO

DISTURBANCE

Rodent ground disturbance: Baseline 0 % of site, Current 0 % Increase >30%? YES NO
 Mammal grazing of Covered plants: Baseline: 0 % Current 0 % Increase >30%? YES NO
 Significant windfall, erosion or hydrology issues? YES NO

Briefly describe or attach additional sheets. Note: ATV tracks and campsite mapped in 2011 not evident in 2014 or 2018.

Describe baseline trail use/trampling: Trail use restricted to established trails; no off-trail impacts observed

Significant increase in trail use or trampling? YES NO

Describe baseline surrounding land use: public park/natural area; commercial forest; agriculture

Significant change in surrounding land use? YES NO

PLANT COMMUNITY COMPOSITION & PLANT LITTER/THATCH ACCUMULATION

	Total % Cover and Date			% Change		THRESHOLD CHECK: Change from Baseline?
	Baseline 2011	Prior Monitoring	Current Monitoring	From Baseline = 100 x (Current # - Baseline #) / Baseline #	From Prior = 100 x (Current # - Prior #) / Prior #	
Native Species	28.1	32.0	46.7	+ 66.2%	+ 45.9%	>30 % Decrease? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Exotic Species	51.7	58.3	46.8	- 9.5%	- 19.7%	>30 % Increase? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Woody Vegetation	6.3	6.2	14.1	+ 123.8%	+ 127.4%	>15 % Increase? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Plant Litter/ Thatch	30.7	70.3	26.7	- 13.0%	- 62.0%	>30 % Increase? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

OTHER NOTES (attach additional pages)



**BENTON COUNTY PRAIRIE SPECIES HCP
Effectiveness Monitoring Summary**

SUBMIT TO: BENTON COUNTY NATURAL AREAS & PARKS
DEPARTMENT, 360 SW Avery Avenue, Corvallis, OR 97333

Complete this form using effectiveness monitoring data from a single site, and **SUBMIT BY DECEMBER 31 OF THE YEAR IN WHICH MONITORING WAS COMPLETED.** For Baseline Monitoring, complete the shaded fields only. For continuing monitoring, if an adaptive management threshold has been triggered (e.g., if YES is checked in any box below), it is the responsibility of the landowner/manager to take and document the designated corrective action (see HCP Section 7.3.2).

CHECK ONE: WORK FOR MITIGATION VOLUNTARY WORK FOR CONSERVATION

Cooperator Name: _____

Site: Fitton Green Natural Area Date of Effectiveness Monitoring: May/June/July 2018

HCP SPECIES STATUS/ABUNDANCE

Species	Abundance (note units)			% Change		<u>THRESHOLD CHECK:</u> >30 % Decrease from Prior?
	Baseline Date: (6/20/11)	Prior Monitoring Date: (5 /30/14)	Current Monitoring	From Baseline =100x (Current # - Baseline #) /Baseline #	From Prior =100x (Current # - Prior #) /Prior #	
<i>Lupinus oregonus</i>	< 1 m ² *	0.46 m ²	0.4 m ²	-20%	-0%	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO

* 2011 cover assumed to be 0.5 m²

TREE AND SHRUB ENCROACHMENT

THRESHOLD CHECK

24.12 Estimated baseline meadow size. Decrease >30%? YES NO
0.8 % Estimated decrease in meadow size from baseline

INVASIVE SPECIES: GROUP A

New population(s) discovered of N/A New occurrence? YES NO
 New population(s) discovered of _____ New occurrence? YES NO

Existing population of N/A increased by _____ % Increase >30%? YES NO
 Existing population of _____ increased by _____ % Increase >30%? YES NO
 Existing population of _____ increased by _____ % Increase >30%? YES NO

INVASIVE SPECIES: GROUP B (relative to baseline)

New population(s) discovered of _____ New population? YES NO
 New population(s) discovered of _____ New population? YES NO

Existing population of Canada thistle increased by - 75 % Increase >30%? YES NO
 Existing population of false brome increased by +3212 % Increase >30%? YES NO
 Existing population of Arm. blackberry increased by >>100 % Increase >30%? YES NO
 Existing population of medusahead rye increased by -10 % Increase >30%? YES NO
 Existing population of tansy ragwort increased by >>100 % Increase >30%? YES NO
 Existing population of Tall oatgrass increased by >>100 % Increase >30%? YES NO

INVASIVE SPECIES: OTHER

New population(s) discovered of _____ New population? YES NO

DISTURBANCE

Rodent ground disturbance: Baseline 0 % of site, Current 0 % Increase >30%? YES NO
 Mammal grazing of Covered plants: Baseline: 0 % Current 0 % Increase >30%? YES NO
 Significant windfall, erosion or hydrology issues? YES NO
 Briefly describe or attach additional sheets.

Describe baseline trail use/trampling: Trail use restricted to established trails; no off-trail impacts observed.
 Significant increase in trail use or trampling? YES NO

Describe baseline surrounding land use Public park/natural area, rural residential, woodlots
 Significant change in surrounding land use? YES NO

PLANT COMMUNITY COMPOSITION & PLANT LITTER/THATCH ACCUMULATION

	Total % Cover and Date			% Change		<u>THRESHOLD CHECK:</u> Change from Baseline?
	Baseline 2011	Prior Monitoring	Current Monitoring	From Baseline =100 x (Current # - Baseline #) /Baseline #	From Prior =100 x (Current # - Prior #) /Prior #	
Native Species	47.1	20.1	35.7	- 24.2%	+ 77.6%	>30 % Decrease? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Exotic Species	39.4	85.7	59.8	+ 51.8%	- 30.2%	>30 % Increase? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Woody Vegetation	17.1	9.2	0.3	- 98.2%	- 96.7%	>15 % Increase? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Plant Litter/ Thatch	24.6	53.0	7.0	- 71.5% %	- 86.8%	>30 % Increase? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

OTHER NOTES (attach additional pages)



BENTON COUNTY PRAIRIE SPECIES HCP Effectiveness Monitoring Summary

SUBMIT TO: BENTON COUNTY NATURAL AREAS & PARKS
DEPARTMENT, 360 SW Avery Avenue, Corvallis, OR 97333

Complete this form using effectiveness monitoring data from a single site, and **SUBMIT BY DECEMBER 31 OF THE YEAR IN WHICH MONITORING WAS COMPLETED.** For Baseline Monitoring, complete the shaded fields only. For continuing monitoring, if an adaptive management threshold has been triggered (e.g., if YES is checked in any box below), it is the responsibility of the landowner/manager to take and document the designated corrective action (see HCP Section 7.3.2).

CHECK ONE: WORK FOR MITIGATION VOLUNTARY WORK FOR CONSERVATION

Cooperator Name: _____

Site: **Jackson-Frazier Wetland** Date of Effectiveness Monitoring: **May-June 2018**

HCP SPECIES STATUS/ABUNDANCE

Species	Abundance (note units)			% Change		<u>THRESHOLD CHECK:</u> >30 % Decrease from Prior?
	Baseline Date: (5/5/11, 5/26/11, 7/7/11)	Prior Monitoring Date: (4 / 30 / 14 - 7/1/14)	Current Monitoring	From Baseline =100x (Current # - Baseline #) /Baseline #	From Prior =100x (Current # - Prior #) /Prior #	
<i>Lomatium bradshawii</i>	213 plants	66 plants	87 plants	- 59.2%	+ 31.8%	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
<i>Lupinus oreganus</i>	1.1 m ²	0.5 m ²	0	- 100%	- 100%	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
<i>Sidalcea nelsoniana</i>	224 plants	212 plants	282 plants	+ 25.9%	+ 33.0%	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO
						<input type="checkbox"/> YES <input type="checkbox"/> NO

TREE AND SHRUB ENCROACHMENT

35.62 acres Estimated baseline meadow size.
35.62 % Estimated decrease in meadow size from baseline

THRESHOLD CHECK

Decrease >30%? YES NO

INVASIVE SPECIES: GROUP A

New population(s) discovered of N/A
New population(s) discovered of _____

New occurrence? YES NO
New occurrence? YES NO

Existing population of N/A increased by _____ % Increase >30%? YES NO
Existing population of _____ increased by _____ % Increase >30%? YES NO
Existing population of _____ increased by _____ % Increase >30%? YES NO

INVASIVE SPECIES: GROUP B (relative to baseline)

New population(s) discovered of _____ New population? YES NO
 New population(s) discovered of _____ New population? YES NO

Existing population of false brome increased by 0*% Increase >30%? YES NO
 Existing population of reed canarygrass increased by 540%% Increase >30%? YES NO
 Existing population of _____ increased by _____% Increase >30%? YES NO
 Existing population of _____ increased by _____% Increase >30%? YES NO

*In 2018, the area of false brome was not estimated as the small amount of lupine in that area was not located.

DISTURBANCE

Rodent ground disturbance: Baseline 0% of site, Current 0% Increase >30%? YES NO
 Significant windfall, erosion or hydrology issues? YES NO

Briefly describe or attach additional sheets.

Describe baseline trail use/trampling: NO
 Significant increase in trail use or trampling? YES NO

Describe baseline surrounding land use public park/natural area; agriculture; residential
 Significant change in surrounding land use? YES NO

PLANT COMMUNITY COMPOSITION & PLANT LITTER/THATCH ACCUMULATION

	Total % Cover and Date			% Change		THRESHOLD CHECK: Change from Baseline?
	Baseline	Prior Monitoring	Current Monitoring	From Baseline = 100 x (Current # - Baseline #) / Baseline #	From Prior = 100 x (Current # - Prior #) / Prior #	
Native Species	65.7	109.2	78.2	+ 19.0%	- 28.4%	>30 % Decrease? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Exotic Species	10.7	5.2	29.4	+ 174.8%	+ 465.4%	>30 % Increase? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Woody Vegetation	16.4	13.2	33.2	+ 102.4%	+ 151.5%	>15 % Increase? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Plant Litter/ Thatch	16.8	42.2	8.9	- 47.0%	- 78.9%	>30 % Increase? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

OTHER NOTES (attach additional pages)



**BENTON COUNTY PRAIRIE SPECIES HCP
Effectiveness Monitoring Summary**

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DEPARTMENT, 360 SW Avery Avenue, Corvallis, OR 97333

Complete this form using effectiveness monitoring data from a single site, and **SUBMIT BY DECEMBER 31 OF THE YEAR IN WHICH MONITORING WAS COMPLETED.** For Baseline Monitoring, complete the shaded fields only. For continuing monitoring, if an adaptive management threshold has been triggered (e.g., if YES is checked in any box below), it is the responsibility of the landowner/manager to take and document the designated corrective action (see HCP Section 7.3.2).

CHECK ONE: WORK FOR MITIGATION VOLUNTARY WORK FOR CONSERVATION

Cooperator Name: _____

Site: Crisp-Lidell FBBCA/PCA Dates of Effectiveness Monitoring: May/June 2018

HCP SPECIES STATUS/ABUNDANCE

Species	Abundance (note units)			% Change		<u>THRESHOLD CHECK:</u> >30 % Decrease from Prior?
	Baseline Date: (6/24/11)	Prior Monitoring Date: (6/2015)	Current Monitoring	From Baseline =100x (Current # - Baseline #) /Baseline #	From Prior =100x (Current # - Prior #) /Prior #	
<i>Kincaid's Lupine</i>	576.2 m ²	645 m ²	398.1 m ²	-31%	-38%	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
<i>Fender's Blue Nectar</i>	130 m ²	135.37 m ²	Change of method.			<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

TREE AND SHRUB ENCROACHMENT

THRESHOLD CHECK

22.5 acres Estimated baseline meadow size.
0.1 % Estimated decrease in meadow size from baseline Decrease >30%? YES NO

INVASIVE SPECIES: GROUP A

New population(s) discovered of N/A New occurrence? YES NO
New population(s) discovered of _____ New occurrence? YES NO

Existing population of N/A increased by _____ % Increase >30%? YES NO
Existing population of _____ increased by _____ % Increase >30%? YES NO
Existing population of _____ increased by _____ % Increase >30%? YES NO

INVASIVE SPECIES: GROUP B

New population(s) discovered of _____ New population? YES NO
New population(s) discovered of _____ New population? YES NO
New population(s) discovered of _____ New population? YES NO

Existing population of bull thistle increased by >>100% % Increase >30%? YES NO
Existing population of Canada thistle increased by >>100% % Increase >30%? YES NO
Existing population of false brome increased by >>100% % Increase >30%? YES NO

Existing population of Arm. blackberry increased by 1344% Increase >30%? YES NO
 Existing population of medusahead rye increased by -100% Increase >30%? YES NO
 Existing population of Scotch broom increased by 174% Increase >30%? YES NO
 Existing population of tansy ragwort increased by >>100% Increase >30%? YES NO
 Existing population of Tall oatgrass increased by >>100% % Increase >30%? YES NO

INVASIVE SPECIES: OTHER

New population(s) discovered of _____ New population? YES NO

DISTURBANCE

Rodent ground disturbance: Baseline 0 % of site, Current 0 % Increase >30%? YES NO
 Mammal grazing of Covered plants: Baseline: 0 % Current 0 % Increase >30%? YES NO
 Significant windfall, erosion or hydrology issues? YES NO

Describe baseline trail use/trampling: Trail use restricted to established trails; no off-trail impacts observed
 Significant increase in trail use or trampling? YES NO

Describe baseline surrounding land use: public park/natural area; commercial forest; agriculture
 Significant change in surrounding land use? YES NO

PLANT COMMUNITY COMPOSITION & PLANT LITTER/THATCH ACCUMULATION

	Total % Cover and Date			% Change		THRESHOLD CHECK: Change from Baseline?
	Baseline 6/17/2011	Prior Monitoring	Current Monitoring	From Baseline =100 x (Current # - Baseline #) /Baseline #	From Prior =100 x (Current # - Prior #) /Prior #	
Native Species	36.4	50.6	37.2	2%	-26%	>30 % Decrease? YES <input checked="" type="checkbox"/> NO
Exotic Species	45.6	61.6	57.38	26%	-7%	>30 % Increase? YES <input checked="" type="checkbox"/> NO
Woody Vegetation	5.6	0	17.75	217%	#DIV/0!	>15 % Increase? YES
Plant Litter/ Thatch	32.5	12.6	9.25	-72%	-27%	>30 % Increase? YES <input checked="" type="checkbox"/> NO



**BENTON COUNTY PRAIRIE SPECIES HCP
Effectiveness Monitoring Summary**

SUBMIT TO: BENTON COUNTY NATURAL AREAS & PARKS
DEPARTMENT, 360 SW Avery Avenue, Corvallis, OR 97333

Complete this form using effectiveness monitoring data from a single site, and **SUBMIT BY DECEMBER 31 OF THE YEAR IN WHICH MONITORING WAS COMPLETED.** For Baseline Monitoring, complete the shaded fields only. For continuing monitoring, if an adaptive management threshold has been triggered (e.g., if YES is checked in any box below), it is the responsibility of the landowner/manager to take and document the designated corrective action (see HCP Section 7.3.2).

CHECK ONE: WORK FOR MITIGATION VOLUNTARY WORK FOR CONSERVATION

Cooperator Name: _____

Site: Pearcy-Schoener FBBCA/PCA Dates of Effectiveness Monitoring: May, June 2018

HCP SPECIES STATUS/ABUNDANCE

Species	Abundance (note units)			% Change		THRESHOLD CHECK: >30 % Decrease from Prior?
	Baseline Date: (6/24/11)	Prior Monitoring Date: (/ /)	Current Monitoring	From Baseline =100x (Current # - Baseline #) /Baseline #	From Prior =100x (Current # - Prior #) /Prior #	
<i>Kincaid's Lupine</i>	297.1 m ²	269 m ²	234.8 m ²	-21%	-13%	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
<i>Fender's Blue Nectar</i>	45.3 m ²	38.1 m ²	Change in method		N/A	<input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

TREE AND SHRUB ENCROACHMENT

18.13 acres Estimated baseline meadow size.
0.1 % Estimated decrease in meadow size from baseline

THRESHOLD CHECK

Decrease >30%? YES NO

INVASIVE SPECIES: GROUP A

New population(s) discovered of N/A
New population(s) discovered of _____

New occurrence? YES NO
New occurrence? YES NO

Existing population of N/A increased by _____ %
Existing population of _____ increased by _____ %
Existing population of _____ increased by _____ %

Increase >30%? YES NO
Increase >30%? YES NO
Increase >30%? YES NO

INVASIVE SPECIES: GROUP B (relative to baseline)

New population(s) discovered of _____
New population(s) discovered of _____
New population(s) discovered of _____

New population? YES NO
New population? YES NO
New population? YES NO

Existing population of bull thistle increased by 0 %
Existing population of Canada thistle increased by 0 %
Existing population of false brome increased by 35 %
Existing population of Arm. blackberry increased by -5 %

Increase >30%? YES NO
Increase >30%? YES NO
Increase >30%? YES NO
Increase >30%? YES NO

Existing population of medusahead rye increased by 56% Increase >30%? YES NO
 Existing population of Meadow knapweed increased by 0% Increase >30%? YES NO
 Existing population of Scotch broom increased by -59% Increase >30%? YES NO
 Existing population of tansy ragwort increased by 0% Increase >30%? YES NO
 Existing population of Tall oatgrass increased by >>100% Increase >30%? YES NO

INVASIVE SPECIES: OTHER

New population(s) discovered of Centaurea cyanus – not on list, but appears aggressive New population? YES
NO

DISTURBANCE

Rodent ground disturbance: Baseline 0% of site, Current 0% Increase >30%? YES NO
 Mammal grazing of Covered plants: Baseline: 0% Current 0% Increase >30%? YES NO
 Significant windfall, erosion or hydrology issues? YES NO

Describe baseline trail use/trampling: Trail use restricted to established trails; no off-trail impacts observed
 Significant increase in trail use or trampling? YES NO

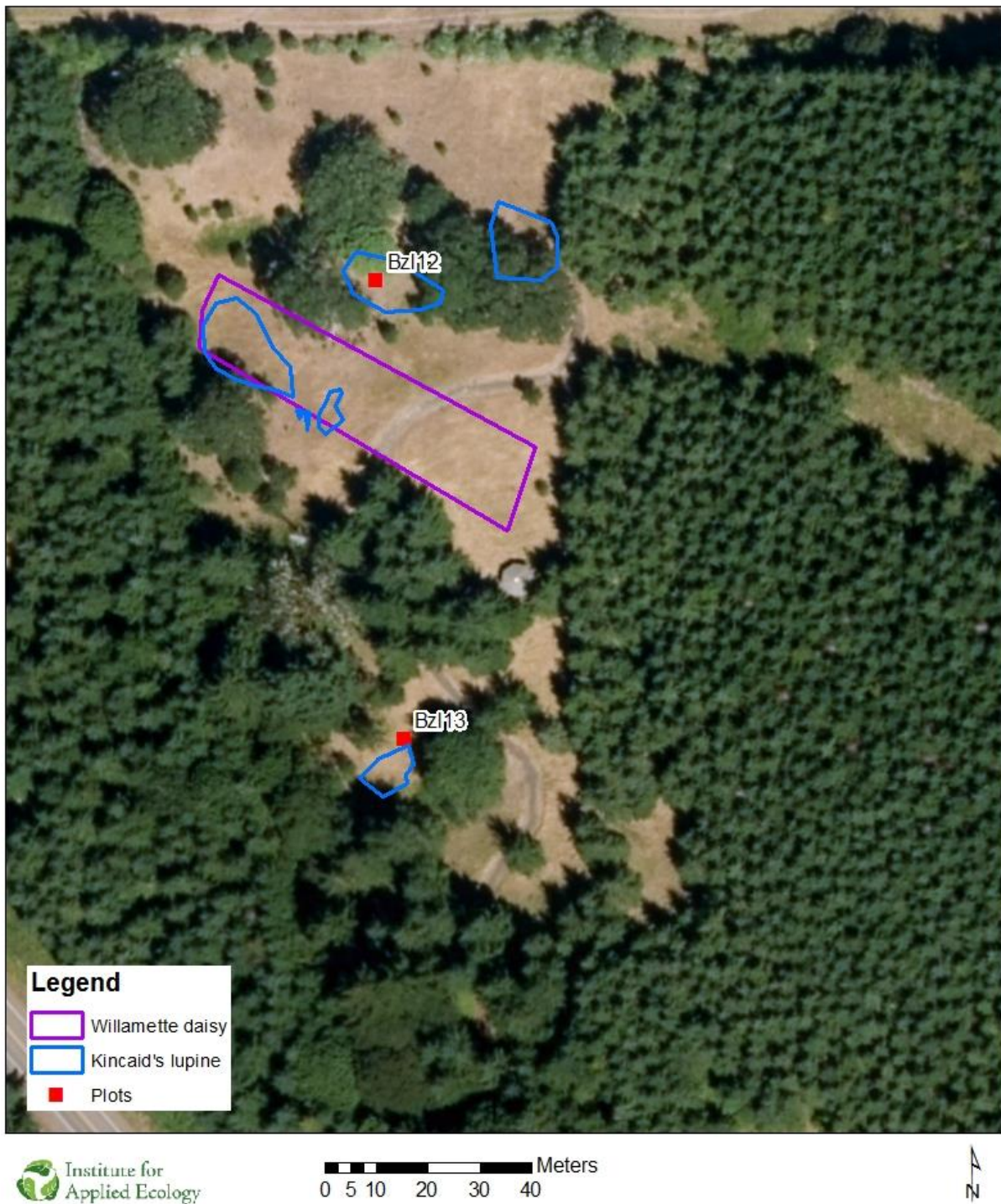
Describe baseline surrounding land use public park/natural area; commercial forest; agriculture
 Significant change in surrounding land use? YES NO

PLANT COMMUNITY COMPOSITION & PLANT LITTER/THATCH ACCUMULATION						
	Total % Cover and Date			% Change		THRESHOLD CHECK: Change from Baseline?
	Baseline 2011	Prior Monitoring	Current Monitoring	From Baseline =100 x (Current # - Baseline #) /Baseline #	From Prior =100 x (Current # - Prior #) /Prior #	
Native Species	32.5	44	30.5	-6%	-31%	>30 % Decrease? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Exotic Species	55.2	53.8	62.5	13%	16%	>30 % Increase? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO
Woody Vegetation	0.5	0.03	1.65	230%	5400%	>15 % Increase? Yes, but still low % cover
Plant Litter/ Thatch	22.8	5	12	-47%	140%	>30 % Increase? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO

Appendix B. HCP Rare Species Maps

Benton County HCP Monitoring 2018

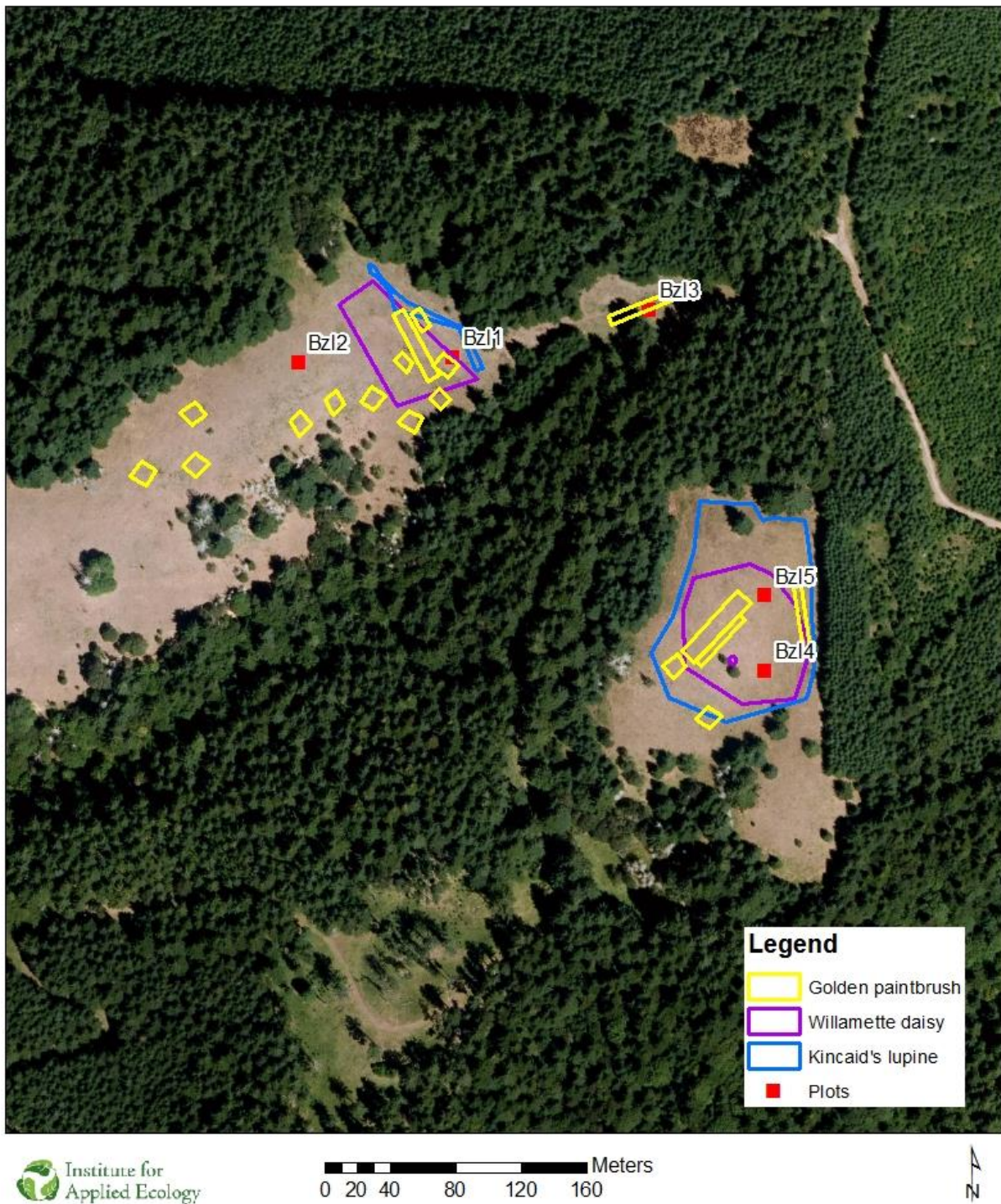
Bezell Memorial Forest - Bird Loop Meadow



Note: While Willamette daisy has been planted in multiple meadows at Bezell, plants have only been observed in the middle meadow to date.

Benton County HCP Monitoring 2018

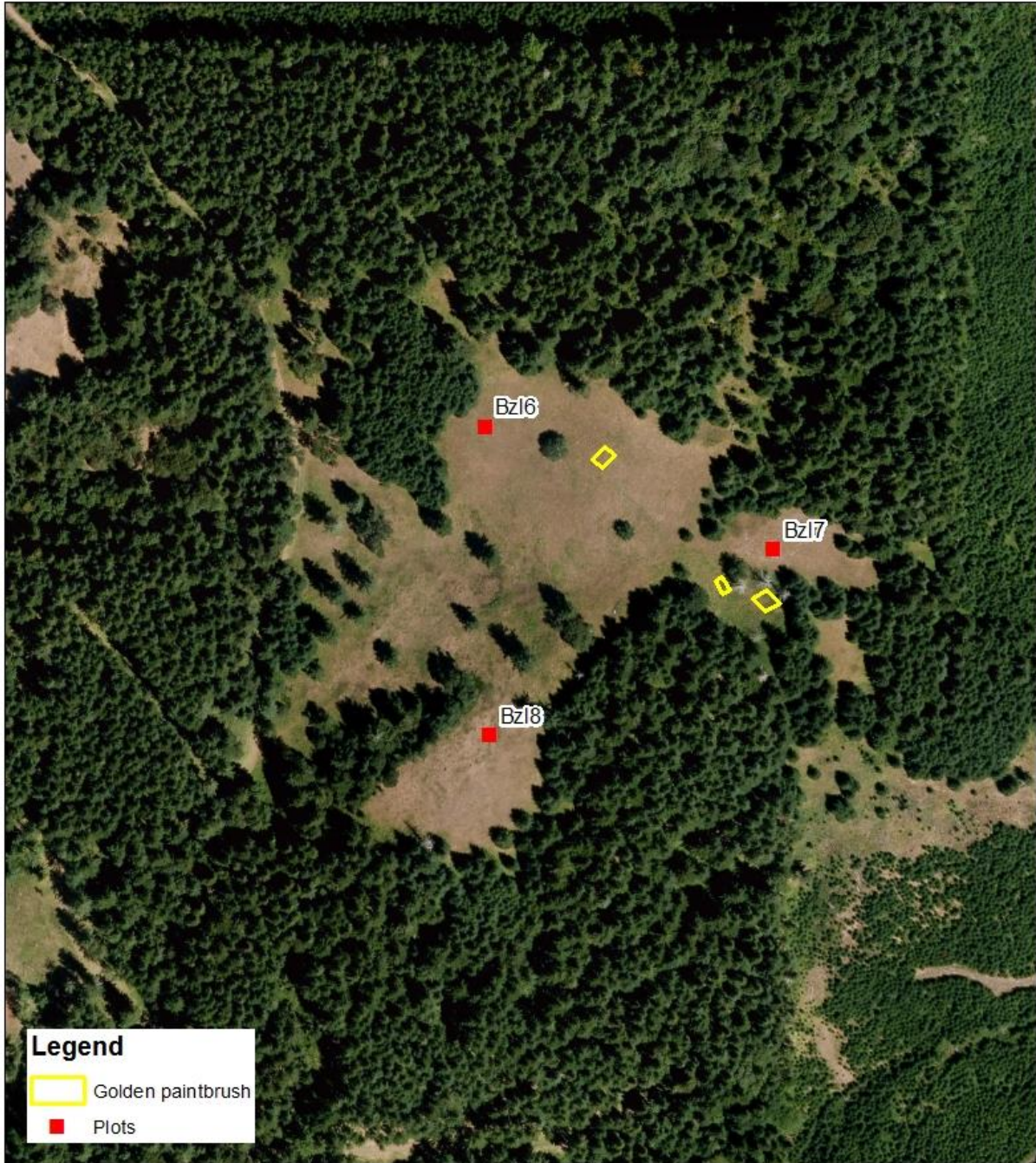
Beazell Memorial Forest - North & Middle Meadow



Note: While Willamette daisy has been planted in multiple meadows at Beazell, plants have only been observed in the middle meadow to date.

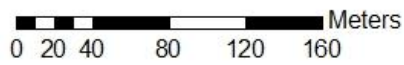
Benton County HCP Monitoring 2018

Bezell Memorial Forest - Summit Meadow



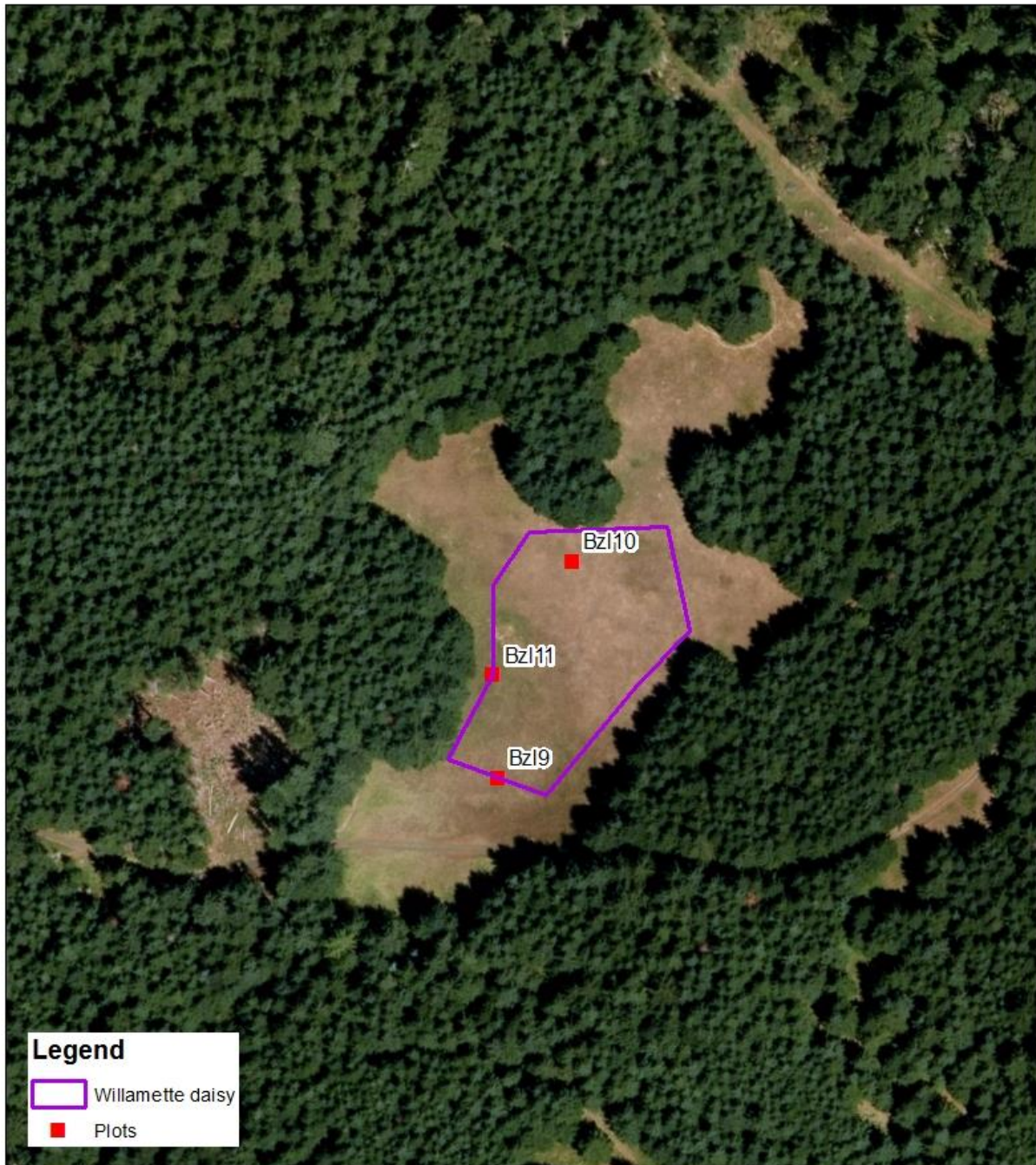
Legend

-  Golden paintbrush
-  Plots



Benton County HCP Monitoring 2018

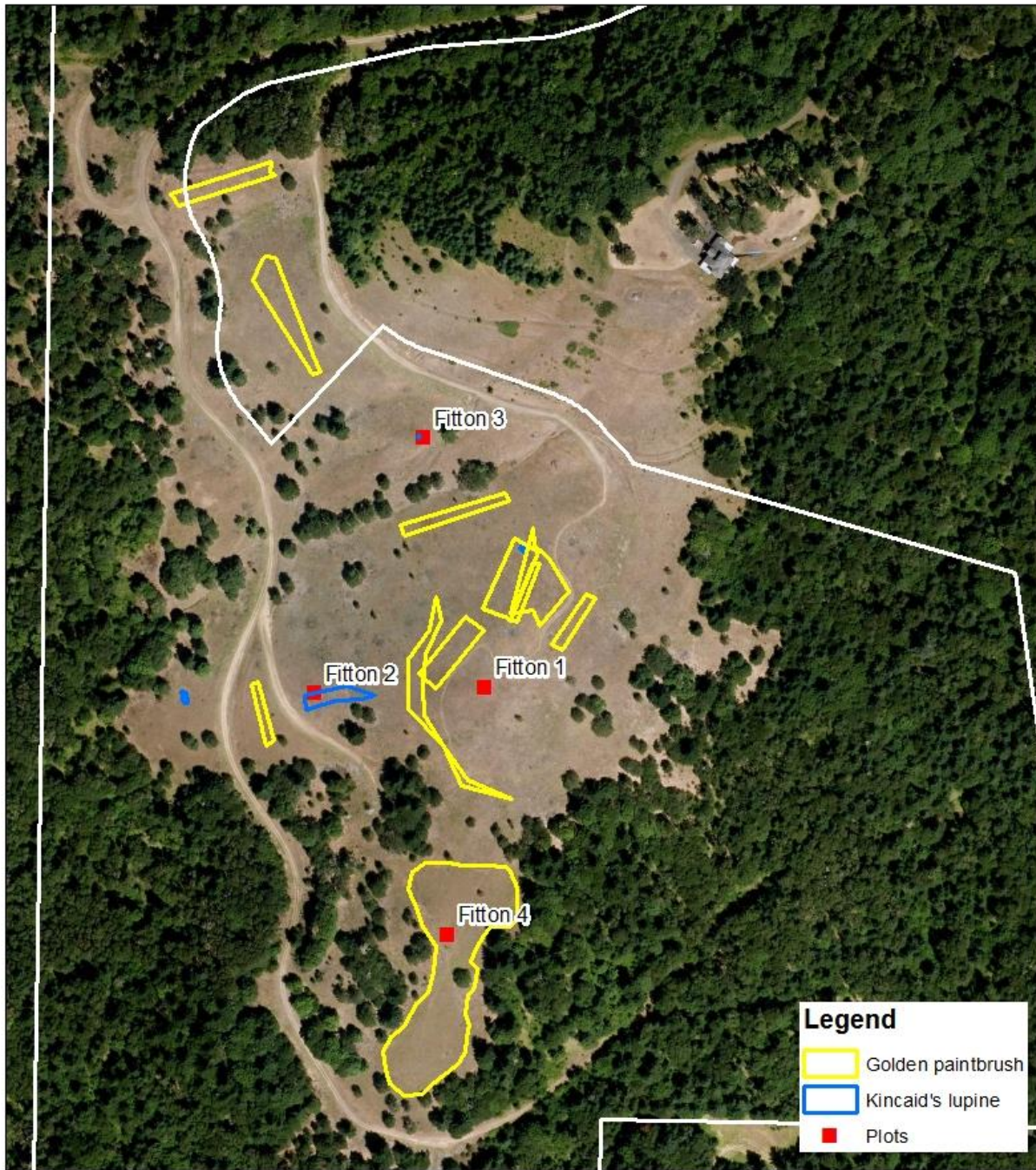
Bezell Memorial Forest - South Meadow



Note: While Willamette daisy has been planted in multiple meadows at Bezell plants have only been observed in the middle meadow to date.

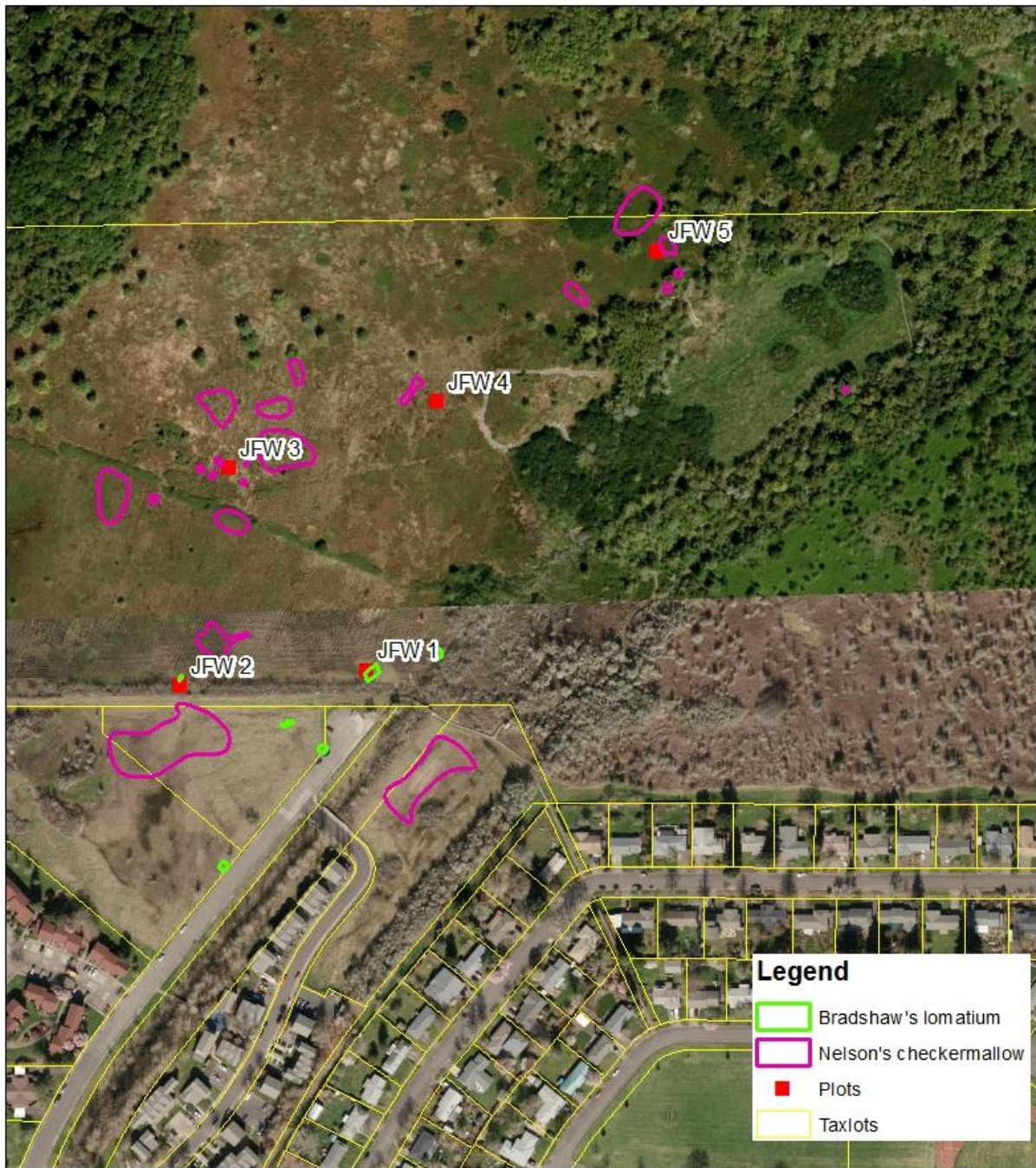
Benton County HCP Monitoring 2018

Fitton Green Natural Area



Benton County HCP Monitoring 2018

Jackson-Frazier Wetland



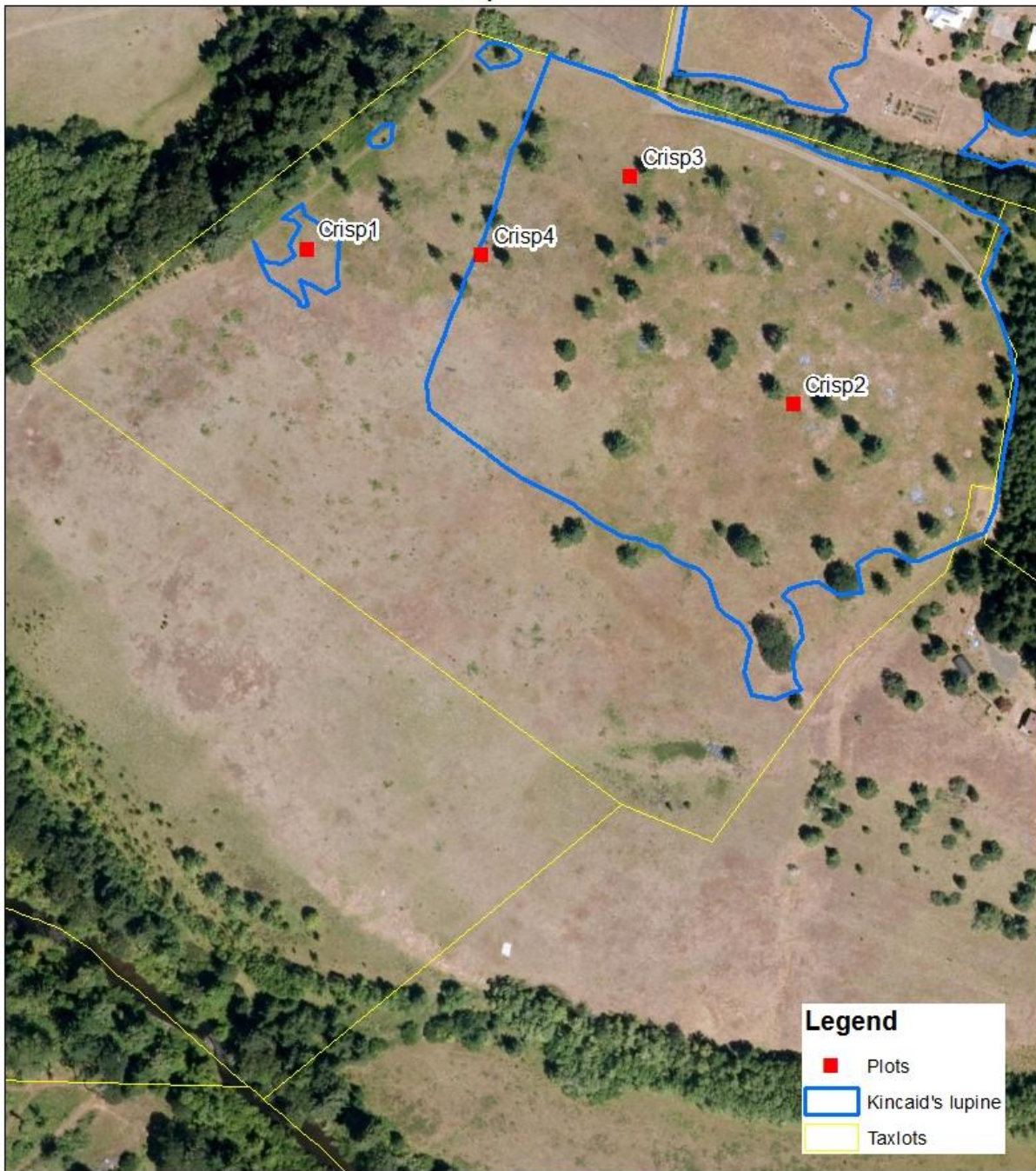
 Institute for Applied Ecology

0 20 40 80 120 160 Meters



Benton County HCP Monitoring 2018

Crisp-Liddell



Benton County HCP Monitoring 2018

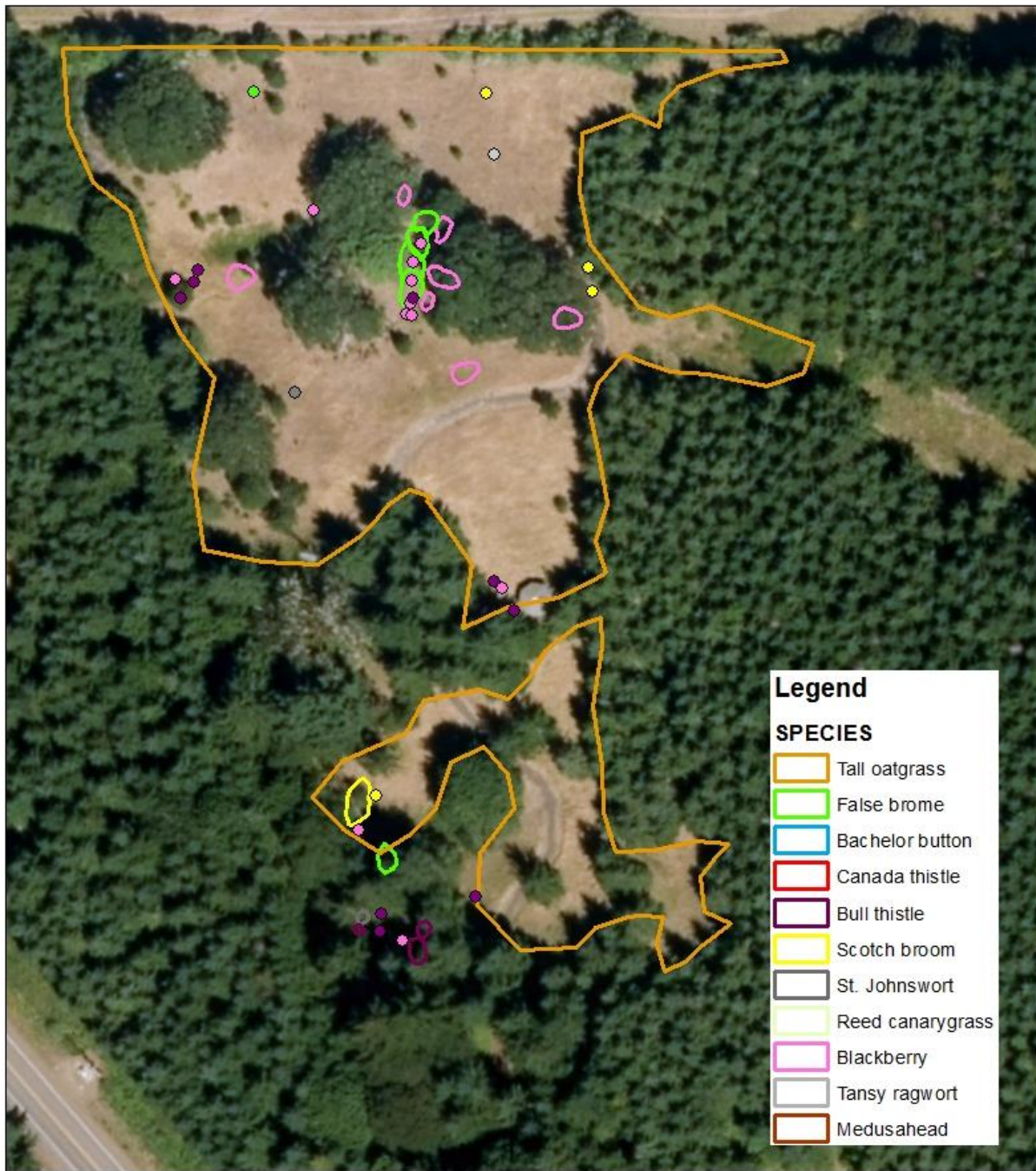
Pearcy



Appendix C. Noxious Weed Maps

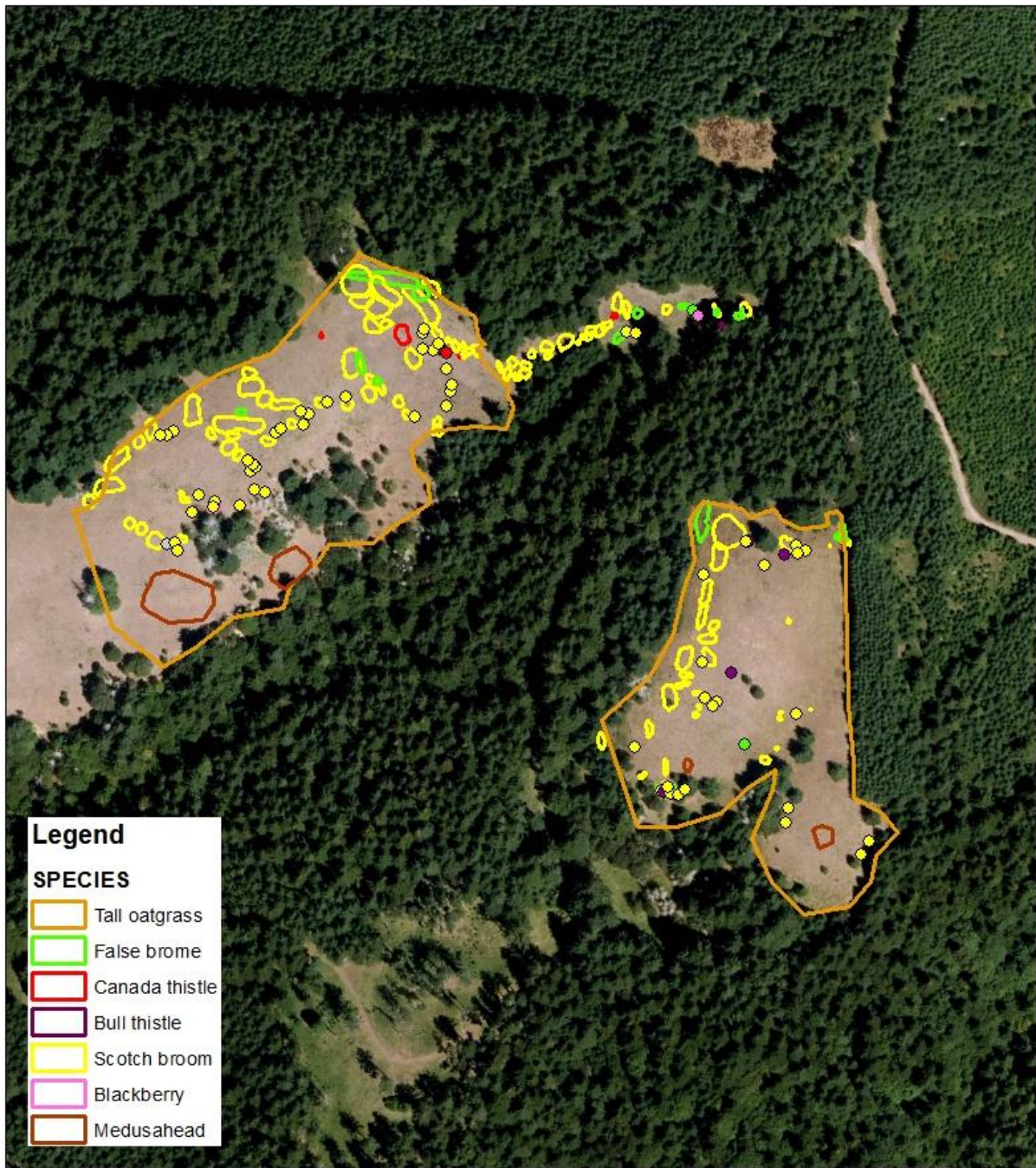
Benton County HCP Monitoring 2018

Bezell Memorial Forest - Bird Loop Meadow



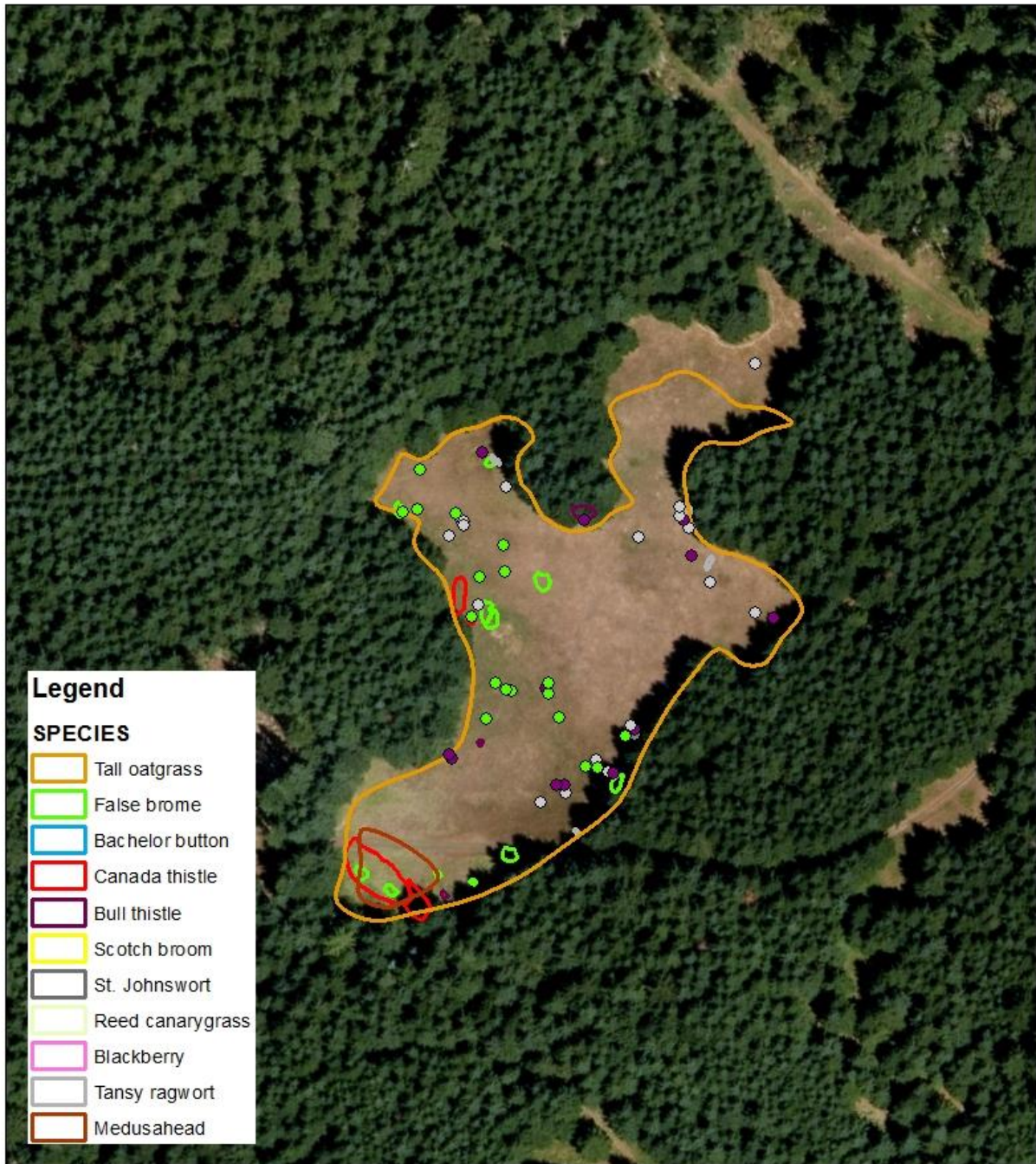
Benton County HCP Monitoring 2018

Beazell Memorial Forest - North & Middle Meadow



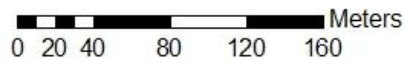
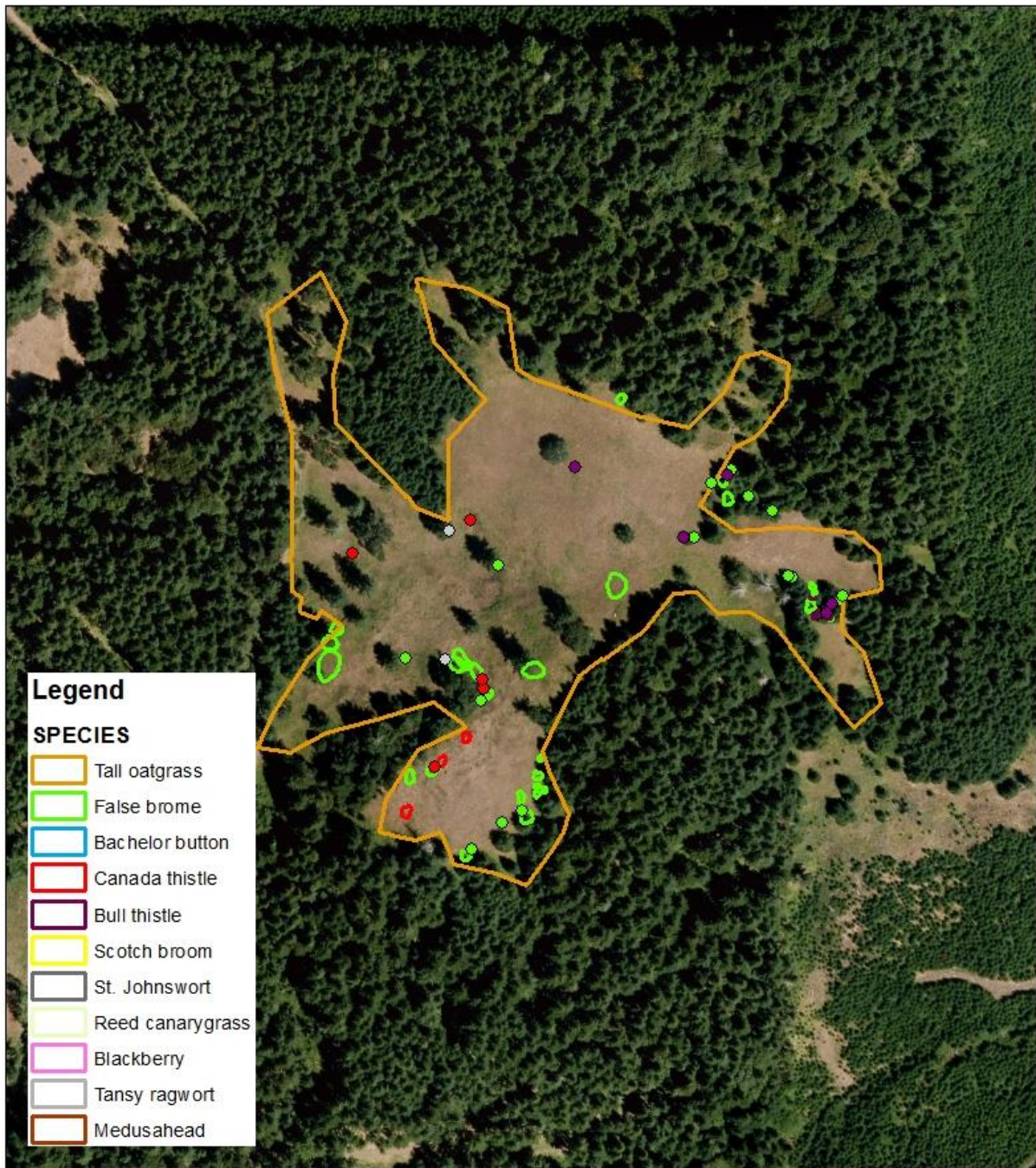
Benton County HCP Monitoring 2018

Bezell Memorial Forest - South Meadow



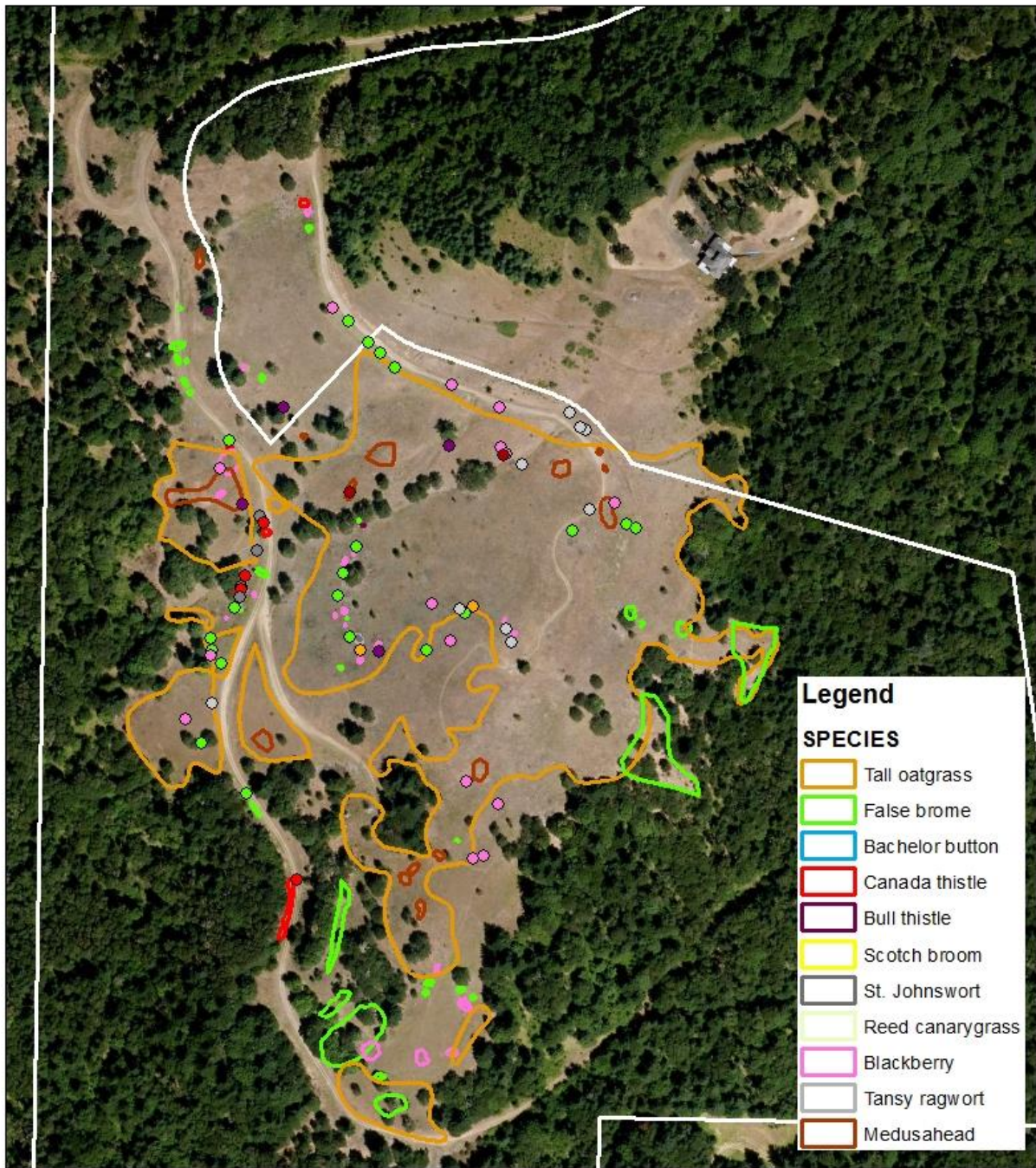
Benton County HCP Monitoring 2018

Bezell Memorial Forest - Summit Meadow



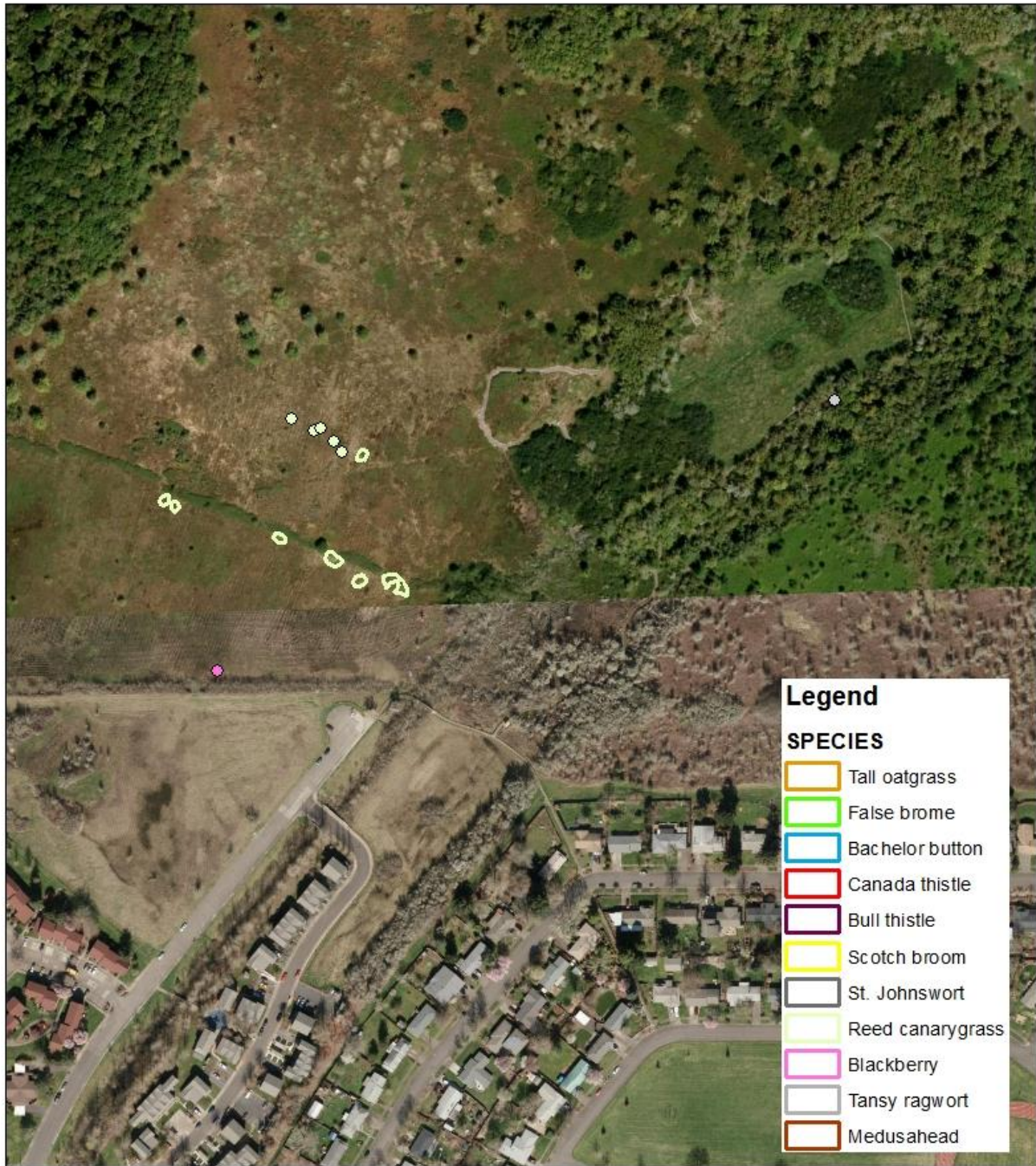
Benton County HCP Monitoring 2018

Fitton Green Natural Area



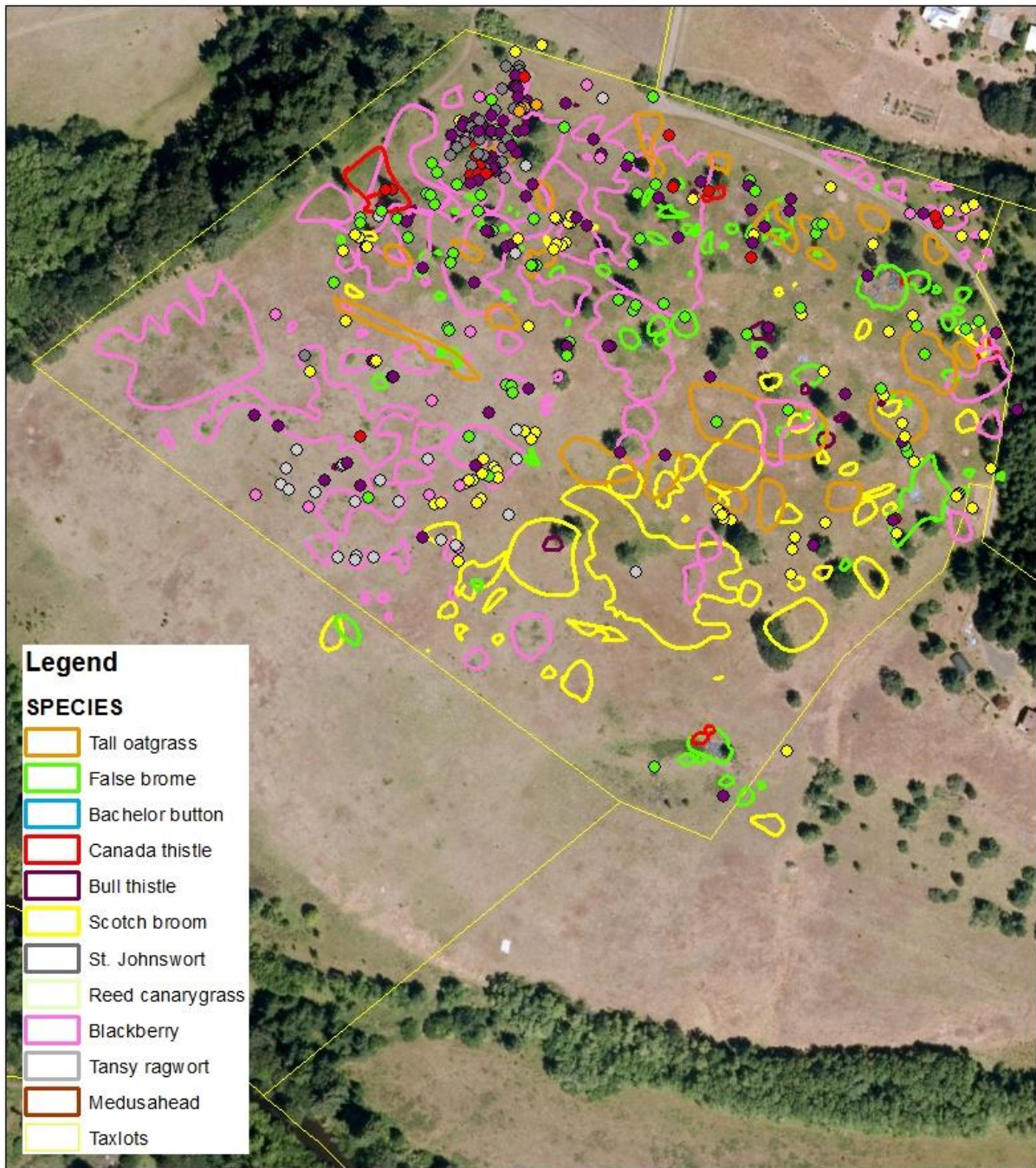
Benton County HCP Monitoring 2018

Jackson-Frazier Wetland



Benton County HCP Monitoring 2018

Crisp-Liddell



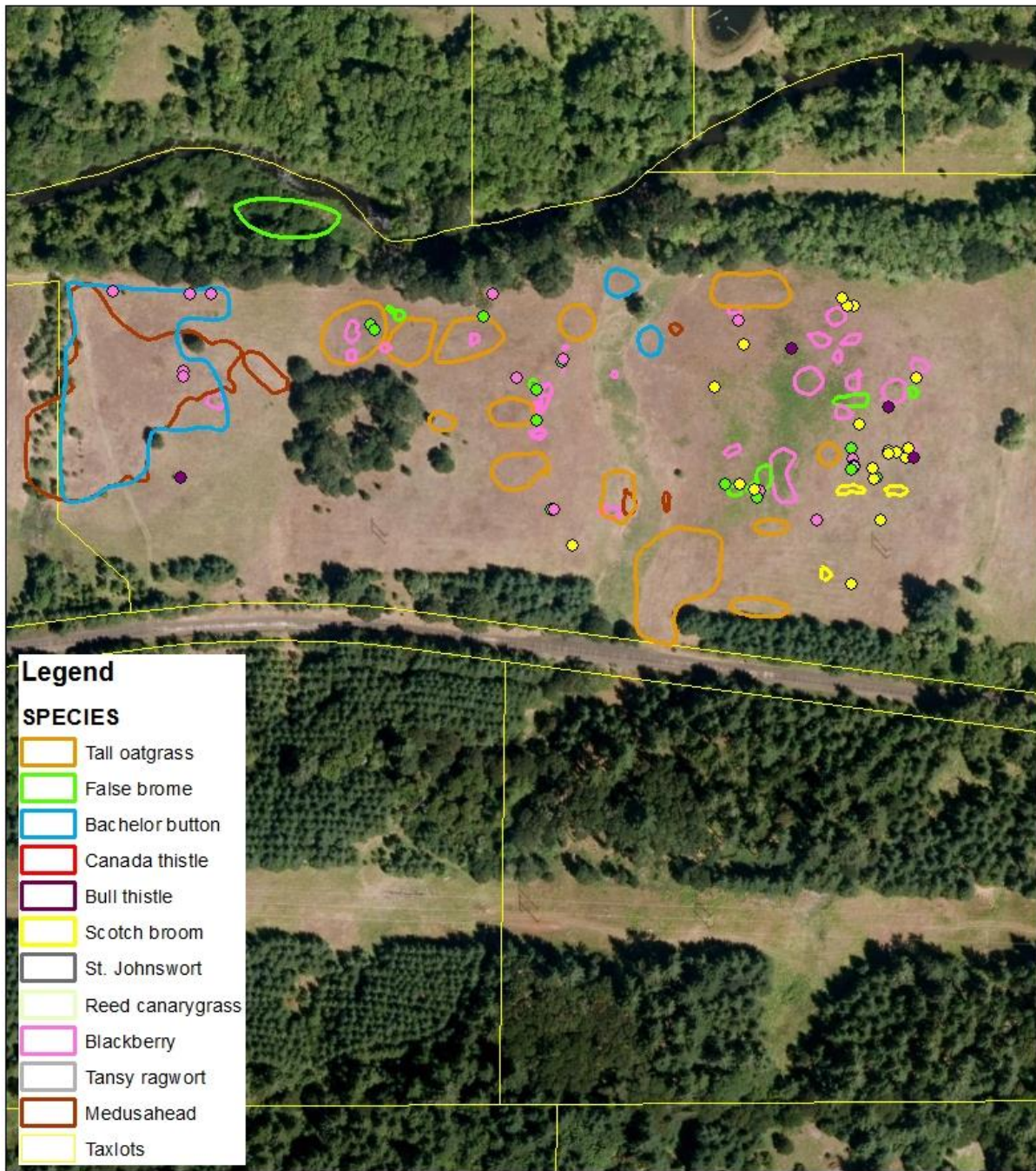
 Institute for Applied Ecology

0 15 30 60 90 120 Meters



Benton County HCP Monitoring 2018

Pearcy



0 15 30 60 90 120 Meters



Appendix D. Woody Encroachment Maps

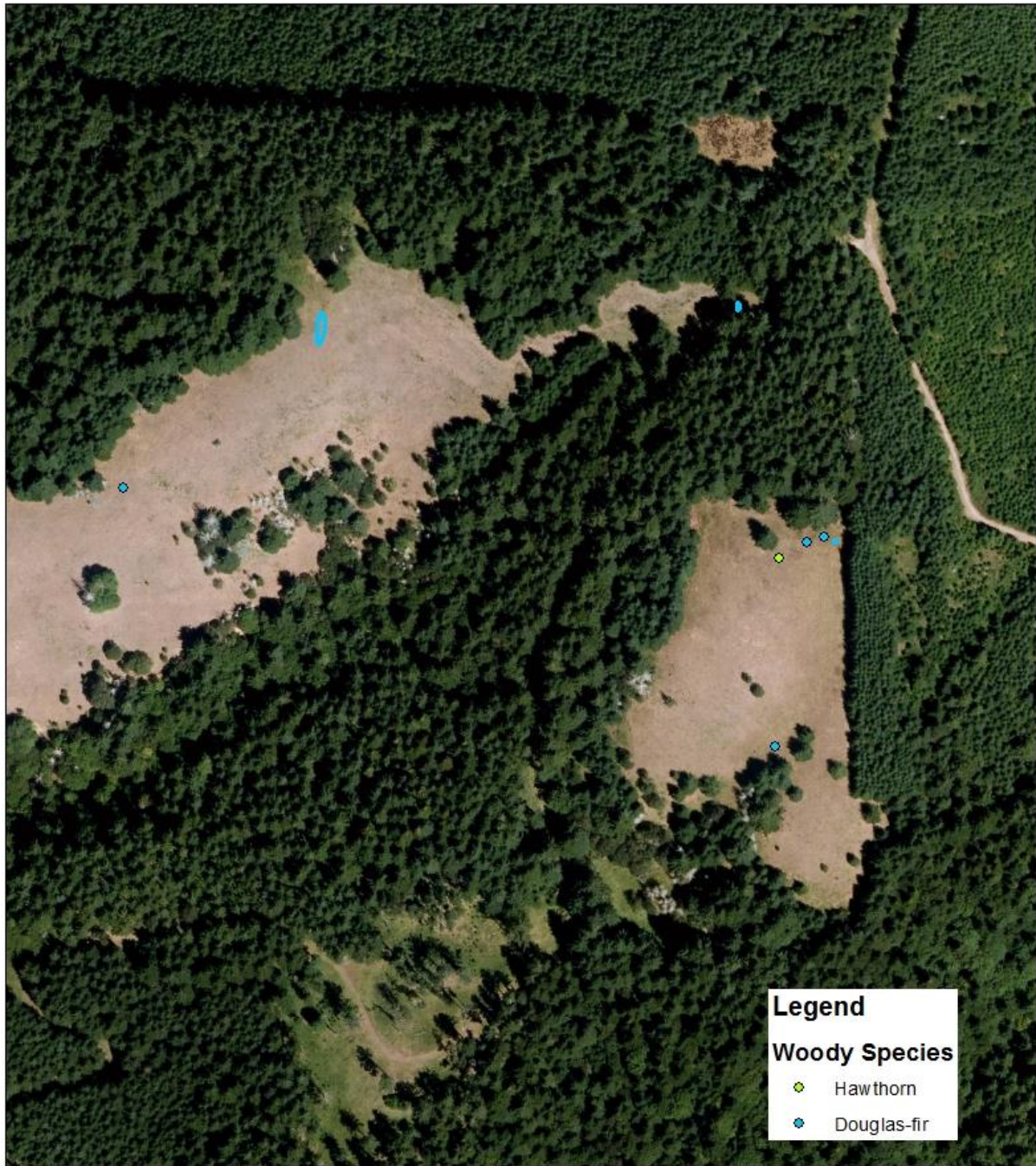
Benton County HCP Monitoring 2018

Bezell Memorial Forest - Bird Loop Meadow



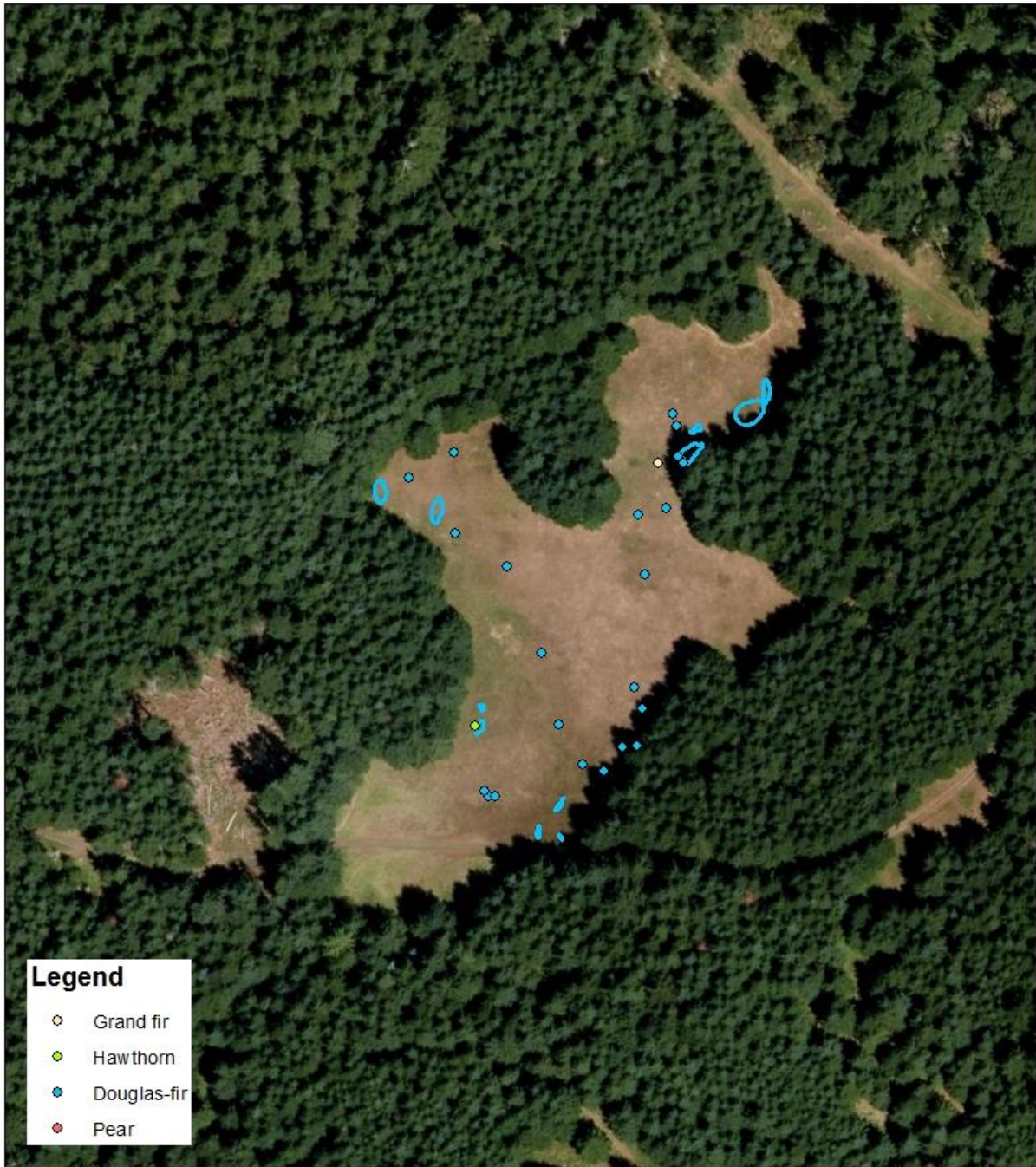
Benton County HCP Monitoring 2018

Beazell Memorial Forest - North & Middle Meadow



Benton County HCP Monitoring 2018

Beazell Memorial Forest - South Meadow



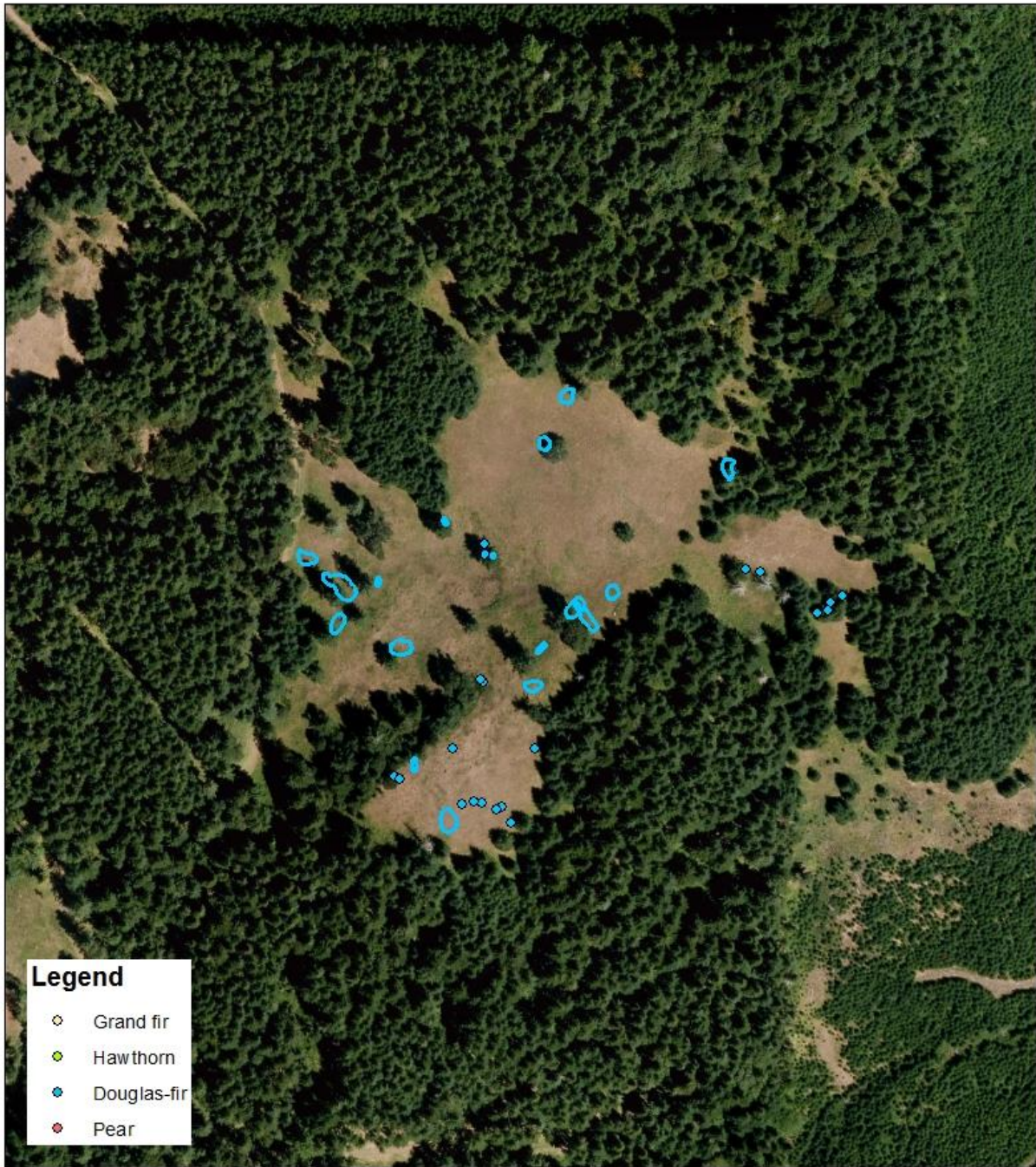
 Institute for Applied Ecology

0 12.5 25 50 75 100 Meters



Benton County HCP Monitoring 2018

Beazell Memorial Forest - Summit Meadow



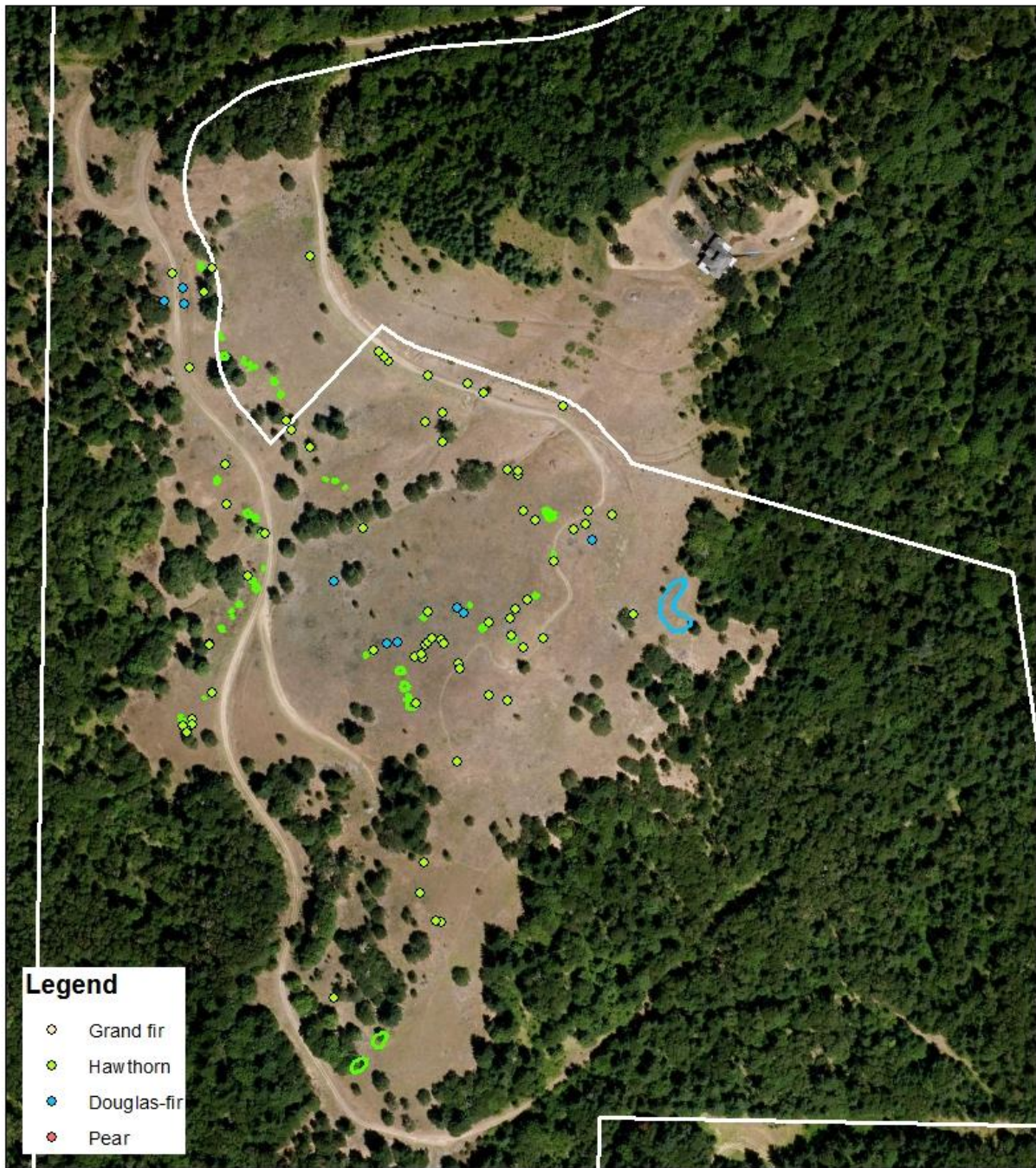
 Institute for Applied Ecology

0 20 40 80 120 160 Meters



Benton County HCP Monitoring 2018

Fitton Green Natural Area



 Institute for Applied Ecology

0 25 50 100 150 200 Meters

N

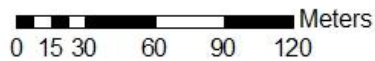
Benton County HCP Monitoring 2018

Crisp-Liddell



Legend

- ◇ Grand fir
- ◇ Hawthorn
- ◇ Douglas-fir
- ◇ Pear
- Taxlots



Note: The hawthorn infestation was only mapped on roughly the western third of the site – this area can be considered representative of conditions on the remainder of the site. Additional and occasional Douglas-fir saplings are also present, and much lower density.

Benton County HCP Monitoring 2018

Pearcy



Appendix E. HCP Effectiveness Monitoring Protocols

Excerpted from the Benton County HCP (Benton County 2010; p. 107-111, Sec. 7.2.1)

Effectiveness Monitoring

Effectiveness Monitoring will be undertaken as a component of the HCP. The purpose of this monitoring is to determine the success of habitat restoration, enhancement, and management, as measured by tracking species status and habitat condition. Effectiveness monitoring will be conducted on Covered Lands where voluntary or mitigation related habitat restoration, enhancement, and management activities are implemented by Benton County or Cooperators. Each Cooperator is responsible for collecting and reporting their own Effectiveness Monitoring data to Benton County.

Effectiveness Monitoring objectives include:

- Tracking population trends of Covered Species on Covered Lands
- Detecting changes in habitat quality (plant community composition and species cover) over time
- Determining whether and what management actions are necessary
- Measuring success of restoration activities (i.e., evaluate effects of mowing, limited livestock grazing, burning, herbicide application, etc.)
- Measuring fulfillment of mitigation requirements
- Early detection of invasive plants and animals
- Detecting woody plant encroachment and litter/thatch build up
- Providing feedback for adaptive management

Monitoring shall be conducted by qualified biologists or natural resource specialists in possession of any permits required by regulatory agencies (state or federal) for the monitoring activities they are conducting.

Monitoring Plans at Sites where Effectiveness Monitoring may be Required

Monitoring plans will be developed for all sites where Effectiveness Monitoring is required, including mitigation sites. At Prairie Conservation Areas, the monitoring plan may be added to any existing management plans or guidelines, such that the required levels of monitoring for the HCP are included. Monitoring plans will be developed by qualified biologists/natural resource specialists, and in some cases, sites may already have a monitoring plan established.

At a minimum, each monitoring plan will include:

1. Name of site.
2. Management goals and objectives (e.g., control of invasive species) for the site.
3. Subject of the monitoring program (e.g., species and/or habitat status).
4. Description of what is being monitored (e.g., species and/or habitats), including a site description (which may be generated using the first year's monitoring data and any prior surveys) with information about the abundance of Fender's Blue or Taylor's checkerspot butterfly host plants and nectar plants or Covered plants.
5. Variables to be measured and how data will be collected.
6. Frequency (minimum of three year cycle), timing (dependent on species being monitored), duration (minimum of six years), and intensity (number of sample plots) of the sampling.
7. Field procedures.
8. Sampling locations.
9. How data will be analyzed, who will conduct analysis (e.g., qualified biologist, statistician), and how results will determine whether the HCP goals and objectives are being met through the Conservation Measures.
10. Adaptive management process (such as use of the results to update management methods).
11. Monitoring equipment needs.
12. Personnel responsible for implementing monitoring program.
13. Process for reviewing/modifying monitoring plan.

Effectiveness Monitoring Timing and Frequency

Monitoring shall be conducted during the growing season of the Covered Species or habitat. This may vary by 1-3 weeks per year due to weather conditions, and differences in site conditions (elevation, aspect, etc.).

The first year of monitoring data, along with data from any prior surveys, will serve as the site's baseline inventory. Once baseline conditions have been established, periodic re-sampling (monitoring) will occur at a minimum of every three years. If significant management activities (e.g., prescribed fire) are implemented, monitoring should be conducted at a greater frequency (e.g., to collect pre-and post-treatment data) if needed to supply data for adaptive management, then return to regular three year monitoring cycles.

If implementation of habitat restoration, enhancement, or management activities at a given site ceases, monitoring will be conducted for a minimum of two monitoring cycles (six years) after cessation of the activities, as long as no adaptive management thresholds (e.g., decrease in population abundance- see **Error! Reference source not found.**) have been triggered. If an adaptive management threshold is triggered, monitoring will be required until the problem has been addressed.

Species Status Monitoring for Effectiveness Monitoring

Species status monitoring will be completed for Covered Species at sites where:

- Covered Activities occur that are likely to result in temporary impacts.
- Habitat restoration and enhancement activities are conducted for conservation purposes.
- Any mitigation work is completed by Benton County or a Cooperator.

Species abundance (or habitat, in the case of Fender's blue and Taylor's checkerspot butterflies) will be monitored. Direct counts of butterflies will not be required as these numbers are extremely variable from year-to-year, and fluctuations may be due to multiple conditions outside the control of the County or Cooperators, including weather. Abundance of each species will be measured using the following metrics:

- Fender's blue butterflies are quantified on the basis of square meters of Kincaid's lupine and native nectar species cover (see Table 2.1 for a list of nectar species).
- Taylor's checkerspot butterflies are quantified on the basis of square meters of host plants (primarily English plantain) and native nectar plants present.
- Kincaid's lupine are quantified on the basis of square meters of foliar cover.
- Nelson's checkermallow are quantified on the basis of individual plants. Plants that are ≥ 30 cm (11.8 in) apart are considered separate individuals.
- Willamette daisy are quantified on the basis of individual plants. Plants that are ≥ 10 cm (3.9 in) apart are considered separate individuals.
- Bradshaw's lomatium are quantified on the basis of individual plants. Plants that are ≥ 10 cm (3.9 in) apart are considered separate individuals
- Peacock larkspur are quantified on the basis of individual plants.

Species abundance will be censused by:

- Counting individuals of the covered plants, using the descriptions above to differentiate individuals. Where necessary, sites will be divided with a grid. The grid will be marked with permanent or GPS markers as needed. This will allow tracking of population trends within specific areas of the population and site.
- Measuring the quantity of butterfly habitat, including cover of host and nectar plants within sections of a grid. The grid will be marked with permanent or GPS markers as needed. This will allow tracking of population trends within specific areas of the population and site.

Prairie Habitat Condition Monitoring for Effectiveness Monitoring

Prairie Habitat Condition Monitoring will be completed at sites where habitat restoration and enhancement activities are implemented. Monitoring will include measurements of:

- Shrub and tree encroachment into prairie habitats
- Invasive species
- Disturbance (anthropogenic and natural)
- Thatch and plant litter accumulation
- Plant community composition

Shrub and Tree Encroachment into Prairie Habitat

The first round of monitoring at a site (baseline monitoring) will include mapping of prairie areas by delineating prairie boundaries. When appropriate, individual trees and shrubs (identified to species) or patches of trees and shrubs will be mapped using a combination of sketch maps, aerial photos, photo points, and GPS.

Invasive Species

During baseline monitoring, established and satellite populations (isolated patches of one to a few individuals) of invasive plant species will be identified and mapped. Methods will include using a combination of sketch maps, aerial photos, photo points, and GPS. Occurrences of invasive animals will be noted and areas of damage caused by these species will be mapped.

Any "A" or "B" Noxious Weeds, following Oregon Department of Agriculture's classification (e.g., ODA 2009) will be identified and mapped. "A" classified weeds are weeds of known economic importance not known to occur in Oregon, or occur in small enough infestations to make eradication/containment possible. "B" classified weeds are weeds of economic importance which are regionally abundant, but which may have limited distribution in some counties (**Error! Reference source not found.**). New problem species may be added to the groups as they are identified in Oregon and the project sites. Problem species may also be re-classified as their status changes. Group A and B classified weeds will be addressed specifically through adaptive management (Table 7.2).

Disturbance

Signs of man-made disturbance will be evaluated during habitat assessments at all sites, especially those with known use by the public. Any signs of new or existing trails or parts of trails with use by horses, mountain bikes, or hikers, will be mapped and tracked using a combination of sketch maps, aerial photos, photo points, and GPS during each monitoring cycle. Trampling off any established trail will be noted. Changes in surrounding land use will also be noted and described.

Signs of natural disturbance will be evaluated during habitat assessments at all sites, including:

- Soil disturbance by animals such as rodents
- Game trails
- Intensive herbivory by animals
- Windfall of trees
- Erosion
- Changes in hydrology

Plant Community Composition and Thatch/Litter Accumulation

Measurement of plant community composition and thatch and litter accumulation will involve fine scale habitat sampling using an appropriate number of randomly placed 5 m x 5 m (16.4 ft by 16.4 ft) plots to sample plant community attributes. The number of plots will vary with the size of the site, the proportion of the site occupied by the Covered Species, and the heterogeneity of the site. Within each plot, the following variables will be estimated:

- Percentage cover of each vascular plant species present
- Percentage cover of plant litter, moss, gravel/rock, and bare soil

Table 7.1 Examples of Oregon Department of Agriculture "A" and "B" classified weeds.

Common Name	Latin Name	Group A	Group B
oblong spurge	<i>Euphorbia oblongata</i>	x	
squarrose knapweed	<i>Centaurea virgata</i>	x	
Himalayan blackberry	<i>Rubus armeniacus</i>		x
Canada thistle	<i>Cirsium arvense</i>		x
oneseed hawthorn	<i>Crataegus monogyna</i>		x
false brome	<i>Brachypodium sylvaticum</i>		x
Italian thistle	<i>Carduus pycnocephalus</i>		x
meadow knapweed	<i>Centaurea pratensis</i>		x
milk thistle	<i>Silybum marianum</i>		x
Scotch broom	<i>Cytisus scoparius</i>		x
spotted knapweed	<i>Centaurea maculosa</i>		x
spurge laurel	<i>Daphne laureola</i>		x
Future species identified as EDRR priorities		x	
Any Oregon State A-listed noxious weeds		x	
Any Oregon State B-listed noxious weeds			x

Effectiveness Monitoring Data Management

Proper data management, analysis, and reporting are critical to the success of the monitoring and adaptive management program. Data on monitoring methods, results, and analysis must be managed, stored, and made available to interested parties including, but not limited to, Benton County staff, Cooperators, any technical advisors, USFWS, ODA and the Oregon Natural Heritage Information Center (ORNHIC). A database and clear reporting procedure are also required for incidental take permit compliance. Information about data management is available in Section 8.2.2. The data will be managed to ensure accurate and up-to-date information is available for making management decisions.