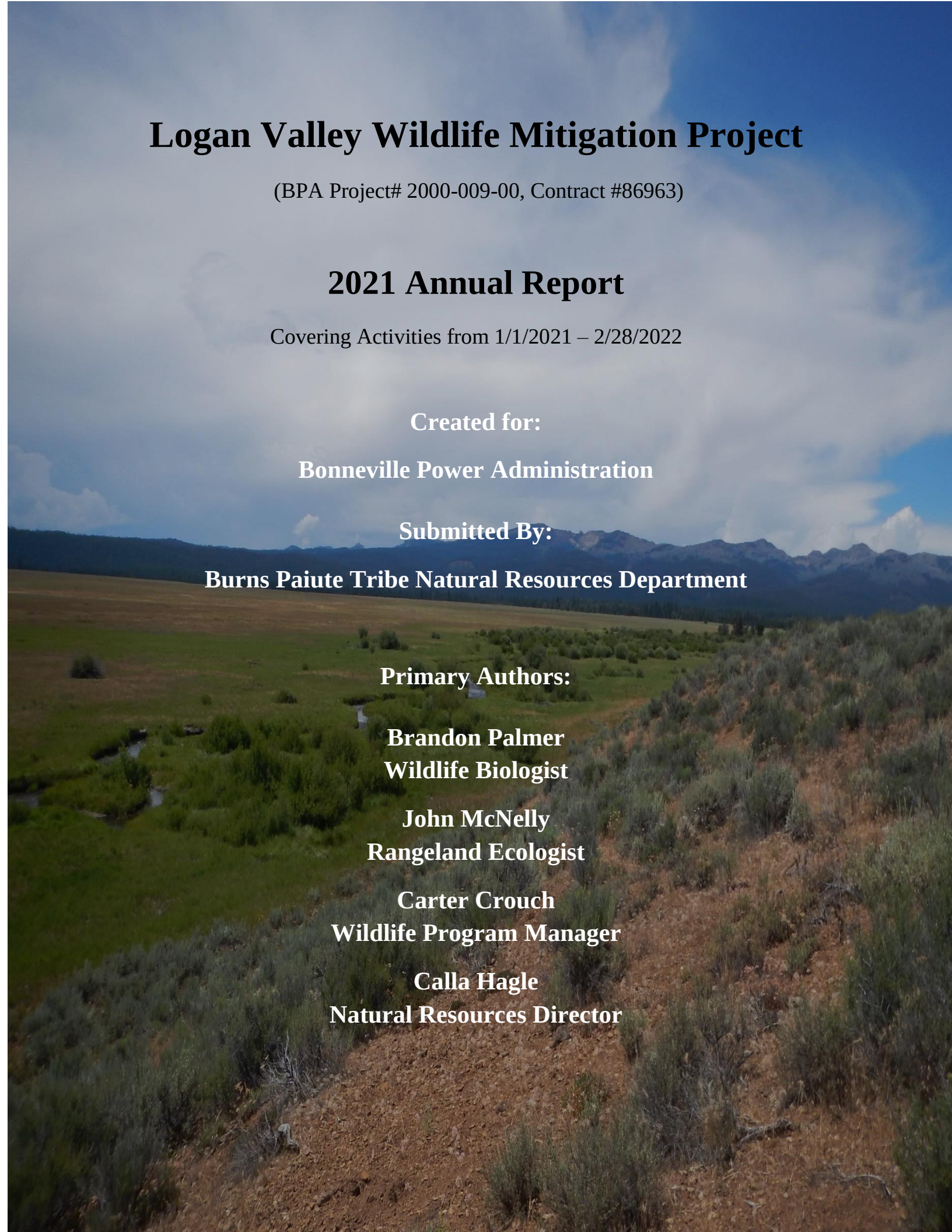


Logan Valley Wildlife Mitigation Project

(BPA Project# 2000-009-00, Contract #86963)

2021 Annual Report

Covering Activities from 1/1/2021 – 2/28/2022

Created for:

Bonneville Power Administration

Submitted By:

Burns Paiute Tribe Natural Resources Department

Primary Authors:

Brandon Palmer
Wildlife Biologist

John McNelly
Rangeland Ecologist

Carter Crouch
Wildlife Program Manager

Calla Hagle
Natural Resources Director

Table of Contents

List of Figures

List of Tables

List of Appendices

Introduction

In 1998, the Burns Paiute Tribe submitted a land acquisition proposal to Bonneville Power Administration (BPA) to acquire the Logan Valley Wildlife Mitigation Site (LVWMS) or Project. In February 2000, the Tribe and BPA entered into a Memorandum of Agreement (MOA) to fund the acquisition and management of LVWMS. The MOA requires the Tribe to dedicate the Project to wildlife habitat protection.

The Logan Valley Wildlife Mitigation Site is located south of the Strawberry Wilderness in Grant County, Oregon. The LVWMS consists of 1,760 deeded acres in which Lake Creek, Big Creek and McCoy Creek combine to form the Malheur River (Figure 1.0.1). Elevation on LVWMS ranges from approximately 4,937–5,111 ft (Google Earth, Google, Inc.).

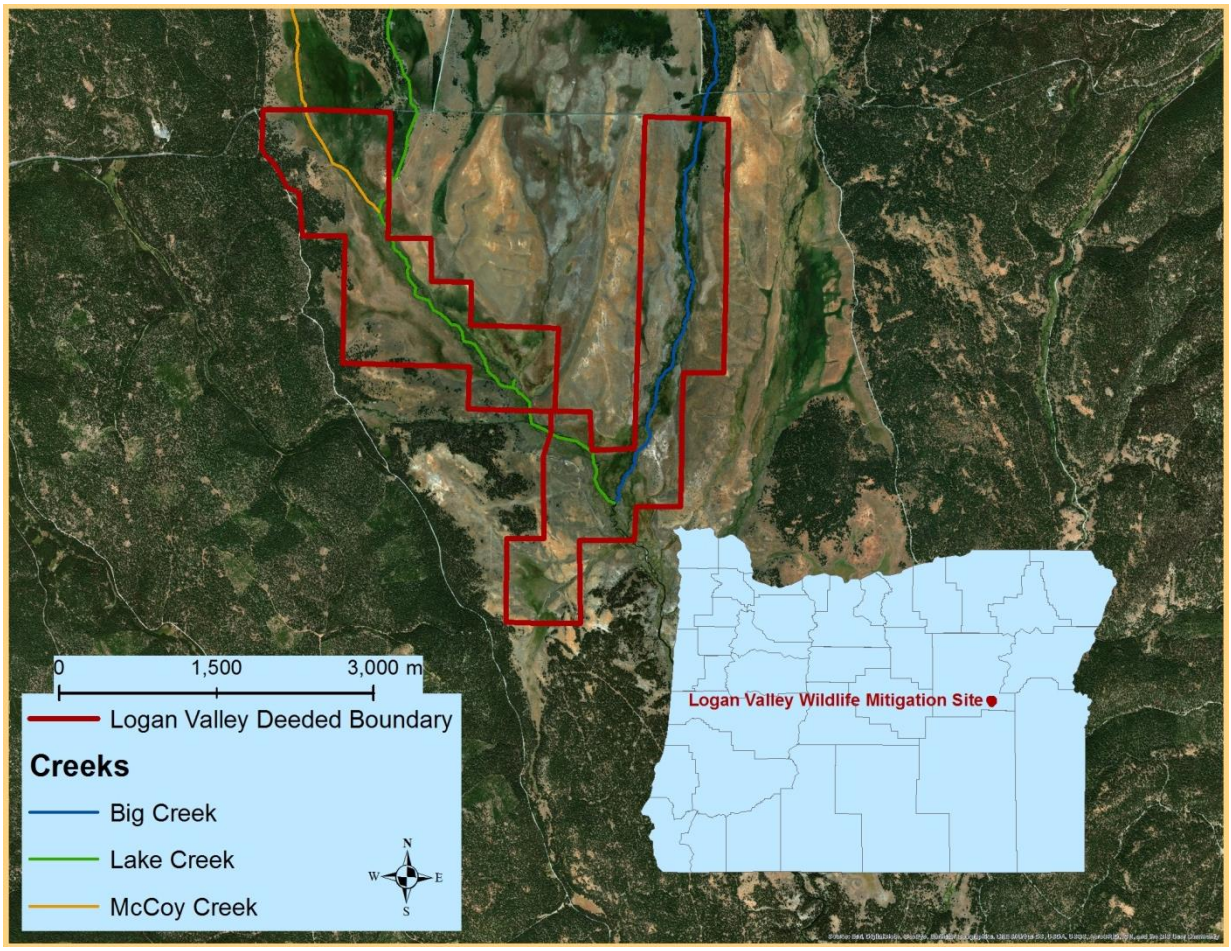


Figure 1.0.1. The location of the Logan Valley Wildlife Mitigation Site.

Wildlife Value

The 1986 Oregon Natural Heritage Program assessed Logan Valley as one of the best examples of mountain meadows in the Blue Mountain Ecoregion. LVWMS's unique assemblage of habitat types includes upland forest, wet meadow, aspen stands, bottomland forest, wetlands and sagebrush steppe. Table 1.1.1 outlines species in the ecoregion designated as sensitive, threatened, endangered, or of special concern by state and federal listings. A number of the species listed are known to occur on Project lands.

Table 1.1.1. Oregon Department of Fish and Wildlife Sensitive Species List for the Blue Mountains ecoregion.

Common Name	**Scientific Name**	**Oregon Department of Fish and Wildlife: Sensitive Species List**
Amphibians and Reptiles		
Columbia Spotted Frog	*Rana luteiventris*	Sensitive-Critical
Rocky Mountain Tailed Frog	*Ascaphus montanus*	Sensitive
Western toad	*Anaxyrus boreas*	Sensitive
Reptiles		
Western Painted Turtle	*Chrysemys picta bellii*	Sensitive-Critical
Birds		
American Three-Toed Woodpecker	*Picoides dorsalis*	Sensitive
Black-Backed Woodpecker	*Picoides arcticus*	Sensitive
Bobolink	*Dolichonyx oryzivorus*	Sensitive
Burrowing Owl (Western)	*Athene cunicularia hypugaea*	Sensitive-Critical
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*	Sensitive-Critical
Ferruginous Hawk	*Buteo regalis*	Sensitive
Flammulated Owl	*Psiloscops flammeolus*	Sensitive
Great Gray Owl	*Strix nebulosa*	Sensitive
Greater Sage-Grouse	*Centrocercus urophasianus*	Sensitive-Critical
Lewis's Woodpecker	*Melanerpes lewis*	Sensitive-Critical
Loggerhead Shrike	*Lanius ludovicianus*	Sensitive
Long-Billed Curlew	*Numenius americanus*	Sensitive
Olive-sided Flycatcher	*Contopus cooperi*	Sensitive
Pileated Woodpecker	*Dryocopus pileatus*	Sensitive
Swainson's Hawk	*Buteo swainsoni*	Sensitive
Trumpeter Swan	*Cygnus buccinator*	Sensitive
Upland Sandpiper	*Bartramia longicauda*	Sensitive-Critical
White-headed Woodpecker	*Picoides albolarvatus*	Sensitive-Critical

*Sensitive or Sensitive-Critical depending on Species Management Unit within the Blue Mountains ecoregion

Table. 1.1.1 continued.

Fish		
Bull Trout	*Siphateles alvordensis*	Sensitive, Sensitive-Critical*
Chinook Salmon - Fall	*Oncorhynchus tshawytscha*	Sensitive
Steelhead-Summer/Columbia Basin Rainbow Trout	*Oncorhynchus mykiss / gairdneri*	Sensitive, Sensitive-Critical*
Western Brook Lamprey	*Lampetra richardsoni*	Sensitive
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	Sensitive-Critical
Mammals		
American Pika	*Ochotona princeps*	Sensitive
California Myotis	*Myotis californicus*	Sensitive
Fringed Myotis	*Myotis thysanodes*	Sensitive
Hoary Bat	*Lasiurus cinereus*	Sensitive
Long-legged Myotis	*Myotis volans*	Sensitive
Pacific Marten	*Martes caurina*	Sensitive
Pallid Bat	*Antrozous pallidus*	Sensitive
Rocky Mountain Bighorn Sheep	*Ovis canadensis canadensis*	Sensitive
Silver-haired Bat	*Lasionycteris noctivagans*	Sensitive
Spotted Bat	*Euderma maculatum*	Sensitive
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Sensitive-Critical

Bird surveys have detected the state and federally listed Lewis' Woodpecker (*Melanerpes lewis*). Two species, state listed as sensitive in other ecoregions, the greater Sandhill Crane (*Antigone Canadensis tabida*) and the Willow Flycatcher (*Empidonax traillii*), have likewise been documented since 2006. Upland Sandpipers (*Bartramia longicauda*) have historically bred on the property; one of only four known areas in Oregon, however, research conducted by the U.S. Forest Service confirmed many reports that there are no longer Upland Sandpiper breeding or using this area. The Bobolink (*Dolichonyx oryzivorus)* was documented on the Project in 2012, and the Black-backed Woodpecker (*Picoides arcticus*) in 2012, 2014, and 2015. The Project also serves as a waterfowl nesting area.

The threatened bull trout (*Salvelinus confluentus*) resides on the Project area and spawns a short distance upstream (Schwabe et al. 2008). The redband trout (*Oncorhynchus mykiss*), designated as sensitive and as a species of concern, inhabits streams on LVWMS (Schwabe et al. 2008). The Columbia spotted frog (*Rana luteiventis*) is common throughout much of the property.

The project area is a known birthing area for pronghorn (*Antilocapra americana*), Rocky Mountain elk (*Cervus elaphus*) and mule deer (*Odocoileus hemionus*). White-tailed deer (*Odocoileus virginianus*) also frequent the property.

Literature Cited

Schwabe, L., D. Brown, R. Perkins, B. Bangs, S. Gunkel, S. Jacobs, and D. Hawkins. 2008. Evaluate the Life History of Native Salmonids in the Malheur Subbasin. FY 2007 Annual Report. Burns Paiute Tribe. Burns, OR. 167p.

Cultural Relationship

The Burns Paiute Tribe (BPT) has significant cultural ties to Logan Valley and the surrounding area. Prior to contact by non-tribal explorers in the mid-nineteenth century, the Northern Paiute people occupied a vast area as far west as the Cascades and as far east as Montana. The tribe ventured as far south as inter-mountain Nevada and as far north as the areas surrounding the Strawberry Mountains. The Wadatika people, the ancestors of the Burns Paiute, utilized this extended area, but maintained a primary traditional use area around the Strawberry Mountains, main stem and tributaries of the Malheur River, Malheur and Harney Lakes, Steens Mountain, and areas in-between. Within this traditional aboriginal area of primary and extended use, numerous areas were of great importance to the tribe. Logan Valley was one such area of importance.

Post-settlement contact, a "Snake Indian" or Paiute tribal reservation was created by Presidential Executive Order. The President signed the Executive Order on September 12, 1872 for the 1.8-million-acre reservation. Central within this described reservation area was Logan Valley, a key area of traditional use.

The Logan Valley area is known through oral histories and traditions as a seasonally utilized area for such activities as hunting of terrestrial and avian species, fishing primarily for salmon, gathering of food, medicinal, and daily use/craft fiber, and other secular and sacred activities (Peck 2008, pers. comm.). Some histories describe pre-settlement contact Logan Valley as a common meeting place between the Paiutes and non-Paiute Indians for trade, gaming, and other activities (Peck 2008, pers. comm.).

The loss of the Logan Valley area at the time the Reservation was removed from Paiute control and use has precluded much of the traditional activities within the valley for decades, although numerous Paiute descendants continued to return to the Logan Valley area (Peck 2008, personal communication). The purchase and continued operation of the Project offers the Tribal members a unique opportunity to resume traditional practices and to utilize the unique resources found within the area.

Literature Cited

Peck, Theresa. 2008. Burns Paiute Tribe Cultural Specialist. Communicated from tribal records.

Habitat Management and Monitoring

Vegetation Management

The Burns Paiute Tribe's Logan Valley Wildlife Mitigation Site (LVWMS) is in a fairly resilient ecological condition, therefore introduced weed species have difficulty becoming established.

Chemical: Herbicide

On August 20, 2021, we conducted a search of noxious weeds for our NRCS Conservation Stewardship Prpgram (CSP) contract (E315A enhancement area). Cheatgrass, bull and Canada thistle were found during the survey. Cheatgrass (*Bromus tectorum*) can outcompete perennial bunchgrasses and litter can build up on the soil surface as plants dry early in the season and pose risks with respect to fire (DiTomaso et al). Bull thistle (*Cirsium vulgare*) competes with native forage as wells as offers no nutritional value for livestock (Mitich, Larry W). Canada thistle (*Cirsium arvense*) is a rhizomatic perennial that is difficult to remove when established. On August 31st, we treated a small patch of cheatgrass (0.005 acre) with a backpack sprayer using Esplanade 200C at a rate of 5 oz/acre. We also treated a combined 0.02 acre of Canada and Bull thistle using Milestone at a rate of 5 oz/acre, this included spraying some Canada thistle in the meadow outside of the E315A enhancement (Figure 2.1.1). In total, .025 acres were treated total in 2021 (Table 2.1.1)

Monitoring for noxious weeds will continue, with emphasis on previously identified weed incursion areas, roads, and property boundaries of LVWMS.

Table 2.1.1. Herbicide type and estimated amount applied within Logan Valley in 2021.

Date	Specific Site	Product by Name	Amount Used (gallons)	Purpose	Acres
8/31/2021	E315A	Esplanade 200C: 5oz	1	Cheatgrass	.005
8/31/2021	E315A	Milestone: 5oz	1	Bull thistle, Canada thistle.	.02

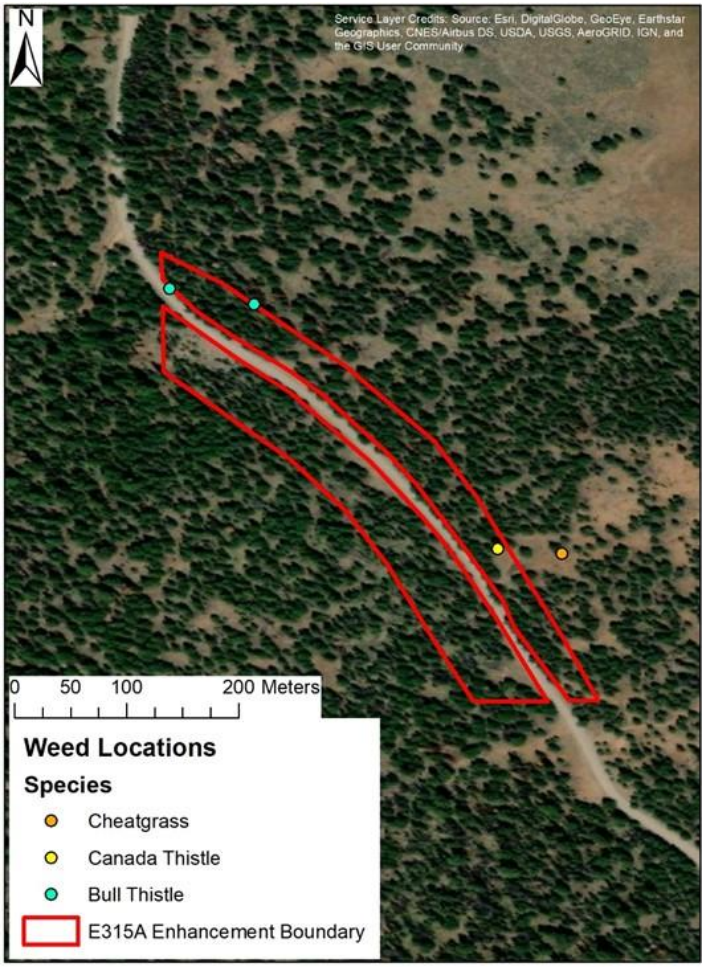


Figure 2.1.1. Locations of weeds found and treated in the E315A Enhancement Area in August 2021. E315A Enhancement Areas is part of the NRCS CSP contract.

Grazing

In 2021 BPT staff worked with a local cattle owner to graze portions of the meadow in order to remove decadent plant material and stimulate new growth of meadow grass and promote forbs. The wet meadow in Logan Valley is extremely productive and the accumulation of decadent plant material constrains new growth.

The cattle owner was required to set up and maintain an electric fence throughout the grazing season preventing cattle from grazing inside of a 180-foot buffer from any riparian area. Four separate pastures were set up with electric fence allowing for shorter duration, higher intensity grazing inside each pasture (Table 2.1.2, Figure 2.1.2). In 2021, 77 cow/calf pairs grazed pastures 2, 3, and 4 (Table 2.1.2). We did not graze pasture 1 in 2021 and do not plan on grazing it for the remainder of the calendar year.

This method of rest-rotation grazing has appeared to work well, resulting in uniform use of the available forage without detriment to available wildlife forage and cover. In 2021, BPT staff continued monitoring rangeland and pasture areas at LVWMS for grazing and habitat management (Table 2.1.3 & 2.1.4, Figure 2.1.3). Photos from fix locations (Appendix A.) and written documentation of monitoring data was collected from two rangeland and two pasture points. This documentation included percent stubble height estimates from pasture points. Pre-grazing data for 2021 was collected on June 8th and post-grazing data was collected on September 8st.

Table 2.1.2. Pasture and grazing rotation schedule in three pastures at LVWMS in 2021.

Start Date	# Cow/calf pairs	Pasture	End Date	AUMS
6/3/2021	75	3	7/5/2021	78
7/6/2021	75	4	8/18/2021	167
8/19/2021	75	2	10/2/2021	108

Table 2.1.3 Rangeland and pasture monitoring post-grazing results in 2021.

Transect Name	Key Spp.	Avg. Stubble Height	Date Collected
PT1	Meadow Foxtail	2” 2.25”	6-30-2021 9-8-2021
PT2	Meadow Foxtail	2” 10”	6-30-2021 9-8-2021
PT3	Meadow Foxtail	.5” 1”	6-30-2021 9-8-2021
PT4	Meadow Foxtail	2.75” 1.75”	6-30-2021 9-8-2021

Table 2.1.4. Rangeland and pasture monitoring land use type and location points.

Transect Name	Land Use Type	UTM X	UTM Y
PT1	Pasture	369202	4890671
PT2	Pasture	368319	4891292
PT3	Pasture	367613	4891652
PT4	Pasture	368039	4890990

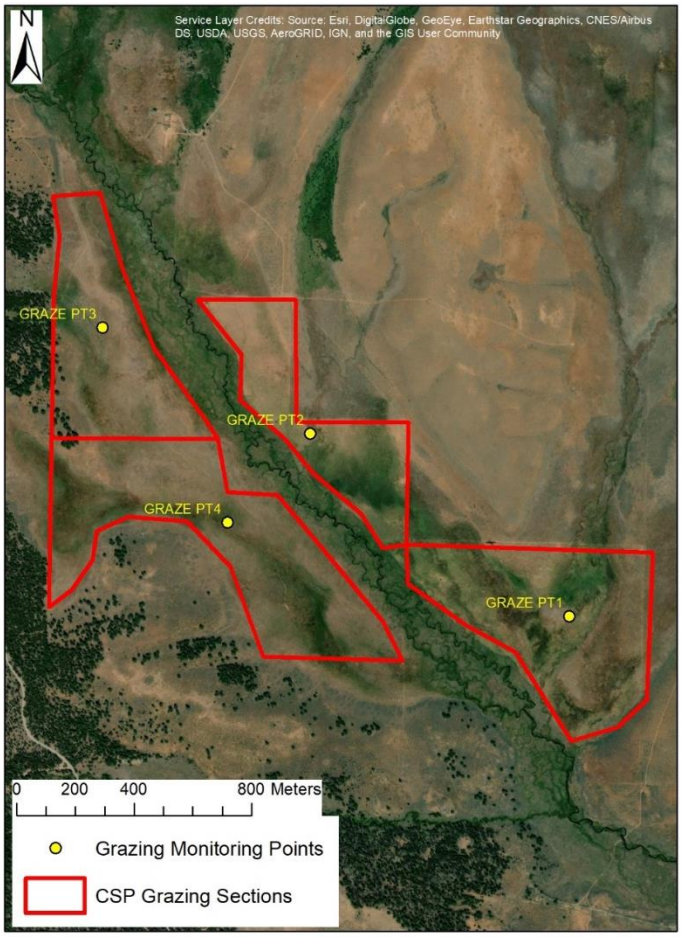


Figure 2.1.2. Vegetation monitoring points within the CREP at LVWMS.

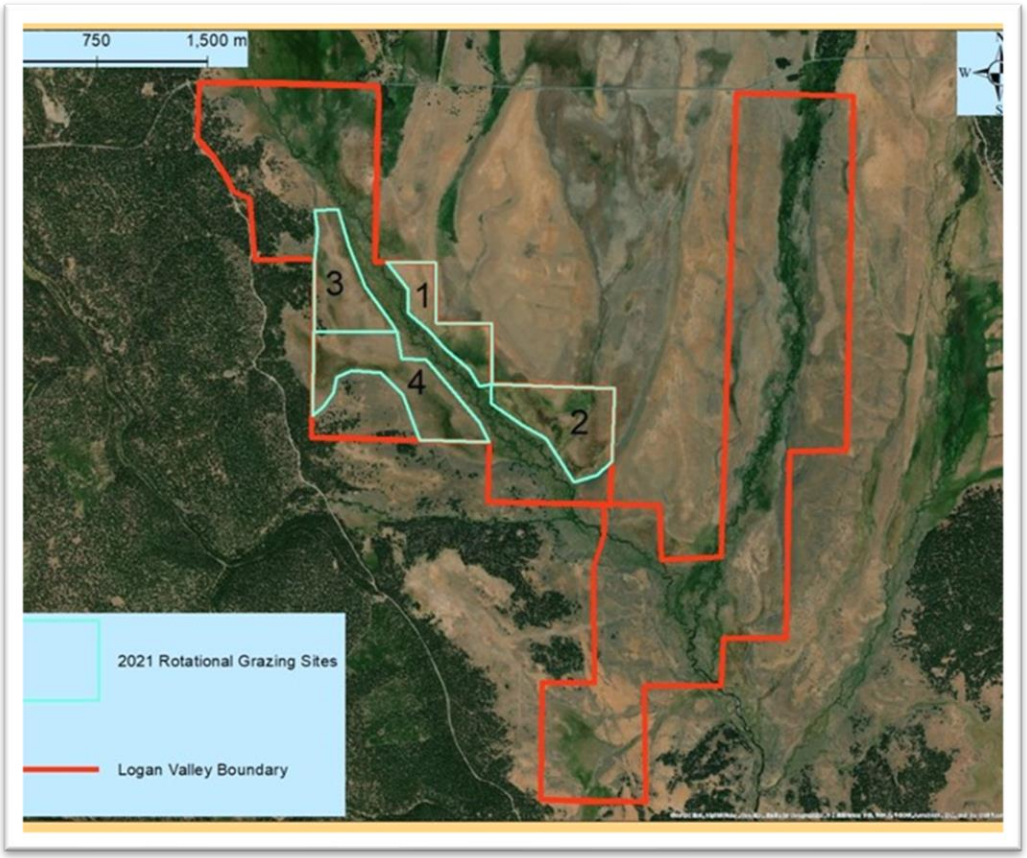


Figure 2.1.3. Rotating grazing pastures within the CREP.

Literature Cited

DiTomaso, J.M., G.B. Kyser et al. 2013. Weed Control in Natural Areas in the Western United States. Weed Research and Information Center, University of California. 544 pp.

NRCS. 1996. Sampling Vegetation Attributes: Interagency Technical Reference. U.S. Department of Agriculture Technical Reference 1734-4. 171 pp.

Irrigation

Irrigation ditches were manually maintained in June of 2020 (Figure 2.2.1). The Big creek ditch located north of Forest Service Road 16 was cleared of all downed and impeding material before irrigation commenced. Lake creek irrigation started in June and was turned off in the Fall. Big Creek irrigation started in June and was continued until Fall to allow for cattle to water in the neighboring Forest Service grazing allotment.

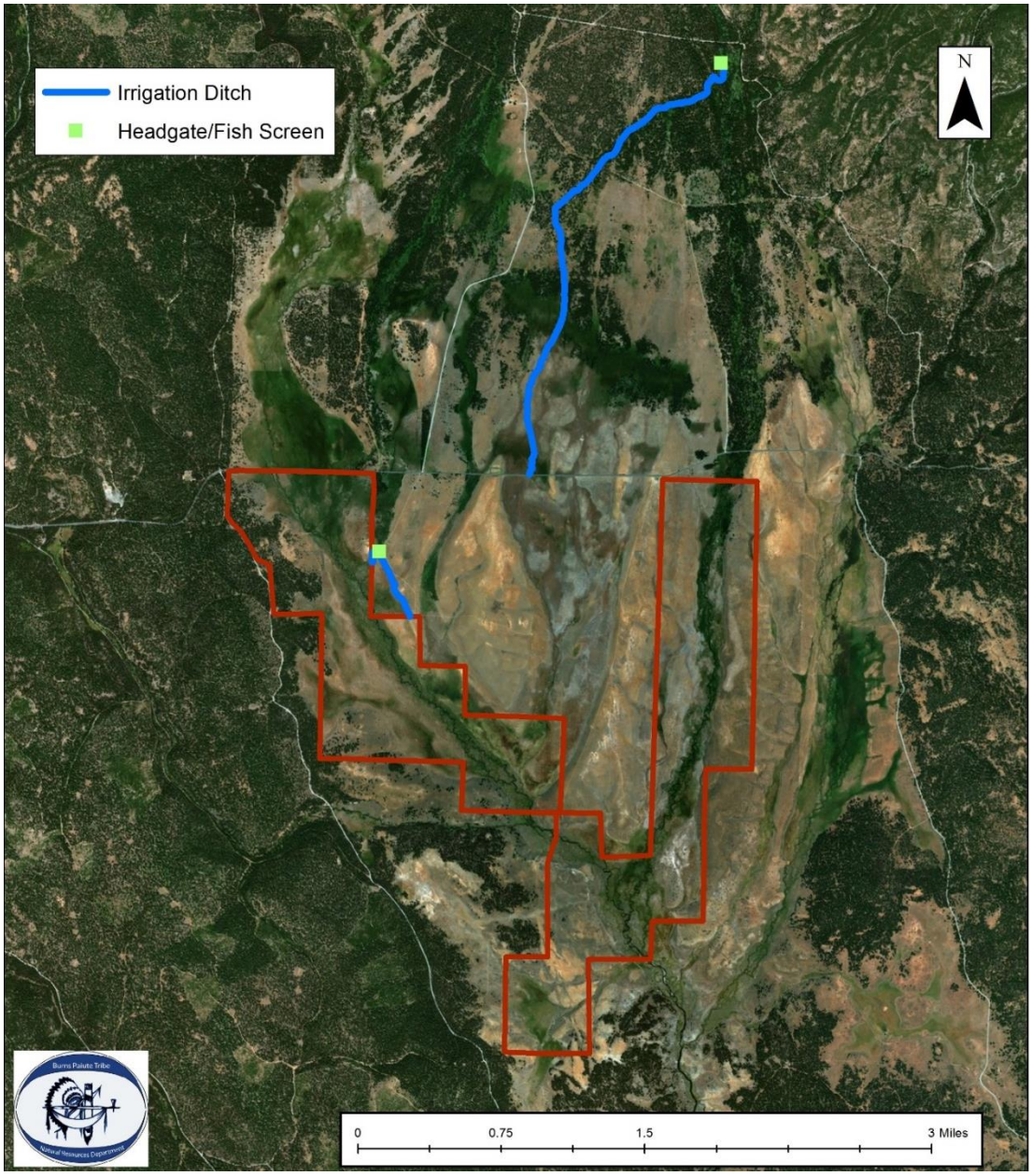


Figure 2.2.1. Location of irrigation ditches maintained at LVWMS in 2020.

Willow Monitoring

In 2021, we monitored willows using the methodology established in 2018, allowing us to collect data while taking streamside photos and adding to the 2021 data (Table 2.3.1). We count every willow 5 m from the water 25 m upstream and 25 m downstream. We count willow bunches as one willow and split the willows into live and dead and into 3 height classes for living willows (0–3 ft, 3–6 ft, and 6+ ft). This methodology likely undercounts dead willows from willow plantings as they are less visible than successful plantings, and we also count live willows whether they were planted by us or already there before plantings (all the willows >3ft were likely there prior to plantings. While this methodology is not perfect, it is a good starting point for monitoring willows in the coming years. In 2021, we counted 89 living willows in the 0–3 ft range, 60 in the 3–6 ft range, 6 over 6+ ft range. We also counted 2 dead willows.

Table 2.3.1. Willow monitoring data from the north population at LVWMS in 2021.

		Live									Dead		
		0–3 ft			3–6 ft			6+ ft					
Date	Point	Up	Down	**TOTAL**	Up	Down	**TOTAL**	Up	down	**TOTAL**	Up	Down	**TOTAL**
8/5/2021	LC2	17	7	24	1	10	11	0	0	0	0	0	0
8/5/2021	LC6	9	0	9	2	4	6	0	0	0	0	0	0
8/5/2021	LC4	3	7	10	0	7	7	2	4	6	0	0	0
8/5/2021	LC5	2	6	8	0	0	0	0	0	0	0	1	1
8/5/2021	LC3	8	4	12	3	4	7	0	0	0	0	0	0
8/5/2021	McC1	7	7	14	3	4	7	0	0	0	0	1	1
8/5/2021	MR1	2	10	12	16	8	22	0	0	0	0	0	0
TOTAL				89			60			6			2
Percent Survival		99.35%											

Oregon Semaphore Grass

Oregon semaphore grass (Pleuropogon oregonus; PLOR) is a rare grass species endemic to eastern Oregon (Chase 1938) and is considered the rarest species of grass in Oregon and one of the rarest in the United States. PLOR is a Threatened species in the state of Oregon and is a Federal Species of Concern. PLOR has a Heritage Rank of G1/S1. There are two known naturally occurring population complexes of PLOR, located in Lake and Union Counties, separated by approximately 230 miles (370 km).

Efforts to propagate and reintroduce PLOR have been conducted since the early 2000's by the Oregon Department of Agriculture (ODA). Many of these plantings have been unsuccessful,

with plantings at Logan Valley proving to be an exception. PLOR has been planted on tribally owned land at Logan Valley in Grant County since 2002. Due to the success of the early plantings, ODA plantings continued until 2017. Many of the ODA are still expanding with an estimated 9,393 tillers on the property in 2018. In 2018, the BPT Natural Resources Department obtained the permits to take over propagating PLOR for Logan Valley. In October 2019, BPT staff and volunteers from Portland Audubon planted 19 new plots on the property. Following this first year of propagation and planting, the BPT Wildlife Program submitted a U.S. Fish and Wildlife Service Tribal Wildlife Grant Program and secured this grant in 2020. The $199,532 grant provides funds for continued propagation and planting to expand the Logan Valley population. This grant will also fund coordinating with staff from the Agricultural Research Service (ARS) out of the Eastern Oregon Agricultural Research Center (EOARC) to study the environmental factors affecting successful establishment of Oregon semaphore. We will collect both field data and conduct controlled greenhouse studies to help understand the effects of water and light availability on establishment, among other things. In addition to this study, we will collect genetic samples at natural and introduced populations to better understand the genetics of PLOR.

Monitoring

In 2021, BPT visited the ODA PLOR established plots. Due to the large size of these established plots, BPT did not count the number of reproductive culms and vegetative culms as ODA has in past years. However, like 2020, BPT staff did visit all these plots to determine presence absence (Table 2.4.1). We checked these plots in mid-June in 2021, and we were able to both locate more of the plots and find PLOR tillers at more plots than in 2020. The shorter vegetation earlier in the growing season made searching for PVC corners and PLOR tillers easier, and we should continue to check the ODA plots before the vegetation has gotten too thick in future years, likely in early to mid-June. These sites likely do not need to be checked every year but should be checked every few years.

Table 2.4.1. ODA plots checked by Carter Crouch and Brandon Palmer on August 8th, 2020, and June 16th, 2021. Some plots lumped due to their proximity and the difficulty in differentiating them. Plots and PLOR were easier to find earlier in the year before extensive vegetative growth.

		August 8, 2020		June 16, 2021	
Plot Type	Planting Area	Plot Found	PLOR Present	Plot Found	PLOR Present
ODA	42	No	No	Yes	No
ODA	50	Yes	No	Yes	Yes
ODA	51	Yes	No	Yes	No
ODA	275	Yes	No	No	No
ODA	274	Yes	No	Yes	No
ODA	278	No	No	No	No
ODA	170	No	No	Yes	No

ODA	276	No	No	No	No
ODA	277	No	No	No	No
ODA	47	Yes	Yes	Yes	Yes
ODA	48	Yes	Yes	Yes	Yes
ODA	11	Yes	Yes	Yes	Yes
ODA	12,13	Yes	Yes	Yes	Yes
ODA	14, 15, 16	Yes	Yes	Yes	Yes
ODA	43	Yes	Yes	Yes	Yes
ODA	18	Yes	Yes	Yes	Yes
ODA	20	Yes	Yes	Yes	Yes
ODA	53	No	No	Yes	Yes
ODA	54	Yes	Yes	Yes	Yes
ODA	40, 44, 49	Yes	Yes	Yes	Yes
ODA	45	Yes	Yes	Yes	Yes
ODA	52	Yes	No	Yes	Yes
ODA	46	Yes	No	Yes	No
ODA	41	Yes	No	Yes	Yes
ODA	5-10	Yes	Yes	Yes	Yes
ODA	1-5	Yes	Yes	Yes	Yes
ODA	31	Yes	Yes	Yes	No
ODA	32	Yes	No	Yes	No
ODA	33	Yes	No	Yes	No
ODA	34	Yes	No	Yes	No
ODA	35	Yes	No	Yes	No
Totals		**25/31**	**14/31**	**27/31**	**17/31**

In addition to monitoring the ODA plots in 2020, we monitored the BPT plots planted in 2019 and 2020. We visited the sites on June 16 and July 15, 2021 and counted all the tillers each time. Counting tillers twice allows us to collect some additional phenology data. We present the high tiller count regardless of the month (Table 2.4.2. Eleven of the 19 (57.9%) plots that we planted in 2019 still had tillers in 2021, and 22 of the 28 (78.6%) of the plots we planted in 2020 still had tillers in 2021. It is worth noting that all the plots that were successful had many fewer tillers than were planted there (Figure 2.4.1 and Figure 2.4.2). In 2019, we planted a total of 5,784 tillers that year, and the following growing season we only counted 395 tillers remaining. Two growing seasons after the 2019 planting, 209 tillers remained. For the 2020, planting we planted a total of 4,931 tillers, and the following growing season we counted 479 tillers. We will continue to monitor these plots in the coming years to document their tiller trends and plot expansion, contraction, or disappearance.

Table 2.4.2. Monitoring data for the BPT Oregon semaphore plots planted in 2019 and 2020.

BPT Planting Area	Tillers Planted	2021 monitoring (June and July)		
		Year Planted	Maximum Total Tillers	Years since planting
1A	333	2019	17	2
1B	354	2019	33	2
2	152	2019	21	2
3	456	2019	0	2
4	264	2019	28	2
5	220	2019	1	2
6	239	2019	0	2
7	375	2019	0	2
8A	249	2019	0	2
8B	278	2019	0	2
8C	215	2019	15	2
9A	243	2019	11	2
9B	282	2019	0	2
10	432	2019	28	2
11	281	2019	0	2
12	296	2019	0	2
13A	350	2019	39	2
13B	272	2019	12	2
13C	493	2019	4	2
1C	162	2020	16	1
1D	181	2020	14	1
14A	163	2020	0	1
14B	264	2020	8	1
14C	186	2020	2	1
15A	161	2020	0	1
15B	154	2020	0	1
15C	161	2020	2	1
16A	114	2020	23	1
16B	153	2020	3	1
16C	196	2020	1	1
17A	150	2020	0	1
17B	157	2020	0	1
17C	153	2020	0	1
17D	160	2020	15	1
18A	164	2020	26	1
18B	175	2020	18	1
18C	169	2020	8	1
19A	150	2020	34	1

19B	160	2020	35	1
19C	151	2020	33	1
20A	176	2020	33	1
20B	197	2020	21	1
20C	199	2020	30	1
21A	202	2020	1	1
21B	263	2020	62	1
21C	208	2020	54	1
21D	202	2020	40	1

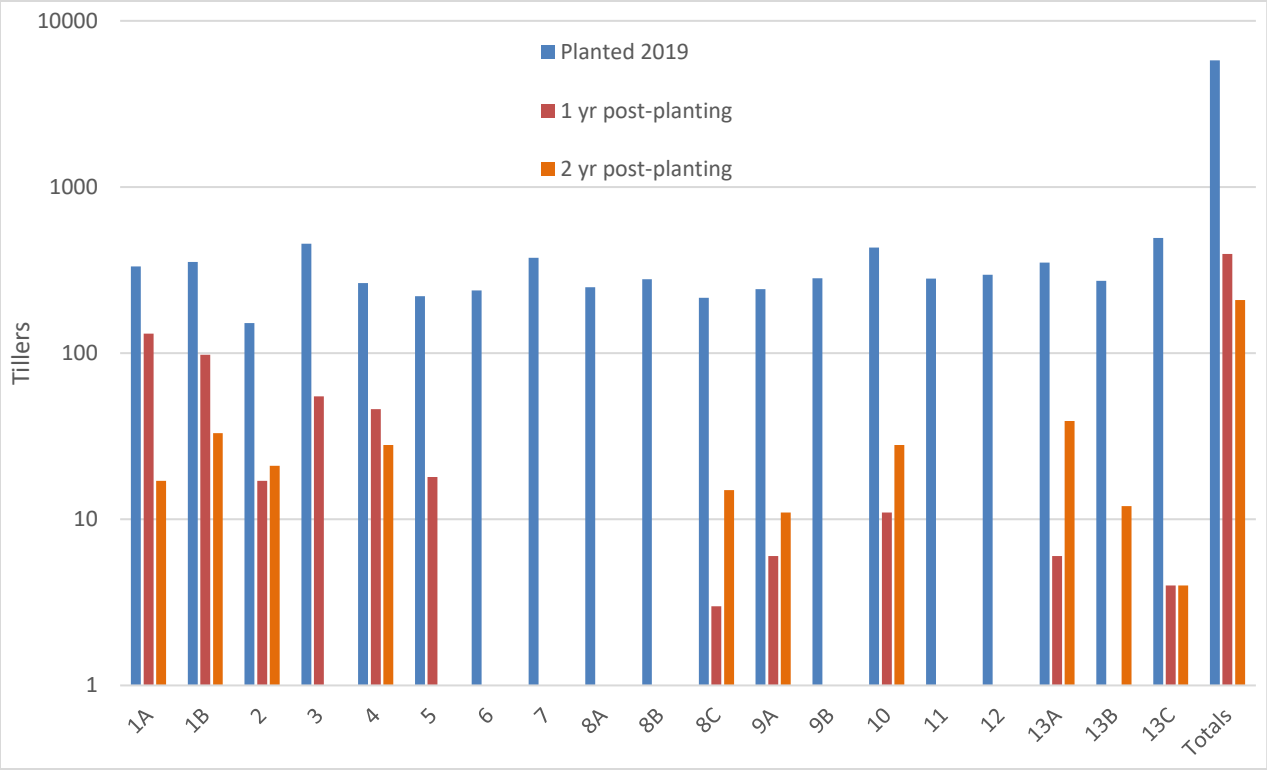


Figure 2.4.1. Oregon semaphore tillers in the 2019 plantings, including how many were planted and how many were counted in the first (July 2020) and second (June and July 2021) growing season following planting. Note the Y axis is on the logarithmic scale.

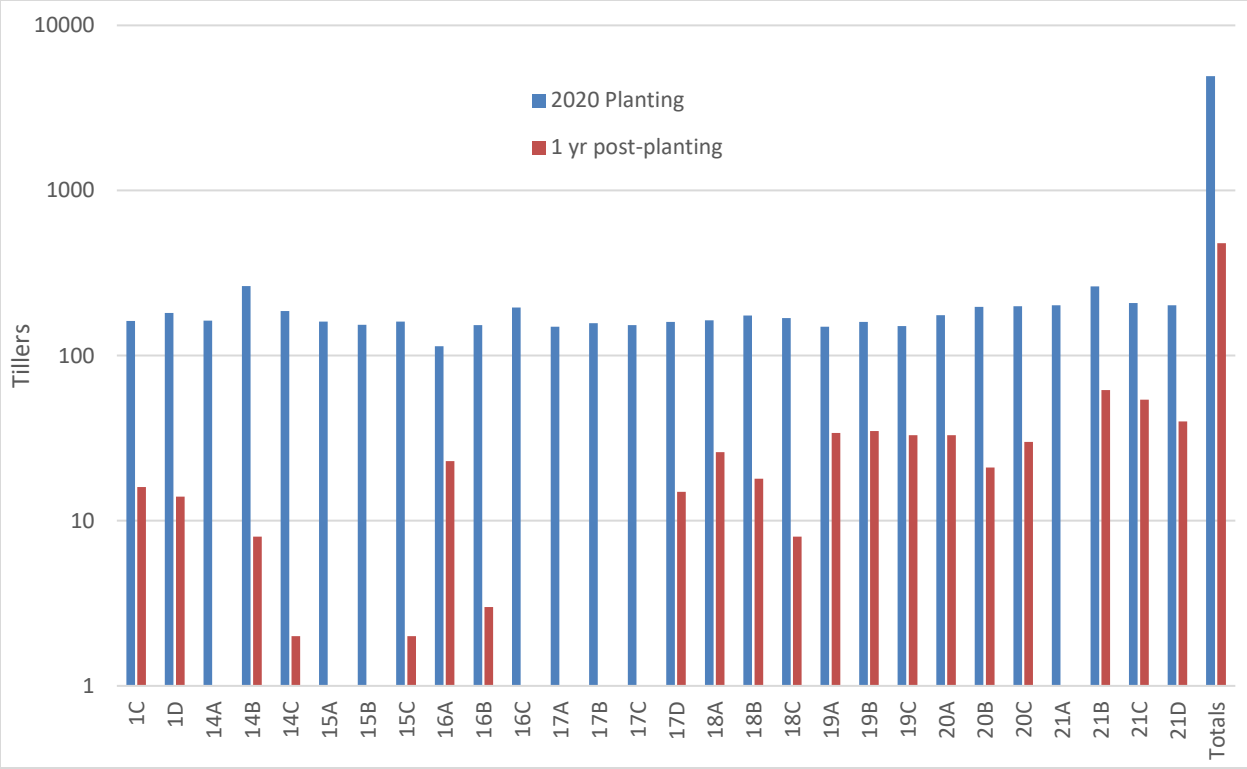


Figure 2.4.2. Oregon semaphore tillers in the 2020 plantings, including how many were planted and how many were counted in the first growing season following planting (June and July 2021). Note the Y axis is on the logarithmic scale.

Soil moisture, leaf area index, and air temperature data

In 2021, we continued collecting data with two researchers from the ARS. We collected soil moisture data both with automatic loggers and with handheld sensors (TDR 150 Soil Moisture Meter, Spectrum Technologies, Inc) with a 4.8 in (12.91 cm) rod. For the handheld soil moisture readings, we take three readings spread out within the plot. If one of our numbers appears to be an outlier, we take a fourth reading. We take the average of the three readings excluding the outlier as the soil moisture percentage for that plot for that month. We collected water depth instead of handheld soil moisture data in the months when plots were underwater. We collected leaf area index data to compare light availability between sites and between dates. These data will help us document environmental factors that affect establishment of PLOR.

In 2021, we collected handheld soil data and water depth at all plots mid-month in May−October. The highest depth observed at a plot was 37.5 cm at BPT 15C in May. We found highly variable soil moisture percentages at successful plantings. For example, in June we observed soil moisture percentages as high as 73.4% and as low as 9.63% at plots still containing PLOR (Figure 2.4.3). In August we observed soil moisture percentages as high as 49.3% and as low as 5.3% at plots still containing PLOR.

In addition, we downloaded data from two air temperature loggers (HOBO MX TidbiT 5000, ONSET®) with radiation shields installed in the north meadow and farther south on the property, both near PLOR plots. We logged temperature data hourly starting October 23, 2020. We downloaded the air temperature data throughout the year, with the last download on October 21, 2021. The loggers are continuing to collect air temperature data through the winter. The lowest temperatures observed since deployment in the two locations was on December 29, 2020. The north location got down to -18.2 ° F (-27.9° C) at 7:25 am, and the south location got down to -22.4 ° F (-30.2 ° C) at 5:03 am. The highest temperatures observed since deployment was on August 15, 2021. The north location got up to 94.6 ° F (34.8° C) at 3:42 pm, and the south location got up to 95.0° F (35.0° C) at 3:29 pm. We also include the high temperatures observed at the south location each day during most of the growing season in Figure 2.4.4.

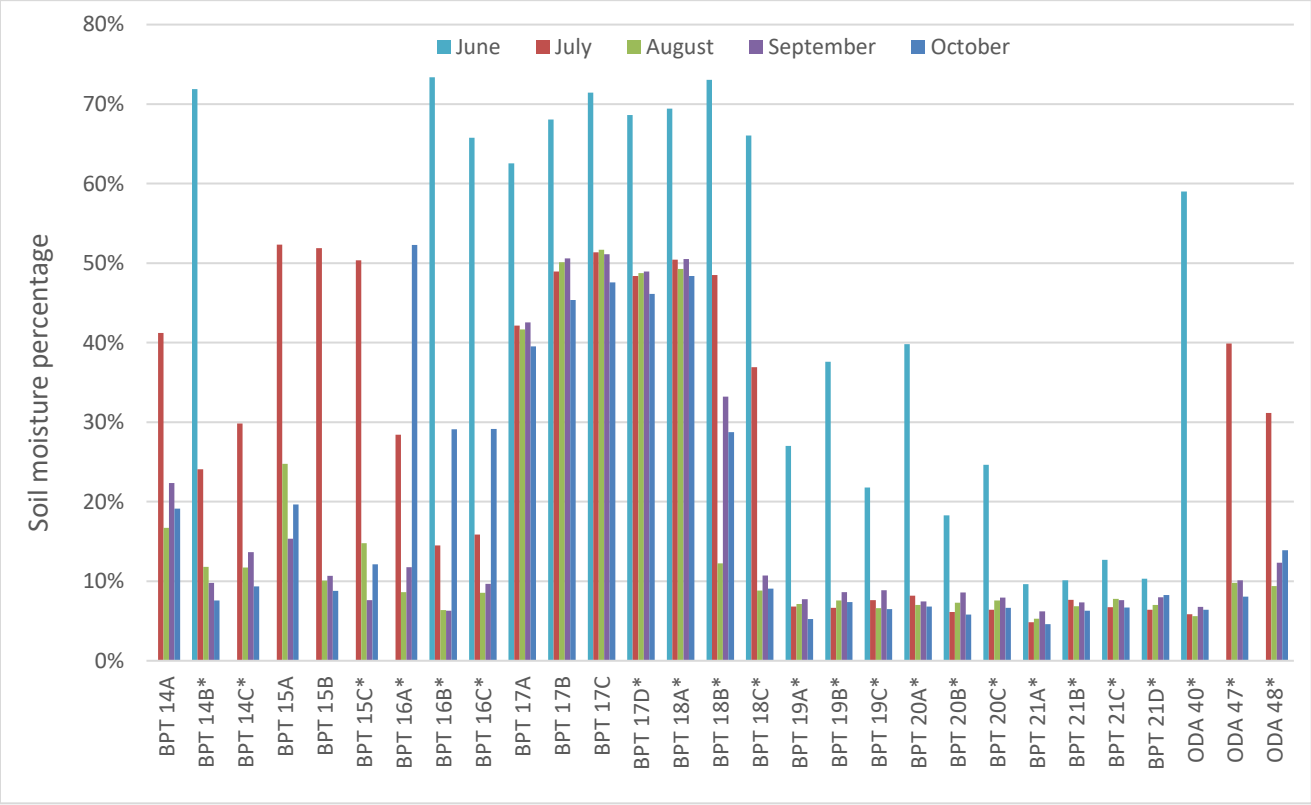


Figure 2.4.3. Soil moisture percentage from June–October 2021 for plots planted in October 2020 and 3 established ODA plots. Not all the plots have data in June, as these plots were still underwater in mid-June.

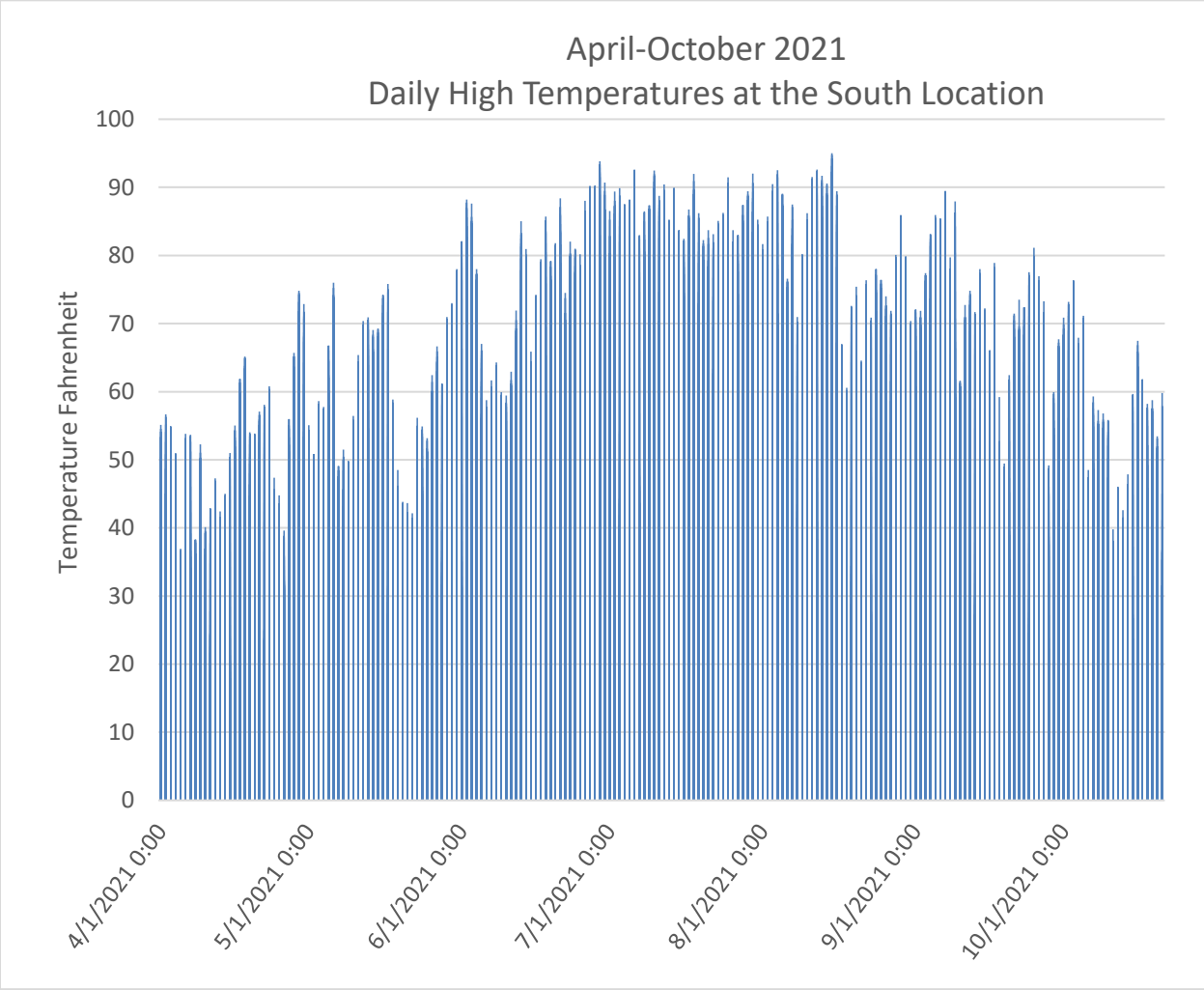


Figure 2.4.4. Daily high temperatures observed at the south location from April 1–October 21, 2021.

Propagation and planting

In 2018, BPT staff obtained an Oregon Department of Agriculture (ODA) permit to collect Oregon semaphore vegetative culms and seed for propagation and re-planting on the LVWMS property. This will give us the ability to transplant Oregon semaphore to new areas on LVWMS, and if transplants are successful expand the population. We updated this permit at the end of 2020 to cover our work with PLOR from 2021–2024. The permit covers collection for genetic sampling, collection at LVWMS for propagation, and for controlled drought experiments. We track all plants and seed collected and report to ODA (Table 2.4.3).

Table 2.4.3. Oregon semaphore stock (vegetative and seed) collected for propagation since acquiring the ODA permit in 2018.

Collection Date	Patch Plant Type	# of Plants Collected	% of Plants Collected From in Patch	ODA Patch #	# of Caryopsis
9/10/2018	Reproductive	12	9.6%	48	122
9/10/2018	Reproductive	3	12.0%	18	12
9/10/2018	Reproductive	2.5	13.2%	16	24
9/10/2018	Reproductive	4	10.0%	44	61
10/10/2018	Vegetative	331	< 10%*	48	NA
10/18/2018	Reproductive	4	10.0%	44	14
June-July 2019	Reproductive	81	N/A	48**	1024
10/28/2019	Vegetative	291	> 10%*	18	N/A
June-July 2020	Reproductive	54	N/A	18**	11
11/4/2020	Vegetative	183	<10%	47	N/A
6/10/2021	Reproductive	102	N/A	47**	74
6/10/2021	Reproductive	31	N/A	18**	1
8/17/2021	Reproductive	25	<10%	47	149
10/21/2021	Vegetative	197	<10%*	48	N/A

* hard to get accurate count due to accidental grazing or plot size

**Collected reproductive tillers from greenhouse and outside trough plants

PLOR can increase in numbers quickly under favorable conditions though its clonal rhizome spreading. Like the two previous years, we produced many more tillers than we collected/saved at the end of the previous year. In 2021, we grew 2,569 tillers from the 183 tillers collected at the end of 2020. We also grew 842 tillers from the 331 tillers that we held onto from greenhouse stock in 2020 (Figure 2.4.5). The vegetative tillers held from 2020 were not split up into as small of clumps as normal nor were they planted as deep, and these differences appeared to affect their growth. They also had a large aphid infestation relative to the two other vegetative tubs, which may have affected growth. We used large tubs in the greenhouse near our office in Burns, OR to propagate PLOR.

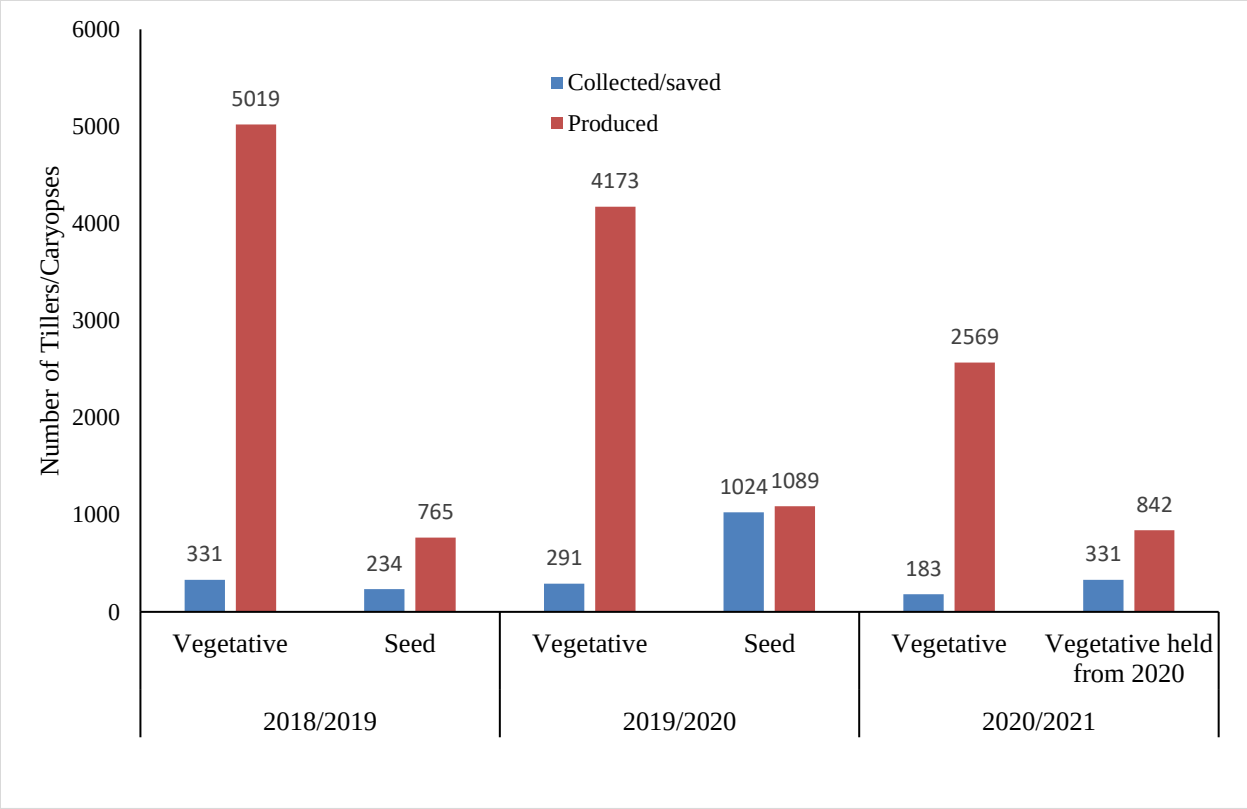


Figure 2.4.5. Collection and propagation information from 2018–2021. One year of propagation is extremely successful at increasing the number of tillers available for planting. *Note the number of seed collected/saved has been corrected from the 2020 report.*

Planting

On October 21, 2021, we took a group of 8 Portland Audubon volunteers, 3 BPT staff members, 1 ARS partner, and 1 USFWS archaeologist to plant tillers in new plots (Figure 2.4.6). We planted 24 new plots, building on the 19 new plots established in 2019, and the 28 new plots established in 2020. (Table 2.4.4, Figure 2.4.7). We ran low on tillers and planted fewer numbers of tillers in a couple of the plots and planted fewer plots than we had planned.

Figure 2.4.6. Volunteers organized by Portland Audubon, ARS staff, BPT staff, and a USFWS archaeologist planted PLOR tillers on October 21st, 2021.

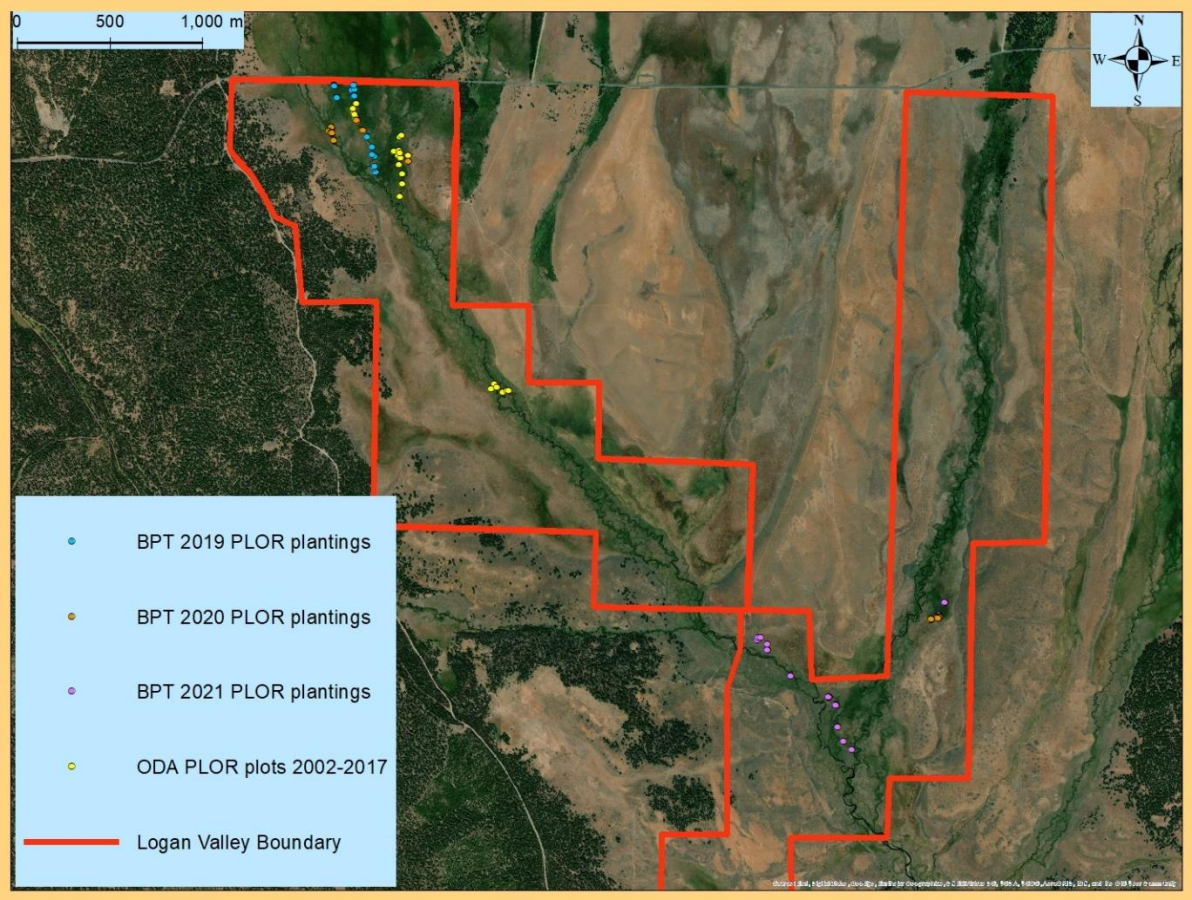


Figure 2.4.7. Oregon semaphore locations at LVWMS, including previously established ODA plots and newly established BPT plots planted by BPT and Portland Audubon.

Table 2.4.4. Data on Oregon semaphore plots planted by BPT and Portland Audubon on October 28th, 2019, October 23rd, 2020, and October 21st, 2021. All plots in 2020 and 2021 were 0.5 x 0.5 m, and we will continue with this size in future years for consistency.

Planting Year	BPT Patch #	Patch Size	# of Tillers	ODA Patch Plant Number Source	Grown from seed or veg?
2019	1A	2x2 ft	333	48	veg
2019	1B	2x2 ft	354	48	veg
2019	2	2x2 ft	152	48	veg
2019	3	2x2 ft	456	48	Veg
2019	4	2x2 ft	264	48	Veg
2019	5	2x2 ft	220	48	veg
2019	6	2x4 ft	239	48	veg

2019	7	2x2 ft	375	48	veg
2019	8A	2x2 ft	249	48	veg
2019	8B	2x2 ft	278	48	veg
2019	8C	2x2 ft	215	48	veg
2019	9A	2x2 ft	243	48	veg
2019	9B	2x2 ft	282	48	veg
2019	10	2x4 ft	432	48	veg
2019	11	2x2 ft	281	48	veg
2019	12	2x3 ft	296	48	veg
2019	13A	2x4 ft	350	48	veg
2019	13B	2x4 ft	272	44	Seed
2019	13C	2x4 ft	493	48, 18, 16	Seed
2020	1C	0.5 x 0.5 m	162	18	veg
2020	1D	0.5 x 0.5 m	181	18	veg
2020	14A	0.5 x 0.5 m	163	18	veg
2020	14B	0.5 x 0.5 m	264	48	seed
2020	14C	0.5 x 0.5 m	186	18	Veg
2020	15A	0.5 x 0.5 m	161	48	seed
2020	15B	0.5 x 0.5 m	154	48	seed
2020	15C	0.5 x 0.5 m	161	48	seed
2020	16A	0.5 x 0.5 m	114	18	veg
2020	16B	0.5 x 0.5 m	153	48	seed
2020	16C	0.5 x 0.5 m	196	48	seed
2020	17A	0.5 x 0.5 m	150	18	veg
2020	17B	0.5 x 0.5 m	157	18	veg
2020	17C	0.5 x 0.5 m	153	18	veg
2020	17D	0.5 x 0.5 m	160	18	veg
2020	18A	0.5 x 0.5 m	164	18	veg
2020	18B	0.5 x 0.5 m	175	18	veg
2020	18C	0.5 x 0.5 m	169	18	veg
2020	19A	0.5 x 0.5 m	150	18	veg
2020	19B	0.5 x 0.5 m	160	18	veg
2020	19C	0.5 x 0.5 m	151	18	veg
2020	20A	0.5 x 0.5 m	176	18	veg
2020	20B	0.5 x 0.5 m	197	18	veg
2020	20C	0.5 x 0.5 m	199	18	veg
2020	21A	0.5 x 0.5 m	202	18	veg
2020	21B	0.5 x 0.5 m	263	18	veg

2020	21C	0.5 x 0.5 m	208	18	veg
2020	21D	0.5 x 0.5 m	202	18	veg
2021	22	0.5 X 0.5 m	56	47	veg
2021	23	0.5 X 0.5 m	50	47	veg
2021	24	0.5 X 0.5 m	44	47	veg
2021	25A	0.5 X 0.5 m	113	47	veg
2021	25B	0.5 X 0.5 m	122	47	veg
2021	26A	0.5 X 0.5 m	151	18	veg
2021	26B	0.5 X 0.5 m	157	18	veg
2021	26C	0.5 X 0.5 m	150	47	veg
2021	27A	0.5 X 0.5 m	153	47	veg
2021	27B	0.5 X 0.5 m	162	47	veg
2021	27C	0.5 X 0.5 m	163	47	veg
2021	27D	0.5 X 0.5 m	127	47	veg
2021	28A	0.5 X 0.5 m	151	47	veg
2021	28B	0.5 X 0.5 m	153	47	veg
2021	28C	0.5 X 0.5 m	152	47	veg
2021	28D	0.5 X 0.5 m	170	47	veg
2021	29A	0.5 X 0.5 m	153	47	veg
2021	30	0.5 X 0.5 m	150	47	veg
2021	31A	0.5 X 0.5 m	155	47	veg
2021	32	0.5 X 0.5 m	128	47	veg
2021	33	0.5 X 0.5 m	149	47	veg
2021	34	0.5 X 0.5 m	156	18	veg
2021	35	0.5 X 0.5 m	159	18	veg
2021	36A	0.5 X 0.5 m	219	18	veg

Genetics work

As part of our USFWS Tribal Wildlife Grant, we collected genetics samples both from natural populations and introduced populations. We visited natural populations in both Lake and Union County, OR and collected 2-3 leaves from every plant we collected from and collected fresh green leaves. We found the natural population locations from Oregon Biodiversity Information Center (2021, ORBIC) data. Since the majority of known sites are on private property, obtaining access is challenging. We attempted to reach out to all landowners whose properties overlapped the ORBIC shapefiles to obtain access. We obtained access to 3 of the 5 known historical locations in Lake County (Forest Service and Private) and 1 of the 4 known locations in Union County (Oregon Department of Transportation). In total we collected from 26 plants from one natural population in Union County, 45 plants from 3 natural populations in Lake County, 21 plants from the introduced Malheur Nation Forest plots in Logan Valley, and

28 plants from the introduced Burns Paiute Tribe LVWMS plots (Figure 2.4.8). We also received mailed samples from 8 plants from the introduced Fremont Winema National Forest plots. We are working with a USGS Genetics for Western Restoration and Conservation group researcher, who is currently processing our 57 samples from introduced populations and 71 samples from natural populations. This work will allow us to understand the genetic variability between and among populations of this rare grass.

Figure 2.4.8. Oregon semaphore natural locations in Lake County and Union County. BPT staff visited 4 of the 9 known natural locations with Oregon semaphore grass and collected genetics samples.

Discussion

We have seen great success with propagation and planting so far. Finding PLOR growing in the majority of the plots planted in 2019 and 2020 is very promising. It is particularly exciting that we have expanded plantings into new areas on the LVWMS. Considering the rarity of this species, these additional plots are important for buffering the species risk from stochastic events. We will continue to monitor them to see if they grow or persist.

We are collecting a great deal of data to better understand environmental factors affecting PLOR establishment. These results should be useful for us for future plantings, but also useful to other parties interested in PLOR work. The variability in soil moisture at successful plantings (in the short term) is interesting, but we will continue to monitor these plots to see if long term establishment is affected more by moisture than short term success. We will also look at interaction effects of soil moisture and light intensity on PLOR establishment.

Our genetics work will be very important to understanding this species, allowing us to investigate patterns of genetic diversity, differentiation, inbreeding in the natural populations, and characterize the genetic patterns at reintroduction sites, including on the LVWMS. The results from this research will also help determine if the two populations should be kept separate in plantings for genetic health.

Acknowledgments

This project was funded by the United States Fish and Wildlife Service Tribal Wildlife Grant OR 21AP00710: A Study of the Propagation and Expansion of the Rarest Grass in Oregon. All work was done under Oregon Department of Agriculture permit OAR 603-073-0100. We thank Erin Rentz and the Fremont-Winema National Forest for collecting and providing genetics samples. We thank private landowners, Jeanette Wilson and the Fremont National Forest, Christian Jilek and the Oregon Department of Transportation for granting access to collect samples, and we thank John Owens, Kail Antonio and the Bureau of Land Management for assisting with landowner outreach and collections. Mike Burton and the National Resources Conservation Service and Jason Jaeger and the Lake County Cooperative Weed Management Area assisted in landowner outreach.

Literature Cited

Chase, A. 1938. New grasses from Oregon. Journal of the Washington Academy of Sciences 28:52-53.

Oregon Biodiversity Information Center. March 2021. Biotics Rare Species Database. Institute for Natural Resources – Portland. Portland State University, Portland, OR.

Infrastructure Management

Fencing

Annual fence maintenance activities occurring at the Logan Valley Wildlife Mitigation Site in 2021 consisted of maintaining perimeter fence. Fence damage over the winter of 2020-2021 was extensive, and we could not complete all of the needed work but have made fence repairs a main priority for the spring of 2022.

Other annual fence maintenance included placing and removing cattle panels at stream crossings. Cattle panels at all stream crossings were installed in the spring to prevent cattle trespass and removed in the fall to prevent ice flow damage.

The Wildlife Department also maintained a riparian exclusion fence bordering the U.S. Forest Service allotments. BPT staff will continue to monitor and maintain this fence for 10 years following its installation in 2012, per an agreement with the U.S. Forest Service and OWEB.

Cattle trespass is a continual problem on the Logan Valley property and frequent monitoring is necessary to prevent trespass cattle from having a negative impact on recovering riparian areas. Trespass was documented on the property in 2021 from neighboring cattle and from cattle escaping the electric fences on our property. In 2022, we are looking into replacing our electric fencing wire with a letdown fence with Farm Service Agency funding. This should be more effective than the electric fence.

Vault Toilet

After many years of coordination with BPA archaeologists and vault toilet contractors, we were able to install a vault toilet on July 13, 2021 (Figure 3.2.1). BPT staff and a BPA archaeologist were on site to oversee excavation and installation. This Gunnison Right Hand vault toilet was purchased at the end of 2020 from CXT, Inc. and L.B. Foster Company. It will provide a functional toilet for Tribal members, Tribal staff, and volunteers in months where the cabin toilet is winterized.

Figure 3.2.1. Vault toilet installed at Logan Valley on July 13th, 2021.

Cargo Unit for Equipment Storage

At the end of 2020, BPA approved cultural and environmental clearances for installation of a 20-foot cargo container as an alternative to ground disturbance associated with building a shed. The shed was needed to safely store equipment on site while protecting it from theft and weather. Unfortunately, due to COVID-19 and changes in global production, cargo containers became cost-prohibitive in 2021. Given this, we delayed the purchase of the cargo container.

Wildlife Monitoring

Fisheries Research

For fisheries work performed in the Malheur Subbasin including work performed on the Logan Valley Wildlife Mitigation Site, please reference BPT's FY2021 Annual Report for BPA Project# 1997-019-00 – Evaluate the Life History of Native Salmonids in the Malheur Subbasin.

Amphibian Surveys

The goal for amphibian monitoring at the LVWMS is to document presence and breeding of amphibians present, with particular emphasis on Columbia spotted frog (*Rana luteiventris*). Columbia spotted frogs are considered a sensitive species in the state of Oregon (Oregon Conservation Strategy 2016). In October 2015, the Great Basin Distinct Population Segment (DPS) of Columbia spotted frogs was removed from the list of Endangered Species Act candidate species by the U.S. Fish and Wildlife Service (USFWS 2015a). This decision was based on the discovery of additional populations, fairly stable populations and distribution, as well as the conservation practices occurring throughout the range of the DPS (USFWS 2015a, 2015b).

Methods

Habitat in Logan Valley consists primarily of wetland meadow bisected by several small stream courses. Each year we survey McCoy, Lake, and Big Creeks on or nearby tribal property. The primary channels of these three creeks are shown in Figure 4.2.1. Since McCoy Creek confluences with Lake Creek shortly after intersecting FS-16 (which borders the BPT's northern property line), the McCoy/Lake Creek surveys included both streams from FS-16 to just below the confluence with Crooked Creek (which is near one of the BPT's southern property lines). Big Creek was surveyed from the FS-16 Road to its confluence with Lake Creek. We survey along the principal channel, side channels, wetlands, and prime habitat of minor tributaries observed. Time constraints limited complete coverage of all marshy areas and split channels. However, we attempt to survey the majority of amphibian habitat.

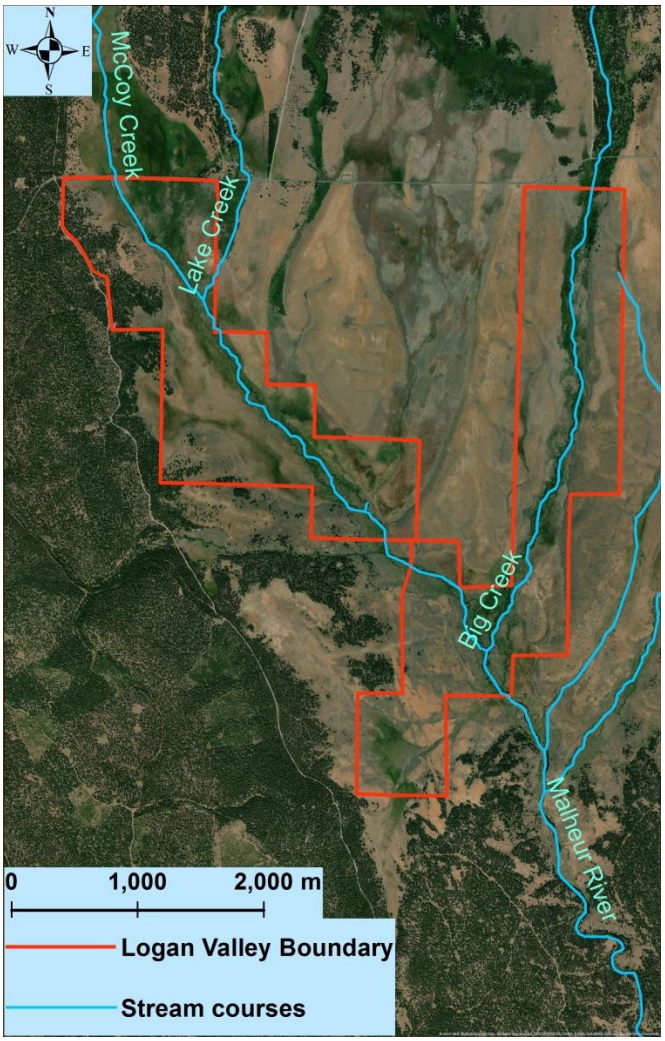


Figure 4.2.1. Map displaying the primary stream courses on LVWMS.

Visual encounter amphibian surveys conducted on the LVWMS were adapted from methods used by Pearl at al. (2010) to survey for Oregon spotted frogs (*Rana pretiosa*). Surveys are conducted in early summer (after snow melt allows access) to coincide with high amphibian activity. Two surveyors, typically one on each side of the principal channel of the selected stream course (habitat can dictate otherwise), search for isolated pools, slow moving channels, marshy habitat, backwater areas, and any other type of habitat with high potential for amphibian presence. If more than two surveyors are used, we make a note and add the time up for all surveyors. Surveyors weave back and forth along the floodplain, keeping within proximity of the bank to assure amphibian habitat is not missed. When a split channel is encountered, the fork with the perceived best amphibian habitat was followed if time constraints limited surveying both forks. Overall effort is quantified by timing searches in amphibian habitat for each observer. Starting in 2018, we began tracking each surveyor's route on GPS units. After surveying, we deleted the parts of the track where we were not surveying (i.e., walking back to the vehicle away from the stream courses). This allows us to map the route, and have a total distance surveyed in addition to the total time.

All amphibians and egg masses located were keyed (if possible) and tallied. When we find egg masses, we also take down some descriptive habitat data (depth, vegetation cover, flow) and a GPS point, so egg masses can be mapped and year to year locations compared in the future. Dip nets were used to capture adult and larval amphibians, when necessary, for identification purposes. To obtain a temporal estimate of breeding occurrence in Logan Valley, egg masses were classified as early, middle, or late stage if this could be reliably determined. Larval amphibian numbers were simply estimated. Based on species range records and habitat requirements, Logan Valley has the potential for the following amphibian species: long-toed salamander (*Ambystoma macrodactylum*), tiger salamander (*Ambystoma tigrinum*), non-native American bullfrog (*Lithobates catesbeiana*), Columbia spotted frog, Pacific tree frog (*Pseudacris regilla*), Great Basin spadefoot toad (*Spea intermontana*), and western toad (*Anaxyrus boreas*) (Stebbins 2003). Surveyors had resources available to them to assist with species identification.

In addition to Logan Valley, we conducted egg mass surveys at nearby Summit Creek, located within the Malheur National Forest in 2021. These surveys were conducted in conjunction with staff from the US Forest Service. The Forest Service is planning Stage 0 work in the future, and this was a great opportunity to collect some on Stage 0 work near the LVWMS. Summit Creek consisted of a control site and 2 planned treatment sites (Figure 4.2.2).

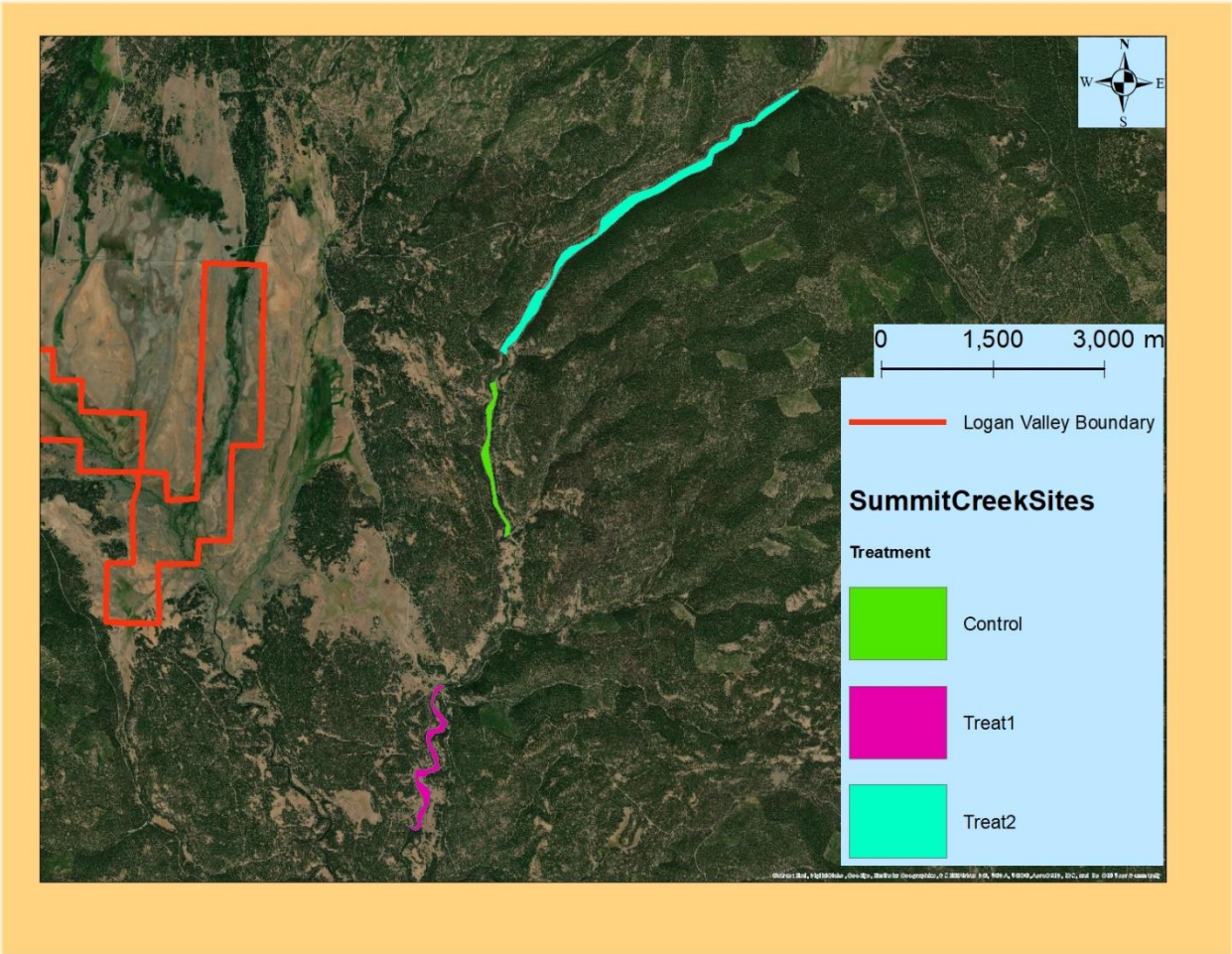


Figure 4.2.2. Summit Creek planned Stage 0 treatments and amphibian surveying stretches. Results from this study may be insightful for future Stage 0 work at LVWMS.

Results

On May 7th, 2021, we surveyed McCoy and Lake Creeks with three surveyors for a combined 639 survey minutes (Table 4.2.1). Big Creek was surveyed by two surveyors on May 10th, 2021, for a combined 312 survey minutes with one covering 7,453 m while the other covered 8,324 m (Figure 4.2.2. B).

All reproductive stages of Columbia spotted frog egg masses were detected in 2021 surveys, however since all the tadpoles detected were still surrounding the egg masses, we treated them as egg masses as opposed to estimating their numbers (Table 4.2.1). Like in past years, we detected egg masses on Big Creek (Table 4.2.1, Figure 4.2.3, Figure 4.2.4). All egg masses found on LVWMS in 2021 were found in slow-moving to stagnant back channels containing less than 1–2 ft of water. Tallies and numbers per minute of egg masses were lower in 2021 than in 2020 on McCoy/Lake Creek. Egg masses detected per minute were higher in 2021 than in 2020 on Big Creek, despite their being lower detections (Table 4.2.1).

Table 4.2.1. Columbia spotted frog numbers from LVWMS in 2017–2021. McCoy/Lake Creek was surveyed twice in 2017, inflating the survey minutes. * For some clusters it was difficult to reliably count egg masses, so a range was used, we then took the mid-point of this range for this table.

	McCoy/Lake Creek					Big Creek				
	Survey Minutes	Egg mass tally		Juveniles and adults		Survey Minutes	Egg mass tally		Juveniles and adults	
		Tally	per minute	Tally	per minute		Tally	per minute	Tally	per minute
2017	1579	5	0.003	126	0.08	470	0	0	13	0.028
2018	835	48*	0.057	30	0.036	705	13*	0.018	28	0.04
2019	516	110	0.213	8	0.016	576	78	0.135	17	0.03
2020	270	218	0.807	5	0.019	389	51	0.131	14	0.04
2021	639	55	0.086	8	0.013	312	47	0.151	0	0.00

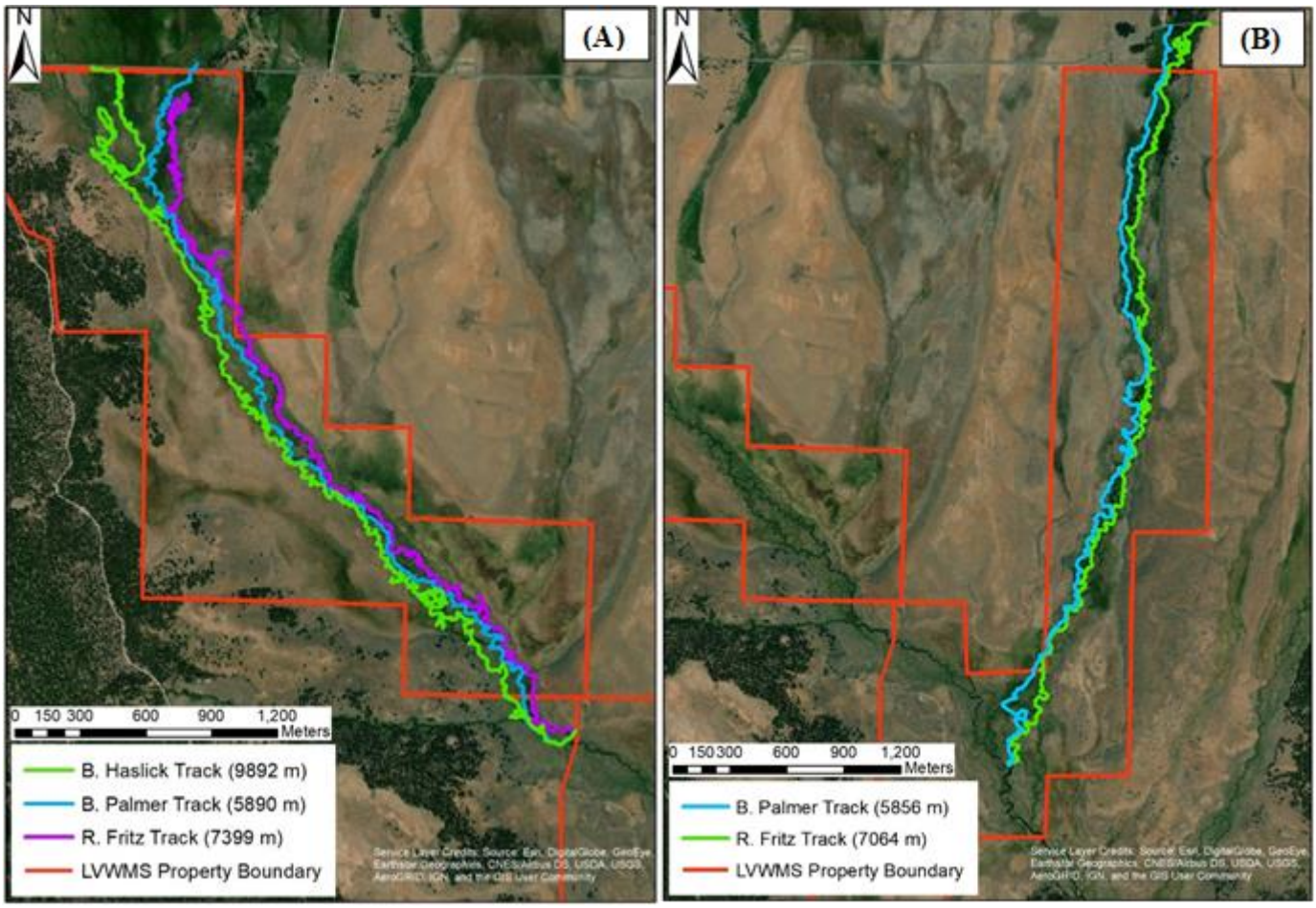


Figure 4.2.3. Survey tracks and distances from Lake/McCoy Creek (A) and Big Creek (B) LVWMS in 2021.

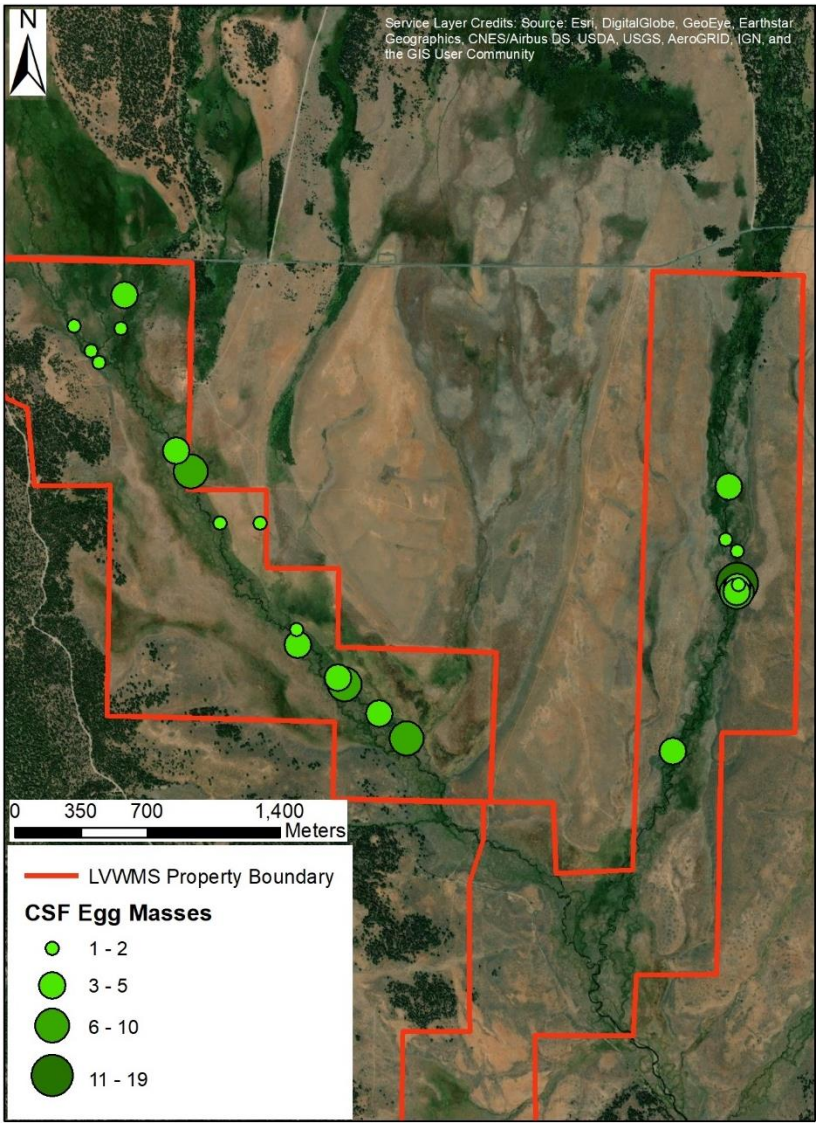


Figure 4.2.4. Columbia Spotted Frog egg mass locations and numbers on LVWMS in 2021.

Discussion

LVWMS appears to provide ample useable space for Columbia spotted frogs, a species of conservation concern in Oregon. Overall, egg mass tallies were lower in 2021 compared to the last two years. In contrast to 2020, egg mass clusters did not seem to be as large at Big Creek, with two large clusters in 2021 containing at least 10 eggs.

Management actions to increase habitat for Columbia spotted frogs include creating shallow pools with submerged and emergent vegetation as this would make excellent reproductive habitat for the species (Davis and Verell 2005). Manually creating pools and ponds

or encouraging beaver activity and placing woody debris to increase channel complexity has the potential to create beneficial habitat for reproduction, sunning, foraging, overwintering, and refugia (Dodd 2013).

Future Columbia spotted frog monitoring may include surveys completed back-to-back to allow for better comparisons between drainages. Because it is difficult to predict the timing of breeding, multiple survey rounds are one option to decrease the chances of missing egg masses. Year over year trends in observation location could also be investigated to obtain insight into population dynamics and habitat preference. Recording more specific habitat where each sighting occurs could prove valuable if the BPT decides to modify habitat to the benefit of the Columbia spotted frog in the future.

We recommend continuing to track and map survey routes in future years as it provides useful data on survey effort and will allow for better year to year comparisons.

Summit Creek Amphibian Surveys

On May 12th, 2021, in collaboration with staff from the Prairie City District of the US Forest Service, we conducted amphibian surveys on Summit Creek, located within the Malheur National Forest and southeast of LVWMS. Three staff members from BPT and one employee from the US Forest Service surveyed both treatment and control sections (Figure 4.2.5).

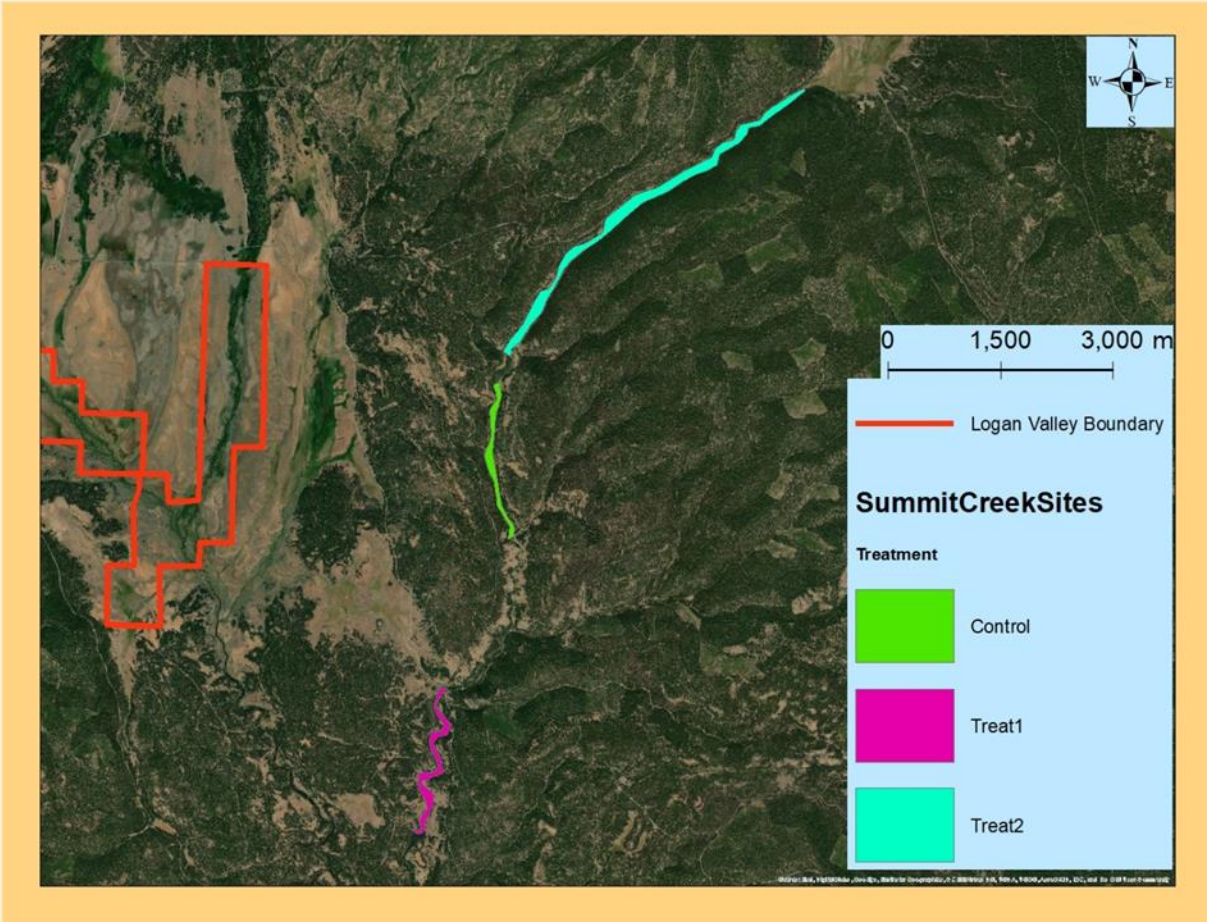


Figure 4.2.5. Summit Creek planned Stage 0 treatments and amphibian surveying stretches.

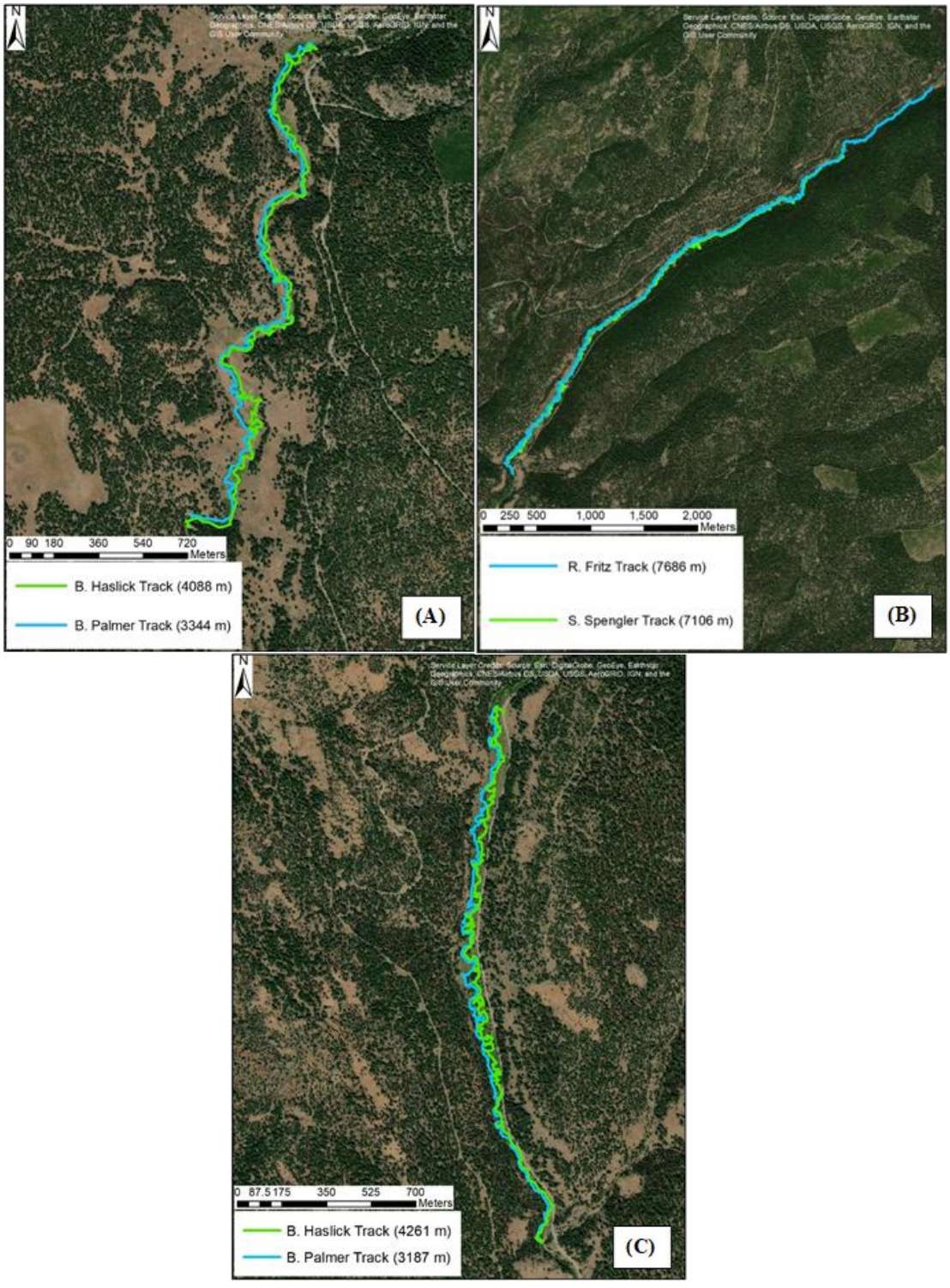


Figure 4.2.6. Tracks and distances of surveyors at the Treatment 1 (A), Treatment 2 (B), and on the Control (C) reaches on Summit Creek on May 12th, 2021.

Results

BPT staff, along with staff from the US Forest Service, surveyed both the treatment and control sections for a total of 624 survey minutes on May 12th, 2021. Staff divided into pairs with 2 BPT staff surveying Treatment 1 and the control while two BPT staff and a FS employee surveyed Treatment 2. Egg mass detections were higher in the Control than in both Treatment 1 Treatment 2 combined (Table 4.2.2).

Table 4.2.2. Columbia spotted frog numbers from the Treatment and Control sections on Summit Creek in 2020–2021.

	Treatment 1				
	Survey Minutes	Egg mass tally		Juveniles and adults	
		Tally	per minute	Tally	per minute
2020	229	34	0.15	16	0.07
2021	174	10	0.06	6	0.03
	Treatment 2				
	Survey Minutes	Egg mass tally		Juveniles and adults	
		Tally	per minute	Tally	per minute
2020	234	5	0.02	7	0.03
2021	222	15	0.07	4	0.02
	Control				
	Survey Minutes	Egg mass tally		Juveniles and adults	
		Tally	per minute	Tally	per minute
2020	243	35	0.14	11	0.05
2021	228	31	0.14	10	0.04

Discussion

Surveying Summit Creek prior to Stage 0 treatments will provide valuable insights into the influence of these treatments on the presence of Columbian spotted frogs. We will survey Summit Creek again in 2022 and we anticipate the first Stage 0 work will also happen in 2022. This information will be particularly helpful for BPT if we pursue Stage 0 treatments on LVWMS in the future.

Literature Cited

Bull, E.L. and M.P. Hayes. 2000. Livestock effects on reproduction of the Columbia spotted frog. Journal of Range Management. 53(3): 291-294.

Davis, A.B. and P.A. Verell. 2005. Demography and reproductive ecology of the Columbia spotted frog (*Rana luteiventris*) across the Palouse. Canadian Journal of Zoology. 83(5): 702–711.

Oregon Conservation Strategy. 2016. Columbia spotted frog. Oregon Department of Fish and Wildlife, Salem, Oregon. http://oregonconservationstrategy.org/strategy-species/columbia-spotted-frog/ Accessed: January 24, 2018.

Pearl, C.A., D. Clayton, and L. Turner. 2010. Surveys for presence of Oregon spotted frog (*Rana pretiosa*): Background information and field methods. Interagency Special Status Sensitive Species Program (ISSSSP). 48 p. Portland, Oregon.

Reaser, J.K. 2000. Demographic analysis of the Columbia spotted frog (*Rana luteiventris*): case study in spatiotemporal variation. Canadian Journal of Zoology. 78(7): 1158–1167.

Stebbins, Robert C. 2003. A Field Guide to Western Reptiles and Amphibians. 3rd ed. Houghton Mifflin. New York, New York.

[USFWS] U.S. Fish and Wildlife Service. 2015a. Endangered and Threatened Wildlife and Plants; 12-Month Findings on Petitions To List 19 Species as Endangered or Threatened Species. Federal Register 80: 60834–60850.

[USFWS] U.S. Fish and Wildlife Service. 2015b. Species status assessment report for the Columbia spotted frog (*Rana luteiventris*), Great Basin Distinct Population Segment. Reno Fish and Wildlife Office, Reno, Nevada. vii + 86 pp.

Stream Photos

There are 14 stream photo points on the Project to monitor vegetative components and changes in stream structure. An upstream and downstream azimuth is used to make the photograph repeatable. The purpose of the stream photos is for qualitative analysis for visual historic reference, see Appendix B.

Nest Box Program

Densities of cavity nesting birds can be limited by the number of cavities available, with densities in areas correlated to the number of nest sites, and populations changing with experimental manipulations of nest site density (Newton 1994). Supplemented nest sites can be a valuable conservation tool. Nest box programs have demonstrated the ability to increase population numbers for American Kestrels (*Falco sparverius*) (Hamerstrom et al. 1973, Shave and Lindell 2017), and the recovery of the Eastern Bluebird (*Sialia sialis*) has been attributed in part to the promotion of nest boxes (American Bird Conservancy 2018).

In 2018, we initiated a nest box program on MRWMS, LVWMS, other tribal properties, and private property in southeastern Oregon. We continued to expand this program in following years. We monitor these nest boxes and collect the data requested by the American Kestrel Partnership (AKP) on all boxes (regardless of which species the boxes were intended).

In 2018, Carter obtained a Bird Banding Lab subpermit and a state permit to band American Kestrels, Mountain Bluebirds (*Sialia currucoides*), Western Bluebirds (*Sialia mexicana*), Northern Saw-whet Owls (*Aegolius acadicus*), Flammulated Owls (*Psiloscops flammeolus*), Northern Pygmy Owls, and Violet-green Swallows (*Tachycineta thalassina*). With these permits he banded nestlings from the nest box program and incorporate bird banding field days with Tu Wa-kii Nobi for education and outreach. In 2020, Carter received his Master Bander permit and will continue banding under this permit.

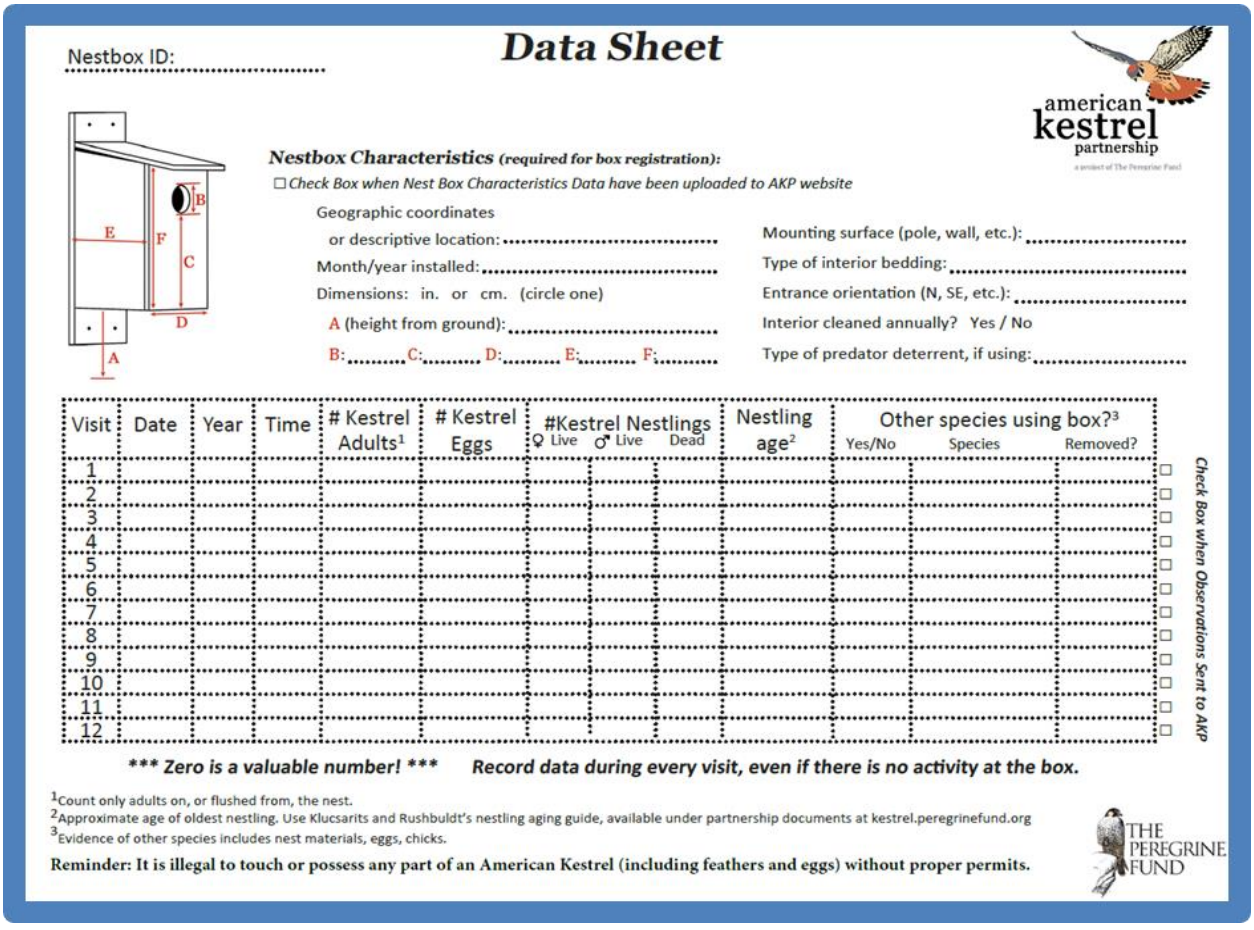
Due to his research background with American Kestrels (*Falco Sparverius*), Carter was asked to take on the role of state coordinator for the American Kestrel Partnership (AKP) in Oregon. "Launched 2012 in response to long-term population declines of kestrels in North America, The Peregrine Fund's American Kestrel Partnership is a network of citizen and professional scientists working to collaboratively understand kestrel demographics and advance kestrel conservation (https://kestrel.peregrinefund.org/)." With this role, Carter oversees field questions, and encourage folks to collect data according to protocol and submit soon after the breeding season, as well as recruiting new Partners for the AKP. Most of the recruiting will take place in southeastern Oregon. Carter will manage the nest box program for the Burns Paiute Tribe, as well as collaborate with other partners and help them run their own programs. With his banding permit he will also help them band nestlings from other partner's nest boxes. The experience with the BPT nest boxes will help him guide others.

Methods

For installation and monitoring, we collect the data requested by the AKP on all boxes, regardless of it was for kestrels (Figure 4.4.1). These data include measurements and other data on the box, as well as what occupies it through the breeding season. The AKP recommends checking the box every two weeks during the breeding season but leaves the decisions up to the

party managing the box. It is unlikely we will be able to check every two weeks, but we will check as frequently as our schedule allows. We will submit data from the kestrel boxes to the AKP each year. If nests contain European Starlings (*Sturnus vulgaris*) or House Sparrows (*Passer domesticus*) nests, we will remove them and try to trap the adults, as these non-native species can negatively affect native birds.

Before fledging, we will band all kestrel nestlings. Bluebirds and swallows have short banding windows so we will band them opportunistically. Banding will take place near the end of the nestling stage but early enough to avoid force fledging any nestlings. For kestrels this will take place when nestlings are 17–26 days old.



Nestbox ID: .....

Data Sheet

american kestrel partnership

Nestbox Characteristics *(required for box registration):*

☐ *Check Box when Nest Box Characteristics Data have been uploaded to AKP website*

Geographic coordinates
or descriptive location: .....
Month/year installed: .....
Dimensions: in. or cm. (circle one)
A (height from ground): .....
B: ..... C: ..... D: ..... E: ..... F: .....

Mounting surface (pole, wall, etc.): .....
Type of interior bedding: .....
Entrance orientation (N, SE, etc.): .....
Interior cleaned annually? Yes / No
Type of predator deterrent, if using: .....

Visit	Date	Year	Time	# Kestrel Adults[1]	# Kestrel Eggs	#Kestrel Nestlings ♀ Live	#Kestrel Nestlings ♂ Live	#Kestrel Nestlings Dead	Nestling age[2]	Other species using box?[3] Yes/No	Species	Removed?	
1													☐
2													☐
3													☐
4													☐
5													☐
6													☐
7													☐
8													☐
9													☐
10													☐
11													☐
12													☐

Check Box when Observations Sent to AKP

**** Zero is a valuable number! **** **Record data during every visit, even if there is no activity at the box.**

[1]Count only adults on, or flushed from, the nest.
[2]Approximate age of oldest nestling. Use Klucsarits and Rushbuldt's nestling aging guide, available under partnership documents at kestrel.peregrinefund.org
[3]Evidence of other species includes nest materials, eggs, chicks.

Reminder: It is illegal to touch or possess any part of an American Kestrel (including feathers and eggs) without proper permits.

THE PEREGRINE FUND

Figure 4.4.1. Example data sheet used for box deployment and monitoring.

Results

Box deployment

Prior to the 2019 breeding season, we deployed 7 kestrel boxes and 10 bluebird boxes on or near the MRWMS (Figure 4.4.2) and we deployed 11 kestrel boxes, 1 Northern-Pygmy Owl box, and 15 bluebird boxes on or near the LVWMS (Figure 4.4.3). We deployed 2 kestrel boxes at tribal employees' houses in Harney County, and 5 kestrel boxes on Beech Creek, tribal property in Grant County. We have also monitored 5 kestrel boxes that had already been deployed on private properties in Burns, OR, and we have also assisted Crane Middle/High School, Portland Audubon, and the U.S. Forest Service Prairie City Ranger District Office in deploying their own boxes to manage.

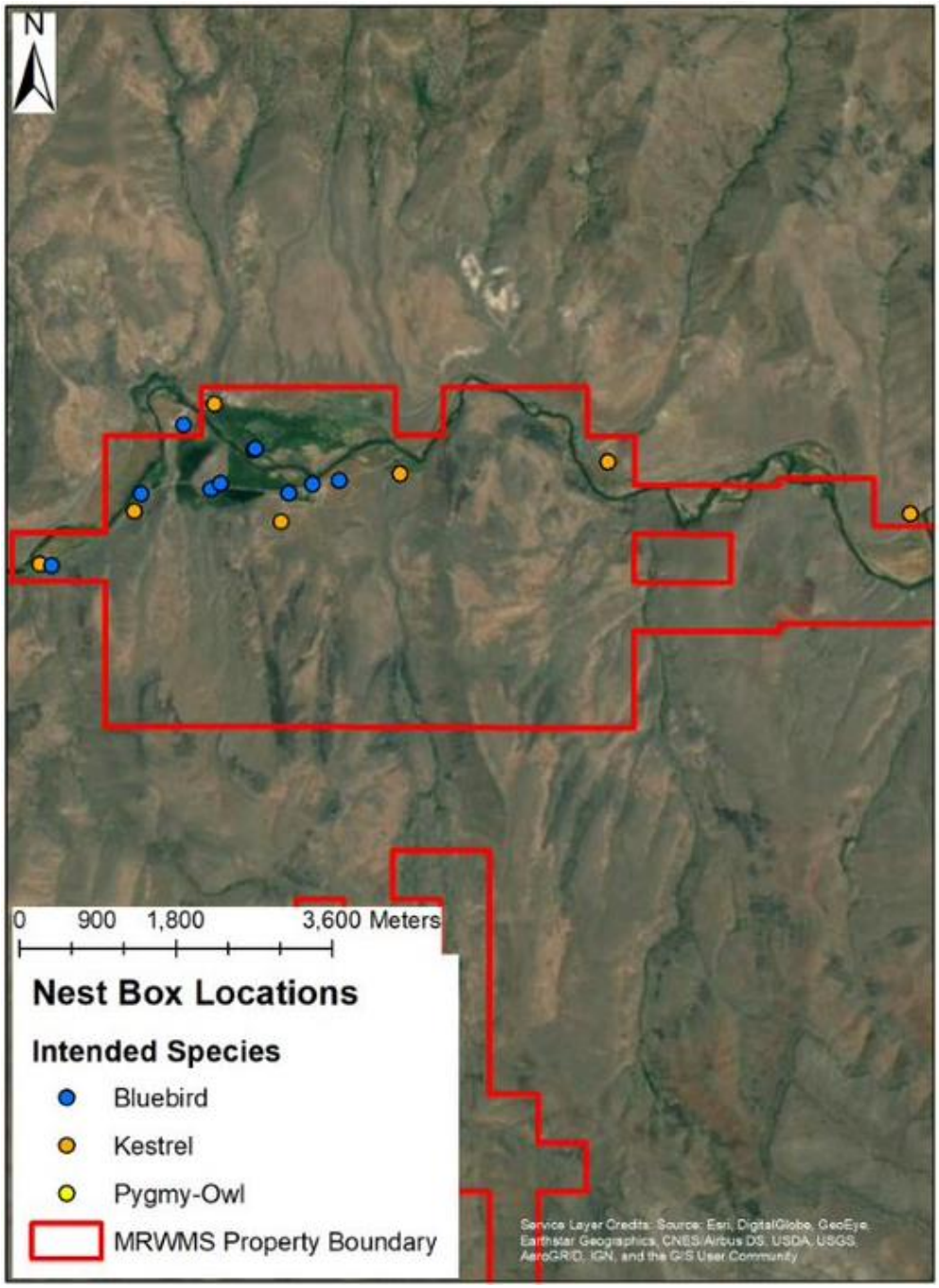


Figure 4.4.2. Nest box locations on the MRWMS.

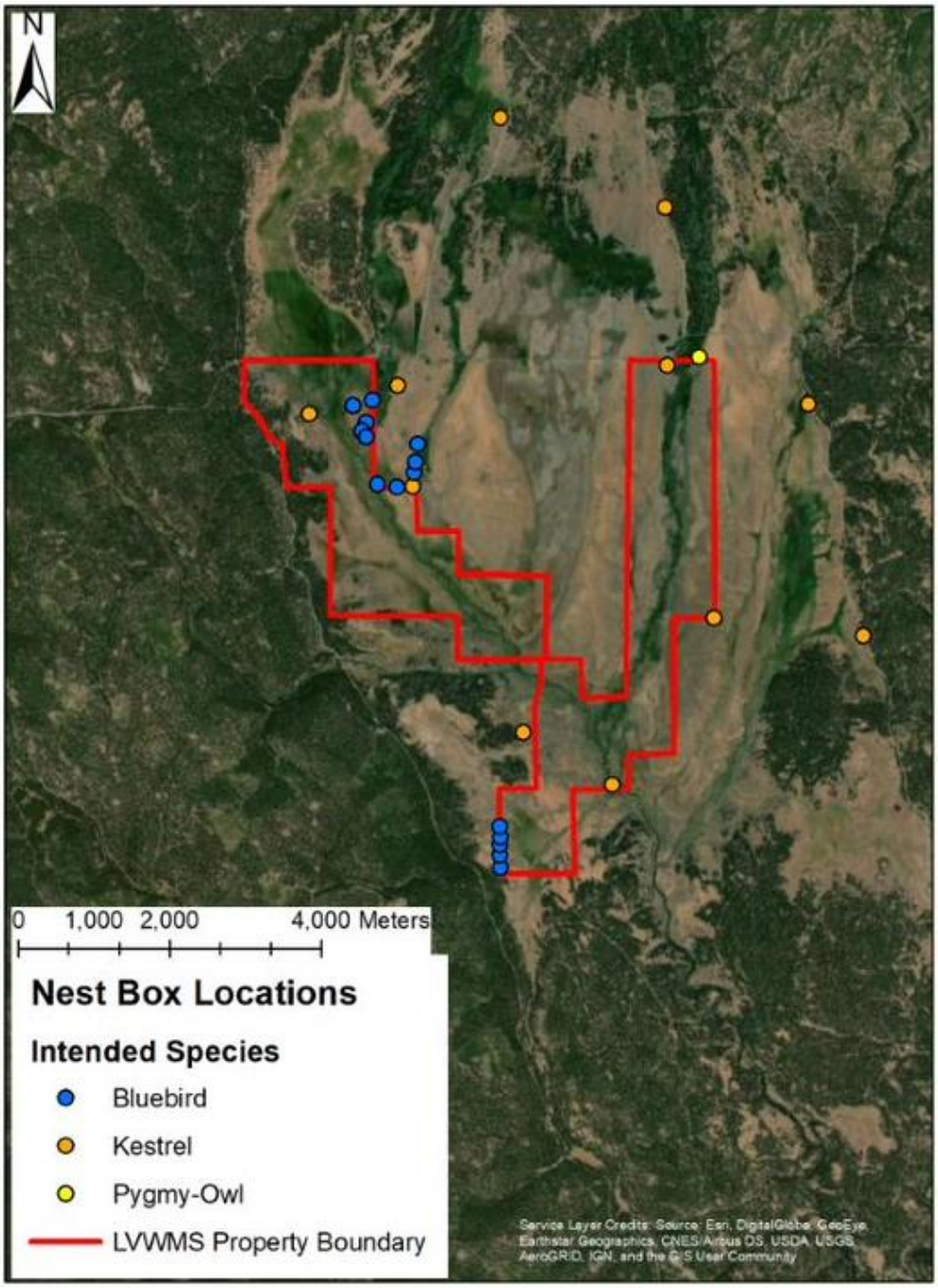


Figure 4.4.3. Nest box locations on the LVWMS.

Box occupancy and success

All data from the kestrel boxes, even unoccupied boxes, were submitted to the AKP database for inclusion in their large-scale nest box monitoring program.

On the MRWMS, 5 of 7 kestrel boxes deployed were occupied by kestrels. Only 2 hatched young and 1 of these nests successfully fledged young. Of note, nestlings were found dead in one of the nest boxes in late June. Low nesting success and low survival are likely due to drought conditions and extreme heat that occurred at MRWMS during the nesting season. On the LVWMS, 7 of 11 kestrel boxes deployed were occupied by kestrels which initiated nests. Six of these boxes successfully hatched and fledged young. Only 1 of 5 boxes at Beech Creek were occupied by kestrels and fledged all 3 young. Two of 7 boxes monitored at private residences around Burns, were occupied by kestrels. However, only one box fledged young. Occupancy, nesting activity, and fledging success are all displayed in Table 4.4.1.

Table 4.4.1. Occupancy and nesting and fledging success at kestrel nest boxes deployed at each site.

Property	**% & # of boxes occupied in 2021**	**Total number of eggs in 2021**	**Number of nests that hatched ≥1 nestling in 2021**	**Number of nestlings in 2021**	**Number of nests that fledged ≥1 nestling in 2021**	**Number of nestlings fledged in 2021**	**TOTAL number of nestlings fledged since 2018**
MRWMS	5/7 = 71.4%	26	2/5	9	1/5	5	56*
LVWMS	7/11 = 63.6%	32	6/7	23	6/7	25	59
Beech Creek	1/5 = 20%	4	1/1	4	1/1	3	12
Other	2/7 = 28.6%	8	2/2	8	1/2	5	26

*1 fledgling was not in nest box when others were dead, so it is possible that it fledged

One of the 10 bluebird boxes deployed at MRWMS were occupied by bluebirds. However, this nest was abandoned and later occupied by an Ash-throated flycatcher. Four of these boxes were occupied by Tree Swallows (*Tachycineta bicolor*). The unknown status of nesting at boxes is typically due to gaps in monitoring and a short window between hatching and fledging. At LVWMS, Mountain Bluebirds were found at 13 out of 15 boxes deployed. The only other native species found using these nest boxes were Tree Swallows. Occupancy and success are shown in Table 4.4.2 below.

Table 4.4.2. Occupancy and success at bluebird boxes deployed at each site. Some boxes are occupied more than once in a year.

Property	% Occupied 2021	Species (# of boxes) *	# Success	# Fail	# Unk.
MRWMS	5/10 = 50%	TRES (4), ATFL (1), MOBL (1)	3	1	1
LVWMS	15/15 = 100%	MOBL (13), TRES (2)	15	0	0

*Each species labeled by its 4 letter Alpha code

Figure 4.4.4 Mountain bluebird nestlings in a box in 2021.

Figure 4.4.5. Kestrel adult and eggs in one box and nestlings in another box.

Bird Banding

On 7 days during the summer of 2021, we hand-captured and banded 37 Kestrel and 11 Mountain Bluebird nestlings at MRWMS and LVWMS (Table 4.4.3). At MRWMS, we only banded a total of 4 kestrel nestlings from 1 nest box. This is a significant decrease from 2020, in which we banded 22 at MRWMS across all 7 boxes deployed. We banded 20 kestrel nestlings at 5 nest boxes and banded 11 nestling Mountain Bluebirds at 2 bluebird boxes at LVWMS. At Beech Creek we banded 3 kestrel nestlings at one nest box, and we banded 10 other kestrel nestlings at other locations.

Table 4.4.3. Total number of each species captured and banded at MRWMS, LVWMS, and other locations in 2021.

Species	MRWMS	LVWMS	Beech Creek	Other
American Kestrel	4	20	3	10
Mountain Bluebird	0	11	0	0

Figure 4.4.6. Carter banding a male kestrel nestling at one of the nest boxes at LVWMS in 2021.

Outreach

On July 9th, 2021, BPT staff banded 12 kestrel nestlings at 3 nest boxes at LVWMS and gave a demonstration to Tribal Stewards and Forest Service seasonal employees. BPT staff and Forest Service employees then banded 5 nestlings in a Forest Service box.

Discussion

Our nest box program has shown great promise with high occupancy rates of many native species, despite the marked decrease in occupancy in 2021 at MRWMS. This is likely due to drought conditions and extreme heat, leading to decreased availability of food. The increased occupancy by Mountain bluebirds at our boxes at LVWMS is promising. Since nesting sites can be a limiting factor for cavity nesting birds, nest boxes can be very beneficial to these species. The data sharing with AKP benefits a large-scale effort to understand the declines of American Kestrels and to better understand their breeding ecology. The nest box program has also been a powerful educational tool that we will continue to build on. We will continue to monitor these nest boxes into 2022.

Literature Cited

American Bird Conservancy. 2018. Eastern Bluebird. https://abcbirds.org/bird/eastern-bluebird/.

Hamerstrom, F., F. N. Hamerstrom, and J. Hart. 1973. Nest boxes: an effective management tool for kestrels. The Journal of Wildlife Management 37:400–403.

Newton, I. 1994. The role of nest sites in limiting the numbers of hole-nesting birds: a review. Biological Conservation 70:265–276.

Shave, M. E., and C. A. Lindell. 2017. Occupancy modeling reveals territory-level effects of nest boxes on the presence, colonization, and persistence of a declining raptor in a fruit-growing region. PLoS ONE 12(10): e0185701.

Winter Raptor Surveys

In 2019, BPT staff was asked to take on a route for the winter raptor survey by the project coordinator.

The following provides a brief introduction, of the winter raptor survey:

"In an effort to get a better understanding of the biology of wintering birds of prey in Oregon, the southern portions of Washington, the California portion of the Klamath Basin, and in Idaho, the East Cascades Audubon Society located in Bend, OR sponsors an extensive survey project designed to reveal population levels and densities for the species that choose to winter in the project area. Volunteers in this citizen science project conduct surveys during November through March on established route transects under the guidance of a Project Coordinator who assists with volunteers needs as well as receives all data collected on the surveys which is then displayed in various project charts and graphs."

Methods

Staff agreed to survey the Double OO route that runs south and west of Burns; it is approximately 102 miles long (Fig 4.5.1).

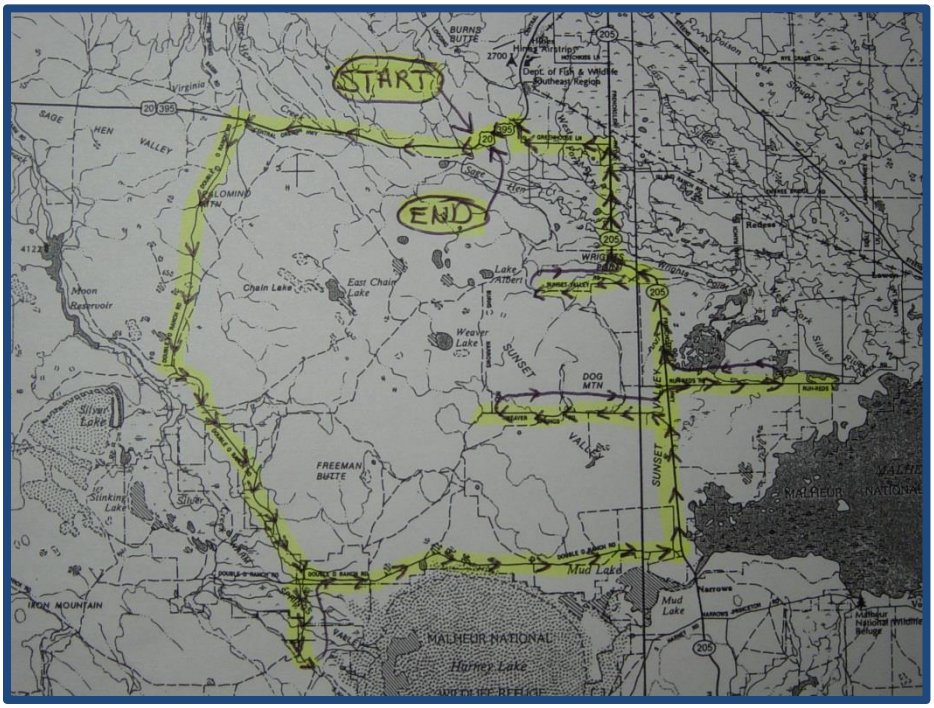


Figure 4.5.1. Double OO winter raptor survey route located south and west of Burns, OR.

Survey methods

1. Routes will be surveyed once a month during the months of December, January, and February. Additional survey options decided on by each volunteer include surveys conducted during November and March and doing more than one survey in a given month. All survey dates will be determined by each volunteer based on their own life schedules.

2. Surveys should be conducted during favorable weather conditions to get the most return for the effort expended. Excessive wind, fog, and precipitation will force birds to shelter and thus make them less visible to see. If a volunteer's life schedule dictates conducting a survey during inclement weather, it will be better to have the survey completed versus having no data for that given month.

3. Volunteers are encouraged to make stops along the route path in order to scan favorable habitat for birds. These stops will be at the discretion of the volunteer, most routes do not have planned stopping points built into the route path.

4. Volunteers should drive slow enough to be able to properly scan all available habitat that they can see that might hold birds. This includes viewing power poles, fence posts, trees, water wheel lines, trees, and any other structure that a bird can perch on. In addition, the skies should be scanned for soaring birds and the ground should be scanned for perching/feeding birds.

5. Suggested driving speeds range up to 30-35 mph to insure viewing coverage. Driving SAFETY will dictate if these slower speeds are safe to do. Volunteers should not compromise their or anyone else's safety on the roads. ECAS will not be held responsible for any accidents resulting from unsafe driving by volunteers. When in doubt, do not drive in an unsafe manner. Volunteers should also make sure that when stopped to view birds, they are parked in a safe and legal manner so as not to disrupt traffic flow around them and compromise their individual safety.

6. All birds observed along the route path should be counted. Every attempt should be made to determine species of the bird viewed. If that is not possible, an attempt should be made to determine the type of bird it is, ie, falcon, eagle, buteo, owl, accipiter, etc and reported as UNID falcon, etc. If that is not possible, birds can then be classified as unidentified raptors.

7. Birds viewed at some distance may have the possibility of being counted from another part of the survey route depending on the design of the route path. Volunteers should be aware of possible double counting in these circumstances. If there is concern about the possibility of double counting a bird, it will be best to be conservative and not count the bird.

8. Some routes will have circumstances where it will be necessary to back track over previously surveyed roads. In these instances, any NEW birds viewed on the second pass can be added to the survey.

9. Age and sex information of birds counted is not necessary with the exception of aging Bald Eagles. For them, the only age differentiation that we would like to have would be if the bird is a white headed/tailed adult bird (A) or a dark subadult bird (S). Age differentiation for the first four years of a Bald Eagles life, when they do NOT have a white head or tail, is not necessary.

Each route will have their own specific data collection form to be used during surveys. These forms display a sequential list of roads that are driven for each route as well as a suggested list of the more common species that will be seen in the area. Four letter codes are used to denote different species that have been found in this project. Following are codes to be used on the data forms:

The data collection forms are to be completed as follows:

1. Each time a bird is located, it should be entered on the appropriate road line and in the appropriate species column on the form.

2. Each form will have a few columns designated for family groupings of birds, i.e., falcons, accipiters, owls. To keep the data form to a manageable size in the field, these family grouping columns are included for the less apt to be seen species. When one of these species is encountered, the bird should be entered into the appropriate family column on the appropriate road line using one of the above listed codes to indicate what species was seen.

3. Because owls are the least likely birds to be seen on any given survey, the owl column can be used to record other species found.

4. In addition to bird data, the top of the form displays other data that must be entered as well. These include the DATE that the survey was completed, the amount of TIME that the survey took to complete (minutes recorded in 5 minute increments), and the MILES that were driven to conduct the survey (recorded down to tenths of a mile). Miles driven to get to the start of the route from home and to get from the end of the route back to home should NOT be included.

5. Additional voluntary information that could be included on the form would be weather conditions, other species of interest seen on the survey, non-route miles, or anything of note that you thought would be of interest to record. All of this information can be added to the bottom of the form below the TOTALS line.

6. When the survey is completed, the TOTALS line needs to be filled out accurately.

7. Completed forms need to be submitted to the Project Coordinator as soon after each survey as possible. The reason for timely submission is because at the end of each month a summary chart is prepared that will include all the data collected for all of the routes surveyed. This summary chart is then sent to all of the project volunteers as soon as possible to keep everyone informed as to what is being seen and where in as close to real time as possible. Preparation of this summary chart is much quicker if the data is submitted throughout the month rather than waiting until the end when I would have to deal with data from close to 200 routes.

Although we are not required to count corvids, we made the decision to count Common Ravens (*Corvus corax*) due to their importance to sage-grouse and potential population management in the future.

Results

Three days of survey routes were run in the winter of 2021–2022. The December survey was conducted on the 19th with temperatures ranging from 18-25º F, little to no wind, and cloud cover starting at approximately 10% but switching to 100% as the day progressed. We tallied a total of 6 Rough-legged Hawks (*Buteo lagopus*). The January survey was conducted on the 28th with temperatures at approximately 25–29 º F, winds at 10–11 mph, and cloud cover at 75% and progressively clearing up to no cloud cover. The February survey was conducted on the 7th with

temperatures ranging from approximately 43–45º F, calm conditions, and cloud cover around 40-45%. We tallied a total of 53 Common Ravens (*Corvus corax*) in the February survey.

Table 4.5.1. Winter raptor road survey results for the Double OO route in the winter of 2020–2021. Un-identified (UNID) birds were not seen well enough to accurately identify the species but were put in the most precise grouping.

Group	Buteos				Falcons		Eagles					
Species	Red-tailed Hawk	Rough-legged Hawk	Ferruginous Hawk	UNID Buteo	American Kestrel	Prairie Falcon	Bald Eagle	Golden Eagle	Northern Harrier	Short-eared Owl	UNID Raptor	Common Raven
12-19-21	11	6	2	2	0	2	5	6	4	0	0	49
1-28-22	5	5	0	0	0	0	8	2	1	0	2	50
2-7-22	15	19	0	1	0	1	5	3	0	0	1	53

Discussion

Data collected during these surveys will provide data from an area with an abundance of wintering raptors and will be included in a large-scale data set.

Administration

Cultural Resources

Federally funded projects require an environmental review of all ground disturbing activities before project implementation can begin. This often entails a cultural resources survey with Tribal and State Historic Preservation Office (SHPO) consultation. Much of the LVWMS has been surveyed for significant cultural resources since its acquisition, however, each year there are new projects that require additional surveys or have never been surveyed before. All ground disturbing activities were monitored by BPT Tribal Staff under the Cultural Department.

Ceremonial Hunting Tags and Landowner Preference Tags

In 2021, the Wildlife Program successfully facilitated the negotiations to 15 elk, 8 deer, and 4 pronghorn ceremonial hunting tags for Burns Paiute tribal members with Oregon Department of Fish and Wildlife. Tribal Council and elders decided on how tags will be distributed and the traditional nature of the hunts. This will continue into 2022, but we are working to expand the hunt to include a mule deer tag on the Malheur National Wildlife Refuge. We will continue to support this process in whatever role is designated by the Council.

Landowner Preference Tags will continue to be distributed in the same manner as currently conducted. Tribal members cannot draw for the same tag (species) two years in a row.

1. Tribal members sign up to draw for LOP deer and elk tags (around May 5th)
2. Names are randomly drawn using a random number generator
3. Submit DEER Tag Distribution Form (must arrive at Salem before May 15th)
4. Tribal members must purchase their hunting license before their names can be submitted (must enter hunter ID on form)
5. Submit ELK Tag Distribution Form (must arrive in Salem before September 15th, address is at bottom of form)
6. Tribal members must purchase their hunting license before their names can be submitted (must enter hunter ID on form)

Outreach and Education

For most of 2021, due to continued limitations brought on by the COVID-19 pandemic, the BPT Natural Resources Department did not participate in many outreach and education activities. On August 18th, BPT led a fishing day with youth from Tu-Wa-kii Nobi at Yellowjacket Lake near Burns, OR. We also banded kestrel nestlings with the Tribal Stewards group and Forest Service staff at LVWMS on August 9th.

Staff attended and represented the tribe at local collaboratives and meetings such as the Harney County Restoration Collaborative, Harney Basin Wetlands Initiative, Harney County Wildland Fire Collaborative, Vale Local Implementation Team meetings (Sage-Grouse), Tribal Council and all staff meetings. Wildlife staff also attended the virtual SageCon Summit in November. The Wildlife Program Manager also attended and presented at the virtual Raptor Research Foundation meeting in October. The Wildlife Biologist served on the interview panel for hiring the new Lakeview and Burns Local Implementation Team Coordinator position. In February 2022, BPT staff attended the Oregon Chapter of The Wildlife Society annual meeting in Newport, Oregon.

In 2021, BPT staff partnered with multiple agencies and entities in their work at MRWMS and eastern Oregon. We collected lek data for inclusion in ODFW sage-grouse lek monitoring, kestrel nest box data for inclusion in the American Kestrel Partnership's monitoring program, songbird and raptor monitoring data for a long-term and large-scale project conducted by OSU graduate students, and winter raptor survey data for inclusion in the East Cascades Audubon Society winter raptor monitoring efforts. The Wildlife Program Manager also continued the role as Oregon State Coordinator for The American Kestrel Partnership, to help streamline nest box data collection in the state and recruit interested partners.

Access

Two access permits for fishing, photography, and biking were requested and issued in 2021 for the Logan Valley Wildlife Mitigation Site.

Project Income

The Project's MOA requires the reporting of all project-generated income and the expenditures covered by the income. A summary of all activities is included (Table 5.5.1).

Table 5.5.1. Accounting of project generate income for LVMWS in 2021.

2021 Beginning Balance		**$277,580.32**
Lake Creek CREP Payment	$25,592.00	$303,172.32
NRCS CSP AG Payment	$22,560.65	$325,732.97
NRCS CSP Payment	$1,966.00	$327,698.97
Water Payment (2020)	$2,500.00	$330,198.97
Water Payment (2021)	$2,500.00	$332,698.97
Grazing	$8,888.11	$341,587.08
Supplies	($783.08)	$340,804.00
Vehicle Operating Expense	($1,994.38)	$338,809.62
Insurance	($27.09)	$338,782.53
Indirect Expenses	($1,493.62)	$337,288.91
Property Tax	($2,920.31)	$334,368.60
2021 Ending Balance		**$334,368.60**

Staff

The Project's success can be attributed to the following staff members:

Calla Hagle – Natural Resource Director
Carter Crouch – Wildlife Program Manager
Brandon Palmer – Wildlife Biologist
John McNelly – Rangeland Ecologist
Lucas Samor – MRWMS Site Manager
Eric Hawley – LVWMS Lead Technician
Daneen Richards– Fish and Wildlife Technician
Brandon Haslick – Fisheries Program Manager
Rebecca Fritz – Fisheries Biologist

Appendix A. Photos from grazing points on LVWMS in 2021.

Burns Paiute Tribe
PLT02—Monitor Grazing
Logan Valley
Early Season photos (6/30/2021)
Post (9/8/2021)
Date Cattle IN: 6/3/2021
Date Cattle OUT: 10/2/2021

Early Season **Late Season**

Species: Meadow foxtail
UTM: 11T 369202 4890671
Photo Point: Graze PT1 (Pasture) North-facing


Photo Point: Graze PT1 (Pasture) South Photo


Appendix A. Photos from grazing points on LVWMS in 2021.

Photo Point: Graze PT1 (Pasture) East Photo

Photo Point: Graze PT1 (Pasture) West Photo

Photo Point: Graze PT1 (Pasture) Ground Photo

Appendix A. Photos from grazing points on LVWMS in 2021.

Early Season **Late Season**

Key Species: Meadow foxtail
UTM: 11T 368319 4891292
Photo Point: Graze PT2 (Pasture) North-facing


Photo Point: Graze PT2 (Pasture) South Photo


Photo Point: Graze PT2 (Pasture) East Photo


Appendix A. Photos from grazing points on LVWMS in 2021.

Photo Point: Graze PT2 (Pasture) West Photo

Photo Point: Graze PT2 (Pasture) Ground Photo

Appendix A. Photos from grazing points on LVWMS in 2021.

Early Season **Late Season**

Photo Point: Graze PT3 (Pasture) (North-facing)
UTM: 11T 367613 4891652
Key Species: Meadow foxtail


Photo Point: Graze PT3 (Pasture) South Photo


Photo Point: Graze PT3 (Pasture) East Photo


Appendix A. Photos from grazing points on LVWMS in 2021.

Photo Point: Graze PT3 (Pasture) West Photo


Photo Point: Graze PT3 (Pasture) Ground Photo


Appendix A. Photos from grazing points on LVWMS in 2021.

Early Season **Late Season**

Key Species: Meadow foxtail
UTM: 11T 368039 4890990
Photo Point: Graze PT4 (Pasture) North-facing


Photo Point: Graze PT4 (Pasture) South Photo


Appendix A. Photos from grazing points on LVWMS in 2021.

Photo Point: Graze PT4 (Pasture) East Photo


Photo Point: Graze PT4 (Pasture) West Photo


Photo Point: Graze PT4 (Pasture) Ground Photo


Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

BC1: Upstream 2007

BC1: Upstream 2021

BC1: Downstream 2007

BC1: Downstream 2021

BC2: Upstream 2007

BC2: Upstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

BC2: Downstream 2007


BC2: Downstream 2021

BC3: Upstream 2007


BC3: Upstream 2021

BC3: Downstream 2007


BC3: Downstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

BC4: Upstream 2007


BC4: Upstream 2021

BC4: Downstream 2007


BC4: Downstream 2021

BC5: Upstream 2007


BC5: Upstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

BC5: Downstream 2007


BC5: Downstream 2021

LC1: Upstream 2007


LC1: Upstream 2021

LC1: Downstream 2007


LC1: Downstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

LC2: Upstream 2007


LC2: Upstream 2021

LC2: Downstream 2007


LC2: Downstream 2021

LC3: Upstream 2007


LC3: Upstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

LC3: Downstream 2007


LC3: Downstream 2021

LC4: Upstream 2007


LC4: Upstream 2021

LC4: Downstream 2007


LC4: Downstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

LC5: Upstream 2007


LC5: Upstream 2021

LC5: Downstream 2007


LC5: Downstream 2021

LC6: Upstream 2007


LC6: Upstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

LC6: Downstream 2007


LC6: Downstream 2021

MR1: Upstream 2007


MR1: Upstream 2021

MR1: Downstream 2007

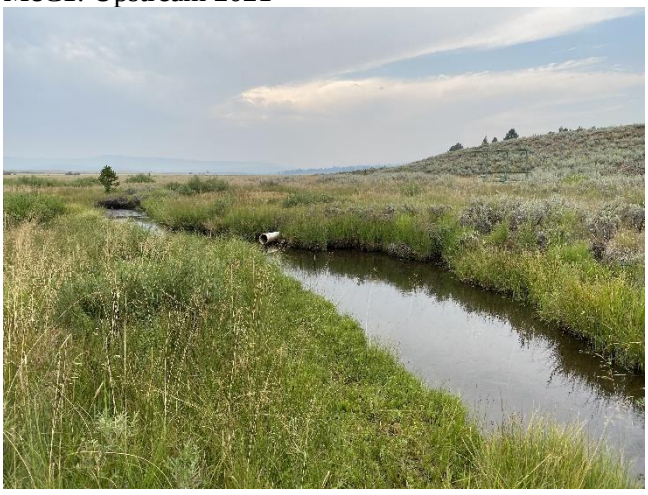

MR1: Downstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

McC1: Upstream 2007


McC1: Upstream 2021

McC1: Downstream 2007


McC1: Downstream 2021

McC2: Upstream 2007


McC2: Upstream 2021

Appendix B. Photo points at LVWMS comparing 2007 to 2021 riparian vegetation and stream bank condition.

McC2: Downstream 2007


McC2: Downstream 2021