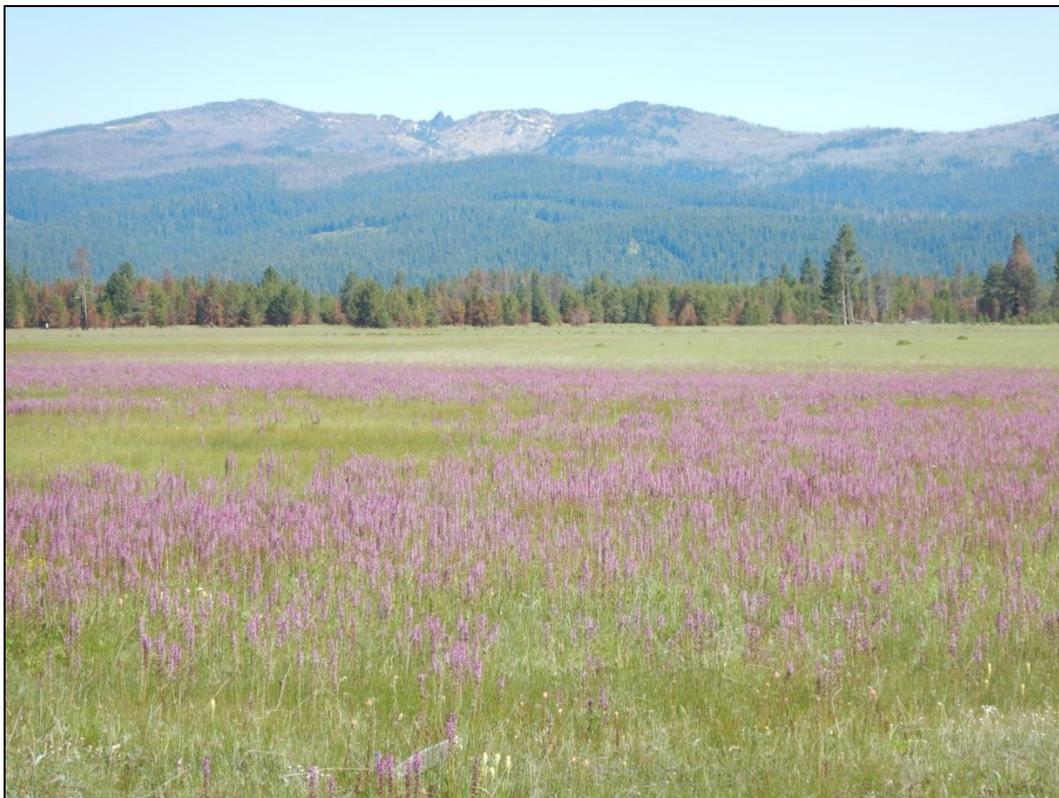


2018 Surveys for Silver-bordered Fritillary (*Boloria selene*) &
Johnson's Hairstreak (*Callophrys johnsoni*) on the
Malheur National Forest



Prepared by Dana Ross (Entomologist, Lepidoptera Specialist)

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SUMMARY

In June of 2018, surveys were performed for potentially undiscovered populations of silver-bordered fritillary (*Boloria selene*) and Johnson's hairstreak (*Callophrys johnsoni*) on public lands managed by the Malheur National Forest.

A total of 17 mid-elevation wet meadow sites were visited in the Bear Valley, Logan Valley, Summit Prairie, North Fork Malheur River and Strawberry Mountain areas in search of the silver-bordered fritillary. Specific sites to survey for Johnson's Hairstreak – those containing dwarf-mistletoe within mature conifer forest (particularly ponderosa pine) – were much more difficult to identify. As such, adult hairstreak surveys were conducted concurrently with fritillary surveys when potential habitats for both species overlapped. Since many of the meadows surveyed were located within areas severely impacted from recent wildfires, overlap with potential hairstreak habitats were encountered only part of the time.

No new populations of either target species were discovered. A concurrent effort to inventory all butterflies encountered did, however, result in over 500 unique site-date records for 62 species, including a first Grant County record and range extension for the Garita skipperling (*Oarisma garita garita*).

INTRODUCTION

The silver-bordered fritillary, *Boloria selene* (BOSE) and Johnson's hairstreak (*Callophrys johnsoni*) (CAJO) are considered federal "sensitive species" in Oregon and Washington (ISSSSP 2018) and as such are butterflies of conservation concern in the Pacific Northwest (The Xerces Society 2005). Within the region, each species is currently known from relatively few locations, yet a number of areas where these butterflies may occur have not been surveyed.

BOSE ranges throughout much of the northern United States and Canada. Its habitats include "bogs, marshes and willowy riparian areas, sometimes tall wet grass" where violets such as *Viola palustris* and *Viola nephrophylla* occur as the caterpillar hostplant (Pyle & LaBar 2018). In the Pacific Northwest, single-brooded populations (generally those occurring above about 4,000 feet) fly from early June to mid-August, whereas populations at lower elevations may have two or three broods and a much longer annual flight period (Warren 2005). The Oregon subspecies of BOSE is unnamed and has been placed in a regional grouping of populations that are considered unique "Pacific Northwestern segregates" (Warren et al 2012). In Oregon, BOSE was unknown until 1961 when it was reported by Ray Albright from Big Summit Prairie in Crook County (Warren 2005). While most subsequent Oregon records have been from that location (Evergreen Aurelians 1996, Ross 2015), it has also been documented sparingly from Grant and

Baker counties (Warren 2005). The single BOSE record from Grant County (Indian Creek, c. 4,000 feet) was made by the late Harold E. Rice (a prolific collector and highly respected PNW lepidopterist) and suggests the possibility of as yet undiscovered populations in that area.

CAJO occurred historically from southern British Columbia south through western Washington to central California. Oregon populations are known primarily from the Cascades and Siskiyou, with an isolated set of populations in the Blue and Willowa Mountains. CAJO habitats include mature western hemlock, pine and true-fir forests that support a sufficient abundance of the larval hostplant - various species of parasitic dwarf mistletoe (DMT). Adults have been recorded from May to early September, with peak flight depending in part on elevation and the number of generations per year (one or two). Adults are infrequently encountered which may be due to a majority of the butterfly's life spent in the tree canopy in the vicinity of DMT (Pyle and LaBar 2018). The butterfly is a Data Gap Species (Fallon & Black 2017).

Over time, many former CAJO habitats have been lost as a result of aggressive logging practices and have resulted in an increased scarcity of the butterfly. Efforts to relocate many historical populations have not been successful. While recent surveys for adults and larvae have met with mixed results (Davis & Weaver 2011), many have benefitted from habitat modeling and an established survey protocol (Davis, McCorkle & Ross 2011). Larval surveys have been shown to be efficient for detecting CAJO, yet adult surveys can also be successful when they are well timed within good potential habitats (the author's personal experience).

The primary objective of this project was to determine if BOSE and CAJO were present within potential habitats on the Malheur National Forest where they had not been surveyed for in the past. Secondly, since the butterfly fauna of Grant County has not been well documented to date, an effort to gain site specific butterfly data was also included.

METHODS

A list of survey areas with the potential to host BOSE was provided by Malheur National Forest personnel with a more refined site selection determined by the surveyor (Ross) using the geobrowser Google Earth and ground truthing. Each site (Table 1) was visited one or more times during early and/or late June. Inadequate potential habitats – those that lacked permanent moisture and/or the larval hostplant and/or sufficient nectar sources - were generally dropped after the initial survey. Most high quality habitats were visited a second time. New sites were added during the late June visit as time allowed.

CAJO survey sites were more difficult to determine. A request was made to have Forest Service biologists and botanists identify areas of mature forest with DMT, but the general consensus

was that DMT was “everywhere” and no specific locations were recommended. This led to a greater focus on BOSE habitats with an awareness of the possible presence of adult CAJO when in the vicinity of mature forest. It was known that habitats supporting the more common thicket hairstreak (*Callophrys spinetorum*) – another DMT obligate species – would have the potential to host CAJO.

Surveys were conducted during warm (60F and warmer) and sunny conditions conducive to butterfly activity between 0900 and 1700 hours, whenever possible. Sites were carefully surveyed on foot throughout all areas with the potential to host BOSE and/or CAJO. Areas with flowers or mud were specifically targeted. If either species was found, an estimate of population size (number of adults flying), areas of use and potential threats to the population and its habitat would be recorded.

During each survey, a checklist of all butterfly species encountered was compiled for each site. An insect net was used to catch and confirm difficult-to-identify butterflies in-hand and to collect vouchers. In rare cases, the identity of an uncertain subspecies required access to properly identified museum specimens. Ultimately, representative voucher specimens were pinned and labeled with essential data and accessioned into the Oregon State Arthropod Collection (OSAC) at Oregon State University in Corvallis.

Finally, it should be noted that these surveys were undertaken by an individual surveyor. As such, whereas BOSE – a conspicuous and often locally common butterfly - should have been relatively easy to detect, the uncommon and inconspicuous nature of CAJO could have resulted in it being overlooked even if present.

RESULTS & DISCUSSION

A total of 27 surveys were performed at 17 sites (Table 1) within BOSE and/or CAJO potential habitats on the Malheur National Forest during 2018. Surveys took place from June 4-8 and from June 25-28, during the expected flight period for BOSE in that area. Although many sites appeared to contain mid-elevation wet meadow characteristics associated with BOSE, no new populations of the butterfly were discovered.

Given the difficulty in locating specific areas of abundant DMT as potential habitats for CAJO, and, given that even if present the hairstreak is rarely seen, its apparent absence was not surprising. One encouraging sign was the occasional observation of a thicket hairstreak (4 sites), which at least confirmed the presence of DMT in the local area and gave some credence to the CAJO effort.

Survey sites are identified below (Table 1). Since proper place names were not easily located, it is important to state that most presented here were created by the author to facilitate this discussion. A summary of findings – including Google Earth maps and habitat photos – follows for each of the 17 areas surveyed.

All butterflies encountered by taxon - Latin names only – at each survey site (Table 2) is followed by a checklist that includes both Latin and common names for each species (Table 3) for ease of reference. Over 500 records for 62 species (nearly all with vouchers) were generated across all sites and included a first time Grant County record and range extension of over 70 miles for the Garita Skipperling (*Oarisma garita*) (see range map in Pyle & LaBar 2018).

Table 1. Sites surveyed for BOSE and CAJO (Latitude & Longitude approximate center of site).

Site #	Site Name	Latitude/Longitude	Elevation (feet)
1	Canyon Meadows	44.24 / -118.77	5,060-5,070
2	Canyon Creek	44.22 / -118.81	4,540-4,620
3	North Summit Prairie	44.22 / -118.52	5,350-5,475
4	Upper Summit Creek	44.19 / -118.54	5,175-5,275
5	Lower Summit Creek	44.15 / -118.57	4,950-5,165
6	Cow/Little Cow Creeks	44.29 / -118.40	5,165-5,200
7	NF16/NF13 Junction	44.26 / -118.40	4,990-5,040
8	Elk Creek	44.25 / -118.39	4,915-4,950
9	Indian Creek	44.36 / -118.73	4,440-4,680
10	Strawberry Mountain Wilderness	44.30 / -118.70	4,740-8,230
11	North Logan	44.19 / -118.63	5,120-5,280
12	Middle Logan	44.18 / -118.62	5,050-5,080
13	West Logan	44.16 / -118.70	5,220-5,370
14	Upper Rd NF24	44.20 / -119.23	5,110-5,215
15	Lower Rd NF24	44.18 / -119.22	5,015-5,150
16	Windfall/Camp Creeks	44.25 / -119.05	4,800-4,860
17	Bear Creek	44.18 / -118.77	4,900-4,980

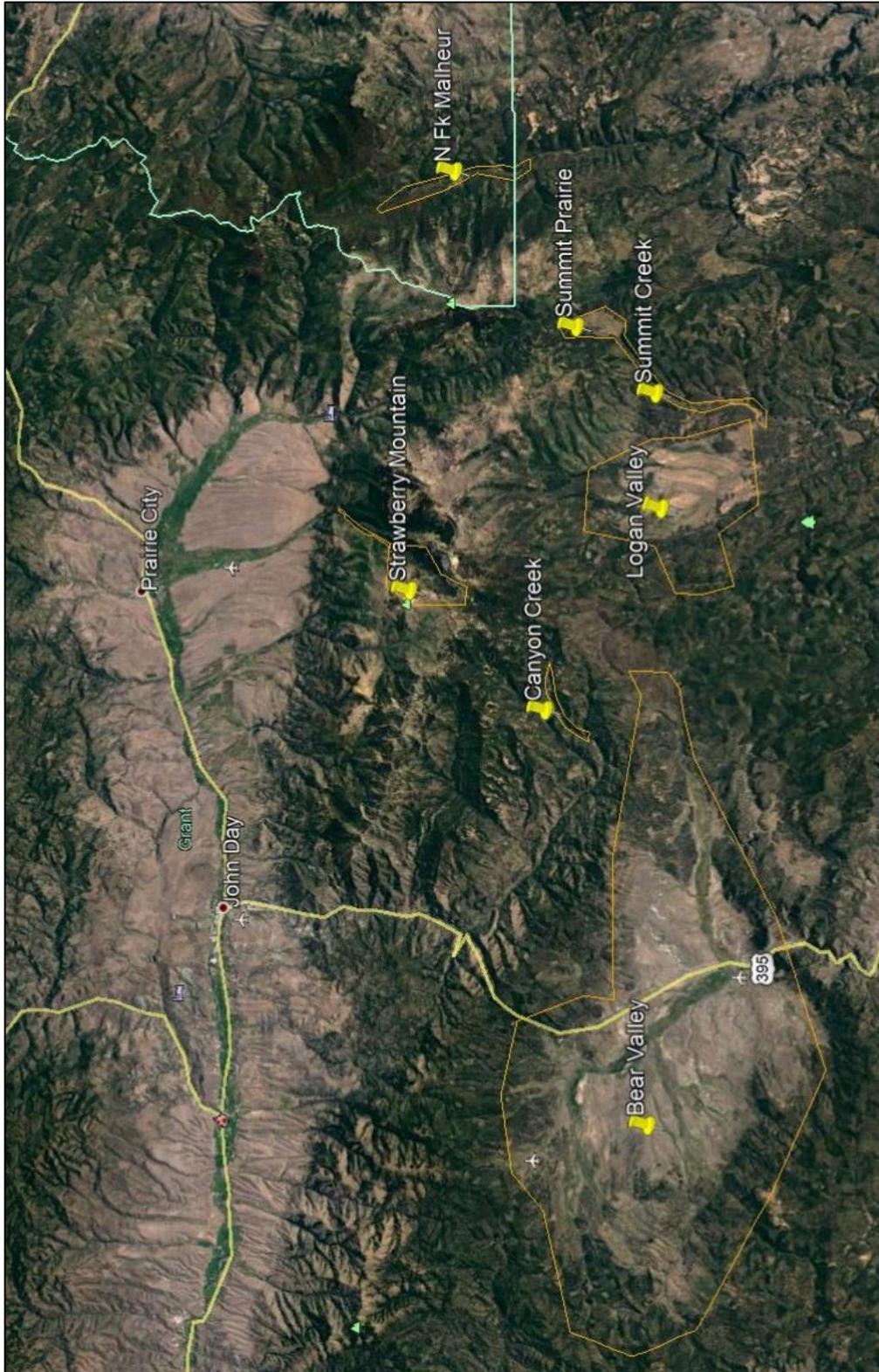


Figure 1. Map of the Malheur National Forest BOS/ CAJO survey region and areas surveyed (pins) in 2018.

CANYON CREEK

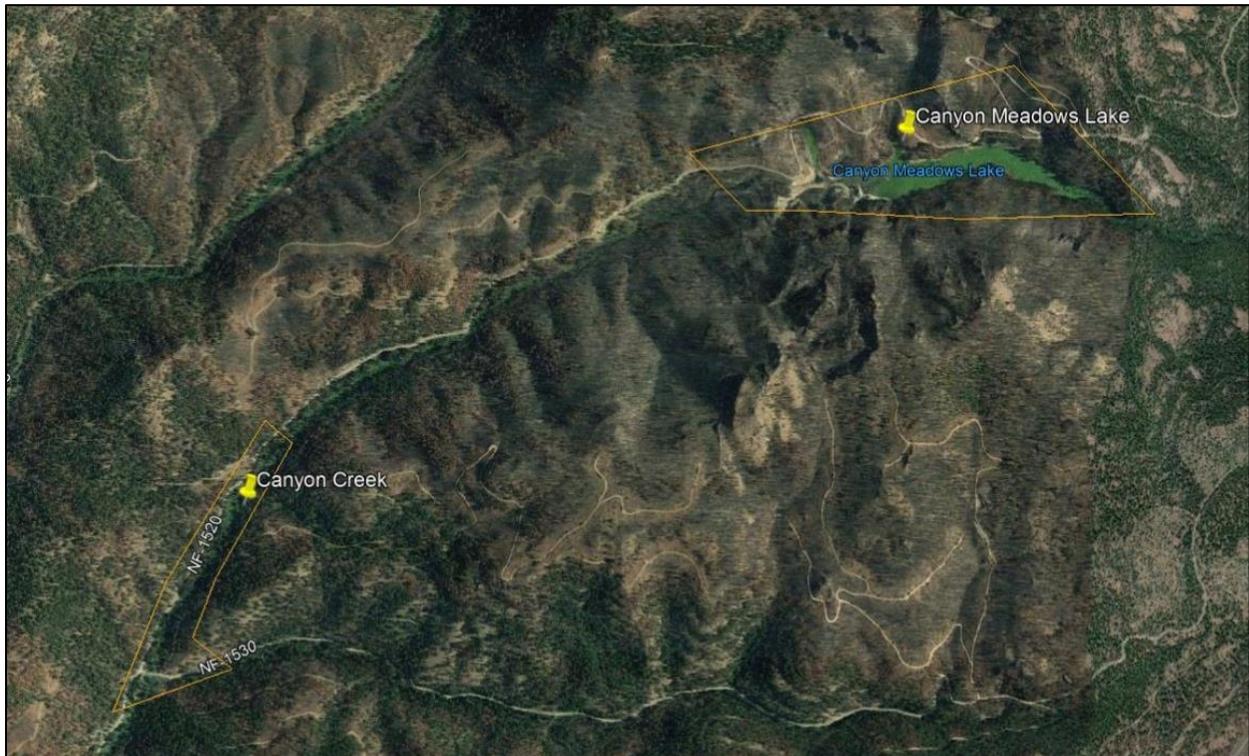


Figure 2. Areas surveyed within the Canyon Creek area.

Site 1. Canyon Meadows (Lake): 5,060 – 5,070 feet.

Surveyed June 4 (1100-1245; mostly sunny with periodic clouds; light winds; low 60s F). The site was dropped after the initial assessment.

Habitat. The site lies within a recent burn. The former lake is now largely filled in with wet meadow vegetation, including some willows. No marsh violets were observed although they may have been present and simply overlooked within this sizeable area. Butterfly nectar sources were mostly limited to the shoreline and surrounding slopes.

BOSE was not observed and appears to be absent. **CAJO** was not observed and is likely absent from this post-burn area due to an apparent lack of DMT.

Butterflies. A total of 19 species were observed throughout the site (Table 2). Most butterflies were observed outside of the vegetation within the former lake, although some were observed at shoreline mud.



Photos 1-2. Two views of Canyon Creek Meadow habitats.

Site 2. Canyon Creek: 4,540 to 4,620 feet.

Surveyed June 4 (1300-1530; mostly sunny with a few clouds; nearly calm; upper 60s F).

Surveyed June 28 (1030-1200; sunny; breezy; upper 60s F).

Habitat. Diverse and well flowered wet to dry creekside riparian meadow plant communities within a mix of burned and unburned forest on adjacent slopes. Some habitat damage observed from camping and vehicles. During the first visit, the *Viola* larval hostplant for BOSE was located within the wettest microsites.

BOSE was not observed on either visit and is probably absent. **CAJO** was not observed. The recent burn appears to have reduced **DMT** abundance throughout the general area and may have negatively impacted any local **CAJO** population, if present.

Butterflies. A total of 30 species (3rd highest for all sites surveyed) were observed throughout the site (Table 2) on the two survey dates combined. Five species of swallowtails (Western Tiger, Pale Tiger, Anise, Two-tailed and Indra) were recorded on June 28.



Photo 3. Some wet depressions along Canyon Creek supported violets.

SUMMIT PRAIRIE-SUMMIT CREEK

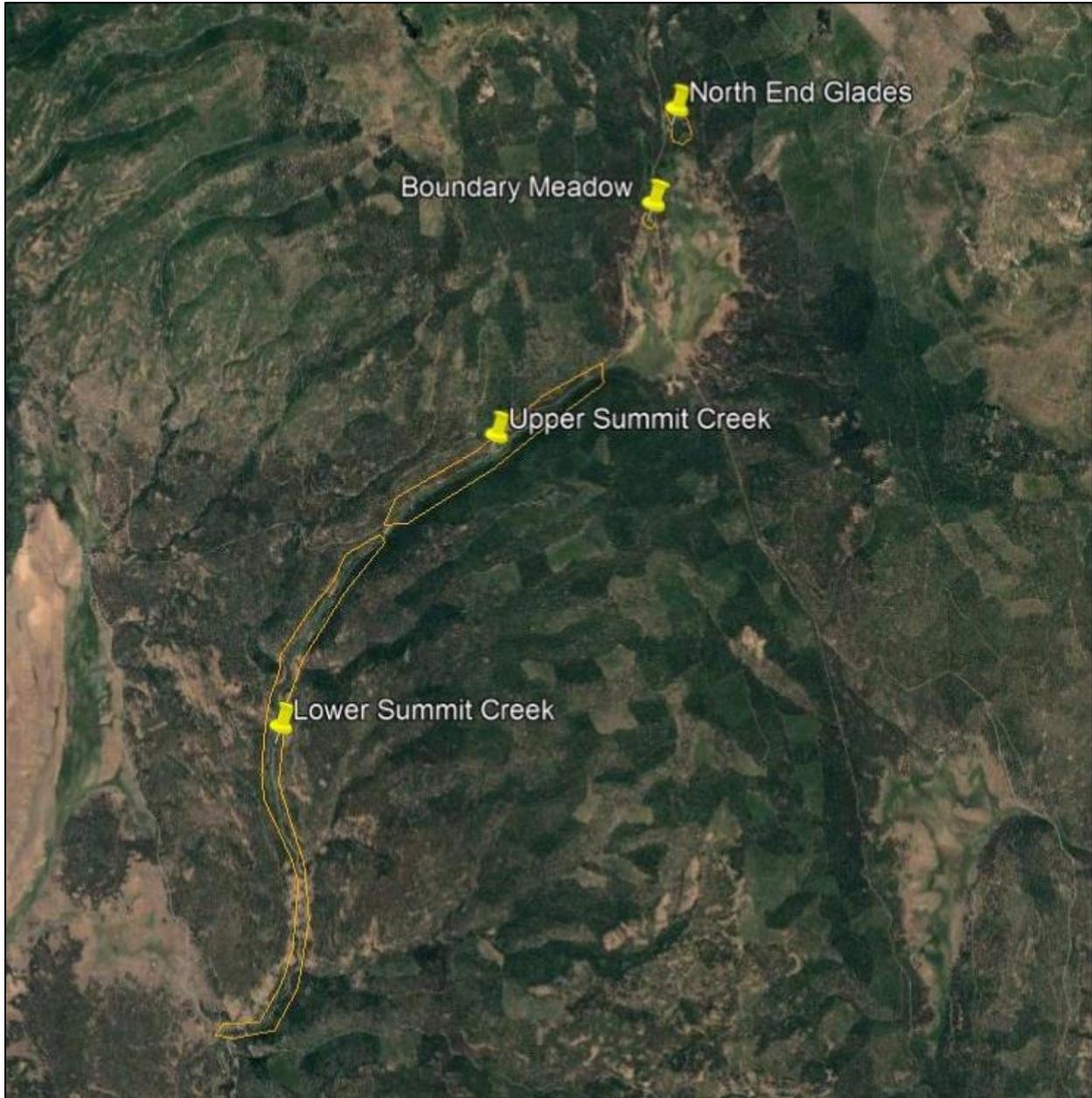


Figure 3. Areas surveyed within the Summit Prairie-Summit Creek sub-unit.

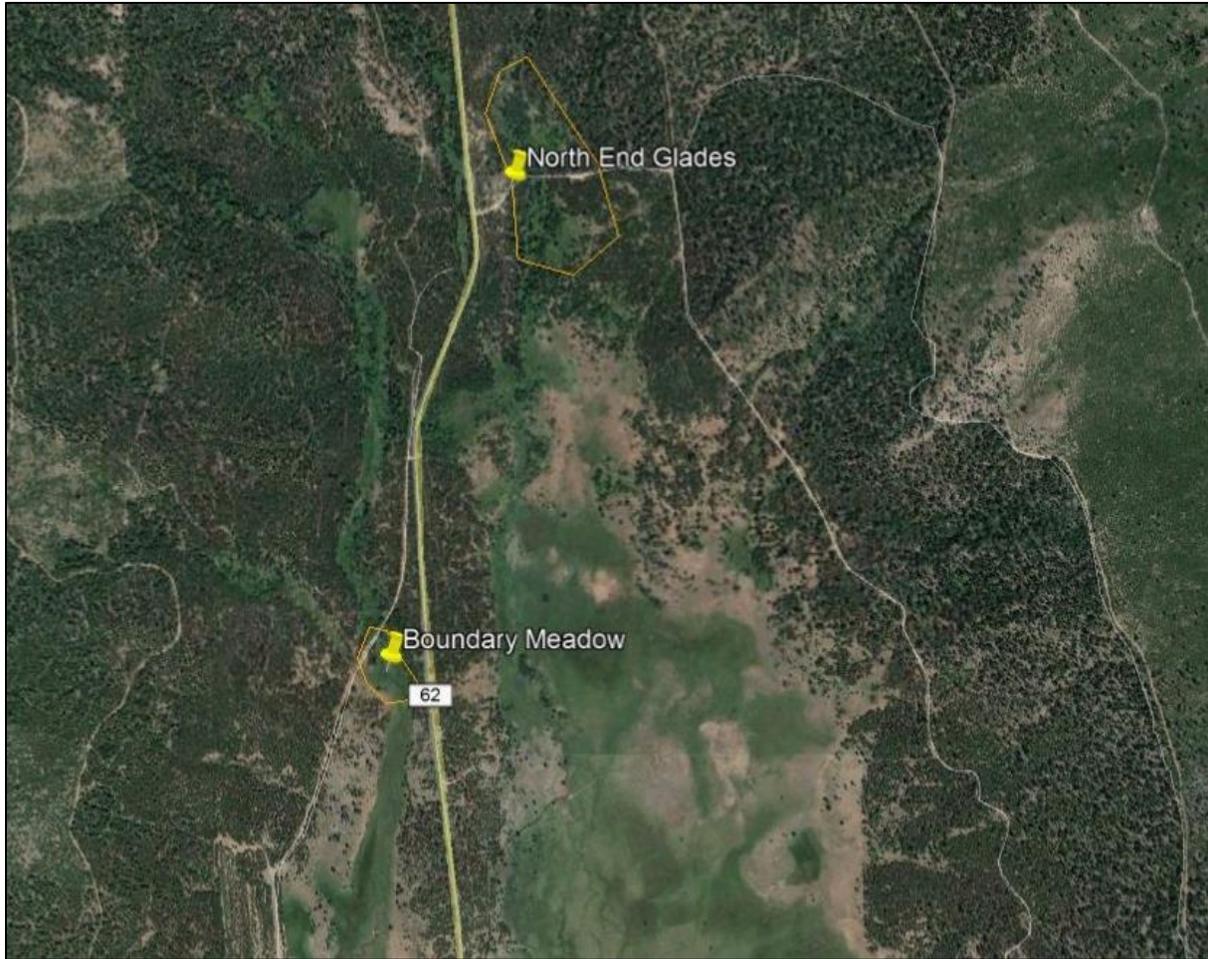


Figure 4. Meadow habitats surveyed at the north end of Summit Prairie

Site 3. North Summit Prairie Meadows: 5,350 to 5,475 feet (Figure 4).

Surveyed June 4 (1000-1130; sunny; nearly calm; low 60s F).

Surveyed June 26 (1400-1450; Sunny, light winds; 70F).

Habitat. The site includes meadow habitats to the north of Summit Prairie private lands. The ‘North End Glades’ includes a series of relatively small, wet to very wet meadow openings along the headwaters of Summit Creek. “Boundary Meadow” is completely open and includes a gradient of streamside wet (marshy) to drier meadow habitats within an enclosure at the boundary of public and private lands. All habitats included various nectar flowers and mud.

BOSE was not observed and is unlikely to occur there. **CAJO** was not observed, but may be present in the area.

Butterflies. A combined total of 22 species were recorded over both survey dates (Table 2).



Photo 4. The Summit Prairie “Boundary Meadow”.

Site 4. Upper Summit Creek: 5,175 to 5,275 feet. (Refer to Figure 3).

Surveyed June 5 (1145-1330; sunny; light winds; mid to upper 60s F).

Surveyed (brief “spot checks”) June 26 (1500-1545; sunny; light winds; low 70’s F).

The site includes a two mile stretch of Summit Creek parallel to Road NF16, from the south end of Summit Prairie and downstream (southwest) for 2 miles to the junction with Road NF1651.

Habitat. A narrow, open matrix of wet to dry streamside meadow habitats bordered by upslope “pine forest”. Both moisture and various flowers attracted many butterflies.

BOSE was not observed and is unlikely to be present. **CAJO** was not observed, but may be present where DMT is locally abundant.

Butterflies. A total of 22 species of butterflies were observed at this site over both dates (Table 2). It was the only location where the Pacific Fritillary (*Boloria epithore*; a single worn individual) – a close relative to BOSE - was observed. In addition, the day-flying noctuid moth ***Alypia langtoni* (Langton’s Forester Moth)** was documented for the first time in Grant County.

Site 5. Lower Summit Creek: 4,950 to 5,165 feet. (Refer to Figure 3).

Surveyed June 7 (1300-1700; sunny, light winds, low to mid 70s F).

Surveyed June 26 (1610-1630; sunny; light winds; low 70s F).

This four-plus mile stretch of Summit Creek borders Road NF1651 from NF16 downstream (south) to lower east Logan Valley. The meadow where the Summit Creek canyon opens up into Logan Valley is included.

Habitat. Similar to Upper Summit Creek (wet to dry meadows) for the upper two miles before entering a steeper walled canyon with more riparian trees and shrubs and fewer meadow openings. A meadow at the lower mouth of the canyon hosted wet to dry areas and a variety of wildflowers.

BOSE was not observed and is unlikely to be present. No violets were seen. **CAJO** was not observed, but the **Thicket Hairstreak (*Callophrys spinetorum*)** was recorded (June 26) and indicates the **presence of DMT in the area.**

Butterflies. A combined total of 28 species of butterflies were observed at this site over both dates (Table 2).



Photo 5. A section of Upper Summit Creek.

NORTH FORK MALHEUR RIVER

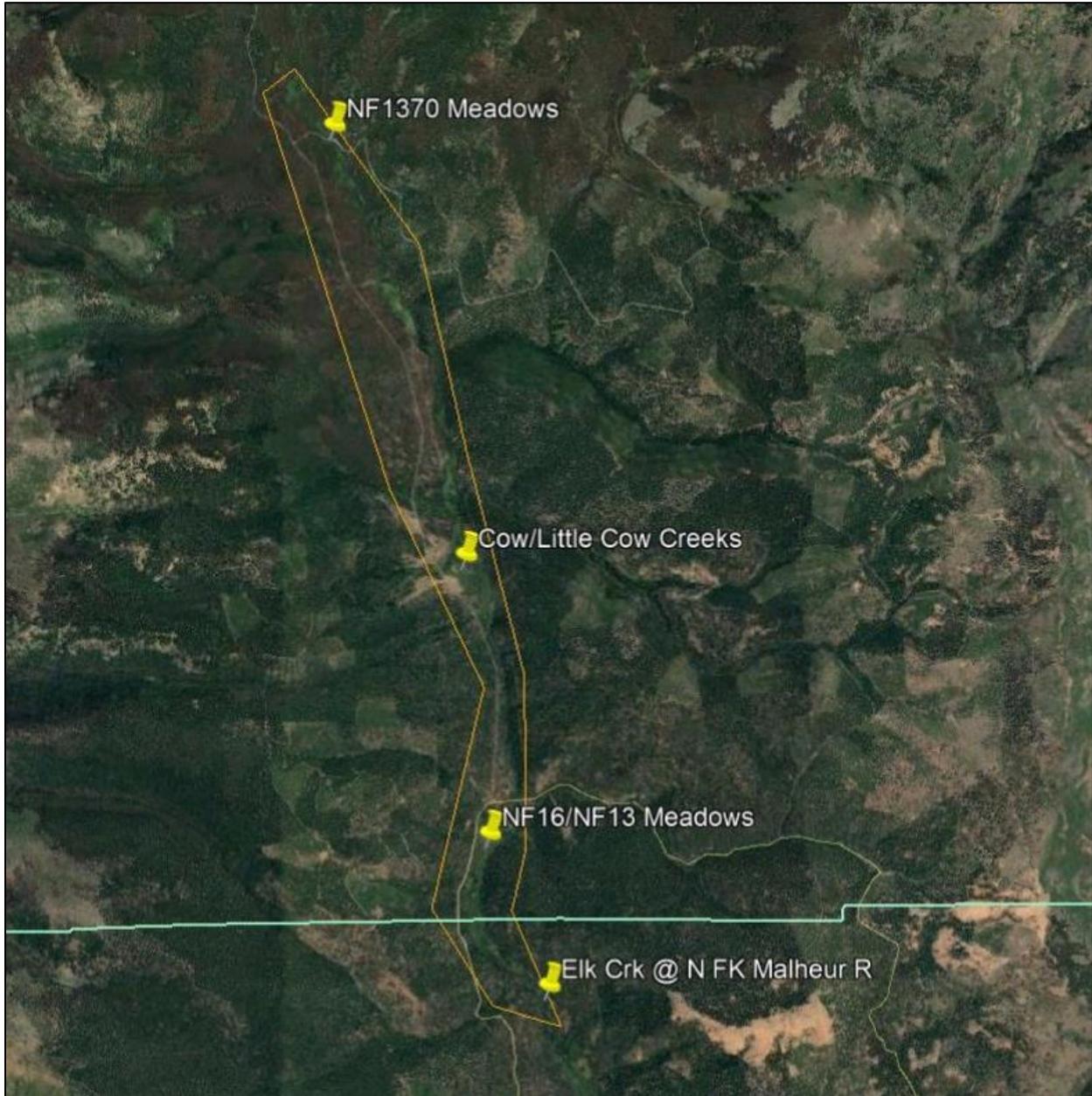


Figure 5. Sites visited in the North Fork Malheur River sub-area. Note that the three upper sites are in Baker County whereas the lowermost site is in Grant County.

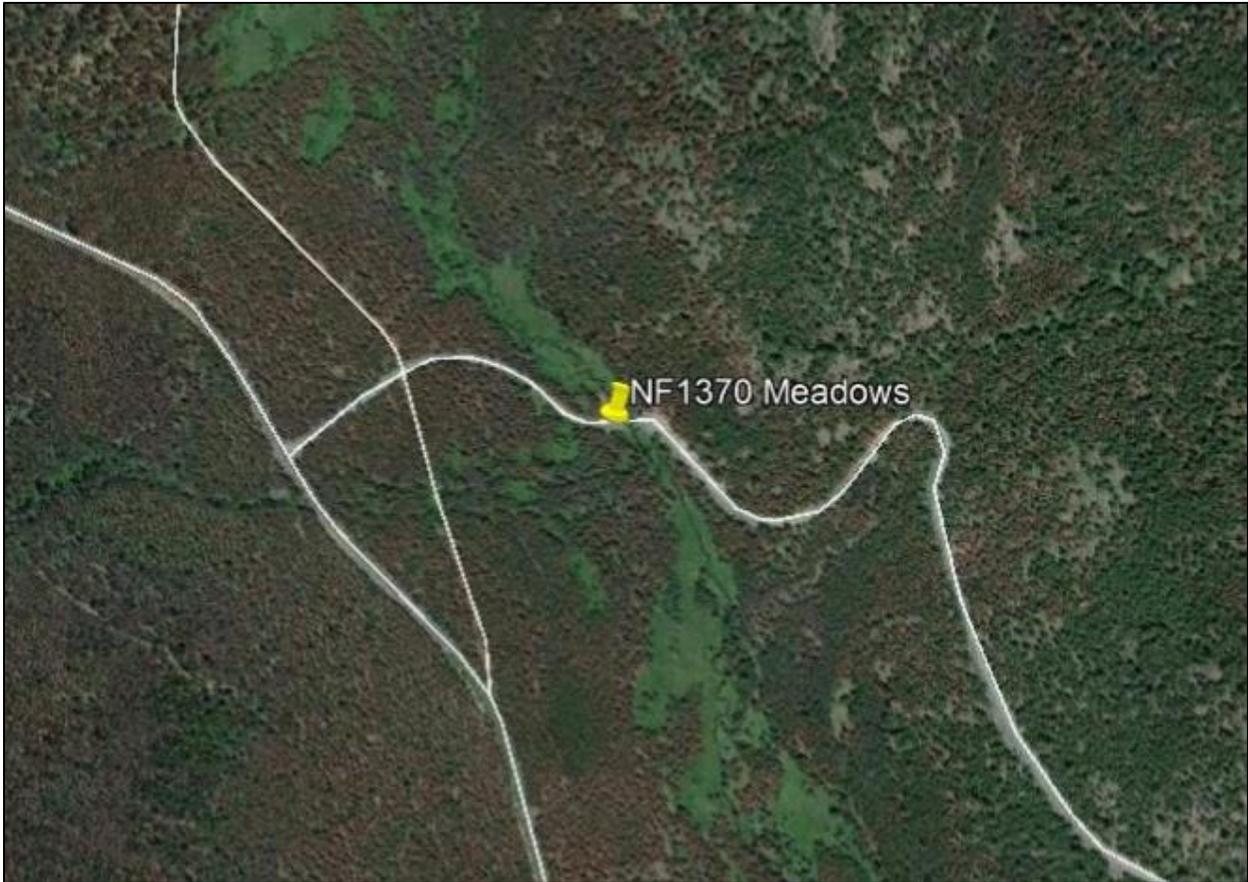


Figure 6. These NF1370 Meadows (5,450 feet) were not surveyed.

NF 1370 Meadows were scouted briefly (930 hours) but **not surveyed** on the morning of June 26 prior to beginning formal surveys elsewhere in the area.

Located east of Road NF13 where Road NF1370 crosses the North Fork Malheur River.

Habitat. Extremely wet streamside meadows on the bank of the North Fork Malheur River.

At nearly 5,500 feet elevation the site was near the upper limit of potential BOSE habitat.

Heavy pine forest habitats likely hosted DMT (not observed) although any adult **CAJO** would not have been detectable until later in the day under warmer conditions.



Figure 7. The Cow Creek/Little Cow Creek survey area.

Site 6. Cow Creek/Little Cow Creek Meadows: 5,165 to 5,200 feet.

Surveyed June 7 (1000-1100; mostly sunny with some clouds ; wind 8-10mph; low 60s F).

Surveyed June 26 (1030-1130; sunny; nearly calm; low 60s F).

These meadows – located between Road NF13 and the North Fork Malheur River were surveyed as a single site.

Habitat. Small streams coursing through dry upland to very wet (boggy) riverside meadows with locally abundant flowers and streambank mud. The surrounding area is well forested (lodgepole pine forest with some ponderosa pine). Good butterfly habitat.

BOSE was not observed and is unlikely to be present. No violets were seen. **CAJO** was not observed, but the more common **Thicket Hairstreak** (*Callophrys spinetorum*) was recorded (June 7) and indicates the **presence of DMT in the area**.

Butterflies. A total of 17 species of butterflies were observed over both dates combined (Table 2).



Photo 6. Little Cow Creek Meadow.



Photo 7. Male greenish blue (*Plebejus saepiolus rufescens*).

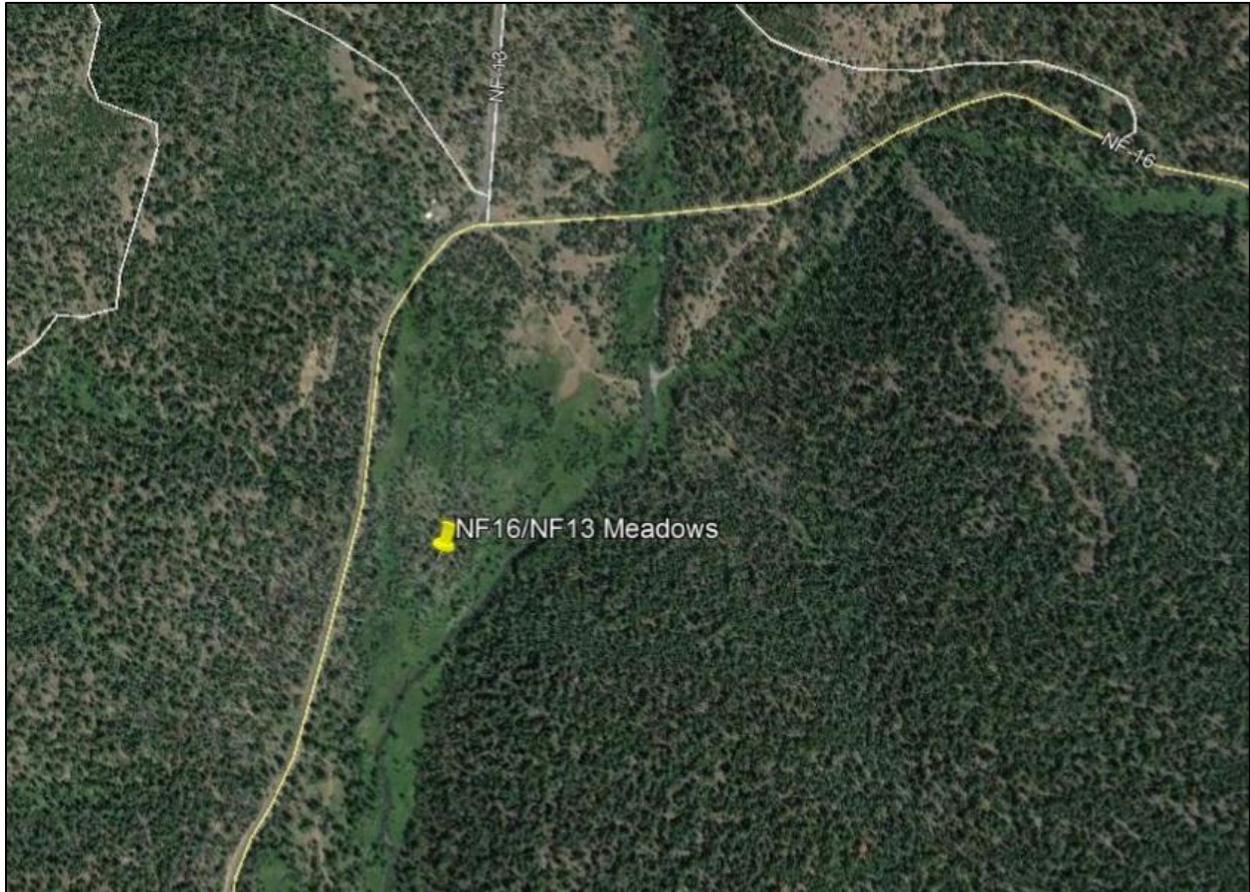


Figure 8. The NF16/NF13 survey area.

Site 7. Road NF16/NF13 Junction Meadows: 4,990 to 5,040 feet.

Surveyed June 7 (1115-1200; sunny to some overcast; breezy; mid 60s F).

Surveyed June 26 (1140-1245; sunny; nearly calm; low to mid 60s F).

A wet meadow complex south of the junction of roads NF16 and NF13 and on the west bank of the North Fork Malheur River.

Habitat. Very wet seep-meadow complex within semi-forested river bottom lands. A moderate abundance of nectar flowers were present.

BOSE was not observed and is unlikely to be present. No violets were seen. **CAJO** was not observed, but Thicket Hairstreak was recorded at nearby Cow Creek and indicates that **DMT** is present in the general area.

Butterflies. A combined total of 10 species of butterflies were observed at this site over both surveys (Table 2).

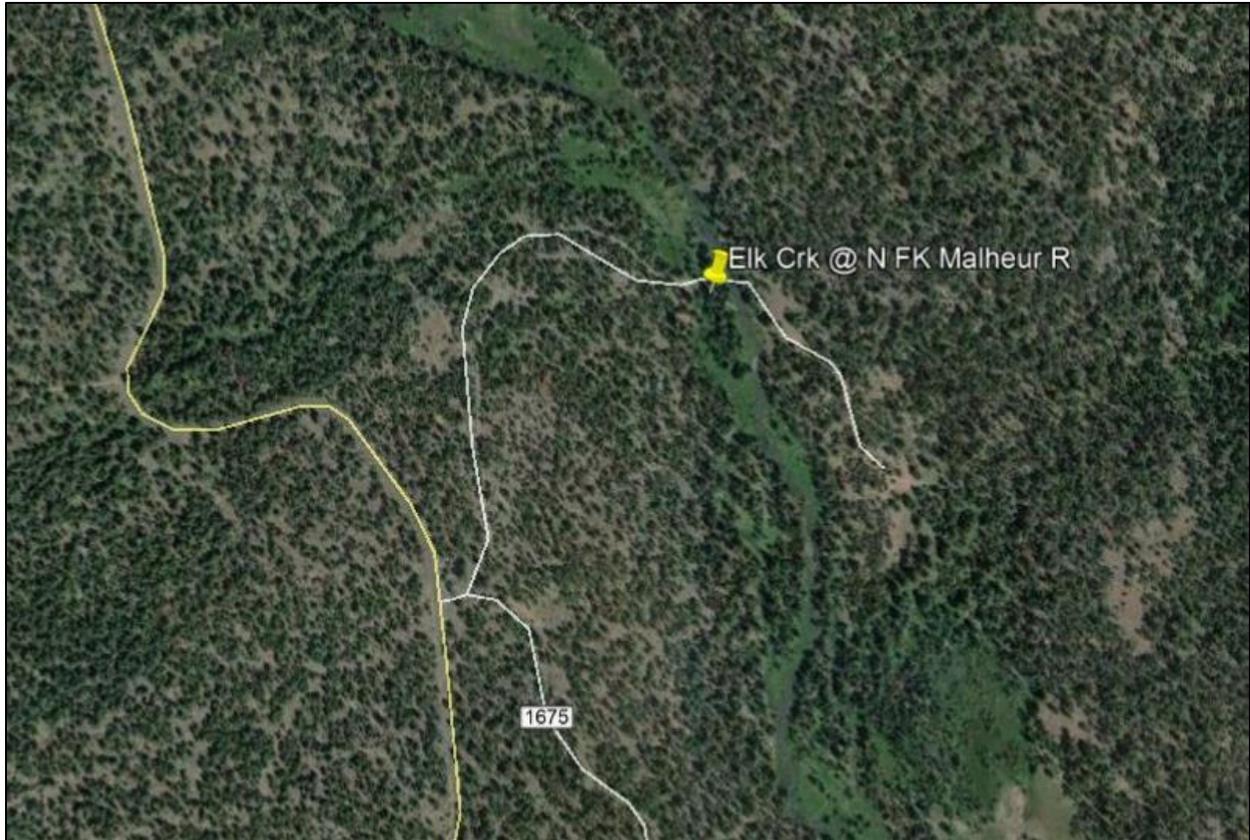


Figure 9. Meadows surveyed at the confluence of Elk Creek and North Fork Malheur River.

Site 8. Confluence of Elk Creek and North Fork Malheur River: 4,915 to 4,950 feet.

Surveyed June 26 (1300-1330; sunny; calm; upper 60's F).

Habitat. Both wet and dry river bank meadow habitats and ponderosa/lodgepole pine forest. Moderate nectar and mud resources present.

BOSE unlikely to occur within the rather limited amount of wet meadow habitat present. **CAJO** was not observed, although the site included some large ponderosa pines which may have hosted **DMT**.

Butterflies. Just 4 species of butterflies were recorded (Table 2) due to a focus on locating wet areas that could support BOSE during just a 30 minute survey.

STRAWBERRY MOUNTAINS



Figure 10. Sites surveyed in the Strawberry Mountain sub-area.

Site 9. Indian Creek Trailhead: 4,440 to 4,680 feet.

Surveyed June 6 (945-1015; sun; nearly calm; low 60's F).

For a distance of about 1/3 mile, Indian Creek (County Road 71) federal lands begin as BLM parcels continuing upslope to the Malheur National Forest and Indian Creek Trailhead.

Habitat. Unsuitable. Dry, steep, upland slopes within a recent burn.

A single central Grant County Record for **BOSE** was obtained by H. E. Rice from Indian Creek (c. 4,000 feet) and was the incentive for this visit to the Indian Creek area. Whereas it is not unlikely that the population may persist, it would be within the open, wet, boggy meadows on private lands downslope and about 3 miles NNW of Indian Creek Trailhead.

Since **CAJO** requires relatively mature conifer stands for DMT to be in sufficient abundance as a larval host, the recent nature of the burn precludes any reasonable likelihood of its occurrence in the local area.

Butterflies. Little time was spent searching the area and just 3 species of butterflies were noted (Table 2).



Photo 8. The upper Indian Creek area proved unsuitable for either target species.



Figure 11. Strawberry Mountain Wilderness Survey Site.

Site 10. Strawberry Mountain Wilderness: 4,740 to 8,230 feet.

Surveyed June 27 (1000-1600; sunny; breezy (ridge) to nearly calm (inside basin); 60-70 F).

The entire trail was surveyed over the course of one day with assistance from Wildlife Program Manager Clark Reames. The best potential **BOSE** habitats were within the “high wet meadows” (7,775 to 7950 feet) which perhaps proved to be “too high” and were much too wet to access on foot. Trailside surveys of several meadows were made without **BOSE** being observed.

Potential **CAJO** habitats included the more heavily forested mid to lower slopes and trailside areas (4,740 to 7,000 feet) all the way to the northeast parking area. While **CAJO** was not observed, the **Thicket Hairstreak** was found at several locations from the east side of

Strawberry Lake to the north parking area. Overall, **this lower area appeared to have the best potential habitat for CAJO of any site surveyed during the project and additional surveys there may be warranted.**

Butterflies. While butterflies were only abundant on the upper south to west facing slope from the trailhead to the ridgetop of the basin, butterflies were seen regularly throughout the survey site. A combined total of 17 species of butterflies was tallied by day's end (Table 2).



Photo 9. Many butterflies were observed from the trail along the south to west facing slopes from the trailhead to the ridgeline, before entering the Strawberry Lake Basin. The Clodius Parnassian, Arrowhead Blue and Coronis Fritillary, as well as hordes of California Tortoiseshells were encountered throughout this area.



Photo 10. One of several high wet meadows surveyed for BOSE. The Indra Swallowtail and Hydaspe Fritillary were regularly seen in this area.



Photo 11. The forested slopes surrounding Strawberry Lake appeared capable of hosting CAJO. The Thicket Hairstreak (another DMT user) was observed several times in this area.

LOGAN VALLEY

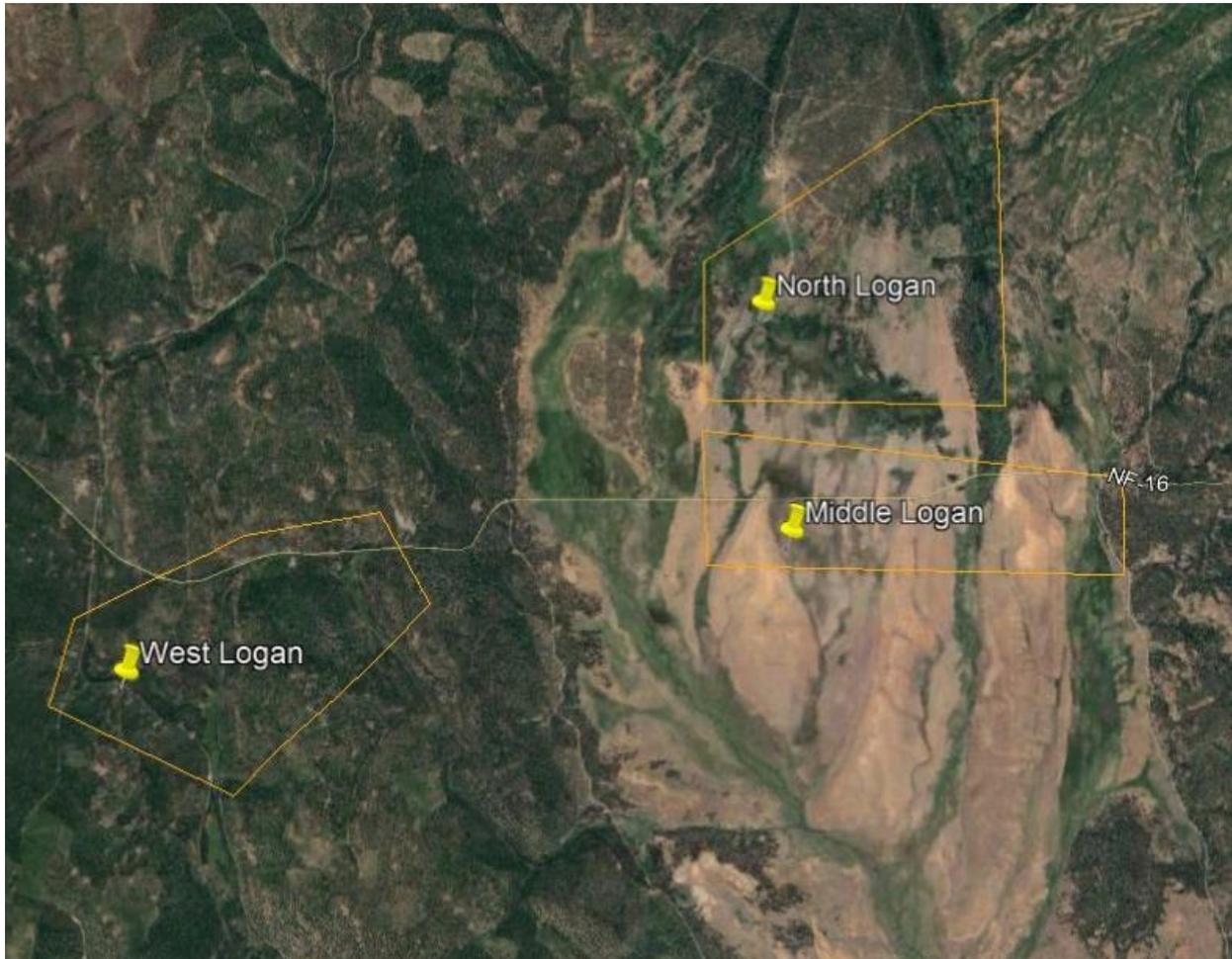


Figure 12. The Logan Valley sub-area showing North, Middle and West site polygons.

The Logan Valley encompasses a large area of mixed public and private lands. The above polygons show three areas, each considered here as sites, within which specific portions of high quality potential habitats for BOSE (all portions) and CAJO (forested areas only) were surveyed. These are referred to below as North Logan, Middle Logan and West Logan. Since most private lands lie within the southern Logan Valley and public access was difficult to assess, little effort was made to include it.

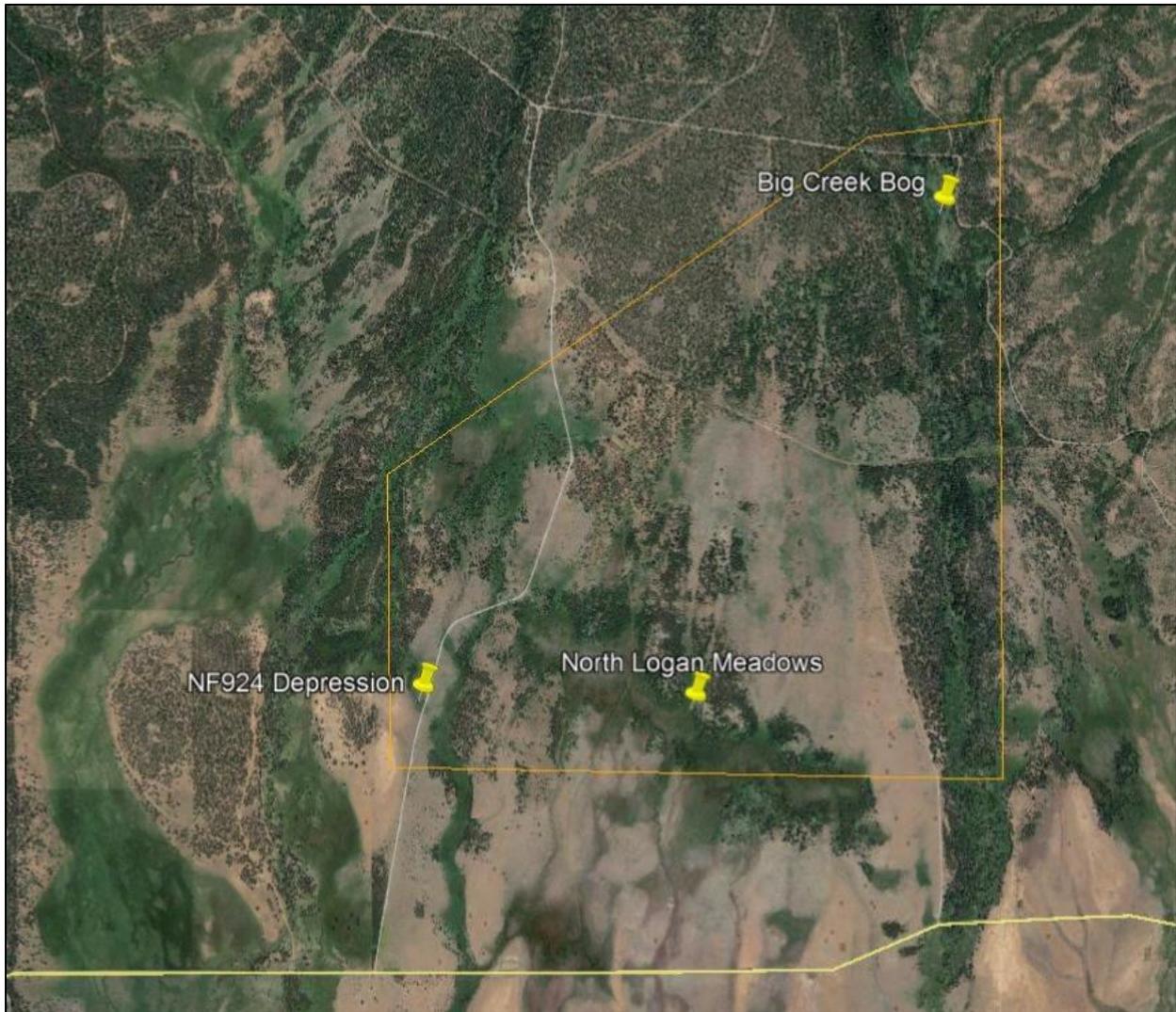


Figure 13. North Logan polygon/site showing areas of survey concentration.

Site 11. North Logan: 5,120 to 5,280 feet.

Surveyed June 6 (1345-1700; sunny; light winds; mid-upper 70s F).

The Road **NF924 Depression** (5,115 feet) was the first area of localized wet prairie encountered in the Logan Valley and was, therefore, surveyed for a “first look” at this habitat type and the associated butterflies. No **BOSE** were encountered, but many other butterflies were concentrated in moister, well flowered areas.

The **North Logan Meadows** (5,120 – 5,150 feet) included a rather large area of seasonally wet prairie habitat, although most of it was already completely dry by the survey date. A search was made for remaining wet areas with little success.

A search for more permanently moist bog habitat ended at **Big Creek Bog** (5,260 – 5,280 feet). Open areas were somewhat limited and movement was hampered by fallen trees and areas of shallow surface water. Many butterflies – particularly various species of blues – were attracted to the available moisture in the heat of the afternoon. A total of 8 species of butterflies and one diurnal sphinx moth (*Hemaris thetis*) were encountered.

Neither **BOSE** nor its violet hostplant were encountered at North Logan.

Only Big Creek Bog offered a realistic possibility of encountering **CAJO**, although the dominant forest type there (lodgepole pine) is not considered good habitat for the butterfly.

Butterflies. A total of 18 species of butterflies were documented for the entire North Logan site (Table 2), including a sizable population of Edith’s Checkerspot (*Euphydryas editha* (NE Oregon segregate)) and a single Northern White Skipper (*Heliopetes ericetorum*), a seldom encountered species throughout much of Oregon.



Photo 12. Wet meadow habitat (North Logan Meadows).



Photo 13. Plentiful bistort in bloom (North Logan Meadows).



Photo 14. Pacific azure (*Celastrina echo*) males on a wet log (Big Creek Bog).



Figure 14. Middle Logan polygon/site showing areas of survey concentration.

Site 12. Middle Logan: 5,050 - 5,080 feet.

Surveyed June 8 (all areas) (1000-1230; sunny; light winds; low to upper 60s F).

Surveyed June 26 (Bosonberg Creek, Logan Willow Bog only) (1700-1745; sunny; breezy; low 70s F).

Seasonal wet prairie on the north side of the NF16 **Observation Parking Area** (5,075 feet) was surveyed in the vicinity of moisture (mud) and flowers. Wet areas were limited even in early June. The area was omitted from the second round of surveys due to a lack of both moisture and violets, as well as by the need to visit higher priority areas.

The **Logan Willow Bog** (5,060 feet) appeared to have good potential habitat for **BOSE** within an area of very wet prairie abundant willows, yet the species was not encountered on either survey date.

The **Bosonberg Creek** habitat included a marshy area south of Road NF16 and between Road 1647 on the east and a private land boundary fence line to the west. Ample nectar flowers were present.

Neither **BOSE** nor **CAJO** were encountered and both can probably be considered absent.

Butterflies. The entire **Middle Logan** survey site covered a variety of seasonal to permanent wet habitats. A combined total of 27 species of butterflies were documented (Table 2).



Photo 15. Middle Logan Willow Bog.



Photo 16. Wet habitat at Bosonberg Creek.



Photo 17. Boisduval's blue (*Plebejus icarioides pembina*).

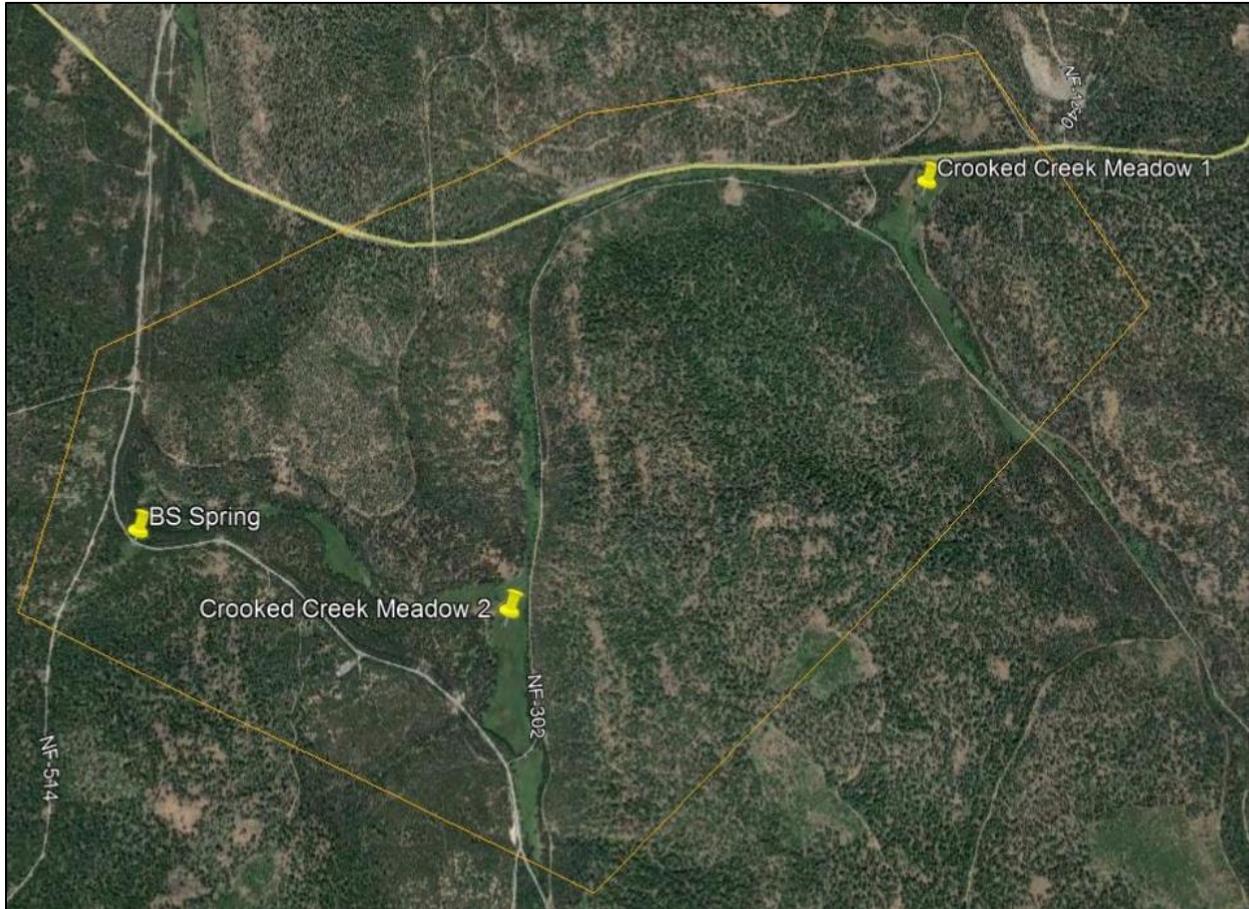


Figure 15. West Logan polygon/site showing areas of survey concentration.

Site 13. West Logan: 5,220 - 5,370 feet.

Surveyed June 5 (Crooked Creek Meadow 1) (1720-1750; sunny; near calm; 75F).

Surveyed June 8 (BS Spring and Crooked Creek Meadow 2) (1300-1500; mostly sunny with overcast periods; quite windy; low to mid 70s F).

Crooked Creek Meadow 1 (5,220 feet) was surveyed briefly late in the day as butterfly activity was waning. Much of the higher quality wet meadow habitat and more disturbed cattle pond areas were searched without success.

BS Spring (5,370 feet) is a small, yet very high quality wet meadow parcel. A quick search for **BOSE** and **CAJO** was made amongst the many flowers without success.

Crooked Creek Meadow 2 is one of the larger wet meadows along this small stream. Much of the meadow had to be searched from the perimeter given the amount of very wet habitat. A walking survey was made in the lee of prevailing winds at the north end, within a wet to dry

area that contained abundant flowers and many butterflies. Signs of cattle grazing were apparent, but appeared to have caused relatively minimal damage to the site.

The West Logan meadows do not appear to host either **BOSE** or **CAJO**. **BOSE**, if present, should have been detected. Detecting **CAJO** is generally more difficult and its apparent absence is less conclusive.

Butterflies. A total of 13 species of butterflies were recorded (Table 2).



Photo 18. Late afternoon at Crooked Creek Meadow 1.



Photo 19. Crooked Creek Meadow 2.



Photo 20. Northern checkerspot (*Chlosyne palla blackmorei*).

BEAR VALLEY



Figure 16. The Bear Valley sub-area and survey locations.

Bear Valley Subarea: 4,850 - 5,215 feet

Bear Valley encompasses a large expanse of valley bottom private lands with National Forest at the periphery of the main valley floor. The above pins indicate the four sites surveyed within the region.

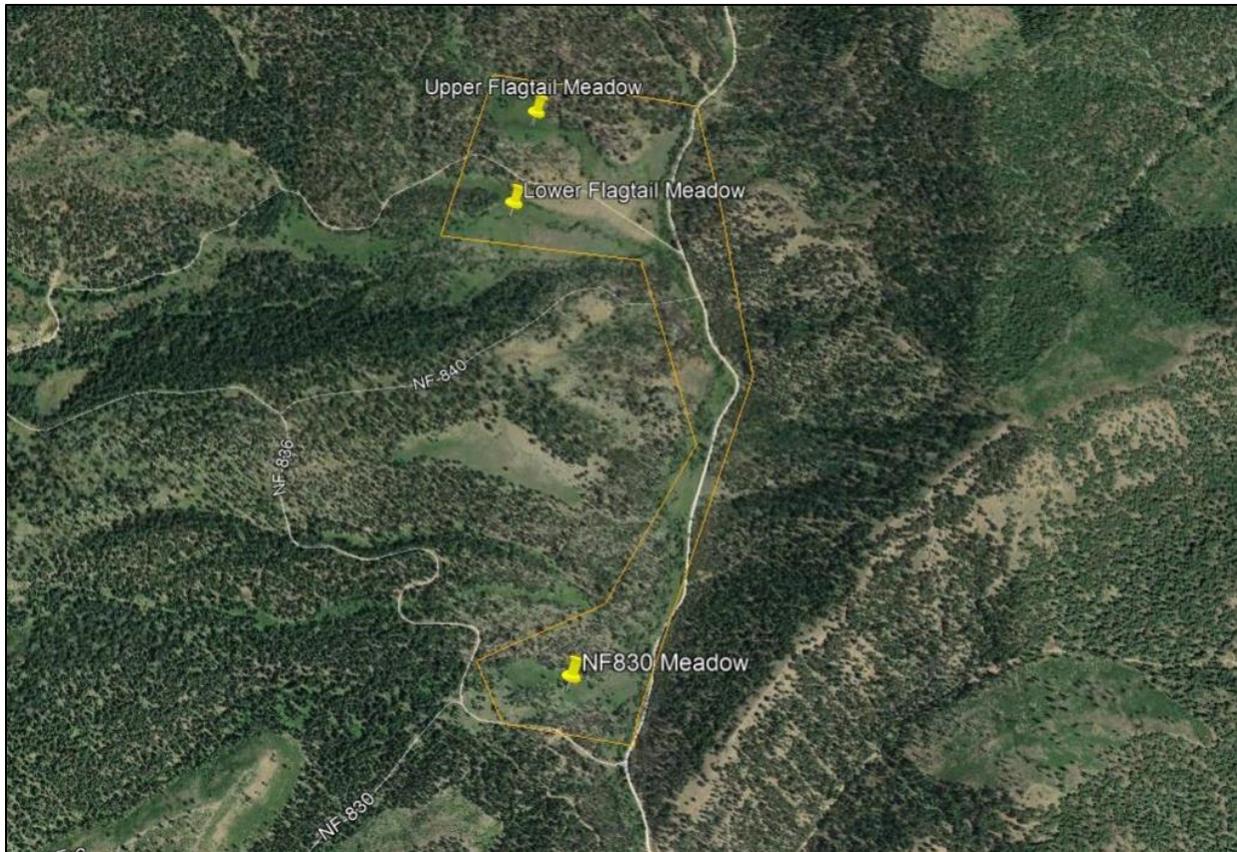


Figure 17. Upper Road 24 meadows site.

Site 14. Upper Road 24 Meadows: 5,110 – 5,215 feet

Surveyed June 6 (1345-1445; mostly sunny with some clouds; light winds; upper 70s F).

Surveyed June 25 (1100-1330; sunny; light winds; low 70s F).

The site includes three nearby meadows situated one to two miles north of the Izee-Paulina Hwy just to the west of road NF24. **North Flagtail Meadow** and **South Flagtail Meadow** are adjacent to road NF 805. The third meadow is located just north of road NF 830, and is referred to here as the **NF830 Meadow**. All meadows had at least some wet areas and a good diversity of flowers. Violets were present in the wettest portion of the **NF830 Meadow**, but were not observed elsewhere at the site.

BOSE was not observed and is unlikely to occur at the site. **CAJO** was not seen, but cannot be ruled out of the local fauna since the presence of the **Thicket Hairstreak** indicates that DMT is present nearby.

Butterflies. An impressive total of 33 species of butterflies was recorded from the survey area (Table 2) and represents the 2nd highest species richness of any site.



Photo 21. Upper Road NF24 site at South Flagtail Meadow: willows within moist prairie.

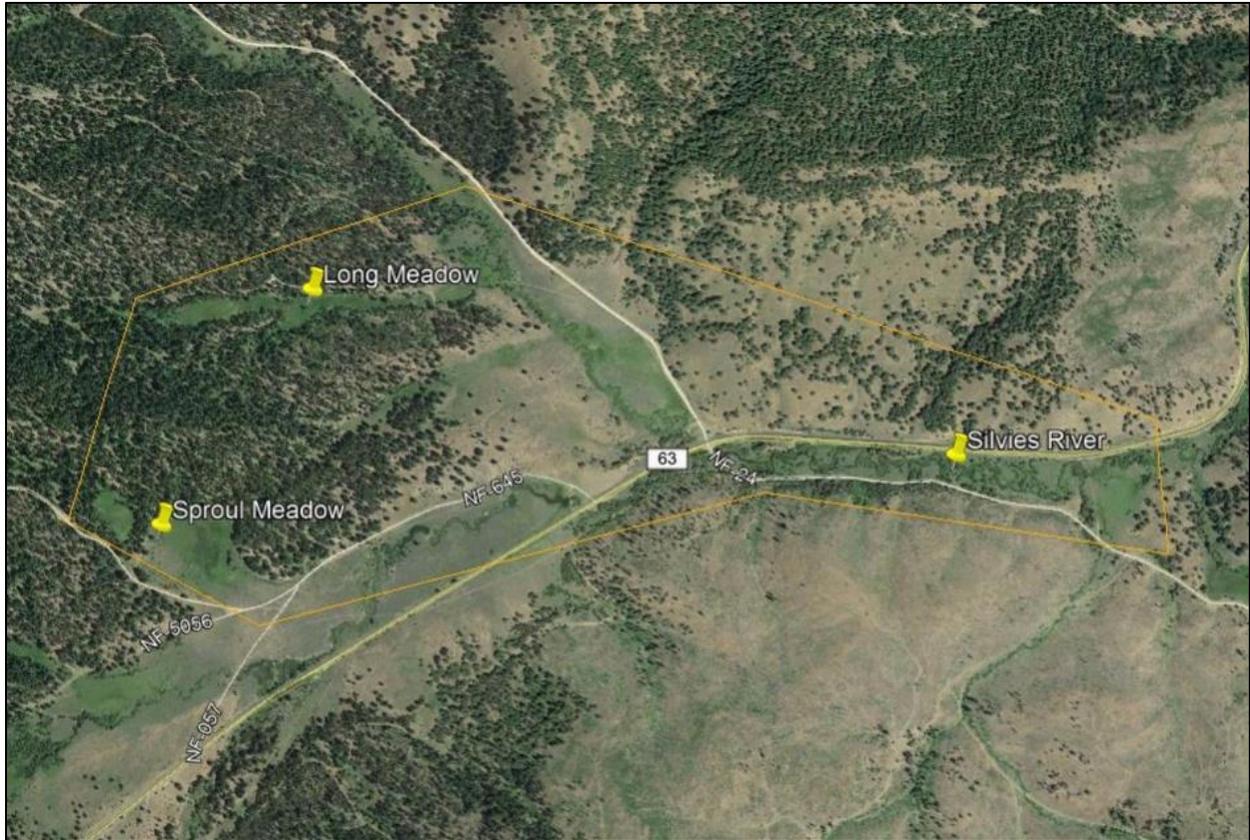


Figure 18. Lower Road 24 meadows site.

Site 15. Lower Road 24 Meadows: 5,015 - 5,150 feet

Surveyed June 6 (1500-1715; sunny; light winds with gusts; upper 70s F).

Surveyed June 25 (1345-1600; sunny; light winds; low to mid 70s F).

Surveyed June 28 (Sproul Meadow only) (1510-1540; sunny; light winds; about 70F).

Three areas of the site were extensively surveyed. Meadows bordering the **Silvies River** were surveyed for about 2/3 mile going east from road NF 24. Few moist meadow microsites were encountered and the area was dropped after the first survey. **Long Meadow** offered fairly extensive areas of very wet meadow habitat, pockets of purple violets, and relatively abundant flowering forbs. **Sproul Meadow** was not surveyed until late June, and then twice over 4 days. The presence of the **Garita Skipperling (*Oarisma garita*)** - a **first time Grant County record** and a range extension to the SW of its known Oregon range – made the site worth a thorough look.

Butterflies. While neither **BOSE** (consider absent) or **CAJO** (remains a possibility) were documented, an all-sites high checklist of 36 butterflies was compiled (Table 2).



Photo 22. Lower Road NF24 at Sproul Meadow - Garita Skipperling habitat.

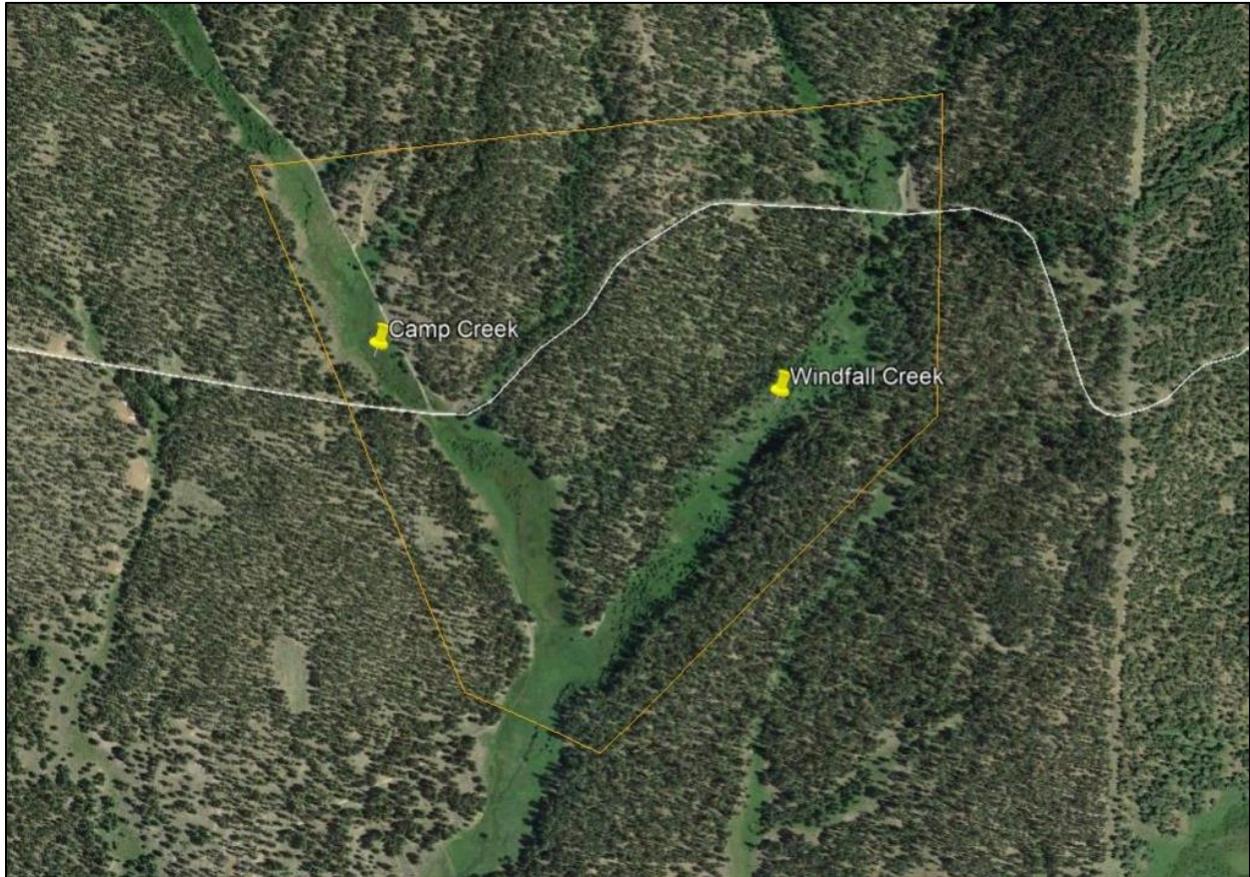


Figure 19. The Windfall Creek/Camp Creek survey site.

Site 16. Windfall/Camp Creeks (4,800 – 4,860 feet)

Surveyed June 6 (1145-1315; sunny; light winds; upper 60s to low 70s F).

Windfall Creek was accessed from the north side of Road 333 and surveyed down to its confluence with Camp Creek. From there, the survey continued up Camp Creek to above Road 333.

Habitat. A number of very wet areas within a mixture of meadow types but none appeared to host violets. Mud and various flowers were encountered on a patchy, yet regular basis.

BOSE was not observed. Flowers were carefully inspected for **CAJO** without success, although ample forest that might host **DMT** surrounded the area.

Butterflies. A total of 24 butterflies were identified from the site (Table 2).



Photo 23. Looking up Camp Creek from the confluence with Windfall Creek. Willows growing within marshy wet meadow habitat offers a “classic” BOSE habitat look.

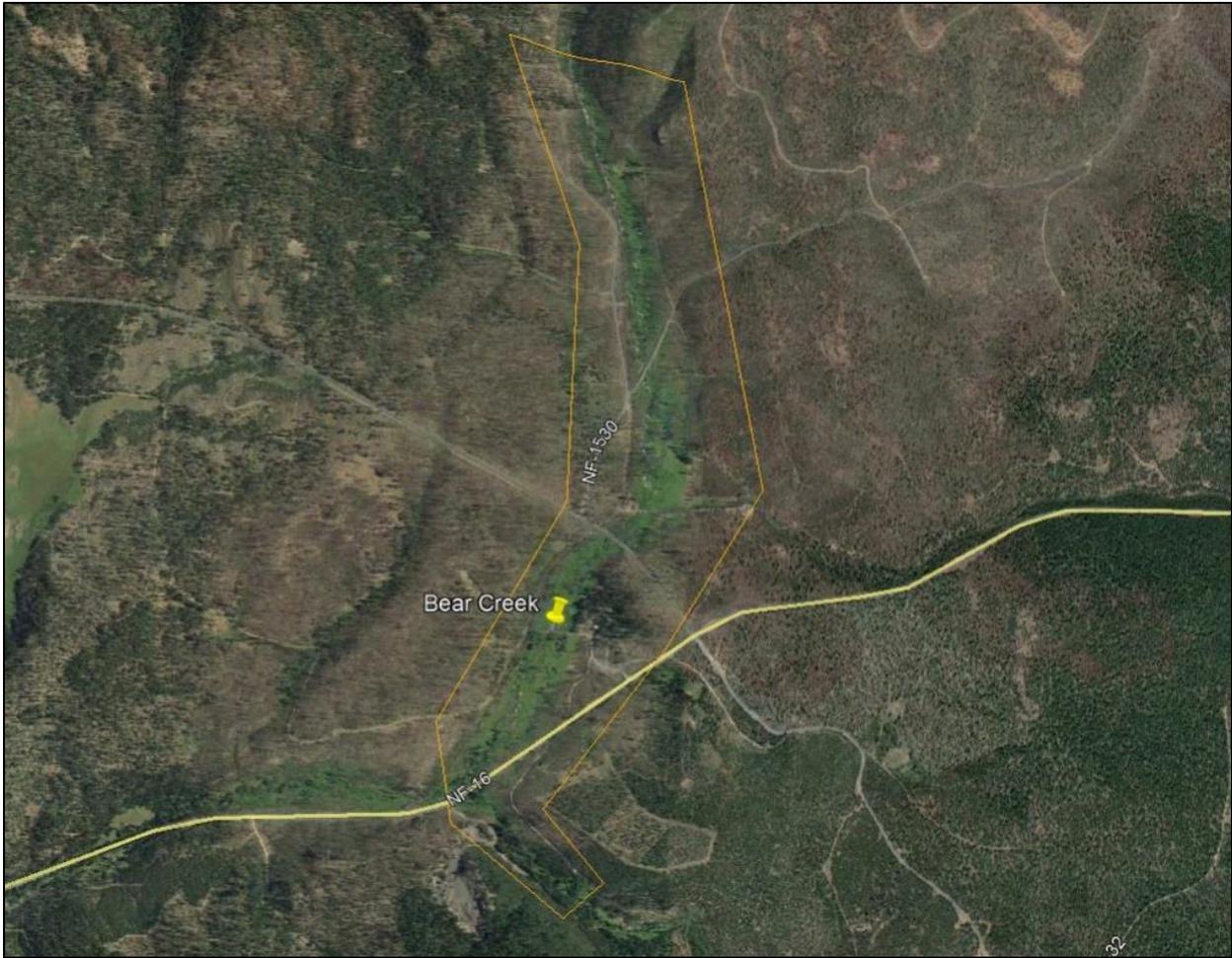


Figure 20. The Bear Creek survey site.

Site 17. Bear Creek: 4,900 – 4,980 feet

Surveyed June 28 (1220-1430; sunny; noticeable wind; upper 60s to about 70F).

Near the junction of roads NF15 and NF16, **Bear Creek** flows slowly, creating a broad lush swath of riparian vegetation that includes a significant amount of willows. The area lies within a recent burn. Creek habitats were accessed on foot where possible, upstream along road NF 1530 to where the creek narrowed, at Parish Cabin Campground, and at the confluence with Little Bear Creek. While the area appeared to be good potential habitat for **BOSE** from a distance, a closer look revealed a severely impacted post-fire environment of little use to the species. **CAJO** would have been excluded from the area by the lack of DMT-bearing pines.

Butterflies. Butterflies were relatively scarce with just 7 species documented (Table 2).



Photos 24-25. Two views of Bear Creek near the junction of roads NF15 and NF16.

Table 2. Butterflies documented by survey site (June 2018).

Family	Taxon	Survey Site (by #)																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Hesperiidae	<i>Erynnis persius ?fredericki</i>		X	X		X						X		X	X	X		X
	<i>Heliopetes ericetorum</i>			X								X						
	<i>Hesperia juba</i>	X	X	X	X		X					X	X	X	X	X	X	
	<i>Oarisma garita garita</i>															X		
	<i>Polites sonora</i> (NE OR segregate)				X	X	X								X	X		
	<i>Pyrgus communis communis</i>			X			X					X	X	X	X	X	X	X
	<i>Pyrgus ruralis ruralis</i>	X									X				X			
Lycaenidae	<i>Callophrys augustinus</i> (ssp. <i>concava</i> ?)	X			X	X					X	X						
	<i>Callophrys eryphon eryphon</i>		X	X	X	X					X	X	X	X	X	X	X	X
	<i>Callophrys gryneus</i> "nr. <i>chalcosiva</i> "					X												X
	<i>Callophrys sheridanii interrupta</i>					X					?		X		X			
	<i>Callophrys spinetorum spinetorum</i>					X	X				X				X			
	<i>Celastrina echo echo</i>		X	X	X		X	X			X	X						
	<i>Euphilotes</i> spp. "on <i>E. heracleoides</i> "					X							X		X	X		
	<i>Glaucopsyche lygdamus columbia</i>	X	X								X					X		X
	<i>Glaucopsyche piasus toxseuma</i>	X	X			X					X	X	X	X	X	X		
	<i>Lycaena cupreus cupreus</i>			X	X	X							X					
	<i>Lycaena editha</i> (NE Oregon segregate)			X												X		
	<i>Lycaena helloides helloides</i>	X	X	X	X	X	X						X		X			X
	<i>Lycaena heteronea rava</i>												X			X		
	<i>Lycaena nivalis</i> (NE Oregon segregate)			X		X							X		X	X		
	<i>Plebejus acmon</i>	X	X			X							?		X	X		
	<i>Plebejus icarioides pembina</i>	X		X	X	X		X				X	X	X	X	X	X	X
	<i>Plebejus lupini lutzi</i>												X			X		
	<i>Plebejus saepiolus rufescens</i>	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X
	<i>Satyrium saepium saepium</i>			X												X		
	<i>Strymon melinus setonia</i>	X											X		X			

Table 2. (Continued).

Family	Taxon	Survey Site (by #)																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Nymphalidae	<i>Aglais milberti subpallida</i>		X	X	X		X				X	X	X	X	X	X		
	<i>Boloria epithore</i> (NE Oregon segregate)				X													
	<i>Cercyonis oetus oetus</i>						X									X		
	<i>Chlosyne palla blackmorei</i>	X	X		X										X	X		
	<i>Coenonympha tullia ampelos</i>	X	X		X	X	X	X		X			X		X	X	X	
	<i>Erebia epipsodea epipsodea</i>		X												X			
	<i>Euphydryas colon wallacensis</i>	X	X	X		X									X	X	X	
	<i>Euphydryas editha</i> (NE Oregon segregate)			X		X						X	X		X	X		
	<i>Limenitis lorquini burrisonii</i>							X	X		X							
	<i>Nymphalis antiopa antiopa</i>	X	X	X	X	X			X				X	X		X	X	X
	<i>Nymphalis californica</i>	X	X	X	X	X	X	X			X	X		X	X	X	X	X
	<i>Phyciodes cocyta pascoensis</i>														X	X		
	<i>Phyciodes mylitta mylitta</i>		X			X												X
	<i>Phyciodes pulchella owimba</i>		X	X	X	X	X			X			X		X	X	X	
	<i>Polygonia gracilis zephyrus</i>	X	X			X		X			X				X	X		
	<i>Polygonia satyrus neomarsyas</i>		X															
	<i>Speyeria callippe semivirida</i>			X			X						X			X		
	<i>Speyeria coronis snyderi</i>			X	X			X			X		X	X	X	X		X
	<i>Speyeria hydasphe rhodope</i>										X					X		
	<i>Speyeria mormonia erinna</i>														X	X		
<i>Vanessa virginiensis</i>													X					
Papilionidae	<i>Papilio eurymedon</i>	X	X		X	X	X	X	X		X	X	X		X	X	X	X
	<i>Papilio indra indra</i>		X								X							
	<i>Papilio multicaudata pusillus</i>	X	X			X												
	<i>Papilio rutulus</i>		X										X		X	X	X	
	<i>Papilio zelicaon</i>	X	X	X	X			X										X

Table 2. (Continued to end).

Family	Taxon	Survey Site (by #)																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Papilionidae	<i>Parnassius clodius altaurus</i>										X							
Pieridae	<i>Anthocharis julia sulfuris</i>	X	X	X	X							X			X			X
	<i>Colias alexandra</i> (?emilia)									X							?	
	<i>Colias eurytheme</i>				X	X	X					X	X	X	X			X
	<i>Colias occidentalis progenitor</i>	X																
	<i>Colias philodice eriphyle</i>						X					X	X					X
	<i>Euchloe ausonides transmontana</i>	X				X						X						X
	<i>Pieris marginalis reicheli</i>	X	X															X
	<i>Pontia occidentalis occidentalis</i>				X	X	X							X		X	X	X



Photo 26. Edith's Checkerspot (*Euphydryas editha* "NE Oregon segregate")

Table 3. Checklist of Butterflies documented on the Malheur National Forest: Scientific and Common Names.

Family Hesperiiidae (Skippers) - 7 species	
<i>Erynnis persius ?fredericki</i>	Persius Duskywing
<i>Heliopetes ericetorum</i>	Northern White-Skipper
<i>Hesperia juba</i>	Juba Skipper
<i>Oarisma garita garita</i>	Garita Skipperling
<i>Polites sonora "NE OR segregate"</i>	Sonoran Skipper
<i>Pyrgus communis communis</i>	Common Checkered-Skipper
<i>Pyrgus ruralis ruralis</i>	Two-banded Checkered-Skipper
Family Lycaenidae (Gossamer Wings) - 20 species	
<i>Callophrys augustinus ?concava</i>	Brown Elfin
<i>Callophrys eryphon eryphon</i>	Western Pine Elfin
<i>Callophrys gryneus "nr. chalcosiva"</i>	Juniper Hairstreak
<i>Callophrys sheridani interrupta</i>	Sheridan's Hairstreak
<i>Callophrys spinetorum spinetorum</i>	Thicket Hairstreak
<i>Celastrina echo echo</i>	Pacific Azure
<i>Euphilotes species "on E. heracleoides"</i>	Cascadia Blue
<i>Glaucopsyche lygdamus columbia</i>	Silvery Blue
<i>Glaucopsyche piasus toxseuma</i>	Arrowhead Blue
<i>Lycaena cupreus cupreus</i>	Lustrous Copper
<i>Lycaena editha "NE Oregon segregate"</i>	Edith's Copper
<i>Lycaena helloides helloides</i>	Purplish Copper
<i>Lycaena heteronea rava</i>	Blue Copper
<i>Lycaena nivalis "NE Oregon segregate"</i>	Lilac-bordered Copper
<i>Plebejus acmon</i>	Acmon Blue
<i>Plebejus icarioides pambina</i>	Boisduval's Blue
<i>Plebejus lupini lutzi</i>	"Lupine" Blue
<i>Plebejus saepiolus rufescens</i>	Greenish Blue
<i>Satyrium saepium saepium</i>	Hedgerow Hairstreak
<i>Strymon melinus setonia</i>	Gray Hairstreak
Family Nymphalidae (Brushfoots) - 21 species	
<i>Aglais milberti subpallida</i>	Milbert's Tortoiseshell
<i>Boloria epithore "NE Oregon segregate"</i>	Pacific Fritillary
<i>Cercyonis oetus oetus</i>	Small Wood-Nymph
<i>Chlosyne palla blackmorei</i>	Northern Checkerspot
<i>Coenonympha tullia ampelos</i>	Common Ringlet
<i>Erebia epipsodea epipsodea</i>	Common Alpine
<i>Euphydryas colon wallacensis</i>	Snowberry Checkerspot

Table 3. (Continued).

<i>Euphydryas editha</i> "NE Oregon segregate"	Edith's Checkerspot
<i>Limenitis lorquini burrisonii</i>	Lorquin's Admiral
<i>Nymphalis antiopa antiopa</i>	Mourning Cloak
<i>Nymphalis californica</i>	California Tortoiseshell
<i>Phyciodes cocyta pascoensis</i>	Northern Crescent
<i>Phyciodes mylitta mylitta</i>	Mylitta Crescent
<i>Phyciodes pulchella owimba</i>	Field Crescent
<i>Polygona gracilis zephyrus</i>	Zephyr Anglewing
<i>Polygona satyrus neomarsyas</i>	Satyr Anglewing
<i>Speyeria callippe semivirida</i>	Callippe Fritillary
<i>Speyeria coronis snyderi</i>	Coronis Fritillary
<i>Speyeria hydaspe rhodope</i>	Hydaspe Fritillary
<i>Speyeria mormonia erinna</i>	Mormon Fritillary
<i>Vanessa virginiensis</i>	American Lady
Family Papilionidae (Swallowtails) - 6 species	
<i>Papilio eurymedon</i>	Pale Tiger Swallowtail
<i>Papilio indra indra</i>	Indra Swallowtail
<i>Papilio multicaudata pusillus</i>	Two-tailed Swallowtail
<i>Papilio rutulus</i>	Western Tiger Swallowtail
<i>Papilio zelicaon</i>	Anise Swallowtail
<i>Parnassius clodius altaurus</i>	Clodius Parnassian
Family Nymphalidae (Whites/Sulphurs) - 8 species	
<i>Anthocharis julia sulfuris</i>	"Sara" Orangetip
<i>Colias alexandra ? emilia</i>	Queen Alexandra's Sulphur
<i>Colias eurytheme</i>	Orange Sulphur
<i>Colias occidentalis progenitor</i>	Western Sulphur
<i>Colias philodice eriphyle</i>	Clouded Sulphur
<i>Euchloe ausonides transmontana</i>	Large Marble
<i>Pieris marginalis reicheli</i>	Margined White
<i>Pontia occidentalis occidentalis</i>	Western White

CONCLUSIONS

The single historical record for BOSE from Indian Creek (Grant County, c. 4,000 feet) placed the Malheur National Forest within the known range of the butterfly and made further surveys for potentially undiscovered populations a worthwhile effort.

It appears unlikely, however, that BOSE is present on National Forest lands within the Bear Valley, Logan Valley, Summit Creek, Summit Prairie, North Fork Malheur and Strawberry Mountain areas. The sites selected and surveyed included quality wet meadow habitats most likely to harbor BOSE, had the butterfly been present. The June timing of surveys would have captured the onset of adult flight for all sites except perhaps the highest meadows (at over 7,500 feet) within the Strawberry Mountain Wilderness.

Additional searches for BOSE are still warranted. Many potential habitats to the north and northeast of the sites surveyed here - in the Blue Mountains of Grant, Umatilla, Union and Baker counties - remain unexplored.

CAJO is a difficult butterfly to detect and was not observed during this study. Whereas sites fully within recent burns and lacking DMT can be omitted, the butterfly has the potential to occur within older stands of ponderosa pines and other conifers supporting DMT almost anywhere in montane NE Oregon. As such, biologists in the region should be familiar with both CAJO and DMT. If a CAJO adult is encountered, a good photograph, or better yet a voucher specimen, must be taken for confirmation. Familiarity with the thicket hairstreak – a butterfly with a nearly identical ventral wing pattern to CAJO – is also recommended, as is having a camera or insect net for documentation.

Searches for undiscovered populations of rare butterflies such as BOSE and CAJO can be like looking for the proverbial “needle in a haystack.” To have success may either take significant focused effort or simply a fortuitous event. Knowing when and where such rarities might be found increases the odds of finding them. Continued systematic searches of remaining areas with potential habitats will help to determine the present-day true range and distribution of these two species.

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