BIODIVERSITY INVENTORY IN THE OREGON BUTTES AND WHITEHORSE CREEK WILDERNESS STUDY AREAS, WYOMING

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This report is dedicated to Everett Tronstad —

Inspired by his care, curiosity, energy, and excitement.

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Cover photo: Oregon Buttes, view from Whitehorse Creek WSA, by B. Heidel

Abstract

The Oregon Buttes and Whitehorse Creek Wilderness Study Areas (WSAs) are adjacent WSAs located between Lander and Rock Springs, Wyoming. They are remote areas that straddle the Continental Divide, encompassing a range of topography and habitats that support diverse plant and animal life. The purpose of this project, conducted by the Wyoming Natural Diversity Database (WYNDD) for the Bureau of Land Management (BLM) under National Landscape Conservation System (NLCS), was to document the flora and fauna of the Oregon Buttes and Whitehorse Creek WSAs, survey for Sensitive species, sample vegetation, and provide this information to the BLM Rock Springs Field Office. We inventoried the biota during spring and summer of 2018 using a suite of survey and monitoring techniques at key locations across the study area.

We conducted systematic surveys for birds, bats, and pocket gophers (*Thomomys* sp.), and made opportunistic observations of birds, mammals, amphibians, and reptiles. The study area supported vertebrate animals associated with both sagebrush steppe and montane habitats. Most montane species occurred in woodland habitats within Oregon Buttes WSA, while extensive shrubland habitat in Whitehorse Creek WSA supported higher densities of sagebrush obligate species, and cliffs and rock outcrops in both WSAs provided habitat for raptors and other species. We documented 75 bird species, including five BLM Sensitive species, 13 raptors, and 62 songbirds. Both WSAs are within the Greater South Pass Sage-grouse Core Area and sign of greater sage-grouse (*Centrocercus urophasianus*) was abundant in Whitehorse Creek WSA. We documented five bat species, including one BLM sensitive species, one amphibian species, and two reptile species. Both WSAs have known value as seasonal habitat for ungulates, including important areas for mule deer (*Odocoileus hemionus*) parturition and migration. Additionally, we detected sign of pocket gopher and pygmy rabbit (*Brachylagus idahoensis*), both of which warrant further investigation to confirm presence of these species.

Many invertebrates live in Oregon Buttes and Whitehorse Creek Wilderness Study Areas and we focused our efforts on pollinating and aquatic taxa. We collected pollinators using traps and hand netting. We identified 16 species of butterflies and moths and 28 genera of bees. Mourning cloak, tiger moth, common ringlet, coronis fritillary, small wood-nymph, Melissa's blue and greenish blue were the most common butterflies. Sweat bees were the most abundant Hymenoptera we captured. Thirty-seven taxa of aquatic invertebrates were collected in ponds, springs and seeps. The beetles *Laccophilus* and *Helophorus* and the non-biting midge (non-Tanypodinae) were the most common aquatic invertebrates collected.

We conducted systematic survey across the study area for vascular plants. We expanded the known study area flora to 260 species, in 40 families, as associated with sagebrush steppe, woodland, spring, seep, pool, and wet meadow features, and the sparsely-vegetated slopes across an array of substrates and settings. The flora has an extremely low non-native component (6.1%), a richness of regional endemics centered in Wyoming, and a diversity that also includes limber pine (*Pinus flexilis*) as a BLM Sensitive Species, one Species of Concern, and two Species of Potential Concern. We detected suitable habitat for another sensitive species, box pussytoes (*Antennaria arcuata*), that warrants mid- or late-summer surveys to confirm presence of this species on Whitehorse Creek. We documented prevailing LANDFIRE vegetation types that included three woody sagebrush types, desert scrub vegetation, and woodland vegetation corresponding to 10 LANDFIRE vegetation units. Qualitative description of springs, seeps, pools, and alkaline meadows were also developed.

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Introduction

Wyoming has 42 wilderness study areas (WSAs) on Bureau of Land Management (BLM) lands. This project was set up under the National Landscape Conservation System (NLCS) with provisions that WSAs were to be managed to preserve their natural characteristics. However, basic knowledge of the natural resources within many of Wyoming's WSAs was limited. BLM Wyoming drafted a strategy for its NLCS lands in order to identify and address information needs and develop cohesive goals and guidelines for managing NLCS lands across the state (BLM 2013).

The Oregon Buttes and Whitehorse Creek WSAs are adjacent WSAs located about halfway between Lander and Rock Springs, Wyoming. They are remote landscape features that straddle the Continental Divide between the Atlantic and Pacific watersheds, while also encompassing landmarks. The WSAs were studied under Section 603 of the Federal Land Policy and Management Act (FLPMA), and were included in the Rock Springs District Wilderness Environmental Impact Statement, filed in October 1990. All Wyoming WSAs were described in greater detail in a report to Congress the following year (USDI BLM 1991). While there have been some biological surveys in and around the WSAs, these two areas have not been the focus of systematic surveys or interdisciplinary surveys.

WYNDD is a service and research unit of the University of Wyoming that collects and disseminates rigorous data on the biology and status of Threatened, Endangered, Sensitive and rare species in Wyoming (http://www.uwyo.edu/wyndd/). Our mission is to compile and generate information that helps agencies such as the BLM make effective management decisions. Along these lines, WYNDD has worked with the Wyoming Game and Fish Department and other state and federal experts to develop revised range maps and predictive distribution maps for Sensitive species in Wyoming. These projects have allowed WYNDD to identify gaps in our knowledge of Sensitive species distributions across the state and basic biodiversity resources. The biota of Oregon Buttes and Whitehorse Creek WSAs are among those information gaps.

Purpose & Objectives

The purpose of this project was to document the plant and animal life in the WSAs, survey for Sensitive species, sample vegetation, and provide this information to the BLM Rock Springs Field Office in a form that can be used as a reference or monitoring framework for key resources in the WSAs. We inventoried the biota using a suite of survey and monitoring methods at key locations across the WSAs. Specific objectives for the project were to work with the BLM Rock Springs Field Office to:

1) Design and conduct surveys and monitoring for animal and plant species in the WSAs including, but not limited to vertebrates, wetland invertebrates, pollinators, and vascular flora, including those that are designated Sensitive by BLM (USDI BLM 2010) or otherwise rare.
2) Sample vegetation across habitat gradients within the WSAs.
3) Integrate the results, into a final report document for BLM use and reference.

Wilderness Study Areas

Location

The Oregon Buttes and Whitehorse Creek WSAs are in the BLM Rock Springs Field Office, encompassing 4,410 ha (10,897 ac) and spanning over 6.5 km (4 mi) of the Continental Divide where it extends south from the Wind River Range across high desert to encircle the Great Divide Basin. They lie at the northwest edge of the Great Divide Basin. Pioneer trails (Oregon Trail, Mormon Trail) followed the course of the Sweetwater River drainage and ran about 4.8 km (3 mi) to the north of the WSAs, hence directly to the Green River drainage. Oregon Buttes was a landmark visible along pioneer travels, marking the Pacific Divide and the start of "Oregon Territory".

The WSAs range in elevation from approximately 2,170–2,592 m (7,120–8,505 ft). Public access is from Fremont County Road 446 via Wyoming Highway 28. The Fremont county road turns into Sweetwater County Road 74 at the Fremont/Sweetwater county line. The county roads run directly east of the study area, and a secondary road (BLM Road 446) marks the boundary between the two contiguous WSAs.

The Oregon Buttes WSA is in Sweetwater County, and the Whitehorse Creek WSA is located directly north of it, mostly in Fremont County, but extending into Sweetwater County (Figure 1). We refer to them collectively as one study area, the WSAs, to the extent that they are adjacent and share some features, but we identify them separately when addressing their unique features and complementarity.

Environment

Geology

The Oregon Buttes-Whitehorse Creek WSAs encompasses a triple divide. The west side flows into a series of creeks leading to Pacific Creek and ultimately the Green River watershed, the northeast side flows into the Sweetwater River drainage and ultimately the North Platte River watershed, and the southeast side flows into the Great Divide Basin, a closed-drainage watershed.

Oregon Buttes has three summits (two flat-topped hills that are connected and a separate conical one) that mark the high points. They are capped by Miocene Rocks with pale to tan tuffaceous sandstone and claystone. Landslide deposits lie below the summits on north-facing slopes. The prevailing uplands that encircle Oregon Buttes and form the uplands and rim of eastern Whitehorse Creek WSA are Bridger Formation, an Eocene greenish-gray, olive-drab, and white tuffaceous sandstone and claystone, and to a lesser extent lenticular marlstone and conglomerate. Oregon Buttes is fringed by the Green River Formation (Laney Member), an Eocene oil shale and marlstone. Knolls above the rim of Whitehorse Creek mark the highest elevations of Whitehorse Creek WSA. The downstream end of Whitehorse Creek marks the lowest point. Low elevations of the study area are predominantly Wasatch Formation, an Eocene and late Paleocene formation. On eastern side is the Cathedral Bluffs Tongue of the formation with variegated claystone and lenticular sandstone, and on the western side is the main body of the Wasatch Formation with drab sandstone, claystone and siltstone, plus locally derived conglomerate around basin margins. Each of these formations are lacustrine deposits of Lake Gosiute, and fossil snails were observed in the study area.

Soils

Five major soil orders are mapped in the study area, Aridisols, Entisols, Inceptisols, Mollisols and Alfisols (Munn and Arneson 1998). Soils at the highest elevations of the WSAs are Typic Haplocryalfs, Typic

Dystrocryepts, and Typic Haplocryolls, loamy-skeletal, mixed; and Histic Cryaquepts, fine-loamy over sandy or sandy-skeletal, mixed. Soils at the lowest elevations of the WSAs are rock outcrop and Typic Torriorthents, loamy-skeletal, mixed, frigid. At intervening elevations east of Oregon Buttes and west of the Whitehorse Creek rim the soils are Ustic Haplocambids and Ustic Torriorthents, coarse-loamy, mixed; and Typic Torrifluvents, loamy-skeletal, mixed, frigid. This landscape has shallow and moderately deep Haplocambids and Torriorthents occurring on slopes along ephemeral channels, and Torrifluvents along gully bottoms.

Vegetation

Vegetation mapping resources were referenced prior to and during fieldwork. The primary reference used to locate areas for sampling or observation in species surveys and in vegetation documentation was the LANDFIRE vegetation map (LANDFIRE 2016).

Methods

WYNDD worked closely with the Rock Springs Field Office of the BLM to develop a list of taxa that would be targeted during inventory and to develop methodologies for the different taxa. During this study we used these protocols to collect baseline data on all target taxa.

Field surveys were conducted by 6–7 WYNDD staff during two trips to the WSA in the summer of 2018, from 21–25 May and 25–29 June. We targeted birds, plants, amphibians, pollinators, aquatic invertebrates and vegetation during the first visit; and bats, small mammals, reptiles, pollinators, plants, raptor nests and vegetation during the second visit. Additionally, 2 WYNDD biologists conducted supplemental bat surveys and opportunistic bird observations from 10–12 June, 2019. Prior to fieldwork, information resources were compiled and preparations made to carry out methods suited to each set of inventory objectives.

Birds

We documented birds in the study area using point-count surveys, in addition to targeted inventories of rare habitats, and opportunistic observations. Point-count surveys provided a structured method to sample birds across the study area, while targeted surveys of woodlands increased effort in that rare habitat type. Opportunistic observations recorded during all field trips documented raptor nests and species not detected by other methods.

We conducted point count surveys on transects located randomly across the study area. To establish survey locations, we used a Geographic Information System (GIS) to place 50 random points within the study area boundary, generated 2.75-km line transects in random directions originating from those points, then established 12 point count locations at 250-m intervals along each line. For surveys, we selected transects that provided even spatial coverage of habitat types within the study area and formed convenient routes to maximize the number of points surveyed. Point-count methods were adapted from the Integrated Monitoring in Bird Conservation Regions land bird monitoring program (Hanni et al. 2014). We conducted a 6-minute count at each point. We began surveys one half hour before local sunrise and ended after no more than 6 hours of effort. For every bird detected during a point count, we recorded species, sex, horizontal distance to the bird, minute of the point count during which the bird was detected, type of detection (i.e. call, song, visual), and whether or not the observer was able to visually identify the bird. We measured the distance to each bird using a laser rangefinder.

We also recorded bird species not previously detected during a point count while traveling between points and transects. At the start and end of each survey, we recorded time, ambient temperature, cloud cover, precipitation, and wind speed.

We targeted aspen and conifer woodlands for inventories to increase sampling effort in that rare habitat type and confirm breeding status for several migrant species detected on our first visit. Additionally, we made opportunistic observations of birds, bird sign, and raptor nests while conducting surveys for other taxa and traveling throughout the study area.

Mammals

We documented mammals in the study area using a variety of survey techniques, including mist-netting and acoustic sampling for bats, area searches for pocket gophers, remote cameras for ungulates and carnivores, and opportunistic observations for other species.

Bats

We sampled bats at water features in the study area using mist-netting and passive acoustic surveys. Capturing live bats with mist nets allowed us to verify species presence, inspect individuals for disease, assess physical condition, and collect demographic information. Passive acoustic surveys allowed us to efficiently collect species presence information from multiple sites each night.

To capture bats, we suspended 6–12-m by 5.6-m mist nets (Avinet bat-specific mist nets, 38mm mesh, black polyester, Dryden, NY, www.Avinet.com) over water between aluminum poles in a "single-high" arrangement. We opened mist nets at dusk unless birds were active, in which case we opened nets when bird activity ceased. We checked nets for captured bats at least every 15 minutes, removed bats from nets immediately, placed them in paper bags for transport, and processed and released them within 30 minutes of capture. To minimize the risk of stress and injury to bats, we did not set nets during high winds or temperatures below 40°F. Captured bats were measured (forearm length, ear length), weighed, sexed, aged, identified to species, and released on site. Additionally, the membranes of both wings and the uropatagium of each captured bat were inspected following the methods of Reichard and Kunz (2009). After each survey, we decontaminated all survey equipment and supplies following the National White-Nose Syndrome Decontamination Protocol Version 4.12.2016 (U.S. Fish and Wildlife Service 2016) and followed all guidelines in the Wyoming White-Nose Strategic Plan (Abel and Grenier 2011).

Acoustic surveys were conducted using Wildlife Acoustics Song Meter full-spectrum recording equipment (SM2Bat+ ultrasonic monitoring unit, Concord, MA, www.wildlifeacoustics.com). Units were programed to begin recording one half hour before civil sunset and to stop recording one half hour after civil sunrise. On each recorder, one microphone (SMX-US ultrasonic microphone, Concord, MA, www.wildlifeacoustics.com) was attached to a 3-m cable and placed on a pole 2 m above the ground. All calls were analyzed using the Sonobatch automated call analysis algorithm in the SonoBat 3 Wyoming Species Package. We used an acceptable call quality threshold of 0.70 and a discriminate probability threshold of 0.90.

Pocket gophers

We conducted surveys for pocket gophers (*Thomomys* sp.) because the study area was on the edge of the predicted range of the Wyoming pocket gopher (*T. clusius*). This rare species is endemic to Wyoming

and classified as Sensitive by Wyoming BLM (USDI BLM 2010) and a Species of Greatest Conservation Need (SGCN) by the Wyoming Game and Fish Department (WGFD). We consulted experts on Wyoming pocket gopher (Britt Brito, University of Wyoming, personal communication) and scouted potential habitat during our first field trip. We used this information and LANDFIRE existing vegetation type data (LANDFIRE 2016) to delineate survey polygons on the eastern slope of Oregon Buttes WSA that had extensive, flat terrain with Gardner saltbush (*Atriplex gardneri*) vegetation. We conducted searches for soil mounds indicative of pocket gopher activity in a selection of these areas during our second field visit.

Ungulates and carnivores

To document ungulates, medium and large carnivores, and other mammals, we placed two digital infrared trail cameras (Reconyx PC800 HyperFire Professional IR camera, Holmen, WI, www.reconyx.com) along prominent game trails in the pine and aspen stands on the western slope of Oregon Buttes. Additionally, we searched for evidence of mammals while traveling throughout the study area and recorded locations of opportunistic sightings, scat, and tracks.

Reptiles and amphibians

Our sampling effort for reptiles and amphibians was limited to opportunistic visual encounter surveys. Amphibian surveys focused on wetlands where we sampled bats and other potential amphibian habitat, including ponds, streams, and other areas likely to retain permanent or ephemeral water. Reptile surveys focused on rock outcrops and other upland habitats likely to be used by snakes and lizards.

Pollinators

We collected insects using blue vane traps, bee cups and visual encounter surveys to estimate the diversity of pollinators in the Oregon Buttes and Whitehorse Creek WSAs. We placed vane traps and bee cups in different habitats for ~48 hours before collecting individuals. We used yellow, blue, and white bee cups filled with soapy water. We recorded location, vegetation type, and deployment on datasheets. Other pollinating insects encountered during our excursions were captured with nets. All captured insects were preserved in ~75% ethanol until they could be processed in the laboratory.

In the laboratory, we hydrated bees in warm water for 30–60 minutes, washed specimens in soapy water using a stir plate, and dried individuals using tubes with forced air. For butterflies and moths, we hydrated individuals in a container with humid air for ~24 hours and dried specimens on a spreading board. All pollinating insects were pinned, labeled, and will be stored at the University of Wyoming. Insects were identified using available keys (Brock and Kaufman 2003, Michener et al. 1994, Williams et al. 2014, Pickering 2015).

Aquatic invertebrates

We collected aquatic invertebrates with from the aquatic habitats we encountered (temporary streams, springs, seeps and stock ponds) in the WSAs. We collected aquatic invertebrates using a dipnet. We preserved samples with ~75% ethanol in the field and identified aquatic invertebrates under a dissecting microscope in the laboratory using available keys (Merritt et al. 2008, Thorp and Covich 2010).

Plants

We compiled data on previous vascular plant collection information using the Rocky Mountain Herbarium (RM) online specimen database search tool by drawing a polygon around the study area (Rocky Mountain Herbarium 2018). A total of 87 species were on record as previously collected within Oregon Butte WSA during one-day Rocky Mountain Herbarium collecting trips by Keith Dueholm (north end of Oregon Buttes on 27 June 1981), Laura Welp (north end of Oregon Buttes on 17 June 1995) and Beth Ward (south end of Oregon Buttes on 20 June 1997). The compiled list of all species collected was referenced during 2018 fieldwork to minimize collecting species that were previously documented.

We expanded the known flora by covering the range of study area settings earlier in the year (May), inclusion of Whitehorse Creek WSA, and deliberate efforts to span the range of environmental conditions with the study area information at hand. We targeted those species not already documented, collecting and pressing specimens, and recording collection locations on a GPS unit. Specimens were identified in the field and upon return using the current state flora and nomenclatural treatment of Dorn (2001), but the nomenclature was later updated in keeping with the Rocky Mountain Herbarium (RM; Nelson 2018). After the field season, determinations were completed and labels were prepared for each specimen from field notes. All suitable specimens have been deposited at RM where they will be databased, scanned, and posted online.

The Sensitive plant species and other rare plant species targeted for survey were identified by querying the central database of Wyoming Natural Diversity Database. Three state and regional endemic plant species have previously been documented in the study area: Payson's penstemon (*Penstemon paysoniorum*), a state endemic that is on the watch list (Heidel 2018), contracted ricegrass (*Achnatherum contractum*), a regional endemic that is no longer a species of concern, and small ballhead ipomopsis[1] (*Ipomopsis crebifolia*), a regional endemic that is also on the watch list. Desert cryptantha (*Cryptantha scoparia*) was also known from the study area, though it is a fairly widespread species and no longer a species of concern. In addition, limber pine (*Pinus flexilis*) is a BLM Sensitive species (USDI BLM 2010) previously collected at Oregon Buttes. More species have been documented within a 10-km radius of the study area including two BLM Sensitive plant species: box pussytoes (*Antennaria arcuata*) and large-fruited bladderpod (*Physaria macrocarpa; Lesquerella macrocarpa*). The closest population of box pussytoes persists at nearby Oregon Gulch (Heidel 2015) about 5 km northeast of the study area. The closest population of large-fruited bladderpod was on a "clay flat" about 7 km east of the study area in Honeycomb Buttes WSA, last seen in 1981. It could not be relocated in 1994 and 1995 (Fertig 1995), or in a 2019 visit to resurvey the area.

Sensitive plant survey work was conducted as part of floristic inventories in both the May and June visits for the 10 target species, focusing on BLM Sensitive species (USDI BLM 2010) and secondarily on other state species of concern (Heidel 2018). The distribution, habitat requirements and population conditions of target species were evaluated. Vouchers were collected and locations were recorded on a GPS unit.

No noxious weeds were known from the study area based on prior floristic inventories. Species on the state and county noxious weed lists were sought in the course of 2018 fieldwork including along access

[1] This species is no longer a Wyoming species of concern but for purposes of this project we address all globally rare species (G1-G3) and legacy data once considered as representing species rarity.

routes into the area. After completion of fieldwork, the non-native (introduced) segment of the study area flora was compared to the native flora.

Vegetation

Vegetation information was scant for the study area from what we could find in the published literature and Wyoming Natural Diversity Database records. Thus, we drew from state vegetation publications (Knight et al. 2014), and national information sources that map the primary vegetation types (LANDFIRE 2016), as described in Knight et al. (2014).

In the field, large compositionally homogeneous areas of vegetation were sought in each LANDFIRE mapping unit. Vegetation sampling took place by completing WYNDD vegetation description forms, during both May and June field visits. Waypoints were collected for later cross-referencing to digital vegetation mapping, and landscape photographs were taken. Vegetation work was conducted in tandem with floristic documentation, sensitive plant species survey, and weed survey.

The vegetation data collected did not represent statistical ground-truthing or basis for re-mapping landscape vegetation, but offers a foundation for vegetation descriptions of the study area. The scope included both upland and wetland vegetation features. Associated species were recorded in making collections of the flora.

Results and Discussion

Birds

We conducted avian point-count surveys on the first field visit during May and targeted surveys of aspen and pine woodland habitat in May and June. We surveyed a total of 111 points on 13 transects, with an average of 8.5 points per transect (Figure 2). We detected a total of 962 individuals of 50 species during point counts. We recorded an additional 25 species opportunistically and during surveys of woodland habitat, resulting in a total of 75 species documented in the study area (Table 1). We classified 47 species as likely resident breeders in the region, 18 as possible residents, and 10 as likely migrants. Among the resident breeders, we detected five species designated as Sensitive by Wyoming BLM (USDI BLM 2010): Brewer's sparrow (*Spizella breweri*), mountain plover (*Charadrius montanus*), sagebrush sparrow (*Artemisiospiza nevadensis*), sage thrasher (*Oreoscoptes montanus*), and ferruginous hawk (*Buteo regalis*). Six additional species were designated as Protected Birds by the Wyoming Game and Fish Department: American kestrel (*Falco sparverius*), Clark's nutcracker (*Nucifraga columbiana*), golden eagle (*Aquila chrysaetos*), red crossbill (*Loxia curvirostra*), Swainson's hawk (*Buteo swainsoni*), and Virginia's warbler (*Oreothlypis virginiae*). The most commonly detected species included the three sagebrush obligate songbirds classified as Sensitive by BLM, as well as other common passerines of sagebrush steppe and barren habitats: green-tailed towhee (*Pipilo chlorurus*), rock wWren (*Salpinctes obsoletus*), horned lark (*Eremophila alpestris*), and vesper sparrow (*Pooecetes gramineus*). Although we did not detect any greater sage-grouse (*Centrocercus urophasianus*) during surveys, the scat of this species was abundant throughout the low-lying shrubland habitats of Whitehorse Creek WSA and both WSAs are within the Greater South Pass Sage-Grouse Core Area (Wyoming Game and Fish Department 2015). The abundance of species in different groups of birds, including sagebrush-obligate, montane, migrating birds, as well as raptors, reflects the diverse habitats within the study area. The extensive and intact shrublands supported breeding by sagebrush-obligate birds, while the isolated forest stands in a

desert landscape provided breeding and migratory stopover habitat for montane bird species. The varied terrain and vegetation of the study area provided nesting habitat for a diverse community of breeding raptors (Figure 3). We observed long-eared owls (*Asio otus*) in most stands of aspen and mature willows in the study area (including two nests), a northern saw-whet owl (*Aegolius acadicus*) nesting in an tree cavity (Figure 4), prairie falcons (*Falco mexicanus*) nesting on cliffs of the main buttes and in cavities in badlands, sharp-shinned hawks (*Accipiter striatus*) and Cooper's hawks (*A. cooperii*) in woodlands, great horned owls (*Bubo virginianus*) in woodlands and badlands, and red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks, and golden eagles flying above the study area. Although we did not find occupied nests of ferruginous hawks and golden eagles, we documented large stick nests likely built by these species. A known golden eagle nest site in the study area (Bob Oakleaf, Wyoming Game and Fish Department, unpublished data) was not occupied in 2018 or 2019.

Mammals

Bats

We conducted mist-nest surveys for bats at a total of four sites, including three nights of surveys in 2018 and two nights of surveys in 2019, with one site surveyed in both years. We conducted four nights of acoustic recording at two sites in 2018 (Figure 5). We detected a total of four species of bats through mist-net surveys and five species of bats through acoustic recording (Table 2). The most frequently captured species was the western small-footed myotis followed by the long-legged myotis, little brown myotis, and long-eared myotis. The most frequently detected species through acoustic recording was little brown myotis, followed by long-legged myotis, and long-eared myotis. The long-eared myotis was the only BLM Sensitive species documented, while all five bat species documented are considered SGCN by WGFD.

Evidence of reproduction was observed in long-eared myotis and long-legged myotis. Pregnant females of both species were captured. In addition, one juvenile long-eared myotis was captured. These data taken together suggest that these WSAs support maternity colonies of these two species.

No evidence of White-nose Syndrome (WNS) was observed. It is important to note that outward signs of WNS may not be present during the time of year when these bats were captured and may not necessarily indicate that the bat population in the study area is disease free.

Pocket gophers

During our second field visit in May, we searched 6 polygons for evidence of pocket gopher activity (Figure 6). We recorded 12 soil mounds characteristic of pocket gophers within survey areas. At one site with evidence of fresh digging, we excavated a small portion of a tunnel and watched as a pocket gopher filled the hole we had created. We did not capture pocket gophers to confirm their species as either the rare Wyoming Pocket Gopher (*Thomomys clusius*) or the more common Idaho Pocket Gopher (*T. idahoensis*). We have provided these data to a University of Wyoming graduate student studying Wyoming Pocket Gopher for possible future trapping efforts to determine the species of pocket gophers in the study area.

Ungulates and carnivores

Two infrared cameras located along game trails in the woodlands on the western slope of Oregon Buttes recorded >20,000 photos (Figure 7). Species recorded included elk (*Cervus Canadensis;* 133 photos), mule deer (*Odocoileus hemionus*; 115 photos), bobcat (*Lynx rufus*; 3 photos), cottontail rabbit (*Sylvilagus*

sp.; 9 photos), and coyote (*Canis latrans*; 5 photos; Figure 8). The Wyoming Game and Fish Department classifies the eastern portion of Whitehorse Creek WSA and north-central portion on Oregon Buttes WSA as a mule deer parturition area (Wyoming Game and Fish Department 2019), and our detections of elk calves and mule deer fawns suggest breeding by both species in the study area. Both WSAs provide habitat for mule deer, elk, and pronghorn (*Antilocapra americana*) in spring, summer, and fall, and the majority of Oregon Buttes WSA is classified as year-long habitat for elk (Wyoming Game and Fish Department 2019). Additionally, the Sublette mule deer herd migration route passes through the eastern half of Whitehorse Creek WSA and the western half of Oregon Buttes WSA, including stopover areas in both WSAs (Wyoming Game and Fish Department 2019).

Opportunistic observations

We observed ground squirrels across the study area, including Wyoming ground squirrels (*Urocitellus elegans*) in the Whitehorse Creek WSA and small colonies of white-tailed prairie dogs (*Cynomys leucurus*) in the Oregon Buttes WSA (Figure 5). At one location in the Whitehorse Creek WSA, we detected piles of small rabbit scat in mature sagebrush habitat characteristic of pygmy rabbit (*Brachylagus idahoensis*); however, we were not able to positively confirm the presence of this species because its scat size and habitat overlap with cottontail rabbit. Pronghorn were abundant in open habitats of the study area, while mule deer and elk occurred in both open an forested areas. We observed tracks and scat of coyotes (*Canis latrans*) and cottontail rabbits throughout the study area. A complete list of mammal species recorded in included in Table 3. Additional small and medium-sized mammal species likely occur in the study area and greater effort, including formal surveys for these taxa would be beneficial to confirm their presence.

Reptiles and amphibians

We detected larval tiger salamanders (*Ambystoma mavortium*) by dip-netting in all three ponds where we netted bats and one adult in a small creek (Figure 9). Additionally, we recorded locations of two greater short-horned lizards (*Phrynosoma hernandesi*) and two garter snakes (*Thamnophis* sp.) encountered while traveling between surveys (Figure 9). Additional reptile and amphibian species likely occur in the study area and formal surveys for these taxa would be beneficial to confirm their presence.

Pollinators

We observed 16 species of butterflies and several moths (Table 4, Figure 11). Mourning cloak, tiger moth, common ringlet, coronis fritillary, small wood-nymph, Melissa's blue and greenish blue were the most common Lepidoptera observed. We collected 28 taxa of bees plus seven other Hymenoptera taxa (Table 5, Figure 11). Insect catch rates (individuals/hour) were higher in vane traps (0.5 ind/hr) than bee cups (0.1 ind/hr), and rates were similar between months (0.3 ind/hr). The sweat bees *Lasioglossum* subgenus *Dialictus* and *Lasioglossum sensu strictu* were the most common bees collected followed by *Agapostemon*, which is common from our collections across the state. We collected four species of bumble bees in the WSAs. Additionally, we focused our efforts on pollinators and aquatic invertebrates, but we observed dune beetles (Scarabaeinae; Figure 11), wood ticks (*Dermacentor*), stink bugs (Pentatomidae), and many other invertebrates in the area.

Aquatic invertebrates

We collected aquatic invertebrates from a temporary stream and several stock ponds, springs and seeps (Figure 12). A pond located in southwestern Oregon Buttes WSA had adequate dissolved oxygen for aquatic life (10.8 mg/L; 124% saturation), moderate specific conductivity (627 µS/cm), near neutral pH (7.57), reducing conditions (159.5 mV), and warm water temperatures (23.4 °C). We collected 37 aquatic taxa (Table 6, Figure 13). Beetles were the most diverse group with 7 families and 22 genera. We captured the genera *Laccophilus* and *Helophorus* in four habitats and non-biting midges (non-Tanypodinae), the beetles *Agabus*, *Hygrotus*, and *Berosus* were collected in three habitats. We found more taxa in ponds than springs; however, caddisflies were only collected in springs and seeps. Zooplankton (Cladocera and Copepoda) were also abundant in ponds.

Plants

We determined that the vascular flora of Oregon Buttes and Whitehorse Creek WSAs supports at least 260 plant species (Table 7). In addition to the original 87 species collected in past decades, 154 more species were collected in 2018, augmented by short visits in 2019, from about 100 collection points (Figure 14). Twenty more species were observed but not collected. The 154 species collected are now vouchered as herbarium specimens at RM and this project almost triples the known flora. All prior collecting had been conducted within the last two weeks of June and restricted to parts of the Oregon Buttes area. This expansion of the known flora from 87 to 260 species is a result of including the Whitehorse Creek area, by making collections earlier and later in the growing season, by the increased amount of time spent collecting, and by the resources available to help target the range of environmental conditions.

The study area is rich in species of Wyoming Basins Ecoregion and its prevailing sagebrush steppe, including species that are centered in Wyoming and others that are widespread across the western United States. It has surprisingly well-developed components of wetland flora as well as woodland and some elements of montane floras. Even more surprising is the scantiness of exotic species. Of the 260 species, only 17 species are not native (6.5% of the flora), most of which barely enter the study area along its road boundaries, and which are restricted if not uncommon where they occur. The study area flora represents over 10% of the native species in the state flora (Nelson 2018).

A total of 40 plant families are represented in the flora. The two plant families having the greatest numbers of species, the Aster Family (49 species) and Grass Family (34 species), are also the ones that had the greatest numbers of collections made to fill gaps in documenting the study area flora. Results represent a robust floristic documentation. Concerted work to document wetland plants late in the growing season might be the best test of floristic documentation completeness.

Limber pine and the other three target species documented in prior plant collections were relocated (Table 8). Payson's beardtongue (*Penstemon paysoniorum*) is present in Whitehorse Creek WSA but was not relocated in Oregon Buttes WSA, ballhead ipomopsis (*Ipomopsis crebrifolia*) is present in both WSAs, and contracted ricegrass (*Achnatherum contractum*) is present in both WSAs, locally dominant in gravelly finger ridge flats east of Oregon Buttes.

Limber pine is a BLM Sensitive species present on steep, moisture-accumulating slopes below the rim of Oregon Buttes, and to a lesser extent on top and on flanks. Seedlings were rare. We did not find blister rust or pine beetle sign but mistletoe (*Arceuthobium cyanocarpum*) and associated sign of witches

broom were common. Two separate areas on top of Oregon Buttes had signs of crownfires having burned through limber pine. Background information about limber pine as a sensitive species, vegetation type, and management concern is presented by Jones (2019).

The two other BLM Sensitive species, box pussytoes (*Antennaria arcuata*) and large-fruited bladderpod (*Physaria macrocarpa*), were not found. Box pussytoes has what appeared to be suitable habitat on lower Whitehorse Creek in a large alkaline meadow where additional survey time late in the growing season (e.g., mid-July to mid-August) would be needed to systematically survey it or rule it out. It often grows in just a segment of apparently suitable habitat, as conditioned by proximity to stream and to groundwater discharge, downstream or upstream location, and microtopography features. Large-fruited bladderpod is documented along the rim of the Great Divide Basin to the immediate south and northeast. Four other species in the genus were found including sharpleaf twinpod (*Physaria acutifolia*), which has a similar cushion growth form and is present on the largest of Oregon Butte summits.

Swallen's ricegrass (*Achnatherum swallenii*) wasn't on the target list of rare species but is a regional endemic that was found on the ridge at the south end of Oregon Buttes WSA. This represents only the second time it has been documented in Sweetwater County and is the easternmost known location of the species in all its distribution. It is a regional endemic of the upper Green River in Wyoming, and in Snake River Plains of eastern Idaho. It is on the Wyoming Plant SOC list, and at opposite ends of the study area compared with Payson's penstemon (Figure 15).

Despite the apparent absence of other sensitive plant species, the study area has a high number of regionally endemic plants that have much or all of their distribution centered in the Wyoming Basins Ecoregion, species such Townsend daisy (*Townsendia spathulata*), singlestem buckwheat (*Eriogonum acaule*), and shortstem buckwheat (*Erigonum brevicaule* var. *micranthum*). Most of these endemic species have a NatureServe global rank of G3 (globally vulnerable) and are considered rare in other states. Results are significant in four other ways: high species diversity, representation of different geographic elements, degree of development of both upland and wetland floras, and paucity of non-native species as contributing to the cumulative botanical significance. Sensitive, SOC, and other regional endemic species are represented by images (Figure 16). Other species that are common across the study area or in given habitats are also represented by images (Figure 17).

Only 6.1% of the flora is comprised of non-native species (16 species). Few non-native species are in the study area interior and there are almost no noxious weeds in the interior. Canada thistle (*Cirsium arvense*) is present at a minority of ponds, springs, and associated drainages in both WSAs. Halogeton (*Halogeton glomeratus*) was found three places: in a badlands outwash by the southern boundary road of the Oregon Buttes WSA, on the Sweetwater County Road 74 boundary of Oregon Buttes WSA, and in an isolated badlands outwash in the middle of Whitehorse Creek WSA.

Part of the eastern boundary for Oregon Buttes WSA reaches Sweetwater County Road 74 where there are noxious and other invasive plants in the roadside right-of-way at WSA boundaries including black henbane (*Hyoscamus niger*), curveseed butterwort (*Ranunculus testiculatus*), prickly Russian thistle (*Salsola tragus*), cheatgrass (*Bromus tectorum*), and quackgrass (*Agropyron repens*). The henbane is on the Wyoming noxious weed list. The county road does not have Canada thistle but the native thistle, Jackson Hole thistle (*Cirsium inamoenum*), may have gotten sprayed with herbicides.

It is noteworthy that there were no non-native species collected from the study area in prior botanical work of 1997 and earlier. Cheatgrass was found at one spot close to the Oregon Buttes summit in 2018 at an upper slope position and south aspect where the rim forms a funnel that intercepts wind-borne material. Even the non-native species desert madwort (*Alyssum desertorum*) that is widespread across much of western Wyoming is scant in the study area, present above a reservoir (Figure 18).

Vegetation

The predominant vegetation of the study area is sagebrush steppe and shrubland of the Inter-Montane Basin Region (Table 9). Vegetation sample points are represented in Figure 19. The primary upland dominant is Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) across rolling uplands, including the butte tops. Mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) dominates in topographic breaks and sheltered slopes and is more typical of mountain ranges (Table 10). Below these big sagebrush zones are interfingered Inter-Mountain Basins Mat Saltbush Shrubland and Mixed Salt Desert Scrub. They are dominated alone or in combination by birdfoot sagebrush (*Artemisia pedatifida*) and Gardner's saltbush (*Atriplex gardneri* var. *gardneri*) on the Green River Formation, forming elongate terraces that are flat or gently-sloped and drop off to incised drainages of the dissected terrain. The vegetation dominated by these shrub species are matrix in the study area as high quality representation of prevalent Wyoming Basins Region. In addition to these steppe, shrubland, and scrub vegetation types are two other sagebrush types, the silver sage (*Artemisia cana* var. *viscidula*) vegetation of riparian areas, and patches dominated by the bud sage (*Artemisia spinescens*) in plains.

The Oregon Buttes summits and slopes have scattered limber pines (*Pinus flexilis*) and small stands of aspen (*Populus tremuloides*), mainly on north-facing slopes. A mosaic of cliffs, outcrops, and shale badlands are present, typically on steep or eroding terrain. Not all barren habitats are steep and eroding; there are also flat or nearly level barrens covered by gravel pavement of the Bridger Formation that are dominated by cushion plant communities.

Vegetation results correspond to ten LANDFIRE vegetation units. The LANDFIRE map shows a preponderance of Inter-Mountain Basins Big Sagebrush Shrubland whereas the GAP map shows a preponderance of Wyoming Basins Dwarf Sagebrush Shrubland and Steppe. The difference between these two is in stature, cover and composition. The Big sagebrush communities are more extensive in the Oregon Buttes WSA but the Wyoming Basins Dwarf Sagebrush Shrubland and Steppe are more extensive in the Whitehorse Creek WSA. In the field, we usually found a preponderance of Wyoming Basins Dwarf Sagebrush Shrubland suggesting that the GAP map may be closer to representing prevailing sagebrush vegetation conditions on the ground than LANDFIRE mapping. A third shrub type is also represented and mapped as Inter-Mountain Basins Montane Sagebrush Steppe on extensive, mainly south-facing slopes of Oregon Buttes and Whitehorse Creek finger ridges covered by bitterbrush (*Purshia tridentata*).

The vegetation units that appeared to be mapped with greatest accuracy as to unique composition and location were that of aspen and pine woodlands. They are localized features on the landscape. There was particularly widespread pine beetle mortality in the pine stands and very little regeneration. More complete background information about limber pine as a sensitive species, vegetation type, and natural resources is presented by Jones (2019).

Areas of Inter-mountain Basins Mixed Saltbush Desert Scrub and Mat Saltbush Shrubland recorded during fieldwork appeared to be under-represented in mapping, and were found on both flat ridgetops and salt-affected basin expanses. The Mat Saltbush Shrubland has a preponderance of Utah Gardner's saltbush (*Atriplex gardneri var. utahensis*) and the Mixed Saltbush Desert Scrub often includes birdsfoot sagebrush (*Artemisia pedatifida*), greasewood (*Sarcobatus vermiculatus*), and bud sage (*Artemisia spinescens*) as dominant or co-dominant with or without the saltbush.

The vegetation units mapped as Great Plains forms of vegetation both appeared to be mismapped, with no Great Plains mixed grass prairie species dominance as mapped along a drainage south of Oregon Buttes, and no Great Plains woodland mapped along a drainage course of Mountain big sagebrush. We also failed to find an area of active or stabilized dune vegetation, but they were mapped as very small areas so the error is very small.

Whitehorse Creek is the only major creek within the study area, an ephemeral drainage with dry wash vegetation and incised gullies along much of its length. It is the only area mapped as having wetland habitat in the National Wetland Inventory (U.S. Fish and Wildlife Service 2018) at its downstream (western) end. Topographic maps show little indication of wetland habitat, but a large alkaline meadow fed by seeps is located along lower Whitehorse Creek in the northwest corner of the study area. Another alkaline meadow is in a very unusual setting, found on wet south-facing slope with contiguous wetland habitat having over 30 m relief in the southeastern end of the study area (located west of Edmund Springs, at the same elevation as these springs, and possibly associated with the same hydrology). There are also a surprising number of springs, spring-fed stream reaches, and other seeps in the study area in headwater settings as well as slump pools and wet meadows. Impoundments and stock ponds were constructed usually at springs or on drainage courses. In general, the water developments did not displace all pre-existing wetland flora. BLM provided a GIS layer of many springs and stock ponds in advance of fieldwork to which we added some.

Even though vegetation mapping of LANDFIRE (2016) provides mapping at high resolution, it does not represent all of the vegetation types. For example, well-developed cushion plant communities are present on the dry, bench-like rim above Whitehorse Creek, which are not mapped. They were described by Jones (2004), and harbor some of the same species as alpine cushion plant communities in the nearby Wind River Range. Vegetation mapping also overlooks the localized native wetland and riparian vegetation with an array of springs, seeps, slump pools, and meadows, many of which are isolated from riparian settings. A highlight of some vegetation images and landscape settings are represented in Figures 20 and 21.

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vegetation results. Joy Handley and Melanie Arnett prepared WYNDD data exports on plant Species of Concern prior to fieldwork. Bob Oakleaf shared raptor nest locations. Reviews of this report at earlier stages were provided by Lorraine Keith and Noelle Glines-Bovio, improving the report product. Members of Wyoming Native Plant Society participated in a 2019 fieldtrip to Oregon Buttes.

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Figures

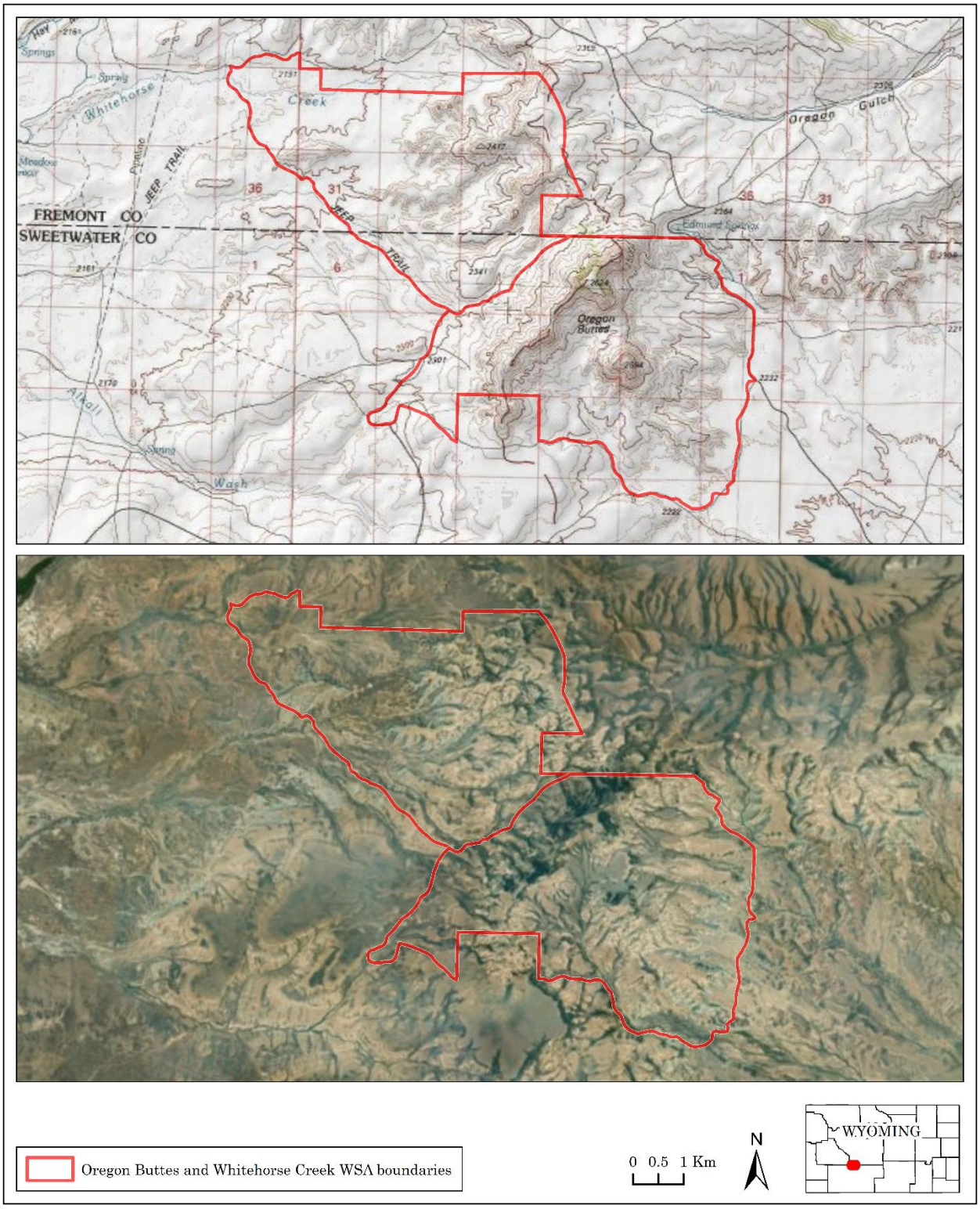


Figure 1. Map of the Oregon Buttes and Whitehorse Creek Wilderness Study Areas in Wyoming, including both map and NAIP imagery.

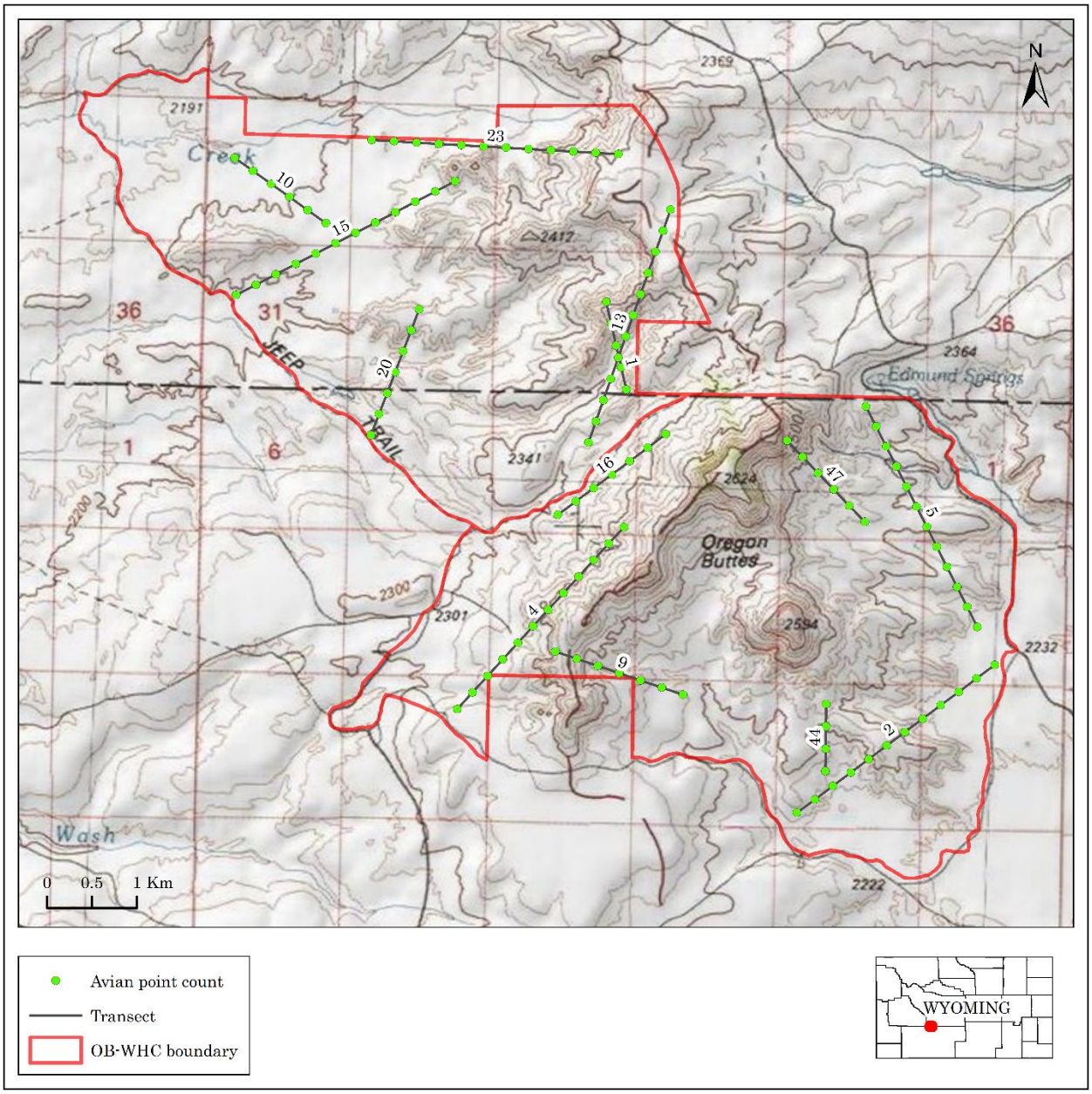


Figure 2. Avian point-count transects surveyed in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas during May, 2018.

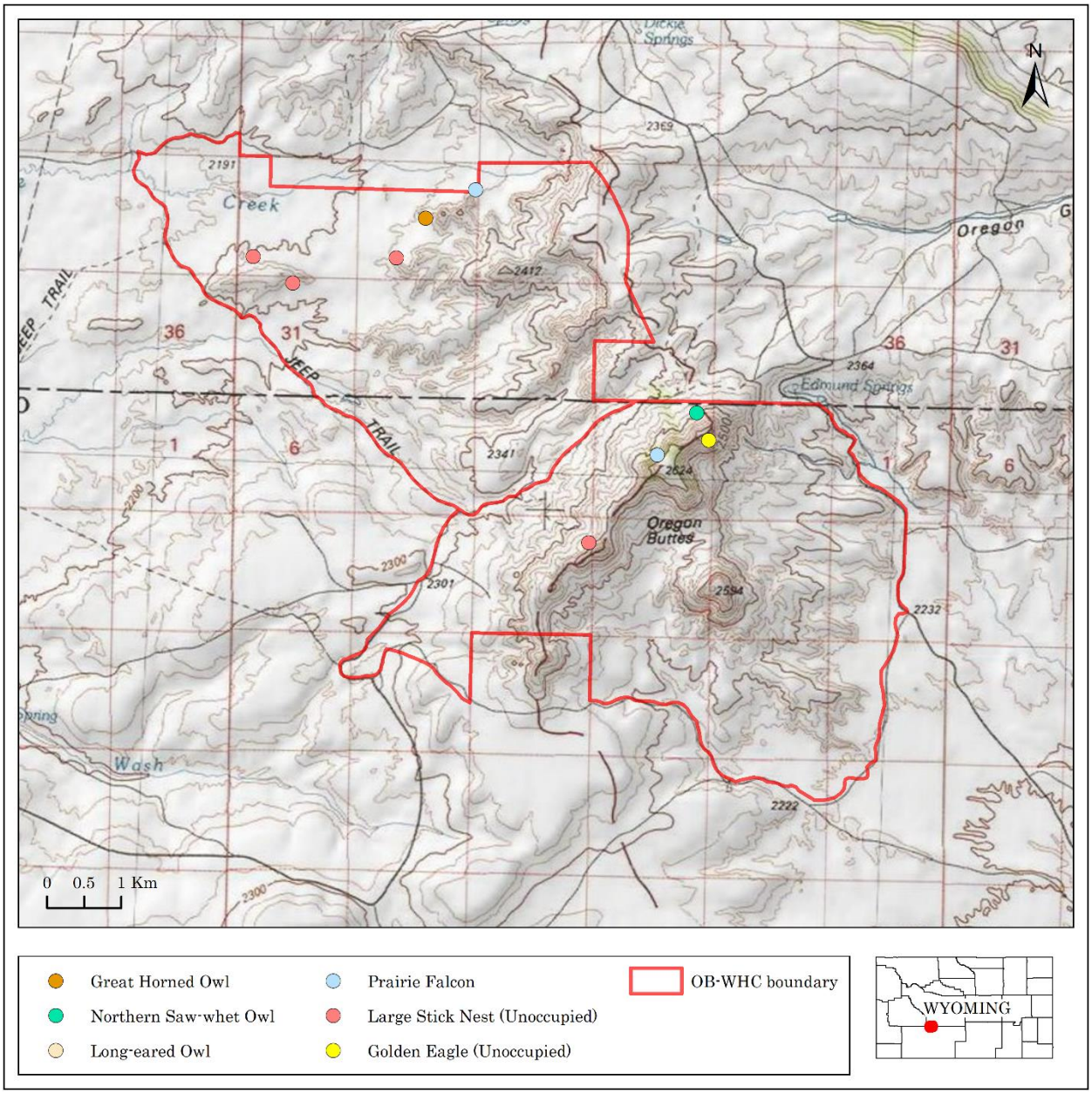


Figure 3. Locations of raptor nest sites in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

Figure 4. Northern saw-whet owl in cavity (top) and ground nest of long-eared owl (bottom), both in forest stand on northwestern slope of Oregon Buttes WSA. Photos by Don Jones.

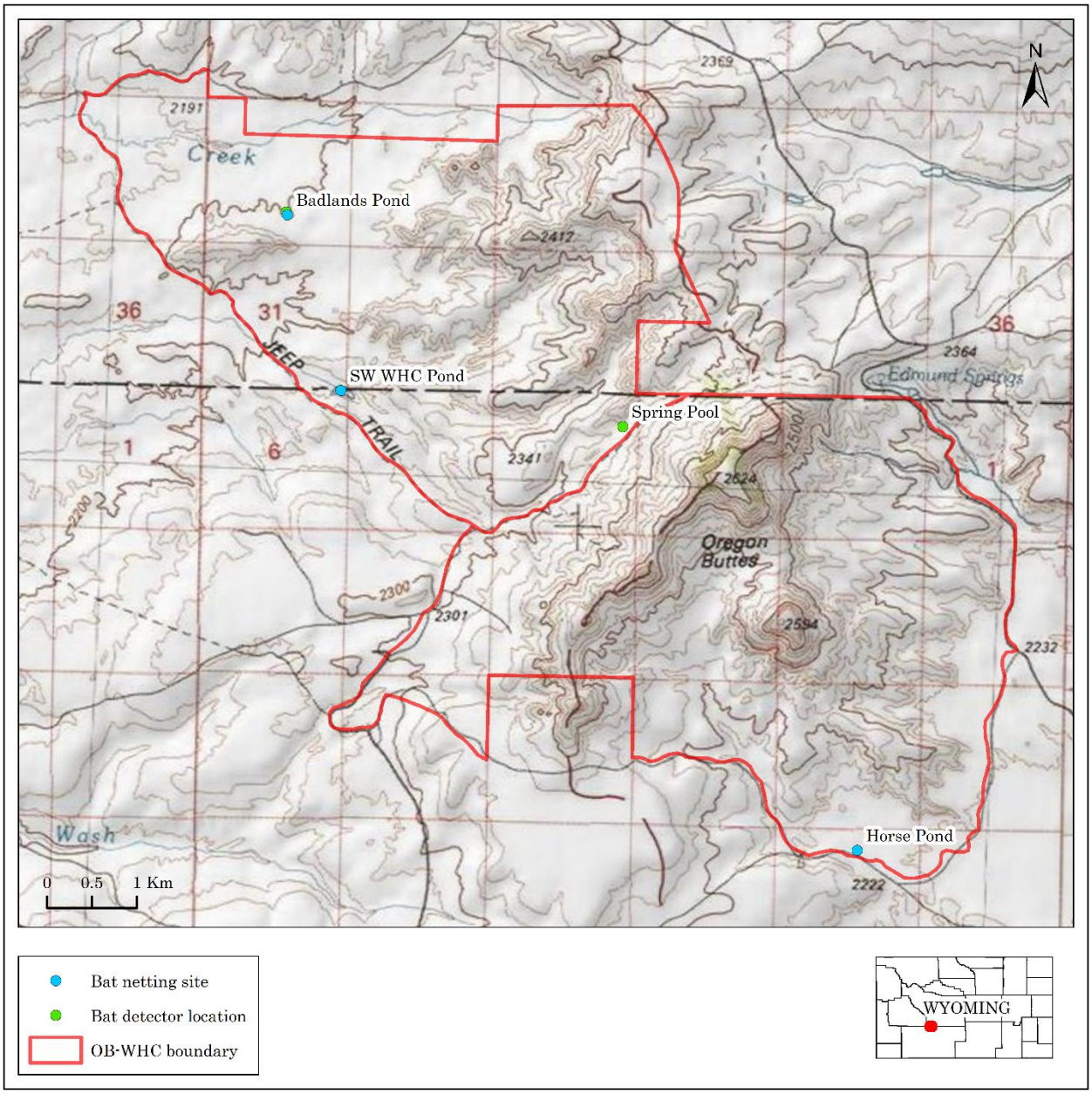


Figure 5. Locations of sites surveyed for bats with mist-netting and passive acoustic recorders in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

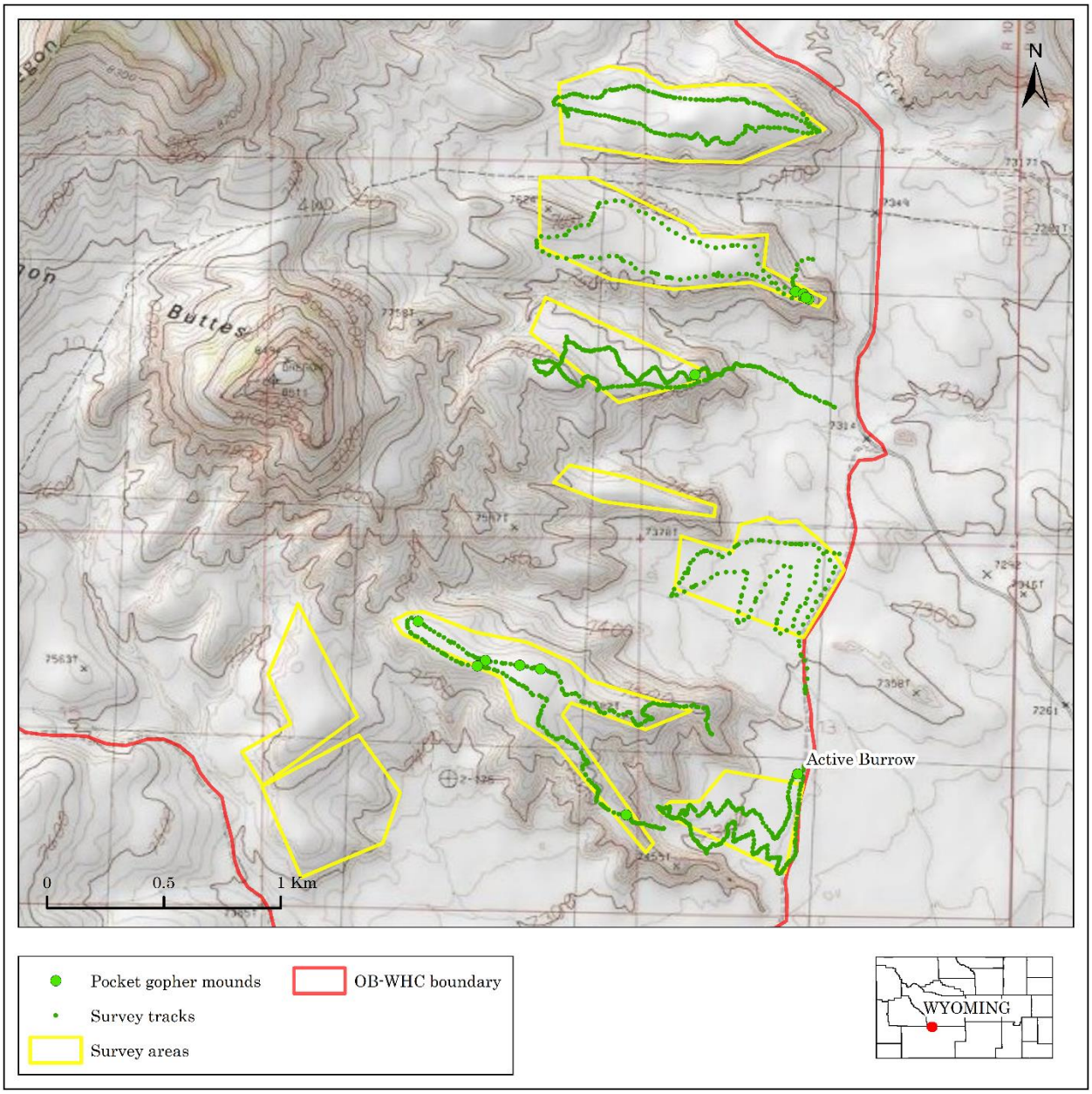


Figure 6. Survey areas, tracks, and locations for pocket gopher mounds in the Oregon Buttes Wilderness Study Areas, 2018.

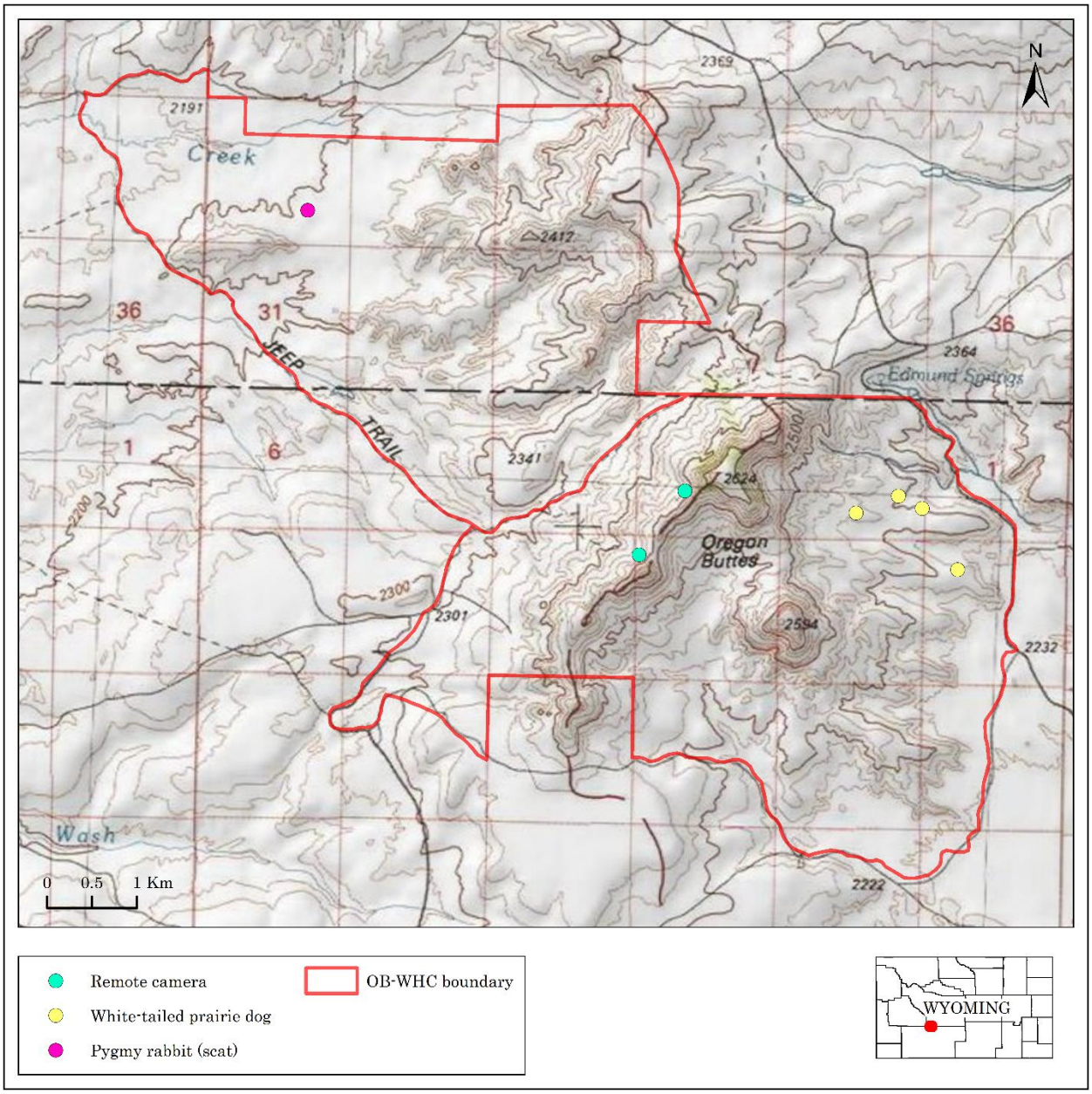


Figure 7. Locations of infrared trail cameras used to document ungulates and carnivores, and detections of small mammals in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

Figure 8. Photos from infrared trail cameras in the Oregon Buttes Wilderness Study Area, 2018. Clockwise from top-left: mule deer with fawns, elk with calf, elk group, bull elk, coyote, and bobcat. Locations of cameras are shown in Figure 7.

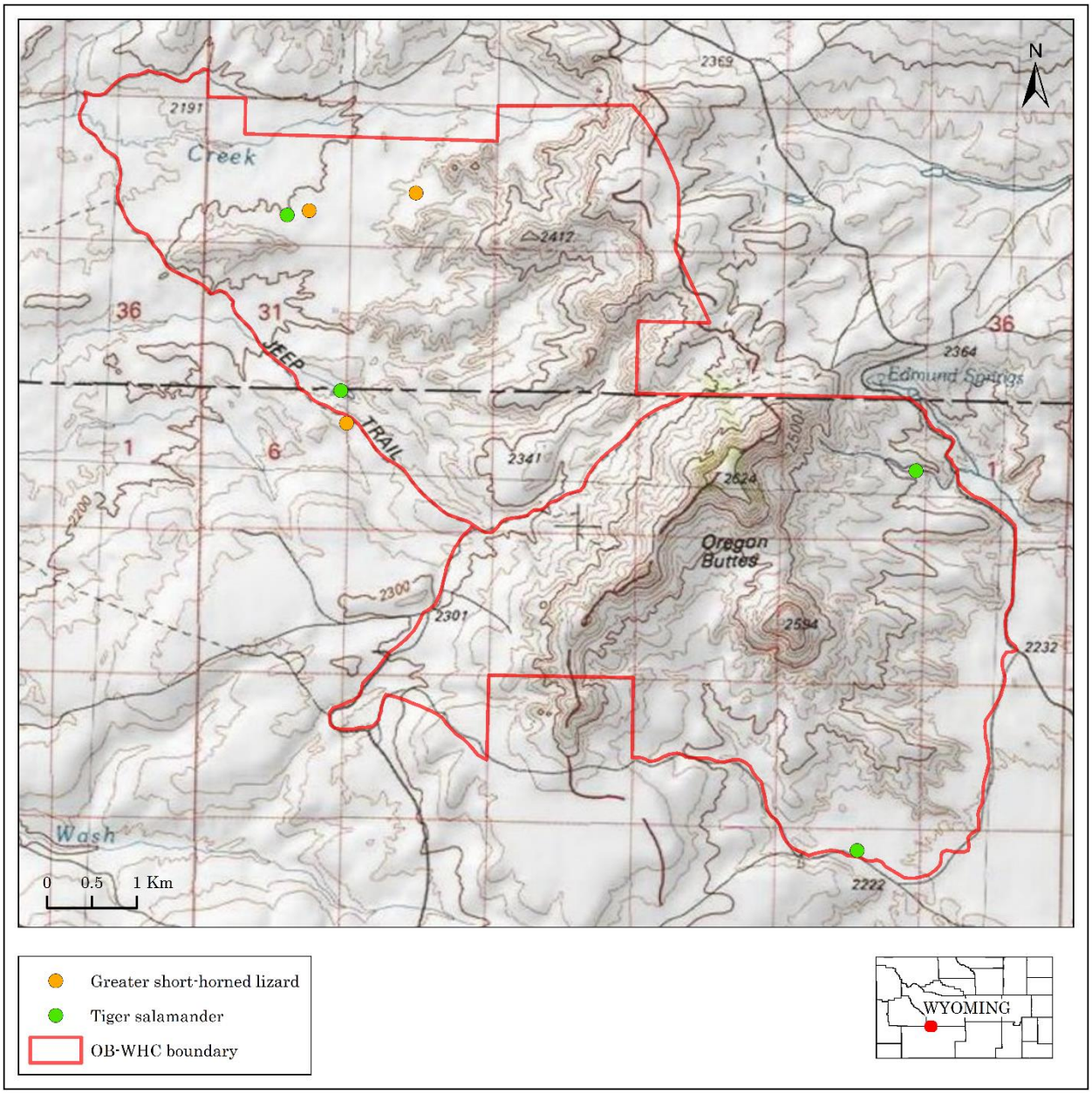


Figure 9. Locations of amphibians and reptiles observed in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

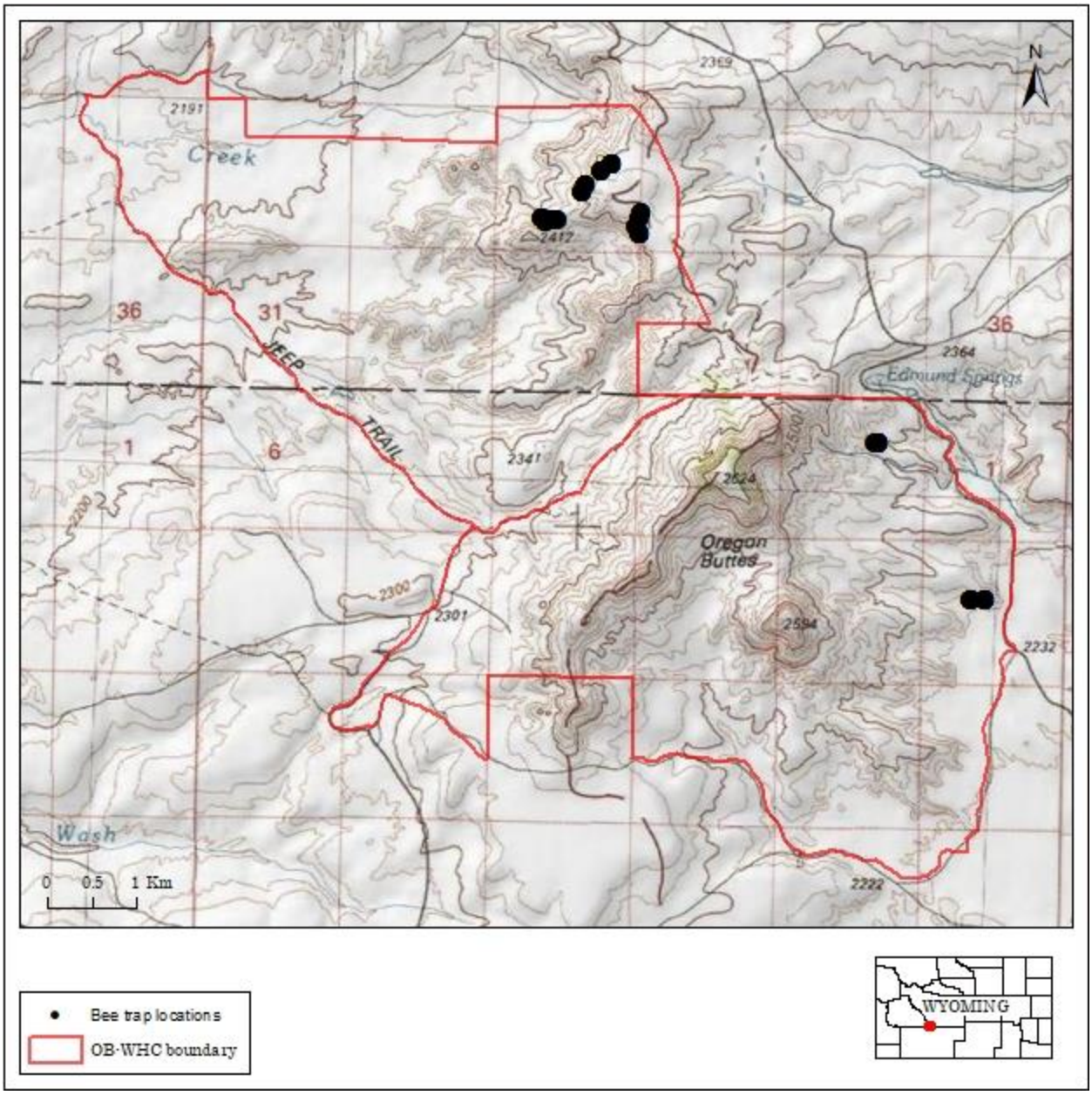


Figure 10. Locations of bee traps placed in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018. A blue vane trap and three bee cups (blue, white and yellow) were placed at each location.

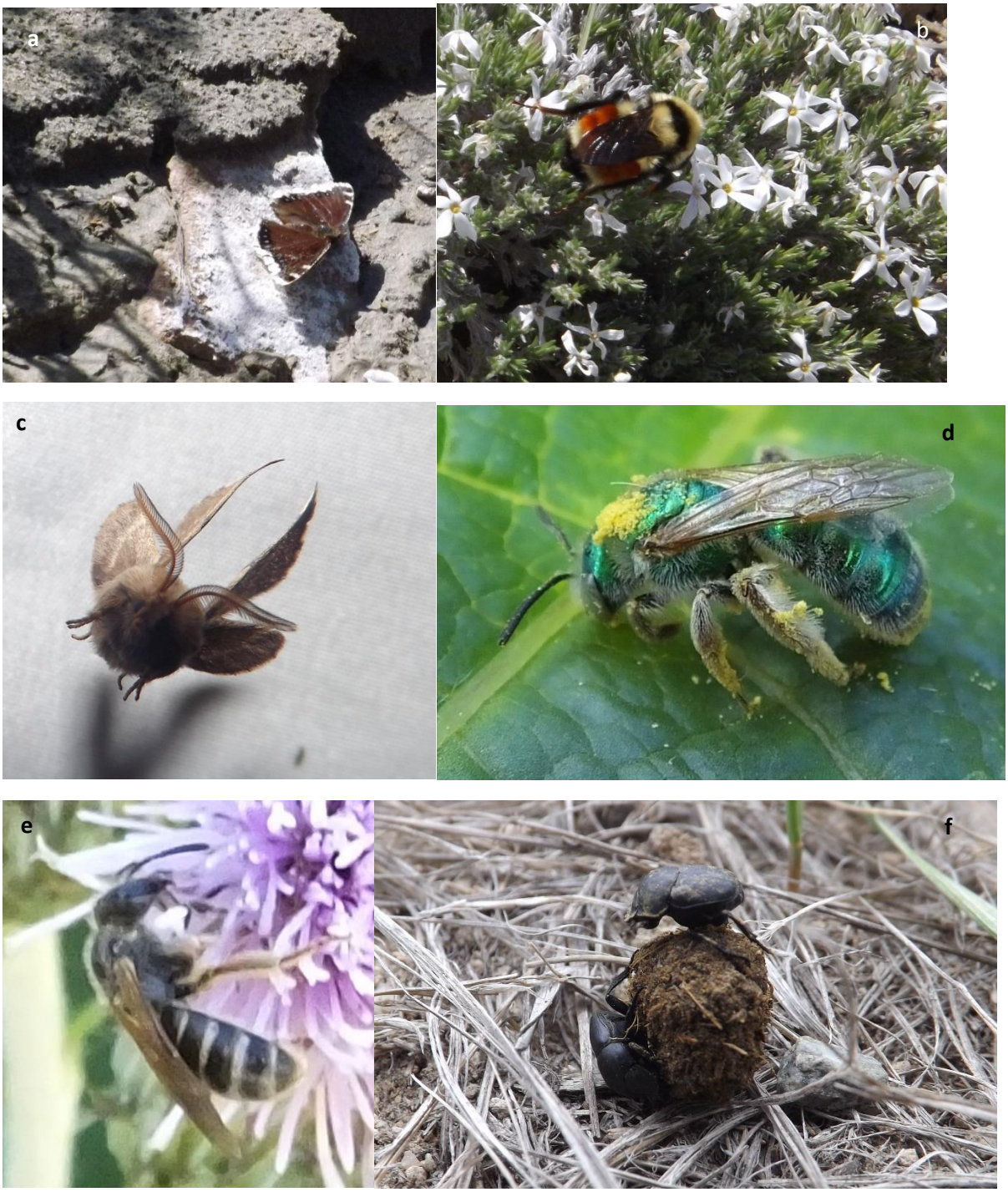


Figure 11. Photos of insects observed at Oregon Buttes and Whitehorse Creek Wilderness Study Areas. a.) Mourning cloak, b.) Hunt's bumble bee, c.) moth, d.) *Agapostemon* sweat bee, e.) *Lasioglossum sensu strictu* sweat bee, and f.) dung beetles.

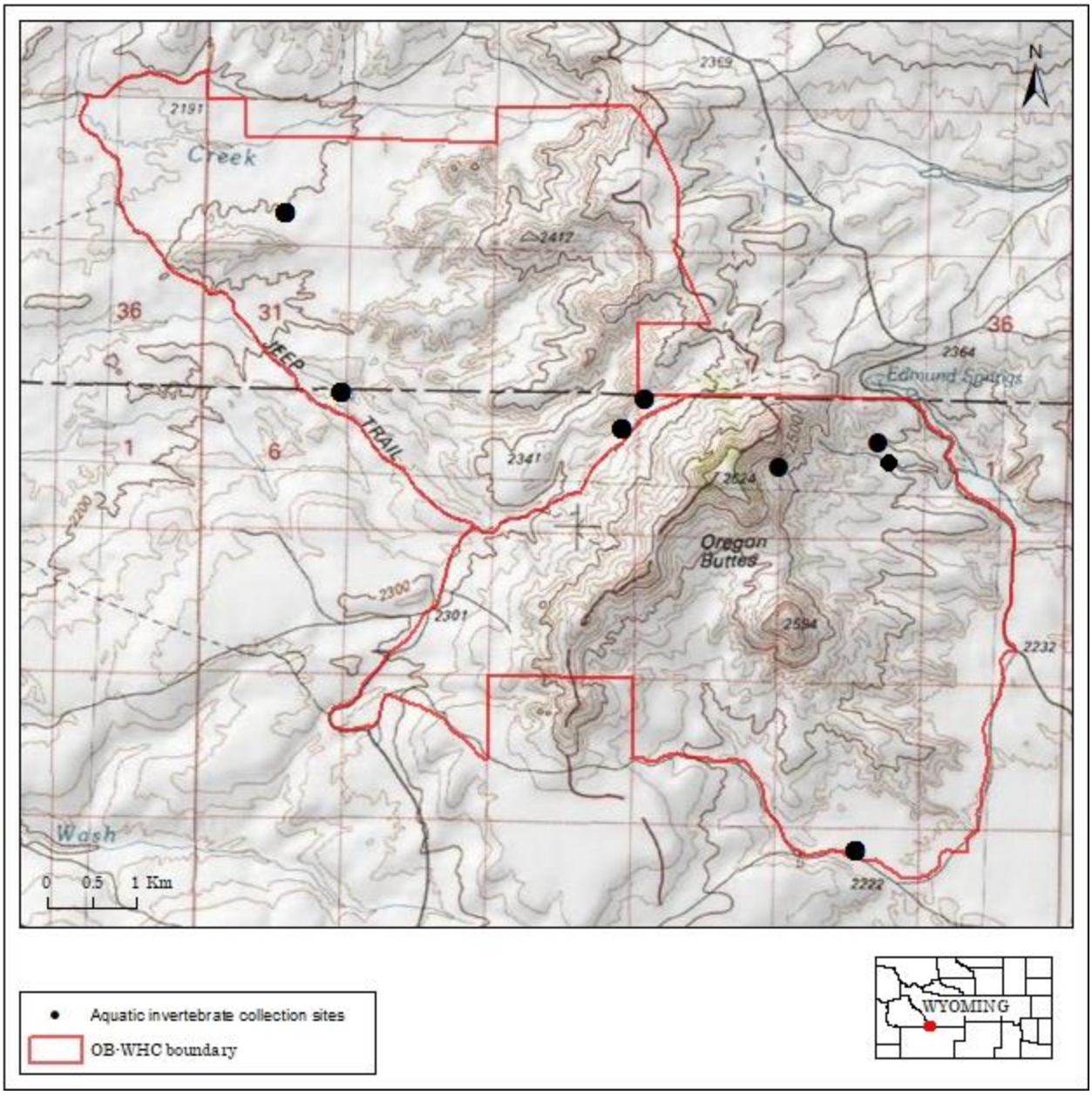


Figure 12. Aquatic invertebrate sample locations in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

Figure 13. Photos of aquatic habitats and the animals living in them at Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018. a.) Sampling a stock pond in Oregon Buttes, b.) tiger salamander in a temporary stream, c.) a spring, d.) a soldier fly (Stratiomyidae), e.) Neoporus beetle larvae, and f.) fairy shrimp.

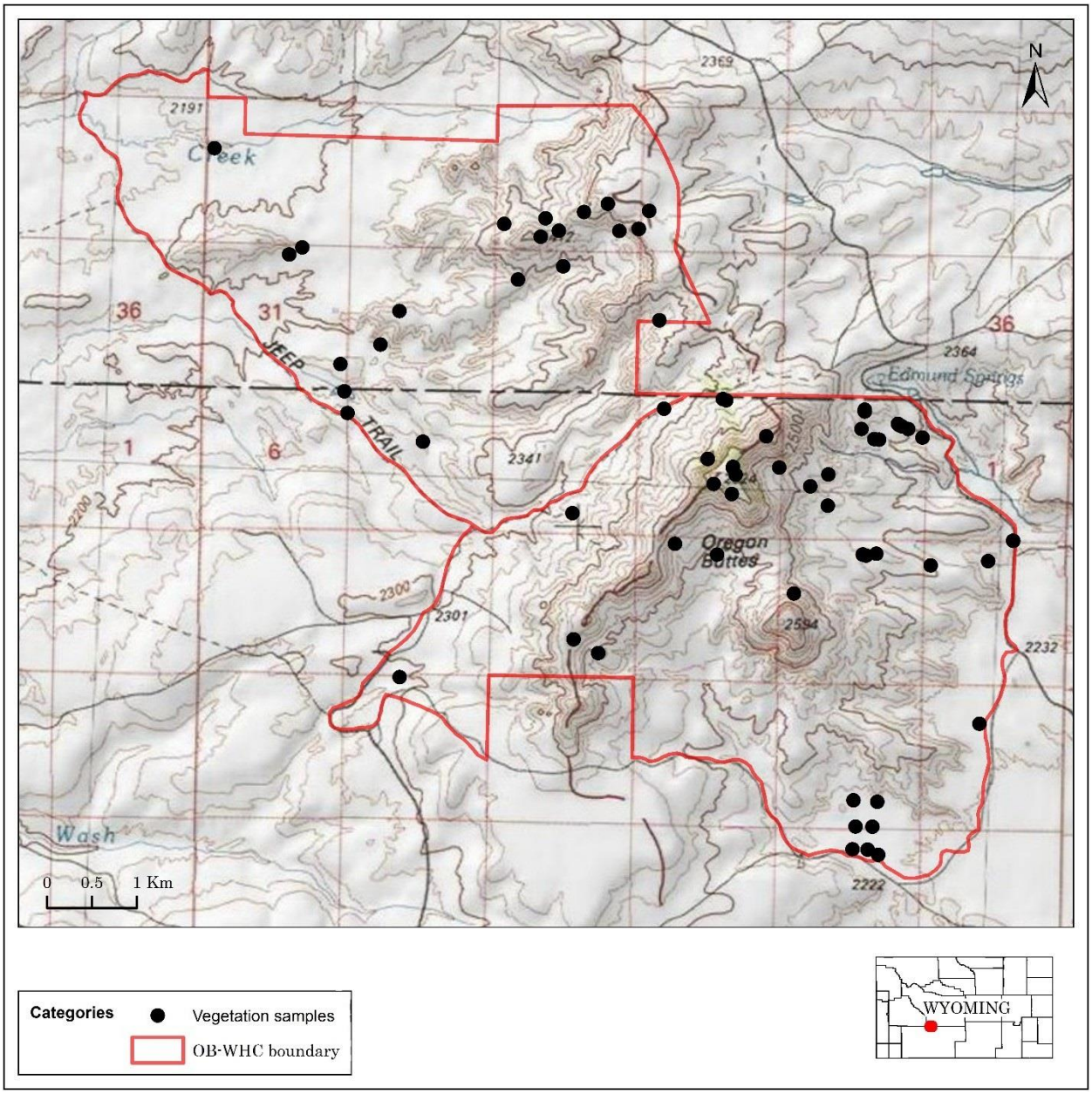


Figure 14. Locations of plant collection points in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

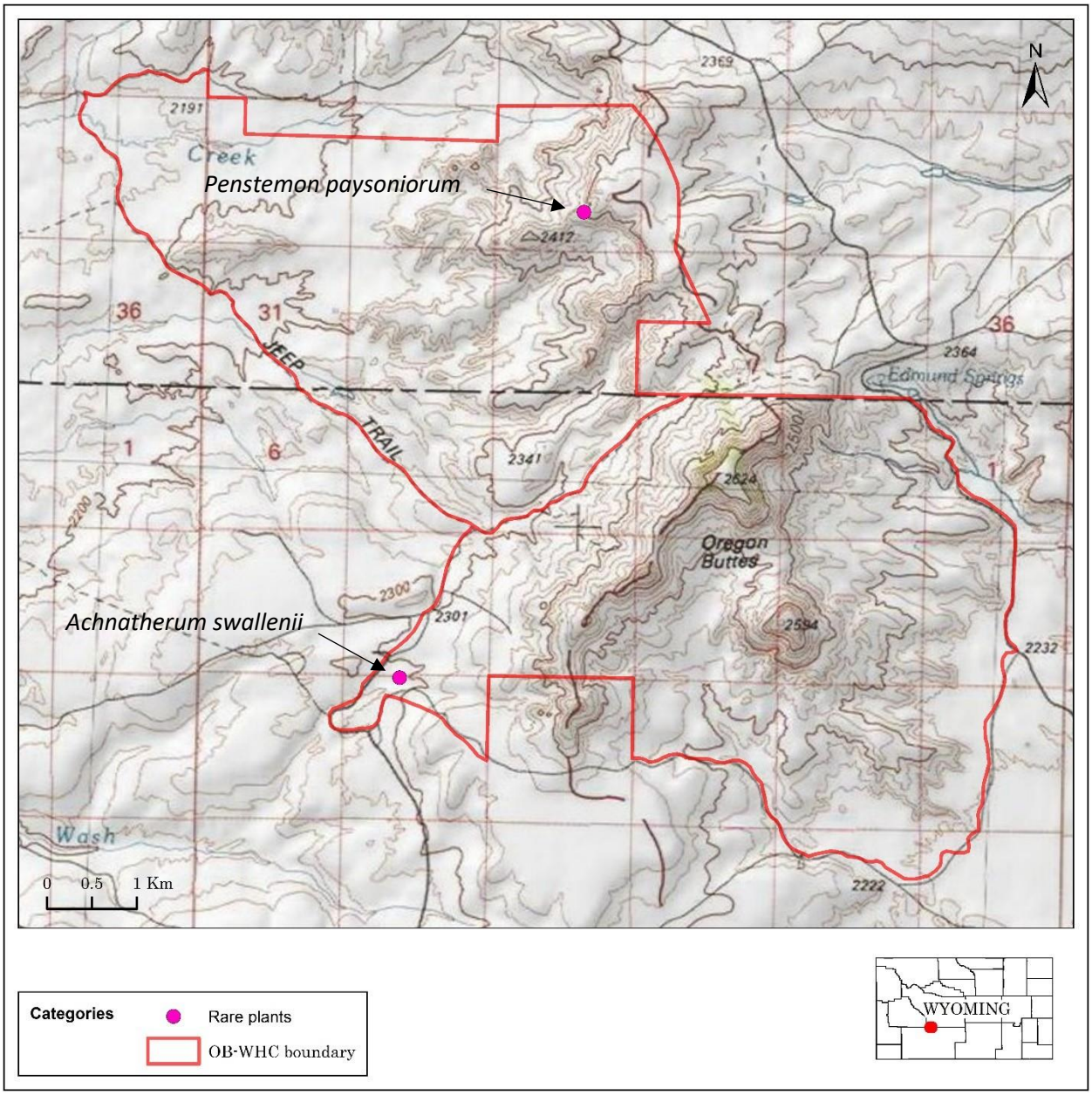
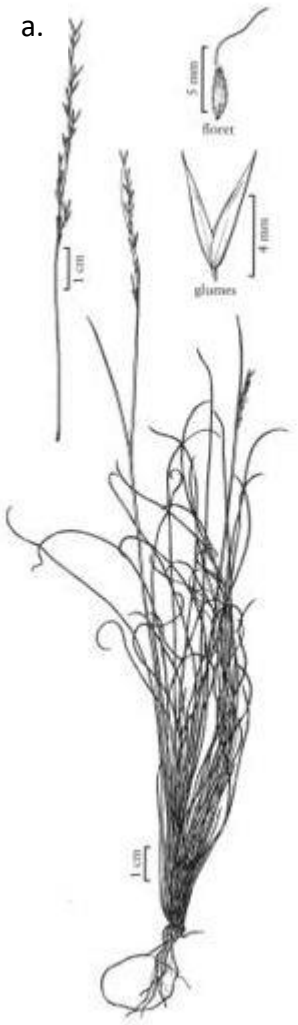


Figure 15. Locations of the two rarest plant records added in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

a.



[1]From: Barkworth, M. E. 2007. *Achnatherum*. Pages 114-142 in Flora of North America Editorial Committe, editor. Flora of North America North of Mexico. Vol. 24. Magnoliophyta: Commelinidae (in part): Poaceae, part 1. Oxford University Press, NY, NY.

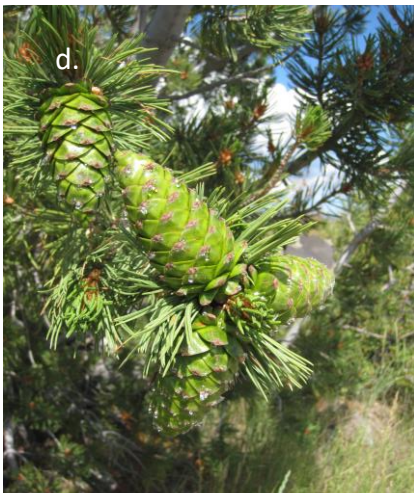


Figure 16. Sensitive and rare plants of the Oregon Buttes and Whitehorse Creek WSAs, a.) *Achnatherum swallenii*[1], b.) *Penstemon paysoniorum*, c.) *Ipomopsis crebifolia*, d.) *Pinus flexilis*, e.) *Eriogonum brevicaule* var. *micranthum*, f.) *Townsendia spathulata*

Figure 17. Common plants of the Oregon Buttes and Whitehorse Creek WSAs, a.) *Eriogonum acaule*, b.) *Lewisia rediviva*, d.) *Castilleja lineariifolia*, d.) *Iris missouriensis.*

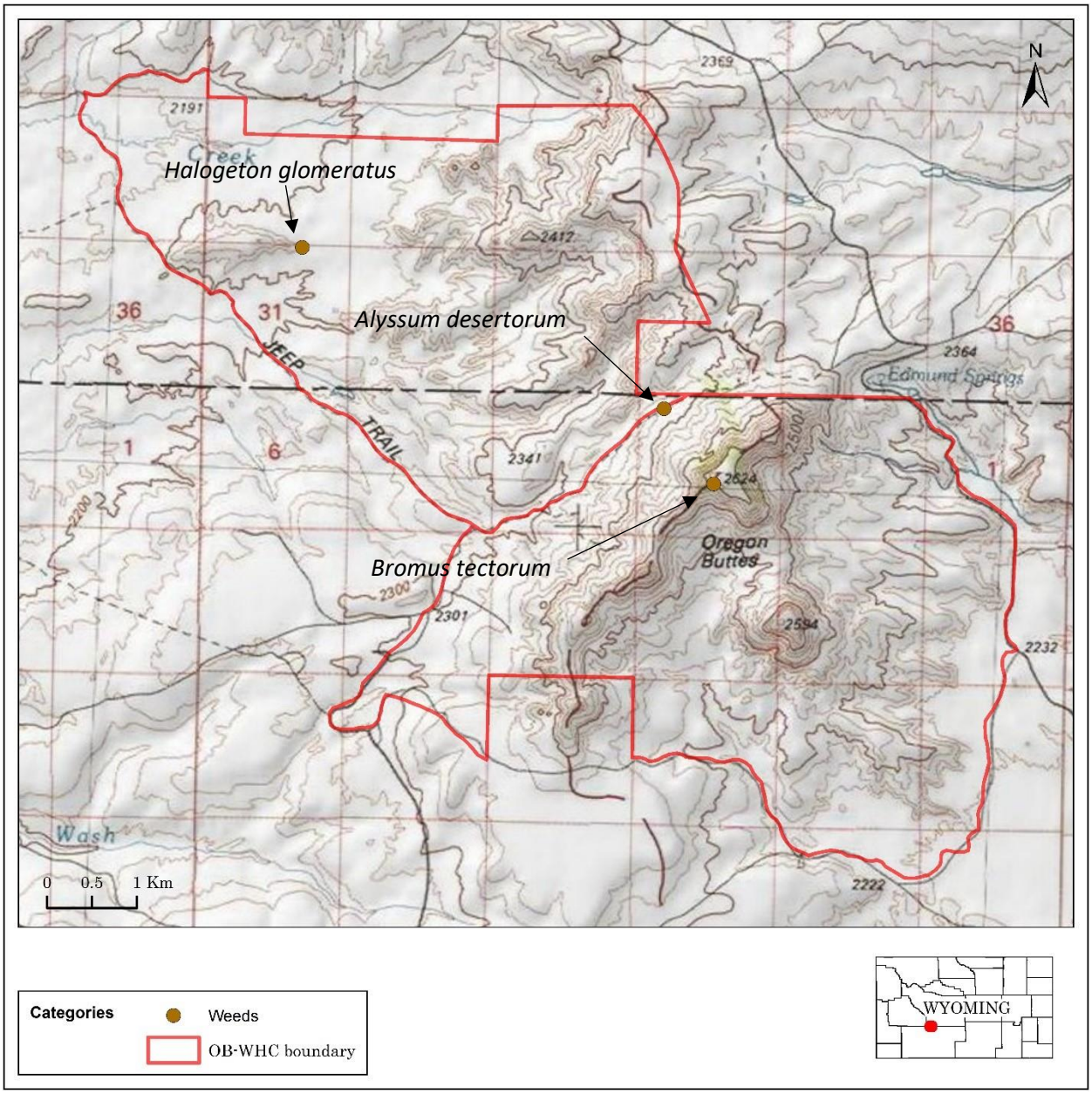


Figure 18. Locations of weeds collected in the interior of Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018[2].

[2] *Cirsium arvense* locations were restricted to ponds and springs and not mapped. Only Halogeton is noxious among species represented on this map.

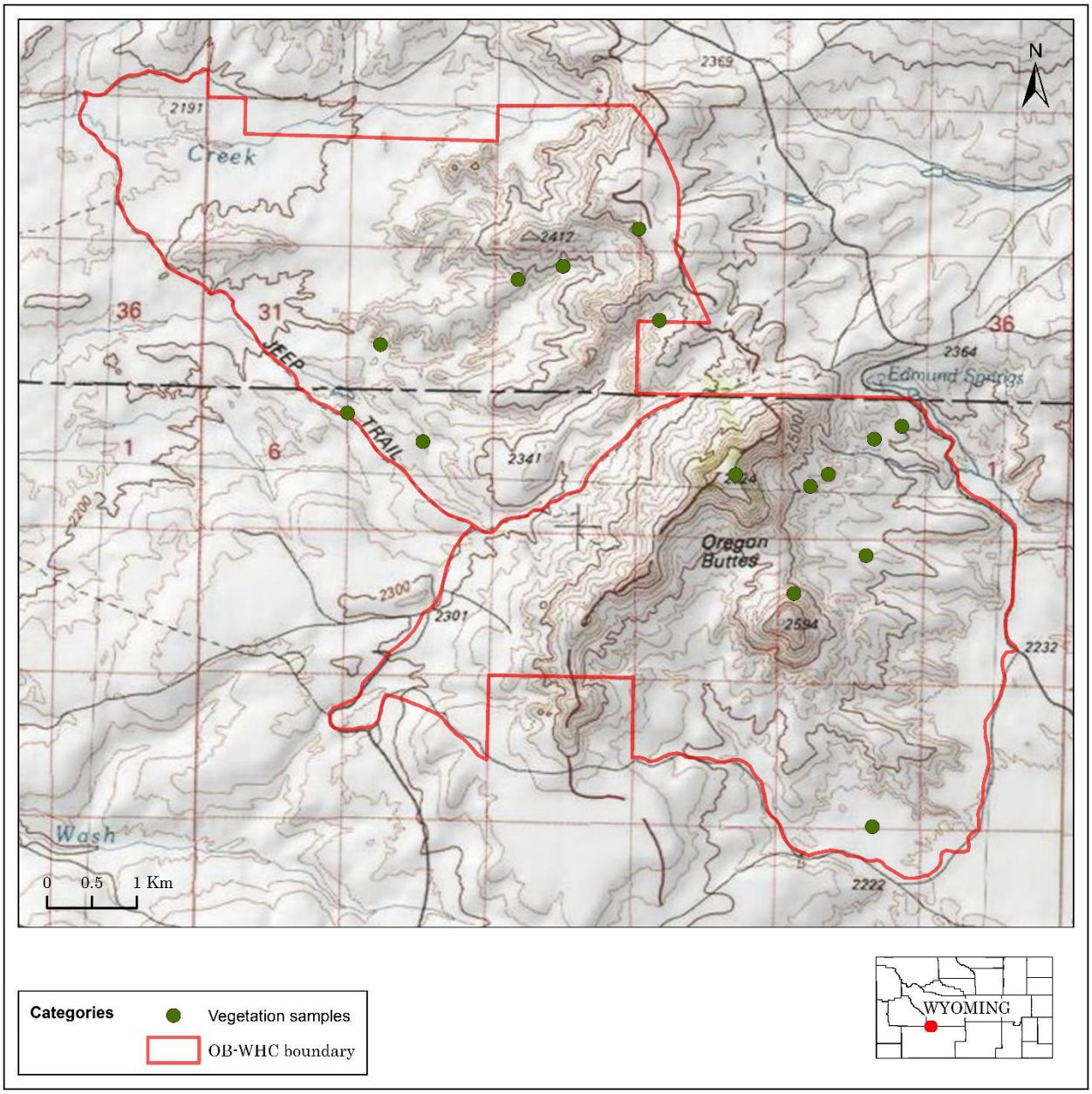
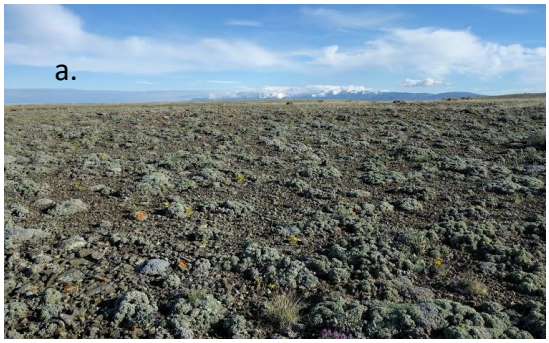


Figure 19. Locations of vegetation samples in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.



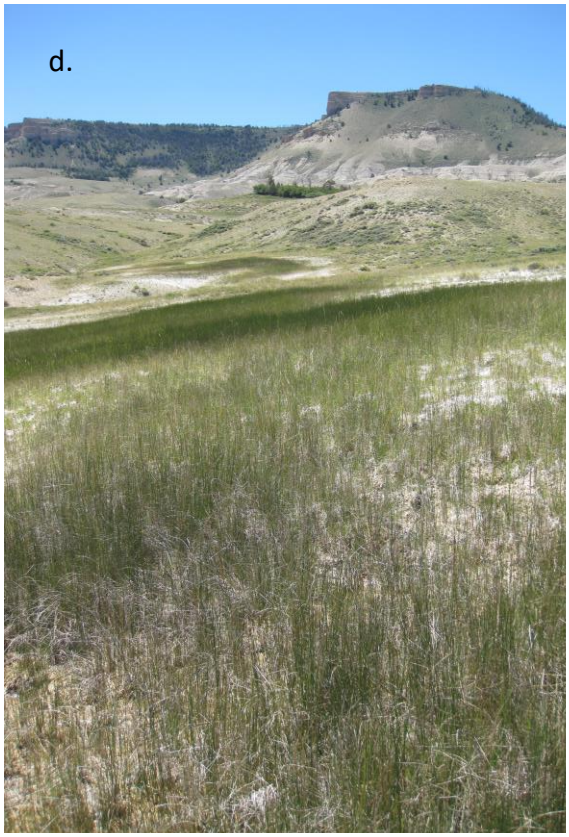


Figure 20. Vegetation of the Oregon Buttes and Whitehorse Creek WSAs, a.) Cushion plant community, b.) Mountain big sage community, c.) Birdsfoot sage community, d.) Alkali meadow community, e.) Utah Gardner's saltbush

Figure 21. Landscape views of Oregon Buttes and Whitehorse Creek WSAs, a.) View from north flanks of Oregon Buttes, looking north over Whitehorse Creek to Wind River Range; sagebrush steppe in foreground. b.) View of Oregon Buttes from finger ridge at south end of WSA, looking north; desert scrub vegetation in foreground.

Tables

Table 1. Birds detected during point-count transects and opportunistic observations in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas.

Common Name	Scientific Name	Count	Migratory Status
American Goldfinch	*Spinus tristis*	6	Resident
American Kestrel	*Falco sparverius*	6	Resident
American Robin	*Turdus migratorius*	8	Resident
Barn Swallow	*Hirundo rustica*	1	Possible
Black-billed Magpie	*Pica hudsonia*	4	Resident
Black-headed Grosbeak	*Pheucticus melanocephalus*	2	Possible
Brewer's Blackbird	*Euphagus cyanocephalus*	1	Resident
Brewer's Sparrow	*Spizella breweri*	163	Resident
Broad-tailed Hummingbird	*Selasphorus platycercus*	1	Migrant
Brown-headed Cowbird	*Molothrus ater*	1	Resident
Bullock's Oriole	*Icterus bullockii*	1	Possible
Canada Goose	*Branta canadensis*	9	Migrant
Cassin's Finch	*Haemorhous cassinii*	1	Possible
Cedar Waxwing	*Bombycilla cedrorum*	1	Possible
Chipping Sparrow	*Spizella passerina*	2	Resident
Clark's Nutcracker	*Nucifraga columbiana*	16	Resident
Cliff Swallow	*Petrochelidon pyrrhonota*	3	Resident
Common Poorwill	*Phalaenoptilus nuttallii*	1	Resident
Common Raven	*Corvus corax*	11	Resident
Cooper's Hawk	*Accipiter cooperii*	1	Resident
Cordilleran Flycatcher	*Empidonax occidentalis*	1	Possible
Dark-eyed Junco	*Junco hyemalis*	1	Possible
Dusky Flycatcher	*Empidonax oberholseri*	4	Resident
Ferruginous Hawk	*Buteo regalis*	1	Resident
Golden Eagle	*Aquila chrysaetos*	2	Resident
Gray Flycatcher	*Empidonax wrightii*	4	Migrant
Great Horned Owl	*Bubo virginianus*	4	Resident

Common Name	Scientific Name	Count	Migratory Status
Green-tailed Towhee	*Pipilo chlorurus*	126	Resident
Green-winged Teal	*Anas crecca*	2	Migrant
Hermit Thrush	*Catharus guttatus*	1	Possible
Horned Lark	*Eremophila alpestris*	97	Resident
House Finch	*Haemorhous mexicanus*	1	Possible
House Wren	*Troglodytes aedon*	2	Resident
Killdeer	*Charadrius vociferus*	2	Resident
Lark Bunting	*Calamospiza melanocorys*	18	Possible
Lark Sparrow	*Chondestes grammacus*	2	Resident
Lazuli Bunting	*Passerina amoena*	1	Possible
Least Flycatcher	*Empidonax minimus*	1	Migrant
Lincoln's Sparrow	*Melospiza lincolnii*	1	Migrant
Long-eared Owl	*Asio otus*	4	Resident
Mallard	*Anas platyrhynchos*	2	Migrant
Mountain Bluebird	*Sialia currucoides*	39	Resident
Mountain Chickadee	*Poecile gambeli*	3	Resident
Mountain Plover	*Charadrius montanus*	1	Resident
Mourning Dove	*Zenaida macroura*	11	Resident
Northern Flicker	*Colaptes auratus*	6	Resident
Northern Harrier	*Circus cyaneus*	2	Resident
Northern Saw-whet Owl	*Aegolius acadicus*	1	Resident
Pine Siskin	*Spinus pinus*	18	Resident
Pinyon Jay	*Gymnorhinus cyanocephalus*	1	Possible
Prairie Falcon	*Falco mexicanus*	8	Resident
Red-breasted Nuthatch	*Sitta canadensis*	1	Resident
Red-tailed Hawk	*Buteo jamaicensis*	2	Resident
Red Crossbill	*Loxia curvirostra*	1	Possible
Rock Wren	*Salpinctes obsoletus*	103	Resident
Ruby-crowned Kinglet	*Regulus calendula*	1	Resident
Sage Thrasher	*Oreoscoptes montanus*	92	Resident
Sagebrush Sparrow	*Artemisiospiza nevadensis*	42	Resident

Common Name	Scientific Name	Count	Migratory Status
Say's Phoebe	*Sayornis saya*	12	Resident
Sharp-shinned Hawk	*Accipiter striatus*	1	Resident
Swainson's Hawk	*Buteo swainsoni*	1	Possible
Swainson's Thrush	*Catharus ustulatus*	1	Migrant
Townsend's Warbler	*Setophaga townsendi*	3	Migrant
Tree Swallow	*Tachycineta bicolor*	1	Possible
Unidentified Bird	*Aves (gen, sp)*	8	Unknown
Unidentified Empidonax Flycatcher	*Empidonax sp.*	1	Unknown
Unidentified Sparrow	*Passerellidae (gen, sp)*	24	Unknown
Unidentified Swallow	*Hirundinidae (gen, sp)*	2	Unknown
Vesper Sparrow	*Pooecetes gramineus*	43	Resident
Violet-green Swallow	*Tachycineta thalassina*	31	Resident
Virginia's Warbler	*Oreothlypis virginiae*	2	Possible
Warbling Vireo	*Vireo gilvus*	1	Resident
Western Kingbird	*Tyrannus verticalis*	1	Possible
Western Meadowlark	*Sturnella neglecta*	8	Resident
Western Tanager	*Piranga ludoviciana*	2	Resident
Western Wood-Pewee	*Contopus sordidulus*	2	Resident
White-crowned Sparrow	*Zonotrichia leucophrys*	1	Possible
Yellow-rumped Warbler	*Setophaga coronata*	3	Resident
Yellow Warbler	*Setophaga petechia*	1	Migrant

Table 2. Bats detected in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

Common Name	Scientific Name	Mist-net Captures	Acoustic Recordings
Pallid Bat	*Antrozous pallidus*	0	1
Long-eared Myotis	*Myotis evotis*	4	4
Little Brown Myotis	*Myotis lucifugus*	7	5
Long-legged Myotis	*Myotis volans*	11	4
Western Small-footed Myotis	*Myotis cilliolabrum*	17	3

Table 3. Mammal species observed in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018. Bats are included in Table 2.

Common Name	**Scientific Name**	**Detection Method**
Cottontail	*Sylvilagus sp.*	Visual, scat, remote camera
Wyoming Ground Squirrel	*Urocitellus elegans*	Visual, audible
White-tailed Prairie Dog	*Cynomys leucurus*	Visual, audible
Pocket Gopher	*Thomomys* sp.	Soil mounds
Coyote	*Canis latrans*	Tracks
Bobcat	*Lynx rufus*	Remote camera
Elk	*Cervus canadensis*	Visual, remote camera
Mule Deer	*Odocoileus hemionus*	Visual, remote camera
Pronghorn	*Antilocapra americana*	Visual

Table 4. Lepidoptera (butterflies and moths) observed in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

Common name	Scientific name
Small wood-nymph	*Cercyonis oetus*
Common ringlet	*Coenonympha tullia*
Queen Alexandrea's Sulphur	*Colias alexandra*
Geometrid moth	Geometridae
Moth	*Grammia williamsii*
Nevada skipper	*Hesperia nevada*
Ferris's Copper	*Lycaena rubidus/ferrisi*
Ridings' Satyr	*Neominois ridingsii*
Moth	Notodontidae
Mourning cloak	*Nymphalis antiopa*
Rocky Mountain Parnassian	*Parnassius smintheus*
Pale crescent	*Phycoides pallida*
Field crescent	*Phycoides pulchella*
Boisduval blue	*Plebejus icarioides*
Melissa's blue	*Plebejus melissa*
Greenish blue	*Plebejus saepiolus*
Shasta blue	*Plebejus shasta*
Draco skipper	*Polites draco*
Coronis fritillary	*Speyeria coronis*

Table 5. Insects, mostly bees, collected in bee traps in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

Common name	Taxa	Number collected
Sweat bee	*Agapostemon angelicus/texanus*	14
Sweat bee	*Agapostemon sericeus/obliquus/femoratus*	48
Mining bee	*Andrena*	6
Digger bee	*Anthophora*	20
Bumble bee digger	*Anthophora bomboides*	15
Mason bee	*Ashmeadiella*	1
Bumble bee	*Bombus californicus/fervidus*	2
Bumble bee	*Bombus centralis*	2
Bumble bee	*Bombus fervidus*	2
Bumble bee	*Bombus huntii*	12
Bumble bee	*Bombus sylvicola*	14
Small carpenter bee	*Ceratina*	33
Chrysidid wasp	*Chrysididae*	6
Plasterer bee	*Colletes*	1
Crabronid wasp	*Crabronidae*	3
Cactus bee	*Diadasia*	1
Long-horned bee	*Eucera*	2
Potter and mason wasp	Eumeninae	8
Sweat bee	*Halictus confusus*	4
Sweat bee	*Halictus farinosus*	1
Sweat bee	*Halictus ligatus*	1
Sweat bee	*Halictus rubicundus*	13
Mason bee	*Hoplitis*	4
Sweat bee	*Lasioglossum Dialictus*	99
Sweat bee	*Lasioglossum Evylaeus*	2
Sweat bee	*Lasioglossum sensu stricto*	68
Leafcutter bee	*Megachile*	1
Long-horned bee	*Melissodes*	1
Cuckoo bee	*Melecta*	2
Velvet ant	*Mutillidae*	1
Cuckoo bee	*Nomada*	1
Mason bee	*Osmia*	24
Spider wash	Pompilidae	1
Wasp	*Pseudomasaris vespoides*	2
Thread-waisted wasp	Sphecidae	4
Sweat bee	*Sphecodes*	2
Sawfly	Symphyta	1

Table 6. Aquatic invertebrates collected in the Oregon Buttes and Whitehorse Creek Wilderness Study Areas, 2018.

Common name	Order	Family	Genus
Water mite	Acari		
Fairy shrimp	Anostraca		
Ground beetle	Coleoptera	Carabidae	
Weevil	Coleoptera	Curculionidae	
Predaceous diving beetle	Coleoptera	Dytiscidae	*Agabinus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Agabus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Colymbetes*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Desmopachria*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Dytiscus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Hydrocolus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Hydroporus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Hygrotus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Laccophilus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Liodessus*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Neoprous*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Oreodytes*
Predaceous diving beetle	Coleoptera	Dytiscidae	*Rhantus*
Whirligig beetle	Coleoptera	Gyrinidae	*Gyrinus*
Water scavenger beetle	Coleoptera	Hydrophilidae	*Berosus*
Water scavenger beetle	Coleoptera	Hydrophilidae	*Helophorus*
Water scavenger beetle	Coleoptera	Hydrophilidae	*Hydrobius*
Water scavenger beetle	Coleoptera	Hydrophilidae	*Tropisternus*
Water scavenger beetle	Coleoptera	Ptilodactylidae/Eulichadidae	
Water scavenger beetle	Coleoptera	Staphlinidae	
Copepod	Crustacea	Cyclopoida	
Cladocera	Crustacea	Cladocera	
Non-biting midge	Diptera	Chironomidae	Non-Tanypodinae
Mosquito	Diptera	Culicidae	*Aedes*
Soldierfly	Diptera	Stratiomyidae	
Mayfly	Ephemeroptera	Baetidae	*Baetis*
Water boatman	Hemiptera	Corixidae	*Hesperocorixa*
Water strider	Hemiptera	Gerridae	*Gerris*
Back swimmer	Hemiptera	Notonectidae	*Notonecta*
Damselfly	Odonata	Coenagrionidae	*Ceonagrion/Enallagma*
Damselfly	Odonata	Lestidae	*Lestes*
Northern caddisflies	Trichoptera	Limnephilidae	*Hesperophylax*
Northern caddisflies	Trichoptera	Limnephilidae	*Limnephilus*

Table 7. Vascular flora of Oregon Buttes and Whitehorse Creek WSAs

Family[3]	Intr.[4]	Scientific Name[5]	Earlier record[6]	2018 (coll. no.)[7]
ADO		Sambucus racemosa L. var. microbotrys (Rydb.) Kearney & Peebles	x	
AMA		Atriplex argentea Nutt. var. argentea		4867
AMA		Atriplex canescens (Pursh) Nutt. var. canescens		4872
AMA		Atriplex gardneri (Moq.) D. Dietr. var. falcata (M. E. Jones) S. L. Welsh		obs
AMA		Atriplex gardneri (Moq.) D. Dietr. var. gardneri	x	
AMA		Atriplex gardneri (Moq.) D. Dietr. var. utahensis (M. E. Jones) Dorn		4637
AMA		Atriplex suckleyi (Torr.) Rydb.		4635
AMA	x	Chenopodium album L.		obs
AMA		Chenopodium atrovirens Rydb.	x	
AMA		Chenopodium glaucum L. var. salinum (Standl.) B. Boivin		4685
AMA	x	Halogeton glomeratus (M. Bieb.) C. A. Mey.		4866
AMA		Kochia americana S. Watson	x	4627
AMA		Krascheninnikovia lanata (Pursh) A. Meeuse & A. Smit	x	
AMA		Micromonolepis pusilla (Torr. ex S. Watson) Ulbr.		4698
AMA		Monolepis nuttalliana (Schult.) Greene		4492
AMA	x	Salsola tragus L.		4963a
AMA		Suaeda calceoliformis (Hook.) Moq.		4892
AMR		Suaeda occidentalis (S. Watson) S. Watson		4699
AMR		Allium geyeri S. Watson var. tenerum M. E. Jones		4924
AMR		Allium textile A. Nelson & J. F Macbr.	x	
API		Cymopterus constancei R. L. Hartm.		4452
API		Cymopterus longipes S. Watson		4449
API		Cymopterus terebinthinus (Hook.) Torr. & A. Gray var. albiflorus (Torr. & A. Gray) M. E. Jones	x	
API		Lomatium cous (S. Watson) J. M. Coult. & Rose		4467
API		Lomatium foeniculaceum (Nutt.) J. M. Coult. & Rose var. foeniculaceum	x	
API		Osmorhiza depauperata Phil.		4670
ASP		Maianthemum stellatum (L.) Link	x	
AST		Agoseris glauca (Pursh) Raf. var. dasycephala (Torr. & A. Gray) Jeps.	x	
AST		Almutaster pauciflorus (Nutt.) Á. Löve & D. Löve		4965
AST		Antennaria microphylla Rydb.	x	
AST		Antennaria rosea Greene	x	
AST		Antennaria umbrinella		4464
AST		Arnica sororia Greene		4500
AST		Artemisia cana Pursh var. viscidula Osterh.		4888
AST		Artemisia dracunculus L.		obs
AST		Artemisia frigida Willd.		4886
AST		Artemisia ludoviciana Nutt. var. ludoviciana		obs

[3] The first three letters of the plant family name are in this column, e.g., ADO is Adoxaceae, AMA is Amaranthaceae, API is Apiaceae, and AST is Asteraceae.
[4] Non-native species are indicated by an X is this column.
[5] Scientific nomenclature follows Nelson (2018).
[6] Species that were collected from the study area prior to 2018 are indicated by an X in this column.
[7] Specimens collected in 2018 were assigned a unique collection number and can be searched on these collector numbers at Rocky Mountain Herbarium online specimen database.

Family[3]	Intr.[4]	Scientific Name[5]	Earlier record[6]	2018 (coll. no.)[7]
AST		Artemisia pedatifida Nutt.	x	
AST		Artemisia spinescens D. C. Eaton		4489
AST		Artemisia tridentata Nutt. var. tridentata		obs
AST		Artemisia tridentata Nutt. var. vaseyana (Rydb.) B. Boivin		4887
AST		Artemisia tridentata Nutt. var. wyomingensis (Beetle & A. M. Young) S. L. Welsh		4890
AST		Balsamorhiza sagittata (Pursh) Nutt.		4670
AST		Chaenactis douglasii (Hook.) Hook. & Arn. var. douglasii	x	
AST		Chrysothamnus viscidiflorus (Hook.) Nutt. var. lanceolatus (Nutt.) Greene		4688
AST	x	Cirsium arvense (L.) Scop.		4964
AST		Cirsium inamoenum (Greene) D. J. Keil var. inamoenum		4641
AST		Crepis modocensis Greene ssp. modocensis	x	
AST		Crepis runcinata (E. James) Torr. & A. Gray var. glauca (Nutt.) B. Boivin		4661
AST		Dieteria canescens (Pursh) Nutt. var. canescens		4655a
AST		Ericameria nauseosa (Pall. ex Pursh) G. L. Nesom & G. I. Baird var. nauseosa		4889
AST		Erigeron compositus Pursh	x	
AST		Erigeron engelmannii A. Nelson	x	
AST		Erigeron nanus Nutt.		4667
AST		Erigeron ursinus D. C. Eaton		4884
AST		Iva axillaris Pursh		4509
AST		Machaeranthera tanacetifolia (Kunth) Nees		obs
AST		Packera cana (Hook.) W. A. Weber & Á. Löve	x	
AST		Psilocarphus brevissimus Nutt. var. brevissimus		4683
AST		Pyrrocoma lanceolata (Hook.) Greene var. lanceolata		4871
AST		Pyrrocoma uniflora (Hook.) Greene var. uniflora		4631
AST		Senecio integerrimus Nutt. var. exaltatus (Nutt.)	x	
AST		Stenotus acaulis (Nutt.) Nutt.	x	
AST		Stenotus armerioides Nutt. var. armerioides	x	
AST		Stephanomeria runcinata Nutt.		4882
AST		Symphyotrichum lanceolatum (Willd.) G. L. Nesom var. hesperium (A. Gray) G. L. Nesom		4879
AST		Symphyotrichum spathulatum (Lindl.) G. L. Nesom var. spathulatum		4885
AST	x	Taraxacum erythrospermum Andrz. ex Besser		4471
AST	x	Taraxacum officinale Weber ex F. H. Wigg.	x	
AST		Tetradymia canescens DC.		4869
AST		Tetradymia spinosa Hook. & Arn.		obs
AST		Tetraneuris torreyana (Nutt.) Greene	x	
AST		Townsendia spathulata Nutt.		4451
AST		Townsendia spp.		4922
AST	x	Tragopogon dubius Scop.		4652
AST		Xanthisma grindelioides (Nutt.) D. R. Morgan & R. L. Hartm.var. grindelioides		4870
BET		Betula occidentalis Hook.		4504
BOR		Cryptantha caespitosa (A. Nelson) Payson	x	
BOR		Cryptantha scoparia A. Nelson	x	
BOR		Cryptantha watsonii (A. Gray) Greene	x	
BOR		Lappula cucullata A. Nelson	x	
BOR		Lithospermum incisum Lehm.		4473

Family[3]	Intr.[4]	Scientific Name[5]	Earlier record[6]	2018 (coll. no.)[7]
BOR		Lithospermum ruderale Douglas ex Lehm.	x	4456
BOR		Mertensia viridis (A. Nelson) A. Nelson	x	
BOR		Plagiobothrys leptocladus (Greene) I. M. Johnst.		4694
BRA	x	Alyssum desertorum Stapf		4477
BRA		Arabis eschscholtziana Andrz.		4501
BRA		Boechera cobrensis (M. E. Jones) Dorn		4482
BRA		Boechera microphylla (Nutt.) Dorn		4479
BRA		Boechera stricta (Graham) Al-Shehbaz	x	4498
BRA		Descurainia incana (Bernh. ex Fisch. & C. A. Mey.) Dorn		4507
BRA		Draba oligosperma Hook.		4446
BRA		Erysimum capitatum (Douglas ex Hook.) Greene var. purshii (T. Durand) Rollins		4476
BRA	x	Erysimum cheiranthoides L.	x	
BRA		Physaria acutifolia Rydb.	x	4454
BRA		Physaria arenosa (Richardson) O'Kane & Al-Shehbaz var. arenosa		4472
BRA		Physaria nelsonii O'Kane & Al-Shehbaz		4921
BRA		Physaria reediana O'Kane & Al-Shehbaz		
BRA		Sisymbrium linifolium (Nutt.) Nutt.	x	4488
BRA		Stanleya viridiflora Nutt.		4883
BRA		Thelypodiopsis elegans (M. E. Jones) Rydb.		4680
CAC		Opuntia polyacantha Haw. var. polyacantha		obs
CAP		Symphoricarpos oreophilus A. Gray var. utahensis (Rydb.) A. Nelson	x	
CAR		Eremogone hookeri (Nutt.) W. A. Weber var. hookeri	x	4665
CAR		Sabulina nuttallii (Pax) Dillenb. & Kadereit	x	
CAR		Silene menziesii Hook.		4878
CAR		Silene menziesii Hook.	x	
CAR		Stellaria longipes Goldie var. longipes		4508
COM		Comandra umbellata (L.) Nutt. var. pallida (A. DC.) M. E. Jones	x	
CRA		Sedum lanceolatum Torr. var. lanceolatum	x	
CRO		Glossopetalon spinescens A. Gray		4868
CUP		Juniperus communis L. var. depressa Pursh		4460
CYP		Amphiscirpus nevadensis (S. Watson) Oteng-Yeb.		4645
CYP		Carex douglasii Boott		4495
CYP		Carex duriuscula C. A. Mey.		4672
CYP		Carex geyeri Boott		4459
CYP		Carex nebrascensis Dewey		4629
CYP		Carex obtusata Lilj.		obs
CYP		Carex parryana Dewey		4621
CYP		Carex petasata Dewey		4664
CYP		Carex praegracilis W. Boott		4497
CYP		Carex rossii Boott		4466
CYP		Carex vallicola Dewey	x	4668
CYP		Eleocharis palustris (L.) Roem. & Schult.		4703
CYP		Eleocharis quinqueflora (Hartm.) O. Schwarz		obs
DRY		Cystopteris fragilis (L.) Bernh.		obs
FAB		Astragalus agrestis Douglas ex G. Don	x	
FAB		Astragalus bisulcatus (Hook.) A. Gray var. major (M. E. Jones) S. L. Welsh	x	
FAB		Astragalus convallarius Greene	x	

Family[3]	Intr.[4]	Scientific Name[5]	Earlier record[6]	2018 (coll. no.)[7]
FAB		Astragalus flavus Nutt.		4655b
FAB		Astragalus kentrophyta A. Gray var. tegetarius (S. Watson) Dorn	x	
FAB		Astragalus megacarpus (Nutt.) A. Gray	x	4490
FAB		Astragalus miser Douglas var. tenuifolius (Nutt.) Barneby	x	
FAB		Astragalus purshii Douglas ex Hook.		4458
FAB		Astragalus spatulatus E. Sheld.	x	
FAB		Glycyrrhiza lepidota Pursh		obs
FAB		Hedysarum boreale Nutt. var. pabulare (A. Nelson) Dorn	x	4640
FAB		Lupinus argenteus Pursh var. argenteus	x	
FAB		Oxytropis besseyi (Rydb.) Blank. var. ventosa (Greene) Barneby		4447
FAB		Oxytropis sericea Nutt. var. sericea	x	
FAB		Psoralidium lanceolatum (Pursh) Rydb.		4676
FAB		Trifolium andinum Nutt. var. andinum		4455
FAB		Vicia americana Muhl. ex Willd. var. minor Hook.		obs
GEN		Frasera speciosa Douglas ex Griseb.		4925
GEN		Gentiana affinis Griseb.		4891
GRO		Ribes aureum Pursh var. aureum		4505
GRO		Ribes cereum Douglas var. cereum		4678
GRO		Ribes oxyacanthoides L. var. setosum (Lindl.) Dorn		4463
HYD		Phacelia hastata Douglas ex Lehm. var. hastata	x	
IRI		Iris missouriensis Nutt.	x	
IRI		Sisyrinchium idahoense E. P. Bicknell var. occidentale (E. P. Bicknell) D. M. Hend.		4660
JUN		Juncus arcticus Willd. var. balticus (Willd.) Trautv	x	
JUN		Juncus bufonius L.		obs
JUG		Triglochin maritima L.		4642
JUG		Triglochin palustris L.		4646
LIL		Calochortus nuttallii Torr. & A. Gray		4881
LIL		Fritillaria atropurpurea Nutt.		4457
LIL		Zigadenus venenosus S. Watson var. gramineus (Rydb.) O. S. Walsh ex M. Peck	x	
LIN		Linum lewisii Pursh var. lewisii	x	
ONA		Chylismia scapoidea (Torr. & A. Gray) Small		4962
ONA		Epilobium glaberrimum Barbey var. fastigiatum (Nutt.) Trel. ex Jeps.		obs
ONA		Gayophytum ramosissimum Torr. & A. Gray	x	
ONA		Gayophytum diffusum Torr. & A. Gray var. strictipes (Hook.) Dorn	x	
ONA		Oenothera albicaulis Pursh		4658
ONA		Oenothera cespitosa Nutt. var. cespitosa		4484
ORC		Corallorhiza maculata (Raf.) Raf. var. maculata		4630
ORO		Castilleja angustifolia (Nutt.) G. Don var. dubia A. Nelson		4468
ORO		Castilleja linariifolia Benth.	x	
ORO		Castilleja pallescens (A. Gray) Greenm. var. pallescens	x	
ORO		Cordylanthus ramosus Nutt. ex Benth.		4923
ORO		Orobanche corymbosa (Rydb.) Ferris \ssp. corymbosa		4657
ORO		Orobanche fasciculata Nutt.		4659
PIN		Pinus flexilis E. James	x	
PLA		Collinsia parviflora Lindl.		4450
PLA		Penstemon laricifolius Hook. & Arn. var. laricifolius		4666
PLA		Penstemon paysoniorum D. D. Keck	x	4713

Family[3]	Intr.[4]	Scientific Name[5]	Earlier record[6]	2018 (coll. no.)[7]
PLA		Penstemon radicosus A. Nelson	x	4486
PLA		Penstemon strictus Benth.	x	4677
PLA		Plantago eriopoda Torr.		4483
PLA	x	Veronica serpyllifolia L. var. humifusa (Dicks.) Vahl		obs
POA		Achnatherum contractum (B. L. Johnson) Barkworth Achnatherum hymenoides (Roem. & Schult.) Barkworth Achnatherum lettermanii (Vasey) Barkworth		4626
POA		Achnatherum hymenoides (Roem. & Schult.) Barkworth Achnatherum lettermanii (Vasey) Barkworth		4638
POA		Achnatherum nelsonii (Scribn.) Barkworth var. dorei (Barkworth & J. Maze) Dorn		4632
POA		Achnatherum swallenii (C. L. Hitchc. & Spellenb.) Barkworth		4874
POA	x	Agropyron cristatum (L.) Gaertn. var. cristatum		obs
POA	x	Elymus repens (L.) Gould		obs
POA		Alopecurus pratensis L.		4491
POA		Bromus inermis Leyss.		4671
POA		Bromus tectorum L.		4470
POA		Calamagrostis inexpansa A. Gray		obs
POA		Catabrosa aquatica (L.) P. Beauv.		4692
POA		Deschampsia cespitosa (L.) P. Beauv. var. cespitosa		4691
POA		Distichlis spicata (L.) Greene		4702
POA		Elymus cinereus Scribn. & Merr.		4480
POA		Elymus elymoides (Raf.) Swezey var. elymoides		4628
POA		Elymus glaucus Buckley var. glaucus		4634
POA		Elymus lanceolatus (Scribn. & J. G. Sm.) Gould var. lanceolatus		4623
POA		Elymus smithii (Rydb.) Gould		4656b
POA		Elymus spicatus (Pursh) Gould	x	
POA		Elymus trachycaulus (Link) Gould ex Shinners var. trachycaulus		4632
POA		Festuca idahoensis Elmer		4877
POA		Hesperostipa comata (Trin. & Rupr.) Barkworth var. comata		4653
POA		Hesperostipa comata (Trin. & Rupr.) Barkworth var. intermedia (Scribn. & Tweedy) Dorn		4875
POA		Hordeum brachyantherum Nevski ssp. brachyantherum		4622
POA		Hordeum jubatum L. ssp. jubatum		4649b
POA		Koeleria macrantha (Ledeb.)	x	
POA		Muhlenbergia richardsonis (Trin.) Rydb.		4650b
POA		Nassella viridula (Trin.) Barkworth		4669
POA		Poa fendleriana (Steud.) Vasey ssp. fendleriana	x	4468
POA	x	Poa pratensis L.		4649a
POA		Poa secunda J. Presl ssp. secunda	x	
POA		Poa wheeleri Vasey	x	
POA		Puccinellia nuttalliana (Schult.) Hitchc.		4690
POA		Spartina gracilis Trin.		4625
POL		Ipomopsis aggregata (Pursh) V. E. Grant ssp. aggregata	x	4651
POL		Ipomopsis crebrifolia (Nutt.) Dorn	x	4485
POL		Lathrocasis tenerrima (A. Gray) L. A. Johnson		4689
POL		Leptosiphon septentrionalis (H. Mason) J. M. Porter & L. A. Johnson		4926
POL		Linanthus pungens (Torr.) J. M. Porter & L. A. Johnson	x	
POL		Phlox andicola E. E. Nelson ssp. andicola	x	
POL		Phlox hoodii Richardson		4453

Family[3]	Intr.[4]	Scientific Name[5]	Earlier record[6]	2018 (coll. no.)[7]
POL		Phlox multiflora A. Nelson	x	
POL		Phlox muscoides Nutt.	x	
PGN		Eriogonum umbellatum Torr. var. dichrocephalum Gand.		
PGN		Eriogonum acaule Nutt.	x	
PGN		Eriogonum brevicaule Nutt. var. micranthum (Nutt.) Reveal		4687
PGN		Eriogonum caespitosum Nutt.	x	
PGN		Eriogonum microthecum Nutt. var. laxiflorum Hook.		4880
PGN		Eriogonum ovalifolium Nutt. var. purpureum (Nutt.) T. Durand	x	
PGN		Eriogonum umbellatum Torr var. majus Hook..	x	
PGN	x	Polygonum aviculare L.		obs
PGN		Rumex triangulivalvis (Danser) Rech. f.		4647
PGN		Stenogonum salsuginosum Nutt.	x	4639
POR		Lewisia rediviva Pursh var. rediviva	x	
POT		Stuckenia pectinata (L.) Börner		4697
POT		Zannichellia palustris L.		4487
PRI		Androsace septentrionalis L.		4465
PRI		Primula pauciflora (Greene) A. R. Mast & Reveal		4503
RAN		Delphinium bicolor Nutt. ssp. bicolor		4499
RAN		Lysimachia maritima (L.) Galasso et al.		4643
RAN		Myosurus apetalus Gay var. montanus (G. R. Campb.) Whittem.		4701
RAN		Ranunculus alismifolius Geyer ex Benth.var. hartwegii (Greene)		4462
RAN		Ranunculus aquatilis L. var. diffusus With.		4696
RAN		Ranunculus cymbalaria Pursh		4893
RAN	x	Ranunculus testiculatus Crantz		4478
ROS		Amelanchier utahensis Koehne	x	
ROS		Holodiscus discolor (Pursh) Maxim. var. dumosus (Nutt. ex Hook.) Maxim. ex J. M. Coult.		4675
ROS		Potentilla anserina L. ssp. anserina		4494
ROS		Prunus virginiana L. var. melanocarpa (A. Nelson) Sarg.	x	
ROS		Purshia tridentata (Pursh) DC. var. tridentata	x	
ROS		Rosa woodsii Lindl. var. woodsii		4648
SAL		Populus tremuloides Michx.	x	
SAL		Salix bebbiana Sarg.		4506
SAL		Salix eriocephala Michx. var. watsonii (Bebb) Dorn		4693
SAL		Salix exigua Nutt. var. exigua		4650a
SAL		Salix scouleriana Barratt ex Hook.		4461
SAR		Sarcobatus vermiculatus (Hook.) Torr.		4636
SOL	x	Hyoscyamus niger L.		4963b
VIO		Viola vallicola A. Nelson		4927
VIS		Arceuthobium cyanocarpum (A. Nelson ex Rydb.) A. Nelson		4674

Table 8. Sensitive and rare plant species surveyed in the Oregon Buttes and Whitehorse Creek WSAs

Scientific Name	Common Name	Global/State Rank	BLM Status	WYNDD recognition	Survey outcome
Achnatherum contractum	Contracted ricegrass	G3G4/S3	None	Regional endemic; Formerly tracked	Present in abundance in both WSAs
Achnatherum swallenii	Swallen's ricegrass		None	Regional endemic; Tracked	Present in Oregon Buttes WSA
Antennaria arcuata	Box pussytoes	G3/S3	Sensitive	Regional endemic; Tracked	Not found; incomplete results
Astragalus bisulcatus var. *haydenianus*	Hayden's twogrooved milkvetch	G5T5?/ S1?	None	Regional Endemic; Tracked	Absent
Boechera pendulina var. *russeola*	Russeola rockcress	G5/S3	None	Taxonomic work that may change its GRANK establishing it as state endemic; Watch	Absent
Cryptantha scoparia	Desert cryptantha	G4?/S3	None	Widespread; Formerly tracked	Present in Oregon Buttes WSA
Ipomopsis crebifolia	Compact gilia	G5T3T4/S3	None	Regional endemic; Formerly tracked	Present in both WSAs
Penstemon paysoniorum	Payson's beardtongue	G3/S3	None	State endemic; Watch	Present in Whitehorse Cr WSA; not relocated in Oregon Buttes WSA
Phacelia demissa var. *demissa*	Intermountain phacelia	G5T3?Q/S1	None	Regional endemic; Tracked	Not found; incomplete results
Physaria macrocarpa	Large-fruited bladderpod	G2S2	Sensitive	State endemic; Tracked	Absent
Pinus flexilis	Limber pine		Sensitive	Widespread; watch	Present in Oregon Buttes WSA

Table 9. Vegetation units mapped in the Oregon Buttes and Whitehorse Creek WSAs (LANDFIRE 2016)

Region	Vegetated/ Non-vegetated	Mapping Unit
Inter-Mountain Basins	Veg	Big Sagebrush Steppe
Inter-Mountain Basins	Veg	Mat Saltbush Shrubland
Inter-Mountain Basins	Veg	Mixed Saltbush Desert Scrub
Inter-Mountain Basins	Veg	Montane Sagebrush Steppe
Inter-Mountain Basins	Non-veg	Shale Badland
Inter-Mountain Basins	Non-veg	Active/stabilized dune
Northern Gt Plains	Veg	Mixed Grass Prairie
Rocky Mountains	Veg	Foothill Limber Pine- Juniper Woodland
Rocky Mountain	Veg	Aspen Forest and Woodland
Wyoming Basins	Veg	Dwarf Sagebrush Shrubland and Steppe
Western Great Plains	Veg	Riparian Woodland and Shrubland
-	Non-veg	Cliff, canyon and talus

Table 10. Vegetation recorded in 2018 fieldwork in comparison with mapping.

Mapping Unit	**WYNDD Veg Data Sets**[8]	**Dominants**
Big Sagebrush Steppe	WH1806, OR1808	*Artemisia tridentata* ssp. *vaseyana*
Mat Saltbush Shrubland	WH1803	*Atriplex gardneri* var. *utahensis*
Mixed Saltbush Scrub	WH1802, WH1804, OR1807, OR1810	*Artemisia pedatifida*
Montane Sagebrush Steppe	Present but not sampled	*Purshia tridentata*
Shale Badland	Present but not sampled	-
Active/stabilized dune	Not found	-
Mixed Grass Prairie	Not found	-
Foothill Limber Pine- Juniper Woodland	OR1815	*Pinus flexilis*/ varying understory
Aspen Forest and Woodland	OR1813	*Populus tremuloides/* *Symphoricarpos oreophilus*
Dwarf Sagebrush Shrubland and Steppe	WH1805, OR1811, OR1812, OR1814	*Artemisia tridentata* ssp. *wyomingensis*
Cushion plant community – not mapped but within above	WH1801	*Phlox muscoides*
Alkaline meadow – not mapped but within above	OR1809	*Juncus balticus, Carex praegracilis*
Cliff, canyon and talus	Present but not sampled	-

[8] The datasets are represented by identifiers that start with 2-letters that correspond with either Oregon Buttes (OR) or Whitehorse Creek (WH), followed by the last two digits in the 2018 year of fieldwork (18), and then sequential numbers assigned in the field (0-15).