THE STATUS OF *TRIFOLIUM OWYHEENSE* (OWYHEE CLOVER) IN IDAHO

by

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ABSTRACT

Owyhee clover (*Trifolium owyheense*) is a low-growing perennial forb endemic to a small portion of east-central Malheur County, Oregon, and immediately adjacent Owyhee County, Idaho. It is a conservation concern in both states because of its limited distribution, the small size of most populations, and the vulnerability of some populations to one or more threat factors. Idaho occurrences are restricted to the Succor Creek drainage, less than one mile east of the Oregon border, on land largely managed by the Bureau of Land Management. To gain an updated and more comprehensive understanding of the distribution, abundance, habitat, and threats facing this species in Idaho, a systematic field survey for Owyhee clover was conducted in southwestern Idaho. Despite extensive searching, no new Owyhee clover occurrences were discovered during 2001. Of the four occurrences reported for Idaho prior to the field investigation, one was found to be misidentified, while two others were originally mismapped by the Conservation Data Center due to vague location information on the original collection labels. Based on my field survey and re-evaluation of these early collections, the number of Owyhee clover occurrences in Idaho now stands at two. This report details the results of the field investigation and provides a conservation overview for Owyhee clover in Idaho. It summarizes information regarding the species' taxonomy, distribution, abundance, biology, habitat, and threats.

ACKNOWLEDGMENTS

I want to thank Bill Olsen, Vale District BLM for sharing his insights about Owyhee clover and its habitat, and for taking me to several populations in Oregon to show me first-hand. Jean Findley, Vale District BLM botanist, and Sue Vrilakas with the Oregon Natural Heritage Program both provided me with information to help make this a more comprehensive report. Ann DeBolt, Lower Snake River District BLM botanist assisted in many ways to make this project possible.

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INTRODUCTION

Owyhee clover (*Trifolium owyheense*) is a low-growing perennial forb endemic to a small portion of east-central Malheur County, Oregon, and immediately adjacent Owyhee County, Idaho. It is known from approximately 40 occurrences rangewide, the great majority located in Oregon. Idaho occurrences are restricted to the Succor Creek drainage, less than one mile east of the Oregon border, on land largely managed by the Bureau of Land Management (BLM). In Idaho, Owyhee clover occurs on sparsely vegetated, light-colored edaphic outcrops of the Sucker Creek Formation, a geology with a limited distribution in the state.

Owyhee clover is a conservation concern in both Idaho and Oregon because of its limited distribution, the small size of most populations, and the vulnerability of some populations to one or more threat factors. Plant surveys targeting Owyhee clover in Idaho have been very limited and sporadic over the years. To gain an updated and more comprehensive understanding of the distribution, abundance, habitat, and threats facing Owyhee clover in Idaho, a Challenge Cost-Share project was initiated between the BLM's Lower Snake River District and the Idaho Department of Fish and Game's Conservation Data Center (CDC). The objective of this project was to conduct a systematic field survey for Owyhee clover in southwestern Idaho.

METHODS

Owyhee clover's narrow distribution and confinement to certain edaphic conditions helped limit and define the field investigation's study area. The study area coincided with the extent and main distribution of Sucker Creek Formation geology in western Owyhee County. Prior to initiating field work, aerial photos were consulted to help locate and map the visually distinct, sparsely vegetated Sucker Creek Formation exposures indicative of potential Owyhee clover habitat. The most extensive exposures in Idaho occur in the Succor Creek drainage, from the Oregon-Idaho state line, upstream to the Succor Creek Reservoir area. Large outcrops of this colorful geology are also common in the McBride Creek, Dry Creek, and especially Coal Mine Basin areas, north of Succor Creek. South of Succor Creek, outcrops quickly become much less common and smaller in size, eventually disappearing around Trout Creek in the Jordan Valley area (Ekren et al. 1981).

Fieldwork was conducted between May 16 and May 23, 2001. I visited as many of the target habitat areas on BLM land as possible during this period, concentrating on areas near the previously known occurrences in Succor Creek. Part of the first field day was spent visiting a series of Owyhee clover sites in Oregon to obtain a fuller appreciation of rangewide habitat conditions supporting this species. Surveys were conducted by walking to and searching outcrops or other areas of potential habitat. Some searching was done from a vehicle to cover more area in a few places with marginal potential habitat. I kept notes on all the areas searched and also had an eye open for other BLM Sensitive plant species known from the study area.

RESULTS

Despite extensive searching, no new Owyhee clover occurrences were discovered during 2001. I did revisit and update information concerning the four occurrences reported for Idaho prior to the field investigation. I discovered the occurrence reported for

McBride Creek was based on a misidentification. This area had lots of big-headed clover (*Trifolium macrocephalum*), but no Owyhee clover. Two other reported occurrences along Succor Creek were based on collections made in the 1970s, but I could not relocate either one despite thorough searching. Further research after the field season strongly suggests the old collections were mismapped by the CDC due to the vague original label location information. I now believe both collections were taken in places corresponding to the Succor Creek South occurrence (001).

Based on my field survey and re-evaluation of these early collections, the number of Owyhee clover occurrences in Idaho now stands at two. These two occurrences, one on the north side of Succor Creek, the other on the opposing south side, support an estimated 1,700 Owyhee clover plants over approximately five acres. Plants were found to be restricted to localized, sparsely vegetated, whitish-colored, edaphic exposures. This visually distinctive substrate had a soft, chalky-clay texture with a high percentage of hard, thin stones mixed in near the surface. Few other species have adapted to the edaphic conditions of these exposures. To one degree or another, the great majority of ash or other edaphic outcrops I visited did not match the “site profile” of the known occurrences. Most have eroded or weathered differently and display a different surficial appearance, or supported a different vegetation/plant composition pattern. I did come across several outcrops near Succor Creek that did not support Owyhee clover, even though the substrates looked identical to the known sites. It seems clear that Owyhee clover is truly rare in Idaho.

This report details the results of the field investigation and provides a conservation overview for Owyhee clover in Idaho. It summarizes information regarding the species’ taxonomy, distribution, abundance, biology, habitat, and threats. Several management recommendations are made at the end of the report. Locations for the known Idaho occurrences, along with maps and descriptions of areas surveyed during the field investigation are included in the appendices.

TRIFOLIUM OWYHEENSE

TAXONOMY

Scientific name: *Trifolium owyheense* Gilkey

Full bibliographic citation: Gilkey, H.M. 1956. A new *Trifolium* from Oregon. Madrono 13:167-169.

Type specimen: Bessie Fleischman Murphy (s.n.), bluff above Sucker Creek, Malheur County, Oregon. May 1954. Holotype at OSC; Isotype at NY.

Pertinent synonyms: None.

Common name: Owyhee clover

Family name: Fabaceae; Leguminosae

Common name for family: Legume; Pea; Bean

History of knowledge of taxon in Idaho: Owyhee clover was first collected in Malheur County, Oregon in 1954. It apparently was not collected again until the 1970s when Dr. Pat Packard, and two of her protégés, Jim Grimes and Barbara Ertter, began their botanical studies of the Succor Creek and Leslie Gulch areas (Siddall et al. 1978). A Barbara Ertter collection in May 1974 near Succor Creek, just east of the Oregon border was the first documented occurrence of Owyhee clover in Idaho. BLM botanist Roger Rosentreter made a collection from the same general area in 1978. BLM botanists have opportunistically looked for this species in western Owyhee County ever since, especially in the late 1990s, as part of rare plant survey work conducted for grazing allotment plan revisions and other resource management issues in the Succor Creek area. No new populations were discovered in Idaho during these efforts. In 2001, I conducted the first systematic survey for Owyhee clover in Idaho as a Challenge Cost-Share project between the BLM and CDC.

Owyhee clover was not included in the initial "redbook" evaluating the status of rare plants in Idaho (Henderson et al. 1977). It was included in an expanded and updated evaluation in 1980 (Packard 1980). In this publication, Owyhee clover was recommended for federal Threatened status because most populations occurred on private land or on near substrates with commercial value. Owyhee clover has been on the Idaho Native Plant Society's state rare plant list since the first Idaho rare plant conference in 1984 (Idaho Native Plant Society 1984). It has been a conservation concern for the BLM since at least 1980 (Rosentreter 1980). In 1978, information about Idaho was noted in a status report for Owyhee clover prepared by Oregon botanists (Siddall et al. 1978) for the U.S. Fish and Wildlife Service. Overall, there has been a paucity of information about this species in Idaho over the years.

Alternative taxonomic treatments: Isley (1998) questions the validity of Owyhee clover at the species level, but offers no alternative treatment.

LEGAL OR OTHER FORMAL CONSERVATION STATUS

National

U.S. Fish and Wildlife Service: None.

Bureau of Land Management: Owyhee clover is a BLM Sensitive plant species in both Idaho and Oregon.

Other current formal status designations: Owyhee clover has been given a global conservation rank of G2G3 by NatureServe (formerly the Association for Biodiversity Information) and its network of Heritage Programs and Conservation Data Centers. The implication of this dual rank is that insufficient conservation information is available at the rangewide scale to confidently assign it to either the G2 or G3 categories. The G2 rank is for taxa imperiled because of rarity or other factors making it vulnerable to extinction; whereas the G3 rank is reserved for taxa that are rare, uncommon, or threatened, but not immediately imperiled.

Idaho

Idaho Native Plant Society: Owyhee clover is on the INPS Global Priority 3 list, which

has the same definition described above for the G3 rank (Idaho Native Plant Society 2001).

Idaho Conservation Data Center: The CDC has assigned a state conservation rank of S1 to Owyhee clover. The S1 category is for taxa considered critically imperiled because of extreme rarity or some other factors that make it especially vulnerable to being extirpated in Idaho (Idaho Conservation Data 2001).

Oregon

Oregon Department of Agriculture: Owyhee clover is on the Endangered list of the Oregon State Endangered Species Program (Oregon Natural Heritage Program 2001a).

Oregon Natural Heritage Program: Owyhee clover is on List 1, reserved for taxa threatened with extinction throughout their entire range (Oregon Natural Heritage Program 2001a).

DESCRIPTION

General non-technical description: Owyhee clover is a taprooted perennial forb about 4-8 inches tall having stems arising singularly or a few together. Plants are hairless below the flower head. The leaves are divided into three leaflets that are more or less round in outline and notched at the apex. The leaflets have a firm-texture and a waxy, bluish-green color (glaucous). Each leaflet also has a distinct light-green, crescent-shaped marking. Each leaf stem has a pair of leaf-like stipules at the base, similar in texture to the leaves. The calyx is greenish-white, hairy, and with long, narrow, pointed teeth. The roundish-shaped flower heads average about 3 inches in diameter and appear disproportionately oversized compared to the rest of the plant. Flowers are one-half to three-quarters inch long, pink-purple, but whitish towards the base.

Technical description: Dwarf, sturdy, xerophytic, perennial herbs, glabrous below the thinly pilose calyces, the stem arising singly and few together from thin, subterranean caudex-branches surmounting a stout fusiform or cylindric taproot, above ground 1-1.5 dm tall including the solitary peduncle and massive, exserted flower-head, the broad, firm, glaucous leaflets each marked with a crescentric, whitish blotch; stipules subtending 2 or 3 cauline leaves broadly obovate 1-1.5 cm long; petioles 2-6 cm long; leaflets 3, suborbicular or broadly cuneate-obcordate, 3-7 cm long; flower heads ovoid when young, becoming subglobose, 4-5 cm diameter; bracts reduced to a low, scarious collar; flowers ascending, the outermost declined in fruit; pedicels +/- 1 mm long; calyx 9.5-11 mm long, thinly villous-pilose with weak, flexuous hairs up to +/- 1 mm long, the pallid, membranous, broadly campanulate, finely 10-nerved tube 4-5.5 mm long, the firm, green, linear-lanceolate, straight, 1-nerved teeth 5.5-6 mm long; petals pink-purple, the keel-tip more deeply colored, the banner 18-22 mm long, the wings and keel +/- 4-6 mm shorter; ovary sessile, oblong, glabrous laterally, densely wooly-crested along ventral suture, 3-ovulate (Barneby 1989).

Local field characters: *Trifolium* is a common and widespread genus in southwestern Idaho, with approximately a dozen species in Owyhee County. The pea-like flowers and clover leaflets make the genus easy to recognize in the field. When in flower, the solitary, very large head of flowers readily distinguishes Owyhee clover from all other clover species in our flora except for big-headed clover (*Trifolium macrocephalum*). This

species also has a massive flower head, but can be quickly distinguished by its 5-9-foliate leaflets, as opposed to Owyhee clover, which always has only three leaflets. Several other character differences can also help distinguish the two species: (1) the herbage of Owyhee clover is hairless except on the calyx, whereas the stems, stipules, and often one side of the leaves of big-headed clover are covered with fine hairs; (2) the hairs on the calyx teeth of Owyhee clover are simple, not long-plumose as found on big-headed clover; (3) the flowers of big-headed clover tend to be whitish, cream, or pink in color, lighter than the pink-purple flowers of Owyhee clover. Even when flower heads are absent, Owyhee clover can usually be distinguished from other regional clovers by the combination of its small, perennial, taprooted habit, mostly hairless herbage, and firm, glaucous, roundish-shaped leaflets.

Photos and line drawings: There is a line drawing in Gilkey's (1956) original description for Owyhee Clover. There are also line drawings in rare plant publications covering Oregon (Meinke 1982) and the Owyhee region in Idaho (DeBolt and Rosentreter 1988). The illustration in Barneby (1989) has been copied in Appendix 1 of this report. Eastman's (1990) book of Oregon rare plants contains a good color photograph of Owyhee clover. A collection of slides showing the habit and habitat of Owyhee clover is on file at the CDC office in Boise.

DISTRIBUTION

Global distribution: Owyhee clover is a local endemic found in a small portion of east-central Malheur County, Oregon, and immediately adjacent Owyhee County, Idaho (Figure 1). The great majority of its range is in Oregon, as it barely enters Idaho in the Succor Creek drainage less than one mile from the Oregon border. It ranges from near Owyhee Reservoir Dam at the northern end of its distribution, to the Mahogany Gap area (between Mahogany Mountain and Spring Mountain) to the south. West to east, it extends from the reservoir eastward to just over the Idaho state line. Owyhee clover is not known from west of the Owyhee River, while the Idaho occurrences in Succor Creek represent the known southeastern distribution limit for the species. The Leslie Gulch and Honeycomb areas seem to be the species' center of distribution. Its entire known range is restricted to an area approximately 30 miles by 20 miles.

Idaho distribution: Two occurrences are known from Idaho, one north of Succor Creek, the other on the south side of the creek. Both are within one mile of the Oregon border in Owyhee County. The CDC data base had four occurrences of Owyhee clover prior to my 2001 field investigation. I found the occurrence reported for McBride Creek to be erroneous. The area reported has a large population of big-headed clover, but no Owyhee clover. An old occurrence based on a 1974 Barbara Ertter collection had relatively vague location data and was originally mapped by the CDC right on the Oregon-Idaho border north of Succor Creek. Based on new information provided by Barbara in October 2001, it now seems reasonably certain her collection was made on the south side of the creek in the area corresponding to occurrence 001 (Barbara Ertter, University of California at Berkeley, pers. comm.). Another occurrence based on a late 1970s collection by Roger Rosentreter with imprecise location data was also apparently mismapped. There is no potential Owyhee clover habitat in the Succor Creek bottomlands where the occurrence was mapped by the CDC. It now seems reasonably clear that this collection was also taken in the Succor Creek South occurrence area (Roger Rosentreter, Idaho Bureau of Land Management, pers. comm.).

Figure 1.

Idaho occurrences: The two Idaho occurrences have been mapped (Appendix 2). The three-digit code labeling each occurrence corresponds to the reference number used by the CDC data base. Additional location, population, habitat, threat, and other conservation information can be found in the Element Occurrence Records for the two occurrences (Appendix 3).

001 Succor Creek South – Located on the slopes above the south side of Succor Creek, less than one mile east of the Oregon-Idaho border, in T3S R6W Sec. 14, Owyhee County.

002 Succor Creek North - Located on the slopes above the north side of Succor Creek, less than one mile east of the Oregon-Idaho border, in T3S R6W Sec. 14, Owyhee County.

To summarize, the CDC database had four occurrences for Owyhee clover prior to 2001. I found two occurrences were mismapped due to vague original collection label information. The Roger Rosentreter collection was formerly mapped as occurrence 002 in the CDC database (originally mapped in T3S R6W sec13 and 24). A collection by Barbara Ertter was formerly mapped as occurrence 003 (originally mapped in T3S R6W sec14 NW4). Both of these collections were apparently taken in the area which now corresponds to the Succor Creek South occurrence. Another former occurrence was found to be based on a misidentified specimen. The occurrence based on this collection at McBride Creek (formerly 004) has been deleted from the CDC database. The original Succor Creek occurrence (formerly 001) has been split into two occurrences, one on the south side, the other on the north side of Succor Creek.

Unverified/undocumented reports: A 1935 collection from Follyfarm, Harney County, Oregon is thought to be erroneous (Siddall et al. 1978). There are no undocumented reports from Idaho of which I am aware.

Synopsis of past and needed inventories: Commencing in the early 1970s, Dr. Pat Packard and several of her students conducted extensive botanical forays into the Owyhee country. Succor Creek and other nearby area supporting interesting ash/tuff geology were targeted during some of these forays. In subsequent years, general and species-specific rare plant inventories in southwestern Idaho were carried out by BLM or other botanists working cooperatively with this agency. The first coarse-level rare plant surveys were conducted by the BLM's Roger Rosentreter starting in 1978 (Rosentreter 1980). In more recent years, Ann DeBolt and her crews have conducted extensive surveys on BLM lands in Owyhee County. DeBolt conducted inventories targeting Owyhee clover and other rare plant species in the Succor Creek area during 1994 and again in 1998. The 1998 survey work was done mostly north of Succor Creek. Field investigations for rare plants such as *Mentzelia mollis* (Smithman 1989), *Chaenactis cusickii* (Moseley 1994), *and Stanleya confertiflora* (Mancuso 1997) have included areas near the Idaho populations of Owyhee clover.

This 2001 Challenge Cost-Share project between the BLM and CDC represents the first systematic inventory targeting Owyhee clover in Idaho. Appendix 4 has maps and descriptions of the specific areas I surveyed for this project. Habitat suitable for Owyhee clover is limited in Idaho. I did not survey the Dry Creek area, north of Highway 95 due to a lack of time. Scattered outcrops of potential habitat occur along this ephemeral tributary to Succor Creek. It probably has the best potential unsurveyed habitat in the

state. Further north, there are scattered ash and tuff exposures from McBride Creek all the way to Homedale that may pass for potential Owyhee clover habitat at first glance. It has been my experience during botanical explorations in the past that these outcrops have a different texture or some other visual edaphic difference compared to the known Owyhee clover sites at Succor Creek. I did not survey any of the Poison Creek Formation or Sucker Creek Formation outcrops north of McBride Creek in 2001. It is not out of the question that Owyhee clover occurs further north, as it is known to the west in the Sage Creek and Honeycomb areas in Oregon. Scattered Sucker Creek Formation outcrops also occur in the upper Dry Creek (west of Flattop Butte) and Texas Basin areas, about two to four miles north of Succor Creek. I observed several of these outcrops from a distance using binoculars, but none looked to have much potential to support Owyhee clover.

HABITAT

General habitat description: Owyhee clover occurs in a relatively wide range of habitats in Oregon. In that state it occurs on a variety of ash and tuff substrates, usually with shallow and rocky soils; on various aspects; and on ridgecrest to lower slope positions, ranging from flat to steep. The typically open, relatively sparsely vegetated sites support some version of either a big sagebrush (*Artemisia tridentata*) or low sagebrush (*Artemisia arbuscula*) plant community.

Habitat in Idaho is characterized by sparsely vegetated, whitish- to light tan-colored, edaphic outcrops of the Sucker Creek Formation. The localized outcrops have a soft, chalky texture at the surface, but a dense, hard texture several inches below the surface. The surface contains a high percentage of hard, thin, angular, platy stones that help make the substrate visually distinctive. Plants occur on various aspects, on steep slopes to nearly flat benches. Both Idaho occurrences are at approximately 4,400 feet elevation and surrounded by sagebrush-steppe-dominated vegetation.

Geology and soils: The geology at both Idaho occurrences of Owyhee clover has been mapped as the Sucker Creek Formation (Ekren et al. 1981). This Miocene-aged Formation is comprised of a thick sedimentary sequence from predominantly volcanic sources (Lawrence 1988). The stratigraphy of the depositional units and related members comprising the Sucker Creek Formation is still not fully understood. In the study area, Sucker Creek exposures host a range of colors, including white, gray, yellowish, greenish, light to dark brown, and even black. One of the main decomposition products of Sucker Creek ash is a mineral called montmorillonite, a kind of clay that is very greasy when wet and cracked and puffed up like popcorn when dry (Kittleman 1973). Many of the colorful ash outcrops in the study area have eroded to these sparsely vegetated montmorillonite clays. However, this is not the material Owyhee clover was found to occur on in Idaho. Plants in Idaho seem to be restricted to localized outcrops of zeolite or possibly bentonitic clay minerals.

All of the clusters of Owyhee clover observed in Idaho occur on sparsely vegetated, whitish- to light tan-colored material having a fine, but gritty texture. The chalky surface substrate extends a few inches in depth and is intermixed with a high percentage of small, hard, thin, angular, platy stones. Below this softer upper layer, the substrate becomes very hard in texture. Outcrops containing this visually distinct erosional variant turn out to be small and localized in Idaho. I found it puzzling that a few suitable-

appearing exposures did not have Owyhee clover, even though they were located in close proximity to known sites.

In Oregon, Owyhee clover occurs on a relatively wide variety of substrates compared to most of the other Succor Creek/Leslie Gulch area endemics (Grimes 1979). The handful of Owyhee clover sites I am familiar with in Oregon are a platy to rounded stony rubble substrate with a yellowish to yellow-tan, or whitish color. These substrates are probably related to the Leslie Gulch Tuff, a member of the Sucker Creek Formation that gets to within a few miles of Idaho, but apparently does not reach the state. The absence of Leslie Gulch Tuff geology in Idaho may account for the absence of several rare Leslie Gulch endemic plants and the minimal distribution of Owyhee clover in the state.

Plant community and associated species: The two Idaho occurrences of Owyhee clover occur in localized, sparsely vegetated habitats that have very high bare ground cover. Openings supporting Owyhee clover are characterized by scattered shrubs, bunchgrasses, and a short list of forb species also adapted to dry, rocky, harsh conditions. There appears to be no microbiotic crust development except for some algae. These sites may be representative of an undescribed, regional, edaphic low sagebrush (*Artemisia arbuscula*) plant community. Associated species include low sagebrush, antelope bitterbrush (*Purshia tridentata*), monardella (*Monardella odoratissima*), bluebunch wheatgrass (*Agropyron spicatum*), Sandberg's bluegrass (*Poa secunda*), Nuttall's sandwort (*Arenaria nuttallii*), and Hood's phlox (*Phlox hoodii*). Cheatgrass (*Bromus tectorum*), which is common in nearby habitats, was rare or absent at the two Owyhee clover sites. Low cover of the small, weedy annual bur buttercup (*Ranunculus testiculatus*) was observed at one occurrence. The surrounding vegetation was dominated by sagebrush-steppe.

Other rare plant species: I encountered two other Idaho BLM sensitive plant species during my field investigation. Malheur yellow phacelia (*Phacelia lutea* var. *calva*) was common on many of the ash outcrops in the study area, and its inclusion on the BLM Sensitive species list probably needs to be reconsidered. Greeley's wavewing (*Cymopterus acaulis* var. *greeleyorum*) was found to be more locally common in the McBride Creek area than previously known. I think 2001 was a poor year for smooth stickleaf (*Mentzelia mollis*) because I did not see any at several known occurrences passed during my survey. Its ash outcrop habitats appeared intact and unchanged from previous reports, however.

In Oregon, Owyhee clover has occasionally been found with Ertter's senecio (*Senecio ertterae*) or Packard's mentzelia (*Mentzelia packardiae*). Both of these rare Leslie Gulch area endemics are Oregon BLM Sensitive species. Both occur within about ten miles of Idaho, but have never been found in the state.

POPULATION BIOLOGY

Population size and condition: An occurrence is a data management unit based on biological information and used to track elements of biodiversity by the Natural Heritage Program/Conservation Data Center network. It is not necessarily equivalent to a "population", which can be difficult to determine in nature.

Owyhee clover is known from two occurrences in Idaho that were both known prior to my field investigation. I did not find any new sites in 2001 despite extensive field survey

work in the Succor Creek and nearby drainage areas. Information about each occurrence was updated in 2001. Each occurrence was also assigned an occurrence rank ("EORANK" field in the records in Appendix 3) based on updated 2001 information. The "A" (highest) to "D" (lowest) ranking system is based primarily on occupied area, ecological quality of the site, and the number of above-ground plants. Habitat fragmentation, isolation, land ownership, and threats are also considered for the ranking. Information about the two Idaho occurrences is provided below.

Succor Creek South (001) – Abundance and size information was not recorded when this occurrence was discovered in 1974. It was revisited by the BLM during the mid-1990s when two subpopulations were delineated. The subpopulations were reported to contain approximately 30 plants at a northern, and 100-200 plants at a southern site. Another small cluster of plants just southeast of the northern subpopulation has also been reported by the BLM. I relocated the northern and southern subpopulations in 2001, and tallied approximately 300 plants at each of them. The subpopulations cover a total of about one acre. Portions of the occurrence area have been destroyed or otherwise disturbed by mining and associated road-building activities. Occurrence rank = C.

Succor Creek North (002) – This occurrence was discovered in 1989. The BLM reported approximately 300 plants during the mid-1990s. In 2001, I observed about 1,000 plants over an area that may be up to five acres in size. The occurrence area is threatened by potential mining operations. Occurrence rank = B.

Owyhee clover is known from over 35 occurrences in Oregon (Oregon Natural Heritage Program 2001b). The majority are less than two acres in size and only a handful are known to support over 1,000 plants.

Phenology: Owyhee clover flowers in May and June, peaking in mid- to late-May most years. Only dried flower heads are typically observed by late June.

Reproductive biology: Few if any flowers are produced at some Oregon populations in some years (Jean Findley, Vale District, BLM, pers. comm.). The flower heads break off the plant beginning around late June and it is speculated seed dispersal may take place by water-tumbling in summer thunderstorms or winter-spring runoff, as well as via strong winds. Results from a research study in Oregon showed that plants produced a mean of 28.3 pods per head, with a mean seed set ranging from 0.76 – 1.10 (Gisler and Meinke 2001). Bagged plants revealed that Owyhee clover is self-compatible and produces seed through auto-autogamy at levels equal to open-pollinated plants. No pollinators were noted in the Oregon study, however, large legume flowers are typically visited by bees and potentially other insects (George Stephens, CDC, pers. comm.). Bumble bees are known to be important pollinators of some other clover species because of their long tongues (Borror et al. 1981).

The Oregon study found seed germination to be high, close to 95% (Gisler and Meinke 2001). Seeds required scarification of the seed coat to germinate. Germination rates were slightly increased if scarification was coupled with four weeks of cold stratification. A small germination experiment at the Berry Botanical Garden found that seeds did not readily germinate even with scarification. Most seeds needed two or more months to germinate in this study (Andrea Raven, Berry Botanical Garden, pers. comm.)

Competition: Owyhee clover is limited to small areas with special edaphic conditions. These edaphic conditions exclude most other species, while the few species that can establish tend to have a well-spaced distribution. In his study of the Leslie Gulch flora, Grimes (1979) concluded the distribution of Owyhee clover, like the other Leslie Gulch area endemics, was determined by edaphic factors, and that physical factors of the substrates were more important than chemical. He also concluded the endemics were pioneer species that may be competitively excluded from more "normal" sites. Owyhee clover is often found on talus slopes in the Leslie Gulch area of Oregon. Grimes (1979) noted the root system of Owyhee clover had a special adaptation to this unstable habitat condition. The root usually lies below the zone where the talus is most active and the many small branches that come off the top of the root grow through the rubble and talus. During a sudden talus slide the stems may be broken off, but the root remains intact which allows new stems to grow in the future.

Herbivory: Domestic livestock grazing is the predominant land use throughout the range of Owyhee clover. I have observed plants eaten by cattle in Oregon. Other botanists have made the same conclusions in Idaho and Oregon (Ann DeBolt, BLM, pers. comm.; Jean Findley, BLM, pers. comm.). It is unknown if, or to what degree livestock herbivory affects the population dynamics of Owyhee clover. It also seems likely that other mammals such as bighorn sheep, deer, elk, and rabbits may forage on Owyhee clover, at least on occasion.

LAND OWNERSHIP AND THREATS

Land ownership: Both Idaho occurrences are located at least partly on land managed by the BLM's Lower Snake River District. Approximately half the occurrence north of Succor Creek (002) extends onto private land.

Land use and threats: Mining, range improvement programs, off-road-vehicle (ORV) use, and heavy spring grazing were identified as possible threats soon after Owyhee clover was discovered in Idaho (Rosentreter 1983). Currently, mining activity is the most serious threat to both Idaho occurrences. Former habitat and portions of the occurrence at Succor Creek South (001) have already been destroyed or heavily disturbed by past zeolite mining and associated road building operations. The remaining portion of the southern subpopulation at this occurrence is located in an area that could easily be destroyed when/if mining operations resume. Most, or all of the Succor Creek North (002) occurrence is located within a mining claim area. I observed at least one small exploration pit within this occurrence in 2001. At least portions of this occurrence would be destroyed if mining operations were to begin in earnest at this site. I did not observe any active mining activity while conducting my field investigation.

The two occurrences are located close to dirt roads. Road improvement or maintenance activities have the potential to destroy individual plants and adversely effect habitat conditions at both occurrences. Noxious weed invasion is another threat associated with the roads. Hoary whitetop (*Cardaria draba*) occurs along the dirt road near the northern subpopulation at the Succor Creek South occurrence. This aggressive weed is locally common near the Succor Creek ford and adjacent flats a little further east. Scotch thistle (*Onopordum acanthium*) is also known from near both occurrences.

Recreational ORV use is increasing in many parts of Owyhee County. I observed one fairly old tread mark passing through a segment of the occurrence north of Succor

Creek. Overall, ORV use seems to be relatively uncommon or limited in the Succor Creek area; but I consider it a serious potential threat because it would not take long for a single machine to do a lot of habitat damage at the small and accessible occurrence sites.

Livestock grazing is the predominant land use throughout the range of Owyhee clover. Relatively low levels of livestock trampling disturbance were observed at both occurrences during my survey. The minimal amount of forage characterizing Owyhee clover habitats probably limits the amount of cattle-related disturbance to some degree. It is likely that the amount of trampling disturbance varies somewhat from year to year. In addition, cattle eating Owyhee clover have been documented in both Idaho and Oregon.

ASSESSMENT AND MANAGEMENT RECOMMENDATIONS

Conservation assessment: Owyhee clover is known from only two occurrences in Idaho. Unlike in Oregon, where it occurs on a variety of substrates, Owyhee clover seems to be restricted to a specific edaphic habitat in Idaho. This habitat itself is rare and was not observed anywhere except near Succor Creek, within two miles of the Idaho-Oregon border. Despite searches by BLM and other botanists over the years, and my 2001 field investigation, no new populations have been discovered in recent years. It seems clear that Owyhee clover is very rare in Idaho. Owyhee clover is locally common in nearby eastern Oregon, but still considered a conservation concern due to its restricted distribution range and the small size of many populations.

The Succor Creek South (001) occurrence is located within a stone's throw of an area disturbed by an open pit zeolite mine. Portions of this occurrence, possibly most of it, were destroyed by road building and general mining operations. Road widening into the mine area that destroyed potential habitat in 1998, was done without BLM authorization. Reactivation and expansion of the mine could easily destroy what remains of the occurrence's southern subpopulation. Mining activities are less of a direct threat at the northern subpopulations, but they are vulnerable to road improvement or related disturbances. Mining is also the main potential threat to the occurrence on the north side of Succor Creek (002). New claim markers indicate the area may be subject to future mining operations. Such operations would undoubtedly be detrimental to Owyhee clover and its habitat in the area. Overall, mining is the main threat to the long-term conservation of Owyhee clover in Idaho.

Habitat degradation related to weed invasion, ORV use, and cattle disturbances are only minor problems at the present time, but still need to be considered in any long-range conservation plans for this species. Exclosure fences have been proposed by the BLM to protect portions of both Idaho occurrences (Ann DeBolt, BLM, pers. com.). The two occurrences are located at least partly on BLM land, and whose management the long-term conservation of Owyhee clover in Idaho depends.

Recommendations:

I recommend Owyhee clover be kept on the Idaho BLM's Sensitive plant list and the two known occurrences in the state be considered a conservation priority for the agency. In this context, I recommend the BLM be as proactive as possible in protecting Owyhee clover and its habitat at the two occurrences. Specific recommendations along this line include:

1. Protecting the Succor Creek South (001) occurrence from any future mining operation expansion, and the Succor Creek North (002) occurrence from the initiation of mining operations. These are the most important conservation efforts that can be made. They are also likely the most challenging and may require the most innovation.

2. Not allowing salting, or other activities that may encourage increased livestock disturbance to the occurrence areas.

3. Initiation of a monitoring program that will help assess threats from mining, weed invasion, livestock grazing and other known or potential habitat disturbances. Counting plants at a subset of each occurrence should also be considered. Perhaps this can be coordinated with the Oregon BLM to create a more comprehensive, rangewide monitoring program.

4. Internal discussion of fire management plans for the area may be appropriate to ensure any future fire fighting-related activities minimize impacts to the Owyhee clover occurrences.

5. Additional field surveys in the Dry Creek and perhaps Poison Creek drainages should be conducted as time allows.

REFERENCES

Barneby, R.C. 1989. *Trifolium*. Pages 210-232 *In*: Intermountain flora. Vascular plants of the Intermountain West, USA. Volume 3, Part B, by A. Cronquist, A.H. Holmgren, N.H. Holmgren, J.L. Reveal, and P.K. Holmgren. The New York Botanical Garden, Bronx N.Y.

Borror, D.L., D.M. Delong, and C.A. Triplehorn. 1981. An introduction to the study of insects. 5th edition. Saunders College Publishing, Philadelphia, PA. 928 p.

DeBolt, A. and R. Rosentreter. 1988. An illustrated guide to the sensitive plants of Boise District Bureau of Land Management, 1988. Technical Bulletin 88-4. Bureau of Land Management, Idaho State Office, Boise.

Eastman, D.C. 1990. Rare and endangered plants of Oregon. Beautiful America Publishing Company, Wilsonville, OR. 194 p.

Ekren, E.B., D.H. McIntyre, E.H. Bennett, and H.E. Meade. 1981. Geologic map of Owyhee County, Idaho, west of longitude 116^0 W. Map I-1256. Miscellaneous Investigation Series, published by the U.S. Geological Survey. 2 sheets.

Gilkey, H.M. 1956. A new *Trifolium* from Oregon. Madrono 13:167-169.

Gisler, S. and R. Meinke. 2001. Reproductive ecology, seed banking, and cultivation of five at-risk legume species in Oregon. Unpublished report prepared for the U.S. Fish and Wildlife Service, Portland, Oregon.

Grimes, J.W. 1979. The flora of Leslie Gulch Malheur County, Oregon. M.S. thesis, Utah State University, Logan, UT. 54 p.

Henderson, D.M., F.D. Johnson, P. Packard, and R. Steele. 1977. Endangered and threatened plants of Idaho: a summary of current knowledge. The Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council. Bulletin No. 21, Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID. 72 p.

Idaho Conservation Data Center. 2001. Idaho Conservation Data Center data base, Boise, ID.

Idaho Native Plant Society. 1984. Workshop Plant List for the 1984 Idaho Rare Plant Conference. Idaho Native Plant Society, Boise, ID. 4 p.

Idaho Native Plant Society. 2001. Results of the seventeenth annual Idaho Rare Plant Conference. Idaho Native Plant Society, Boise, ID. Internet availability at http://www.state.id.us/fishgame/info/cdc/htm.

Isley, D. 1998. Native and naturalized Leguminosae (Fabaceae) of the United States (exclusive of Alaska and Hawaii). Monte L. Bean Life Science Museum, Brigham Young University, Provo, UT. 1007 p.

Kittleman, L.R. 1973. Guide to the geology of the Owyhee region of Oregon. Bulletin No. 21 of the Museum of Natural History, University of Oregon, Eugene, OR. 61 p.

Lawrence, D.C. 1988. Geology and revised stratigraphic interpretation of the Miocene Sucker Creek Formation, Malheur County, Oregon. M.S. thesis, Boise State University, Boise, ID. 67 p.

Mancuso, M. 1997. The status of Malheur prince's plume (*Stanleya confertiflora*) in Idaho. Unpublished report prepared for the Lower Snake River District, Bureau of Land Management by the Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 18 p., plus appendices.

Meinke, R.J. 1982. Threatened and endangered vascular plants of Oregon: an illustrated guide. U.S. Fish and Wildlife Service, Region 1, Portland, OR. 326 p.

Moseley, R.K. 1994. The status and distribution of Cusick's false yarrow (*Chaenactis cusickii*) in Idaho. Unpublished report prepared for the Boise District Bureau of Land Management, by the Idaho Department of Fish and Game, Conservation Data Center Boise, ID. 12 p., plus appendices.

Oregon Natural Heritage Program. 2001a. Rare, threatened, and endangered species of Oregon. Oregon Natural Heritage Program, Portland, OR. 94 p.

Oregon Natural Heritage Program. 2001b. Oregon Natural Heritage Program data base. Oregon Natural Heritage Program, Portland, OR.

Packard, P.L. *Trifolium owyheense*. 1980. Page 39 *In*: Vascular plants of concern in Idaho, by the Rare and Endangered Plants Technical Committee of the Idaho Natural Areas Council. Bulletin No. 34, Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID.

Rosentreter, R. 1980. Endangered, threatened, and uncommon plants inventory report for the Boise District Bureau of Land Management, 1980. Unpublished report prepared for the Bureau of Land Management, Idaho State Office, Boise. 66 p.

Rosentreter, R. 1983. Sensitive and uncommon plants inventory report for the Boise District Bureau of Land Management, 1983. Bureau of Land Management, Idaho State Office, Boise. 92 p.

Siddall, J.L., P. Packard, and K.L. Chambers. 1978. Status report for *Trifolium owyheense*. Unpublished report prepared for the U.S. Fish and Wildlife Service.

Smithman, L.C. 1989. Distribution and occurrence of *Mentzelia mollis* Peck. Unpublished report prepared for the Vale District, Bureau of Land Management, Vale, OR.

Appendix 1

Line drawing of *Trifolium owyheense* (from Barneby 1989).

Appendix 2

Occurrence map for *Trifolium owyheense* in Idaho.

Appendix 3.

Element Occurrence Records for *Trifolium owyheense* in Idaho.

OWYHEE CLOVER
Occurrence Number: 001

Survey Site Name: SUCCOR CREEK SOUTH

County: Owyhee

USGS quadrangle: SHEAVILLE

Latitude: 430937N Longitude: 1170122W

TOWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
003S006W	14	BO	NW4SW4, SE4SE4SW4

Location: Slopes above south side of Succor Creek, less than 0.5 mile east of the Oregon-Idaho state line boundary. Access is via an unmarked road off of U.S. Route 95.

Survey Date: 2001-05-23 First Observed: 1974-05-19 Last Observed: 2001-05-23

EORANK: C
EORANK Comments: Occurrence is small in size. A portion of occurrence area has been destroyed by mining operations.

Population Data: 1974: No data. Collection by Barbara Ertter. 1978: No data. Collection by Roger Rosentreter, BLM. 1995: Two subpopulations found on the SW side of Succor Creek by Ann DeBolt, BLM. Ca 30 ramets at the northern subpopulation and ca 100-200 ramets at the southern subpopulation. Plants 20% in flower. Population age class structure is 50% immature and 50% mature. Population vigor assessed as low to moderate. The BLM has visited the occurrence area most years since the mid 1990s. Another small cluster of ca 30 plants just southeast of the northern subpopulation has also been reported by the BLM. 2001: Two subpopulations relocated; they are located ca 0.35 mile from one another. Northern subpopulation is ca 0.5 acre in size, with 100 flowering and ca 200 vegetative plants. The southern subpopulation is ca 0.25 acre in size, with ca 150 flowering and an estimated similar number of vegetative individuals. Estimated total number of plants for the occurrence is 600-800; several size classes present. Observation by Michael Mancuso, CDC.

Habitat Description: 1978: Rocky or rocky ash soils, barren ground; various aspects; 45% slope; associated with *Eriogonum, Draba, Trifolium, Astragalus* (R. Rosentreter, BLM). 2001: Sparsely vegetated, edaphic openings surrounded by sagebrush-steppe vegetation. Substrate is a whitish- to light tan-colored chalky ash with high percentage of hard, angular, thin, platy stones. Substrate is relatively soft at the surface, but dense and hard a few inches below the surface. Mostly flat to gently sloping. *Artemisia tridentata* present at northern subpopulation, while *A. arbuscula* occurs at the southern subpopulation; other associates include *Purshia tridentata, Monardella odoratissima, Agropyron spicatum, Poa secunda, Arenaria nuttallii. Montia linearis* is common within northern subpopulation, which also contains a small amount of *Bromus tectorum* (M. Mancuso, CDC).

Minimum Elevation: 4400 feet Maximum Elevation: 4450 feet

Size: 1 acre

Land Owner/Manager:
LOWER SNAKE RIVER DISTRICT
OWYHEE RESOURCE AREA

Ownership Comments: Lower Snake River District BLM, Owyhee FO.

Comments: GPS coordinates; UTM 11T, Map Datum = NAD 27 Central.
Northern subpopulation = E 0498155 N 4778426;
Southern subpopulation = E 0498582 N 4778089.

Protection Comments: Unauthorized road widening for mining operations destroyed part of the occurrence area in 1998. 2001: Northern subpopulation (1) some plants located within a few feet of main dirt road; (2) cattle graze the general area with some disturbance within the occurrence; (3) a small amount of *Cardaria draba* occurs along the dirt road near subpopulation; more whitetop can be found near the end of the dirt road at the Succor Creek ford. *Onopordum acanthium* is also present nearby along the road. Southern subpopulation (1) portions of occurrence area destroyed and/or otherwise disturbed by open pit mining for zeolite; mine operations inactive at time of survey; (2) cattle graze general area, but related disturbance is minimal, probably due to the relative paucity of forage.

Management Comments: 2001: Future zeolite and/or bentonite mining in the area needs to be restricted to ensure persistence of this occurrence.

Specimens: Barbara Ertter 29/4 (CIC).
Roger Rosentreter 259 (CIC) – collection label gives elevation as 4,000 feet; also says that population covers 400 acres.
Ann DeBolt 1119 (Lower Snake River District BLM).

OWYHEE CLOVER
Occurrence Number: 002

Survey Site Name: SUCCOR CREEK NORTH

County: Owyhee

USGS quadrangle: SHEAVILLE

Latitude: 430947N Longitude: 1170054W

TOWNRANGE:	SECTION:	MERIDIAN:	TRSNOTE:
003S006W	14	BO	center

Location: Lower slopes above the north side of Succor Creek, ca 0.5 mile east of the Idaho-Oregon state line boundary. Access is via an unmarked dirt road off of Highway 95 about 13 miles north of Jordan Valley.

Survey Date: 2001-05-22 First Observed: 1989 Last Observed: 2001-05-22

EORANK: B
EORANK Comments: Relatively large number of plants; habitat is mostly undisturbed, although several threats present.

Population Data: 1989: Ca 50 individuals in flower. Observation by Ann DeBolt, BLM. 1994: Ca 300+ mature genets, 70% vegetative and 30% with flowers. Population vigor assessed as good. Immediate vicinity thoroughly searched by Ann DeBolt, BLM. The area was again visited by the BLM in 1998. 2001: Two subpopulations separated by ca 0.1 mile of suitable-looking, but apparently unoccupied habitat. Northern subpopulation with ca 130 flowering and an equal number of non-flowering individuals; southern subpopulation with ca 500 flowering and many small non-flowering plants; an estimated total of 1000 plants for both subpopulations. Observation by Michael Mancuso, CDC.

Habitat Description: 1994: On bottomland and lower SE-facing slopes on NE side of Succor Creek. Barren, white chalky ash soils, mostly flat. With *Artemisia arbuscula, Apocynum androsaemifolium, Phlox hoodii, Senecio canus, Poa secunda, Lewisia rediviva*, and *Monardella odoratissima* (A. DeBolt, BLM). 2001: Sparsely vegetated openings of white-colored, chalky-textured substrate with high percentage of hard, thin, angular, flat, platy stones. Substrate is softer at the surface than the hard material a few inches below the surface. Northerly to southerly aspects; nearly flat to 40 degree slope. Additional associates include *Purshia tridentata, Chrysothamnus nauseosus, Agropyron spicatum, Arenaria nuttallii*. Sparse cover of *Ranunculus testiculatus* present (Mancuso, CDC).

Minimum Elevation: 4260 feet Maximum Elevation: 4440 feet

Size: 5 acres

Land Owner/Manager:
LOWER SNAKE RIVER DISTRICT
OWYHEE RESOURCE AREA

Ownership Comments: Private land; and Lower Snake River District BLM, Owyhee FO.

Comments: GPS coordinate; UTM 11T, Map Datum = NAD 27 Central. E 0498753 N 4778675.

Protection Comments: 2001: (1) cattle graze general area, but disturbance within sparsely vegetated occurrence is minimal; (2) two-track dirt road passes close to occurrence; one old tire tread mark passes through part of occurrence; (3) a small excavation pit within occurrence and a nearby benchmark post that says "Whelan's Mining Inc. BM5 1998. Box 2782, Boise, ID 83701. Official survey". There is another Whelan's Mining Inc. benchmark post atop knob at SE end of occurrence area, but no *Trifolium owyheense* was observed at this point in 2001.

Management Comments:

Specimens:

Appendix 4.

Descriptions and maps of areas surveyed for *Trifolium owyheense* in 2001.

Areas surveyed for *Trifolium owyheense* in 2001.

McBride Creek (Map 1) – the CDC data base had an Owyhee clover occurrence (004) reported for T1S R 5W section 19, between McBride Creek and Highway 95. This site was revisited, and found to have big-headed clover, not Owyhee clover. As a result, this occurrence was deleted from the CDC data base. In addition to the reported location, I visited several ash outcrops in the general area to make sure there was no Owyhee clover nearby. Over the years, I have looked at all of the ash outcrops in sections 18 and 19 and never found Owyhee clover. The 2001 survey did make it clear that Greeley's wavewing (occurrence 010) was more common in the general area than previously reported.

Coal Mine Basin Creek (Map 2) – no direct survey work was conducted in the northern part of Coal Mine Basin where botanists have found several rare plant species over the years, but no Owyhee clover. I did not think it was worth my time to walk over ground that has been relatively well surveyed in the past. I did directly survey several areas of potential habitat in T3S R6W section 2. In addition I walked much of the southern half of this section to reach the ashy-clay outcrops located just east of the state line. Most of the country I passed through enroute to these outcrops was excellent condition sagebrush-steppe vegetation. It is an area worth additional inventory as a reference site for high quality sagebrush-steppe plant communities. In several places I encountered big-headed clover, but no Owyhee clover was found in this area.

Succor Creek Reservoir West (Map 3) – There is a series of ashy outcrops on the slopes above the west side of Succor Creek Reservoir, extending from the dam area upstream for about 0.7 mile. Like most places in the study area, the bulk of the outcrops are dominated by popcorn clays and apparently unsuitable for Owyhee clover. More Malheur yellow phacelia was observed in this area.

Succor Creek Northeast (Map 4) – There are a lot of volcanic ash substrates exposed along the slopes and ridges about one mile southwest of Succor Creek Reservoir (T3S R6W section 12 E2 and adjacent R5W section 7 W2). Exposures in this area are highly variable, ranging from soft and powdery to cindery in texture, and from white to black in color. Malheur yellow phacelia was plentiful on some outcrops, but none had an edaphic profile matching the Owyhee clover 001 and 002 sites.

Succor Creek North (Maps 4 and 5) – Extensive Sucker Creek Formation geology is exposed on the slopes on the north side of Succor Creek, from the state line, eastward for about 1.5 miles. Outcrops are common from the Succor Creek bottoms upslope to the breaklands delimiting the southern extent of Coal Mine Basin. Some of the most extensive and picturesque exposures in the study area occur in this area. Exposures that seem to match the edaphic profile for the two Owyhee clover sites extend for a radius of about 0.25 mile north, east, and west of where plants were found on the north side. It seemed odd that Owyhee clover was absent from these nearby sites. Portions of the steep southerly-facing slope located upstream of the Succor Creek narrows (below Point 4565 in T3S R6W SW4 SW4 section 13 and adjacent portion of sections 14 and 23) also has very good potential habitat, although no Owyhee clover was not found in this area. All of the many other exposures searched have erosional and/or color properties different than occurrences 001 and 002.

Succor Creek South (Maps 4 and 5) – Ash outcrops are common on the slopes south of Succor Creek, extending from the Oregon-Idaho state line, eastward for about 1.5 miles. Outcrops on the south side become much more scattered, generally smaller in size, and more confined to upper gully positions as one proceeds further upstream. They more or less disappear past the Succor Creek Reservoir area. Ash outcrops on the slopes south of Succor Creek have eroded to various textures and colors. With the exception of areas near the state line and the old zeolite open pit mine vicinity, none of the numerous exposures surveyed replicate the edaphic profile characterizing occurrences 001 and 002. I encountered big-headed clover in T3S R 6 W section 23 NE4, less than 0.5 mile southeast of Owyhee clover occurrence 001. Malheur yellow phacelia was common on many outcrops in this area.

Succor Creek Southeast (Map 6) – This area has a series of scattered bowl-like ash outcrops. They range in color from brown and tan to gray with large segments barren of vegetation. None appeared to be good potential Owyhee clover habitat and no other rare plant species were observed either. I was able to view a series of outcrops in nearby T3S R5W section 17 NW4, but did not have time to directly visit them. These outcrops (marked by “Xs” on Map *) looked similar to the exposures I did directly survey in the general area, none of which had Owyhee clover. I did not visit a handful of ash outcrops on nearby private land in section 16 SW4.

Westgate Gulch (Map 5) – The two exposures visited in this area have different edaphic and vegetation characteristics compared to Owyhee clover occurrences 001 and 002. The outcrop in T3S R6W section 26 is quite weedy, while the one in section 25 supports an open low sagebrush community. A small outcrop near SW Gate Gulch Reservoir was not directly visited. It did not look to have suitable habitat when viewed through binoculars from a nearby vantage point. For miles, most of the country south of Westgate Gulch has burned with only scattered remnant shrub patches

Upper Hooker Creek (Map 7) – The relatively sparsely vegetated, brownish, gravelly volcanic sand outcrops in this area are apparently unsuitable for Owyhee clover. Outcrops are all small and localized. No additional potential habitat was observed from several vantage points in upper Hooker Creek. A series of brownish outcrops occur in the Baxter Creek drainage to the south of Hooker Creek. When viewed from a distance, they all looked identical to the outcrops in Hooker Creek and I did not feel they were worth the time to go directly visit and search. The location of the outcrops in Baxter Creek are marked with “X’s” on Map 7.

East of Jordan Valley (Map 8) – This area contains a series of scattered, mostly small, light-colored openings within a matrix dominated by sagebrush-bitterbrush/ bunchgrass vegetation and rhyolitic geology. Most of the exposures were tan-colored, with a stony-silty texture. However, several have habitat that looked potentially suitable for Owyhee clover. The substrate was a yellowish-hued silty-ash with a high platy stone component. Monardella, Hood’s phlox, and Sandberg’s bluegrass were present in these areas, but not Owyhee clover.