

**Biological Soil Crust Survey -
Rome Cliffs Area, T31S, R41E, Sec. 32,
Malheur County, Oregon**

Original prepared for the
Bureau of Land Management
Oregon State Office
January 28, 2010

(Revisions, additions – September 1, 2016)

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Abstract

During a 2009 biological soil crust survey of the Rome Cliffs area in southeast Oregon, forty-six species of lichens, bryophytes, and cyanobacteria taxa were identified. Of the 46 taxa, there were 38 lichens (36 on soil, 1 on wood, 1 on pebbles), 6 bryophytes (mosses/liverworts; soil), and 2 cyanobacteria (soil). The lichen *Placidium acarosporoides* is reported as new for Oregon. *Heteroplacidium congestum*, *Lecidea laboriosa*, and *Acarospora obpallens*, each collected during this Rome Cliffs survey, have been reported one other time from Oregon, all from Deschutes County, and all by different collectors over a period of 40+ years. Soil types and vegetation differed considerably among the four study plots, as reflected by the biological soil crusts, with up to eleven taxa unique to one of the plots. Overall biological soil crust diversity ranged from 14 to 26 species per 1 acre plot. This survey exemplifies the diversity and richness found within this micro-flora, and illustrates just how poorly known it is.

Introduction

The Rome Cliffs Area and associated zeolite deposits are located in the vicinity of Rome, Oregon, approximately 130 km southwest of the town of Vale. Neogene and Quaternary volcanic and sedimentary rocks are the primary outcroppings in this area (Sheppard 1987). The zeolites and associated minerals occur in a sequence of alluvial and lacustrine volcanoclastic rocks known informally as the Rome beds (Sheppard 1987). The beds are nearly 100 m thick and consist of an alluvial and lacustrine sequence of conglomerate, mudstone, sandstone, tuff, and minor limestone and chert (Sheppard 1987). The rocks of the Rome beds are primarily volcanic except for minor limestone, chert, and mudstone. It is largely because of this area's unique and varied geology and soils that botanists have been interested in its flora for many years, as the soils support at least six, and possibly more, edaphic endemic and other uncommon vascular plant species.

Although relatively distant from large population centers, the unique geology and accessibility of this area (near a major highway, moderate topography, 2-track roads traverse the site) lends itself to the potential for unmanageable off-road vehicle activity. It is important to determine resource values under current conditions, since it is expected that planning documents will be needed for this area in the not too distant future.

As mentioned above, vascular plant surveys have turned up several uncommon taxa in the Rome area, specifically at Sec. 32, Township 31S, Range 41E. According to local botanists, additional inventories are still needed in this area (Don Mansfield, College of Idaho, personal communication, 2009). For the lower plants, including lichens and bryophytes, surveys in this or other regions of eastern Oregon have been limited. In 1984, Mayfield and Kjelmlyr identified 14 bryophyte and 7 lichen taxa from the Boardman Research Natural Area in north-central Oregon. While investigating biological soil crust composition in relation to soil chemistry, climate, and livestock grazing, Ponzetti and McCune (2001) identified 48 taxa or morphological groups at nine shrub-steppe sites in central and eastern Oregon. None of these sites were extensively surveyed, but transect sampling was intensive and to the species level whenever possible. Of the nine sites, the closest one to Rome is 180 km to the west. DeBolt (2008) identified 47 biological

soil crust taxa during an inventory of the Birch Creek area, 50 km northeast of Rome, and 56 taxa within the Coal Mine Basin Area of Critical Environmental Concern (DeBolt 2011), on the Idaho-Oregon border, 80 km to the northeast. Prior to the 2008 inventory, systematic surveys for these organisms in this part of the state are not believed to exist.

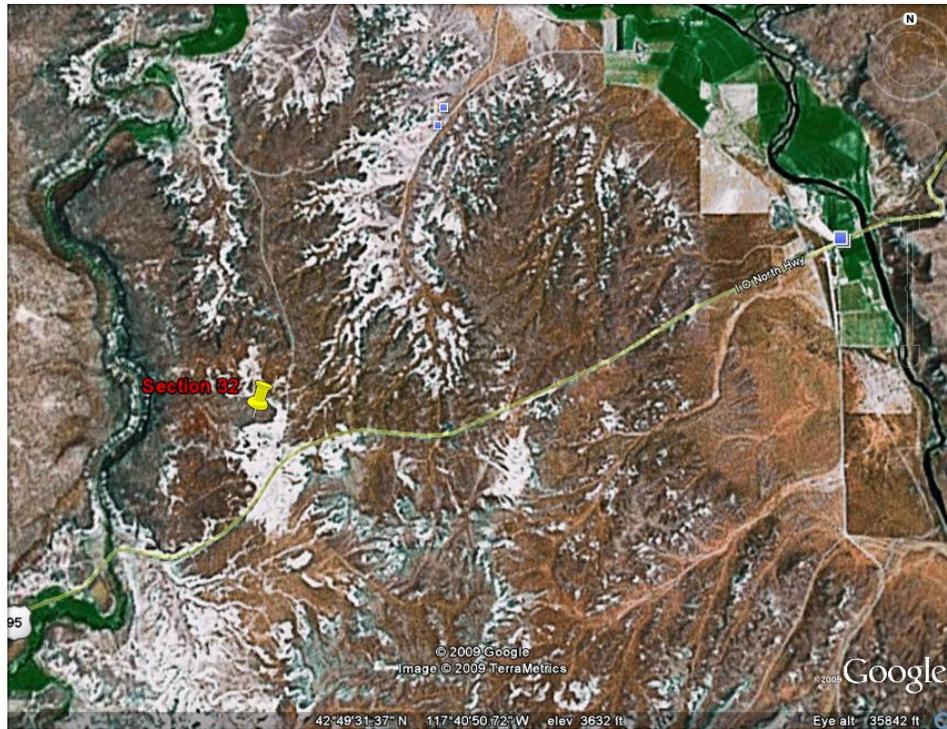
Biological soil crusts are a close association between soil particles and cyanobacteria, microfungi, algae, lichens, and bryophytes (mosses, liverworts) which live within or on top of the uppermost millimeters of soil (Belnap et al. 2001). They are found in all dryland regions of the world and in all vegetation types within these lands, including the arid and semi-arid regions of North America (Rosentreter and Belnap 2001). Also known as cryptobiotic crusts, biotic crusts, microbiotic crusts, and cryptogamic crusts, biological soil crusts are often overlooked due to their tendency to blend in with the soil; thus, they are seldom collected. Due to the small size and fragility of the specimens, they can be difficult to return to the lab intact and suitable for species determination. However, the ecological importance of these organisms in nutrient cycling, moisture storage, and soil stabilization has been well documented (Belnap et al. 2001, Hilty et al. 2004, Ponzetti et al. 2007, Rosentreter et al. 2007, Serpe et al. 2007), and will not be discussed further in this report.

For this survey of Sec. 32 west of Rome, objectives were to 1) identify which soil-occurring lichen and bryophyte taxa are present; (2) prepare a herbarium reference collection of all species observed, including duplicates whenever possible; (3) determine if taxa differ by habitat and soil type, and (4) prepare a summary report, including photos. These products will further our knowledge of an important but poorly known component of the sagebrush steppe ecosystem.

Methods

Soil-occurring lichens and bryophytes were collected in June 2009 at the Sec. 32 portion of the Rome (sometimes referred to as the Rome Cliffs) area. This area is located at T31S, R41E, 85 km SW of Jordan Valley, OR, and about 225 km southwest of Boise, Idaho (actual highway km). The area is accessed via Highway #95. More specifically, after crossing the Owyhee River at Rome, OR, continue 6.5 additional kilometers before turning north onto a wide dirt road (Fig. 1). This dirt road slices through the eastern portion of Section 32, from north to south, providing excellent access to the study area.

Figure 1. Google Earth map shows location of Sec. 32, 6.5 km west of the Owyhee River.



To be as objective as possible in assessing biological soil crust diversity at the study site, Forest Health Monitoring sampling protocols were loosely followed. A minimum of 30 minutes and a maximum of 2 hours were spent examining plots with a 35 m radius within a given habitat or vegetation type (McCune et al. 1997). As best as could be determined (biological soil crusts are difficult to field identify), each different species encountered within a site was carefully collected and numbered. Only soil-occurring species were sampled (wood- and rock-occurring species were collected only incidentally). Each sample was gently wrapped in tissue and placed in a small paper bag. Small bags were then grouped into one large paper bag or box per plot once sampling was completed. Other data recorded at each site included the GPS coordinates, elevation, aspect, slope, and associated vascular plant species. Soil samples were taken for subsequent texture and pH testing.

This relatively small area (640 acres) of limited topographic relief is fairly homogeneous in terms of vascular plant diversity, yet at least six uncommon to rare plant species are known to occur here or in adjacent sections, most likely due to unique edaphic factors. These species and their state and Bureau global rarity status are as follows:

- *Astragalus alvordensis* M.E. Jones (Alvord milk-vetch); G4, S4, List 4
- *Chaenactis cusickii* A. Gray (Cusick's chaenactis); G3, S3, List 4
- *Chaetadelpa wheeleri* A. Gray ex S. Watson (Wheeler's skeleton-weed); G4, S2, List 2, Bureau Sensitive
- *Eatonella nivea* (D.C. Eaton) A. Gray (White eatonella); this former Bureau sensitive plant species occurs in an adjacent section of land

- *Lomatium foeniculaceum* (Nutt.) J.M. Coult. & Rose ssp. *fimbriatum* W.L. Theobald) (Fringed desert-parsley); G5T2T4, S1, List 2, Bureau Sensitive
- *Lomatium ravenii* Mathias & Constance (Raven's lomatium); G4, S1, List 2, Bureau Sensitive

Four representative vegetation types were selected for sampling. Plots were selected randomly after being stratified by soil and vegetation type. The four sites are described as follows, with dominants listed in order of prevalence (from most dominant to less dominant):

Plot 1: alkaline, clay-silt soil of swale area (pH 8) with no detectable aspect, dominated by *Atriplex nuttallii* S. Watson, *Grayia spinosa* (Hook.) Moq., *Elymus elymoides* (Raf.) Swezey, *Poa secunda* J. Presl.; where burned on south edge of plot, dominated by *Halogeton glomeratus* (M. Bieb.) C.A. Mey. and *Lepidium perfoliatum* L., with few biological soil crusts.

Plot 2: clay soil (pH 7), from flat to 35% slope with a northerly aspect; mostly barren of vasculars but when present, dominated by *Atriplex confertifolia* (Torr. & Frém.) S. Watson, *Elymus elymoides*, *Poa secunda*, *Tetradymia spinosa* Hook. & Arn., *Atriplex argentea* Nutt., and *Gutierrezia sarothrae* (Pursh) Britton & Rusby.

Plot 3: fine, sandy-silt soil (pH 7) with cobble surface, flat to slight SW aspect on top of ridge; dominated by *Tetradymia glabrata*, *Artemisia tridentata* Nutt. ssp. *wyomingensis* Beetle & Young, *Elymus elymoides*, *Phlox* sp., and *Bromus tectorum* L.

Plot 4: sandy-silt soil (pH 7) of flat area that partially burned a few years ago; dominated by *Bromus tectorum*, *Halogeton glomeratus*, *Elymus elymoides*, *Atriplex confertifolia*, *Ceratocephala testiculata* (Crantz) Roth (= *Ranunculus testiculatus*), *Sphaeralcea munroana* (Douglas) Spach, and *Salsola tragus* L.

Biological soil crust specimens were returned to the lab and curated using standard bryological and lichenological techniques (Brodo et al. 2001, McCune and Rosentreter 2007). Species were identified using the floras listed in the "References" section, primarily McCune and Rosentreter (2007) and Rosentreter et al. (2007). Soil pH and texture were analyzed in the lab using standard techniques.

Results and Discussion

Among the 94 herbarium specimens prepared for this project (see Appendix A. Collection Notebook), **forty-six lichen, bryophyte, and cyanobacteria taxa were identified.** Among the 46 taxa, there are 38 lichens (36 on soil, 1 on wood, 1 on pebbles), 6 bryophytes (mosses and liverworts – all on soil), and 2 cyanobacteria (on soil) (Table 1, Fig. 2).

***Placidium acarosporoides* (Zahlbr.) Breuss is reported as new for Oregon.** This lichen is known from Arizona, California, and Baja California in North America, Argentina and Chile in South America, and South Africa (Consortium of North American Lichen Herbaria, 2010). It generally grows on rock, but can occasionally be found on soil as it was in the Rome area. *Placidium acarosporoides* was collected in Plot #3, where it was growing intermixed with *Heteropladidium congestum* (#2450). Since it was discovered after curation, it has been assigned to collection #2450a.

Heteropladidium congestum (Breuss & McCune) Breuss (formerly *Catapyrenium congestum* Breuss & McCune) was collected once each in Plot #1 (#2395) and Plot #3 (#2450). This brown-colored lichen is uncommon in *Artemisia* and *Atriplex* steppe, where it is most often found on saline soils (McCune and Rosentreter 2007). It is known from southern Idaho, Utah, and Colorado. **This is the second report of *Heteropladidium congestum* for Oregon.** It was previously collected in Deschutes County, northwest of Redmond, Oregon, by Rosentreter (#9244a) in 1995 (Consortium of North American Lichen Herbaria, 2016).

The lichen *Lecidea laboriosa* Müll. Arg. was collected in Plot #1 (#2381) and Plot #2 (#2424). **This is the second collection of *L. laboriosa* from Oregon,** first reported by Pike (#2143) in Deschutes County in 1971 (Consortium of North American Lichen Herbaria, 2016). *Lecidea laboriosa* is typically found on calcareous rock and sandy soil in the southwest U.S., plus a few sites on the Snake River Plain in Idaho (McCune and Rosentreter 2007). Plot #2 had the highest biological soil crust diversity (Table 2, Fig. 2).

Acaropora obpallens (Nyl. Ex Hasse) Zahlbr was collected within Sec. 32 (#2491), but not within a study plot. **This rarely collected brown squamulose species has been collected just one other time in Oregon,** from a cinder pit in Deschutes County by Root (#2474) in 2010 (Consortium of North American Lichen Herbaria, 2016).

Of the four study plots, Plot #2 supported the most taxa (26), and also the most unique taxa, with ten lichens and one cyanobacteria found only in this plot (Table 2, Fig. 3). Biological soil crust taxa found only in this plot include the lichens *Acarospora fuscata* (Schrad.) Arnold, *A. glaucocarpa* (Ach.) Körber, *Aspicilia calcarea* (L.) Mudd, *A. contorta* (Hoffm.) Kremp., *Lecanora garovaglii* (Körber) Zahlbr., *L. laatokkaensis* (Räsänen) Poelt, *Megaspora verrucosa* (Ach.) Hafellner & V. Wirth, *Rhizoplaca melanophthalma* (DC.) Leuckert & Poelt, *Staurothele areolata* (Ach.) Lettau, and the cyanobacteria *Nostoc*. This site is characterized by clay soil with a northerly aspect, the greatest slope ranges, from flat to 35%, and it is the most visually distinctive, with multi-colored soils of extensive microtopography and very sparse vascular plant cover (see photos below). *Tetradymia spinosa*, *Atriplex argentea*, and *Gutierrezia sarothrae* were vascular plant dominants recorded only in Plot #2.



Plot #2 photos illustrate its topographic relief, soil color variation, and sparse vascular plant cover.

The saxicolous lichen, *Rhizoplaca melanophthalma*, was collected on both rock and soil in Plot #2. While the soil-occurring growth form has been observed elsewhere, it is relatively uncommon. Some lichenologists consider the two growth forms as separate subspecies. In Plot #2, *R. melanophthalma* on soil was nearly fruticose, giving it an even more atypical appearance. Other normally saxicolous species growing on the clay soil in this plot included *Acarospora glaucocarpa*, *A. fuscata*, *Aspicilia desertorum* (Krempelh.) Mereschk., *Lecanora garovaglii*, *L. laatokkaensis*, *Protoparmelia badia* (Hoffm.) Hafellner, and *Staurothele areolata*.

Unfortunately, Plot #2, with its combination of sparse vascular plants and relatively steep hillside topography, may be one of the more inviting areas to off-highway vehicle users. Its unique soil crust flora would certainly be impacted by this type of use.

Generally speaking, Plot #1 was not nearly as visually distinctive as Plot #2, though the biological soil crust cover was extensive, except where burned. Four taxa were unique to this plot – two lichens, *Placidium squamulosum* (Ach.) Breuss and *Placidium rufescens* (Ach.) Breuss, and two bryophytes - *Crossidium aberrans* Holz. & E.B. Bartram and *Grimmia alpestris* (Weber & Mohr) Schleicher (also see Table 2). Plot #1 was the most alkaline, with a pH of 8 (all others were pH 7), clay-silt soil, and the only area occupied by *Atriplex nuttallii*.





The four Plot #1 photos above illustrate the high biological soil crust cover of what superficially looks like barren ground within this swale zone. In the lower right photo, biological soil crusts are reduced by fire and dense non-native annual plant litter.

Megaspora verrucosa, a rather widespread lichen in the western U.S., grows from desert to alpine regions, typically on organic matter over the soil. It is most often found in calcareous habitats. In the Rome area, *Megaspora verrucosa* was collected only in Plot #2. Lichens on soil are good indicators of soil pH, or free calcium carbonates (McCune and Rosentreter 2007). Other Rome area taxa indicative of calcareous soils include *Acarospora glaucocarpa* (Ach.) Körber, *Aspicilia calcarea* (L.) Mudd, *A. hispida* Mereschk., *Caloplaca tominii* Savicz, *Collema tenax* (Sw.) Ach., *Psora cerebriformis* W.A. Weber, *P. decipiens* (Hedwig) Hoffm., and *P. tuckermanii* R. Anderson ex Timdal, or at least 21% of this area’s soil crust flora (Table 3).

Table 3. Calcareous indicator species by plot.

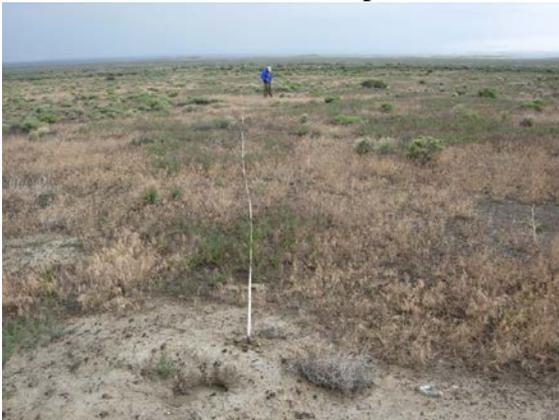
Plot #1	Plot #2	Plot #3	Plot #4
<i>Aspicilia hispida</i>	<i>Acarospora glaucocarpa</i>	<i>Caloplaca tominii</i>	<i>Caloplaca tominii</i>
<i>Caloplaca tominii</i>	<i>Aspicilia calcarea</i>	<i>Collema tenax</i>	<i>Collema tenax</i>
<i>Collema tenax</i>	<i>Caloplaca tominii</i>	<i>Psora cerebriformis</i>	<i>Psora decipiens</i>
<i>Psora decipiens</i>	<i>Collema tenax</i>		<i>Psora tuckermanii</i>
<i>Psora tuckermanii</i>	<i>Megaspora verrucosa</i>		

Biological soil crust taxa unique to Plot #3 include the four lichens, *Candelariella rosulans* (Müll. Arg.) Zahlbr, *Placidium acarosporoides* (Zahlbr.) Breuss, *Placidium lachneum* (Ach.) Breuss, and *Psora cerebriformis* (Table 2, Fig. 3). Of these, *P. lachneum* probably has the most limited global distribution. Plot #3’s flat ridgetop area with fine, sandy-silt soil and a cobble surface was dominated by vascular plants including *Tetradymia glabrata*, *Artemisia tridentata* ssp. *wyomingensis*, *Elymus elymoides*, and an unidentified *Phlox*. *Tetradymia glabrata* and the *Phlox* sp. were not detected in other plots. A total of twenty-one biological soil crust taxa were collected in Plot #3 (16 lichens, 3 bryophytes, 2 cyanobacteria) (Table 2, Fig. 2). Among the four study plots, this vegetation type is probably the most common in southeast Oregon.



Plot #3 photos illustrate the cobble soil surface, which supported 21 biological soil crust taxa.

No taxa were unique to Plot #4 (Table 2, Fig. 3). This site partially burned several years ago and is presently dominated by exotics including *Bromus tectorum*, *Halogeton glomeratus*, *Ceratocephala testiculata* (*Ranunculus testiculatus*), with scattered remnant native perennials such as *Elymus elymoides*, *Atriplex confertifolia*, and *Sphaeralcea munroana*. In spite of habitat degradation, it is still somewhat remarkable that **14 biological soil crust taxa were collected in this disturbed plot**, including three of the six bryophytes (Table 1). Remnant biological soil crust taxa are often indicators of low intensity burns (Rosentreter 2001). Slickspots, of which there are several within this plot, also serve as refugia from fire for biological soil crust taxa.



Plot #4 photos illustrate dominance by non-native annuals after the area partially burned several years ago. Native perennials and biological soil crust taxa continue to persist, suggesting a low intensity burn. Slickspot areas also serve as refugia from fire for biological soil crust taxa.

Taxa collected in the general area of Sec. 32 but not from a specific study plot were *Thelomma occidentale* (Herre) Tibell and *Aspicilia desertorum* f. *contorta*. Both were on non-soil substrates. *Thelomma occidentale* was growing on pieces of old wooden fenceposts, while

the *contorta* form of *A. desertorum* encompassed many of the small pebbles. While neither species was on soil, it helps demonstrate substrate specificity of many lichen and bryophyte taxa.

Bryophyte (both moss and liverwort) diversity in the Rome Cliffs area was 50% lower than at the Birch Creek study site, where twelve bryophyte species were observed (DeBolt 2008) (Fig. 4). Birch Creek bryophyte taxa missing from the Rome Cliffs area included *Brachythecium collinum* (Schleich. ex Müll. Hal.) Schimp., *Cephaloziella byssacea* (Roth) Warnst., *Ceratodon purpureus* (Hedw.) Brid., *Coscinodon calyptratus* (Hook.) C.E.O. Jensen ex Kindb., and *Homalothecium aeneum* (Mitt.) E. Lawton. This is likely because of the more open and gentle topography of the Rome area (specifically Sec. 32) versus the canyon environment of Birch Creek, with its tremendous topographic diversity and abundance of shaded, sheltered sites.

Additional soil-occurring species would likely be found in the Rome Cliffs area if more time were spent, as its unique microhabitats and soil outcrops appear endless. However, the information gathered during this project, in combination with Birch Creek and Coal Mine Basin inventories (DeBolt 2008 and 2011, respectively), begin to give us a snapshot of biological soil crust diversity in southeast Oregon.

Conclusion

During the 2009 survey of biological soil crust diversity in the Rome Cliffs area in southeast Oregon, 46 taxa were identified from a square mile (640 acre) parcel of public land (T31S, R41E, Sec. 32). Among the 46 taxa, there were 38 lichens, 6 bryophytes, and 2 cyanobacteria. The lichen *Placidium acarosporoides* is reported as new for Oregon. The lichens *Heteroplacidium congestum*, *Lecidea laboriosa*, and *Acarospora obpallens* have each been collected only one other time within the state, all from Deschutes County, Oregon.

The soil types and vegetation differed considerably among the four one acre study plots at the Rome Cliffs area, and this is reflected to some extent by the biological soil crust flora. Plots supported between 14 and 26 taxa. Of the 26 taxa collected in Plot #2, eleven were unique to this site. This plot is possibly the most vulnerable to off-highway activity, as it has relatively steep slopes largely devoid of shrubs, and would appeal to those wishing to “hill climb” with recreational vehicles. This study helps illustrate that while some may see this landscape as barren, its diversity is remarkable if time is taken to look more closely.

Acknowledgements

I would like to thank Gillian Wigglesworth, Vale District BLM botanist, for proposing the project and providing direction and support, and Kelli VanNorman, Oregon State Office - BLM, for funding. Dr. Bruce McCune graciously identified several specimens, and Drs. Othmar Breuss, John Badina, and Bjorn Owe-Larsson have kindly agreed to examine several others. Roger Rosentreter, local soil crust expert, provided invaluable assistance and recommendations, both in the field and beyond.

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Appendices, Tables, and Figures

Appendix A.

This portion of the document is my Collection Notebook. It includes label and species data for each site. DeBolt collection numbers for this project range from 2380 to 2491.

Table 1. Alphabetical list of taxa collected in the Rome Cliffs Area, Sec. 32.

This alphabetical list of species includes their respective collection number(s), the number of specimens for each collection, life form (i.e. bryophyte or lichen), and notes. It follows the Collection Notebook.

Table 2. Alphabetical list of taxa by collection site in the Rome Cliffs Area, Sec. 32. It follows the Collection Notebook.

Table 3. Calcareous indicator species by plot. Unlike Tables 1 and 2, this table is within the body of the document.

Figure 1. Google Earth map shows location of Sec. 32, 6.5 km west of the Owyhee River. Unlike Figs. 2-4, this figure is within the document body.

Figure 2. Total number of biological soil crust taxa collected in each of the four plots, Rome Cliffs Area, Sec. 32. It follows Table 2.

Figure 3. The number of biological soil crust taxa unique to each of the four plots, Rome Cliffs Area. It follows Figure 2.

Figure 4. Pie charts illustrate the number of taxa per life form at the Rome Cliffs area and Birch Creek (2008). It follows Figure 3.

- 1) **Digital Photographs.** All photos have been copied onto a separate CD, transferred to the BLM in 2010.
- 2) **PDF file.** All files (report plus tables and figures) are incorporated into one document.

APPENDIX A.

Collection Notebook, Rome Cliffs Area, T31S, R41E, Sec. 32, Malheur County, Oregon

PLOT #1:

Alkaline, clay-silt soil of swale area (pH 8) with no detectable aspect. Approx. 6.5 km SW of Rome, OR and the Owyhee River, and 85 km SW of Jordan Valley, OR. *Atriplex nuttallii*, *Grayia spinosa*, *Elymus elymoides*, *Poa secunda* site. Where burned, largely dominated by *Halogeton glomeratus* and *Lepidium perfoliatum*.

N 42° 494' W 117° 424' 1122 m (3679 feet elevation) 14 June 2009

- 2380 *Psora decipiens* (Hedwig) Hoffm.
2381 *Lecidea laboriosa* Müll. Arg. (2nd report for Oregon)
2382 *Collema tenax* (Sw.) Ach. (fertile)
2383 *Candelariella aggregata* M. Westb. (K- ; on organic matter)
2384 *Placidium rufescens* (Ach.) Breuss
2385 *Psora tuckermanii* R. Anderson ex Timdal
2386 *Placidium rufescens* (Ach.) Breuss
2387 *Placidium lacinulatum* (Ach.) Breuss (fertile)
2388 *Crossidium aberrans* Holz. & E.B. Bartram
2389 *Syntrichia caninervis* Mitten
2390 *Pterygoneurum ovatum* (Hedw.) Dix
2391 *Thrombium epigaeum* (Pers.) Wallr. (1 spec. kept for BSU)
2392 *Aspicili reptans* (K-) (1 spec. kept for further evaluation)
2393 *Collema tenax* (Sw.) Ach. (on soil)
2394 *Endocarpon pusillum* Hedw. (on organic matter)
2395 *Heteroplacidium congestum* (Breuss & McCune) Breuss (2nd report for OR)
(Syn.: *Catapyrenium congestum*) (Verified by O. Breuss, March 2010; B. McCune 12/10)
2396 *Syntrichia ruralis* (Hedw.) Web. & Mohr
2397 *Collema tenax* (Sw.) Ach. (young thalli)
2398 *Caloplaca tominii* Savicz (K+ red)
2399 *Aspicilia desertorum* (Krempelh.) Mereschk. form *terrestris* (K-)
2400 *Grimmia alpestris* (Weber & Mohr) Schleicher (on soil over rock)
2401 *Aspicilia hispida* Mereschk. (on soil)
2402 *Microcoleous* sp. (cyanobacteria)
2403 *Placidium squamulosum* (Ach.) Breuss (Identified by O. Breuss, March 2010)
2405 xxxxx
2406 xxxxx

xxxxx = blank numbers

PLOT #2:

Clay soil (pH 7). N aspect, from flat to 35% slope. Approx. 6.5 km SW of Rome, OR and the Owyhee River, and 85 km SW of Jordan Valley, OR. Associated vegetation: *Atriplex confertifolia*, *Elymus elymoides*, *Poa secunda*, *Tetradymia spinosa*, annual *Atriplex*, and *Gutierrezia sarothrae*.
N 42° 492' W 117° 421' 1131 m (3709 feet elevation) 14 June 2009

- 2407 *Rhizoplaca melanophthalma* (DC.) Leuckert & Poelt (on soil)
(several specimens kept for BSU since this is unusual; Ver. by McCune, March 2010)
- 2408 *Rhizoplaca melanophthalma* (DC.) Leuckert & Poelt (on rock)
- 2409 *Lecanora garovaglii* (Körber) Zahlbr. (on rock; K-, KC-) Ver. B. McCune
- 2410 *Staurothele aerolata* (Ach.) Lettau
- 2411 xxxxx
- 2412 *Lecanora garovaglii* (Körber) Zahlbr. (on rock) (1 spec. kept for BSU)
- 2413 *Aspicilia aspera* (Mereschk.) Tomin. (very adnate) (1 spec. kept for BSU)
- 2414 *Collema tenax* (Sw.) Ach.
- 2415 *Prototermelia badia* (Hoffm.) Hafellner (blk apothecia, olive green thallus, disc/thallus K-) (1 spec. kept for BSU)
- 2416 *Aspicilia desertorum* (Krempelh.) Mereschk. (on rock)
- 2417a. *Staurothele drummondii* (Tuck.) Tuck. Det: McCune 3/10
- 2417b. *Aspicilia calcarea* (L.) Mudd Det. McCune 3/10
- 2418 *Staurothele areolata* (Ach.) Lettau
- 2419 *Bryum argenteum* Hedw. (synonym: *Bryum lanatum*) (very small with long awns)
- 2420 Fungi on rabbit pellets (1 spec. kept for further evaluation)
- 2421 *Aspicilia desertorum* (Krempelh.) Mereschk. form *terrestris*
- 2422 *Syntrichia ruralis* (Hedw.) Web. & Mohr
- 2423 *Endocarpon pusillum* Hedwig
- 2424 *Lecidea laboriosa* Müll. Arg. (on soil, K-, spores simple, 8/asci, hyline)
(2nd report for Oregon; 1 spec. kept for BSU)
- 2425 *Caloplaca tominii* Savicz
- 2426a Parasite on *A. reptans*
- 2426b *Aspicilia reptans* (small apothecia) (1 spec. kept for further eval.); Filed under 2426a
- 2427 *Acarospora fuscata*-like (on pebbles) (1 spec. kept for further evaluation)
- 2428 *Bryum argenteum* Hedw. (synonym: *Bryum lanatum*)
- 2429 *Nostoc* sp. (mixed with moss)
- 2430 *Acarospora fuscata*-like (but on soil) (1 spec. kept for further evaluation)
- 2431 *Placidium* sp. (small thallus; O. Breuss – indeterminate species, March 2010)
- 2432 *Microcoleous* sp. (cyanobacteria)
- 2433 *Megaspora verrucosa* (Ach.) Hafellner & V. Wirth
- 2434 *Syntrichia caninervis* Mitten (ver: John Badina, 2010)
- 2435 *Acarospora glaucocarpa* (Ach.) Körber (det. by B. McCune, 7/09)
- 2436 *Aspicilia contorta* (Hoffm.) Kremp. (on pebbles)
#2435 and #2436 are together in the same packet
- 2437 *Lecanora laatokkaensis* (Räsänen) Poelt (small thalli on rock)
- 2438 xxxxx
- 2439 xxxxx
- 2440 xxxxx

PLOT #3:

Fine, sandy-silt soil (pH 7) with cobble on surface. Slight SW aspect on top of hills. Approx. 6.5 km SW of Rome, OR and the Owyhee River, and 85 km SW of Jordan Valley, OR. Associated vegetation: *Tetradymia glabrata*, *Artemisia tridentata* ssp. *wyomingensis*, *Elymus elymoides*, *Phlox* sp., and *Bromus tectorum*.

N 42° 491' W 117° 424' 1146 m (3756 feet elevation) 15 June 2009

- 2441 *Thrombium epigaeum* (Pers.) Wallr.
- 2442 *Aspicilia aspera* (Mereschk.) Tomin. (poor specimen)
(1 spec. kept for further evaluation)
- 2443 *Collema tenax* (Sw.) Ach.
- 2444 *Candelariella aggregata* M. Westb.
- 2445 *Syntrichia ruralis* (Hedw.) Web. & Mohr
- 2446 *Placidium* sp. (O. Breuss – indeterminate species, March 2010)
- 2447 *Caloplaca tominii* Savicz (K+ red)
- 2448 *Aspicilia desertorum* (Krempelh.) Mereschk. form *terrestris*
- 2449 *Microcoleous* sp. (cyanobacteria)
- 2450 *Heteropladidium congestum* (Breuss & McCune) Breuss (2nd report for OR)
**(Packet also includes *Placidium acarosporoides* (Zahlbr.) Breuss (#2450a) (1st report for OR)
(Verified by O. Breuss, March 2010; B. McCune 12/10)**
- 2451 *Syntrichia caninervis* Mitten
- 2452 *Aspicilia desertorum* (Krempelh.) Mereschk. (on pebbles)
- 2453 *Endocarpon pusillum* Hedwig
- 2454 *Placidium lachneum* (Ach.) Breuss
- 2455 *Placidium lacinulatum* (Ach.) Breuss
- 2456 *Psora cerebriformis* W.A. Weber
- 2457 *Bryum argenteum* Hedw. (synonym: *Bryum lanatum*)
- 2458 *Candelariella rosulans* (Müll. Arg.) Zahlbr. (K-)
- 2459 *Psora montana* Timdal
- 2460 *Aspicilia* sp. (on organic matter)
- 2461 xxxxx
- 2462 xxxxx
- 2463 xxxxx

PLOT #4:

Sandy-silt soil (pH 7). Flat area that partially burned at least a few years ago. Approx. 6.5 km SW of Rome, OR and the Owyhee River, and 85 km SW of Jordan Valley, OR. Associated vegetation: *Bromus tectorum*, *Halogeton glomeratus*, *Elymus elymoides*, *Atriplex confertifolia*, *Sphaeralcea munroana*, *Ranunculus testiculatus*, *Salsola* sp.

N 42° 492' W 117° 423' 1128 m (3699 feet elevation) 15 June 2009

- 2464 *Aspicilia desertorum* (Krempelh.) Mereschk. (on pebbles)
- 2465 *Collema tenax* (Sw.) Ach.
- 2466 *Pterygoneurum ovatum* (Hedw.) Dix.
- 2467 *Placidium lacinulatum* (Ach.) Breuss
- 2468 *Psora tuckermanii* R. Anderson ex Timdal
- 2469 *Psora decipiens* (Hedwig) Hoffm.
- 2470 *Bryum argenteum* Hedw. (synonym: *Bryum lanatum*)
- 2471 *Syntrichia ruralis* (Hedw.) Web. & Mohr
- 2472 *Aspicilia* cf. *reptans*
- 2473 *Protoparmelia badia* (Hoffm.) Hafellner (on soil, but usually on rock)
- 2474 *Psora montana* Timdal
- 2475 *Microcoleous* sp. (cyanobacteria)
- 2476 *Caloplaca tominii* Savicz
- 2477 *Candelariella aggregata* M. Westb.
- 2478 xxxx
- 2479 xxxx

COLLECTIONS FROM GENERAL AREA BUT NOT FROM A SPECIFIC PLOT

On various substrates. Approx. 6.5 km SW of Rome, OR and the Owyhee River, and 85 km SW of Jordan Valley, OR. Associated vegetation: *Bromus tectorum*, *Halogeton glomeratus*, *Elymus elymoides*, *Atriplex confertifolia*, *Sphaeralcea munroana*, *Salsola* sp.

N 42° 493' W 117° 42' 1120 m (3675 feet elevation) 15 June 2009

- 2480 *Aspicilia desertorum* (Kremp.) Mereschk. form *contorta* (in edit)
(completely encompassing small pebbles) **(1 spec. kept to send to Bjorn Owe-Larsson)**
- 2481 *Aspicilia hispida* Mereschk. (on soil)
- 2482 *Thelomma occidentale* (Herre) Tibell (on wood)
- 2483 *Microcoleous* sp. (cyanobacteria; within the soil)
- 2484 *Psora tuckermanii* R. Anderson ex Timdal (on soil)
- 2485 *Aspicilia desertorum* (Kremp.) Mereschk. (on rock)
(small apothecia, more adnate, whiter thallus) **(1 spec. sent to Bjorn Owe-Larsson)**
- 2486 xxxxx
- 2487 xxxxx
- 2489 xxxxx

Rome Cliffs Area, T31S, R41E, Sec. 32, Malheur County, Oregon

Approx. 6.5 km SW of Rome, OR and the Owyhee River, and 85 km SW of Jordan Valley, OR.

N 42° 493' W 117° 42' 1120 m (3675 feet elevation) 2 June 2010

- 2490 *Psora cerebriformis* W.A. Weber
- 2491 *Acarospora obpallens* (Nyl. ex Hasse) Zahlbr. – uncommon **(2nd report for OR)**

Table 1. Alphabetical List of Biological Soil Crust Taxa Collected in the Rome Cliffs Area, Sec. 32 (T31S, R41E)

Species	Collection No.	Number of Specimens for Each Collection No.	Lichen (L), Bryophyte (B), Other (O)	Notes
<i>Acarospora fuscata</i> (Schrad.) Arnold	2427, 2430	1; 1	L	both specimens kept in Boise for further eval.
<i>Acarospora glaucocarpa</i> (Ach.) Körber	2435	1	L	det. by B. McCune; in same packet as #2436 - <i>Aspicilia contorta</i>
<i>Acarospora obpallens</i> (Nyl. ex Hasse) Zahlbr.	2491	1	L	2nd report for OR
<i>Aspicilia aspera</i> (Mereschk.) Tomin	2413, 2442	4; 2	L	1 spec. each of #2413, #2442 to BSU
<i>Aspicilia calcarea</i> (L.) Mudd	2417b	1	L	Det by. B. McCune, 3/2010; in packet with <i>Staurothele drummondii</i>
<i>Aspicilia contorta</i> (Hoffm.) Kremp.	2436	1	L	in same packet as #2435 - <i>Acarospora glaucocarpa</i>
<i>Aspicilia desertorum</i> (Krempelh.) Mereschk.	2416, 2452, 2464, 2485	1; 2; 2; 1	L	#2485 to B. Owe-Larsson for verification
<i>Aspicilia desertorum</i> (Kremp.) Mereschk. f. <i>contorta</i>	2480	4	L	in edit; encompasses small pebbles; 1 spec. to B. Owe-Larsson for verification
<i>Aspicilia desertorum</i> (Krempelh.) Mereschk. f. <i>terrestris</i>	2399, 2421, 2448	4; 2; 3	L	1 spec. #2472 to BSU
<i>Aspicilia hispida</i> Mereschk.	2401, 2481	1; 1	L	
<i>Aspicilia reptans</i>	2392, 2426, 2472	3; 1; 5	L	#2392 & #2426 orig id as <i>A. sp.</i> ; #2472 orig. id as <i>A. desertorum</i> f. <i>terrestris</i>
<i>Aspicilia</i> sp.	2460	1	L	
<i>Bryum argenteum</i> Hedw.	2419, 2428, 2457, 2470	1; 1; 2; 1	B	syn: <i>B. lanatum</i>
<i>Caloplaca tominii</i> Savicz	2398, 2425, 2447, 2476	4; 3; 2; 1	L	
<i>Candelariella aggregata</i> M. Westb.	2383, 2444, 2477	4; 1; 2	L	
<i>Candelariella rosulans</i> (Müll. Arg.) Zahlbr	2458	1	L	
<i>Collema tenax</i> (Sw.) Ach.	2382, 2393, 2397, 2414, 2443, 2465	2; 2; 1; 3; 5; 5	L	
<i>Crossidium aberrans</i> Holz. & E.B. Bartram	2388	2	B	
<i>Endocarpon pusillum</i> Hedw.	2394, 2423, 2453	1; 3; 3	L	
<i>Grimmia alpestris</i> (Weber & Mohr) Schleicher	2400	2	B	
<i>Heteroplacidium congestum</i> (Breuss & McCune) Breuss	2395, 2450	3; 5	L	2nd report for OR; both spec. verified by O. Breuss, March 2010

Table 1. Alphabetical List of Biological Soil Crust Taxa Collected in the Rome Cliffs Area, Sec. 32 (T31S, R41E)

Species	Collection No.	Number of Specimens for Each Collection No.	Lichen (L), Bryophyte (B), Other (O)	Notes
<i>Lecanora garovaglii</i> (Körber) Zahlbr.	2409, 2412	1; 5	L	1 spec. #2412 to BSU
<i>Lecanora laatokkaensis</i> (Räsänen) Poelt	2437	1	L	
<i>Lecidea laboriosa</i> Müll. Arg.	2381, 2424	1; 1	L	2nd report for OR; 1 spec. #2424 to BSU
<i>Megaspora verrucosa</i> (Ach.) Hafellner & V. Wirth	2433	2	L	
<i>Microcoleous</i> sp.	2402, 2432, 2449, 2475, 2483	3; 2; 3; 1; 4	O	cyanobacteria
<i>Nostoc</i> sp.	2429	1	O	cyanobacteria
<i>Placidium acarosporoides</i> (Zahlbr.) Breuss	2450a; in packet with 2450	5	L	in <i>Heteroplacidium congestum</i> packet #2450; 1st report for OR; identified by O. Breuss, 3/10; only specimen is in Austria
<i>Placidium lachneum</i> (Ach.) Breuss	2454	2	L	
<i>Placidium lacinulatum</i> (Ach.) Breuss	2387, 2455, 2467	2; 3; 5	L	
<i>Placidium rufescens</i> (Ach.) Breuss	2384, 2386	2; 2	L	
<i>Placidium squamulosum</i> (Ach.) Breuss	2403	1	L	Det: O. Breuss, 3/2010
<i>Placidium</i> sp.	2431, 2446	3; 1	L	sterile; could not be determined by O. Breuss, March 2010
<i>Protoparmelia badia</i> (Hoffm.) Hafellner	2415, 2473	2; 1	L	1 spec. #2415 to BSU
<i>Psora cerebriiformis</i> W.A. Weber	2456	1	L	
<i>Psora decipiens</i> (Hedwig) Hoffm.	2380, 2469	1; 1	L	
<i>Psora montana</i> Timdal	2459, 2474	2; 3	L	
<i>Psora tuckermanii</i> R. Anderson ex Timdal	2385, 2468, 2484	2; 2; 2	L	
<i>Pterygoneurum ovatum</i> (Hedw.) Dix	2390, 2466	3; 1	B	
<i>Rhizoplaca melanophthalma</i> (DC.) Leuckert & Poelt	2407, 2408	9; 1	L	#2407 on soil, an uncommon substrate; B. McCune verified 3/2010; #2408 is on rock
<i>Staurothele areolata</i> (Ach.) Lettau	2410, 2418	1; 1	L	
<i>Staurothele drummondii</i> (Tuck.) Tuck.	2417a	1	L	Det by. B. McCune, 3/2010; in packet with <i>Aspicilia calcarea</i>
<i>Syntrichia caninervis</i> Mitten	2389, 2434, 2451	3; 3; 2	B	#2434 verified by J. Badina
<i>Syntrichia ruralis</i> (Hedw.) Web. & Mohr	2396, 2422, 2445, 2471	2; 1; 3; 2	B	
<i>Thelomma occidentale</i> (Herre) Tibell	2482	1	L	on wood
<i>Thrombium epigaeum</i> (Pers.) Wallr.	2391, 2441	2; 2	L	1 spec. #2391 to BSU
Unknown; fungus on rabbit pellets	2420	1	O	spec. retained in Boise for further evaluation
* specimens given to BSU are housed in the Biology Department Herbarium (SRP)				

Table 2. Alphabetical List of Biological Soil Crust Taxa by Collection Site, Rome Cliffs Area, Malheur County, OR (T31S, R41E, Sec. 32)

An "x" indicates which species were collected at each site. An * in a cell indicates species unique to a given plot.

Species	Collection No.	Plot 1 - alkaline, clay-silt soil of swale area; <i>Atriplex nuttallii</i> , <i>Grayia spinosa</i> , <i>Elymus elymoides</i> , <i>Poa secunda</i>	Plot 2 - clay soil from flat to 35% slope with northerly aspect; <i>Atriplex confertifolia</i> , <i>Elymus elymoides</i> , <i>Poa secunda</i> , <i>Tetradymia spinosa</i> , annual <i>Atriplex</i> , <i>Gutierrezia sarothrae</i>	Plot 3 - fine, sandy-silt soil with cobble surface and slight SW aspect on top of hills; <i>Tetradymia glabrata</i> , <i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> , <i>Elymus elymoides</i> , <i>Phlox</i> sp., and <i>Bromus tectorum</i>	Plot 4 - sandy-silt soil of flat area, partially burned a few years ago; <i>Bromus tectorum</i> , <i>Halogeton glomeratus</i> , <i>Elymus elymoides</i> , <i>Atriplex confertifolia</i> , <i>Ranunculus testiculatus</i> , <i>Sphaeralcea munroana</i> , and <i>Salsola</i> sp.	From general area; not within a particular plot
<i>Acarospora fuscata</i> (Schrad.) Arnold (?)	2427, 2430		x*			
<i>Acarospora glaucocarpa</i> (Ach.) Körber	2435		x*			
<i>Acarospora obvallens</i> (Nyl. Ex Hasse) Zahlbr.	2491					x*
<i>Aspicilia aspera</i> (Mereschk.) Tomin	2413, 2442		x	x		
<i>Aspicilia calcarea</i> (L.) Mudd	2417b		x*			
<i>Aspicilia contorta</i> (Hoffm.) Kremp.	2436		x*			
<i>Aspicilia desertorum</i> (Krempelth.) Mereschk.	2416, 2452, 2464, 2485		x	x	x	x
<i>Aspicilia desertorum</i> (Kremp.) Mereschk. f. <i>contorta</i>	2480					x*
<i>Aspicilia desertorum</i> (Krempelth.) Mereschk. f. <i>terrestris</i>	2399, 2421, 2448	x	x	x		
<i>Aspicilia hispida</i> Mereschk.	2401, 2481	x				x
<i>Aspicilia reptans</i>	2392, 2426, 2472	x	x		x	
<i>Aspicilia</i> sp.	2460			x		
<i>Bryum argenteum</i> Hedw.	2419, 2428, 2457, 2470		x	x	x	
<i>Caloplaca tominii</i> Savicz	2398, 2425, 2447, 2476	x	x	x	x	
<i>Candelariella aggregata</i> M. Westb.	2383, 2444, 2477	x		x	x	
<i>Candelariella rosulans</i> (Müll. Arg.) Zahlbr	2458			x*		
<i>Collema tenax</i> (Sw.) Ach.	2382, 2393, 2397, 2414, 2443, 2465	x	x	x	x	
<i>Crossidium aberrans</i> Holz. & E.B. Bartram	2388	x*				
<i>Endocarpon pusillum</i> Hedw.	2394, 2423, 2453	x	x	x		
<i>Grimmia alpestris</i> (Weber & Mohr) Schleicher	2400	x*				
<i>Heteroplacidium congestum</i> (Breuss & McCune) Breuss	2395, 2450	x		x		

Table 2. Alphabetical List of Biological Soil Crust Taxa by Collection Site, Rome Cliffs Area, Malheur County, OR (T31S, R41E, Sec. 32)

An "x" indicates which species were collected at each site. An * in a cell indicates species unique to a given plot.

Species	Collection No.	Plot 1 - alkaline, clay-silt soil of swale area; <i>Atriplex nuttallii</i> , <i>Grayia spinosa</i> , <i>Elymus elymoides</i> , <i>Poa secunda</i>	Plot 2 - clay soil from flat to 35% slope with northerly aspect; <i>Atriplex confertifolia</i> , <i>Elymus elymoides</i> , <i>Poa secunda</i> , <i>Tetradymia spinosa</i> , annual <i>Atriplex</i> , <i>Gutierrezia sarothrae</i>	Plot 3 - fine, sandy-silt soil with cobble surface and slight SW aspect on top of hills; <i>Tetradymia glabrata</i> , <i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> , <i>Elymus elymoides</i> , <i>Phlox</i> sp., and <i>Bromus tectorum</i>	Plot 4 - sandy-silt soil of flat area, partially burned a few years ago; <i>Bromus tectorum</i> , <i>Halogeton glomeratus</i> , <i>Elymus elymoides</i> , <i>Atriplex confertifolia</i> , <i>Ranunculus testiculatus</i> , <i>Sphaeralcea munroana</i> , and <i>Salsola</i> sp.	From general area; not within a particular plot
<i>Lecanora garovaglii</i> (Körber) Zahlbr.	2409, 2412		x*			
<i>Lecanora laatokkaensis</i> (Räsänen) Poelt	2437		x*			
<i>Lecidea laboriosa</i> Müll. Arg.	2381, 2424	x	x			
<i>Megaspora verrucosa</i> (Ach.) Hafellner & V. Wirth	2433		x*			
<i>Microcoleous</i> sp.	2402, 2432, 2449, 2475, 2483	x	x	x	x	x
<i>Nostoc</i> sp.	2429		x*			
<i>Placidium acarosporoides</i> (Zahlbr.) Breuss	2450a			x*		
<i>Placidium lachneum</i> (Ach.) Breuss	2454			x*		
<i>Placidium lacinulatum</i> (Ach.) Breuss	2387, 2455, 2467	x		x	x	
<i>Placidium rufescens</i> (Ach.) Breuss	2384, 2386	x*				
<i>Placidium squamulosum</i>	2403	x*				
<i>Placidium</i> sp.	2431, 2446		x	x		
<i>Protoparmelia badia</i> (Hoffm.) Hafellner	2415, 2473		x		x	
<i>Psora cerebriformis</i> W.A. Weber	2456			x*		
<i>Psora decipiens</i> (Hedwig) Hoffm.	2380, 2469	x			x	
<i>Psora montana</i> Timdal	2459, 2474			x	x	
<i>Psora tuckermanii</i> R. Anderson ex Timdal	2385, 2468, 2484	x			x	x
<i>Pterygoneurum ovatum</i> (Hedw.) Dix	2390, 2466	x			x	
<i>Rhizoplaca melanophthalma</i> (DC.) Leuckert & Poelt	2407, 2408		x*			
<i>Staurothele areolata</i> (Ach.) Lettau	2410, 2418		x*			
<i>Staurothele drummondii</i> (Tuck.) Tuck.	2417a		x*			
<i>Syntrichia caninervis</i> Mitten	2389, 2434, 2451	x	x	x		
<i>Syntrichia ruralis</i> (Hedw.) Web. & Mohr	2396, 2422, 2445, 2471	x	x	x	x	
<i>Thelomma occidentale</i> (Herre) Tibell	2482					x*
<i>Thrombium epigaeum</i> (Pers.) Wallr.	2391, 2441	x		x		
Unknown; fungus on rabbit pellets	2420		x			

Table 2. Alphabetical List of Biological Soil Crust Taxa by Collection Site, Rome Cliffs Area, Malheur County, OR (T31S, R41E, Sec. 32)

An "x" indicates which species were collected at each site. An * in a cell indicates species unique to a given plot.

Species	Collection No.	Plot 1 - alkaline, clay-silt soil of swale area; <i>Atriplex nuttallii</i> , <i>Grayia spinosa</i> , <i>Elymus elymoides</i> , <i>Poa secunda</i>	Plot 2 - clay soil from flat to 35% slope with northerly aspect; <i>Atriplex confertifolia</i> , <i>Elymus elymoides</i> , <i>Poa secunda</i> , <i>Tetradymia spinosa</i> , annual <i>Atriplex</i> , <i>Gutierrezia sarothrae</i>	Plot 3 - fine, sandy-silt soil with cobble surface and slight SW aspect on top of hills; <i>Tetradymia glabrata</i> , <i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> , <i>Elymus elymoides</i> , <i>Phlox</i> sp., and <i>Bromus tectorum</i>	Plot 4 - sandy-silt soil of flat area, partially burned a few years ago; <i>Bromus tectorum</i> , <i>Halogeton glomeratus</i> , <i>Elymus elymoides</i> , <i>Atriplex confertifolia</i> , <i>Ranunculus testiculatus</i> , <i>Sphaeralcea munroana</i> , and <i>Salsola</i> sp.	From general area; not within a particular plot
TOTALS		21	26	20	14	7

Figure 2. Total number of biological soil crust taxa collected in each of the four one-acre vegetation plots in the Rome Cliffs Area, Sec. 32.

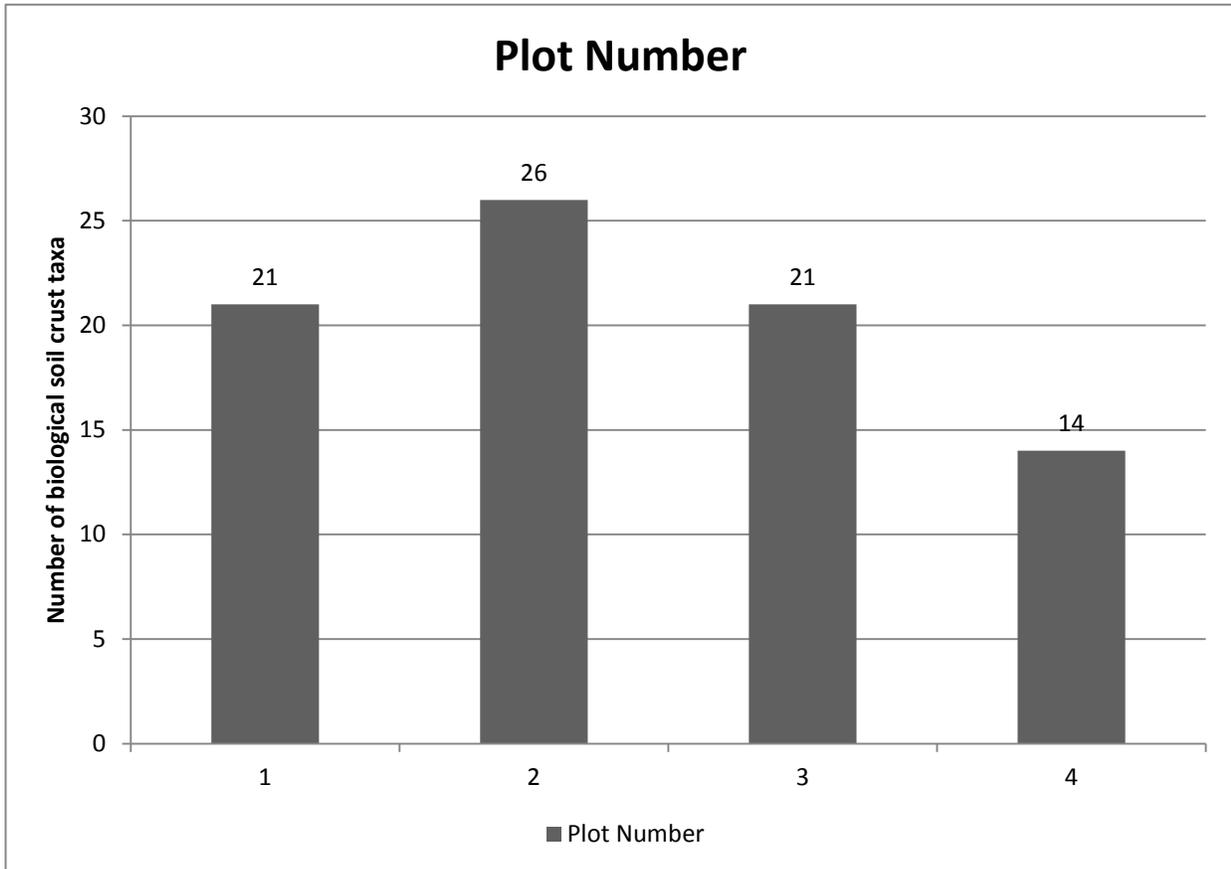


Figure 3. The number of biological soil crust taxa unique to each of the four one-acre vegetation plots in the Rome Cliffs Area, Sec. 32.

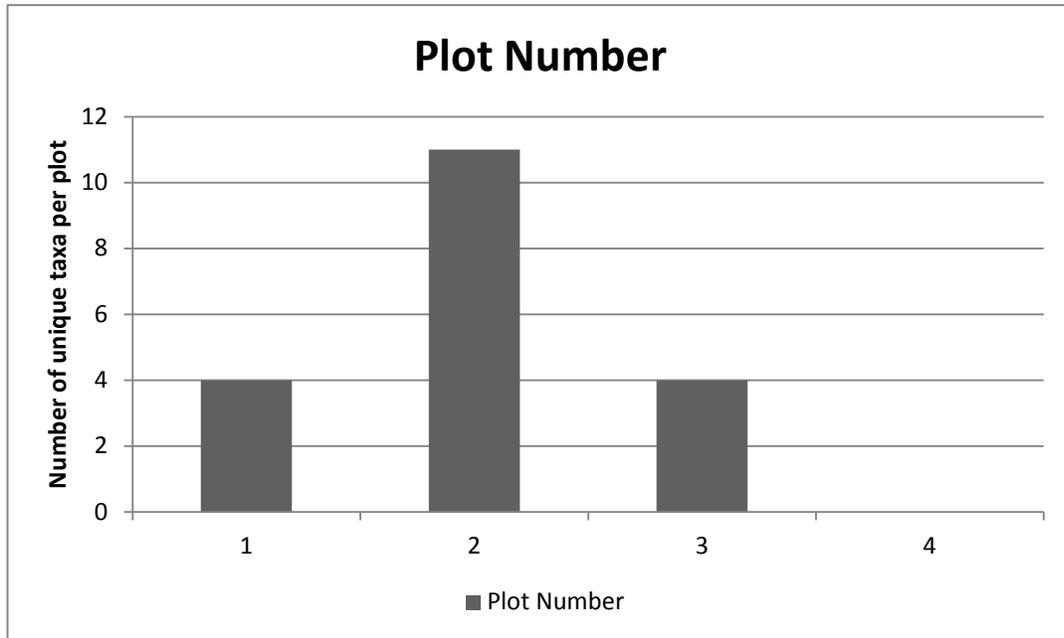
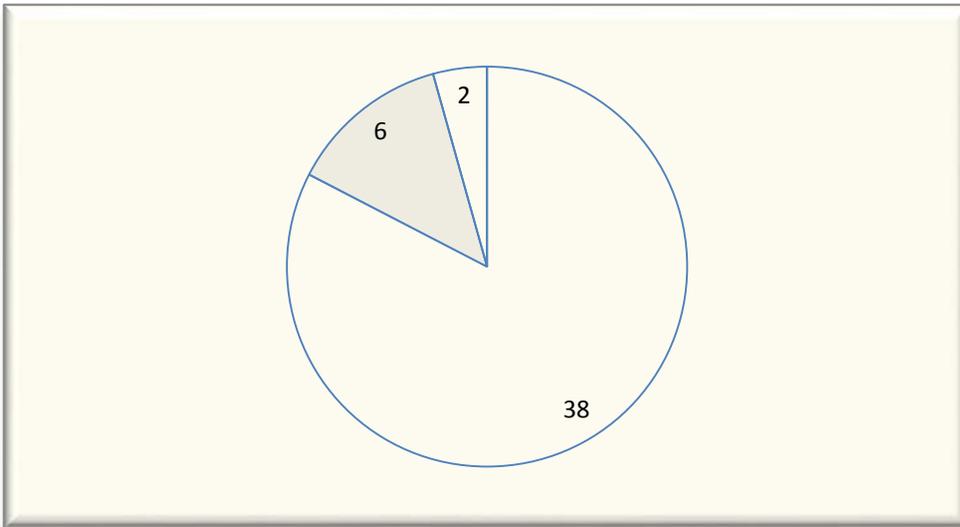


Figure 4. Pie charts illustrate the number of biological soil crust taxa per life form at the Rome Cliffs area and at Birch Creek (DeBolt 2008).

2009 Rome Cliffs Area

Lichens	Bryophytes	Cyanobacteria
38	6	2
82%	13%	5%



2008 Birch Creek Area

Lichens	Bryophytes	Cyanobacteria
34	12	1
72%	26%	2%

