

FINAL REPORT

SUBMITTED TO

**LESLIE STEWART
OF
THE SAN JUAN NATIONAL FOREST, COLORADO,
U.S. FOREST SERVICE**

REGARDING

**ESTABLISHMENT OF A LICHEN BIOMONITORING PROGRAM AND
BASELINE IN THE SAN JUAN AND RIO GRANDE NATIONAL FORESTS,
COLORADO**

COPY

PREPARED BY

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30 SEPTEMBER 1999

PROJECT SUMMARY

Between 1993 and 1997 a total of 33 lichen air quality biomonitoring reference sites were established in the San Juan and Rio Grande national forests. To date 320 species in 105 genera including 45 new species records for Colorado have been identified from our collections. A total of 83 elemental analysis samples have been collected from the 33 reference sites. This collection includes 13 sensitive indicator species in 7 genera collected from three substrates (rock, bark, and soil). During the course of this study lichens were collected from four basic substrates (rocks, bark/lignum, soil, and moss/detritus). Typical of southern Rocky Mountain lichen floras the lichen flora of southwestern Colorado is dominated by foliose species (44% or 142 species), followed by crustose species (35% or 111 species), squamulose species (14% or 46 species), and fruticose species (14% or 21 species). Like most other Intermountain Area floras the lichen flora of southwestern Colorado is dominated by saxicolous (rock) species (45% or 146 species), followed by corticolous species (bark/lignum) (25% or 81 species), terricolous species (soil) (23% or 72 species), and lichenicolous (over other lichens) (1% or 3 species).

Across both the San Juan and Rio Grande national forests an average of 16 sensitive indicator species were collected from each reference site. This is the highest average number of sensitive indicator species per reference site of any area in the intermountain western United States. Reference sites west of the continental divide (San Juan National Forest) averaged 15.5 sensitive indicator species per site in comparison to 19.1 sensitive indicator species per reference site for the area east of the continental divide (Rio Grande National Forest). These values compare with an average of 6.3 along the Wasatch Front (Uintah National Forest), 8.0 in the Bridger Wilderness Area (western Wyoming), 10.3 in the High Uintas Wilderness Area (northeastern Utah), and 11.1 in the Gila Wilderness Area (western New Mexico).

Elemental analysis data suggest some areas of concern. Sulfur concentrations were elevated (.209% - .259%) in lichen tissues from four sites (Taylor Mesa, south slope of Groundhog Mountain, Benchmark Lookout, and the Pinnacles). Lichenologists generally agreed that thallus sulfur concentrations $\geq .2\%$ indicate significant sulfur accumulation, which may interfere with sensitive metabolic activities such as photosynthesis, cellular respiration and nitrogen fixation. All of the samples with elevated sulfur levels are from higher elevation sites (9,300 - 10,700 feet); with three out of four sites located west of the continental divide in the San Juan National Forest (Taylor Mesa, south slope of Groundhog Mountain, and Benchmark Lookout). Seven additional samples showed marginally elevated sulfur concentrations ($>.15\%$ $<.2\%$). Arsenic concentrations were elevated (5.2 ppm - 8.57 ppm) in 14 out of 66 samples, with 9 out of 14 samples from sites west of the continental divide. Nickel concentrations were marginally elevated (8 ppm - 10.2 ppm) in 4 out of 66 samples, three of which are from sites west of the continental divide. Lead concentrations in 7 out of 66 samples were slightly elevated (≥ 50 ppm, 52.8 ppm - 105 ppm). All but one of these samples were from sites west of the continental divide. Finally, there was one element ratio (Cu/Zn) that showed an unusual pattern at two sites {Treasure Falls (1.81) and near Needleton (8.0)}. More than likely this pattern is related to some local phenomenon. Typically, background Cu/Zn ratios range from .1 to .5 with any value approaching or exceeding 1 indicating unusual copper accumulation. Overall, these accumulation patterns suggest that at least some of the reference sites in the San Juan and Rio Grande national forests maybe experiencing some air pollution impact. Particularly, sites west of the continental divide (in the San Juan National Forest) appear to be most impacted. This pattern may be caused by the proximity of these sites to several specific air pollution sources (e.g. coal-fired power plants).

In light of the extensive development and urbanization occurring in the Four Corners area reevaluation of pollutant element concentrations in the tissues of sensitive indicator species should be performed every five years. This review schedule is particularly essential for sites west of the continental divide where elevated concentrations of several pollutant elements have already been documented.

INTRODUCTION

PROJECT OBJECTIVES:

1. Identify reference sites across the San Juan and Rio Grande national forests, Colorado.
2. Collect, curate, and identify lichen species from various habitats and substrates at each reference site.
3. Identify 3-5 pollution-sensitive lichen species at each reference site. Collect enough tissue of at least one sensitive indicator species (approximately 6-10 grams dry weight) from each reference site for elemental analyses. Rare sensitive species will not be sampled for analysis, but their distribution will be noted.
4. Determine baseline thallus concentrations of 20 potential pollutant elements (including sulfur, selenium, arsenic, copper, bromine, manganese, lead, vanadium, potassium, iron, etc.), using replicate samples of one documented pollution-sensitive indicator species collected at each reference site. Samples will be analyzed using Proton Induced X-ray Emission (PIXE) techniques.
5. Prepare and submit a draft report by 31 May 1996.
6. Prepare and submit the final report by 30 September 1999.

LICHENS AS BIOLOGICAL INDICATORS OF AIR QUALITY:

Lichens have been used extensively as biomonitors of air quality (Fields & St. Clair 1984; St. Clair 1989; Richardson 1992). Hale (1983) noted that lichens have been used in three basic ways to monitor the effects of air pollution on biological systems: 1) elemental analysis of lichen tissues, 2) mapping of all (or selected) lichen species found in areas adjacent to pollution sources, and 3) transplant studies. Currently, the most common approach involves a floristic survey along with elemental analyses of tissues from sensitive indicator species (St. Clair 1989; Wetmore 1989).

As lichens accumulate many different pollutants from atmospheric outwash, lichen tissues provide a record of the kinds and relative quantities of air pollutants in any particular airshed (Schutte 1977; Wetmore 1989; Rope & Pearson 1990). Pollutant accumulation patterns for specific elements have been monitored over time by correlating thallus growth rates and pollutant concentrations in excised portions of lichen thalli (Lawrey & Hale 1981). Changes in lichen physiological processes indicate air pollution-related damage long before other, more easily detectable characteristics, such as changes in thallus color, morphology, or community structure become apparent (Fields & St. Clair 1984).

Lists of air pollution-sensitive lichen species have commonly been published in conjunction with floristic and ecological surveys (Rushforth et al. 1982; Wetmore 1989). As certain lichen species are inherently more sensitive to airborne contaminants, air quality can be effectively monitored by occasionally reevaluating lichen community and/or physiological parameters. Pollution-related changes can then be documented by comparing follow-up data to original baseline data.

GENERAL HABITAT DESCRIPTION OF THE SAN JUAN AND RIO GRANDE NATIONAL FORESTS:

The San Juan and Rio Grande national forests administer approximately four million acres of publicly owned land occupying much of the southwestern corner of the state of Colorado (figures 1a and 1b). This land mass is almost equally divided between the east and west sides of the Continental Divide. Parts of four large road-less areas, including the Lizard Head, Weminuche,

San Juan National Forest

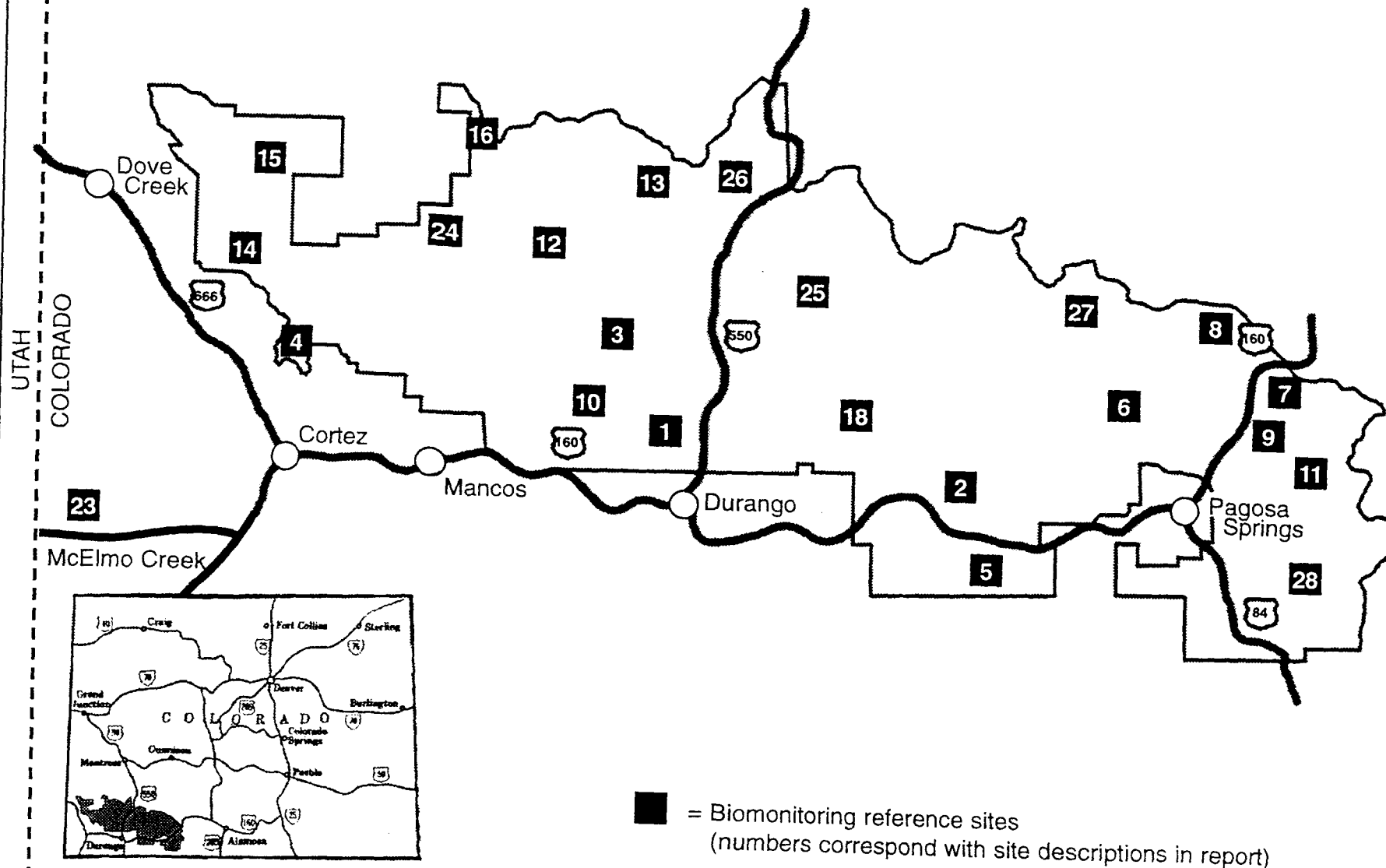


Figure 1a.

Rio Grande National Forest

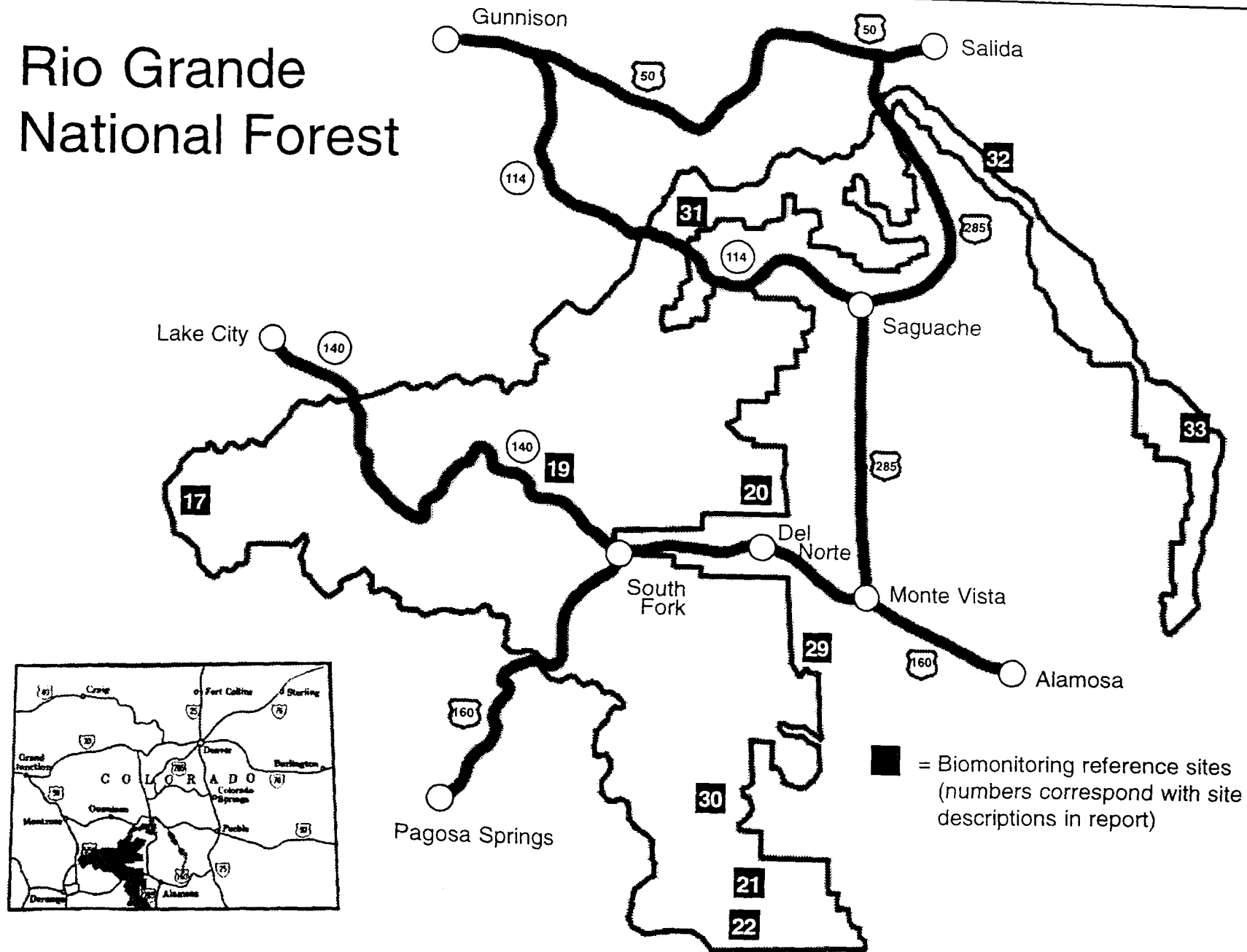


Figure 1b.

South San Juan and La Garita wilderness areas occur within these two national forests. The area overlaps two major physiographic provinces, the Colorado Plateau and the Southern Rocky Mountains. The Colorado Plateau region includes parts of four Intermountain Area states, Colorado, Utah, New Mexico, and Arizona. The "Plateau" is a large elevated block consisting of thousands of feet of Paleozoic and Mesozoic rocks, which have eroded to form a complex network of massive canyons and mesas. The block pattern is disrupted in several places by igneous intrusions, which lifted up and domed the sedimentary layers during the Tertiary. The "Plateau" also has monoclines, upwarps, collapsed salt anticlines, basins, and faults. The Southern Rocky Mountain province is associated with anticlinal arches, intervening basins and heavily glaciated mountain ranges. The San Juan Mountains dominate the western portion of the San Juan National Forest (with 13 peaks over 14,000 feet) while the eastern edge of the Rio Grande National Forest includes a portion of the Sangre De Cristo Mountains (with 8 peaks over 14,000 feet). Between these two mountain ranges is the San Luis Valley, a high elevation grassland basin. Annual precipitation in the forest ranges between 20 and 50 inches; and comes as either snow in the winter months (especially at higher elevations) or as summer monsoonal rains, mainly from the Gulf of Mexico.

Vegetation types within the San Juan and Rio Grande national forests include some sagebrush, saltbush-oak scrub and Pinyon-juniper woodland, especially in the San Juan National Forest. Upslope, large portions of both national forests fall into the Pine-spruce-fir woodland vegetation type; with extensive alpine meadow-barren rock areas at the highest elevations. Most of the grassland communities in the San Luis Valley are privately owned but a small amount of the Wheatgrass-sandsage vegetation type, along the periphery of the valley, falls within the boundary of the Rio Grande National Forest. The diversity of vegetation types, unique geological formations and summer monsoonal precipitation patterns yield a variety of complex and interesting habitat types; which in turn produce a diverse and well developed series of lichen communities across the region.

LICHEN BIOMONITORING REFERENCE SITES IN THE SAN JUAN AND RIO GRANDE NATIONAL FORESTS:

A total of 33 air quality biomonitoring reference sites were established in the San Juan and Rio Grande national forests during the 1993, 1994, 1995, 1996, and 1997 field seasons. Specifically, reference sites have been established at the following locations:

SITE #1: 10 August 1993. Colorado, La Plata County, San Juan-Rio Grande National Forest: Vicinity of Indian cliff dwellings along USFS rd. #065. 37° 21.182' north latitude; 107° 51.962' west longitude. Elevation: 2073 m (6800 feet).

SITE #2: 11 August 1993. Colorado, Archuleta County, San Juan-Rio Grande National Forest: Vicinity of Sheep Creek Trail from USFS rd. #622 to Piedra River. 37° 18.192' north latitude; 107° 20.240' west longitude. Elevation: 2225 m (7300 feet).

SITE #3: 12 August 1993. Colorado, La Plata County, San Juan-Rio Grande National Forest: Vicinity of Kennebec Pass (with some collections along the La Plata River below Kennebec Pass). 37° 27.100' north latitude; 108° 00.670' west longitude. Elevation: 3566 m (11700 feet).

SITE #4: 13 August 1993. Colorado, Montezuma County, San Juan-Rio Grande National Forest: Vicinity of Sundial Indian Ruins near McPhee Reservoir. 37° 28.077' north latitude; 108° 31.916' west longitude. Elevation: 2164 m (7100 feet).

SITE #5: 17 August 1993. Colorado, Archuleta County, San Juan-Rio Grande National Forest: Vicinity of Chimney Rock, between gate and upper parking lot. 37° 11.417' north latitude; 107° 18.678' west longitude. Elevation: 2408 m (7900 feet).

SITE #6: 17 August 1993. Colorado, Mineral County, San Juan-Rio Grande National Forest: Vicinity of Martinez Creek. 37° 23.302' north latitude; 107° 5.508' west longitude. Elevation: 2652 m (8700 feet).

SITE #7: 18 August 1993. Colorado, Mineral County, San Juan-Rio Grande National Forest: Vicinity Wolf Creek Pass. 37° 28.300' north latitude; 106° 47.472' west longitude. Elevation: 3414 m (11200 feet).

SITE #8: 18 August 1993. Colorado, Mineral County, San Juan-Rio Grande National Forest: Communications relay site above Wolf Creek Pass. 37° 29.539' north latitude; 106° 47.472' west longitude. Elevation: 3719 m (12200 feet).

SITE #9: 18 August 1993. Colorado, Mineral County, San Juan-Rio Grande National Forest: Vicinity of Treasure Falls. 37° 26.510' north latitude; 106° 52.594' west longitude. Elevation: 2469 m (8100 feet).

SITE #10: 18 August 1993. Colorado, La Plata County, San Juan-Rio Grande National Forest: Vicinity of Madden Peak. 37° 21.965' north latitude; 108° 10.348' west longitude. Elevation: 2774 m (9100 feet).

SITE #11: 25 August 1994. Colorado, Archuleta County, San Juan-Rio Grande National Forest: Along Quartz Creek and USFS rd. #684 at seasonal closure gate. 37° 24.203' north latitude; 106° 45.154' west longitude. Elevation: 2896 m (9500 feet).

SITE #12: 26 August 1994. Colorado, Montezuma County, San Juan-Rio Grande National Forest: Taylor Mesa, along USFS rd. #545 open rocky meadow, head of Taylor Creek. 37° 38.552' north latitude; 108° 09.887' west longitude. Elevation: 3231 m (10600 feet).

SITE #13: 31 August 1994. Colorado, Dolores County, San Juan-Rio Grande National Forest: Lizard Head Wilderness Area, along Cross Mountain Trail, approximately 1 mile SW of Lizard Head Peak. 37° 49.244' north latitude; 107° 57.183' west longitude. Elevation: 3475 m (11400 feet).

SITE #14: 1 September 1994. Colorado, Montezuma County, San Juan-Rio Grande National Forest: Ferris Canyon Campground along Dolores River. 37° 36.870' north latitude; 108° 38.156' west longitude. Elevation: 2073 m (6800 feet).

SITE #15: 1 September 1994. Colorado, Dolores County, San Juan-Rio Grande National Forest: Immediate vicinity of Benchmark Lookout. 37° 46.052' north latitude; 108° 34.313' west longitude. Elevation: 2865 m (9400 feet).

SITE #16: 22 August 1995. Colorado, Dolores County, San Juan-Rio Grande National Forest: Groundhog Mountain, along USFS rd. #534 (rockslide area). 37° 54.409' north latitude; 108° 16.099' west longitude. Elevation: 3261 m (10700 feet).

SITE #17: 23 August 1995. Colorado, San Juan County, San Juan-Rio Grande National Forest: vicinity of Stony Pass. 37° 47.760' north latitude; 107° 32.945' west longitude. Elevation: 3840 m (12600 feet).

SITE #18: 24 August 1995, 20 September 1995, and 6 August 1996. Colorado, La Plata County, San Juan-Rio Grande National Forest, Weminuche Wilderness Area: Along Vallecito Creek Trail. 37° 29.163' north latitude; 107° 32.419' west longitude. Elevation: 2621 m (8600 feet).

SITE #19: 25 August 1995 and 21 September 1995. Colorado, Mineral County, San Juan-Rio Grande National Forest: vicinity of Wagon Wheel Gap. (Head of Spring Gulch along USFS rd. #600). 37° 47.686' north latitude; 106° 47.937' west longitude. Elevation: 3048 m (10000 feet).

SITE #20: 7 August 1996. Colorado, Rio Grande County, San Juan-Rio Grande National Forest: Elephant Rocks (BLM land) west of State Highway #112. 37° 44.051' north latitude; 106° 18.510' west longitude. Elevation: 2377 m (7800 feet).

SITE #21: 8 August 1996. Colorado, Conejos County, San Juan-Rio Grande National Forest: near La Manga Pass, along USFS rd. #113 (end of road). 37° 05.049' north latitude; 106° 23.518' west longitude. Elevation: 3139 m (10300 feet).

SITE #22: 8 August 1996. Colorado, Conejos County, San Juan-Rio Grande National Forest: between La Manga Pass and Cumbres Pass, along State Highway #17 (rocky slide area). 37° 01.432' north latitude; 106° 24.997' west longitude. Elevation: 3109 m (10200 feet).

SITE #23: 11 August 1997. Colorado, Montezuma County, Mc Elmo Canyon, Cannonball Mesa (BLM land). 37° 20.892' north latitude; 108° 55.856' west longitude. Elevation: 1707 m (5600 feet).

SITE #24: 11 August 1997. Colorado, Dolores County, San Juan-Rio Grande National Forest: along Mavreeso Road (USFS rd. #209), Site #1 (end of road), Site #2 (1km back along Mavreeso Road from Site #1), San Juan-Rio Grande National Forest. 37° 41.560' north latitude; 108° 18.639' west longitude. Elevation: 2743 m (9000 feet).

SITE #25: 12 August 1997. Colorado, LaPlata County, San Juan-Rio Grande National Forest: .5 km from Needleton, along USFS Trail # 504. 37° 37.598' north latitude; 107° 41.674' west longitude. Elevation: 2682 m (8800 feet).

SITE #26: 13 August 1997. Colorado, San Juan County, San Juan-Rio Grande National Forest: vicinity of Little Molas Lake. 37° 44.674' north latitude; 107° 42.467' west longitude. Elevation: 3353 m (11000 feet).

SITE #27: 14 August 1997. Colorado, Hinsdale County, San Juan-Rio Grande National Forest: vicinity of William's Creek Trailhead and along USFS Trail # 587. 37° 32.492' north latitude; 107° 11.933' west longitude. Elevation: 2438 m (8000 feet).

SITE #28: 14 August 1997. Colorado, Archuleta County, San Juan-Rio Grande National Forest: vicinity of V-Rock Trailhead (at end of USFS rd. #663). 37° 07.984' north latitude; 106° 48.516' west longitude. Elevation: 2987 m (9800 feet).

SITE #29: 1 September 1997. Colorado, Rio Grande County, San Juan-Rio Grande National Forest: vicinity of Bishop Rock, along USFS rd. #28. 37° 29.207' north latitude; 106° 16.280' west longitude. Elevation: 2530 m (8300 feet).

SITE #30: 2 September 1997. Colorado, Conejos County, San Juan-Rio Grande National Forest: vicinity of "The Pinnacles", along USFS rd. #250. 37° 12.720' north latitude; 106° 27.148' west longitude. Elevation: 2835 m (9300 feet).

SITE #31: 3 September 1997. Colorado, Saguache County, San Juan-Rio Grande National Forest: vicinity of Buffalo Pass, near USFS rd. # 810. 38° 11.825' north latitude; 106° 29.100' west longitude. Elevation: 2926 m (9600 feet).

SITE #32: 4 September 1997. Colorado, Saguache County, San Juan-Rio Grande National Forest: vicinity of Hayden Pass, along USFS rd. #970. 38° 17.602' north latitude; 105° 50.987' west longitude. Elevation: 3261 m (10700 feet).

SITE #33: 5 September 1997. Colorado, Saguache County, San Juan-Rio Grande National Forest: vicinity of Medano Pass, along USFS rd. #235. 37° 51.383' north latitude; 105° 25.902' west longitude. Elevation: 2835 m (9300 feet).

METHODS

COLLECTION, CURATION, IDENTIFICATION, AND DEPOSITION OF LICHEN SPECIES:

Because lichen distribution is directly influenced by substrate, moisture and sunlight, all available substrates and habitats at each reference site were carefully examined. Small amounts of each lichen species were either removed directly from the substrate, or depending on the species, with a small piece of the substrate (bark, wood, soil, or rock).

All specimens were placed in carefully labeled paper sacks and taken back to the BYU Herbarium of Nonvascular Cryptogams, where they were curated, identified, placed in permanent herbarium packets, and labeled with the current epithets and authors' names as well as detailed information about the collection site, habitat, and substrate. Herbarium numbers (BRY C-) were also assigned.

Species were identified using standard lichen keys and taxonomic treatises. Chemical spot tests and, where necessary, thin-layer chromatography techniques were used to finalize species identifications.

One set of specimens collected from each reference site will be permanently housed at the BYU Herbarium of Nonvascular Cryptogams located in the M.L. Bean Life Science Museum in Provo, Utah. A second set of voucher specimens will be sent to any herbarium designated by the U.S. Forest Service.

COLLECTION OF SENSITIVE INDICATOR SPECIES FOR ELEMENTAL ANALYSES:

After careful consideration of species, substrates, growth forms, documented/suspected pollution sensitivities, and general distribution patterns one to several pollution sensitive indicator species were collected and returned to BYU where elemental analyses were performed using PIXE technology.

At each reference site sufficient material of at least one sensitive indicator species was collected for elemental analyses (6-10 grams dry weight). All elemental analysis material was placed in Nasco sterile plastic bags (to avoid contamination) and transported back to the BYU Herbarium of Nonvascular Cryptogams. Excess material is permanently stored in Nasco sterile plastic bags in the elemental analysis collection at the BYU Herbarium of Nonvascular Cryptogams. This material is available for additional testing upon request.

DETERMINATION OF POLLUTANT ELEMENT CONCENTRATIONS IN TISSUES OF SENSITIVE INDICATOR SPECIES:

In the laboratory, surface debris and dust were removed from all elemental analysis samples. Clean two gram samples of at least one sensitive indicator species from each reference site were delivered to the Elemental Analysis Laboratory at Brigham Young University.

Samples were prepared for PIXE analysis using the methods of Duflou et al. (1987). Lichen samples were placed in teflon containers with a teflon coated steel ball, cooled to liquid nitrogen temperature, powdered by brittle fracture using a Braun Mikro-Dismemberator II, and then dried in an Imperial IV Microprocessor Oven for 14 hours at 80°C. Subsamples of 150 mg were then

placed in teflon containers and spiked with 1 ml of a 360 ppm yttrium solution. The samples were then oven dried again for 14 hours at 80°C. Samples were then homogenized again using the micro-dismemberator. Approximately 1 mg of powdered lichen tissue was then carefully weighed out onto a thin polycarbonate film in an area of 0.5 cm². A 1.5% solution of polystyrene in toluene was used to secure the sample to the film.

Samples were analyzed using a 2 MV Van de Graaff accelerator with a 2.28 MeV proton beam which passed through a 1.1 mg/cm² pyrolytic graphite diffuser foil. The proton beam was collimated to irradiate an area of 0.38 cm² on the sample. Typically, 10-100 nA proton beam currents were used. X-rays were detected using a Tracor X-ray Spectrometer, model TX-3/48-206, with a 10mm² by 3 mm thick Si(Li) detector positioned at 90° to the proton beam. Samples were analyzed twice using different X-ray absorbers between the samples and the detector. One was a 49 mg/cm² Mylar absorber with a 0.27 mm² pinhole (2.8% of detector area). The Mylar was backed with 8.5 mg/cm² beryllium foil. A 98 mg/cm² Mylar absorber was also used.

To insure adequate quality control, samples of NIST SRM 1571, orchard leaves, and other standards were also prepared and analyzed using the same procedures.

RESULTS AND RECOMMENDATIONS

LICHEN MATERIAL COLLECTED FOR ELEMENTAL ANALYSIS:

To date a total of 83 samples (from 33 reference sites) consisting of 13 species in 7 genera from three substrates (bark, soil, and rock) have been collected for elemental analysis. Proton Induced X-ray Emission (PIXE) techniques have been used to analyze all samples. Below is the list of elemental analysis samples by sample number (the first number represents the storage drawer and the second number represents the specimen bag), species, substrate and collection site (see list of reference sites for detailed site information). All samples are stored in Nasco sterile plastic bags and archived in the Elemental Analysis Collection in the Herbarium of Non-vascular Cryptogams at Brigham Young University, Provo, Utah.

Sample #	Taxa	Substrate	Reference site
25-207	Xanthoparmelia cumberlandia	rock	3
25-208	Xanthoparmelia cumberlandia	rock	3
25-209	Xanthoparmelia cumberlandia	rock	2
25-210	Xanthoparmelia cumberlandia	rock	4
26-211	Usnea hirta	bark	1
26-212	Rhizoplaca peltata	rock	1
26-213	Xanthoparmelia cumberlandia	rock	10
26-214	Usnea hirta	bark	9
26-215	Usnea subfloridana	bark	2
26-216	Xanthoparmelia cumberlandia	rock	5
26-217	Usnea hirta	bark	5
26-218	Xanthoparmelia cumberlandia	rock	7
26-219	Xanthoparmelia cumberlandia	rock	6
26-220	Usnea hirta	bark	6
36-325	Usnea hirta	bark	5
36-326	Rhizoplaca melanophthalma	rock	15
36-327	Xanthoparmelia cumberlandia	rock	14
36-328	Rhizoplaca melanophthalma	rock	14
36-329	Xanthoparmelia cumberlandia	rock	13
36-330	Usnea subfloridana	bark	13
36-331	Xanthoparmelia coloradoensis	rock	8
36-332	Rhizoplaca chrysoleuca	rock	8

Sample #	Taxa	Substrate	Reference site
36-333	<i>Usnea hirta</i>	bark	11
36-334	<i>Pseudevernia intensa</i>	bark	11
36-335	<i>Bryoria fuscescens</i>	bark	12
36-336	<i>Xanthoparmelia cumberlandia</i>	rock	12
36-337	<i>Evernia divaricata</i>	bark	12
44-430	<i>Usnea cavernosa</i>	bark	16
44-431	<i>Xanthoparmelia cumberlandia</i>	rock	16
44-432	<i>Rhizoplaca melanophthalma</i>	rock	16
44-433	<i>Rhizoplaca melanophthalma</i>	rock	17
44-434	<i>Xanthoparmelia cumberlandia</i>	rock	17
44-435	<i>Cetraria nivalis</i>	soil	17
44-436	<i>Usnea subfloridana</i>	bark	18
44-437	<i>Xanthoparmelia cumberlandia</i>	rock	18
44-438	<i>Rhizoplaca chrysoleuca</i>	rock	18
44-439	<i>Xanthoparmelia cumberlandia</i>	rock	19
44-440	<i>Usnea subfloridana</i>	bark	19
44-441	<i>Rhizoplaca chrysoleuca</i>	rock	19
45-456	<i>Usnea subfloridana</i>	bark	20
45-457	<i>Xanthoparmelia cumberlandia</i>	rock	20
45-458	<i>Rhizoplaca chrysoleuca</i>	rock	20
45-459	<i>Rhizoplaca melanophthalma</i>	rock	20
45-460	<i>Xanthoparmelia cumberlandia</i>	rock	22
45-461	<i>Xanthoparmelia cumberlandia</i>	rock	21
45-463	<i>Usnea subfloridana</i>	bark	22
45-464	<i>Usnea subfloridana</i>	bark	21
49-555	<i>Rhizoplaca melanophthalma</i>	rock	23
49-556	<i>Xanthoparmelia plittii</i>	rock	23
49-557	<i>Xanthoparmelia cumberlandia</i>	rock	23
50-597	<i>Rhizoplaca melanophthalma</i>	rock	24
50-598	<i>Xanthoparmelia cumberlandia</i>	rock	24
50-599	<i>Xanthoparmelia cumberlandia</i>	rock	24
50-600	<i>Bryoria fuscescens</i>	bark	25
50-601	<i>Usnea</i> sp.	bark	25
50-602	<i>Xanthoparmelia cumberlandia</i>	rock	24
50-603	<i>Rhizoplaca melanophthalma</i>	rock	25
50-604	<i>Xanthoparmelia cumberlandia</i>	rock	25
50-605	<i>Rhizoplaca melanophthalma</i>	rock	26
50-606	<i>Xanthoparmelia cumberlandia</i>	rock	26
50-607	<i>Xanthoparmelia cumberlandia</i>	rock	28
50-608	<i>Usnea</i> sp.	bark	28
50-609	<i>Bryoria fuscescens</i>	bark	27
50-610	<i>Usnea</i> sp.	bark	27
50-611	<i>Xanthoparmelia cumberlandia</i>	rock	27
50-627	<i>Usnea</i> sp.	bark	26
51-629	<i>Usnea</i> sp.	bark	31
51-630	<i>Xanthoparmelia cumberlandia</i>	rock	31
51-631	<i>Rhizoplaca chrysoleuca</i>	rock	31
51-632	<i>Usnea</i> sp.	bark	33
51-633	<i>Rhizoplaca chrysoleuca</i>	rock	33
51-634	<i>Xanthoparmelia cumberlandia</i>	rock	33
51-635	<i>Pseudevernia intensa</i>	bark	32
51-636	<i>Usnea</i> sp.	bark	32

Sample #	Taxa	Substrate	Reference site
51-637	<i>Xanthoparmelia cumberlandia</i>	rock	32
51-638	<i>Rhizoplaca melanophthalma</i>	rock	29
51-639	<i>Xanthoparmelia cumberlandia</i>	rock	29
51-640	<i>Rhizoplaca chrysoleuca</i>	rock	29
51-641	<i>Usnea</i> sp.	bark	29
51-642	<i>Xanthoparmelia cumberlandia</i>	rock	30
51-643	<i>Usnea</i> sp.	bark	30
51-644	<i>Rhizoplaca melanophthalma</i>	rock	30
51-645	<i>Rhizoplaca chrysoleuca</i>	rock	30

POLLUTION SENSITIVE INDICATOR SPECIES BY REFERENCE SITE:

Vicinity of Benchmark Lookout:

Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Bishop Rock:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Bryoria fuscescens (sensitive to intermediately sensitive to sulfur dioxide)
Cladonia chlorophaea (intermediately sensitive to sulfur dioxide)
Collema cristatum (sensitive to intermediately sensitive to ozone)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subargentifera (intermediately sensitive to sulfur dioxide)
Melanelia subelegantula (sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Nephroma parile (sensitive to sulfur dioxide)
Normandina pulchella (sensitive to intermediately sensitive to sulfur dioxide)
Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)
Phaeophyscia sciastra (sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (sensitive to intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Physconia enteroxantha (sensitive to sulfur dioxide)
Physconia perisidiosa (intermediately sensitive to sulfur dioxide)
Punctelia subrudecta (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of Buffalo Pass:

Bryoria fuscescens (sensitive to intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Collema coccophorum (sensitive to intermediately sensitive to ozone)
Collema crispum (sensitive to intermediately sensitive to ozone)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subargentifera (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Nephroma helveticum (sensitive to sulfur dioxide)
Ochrolechia androgyna (sensitive to sulfur dioxide)
Parmelia saxatilis (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Parmeliopsis hyperopta (sensitive to intermediately sensitive to sulfur dioxide)
Peltigera didactyla (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)
Physcia caesia (sensitive to intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Physconia enteroxantha (sensitive to sulfur dioxide)
Pleopsidium flavum (sensitive to sulfur dioxide)
Punctelia subrudecta (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Sticta weigeli (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Cannonball Mesa:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Collema coccophorum (sensitive to intermediately sensitive to ozone)
Collema tenax (sensitive to intermediately sensitive to ozone)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Pleopsidium chlorophanum (sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)

Vicinity of Chimney Rock:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Peltigera canina (sensitive to ozone)

Vicinity of Chimney Rock (continued):

Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Communications relay site (near Wolf Creek Pass):

Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Parmeliopsis hyperopta (intermediately sensitive to sulfur dioxide)

Vicinity of Elephant Rocks:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia caesia (intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide;
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Ferris Canyon Campground:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Caloplaca cerina (sensitive to intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Peltigera canina (sensitive to ozone)
Phaeophyscia nigricans (intermediately sensitive to sulfur dioxide)
Phaeophyscia orbicularis (sensitive to ozone; intermediately sensitive to sulfur dioxide;
sensitive to fluoride)
Phaeophyscia sciastra (sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Groundhog Mountain (along USFS Rd. #534):

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Lecanora saligna (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Hayden Pass:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Bryoria fuscescens (sensitive to intermediately sensitive to sulfur dioxide)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Parmeliopsis hyperopta (sensitive to intermediately sensitive to sulfur dioxide)
Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Vulpicida pinastri (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of the Indian Cliff Dwellings:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Caloplaca cerina (sensitive to intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Physcia aipolia (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (intermediately sensitive to sulfur dioxide)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PA N)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Kennebec Pass:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Caloplaca cerina (sensitive to intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)
Collema crispum (sensitive to intermediately sensitive to ozone)
Collema fuscovirens (sensitive to intermediately sensitive to ozone)
Collema glebulentum (sensitive to intermediately sensitive to ozone)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Peltigera aphthosa (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Pleopsidium chlorophanum (sensitive to sulfur dioxide)
Pseudephebe pubescens (intermediately sensitive to ozone)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of La Manga Pass: (limited collections)

Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Peltigera aphthosa (intermediately sensitive to sulfur dioxide)
Peltigera rufescens (sensitive to intermediately sensitive ozone)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)

Between La Manga Pass and Cumbres Pass:

Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Parmelia saxatilis (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (intermediately sensitive to sulfur dioxide)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Pseudephebe pubescens (intermediately sensitive to ozone)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)

Vicinity of Little Molas Lake:

Amandinea (intermediately sensitive to sulfur dioxide)
Caloplaca cerina (sensitive to intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)
Collema cristatum (sensitive to intermediately sensitive to ozone)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Peltigera canina (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia aipolia (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (sensitive to intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Lizard Head Wilderness Area (along Cross Mountain Trail):

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Lecanora saligna (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Peltigera aphthosa (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Physcia aipolia (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (intermediately sensitive to sulfur dioxide)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Rhizocarpon geographicum (sensitive to fluoride)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Madden Peak:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately to sulfur dioxide and ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Rhizocarpon geographicum (sensitive to fluoride)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Martinez Creek:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Parmeliopsis hyperopta (intermediately sensitive to sulfur dioxide)
Peltigera aphthosa (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Phaeophyscia sciastra (sensitive to ozone)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Along Mavreeso Road (USFS Rd. #209):

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Nephroma parile (sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of Medano Pass:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Caloplaca holocarpa (intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Ochrolechia androgyna (sensitive to sulfur dioxide)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Phaeophyscia sciastra (sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (sensitive to intermediately sensitive to sulfur dioxide)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of Medano Pass (continued):

Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Vulpicida pinastri (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of Needleton (along USFS Trail # 504)

Bryoria fuscescens (sensitive to intermediately sensitive to sulfur dioxide)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Leptogium saturninum (sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Nephroma parile (sensitive to sulfur dioxide)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone)
Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Peltigera aphthosa (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)
Phaeophyscia sciastra (sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (sensitive to intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Punctelia subrudecta (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Vulpicida pinastri (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of the Pinnacles:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Caloplaca cerina (sensitive to intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)
Collema crispum (sensitive to intermediately sensitive to ozone)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subargentifera (intermediately sensitive to sulfur dioxide)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)
Phaeophyscia orbicularis (intermediately sensitive to sulfur dioxide; sensitive to ozone; sensitive to fluoride)
Physcia caesia (sensitive to intermediately sensitive to sulfur dioxide)
Physcia dubia (sensitive to intermediately sensitive to fluoride)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Pleopsidium flavum (sensitive to sulfur dioxide)

Vicinity of the Pinnacles (continued):

Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Vulpicida pinastri (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Along Quartz Creek:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Parmeliopsis hyperopta (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Physcia aipolia (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Sheep Creek Trail:

Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)
Collema fuscovirens (sensitive to intermediately sensitive to ozone)
Lecanora carpinea (intermediately sensitive to sulfur dioxide)
Lecanora saligna (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Ochrolechia androgyna (sensitive to sulfur dioxide)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Phaeophyscia orbicularis (sensitive to ozone; intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia aipolia (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Head of Spring Gulch:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia fuliginosa (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Ochrolechia androgyna (sensitive to sulfur dioxide)
Peltigera aphthosa (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (intermediately sensitive to sulfur dioxide)
Pleopsidium chlorophanum (sensitive to sulfur dioxide)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Stony Pass:

Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Physcia dubia (sensitive to intermediately sensitive to sulfur dioxide)
Pleopsidium chlorophanum (sensitive to sulfur dioxide)
Pseudephebe minuscula (intermediately sensitive to ozone)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)

Vicinity of Sundial Indian Ruins:

Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Phaeophyscia sciastra (sensitive to ozone)
Physcia dubia (sensitive to intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of Taylor Mesa:

Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Caloplaca holocarpa (intermediately sensitive to sulfur dioxide)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Peltigera aphthosa (intermediately sensitive to sulfur dioxide)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Rhizocarpon geographicum (sensitive to fluoride)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)

Vicinity of Treasure Falls: (limited collections)

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Melanelia exasperatula (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Peltigera canina (sensitive to ozone)
Phaeophyscia orbicularis (sensitive to ozone; intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia aipolia (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Platismatia glauca (intermediately sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vallecito Creek Trail:

Amandinea punctata (intermediately sensitive to sulfur dioxide)
Bryoria fuscescens (intermediately sensitive to sulfur dioxide)
Cladonia coniocraea (intermediately sensitive to sulfur dioxide)
Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)
Collema fuscovirens (sensitive to intermediately sensitive to ozone)
Hypogymnia physodes (intermediately sensitive to sulfur dioxide)
Lecanora chlarotera (intermediately sensitive to sulfur dioxide)
Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)
Ochrolechia androgyna (sensitive to sulfur dioxide)
Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride)
Parmeliopsis ambigua (intermediately sensitive to sulfur dioxide)
Peltigera canina (sensitive to ozone)
Phaeophyscia nigricans (intermediately sensitive to sulfur dioxide)
Physcia aipolia (intermediately sensitive to sulfur dioxide; sensitive to fluoride)
Physcia caesia (intermediately sensitive to sulfur dioxide)
Physcia stellaris (intermediately sensitive to sulfur dioxide)
Physconia detersa (intermediately sensitive to sulfur dioxide)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)
Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)
Xanthoria fallax (intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN)

Vallecito Creek Trail (continued):

Xanthoria polycarpa (intermediately sensitive to sulfur dioxide)

Vicinity of V-Rock Trailhead:

Amandinea punctata (intermediately sensitive to sulfur dioxide)

Caloplaca cerina (sensitive to intermediately sensitive to sulfur dioxide)

Melanelia subolivacea (intermediately sensitive to sulfur dioxide and ozone)

Nephroma parile (sensitive to sulfur dioxide)

Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)

Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)

Physcia dubia (sensitive to intermediately sensitive to fluoride)

Physcia stellaris (intermediately sensitive to sulfur dioxide)

Rhizocarpon geographicum (sensitive to fluoride)

Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)

Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)

Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of William's Creek Trailhead:

Amandinea punctata (intermediately sensitive to sulfur dioxide)

Bryoria fuscescens (sensitive to intermediately sensitive to sulfur dioxide)

Caloplaca holocarpa (intermediately sensitive to sulfur dioxide)

Cladonia coniocraea (intermediately sensitive to sulfur dioxide)

Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)

Collema furfuraceum (sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone)

Melanelia exasperatula (intermediately sensitive to sulfur dioxide)

Nephroma parile (sensitive to sulfur dioxide)

Parmelia sulcata (intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone)

Peltigera canina (sensitive to ozone)

Peltigera rufescens (sensitive to intermediately sensitive to sulfur dioxide; sensitive to ozone)

Phaeophyscia orbicularis (intermediately sensitive to sulfur dioxide; sensitive to ozone; sensitive to fluoride)

Physcia adscendens (intermediately sensitive to sulfur dioxide; sensitive to fluoride)

Physcia caesia (sensitive to intermediately sensitive to sulfur dioxide)

Physcia stellaris (intermediately sensitive to sulfur dioxide)

Physconia enteroxantha (sensitive to sulfur dioxide)

Physconia perisidiosa (intermediately sensitive to sulfur dioxide)

Rhizocarpon geographicum (sensitive to fluoride)

Usnea hirta (sensitive to intermediately sensitive to sulfur dioxide)

Usnea subfloridana (sensitive to intermediately sensitive to sulfur dioxide)

Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)

Xanthoria candelaria (intermediately sensitive to sulfur dioxide; sensitive to ozone)

Xanthoria polycarpa (sensitive to intermediately sensitive to sulfur dioxide)

Vicinity of Wolf Creek Pass:

Candelariella vitellina (intermediately sensitive to sulfur dioxide; sensitive to fluoride)

Cladonia coniocraea (intermediately sensitive to sulfur dioxide)

Cladonia fimbriata (sensitive to intermediately sensitive to sulfur dioxide)

Cladonia stricta (sensitive to ozone)

Lecanora saligna (intermediately sensitive to sulfur dioxide)

Parmeliopsis hyperopta (intermediately sensitive to sulfur dioxide)

Vicinity of Wolf Creek Pass (continued):

Peltigera canina (sensitive to sulfur dioxide)
Peltigera rufescens (sensitive to intermediately sensitive to ozone)
Pleopsidium chlorophanum (sensitive to sulfur dioxide)
Pseudephebe minuscula (intermediately sensitive to ozone)
Rhizocarpon geographicum (sensitive to fluoride)
Rhizoplaca chrysoleuca (sensitive to sulfur dioxide; sensitive to NO_x/PAN)
Rhizoplaca melanophthalma (sensitive to sulfur dioxide)
Xanthoparmelia cumberlandia (sensitive to sulfur dioxide)
Xanthoria elegans (intermediately sensitive to sulfur dioxide)

**CHECKLIST OF LICHEN SPECIES
SAN JUAN-RIO GRANDE NATIONAL FOREST, COLORADO**

Acarospora americana H. Magn.

Growth form: crustose
Substrate: rock
Site(s): Stony Pass
Relative abundance: rare
Pollution sensitivity: unknown
Comments: this taxon is a new species record for Colorado
Deposition of specimens: (BYU Herbarium) BRY C-31658

Acarospora fuscata (Schrader) Arnold

Growth form: crustose
Substrate: rock
Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Sundial Indian Ruins near McPhee Reservoir, Vallecito Creek Trail, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, The Pinnacles, Medano Pass
Relative abundance: locally common to abundant
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-29029, BRY C-29122, BRY C-31756a, BRY C-33328, BRY C-33402, BRY C-34885, BRY C-35800, BRY C-36551

Acarospora glaucocarpa (Ach.) Körber

Growth form: squamulose
Substrate: rock
Site(s): vicinity of Little Molas Lake
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-35270

Acarospora schleicheri (Ach.) A.Massal.

Growth form: crustose

Substrate: rock, soil

Site(s): vicinity of Elephant Rocks, Buffalo Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33354, BRY C-35831

Acarospora smaragdula (Wahlenb.) A. Massal.

Growth form: crustose

Substrate: rock

Site(s): V-Rock Trailhead

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35358

Acarospora stapfiana (Müll. Arg.) Hue

Growth form: crustose

Substrate: growing over other lichens, usually Caloplaca trachyphylla

Site(s): Cannonball Mesa

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-34915

Acarospora strigata (Nyl.) Jatta

Growth form: crustose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Elephant Rocks, Cannonball Mesa

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29051, BRY C-33352, BRY C-34874

Amandinea punctata (Hoffm.) Coppins & Scheid.

Growth form: crustose

Substrate: lignum, Serviceberry, Engelmann Spruce, Doug Fir, Pinyon Pine, Gambel Oak, rock, Subalpine Fir, Quaking Aspen, Acer glabrum, White Fir, Willow, decomposing wood, Limber Pine

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, along Quartz Creek, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, vicinity of Treasure Falls, vicinity of Madden Peak, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Elephant Rocks, Cannonball Mesa, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26676, BRY C-26826, BRY C-26871, BRY C-26886, BRY C-29100, BRY C-29150, BRY C-29203, BRY C-29272, BRY C-29371, BRY C-31100, BRY C-31103, BRY C-31109, BRY C-31121, BRY C-31556, BRY C-31560, BRY C-31568, BRY C-31738, BRY C-31751a, BRY C-31868, BRY C-32061, BRY C-33370, BRY C-34855a, BRY C-34937, BRY C-34995, BRY C-35301, BRY C-35401, BRY C-35465, BRY C-35618, BRY C-35706, BRY C-35967, BRY C-36479

Anaptychia ulotrichoides (Vainio) Vainio

Growth form: foliose

Substrate: moss/soil over rock

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34912

Arthrorhaphis alpina (Schaerer) R. Sant.

Growth form: squamulose

Substrate: soil

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29325

Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold

Growth form: crustose

Substrate: rock

Site(s): along U.S.F.S. road #5344 (Groundhog Mountain)

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31529a

Aspicilia calcarea (L.) Mudd

Growth form: crustose

Substrate: rock

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34886

Aspicilia cinerea (L.) Körber

Growth form: crustose

Substrate: rock

Site(s): vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness

Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, near Needleton, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26740, BRY C-26787, BRY C-26897, BRY C-29038, BRY C-29128, BRY C-29262, BRY C-31029, BRY C-31529b, BRY C-31647, BRY C-31813, BRY C-31822, BRY C-32023, BRY C-33327, BRY C-33413, BRY C-34960, BRY C-35333, BRY C-35357, BRY C-35652, BRY C-35880, BRY C-36402, BRY C-36517

Aspicilia contorta (Hoffm.) Kremp.

Growth form: crustose

Substrate: rock

Site(s): vicinity of Martinez Creek, Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31156, BRY C31754a

Aspicilia desertorum (Kremp.) Mereschk.

Growth form: crustose

Substrate: rock, small rocks on calcareous soil

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, vicinity of Benchmark Lookout, vicinity of Wolf Creek Pass, Vallecito Creek Trail, Stony Pass, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), Cannonball Mesa, vicinity of Little Molas Lake, Williams Creek Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: BYU Herbarium: BRY C-26735, BRY C-26882, BRY C-26927, BRY C-29055, BRY C-29056, BRY C-29141, BRY C-29399, BRY C-31541, BRY C-31542, BRY C-31620, BRY C-31621, BRY C-31635, BRY C-31637, BRY C-31644, BRY C-31752a, BRY C-31816, BRY C-31821, BRY C-34845, BRY c-35248, BRY C-35339, BRY C-35655, BRY C-35742, BRY C-35860, BRY C-36413, BRY C-36552

Aspicilia lignicola Hue

Growth form: crustose

Substrate: lignum

Site(s): Cannonball Mesa. Williams Creek Trailhead, V-Rock Trailhead, The Pinnacles, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-34851, BRY C-35387, BRY C-35471, BRY C-35721, BRY C-36540

Aspicilia quartzitica W.A. Weber

Growth form: crustose

Substrate: rock

Site(s): vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33304, BRY C-33422

Bellemeria alpina (Sommerf.) Clauz. & Roux

Growth form: crustose

Substrate: rock

Site(s): head of Spring Gulch, near Needleton

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31844b, BRY C-34961

Bellemerea cinereorufescens (Ach.) Clauz. & Roux

Growth form: crustose

Substrate: rock

Site(s): near Needleton

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34967

Biatora vernalis (L.) Fr.

Growth form: crustose (absent)

Substrate: Engelmann Spruce, lignum, Doug Fir, moss, soil, Willow

Site(s): vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek,

Vallecito Creek Trail, along U.S.F.S. Rd. #534 (Groundhog Mountain), between La

Manga Pass and Cumbres Pass, V-Rock Trailhead, Hayden Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-30952, BRY C-31045, BRY C-31124,

BRY C-31554, BRY C-31757b, BRY C-33383, BRY C-35476, BRY C-36426

Brodoa oroarctica (Krog) Goward

Growth form: foliose

Substrate: rock

Site(s): Stony Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31625

Bryoria chalybeiformis (L.) Brodo & D. Hawksw.

Growth form: fruticose

Substrate: rock

Site(s): Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35905

Bryoria fuscescens (Gyelnik) Brodo & D. Hawksw.

Growth form: fruticose

Substrate: Engelmann Spruce, Doug Fir, Ponderosa Pine, White Fir, Bristlecone Pine, lignum, Limber Pine

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, vicinity of La Manga Pass, between La Manga Pass and Cumbres Pass, near Needleton, Williams Creek Trailhead, Bishop Rock, Buffalo Pass, Hayden Pass

Relative abundance: locally common to abundant

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26724, BRY C-26822, BRY C-29275, BRY C-30971, BRY C-31014, BRY C-31133, BRY C-31710, BRY C-31721, BRY C-31853, BRY C-31872, BRY C-31891, BRY C-32084, BRY C-33375, BRY C-33430, BRY C-35168, BRY C-35409, BRY C-35578, BRY C-35882, BRY C-35969

Bryoria lanestris (Ach.) Brodo & D. Hawksw.

Growth form: fruticose

Substrate: Bristlecone Pine

Site(s): Hayden Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-36457a

Buellia elegans Poelt

Growth form: squamulose (with marginal lobes)

Substrate: soil

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34844

Buellia erubescens Arnold

Growth form: crustose

Substrate: lignum

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34855b

Buellia papillata (Sommerf.) Tuck.

Growth form: crustose

Substrate: soil, detritus

Site(s): Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31634

Buellia turgescens Tuck.

Growth form: crustose

Substrate: rock

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-34928

Caloplaca ammiospila (Wahlenb.) H. Olivier

Growth form: crustose

Substrate: soil, over moss

Site(s): vicinity of Taylor Mesa, head of Spring Gulch, Stony Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-26744, BRY C-31806, BRY C-31664a

Caloplaca arizonica H. Magn.

Growth form: crustose

Substrate: Gambel Oak, lignum, Boxelder Maple, Narrowleaf Cottonwood, Pinyon Pine, Engelmann Spruce

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, vicinity of Benchmark Lookout, along U.S.F.S. Rd. #534 (Groundhog Mountain)

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-26726, BRY C-26759, BRY C-26841, BRY C-26850, BRY C-26857, BRY C-26889, BRY C-26917, BRY C-29085, BRY C-31571

Caloplaca cerina (Hedwig) Th. Fr.

Growth form: crustose (absent)

Substrate: Gambel Oak, moss, Subalpine Fir, White Fir, Willow

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, vicinity of Little Molas Lake, V-Rock Trailhead, The Pinnacles

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26864, BRY C-29205, BRY C-29312, BRY C-35307b, BRY C-35486b, BRY C-35702

Caloplaca cinnabarina (Ach.) Zahlbr.

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area, along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Ferris Canyon Campground, Stony Pass, along U.S.F.S. road #534, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-26770, BRY C-26907, BRY C-31511, BRY C-31641, BRY C-31642, BRY C-33323, BRY C-33420

Caloplaca cladodes (Tuck.) Zahlbr.

Growth form: fruticose

Substrate: soil over rock

Site(s): vicinity of Martinez Creek, Bishop Rock, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31138, BRY C-35598, BRY C-35913

Caloplaca crenularia (With.) J.R. Laundon

Growth form: crustose

Substrate: rock

Site(s): V-Rock Trailhead

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-35418

Caloplaca decipiens (Arnold) Blomb. & Forss.

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29173, BRY C-34901

Caloplaca epithallina Lynge

Growth form: crustose (absent)

Substrate: over lichen thalli, rock

Site(s): vicinity of Wolf Creek Pass, vicinity of Martinez Creek, Stony Pass, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29393, BRY C-31158, BRY C-31653, BRY C-31814, BRY C-33326, BRY C-33419, BRY C-34882, BRY C-35657

Caloplaca flavovirescens (Wulfen) Dalla Torre & Sarnth.

Growth form: crustose

Substrate: rock

Site(s): vicinity of Ferris Canyon Campground, Vallecito Creek Trail

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26896, BRY C-31770, BRY C-32074

Caloplaca fraudans (Th. Fr.) H. Olivier

Growth form: crustose (absent)

Substrate: rock, lignum, White Fir, Engelmann Spruce

Site(s): vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, vicinity of Madden Peak, Vallecito Creek Trail, Head of Spring Gulch, along U.S.F.S. road #53 (Groundhog Mountain), vicinity of Elephant Rocks, near Needleton, vicinity of Little Molas Lake, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26764, BRY C-29035, BRY C-29134, BRY C-29271, BRY C-31047, BRY C-31088, BRY C-31538, BRY C-31740, BRY C-31836, BRY C-31888, BRY C-33344, BRY C-34991, BRY C-35246, BRY C-35628, BRY C-35775, BRY C-35884, BRY C-36424, BRY C-36495

Caloplaca holocarpa (Hoffm, ex Ach.) R. Wade

Growth form: crustose

Substrate: Engelmann Spruce, lignum

Site(s): vicinity of Taylor Mesa, Williams Creek Trailhead, Medano Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26758, BRY C-35391, BRY C-36541

Caloplaca jungermanniae (Vahl) Th. Fr.

Growth form: crustose
Substrate: moss
Site(s): head of Spring Gulch
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31798

Caloplaca microphyllina (Tuck.) Hasse

Growth form: crustose
Substrate: lignum
Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, Cannonball Mesa
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-29147, BRY C-34866

Caloplaca modesta (Zahlbr.) Fink

Growth form: crustose (with effigurate margins)
Substrate: rock
Site(s): Stony Pass, vicinity of Little Molas Lake, The Pinnacles, Buffalo Pass
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31610b, BRY C-35319, BRY C-35802, BRY C-35895

Caloplaca saxicola (Hoffm.) Nordin

Growth form: crustose (with effigurate margins)
Substrate: rock
Site(s): vicinity of Sheep Creek Trail, head of Spring Gulch
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31016, BRY C-31831

Caloplaca sideritis (Tuck.) Zahlbr.

Growth form: crustose
Substrate: rock
Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Ferris Canyon Campground, Bishop Rock
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-26878, BRY C-29198, BRY C-35664

Caloplaca tirolensis Zahlbr.

Growth form: crustose (absent)

Substrate: detritus, moss

Site(s): vicinity of Kennebec Pass, vicinity of Martinez Creek, Stony Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29303, BRY C-31149, BRY C-31664b

Caloplaca tominii Savicz

Growth form: squamulose

Substrate: soil

Site(s): Cannonball Mesa

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-34848

Caloplaca trachyphylla (Tuck.) Zahlbr.

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Elephant Rocks, Cannonball Mesa

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29044, BRY C-33337, BRY C34903

Candelariella aurella (Hoffm.) Zahlbr.

Growth form: crustose

Substrate: soil over rock, detritus, rock

Site(s): vicinity of Benchmark Lookout, vicinity of Kennebec Pass, Vallecito Creek Trail, The Pinnacles, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26925, BRY C-29295, BRY C-31751a, BRY C-35792, BRY C-35881

Candelariella deflexa (Nyl.) Zahlbr.

Growth form: crustose (lacking)

Substrate: Narrowleaf Cottonwood, Gambel Oak, lignum, Rocky Mountain Juniper

Site(s): vicinity of Treasure Falls, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, Cannonball Mesa, Williams Creek Trailhead, Bishop Rock, The Pinnacles

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26839, BRY C-26916, BRY C-29200, BRY C-34871, BRY C-35407, BRY C-35582c, BRY C-35739

Candelariella reflexa (Nyl.) Lettau

Growth form: squamulose

Substrate: moss over rock

Site(s): Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31619

Candelariella rosulans (Müll. Arg.) Zahlbr.

Growth form: crustose

Substrate: soil over rock, rock, lignum

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Wolf Creek Pass, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Madden Peak, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Elephant Rocks, Bishop Rock, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26900, BRY C-29143, BRY C-29170, BRY C-31090, BRY C-31547, BRY C-33306, BRY C-35647, BRY C-36410, BRY C-36548b

Candelariella subdeflexa (Nyl.) Lettau

Growth form: crustose

Substrate: Quaking Aspen

Site(s): near Needleton

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35191

Candelariella terrigena Räsänen

Growth form: crustose

Substrate: detritus, moss, soil over rock

Site(s): Stony Pass, Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31626, BRY C-31663, BRY C-34878

Candelariella vitellina (Hoffm.) Müll. Arg.

Growth form: crustose

Substrate: lignum, rock, soil over rock, Doug Fir

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, head of Spring Gulch, Cannonball Mesa, vicinity of Little Molas Lake, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide; sensitive to fluoride (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29046, BRY C-29129, BRY C-29153, BRY C-29330, BRY C-29395, BRY C-30998, BRY C-31025, BRY C-31111, BRY C-31873c, BRY C-34856, BRY C-35252, BRY C-35753a, BRY C-35836, BRY C-36493

Candelariella xanthostigma (Ach.) Lettau

Growth form: crustose

Substrate: Subalpine fir, decomposing wood, lignum

Site(s): vicinity of Treasure Falls, vicinity of Martinez Creek, head of Spring Gulch, V-Rock Trailhead

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29343, BRY C-31137, BRY C-31873b, BRY C-35469

Catapyrenium cinereum (Pers.) Körber

Growth form: squamulose

Substrate: soil

Site(s): vicinity of Kennebec Pass, Stony Pass, Hayden Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29230, BRY C-31609, BRY C-35986

Catapyrenium zahlbruckneri (Hasse) J.W. Thomson

Growth form: crustose

Substrate: rock

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Ferris Canyon Campground

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-26894, BRY C-29043

Cetraria aculeata (Schreber) Fr.

Growth form: fruticose

Substrate: soil

Site(s): Stony Pass

Relative abundance: common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31597

Cetraria ericetorum Opiz

Growth form: foliose

Substrate: soil

Site(s): Stony Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31587b

Cetraria islandica (L.) Ach.

Growth form: foliose

Substrate: soil

Site(s): Stony Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31587a

Cladonia cariosa (Ach.) Sprengel

Growth form: squamulose (with podetia)

Substrate: soil, moss, humic soil, moss over soil, moss over rock, moss over wood

Site(s): vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness

Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity

of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of

Madden Peak, vicinity of Martinez Creek, head of Spring Gulch, along U.S.F.S. Rd.

#534 (Groundhog Mountain), between La Manga Pass and Cumbres Pass, vicinity of Little

Molas Lake, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26742, BRY C-26801, BRY C-26824,
BRY C-29098, BRY C-29237, BRY C-30959, BRY C-31105, BRY C-31173,
BRY C-31573, BRY C-31576, BRY C-31810, BRY C-33439, BRY C-35276, BRY C-
35615, BRY C-35714, BRY C-35861, BRY C-35988, BRY C-36546

Cladonia chlorophaea (Flörke ex Sommerf.) Sprengel

Growth form: squamulose (with podetia)

Substrate: moss, soil, soil over rock, decomposing wood, moss over soil, moss over Doug Fir, moss over rock,

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Martinez Creek, Vallecito Creek Trail, along U.S.F.S. Rd. #534 (Groundhog Mountain), Bishop Rock

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26731, BRY C-26749, BRY C-26784, BRY C-26803, BRY C-26811, BRY C-29234, BRY C-29379, BRY C-30946, BRY C-31162, BRY C-31163, BRY C-31577, BRY C-31726, BRY C-31765, BRY C-31774, BRY C-35671

Cladonia coniocraea (Flörke) Sprengel

Growth form: squamulose (with podetia)

Substrate: decomposing wood, humic soil, moss, lignum, moss over wood, moss at base of Ponderosa Pine, detritus

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, along Quartz Creek, vicinity of Taylor Mesa, vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, The Pinnacles, Buffalo Pass, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26669, BRY C-26748, BRY C-26750, BRY C-26805, BRY C-26812, BRY C-26814, BRY C-26816, BRY C-26817, BRY C-30948, BRY C-30964, BRY C-31170, BRY C-31581, BRY C-31747, BRY C-31762, BRY C-31763, BRY C-31805, BRY C-32048, BRY C-35206, BRY C-35293, BRY C-35378, BRY C-35728, BRY C-35840, BRY C-35983

Cladonia ecmocyna Leighton

Growth form: squamulose (with podetia)

Substrate: soil, decomposing wood

Site(s): vicinity of Taylor Mesa, Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26741, BRY C-31766

Cladonia fimbriata (L.) Fr.

Growth form: squamulose (with podetia)

Substrate: humic soil, decomposing wood, soil, soil/moss over rock, moss

Site(s): vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, Vallecito Creek Trail, head of Spring Gulch, between La Manga Pass and Cumbres Pass, vicinity of Little Molas Lake, Williams Creek Trailhead, The Pinnacles

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29241, BRY C-30945, BRY C-30961, BRY C-31067, BRY C-31701, BRY C-31764, BRY C-31801, BRY C-33435, BRY C-35256, BRY C-35384, BRY C-35726

Cladonia macrophyllodes Nyl.

Growth form: squamulose (with podetia)

Substrate: detritus

Site(s): near Needleton

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35211

Cladonia norvegica Tonsberg & Holien

Growth form: squamulose (with podetia)

Substrate: soil, decomposing wood

Site(s): Medano Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-36547

Cladonia pocillum (Ach.) Grognot

Growth form: squamulose (with podetia)

Substrate: humic soil, moss, soil, soil/moss over rock

Site(s): vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), near Needleton, vicinity of Little Molas Lake, Buffalo Pass, Hayden Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26738, BRY C-29285, BRY C-30957, BRY C-31006, BRY C-31520, BRY C-31615, BRY C-31655, BRY C-31668, BRY C-31800, BRY C-34954, BRY C-35281, BRY C-35839, BRY C-35987

Cladonia pyxidata (L.) Hoffm.

Growth form: squamulose (with podetia)

Substrate: soil, decomposing wood, soil over rock, moss over soil/wood, humic soil

Site(s): vicinity of Taylor Mesa, vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, Vallecito Creek Trail, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of La Manga Pass, between La Manga Pass and Cumbres Pass, along Mavreeso Road, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26729, BRY C-29378, BRY C-29380, BRY C-31007, BRY C-31080, BRY C-31579, BRY C-31777, BRY C-31802, BRY C-31804, BRY C-32029, BRY C-33378, BRY C-33438, BRY C-34947a BRY C-35278, BRY C-35350, BRY C-35368, BRY C-35610, BRY C-35998, BRY C-36510

Cladonia stricta (Nyl.) Nyl.

Growth form: squamulose (with podetia)

Substrate: humic soil

Site(s): vicinity of Wolf Creek Pass

Relative abundance: rare

Pollution sensitivity: sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-30960

Cladonia sulphurina (Michaux) Fr.

Growth form: squamulose (with podetia)

Substrate: decomposing wood

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, along Quartz Creek, vicinity of Martinez Creek

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26673, BRY C-26815, BRY C-31168

Collema ceraniscum Nyl.

Growth form: foliose

Substrate: soil

Site(s): Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31604

Collema coccophorum Tuck.

Growth form: squamulose

Substrate: soil

Site(s): Cannonball Mesa, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to intermediately sensitive to ozone (Ryan)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34838, BRY C-35930

Collema crispum (Hudson) F.H. Wigg.

Growth form: foliose

Substrate: rock, soil over rock

Site(s): vicinity of Kennebec Pass, The Pinnacles, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: sensitive to intermediately sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29219, BRY C-35773, BRY C-35859

Collema cristatum (L.) F.H. Wigg.

Growth form: foliose

Substrate: rock

Site(s): vicinity of Little Molas Lake

Relative abundance: rare

Pollution sensitivity: sensitive to intermediately sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29219, BRY C-35271

Collema furfuraceum (Arnold) Du Rietz

Growth form: foliose

Substrate: White Fir, Doug Fir, decomposing wood

Site(s): Vallecito Creek Trail, Williams Creek Trailhead, Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31734, BRY C-35430, BRY C-35614a

Collema fuscovirens (With.) J.R. Laundon

Growth form: foliose

Substrate: soil, moss over rock, rock

Site(s): vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, Vallecito Creek Trail

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to intermediately sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29229, BRY C-30978, BRY C-32047

Collema glebulentum (Nyl. ex Crombie) Degel.

Growth form: foliose

Substrate: moss

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: sensitive to intermediately sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29284

Collema subflaccidum Degel.

Growth form: foliose

Substrate: Ponderosa Pine

Site(s): Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to intermediately sensitive to ozone (Ryan 1990)

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-35685b

Collema tenax (Sw.) Ach.

Growth form: foliose
Substrate: soil
Site(s): Cannonball Mesa
Relative abundance: locally common
Pollution sensitivity: sensitive to intermediately sensitive to ozone
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-34918

Collema undulatum var. granulosum Degel.

Growth form: foliose
Substrate: rock
Site(s): vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass
Relative abundance: rare
Pollution sensitivity: unknown
Comments: this taxon is a new species record for Colorado
Deposition of specimens: (BYU Herbarium) BRY C-26875, BRY C-29273

Cyphelium tigillare (Ach.) Ach.

Growth form: crustose
Substrate: lignum
Site(s): vicinity of Sheep Creek Trail
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31043

Cystocoleus ebeneus (Dillwyn) Thwaites

Growth form: minutely fruticose
Substrate: rock
Site(s): V-Rock Trailhead
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-35364

Dactylina madreporiformis (Ach.) Tuck.

Growth form: fruticose
Substrate: soil
Site(s): Stony Pass
Relative abundance: locally common to abundant
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31586

Dermatocarpon intestiniforme (Körber) Hasse

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, between La Manga Pass and Cumbres Pass, Williams Creek Trailhead

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29267, BRY C-31084, BRY C-33392, BRY C-35326

Dermatocarpon lorenzianum Anders

Growth form: squamulose (umbilicate)

Substrate: rock

Site(s): Stony Pass, vicinity of Elephant Rocks

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31617, BRY C-33350

Dermatocarpon miniatum (L.) W. Mann

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, vicinity of Madden Peak, vicinity of Martinez Creek, Vallecito Creek Trail, Stony Pass, along U.S.F.S. road #534 (Goundhog Mountain), vicinity of Elephant Rocks, Cannonball Mesa, along Mavreeso Road, Bishop Rock, Buffalo Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26699, BRY C-26789, BRY C-26793, BRY C-29049, BRY C-29195, BRY C-29309, BRY C-31082, BRY C-31085, BRY C-31095, BRY C-31146, BRY C-31509a, BRY C-31624, BRY C-31705a, BRY C-32042, BRY C-33308, BRY C-34879, BRY C-34944, BRY C-35597, BRY C-35870

Dermatocarpon moulinsii (Mont.) Zahlbr.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of Chimney Rock between gate and upper parking lot

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29050

Dermatocarpon reticulatum H. Magn.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Martinez Creek, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), between La Manga Pass and Cumbres Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26739, BRY C-26799, BRY C-26893, BRY C-29167, BRY C-29311, BRY C-30976, BRY C-31147, BRY C-31509b, BRY C-31603, BRY C-31705b, BRY C-31828, BRY C-33386

Dimelaena oreina (Ach.) Norman

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings, along Forest Service road #065, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Bishop Rock, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29199, BRY C-31843, BRY C-33330, BRY C-33404, BRY C-35678, BRY C-35805, BRY C-35910, BRY C-36515

Diploschistes actinostomus (Ach.) Zahlbr.

Growth form: crustose

Substrate: rock

Site(s): near Needleton, Williams Creek Trailhead

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34864, BRY C-35332

Diploschistes muscorum (Scop.) R. Sant.

Growth form: crustose

Substrate: soil, burned lignum, soil/moss over rock, Doug Fir, detritus

Site(s): vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, Stony Pass, near Needleton, Bishop Rock, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29296, BRY C-31039, BRY C-31593, BRY C-34959, BRY C-35577, BRY C-35833, BRY C-35989, BRY C-36502

Diploschistes scruposus (Schreber) Norman

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, between La Manga Pass and Cumbres Pass, Cannonball Mesa, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26779, BRY C-33398, BRY C-34934, BRY C-35949

Diplotomma alboatrum (Hoffm.) Flotow

Growth form: crustose

Substrate: rock

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34902

Endocarpon pulvinatum Th. Fr.

Growth form: fruticose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26794

Evernia divaricata (L.) Ach.

Growth form: fruticose

Substrate: Engelmann Spruce, White Fir, Doug Fir, Subalpine Fir, Blue Spruce

Site(s): vicinity of Treasure Falls, vicinity of Kennebec Pass, vicinity of Martinez Creek, Vallecito Creek Trail, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Little Molas Lake, Williams Creek Trailhead

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26723, BRY C-29294, BRY C-31132, BRY C-31570, BRY C-31719, BRY C-35309a, BRY C-35461

Flavocetraria nivalis (L.) Kärnefelt & Thell

Growth form: foliose

Substrate: soil

Site(s): Stony Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31588

Flavoparmelia caperata (L.) Hale

Growth form: foliose

Substrate: Pinyon Pine, Ponderosa Pine, Doug Fir

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Martinez Creek, Vallecito Creek Trail

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29074, BRY C-29084, BRY C-31125, BRY C-31711

Flavopunctelia darrowi (J.W. Thomson) Hale

Growth form: foliose

Substrate: Alder

Site(s): Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31785c

Flavopunctelia flaventior (Stirton) Hale

Growth form: foliose

Substrate: Doug Fir, lignum, Ponderosa Pine, Willow, Bristlecone Pine, Engelmann Spruce

Site(s): vicinity of Sheep Creek Trail, head of Spring Gulch, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31073, BRY C-31878, BRY C-35684, BRY C-35709, BRY C-35812, BRY C-35976, BRY C-36464

Flavopunctelia praesignis (Nyl.) Hale

Growth form: foliose

Substrate: Alder

Site(s): Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31785b

Flavopunctelia soledica (Nyl.) Hale

Growth form: foliose

Substrate: lignum, Pinyon Pine, Gambel Oak, Mexican White Pine, Rocky Mountain Juniper, Bristlecone Pine, Ponderosa Pine, Engelmann Spruce, rock, Limber Pine

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road # 065, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Ferris Canyon Campground, vicinity of Sheep Creek Trail, Vallecito Creek Trail, Head of Spring Gulch, vicinity Elephant Rocks, Bishop Rock, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: rock is an unusual substrate for this species

Deposition of specimens: (BYU Herbarium) BRY C-26858, BRY C-26868, BRY C-26884, BRY C-29073, BRY C-29148, BRY C-29212, BRY C-31048, BRY C-31797, BRY C-31861, BRY C-31865, BRY C-32097, BRY C-33345, BRY C-33359, BRY C-35573, BRY C-35757b, BRY C-35814b, BRY C-36473

Fulgensia desertorum (Tomin) Poelt

Growth form: squamulose

Substrate: soil

Site(s): Cannonball Mesa

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34846

Fuscopannaria leucophaea (Vahl) P.M. Jorg.

Growth form: squamulose

Substrate: humic soil, soil over rock

Site(s): vicinity of Kennebec Pass, Vallecito Creek Trail, Williams Creek Trailhead

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29326, BRY C-31681, BRY C-35340

Fuscopannaria leucosticta (Tuck.) P.M. Jorg.

Growth form: squamulose

Substrate: humic soil, soil over rock, moss over soil

Site(s): vicinity of Kennebec Pass, Vallecito Creek Trail, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29326, BRY C-31681, BRY C-35934

Glypholecia scabra (Pers.) Müll. Arg.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Cannonball Mesa

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34931

Heppia lutosa (Ach.) Nyl.

Growth form: squamulose

Substrate: soil

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34875

Heterodermia diademata (Taylor) D.D. Awasthi

Growth form: foliose

Substrate: Pinyon Pine

Site(s): vicinity of Chimney Rock between gate and upper parking lot

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29078

Heterodermia microphylla (Kurok.) Skorepa

Growth form: foliose

Substrate: moss over rock

Site(s): Bishop Rock

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-35692

Heterodermia speciosa (Wulfen) Trevisan

Growth form: foliose

Substrate: moss, lichen over rock, moss over rock, Doug Fir

Site(s): vicinity of Martinez Creek, Vallecito Creek Trail, Williams Creek Trailhead, The Pinnacles, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31184, BRY C-32034, BRY C-35348, BRY C-35772, BRY C-35821a

Hypocenomyce friesii (Ach.) P. James & Gotth. Schneider

Growth form: squamulose

Substrate: burned lignum

Site(s): vicinity of Sheep Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31036

Hypogymnia austerodes (Nyl.) Räsänen

Growth form: foliose

Substrate: Engelmann Spruce, Subalpine Fir, Doug Fir, White Fir, Mexican White Pine, lignum, Bristlecone Pine, Blue Spruce

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Treasure Falls, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, near Needleton, Williams Creek Trailhead, The Pinnacles, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26831, BRY C-29355, BRY C-29373, BRY C-31072, BRY C-31126, BRY C-31128, BRY C-31761, BRY C-31790, BRY C-31792, BRY C-31862, BRY C-31866, BRY C-31885, BRY C-35166, BRY C-35410, BRY C-35725a, BRY C-35823b

Hypogymnia bitteri (Lynge) Ahti

Growth form: foliose

Substrate: Doug Fir

Site(s): The Pinnacles

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35750b

Hypogymnia physodes (L.) Nyl.

Growth form: foliose

Substrate: lignum, Mexican White Pine

Site(s): Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31759, BRY C-31796

Imshaugia placododia (Ach.) S. F. Meyer

Growth form: foliose

Substrate: Ponderosa Pine

Site(s): vicinity of Sheep Creek Trail, near Needleton

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-30999, BRY C-35174

Lasallia papulosa (Ach.) Llano

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Vallecito Creek Trail, vicinity of Elephant Rocks, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31706, BRY C-33713, BRY C-35954

Lasallia pustulata (L.) Mérat

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of Martinez Creek

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: observed in the field, but not collected.

Lecanora argopholis (Ach.) Ach.

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, Vallecito Creek Trail, Stony Pass, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, near Needleton, Bishop Rock, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26798, BRY C-26904, BRY C-29306, BRY C-31607, BRY C-31832, BRY C-31835, BRY C-32064, BRY C-32073, BRY C-33324, BRY C-33418, BRY C-34881, BRY C-34986, BRY C-35644, BRY C-35953

Lecanora bicincta Ramond

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, V-Rock Trailhead, Bishop Rock, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-26771, BRY C-31825, BRY C-33329, BRY C-33389, BRY C-35370, BRY C-35669, BRY C-35947

Lecanora carpinea (L.) Vainio

Growth form: crustose

Substrate: Gambel Oak, Doug Fir, Willow, Limber Pine

Site(s): vicinity of Sheep Creek Trail, Williams Creek Trailhead, V-Rock Trailhead, Hayden Pass, Medano Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31059, BRY C-35435, BRY C-35466, BRY C-35966b, BRY C-36529a

Lecanora cenisia Ach.

Growth form: crustose

Substrate: rock, lignum

Site(s): vicinity of Martinez Creek, vicinity of Taylor Mesa, Vallecito Creek Trail, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, near Needleton, V-Rock Trailhead

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: lignum is an unusual substrate for this species

Deposition of specimens: (BYU Herbarium) BRY C-26730, BRY C-31691, BRY C-31519, BRY C-31871, BRY C-32068, BRY C-33317, BRY C-33333, BRY C-34962, BRY C-35373

Lecanora chlarotera Nyl.

Growth form: crustose

Substrate: *Acer glabrum*

Site(s): Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32057

Lecanora crenulata Hook.

Growth form: crustose (absent)

Substrate: rock

Site(s): vicinity of Sheep Creek Trail, Williams Creek Trailhead, V-Rock Trailhead, Hayden Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-36423

Lecanora dispersa (Pers.) Sommerf.

Growth form: crustose (absent)

Substrate: rock

Site(s): Bishop Rock

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35641

Lecanora garovaglii (Körber) Zahlbr.

Growth form: crustose (with effigurate margins)

Substrate: rock, lignum

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Benchmark Lookout, head of Spring Gulch, vicinity of Elephant Rocks, Cannonball Mesa, vicinity of Little Molas Lake, Bishop Rock, The Pinnacles, Buffalo Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: lignum is an unusual substrate for this species

Deposition of specimens: (BYU Herbarium) BRY C-26921, BRY C-29037, BRY C-31837, BRY C-33318, BRY C-34852, BRY C-35260, BRY C-35653, BRY C-35803, BRY C-35862

Lecanora hageni (Ach.) Ach.

Growth form: crustose (lacking)

Substrate: Narrowleaf Cottonwood, Gambel Oak, detritus, Engelmann Spruce, White Fir, *Selaginella densa*, lignum, Quaking Aspen

Site(s): vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, vicinity of Kennebec Pass, vicinity of Madden Peak, vicinity of Martinez Creek, Stony Pass, Cannonball Mesa, near Needleton, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26842, BRY C-26914b, BRY C-29302, BRY C-31101, BRY C-31191, BRY C-31595, BRY C-34859, BRY C-35194, BRY C-36453a

Lecanora impudens Degel.

Growth form: crustose

Substrate: Gambel Oak, White Fir, Narrowleaf Cottonwood, Subalpine Fir

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Sheep Creek Trail, Vallecito Creek Trail, near Needleton, Williams Creek Trailhead, Hayden Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29088, BRY C-31061, BRY C-31741, BRY C-35195, BRY C-35402, BRY C-36445a

Lecanora meridionalis H. Magn.

Growth form: crustose

Substrate: lignum, Doug Fir, Pinyon Pine, Gambel Oak, White Fir, Southern White Pine, Limber Pine

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, along Quartz Creek, vicinity of Ferris Canyon Campground, vicinity of Treasure Falls, vicinity of Martinez Creek, Vallecito Creek Trail, near Needleton, Williams Creek Trailhead, Hayden Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26678, BRY C-26855, BRY C-26870, BRY C-26885, BRY C-29152, BRY C-29209, BRY C-29358, BRY C-31114, BRY C-31736, BRY C-35184, BRY C-35399, BRY C-35966a, BRY C-36477

Lecanora mughicola Nyl.

Growth form: crustose

Substrate: lignum

Site(s): vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, along U.S.F.S. Rd. #534 (Groundhog Mountain)

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29279, BRY C-31044, BRY C-31549

Lecanora muralis (Schreber) Rabenh.

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, head of Spring Gulch, vicinity of Elephant Rocks, Cannonball Mesa, vicinity of Little Molas Lake, The Pinnacles, Buffalo Pass, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31032, BRY C-31811, BRY C-33339, BRY C-34895, BRY C-35315, BRY C-35789, BRY C-35888, BRY C-36422

Lecanora novomexicana H. Magn.

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Martinez Creek, vicinity of Madden Peak, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Stony Pass, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, Cannonball Mesa, vicinity of Little Molas Lake, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26766, BRY C-26902, BRY C-29175, BRY C-29243, BRY C-29394, BRY C-31157, BRY C-33335, BRY C-34898, BRY C-35317, BRY C-35656, BRY C-35784, BRY C-35890, BRY C-31510, BRY C-31516, BRY C-31640, BRY C-36404, BRY C-36521

Lecanora phaedrophthalma Poelt

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Benchmark Lookout, vicinity of Wolf Creek Pass, Stony Pass, The Pinnacles

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26924, BRY C-29036, BRY C-29116, BRY C-29388, BRY C-31628, BRY C-35807

Lecanora polytropa (Hoffm.) Rabenh.

Growth form: crustose (lacking)

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Stony Pass, along U.S.F.S. Rd. #534 (Groundhog Mountain), between La Manga Pass and Cumbres Pass, near Needleton, vicinity of Little Molas Lake, V-Rock Trailhead, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26747, BRY C-26788, BRY C-29254, BRY C-29376, BRY C-31543, BRY C-31639, BRY C-33424, BRY C-34979, BRY C-35250, BRY C-35356, BRY C-36522

Lecanora rupicola (L.) Zahlbr.

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Vallecito Creek Trail, Stony Pass, along U.S.F.S. road #534 (Groundhog Mountain), Williams Creek Trailhead, The Pinnacles, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26775, BRY C-29287, BRY C-30943, BRY C-31506, BRY C-31521, BRY C-31611, BRY C-32071, BRY C-35337, BRY C-35794, BRY C-36554

Lecanora saligna (Schrader) Zahlbr.

Growth form: crustose (absent)

Substrate: lignum, decomposing wood

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26825, BRY C-30947, BRY C-31046, BRY C-31557, BRY C-35285, BRY C-35392, BRY C-35470, BRY C-35607, BRY C-35718, BRY C-35842, BRY C-35992, BRY C-36542

Lecanora thallophila H. Magn.

Growth form: crustose (absent)

Substrate: *Dermatocarpon* spp.

Site(s): vicinity of Sheep Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31004

Lecanora valesiaca (Müll. Arg.) Stizenb.

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Ferris Canyon Campground, Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26906, BRY C-29034, BRY C-29176, BRY C-35629

Lecanora varia (Hoffm.) Ach.

Growth form: crustose (absent)

Substrate: lignum, Engelmann Spruce

Site(s): vicinity of Wolf Creek Pass, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, head of Spring Gulch, vicinity of Little Molas Lake, The Pinnacles, Hayden Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29278, BRY C-30993, BRY C-31874, BRY C-35300, BRY C-35716, BRY C-36436

Lecidea atrobrunnea (Ramond ex Lam. & DC.) Schaerer

Growth form: crustose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Martinez Creek, vicinity of Wolf Creek Pass, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Benchmark Lookout, vicinity of Sheep Creek Trail, vicinity of Madden Peak, Vallecito Creek Trail, Stony Pass, head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26692, BRY C-26765, BRY C-26790, BRY C-26931, BRY C-29027, BRY C-29131, BRY C-29180, BRY C-29246, BRY C-29392, BRY C-30937, BRY C-31031, BRY C-31089, BRY C-31151, BRY C-31508, BRY C-31534, BRY C-31606, BRY C-31614, BRY C-31689, BRY C-31815, BRY C-32072, BRY C-33331, BRY C-33391, BRY C-34965, BRY C-35243, BRY C-35342, BRY C-35361, BRY C-35654, BRY C-35783, BRY C-35893, BRY C-36403, BRY C-36523

Lecidea leucothallina Arnold

Growth form: crustose

Substrate: rock

Site(s): vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Taylor Mesa, Stony Pass, along U.S.F.S. road #534 (Groundhog Mountain)

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26693, BRY C-26694, BRY C-29256, BRY C-31528, BRY C-31540, BRY C-31618

Lecidea lapicida (Ach.) Ach.

Growth form: crustose

Substrate: rock

Site(s): V-Rock Trailhead

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35366

Lecidea saxosa Anderson

Growth form: crustose

Substrate: rock

Site(s): V-Rock Trailhead

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35369

Lecidea tessellata Flörke

Growth form: crustose (lacking)

Substrate: rock

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, vicinity of Benchmark Lookout, vicinity of Martinez Creek, Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26732, BRY C-26768, BRY C-26786, BRY C-26895, BRY C-26898, BRY C-26926, BRY C-29033, BRY C-29120, BRY C-29225, BRY C-29245, BRY C-30980, BRY C-31152, BRY C-31505, BRY C-31530, BRY C-31623, BRY C-31638, BRY C-31812, BRY C-32024, BRY C-33309, BRY C-33390, BRY C-34892, BRY C-34969, BRY C-35258, BRY C-35330, BRY C-35362, BRY C-35650, BRY C-35781, BRY C-35878, BRY C-36412, BRY C-36516

Lecidella euphorea (Flörke) Hertel

Growth form: crustose

Substrate: lignum, decomposing wood, White Fir, Doug Fir

Site(s): vicinity of Kennebec Pass, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29328, BRY C-35233, BRY C-35294, BRY C-35388, BRY C-35487, BRY C-35722, BRY C-35845, BRY C-36530a

Lecidella stigmathea (Ach.) Hertel & Leuckert

Growth form: crustose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, vicinity of Benchmark Lookout, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Martinez Creek, Vallecito Creek Trail, Stony Pass, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26695, BRY C-26776, BRY C-26791, BRY C-26879, BRY C-26923, BRY C-29030, BRY C-29247, BRY C-30936, BRY C-30981, BRY C-31024, BRY C-31153, BRY C-31518, BRY C-31527, BRY C-31613, BRY C-32065, BRY C-33303, BRY C-33407, BRY C-34880, BRY C-34978, BRY C-35247, BRY C-35338, BRY C-35355, BRY C-35627, BRY C-35779, BRY C-35886, BRY C-36409

Lecidella viridans (Flotow) Körber

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Kennebec Pass, Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26783, BRY C-29252, BRY C-31659

Lecidoma demissum (Rutstr.) Gotth. Schneider & Hertel.

Growth form: squamulose

Substrate: soil

Site(s): Stony Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31666

Lepraria incana (L.) Ach.

Growth form: crustose (leprose)
Substrate: soil
Site(s): along U.S.F.S. Rd. #534 (Groundhog Mountain)
Relative abundance: rare
Pollution sensitivity: unknown
Comments: this taxon is a new species record for Colorado
Deposition of specimens: (BYU Herbarium) BRY C-31580

Leptoloma diffusum J.R. Laundon var. diffusum

Growth form: crustose (leprose)
Substrate: decomposing wood
Site(s): Vallecito Creek Trail
Relative abundance: rare
Pollution sensitivity: unknown
Comments: this taxon is a new species record for Colorado
Deposition of specimens: (BYU Herbarium) BRY C-32062

Leptogium arsenei Sierk

Growth form: foliose
Substrate: rock, decomposing wood
Site(s): Williams Creek Trailhead, Bishop Rock
Relative abundance: rare to locally common
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31682, BRY C-32026, BRY C-32031, BRY C-32038, BRY C-35325, BRY C-35614b

Leptogium denticulatum Tuck.

Growth form: foliose
Substrate: rock, moss over rock
Site(s): Vallecito Creek Trail
Relative abundance: rare to locally common
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31682, BRY C-32026, BRY C-32031, BRY C-32038

Leptogium furfuraceum (Harm.) Sierk

Growth form: foliose
Substrate: Gambel Oak, Quaking Aspen, Narrowleaf Cottonwood, moss over rock
Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Sheep Creek Trail, Vallecito Creek Trail, Williams Creek Trailhead, Buffalo Pass
Relative abundance: rare to locally common
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-29091, BRY C-31051, BRY C-31787b, BRY C-35405, BRY C-35914

Leptogium gelatinosum (With.) J.R.Laundon

Growth form: foliose
Substrate: rock
Site(s): Bishop Rock
Relative abundance: rare to locally common
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-35694

Leptogium hirsutum Sierk

Growth form: foliose
Substrate: moss over rock
Site(s): Vallecito Creek Trail
Relative abundance: rare to locally common
Pollution sensitivity: unknown
Comments: none
Deposition sensitivity: (BYU Herbarium) BRY C-32033

Leptogium lichenoides (L.) Zahlbr.

Growth form: foliose
Substrate: moss over rock
Site(s): vicinity of Sheep Creek Trail
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-31034, BRY C-31078

Leptogium saturninum (Dickson) Nyl.

Growth form: foliose (umbilicate)
Substrate: Engelmann Spruce, Doug Fir, moss, rock, Gambel Oak, Quaking Aspen, Ponderosa Pine, moss over rock
Site(s): vicinity of Taylor Mesa, vicinity of Treasure Falls, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Vallecito Creek Trail, near Needleton, Bishop Rock
Relative abundance: locally common
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-26666, BRY C-26757, BRY C-29327, BRY C-29332, BRY C-31052, BRY C-31130, BRY C-31148, BRY C-31702, BRY C-31787a, BRY C-32039, BRY C-34989, BRY C-35683

Leptogium tenuissimum (Dickson) Körber

Growth form: foliose
Substrate: soil
Site(s): Medano Pass
Relative abundance: rare
Pollution sensitivity: unknown
Comments: none
Deposition of specimens: (BYU Herbarium) BRY C-36501

Leptogium teretiusculum (Wallr.) Arnold

Growth form: foliose

Substrate: Narrowleaf Cottonwood

Site(s): Williams Creek Trailhead

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31682, BRY C-32026, BRY C-32031, BRY C-32038, BRY C-35406

Lichinella nigrifella (Lettau) Moreno & Egea

Growth form: foliose

Substrate: rock

Site(s): vicinity of Martinez Creek

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C31140

Lobothallia alphoplaca (Wahlenb.) Hafellner

Growth form: crustose (with effigurate margins)

Substrate: rock, soil

Site(s): vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness

Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Benchmark Lookout, vicinity of Kennebec Pass, Vallecito Creek Trail, Stony Pass, head of Spring Gulch, vicinity of Elephant Rocks, Cannonball Mesa, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26767, BRY C-26932, BRY C-29031, BRY C-29125, BRY C-29178, BRY C-29179, BRY C-29258, BRY C-29259, BRY C-31673, BRY C-31673, BRY C-31830, BRY C-33338, BRY C-34888, BRY C-34988, BRY C-35245, BRY C-35331, BRY C-35636, BRY C-35790, BRY C-35872

Lobothallia praeradiosa (Nyl.) Hafellner

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: observed in the field, but not collected.

Lobothallia radiosa (Hoffm.) Hafellner

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31648

Megaspora verrucosa (Ach.) Hafellner & V. Wirth

Growth form: crustose

Substrate: Juniper, Pinyon Pine, Gambel Oak, Subalpine Fir, detritus, Narrowleaf

Cottonwood, Bristlecone Pine

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Ferris Canyon Campground, vicinity of Treasure Falls, vicinity of Sheep Creek Trail, Stony Pass, Williams Creek Trailhead, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26863, BRY C-26891, BRY C-29187, BRY C-29204, BRY C-29342, BRY C-31057, BRY C-31645, BRY C-35403, BRY C-35813

Melanelia elegantula (Zahlbr.) Essl.

Growth form: foliose

Substrate: rock, Juniper, lignum, Gambel Oak, Sage, Pinyon Pine, Engelmann Spruce, soil over rock, White Fir, Quaking Aspen, Doug Fir, Blue Spruce, Willow, Ponderosa Pine

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Elephant Rocks, near Needleton, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26856, BRY C-26865, BRY C-26887a, BRY C-26892a, BRY C-29071, BRY C-29097, BRY C-29103, BRY C-29110, BRY C-29145, BRY C-29164, BRY C-29186, BRY C-29189, BRY C-29207, BRY C-29292, BRY C-31002, BRY C-31143, BRY C-31190, BRY C-31565b, BRY C-33369, BRY C-35214, BRY C-35454, BRY C-35464, BRY C-35686b, BRY C-35705, BRY C-35901

Melanelia exasperatula (Nyl.) Essl.

Growth form: foliose

Substrate: Gambel Oak, Pinyon Pine, Engelmann Spruce (twigs & bark), Doug Fir, rock, Subalpine Fir, lignum, Quaking Aspen, Rocky Mountain Maple, Ponderosa Pine

Site(s): vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Treasure Falls, vicinity of Sheep Creek Trail, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), between La Manga Pass and Cumbres Pass, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26679b, BRY C-26727a, BRY C-26827, BRY C-26887c, BRY C-26892b, BRY C-29066, BRY C-29111, BRY C-29208, BRY C-29291, BRY C-29341, BRY C-29362, BRY C-30997, BRY C-31562, BRY C-31565a, BRY C-31882, BRY C-31884b, BRY C-31886, BRY C-33431a, BRY C-34948, BRY C-34996, BRY C-35296, BRY C-35417, BRY C-35574b, BRY C-35749, BRY C-35816b, BRY C-36431, BRY C-36485

Melanelia fuliginosa (Fr. ex Duby) Essl.

Growth form: foliose

Substrate: rock

Site(s): Head of Spring Gulch, between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1991)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32098, BRY C-33423

Melanelia panniformis (Nyl.) Essl.

Growth form: foliose

Substrate: rock

Site(s): vicinity of Little Molas Lake

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35267

Melanelia solediata (Ach.) Goward & Ahti

Growth form: foliose

Substrate: rock, Doug Fir

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, between La Manga Pass and Cumbres Pass, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33393, BRY C-35824

Melanelia stygia (L.) Essl.

Growth form: foliose

Substrate: rock

Site(s): Bishop Rock

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35677b

Melanelia subargentifera (Nyl.) Essl.

Growth form: foliose

Substrate: rock, moss/soil over rock

Site(s): Vallecito Creek Trail, Bishop Rock, The Pinnacles, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31696, BRY C-35691, BRY C-35766,
BRY C-35945

Melanelia subaurifera (Nyl.) Essl.

Growth form: foliose

Substrate: rock

Site(s): between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33403

Melanelia subelegantula (Essl.) Essl.

Growth form: foliose

Substrate: Rocky Mountain Juniper, lignum

Site(s): vicinity of Elephant Rocks, Bishop Rock

Relative abundance: rare

Pollution sensitivity: sensitive to sulfur dioxide

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-33360, BRY C-35621

Melanelia subolivacea (Nyl. in Hasse) Essl.

Growth form: foliose

Substrate: Gambel Oak, Pinyon Pine, Ponderosa Pine, Engelmann Spruce, Doug Fir, White Fir, Acer glabrum, Alder, Bristlecone Pine, Limber Pine

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, vicinity of Treasure Falls, vicinity of Madden Peak, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, between La Manga Pass and Cumbres Pass, Cannonball Mesa, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, V-Rock Trailhead, Bishop Rock, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: common to locally abundant

Pollution sensitivity: intermediately sensitive to sulfur dioxide and ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26679a, BRY C-26827a, BRY C-26869, BRY C-26887b, BRY C-26913, BRY C-29067, BRY C-29083, BRY C-29096, BRY C-29109, BRY C-29114, BRY C-29206, BRY C-29362, BRY C-31035, BRY C-31063, BRY C-31099, BRY C-31118, BRY C-31189, BRY C-31782, BRY C-31884a, BRY C-32060, BRY C-33428, BRY C-34869, BRY C-34939, BRY C-35179a, BRY C-35303, BRY C-35480, BRY C-35588, BRY C-35811, BRY C-35964, BRY C-36463

Melanelia tominii (Oksner) Essl.

Growth form: foliose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, Vallecito Creek Trail, Head of Spring Gulch, Cannonball Mesa, near Needleton, Bishop Rock, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29163, BRY C-31672, BRY C-31776, BRY C-32080, BRY C-32093, BRY C-34905, BRY C-34981, BRY C-35600, BRY C-35898

Micarea lignaria (Ach.) Hedl.

Growth form: crustose

Substrate: detritus

Site(s): vicinity of Wolf Creek Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29381

Mycobilimbia berengeriana (Massal.) Hafellner & V. Wirth

Growth form: crustose

Substrate: moss, soil

Site(s): vicinity of Martinez Creek, vicinity of La Manga Pass, Hayden Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31178, BRY C-33071, BRY C-35995

Mycocalicium subtile (Pers.) Szat.

Growth form: thallus endoxylic

Substrate: lignum

Site(s): vicinity of Kennebec Pass, vicinity of Madden Peak

Relative abundance: rare

Pollution sensitivity: unknown

Comments: technically, this taxon is not lichenized; however, it is often classified with the lichens

Deposition of specimens: (BYU Herbarium) BRY C-29281, BRY C-31104

Neofuscelia occidentalis (Essl.) Essl.

Growth form: foliose

Substrate: rock

Site(s): vicinity of Elephant Rocks

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-33310

Nephroma bellum (Sprengel) Tuck.

Growth form: foliose

Substrate: moss over decomposing wood

Site(s): Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32063

Nephroma helveticum Ach. subsp. helveticum

Growth form: foliose

Substrate: moss over rock

Site(s): Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35957

Nephroma laevigatum Ach.

Growth form: foliose

Substrate: White Fir

Site(s): vicinity of Martinez Creek

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31129

Nephroma parile (Ach.) Ach.

Growth form: foliose

Substrate: Doug Fir, moss over rock, soil, moss over decomposing wood, rock, lignum, moss over bark,

Site(s): vicinity of Treasure Falls, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Vallecito Creek Trail, along Mavreeso Road, near Needleton, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26665, BRY C-29315, BRY C-31066, BRY C-31144, BRY C-31164, BRY C-31165, BRY C-31166, BRY C-31175, BRY C-31183, BRY C-31676, BRY C-32030, BRY C-34947b, BRY C-34956, BRY C-35327, BRY C-35375, BRY C-35616

Normandina pulchella (Borrer) Nyl.

Growth form: squamulose

Substrate: moss over rock

Site(s): Bishop Rock

Relative abundance: rare

Pollution sensitivity: sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1989)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35689a

Ochrolechia androgyna (Hoffm.) Arnold

Growth form: crustose

Substrate: Doug Fir, lignum

Site(s): vicinity of Sheep Creek Trail, Vallecito Creek Trail, head of Spring Gulch, Buffalo Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to sulfur dioxide (Wetmore 1987)

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31071, BRY C-31713, BRY C-31869, BRY C-35825, BRY C-36535

Ochrolechia pallescens (L.) Massal.

Growth form: crustose

Substrate: *Acer glabrum*

Site(s): Vallecito Creek Trail

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32056

Ochrolechia upsaliensis (L.) A. Massal.

Growth form: crustose

Substrate: soil, over *Selaginella densa*

Site(s): Stony Pass, The Pinnacles, Buffalo Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31594, BRY C-35740, BRY C-35937

Omphalora arizonica (Tuck. ex Willey) T. Nash & J. Hafellner

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): The Pinnacles

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35804

Pannaria pezizoides (Weber) Trevisan

Growth form: squamulose

Substrate: humic soil, moss

Site(s): vicinity of Martinez Creek, Lizard Head Wilderness Area along Cross Mountain Trail
approximately 1 mile SW of Lizard Head Peak, vicinity of Kennebec Pass, vicinity of Wolf
Creek Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26833, BRY C-29238, BRY C-30949,
BRY C-31179

Pannaria tavaresii P.M. Jørg.

Growth form: foliose

Substrate: moss over rock, rock

Site(s): Vallecito Creek Trail, Williams Creek Trailhead, Bishop Rock, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31674, BRY C-32032, BRY C-35324,
BRY C-35689b, BRY C-35920

Parmelia saxatilis (L.) Ach.

Growth form: foliose

Substrate: moss over rock, rock

Site(s): between La Manga Pass and Cumbres Pass, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33416, BRY C-35907

Parmelia sulcata Taylor

Growth form: foliose

Substrate: Pinyon Pine, Subalpine Fir, Doug Fir, Gambel Oak, Acer glabrum, White Fir, lignum, Alder, Mexican White Pine,

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Treasure Falls, vicinity of Martinez Creek, Vallecito Creek Trail, near Needleton, Williams Creek Trailhead, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide; sensitive to intermediately sensitive to ozone; sensitive to fluoride (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29068, BRY C-29345, BRY C-30968, BRY C-31060, BRY C-31123, BRY C-31730, BRY C-31739, BRY C-31752b, BRY C-31783, BRY C-31795, BRY C-32053, BRY C-32081, BRY C-35169, BRY C-35427, BRY C-35725b, BRY C-35823a, BRY C-36534

Parmelinopsis minarum (Vainio) Elix & Hale

Growth form: foliose

Substrate: Doug Fir, White Fir

Site(s): Vallecito Creek Trail

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31715, BRY C-31742, BRY C-32082

Parmeliopsis ambigua (Wulfen) Nyl.

Growth form: foliose

Substrate: decomposing wood, Engelmann Spruce, Doug Fir, Ponderosa Pine, lignum

Site(s): vicinity of Martinez Creek, vicinity Wolf Creek Pass, along Quartz Creek, Vallecito Creek Trail, near Needleton, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26671, BRY C-30951, BRY C-31112, BRY C-31748, BRY C-31760, BRY C-35165, BRY C-35868, BRY C-35997, BRY C-36560

Parmeliopsis hyperopta (Ach.) Arnold

Growth form: foliose

Substrate: decomposing wood, Engelmann Spruce, Doug Fir, lignum

Site(s): vicinity of Martinez Creek, vicinity Wolf Creek Pass, along Quartz Creek, Buffalo Pass, Hayden Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26672, BRY C-30944, BRY C-30953, BRY C-31113, BRY C-35867, BRY C-35996

Peccania arizonica (Tuck.) Herre

Growth form: fruticose

Substrate: soil over rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29165

Peltigera apthosa (L.) Willd.

Growth form: foliose

Substrate: humic soil, moss

Site(s): vicinity of Martinez Creek, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, below Kennebec Pass, head of Spring Gulch, vicinity of La Manga Pass, near Needleton

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26753, BRY C-26818, BRY C-29288, BRY C-31181, BRY C-31809, BRY C-33376, BRY C-35201

Peltigera canina (L.) Willd.

Growth form: foliose

Substrate: moss over wood, decomposing wood, humic soil, moss, moss/soil over rock

Site(s): vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Ferris Canyon Campground, vicinity of Treasure Falls, along Quartz Creek, vicinity of Wolf Creek Pass, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, between La Manga Pass and Cumbres Pass, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead

Relative abundance: locally common to abundant

Pollution sensitivity: sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26667, BRY C-26686, BRY C-26810, BRY C-26877, BRY C-30955, BRY C-31180, BRY C-31768, BRY C-31807, BRY C-31823, BRY C-33437, BRY C-34951, BRY C-34955, BRY C-35277, BRY C-35383

Peltigera didactyla (With.) J.R. Laundon

Growth form: foliose

Substrate: moss over soil

Site(s): Buffalo Pass

Relative abundance: rare

Pollution sensitivity: sensitive to ozone

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35931

Peltigera malacea (Ach.) Funck

Growth form: foliose

Substrate: moss over soil, humic soil

Site(s): vicinity of Little Molas Lake

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35284

Peltigera neckeri Hepp *ex* Müll Arg.

Growth form: foliose

Substrate: moss, moss over decomposing wood, soil

Site(s): Vallecito Creek Trail, Stony Pass, vicinity of Sheep Creek Trail, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-30975, BRY C-31662, BRY C-31769, BRY C-35866

Peltigera polydactylon (Necker) Hoffm.

Growth form: foliose

Substrate: moss, moss over rock, decomposing wood, moss over wood, humic soil

Site(s): along Quartz Creek, vicinity of Kennebec Pass, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, head of Spring Gulch, near Needleton, Williams Creek Trailhead, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26687, BRY C-29286, BRY C-31070, BRY C-31167, BRY C-31174, BRY C-31808, BRY C-35202, BRY C-35382, BRY C-35841

Peltigera praetextata (Flörke *ex* Sommerf.) Zopf

Growth form: foliose

Substrate: moss over decomposing wood, humic soil, soil, moss

Site(s): vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Stony Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31076, BRY C-31081, BRY C-31172, BRY C-31667, BRY C-31670

Peltigera rufescens (Weiss) Humb.

Growth form: foliose

Substrate: soil, moss, soil over rock, moss over soil

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of Martinez Creek, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, along Quartz Creek, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Stony Pass, Head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of La Manga Pass, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: sensitive to intermediately sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26670, BRY C-26743, BRY C-26808, BRY C-26819, BRY C-26820, BRY C-29105, BRY C-29236, BRY C-30958, BRY C-31578, BRY C-31589, BRY C-31803, BRY C-32086, BRY C-33377, BRY C-35204, BRY C-35257, BRY C-35381, BRY C-35491, BRY C-35617, BRY C-35713, BRY C-35864, BRY C-35981, BRY C-36500

Peltigera venosa (L.) Hoffm.

Growth form: foliose

Substrate: soil, moss, humic soil

Site(s): vicinity of Martinez Creek, vicinity of Wolf Creek Pass, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, below Kennebec Pass, vicinity of Wolf Creek Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26809, BRY C-29289, BRY C-30954, BRY C-31176

Peltula obscurans var. hassei (Zahlbr.) Wetmore

Growth form: squamulose

Substrate: soil

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-34841

Pertusaria saximontana Wetmore

Growth form: crustose

Substrate: Bristlecone Pine, lignum

Site(s): head of Spring Gulch

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31855

Phaeophyscia cernohorskyi (Nádv.) Essl.

Growth form: foliose

Substrate: Narrowleaf Cottonwood, Gambel Oak

Site(s): vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26838, BRY C-26861, BRY C-26936

Phaeophyscia ciliata (Hoffm.) Moberg

Growth form: foliose

Substrate: White Fir, Subalpine Fir, Engelmann Spruce, moss/soil over rock, Quaking Aspen

Site(s): Vallecito Creek Trail, along U.S.F.S. Rd. #534 (Groundhog Mountain), near
Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, The Pinnacles,
Medano Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31569, BRY C-31746b, BRY C-35241,
BRY C-35298, BRY C-35329, BRY C-35765, BRY C-36487

Phaeophyscia constipata (Norrlin & Nyl.) Moberg

Growth form: foliose

Substrate: rock, moss over rock, over *Selaginella densa*

Site(s): Head of Spring Gulch, Bishop Rock, Medano Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32091, BRY C-35687, BRY C-36505a

Phaeophyscia decolor (Kashiw.) Essl.

Growth form: foliose

Substrate: rock, soil/moss over rock

Site(s): near Needleton, V-Rock Trailhead, The Pinnacles

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34990, BRY C-35372, BRY C-35769

Phaeophyscia endococcina (Körber) Moberg

Growth form: foliose

Substrate: rock, Gambel Oak, soil over rock, moss over rock

Site(s): vicinity of Taylor Mesa, vicinity of Benchmark Lookout, vicinity of Sheep Creek Trail,
Vallecito Creek Trail, Head of Spring Gulch

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26697, BRY C-26698, BRY C-26915,
BRY C-31033, BRY C-31055, BRY C-32035, BRY C-32037, BRY C-32079,
BRY C-32090

Phaeophyscia hispidula (Ach.) Essl.

Growth form: foliose

Substrate: rock, moss over rock, moss over soil

Site(s): Vallecito Creek Trail, Williams Creek Trailhead, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31773, BRY C-31779, BRY C-32027, BRY C-32044, BRY C-35353, BRY C-35940

Phaeophyscia kairamoi (Vainio) Moberg

Growth form: foliose

Substrate: rock, moss over rock

Site(s): vicinity of Little Molas Lake, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35264, BRY C-35915

Phaeophyscia orbicularis (Necker) Moberg

Growth form: foliose

Substrate: Boxelder Maple, Subalpine Fir, Gambel Oak, Quaking Aspen, Willow

Site(s): vicinity of Ferris Canyon Campground, vicinity of Treasure Falls, vicinity of Sheep Creek Trail, Williams Creek Trailhead, The Pinnacles

Relative abundance: rare

Pollution sensitivity: sensitive to ozone; intermediately sensitive to sulfur dioxide; sensitive to fluoride (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26847, BRY C-29350, BRY C-31062, BRY C-35411, BRY C-35710

Phaeophyscia nigricans (Flörke) Moberg

Growth form: foliose

Substrate: rock, Willow

Site(s): vicinity of Ferris Canyon Campground, Vallecito Creek Trail, The Pinnacles

Relative abundance: rare to locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26874, BRY C-31693, BRY C-35707

Phaeophyscia sciastra (Ach.) Moberg

Growth form: foliose

Substrate: Gambel Oak, lignum, Boxelder Maple, rock, soil over rock, detritus

Site(s): vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Martinez Creek, near Needleton, Bishop Rock, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26846, BRY C-26852, BRY C-29113, BRY C-31185, BRY C-34974, BRY C-35670, BRY C-36508

Phaeorrhiza nimbosa (Fr.) H. Mayrh.

Growth form: squamulose

Substrate: soil, detritus

Site(s): vicinity of Kennebec Pass, Stony Pass, Hayden Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29298, BRY C-31592, BRY C-31596, BRY C-31633, BRY C-35991

Phaeorrhiza sareptana (Tomin) H. Mayrh. & Poelt

Growth form: squamulose

Substrate: soil, detritus

Site(s): vicinity of Kennebec Pass, Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29297, BRY C-31657

Physcia adscendens (Fr.) H. Olivier

Growth form: foliose

Substrate: Narrowleaf Cottonwood, Gambel Oak, Engelmann Spruce, Bristlecone Pine, Rocky Mountain Maple, Blue Spruce, White Fir, Rocky Mountain Juniper, Ouaking Aspen

Site(s): vicinity of Madden Peak, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, vicinity of Sheep Creek Trail, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide; sensitive to fluoride (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26835, BRY C-26918, BRY C-31054, BRY C-31102, BRY C-31849, BRY C-33361, BRY C-33431b, BRY C-34941, BRY C-34997, BRY C-35299, BRY C-35453, BRY C-35489, BRY C-35582a, BRY C-36490

Physcia aipolia (Ehrh. ex Humb.) Fűrnr.

Growth form: foliose

Substrate: Engelmann Spruce, Doug Fir, Subalpine Fir, Gambel Oak, White Fir, lignum

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of the Indian Cliff dwellings along Forest Service road #065, along Quartz Creek, vicinity of Treasure Falls, vicinity of Sheep Creek Trail, Vallecito Creek Trail, vicinity of Little Molas Lake

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide; sensitive to fluoride (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26680, BRY C-26830, BRY C-29218, BRY C-29347, BRY C-29359, BRY C-31053, BRY C-31746a, BRY C-31754b, BRY C-35310

Physcia albinea (Ach.) Nyl.

Growth form: foliose

Substrate: moss over rock, rock

Site(s): between La Manga Pass and Cumbres Pass, vicinity of Little Molas Lake, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33408, BRY C-35266, BRY C-35871

Physcia biziana (Massal.) Zahlbr.

Growth form: foliose

Substrate: Quaking Aspen

Site(s): along U.S.F.S. Rd. #534 (Groundhog Mountain)

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31564

Physcia caesia (Hoffm.) F  rn  r.

Growth form: foliose

Substrate: rock, Gambel Oak, moss over rock, lignum, over *Selaginella densa*

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep

Creek Trail from Forest Service road #622 to the Piedra River, Lizard Head Wilderness

Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity

of Ferris Canyon Campground, Vallecito Creek Trail, Head of Spring Gulch, vicinity of

Elephant Rocks, between La Manga Pass and Cumbres Pass, near Needleton, vicinity of

Little Molas Lake, Williams Creek Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass,

Medano Pass

Relative abundance: locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26797, BRY C-26782, BRY C-26909,

BRY C-29168, BRY C-31000, BRY C-31030, BRY C-31671, BRY C-31692, BRY C-

31694, BRY C-32036, BRY C-32041, BRY C-32045, BRY C-32094, BRY C-33314,

BRY C-33394, BRY C-34983, BRY C-35265, BRY C-35334, BRY C-35624, BRY C-

35796, BRY C-35927, BRY C-36505b

Physcia callosa Nyl.

Growth form: foliose

Substrate: rock

Site(s): Vallecito Creek Trail, Head of Spring Gulch

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31695, BRY C-32095

Physcia dubia (Hoffm.) Lettau

Growth form: foliose

Substrate: lignum, Juniper, Gambel Oak, rock, Pinyon Pine, Narrowleaf Cottonwood, Blue Spruce, detritus over rock, over *Selaginella densa*

Site(s): vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, vicinity of Madden Peak, Stony Pass, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, V-Rock Trailhead, The Pinnacles, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: sensitive to intermediately sensitive to fluoride (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26777, BRY C-26781, BRY C-26836, BRY C-26866, BRY C-26883b, BRY C-29076, BRY C-29107, BRY C-29119, BRY C-29151, BRY C-29188, BRY C-29193, BRY C-29213, BRY C-29255, BRY C-31093, BRY C-31612, BRY C-33354, BRY C-33387, BRY C-34858, BRY C-35363, BRY C-35748a, BRY C-36406, BRY C-36506

Physcia magnussonii Frey

Growth form: foliose

Substrate: moss/soil over rock

Site(s): The Pinnacles

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35767

Physcia phaea (Tuck.) J.W. Thomson

Growth form: foliose

Substrate: rock

Site(s): near Needleton

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34952

Physcia stellaris (L.) Nyl.

Growth form: foliose

Substrate: Gambel Oak, Pinyon Pine, lignum (Sage), Serviceberry, Boxelder Maple, Engelmann Spruce, Acer glabrum, Alder, Subalpine Fir, Rocky Mountain Maple, Quaking Aspen, White Fir, Ponderosa Pine, Willow, Bristlecone Pine, Limber Pine, Doug Fir

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Sundial Indian Ruins Near McPhee Reservoir, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, Vallecito Creek Trail, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26844, BRY C-26854, BRY C-26860a, BRY C-26883a, BRY C-26911, BRY C-29075, BRY C-29090, BRY C-29101, BRY C-29108, BRY C-29115, BRY C-29146, BRY C-29217, BRY C-29293, BRY C-31567, BRY C-31584, BRY C-31786, BRY C-32055b, BRY C-32059, BRY C-33362, BRY C-33429, BRY C-34867b, BRY C-34938, BRY C-34992, BRY C-35295, BRY C-35415, BRY C-35490, BRY C-35574a, BRY C-35708, BRY C-35809, BRY C-35965, BRY C-36466

Physciella chloantha (Ach.) Essl.

Growth form: foliose

Substrate: Gambel Oak, Quaking Aspen, lignum

Site(s): along Mavreeso Road, near Needleton, Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34940, BRY C-35190, BRY C-35584

Physciella nepalensis (Poelt) Essl.

Growth form: foliose

Substrate: Willow

Site(s): V-Rock Trailhead

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35463

Physconia detersa (Nyl.) Poelt

Growth form: foliose

Substrate: Acer glabrum

Site(s): Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32055a

Physconia enteroxantha (Nyl.) Poelt

Growth form: foliose

Substrate: moss over rock, rock, Gambel Oak, Subalpine Fir, Doug Fir, White Fir, decomposing wood

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Treasure Falls, Vallecito Creek Trail, Williams Creek Trailhead, Bishop Rock, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29158, BRY C-29216, BRY C-29349, BRY C-31727, BRY C-31745b, BRY C-31778a, BRY C-31780, BRY C-35345, BRY C-35612, BRY C-35821b

Physconia isidiigera (Zahlbr.) Essl.

Growth form: foliose

Substrate: White Fir, moss over rock

Site(s): Vallecito Creek Trail, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-31735, BRY C-31745a, BRY C-31778b, BRY C-35924

Physconia muscigena (Ach.) Poelt

Growth form: foliose

Substrate: detritus, moss, moss/soil over rock, over *Selaginella densa*

Site(s): vicinity of Kennebec Pass, Stony Pass, between La Manga Pass and Cumbres Pass, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29300, BRY C-31591, BRY C-31627, BRY C-31650, BRY C-33409, BRY C-35741, BRY C-35837, BRY C-35990, BRY C-36503

Physconia perisidiosa (Erichsen) Moberg

Growth form: foliose

Substrate: rock, moss over rock, Doug Fir

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Martinez Creek, Vallecito Creek Trail, Williams Creek Trailhead, Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29196, BRY C-31186, BRY C-31729, BRY C-32025, BRY C-32040, BRY C-32043, BRY C-35429, BRY C-35690

Placidium squamulosum (Ach.) Breuss

Growth form: squamulose

Substrate: soil

Site(s): vicinity of Chimney Rock between gate and upper parking lot, head of Spring Gulch, vicinity of Kennebec Pass, Cannonball Mesa, The Pinnacles, Buffalo Pass, Hayden Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29065, BRY C-29231, BRY C-31827, BRY C-34843, BRY C-35701, BRY C-35858, BRY C-35982

Placynthium asperellum (Ach.) Trevisan

Growth form: minutely fruticose

Substrate: rock

Site(s): Bishop Rock

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35599

Placynthium nigrum (Hudson) Gray

Growth form: squamulose

Substrate: rock

Site(s): vicinity of Sheep Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31019

Platismatia glauca (L.) Culb. & C. Culb.

Growth form: foliose

Substrate: Subalpine Fir

Site(s): vicinity of Treasure Falls

Relative abundance: rare

Pollution sensitivity: sensitive to ozone; intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29346

Pleopsidium chlorophanum (Wahlenb.) Zopf

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Stony Pass, Head of Spring Gulch, Cannonball Mesa

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29242, BRY C-29396, BRY C-31622, BRY C-32089, BRY C-34900

Pleopsidium flavum (Bellardi) Körber

Growth form: crustose (with effigurate margins)

Substrate: rock

Site(s): vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, The Pinnacles, Buffalo Pass

Relative abundance: locally common

Pollution sensitivity: sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33325, BRY C-33421, BRY C-35797, BRY C-35911

Protoparmelia badia (Hoffm.) Hafellner

Growth form: crustose

Substrate: moss over rock, rock

Site(s): vicinity of Martinez Creek, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Stony Pass, along U.S.F.S. road #534 (Groundhog Mountain), between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29157, BRY C-29228, BRY C-30942, BRY C-31154, BRY C-31514, BRY C-31526, BRY C-31636, BRY C-33388

Pseudephebe minuscula (Nyl. ex Arnold) Brodo & D. Hawksw.

Growth form: fruticose

Substrate: rock

Site(s): vicinity of Wolf Creek Pass, Stony Pass

Relative abundance: rare to locally common

Pollution sensitivity: intermediately sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-30941, BRY C-31649

Pseudephebe pubescens (L.) Choisy

Growth form: fruticose

Substrate: rock

Site(s): vicinity of Kennebec Pass, between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: intermediately sensitive to ozone (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29331, BRY C-33412

Pseudevernia intensa (Nyl.) Hale & Culb.

Growth form: foliose

Substrate: Doug Fir, lignum, Mexican White Pine, Bristlecone Pine, Limber Pine

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Martinez Creek, vicinity of Treasure Falls, along Quartz Creek, Vallecito Creek Trail, head of Spring Gulch, near Needleton, Williams Creek Trailhead, Hayden Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26677, BRY C-29363, BRY C-30968, BRY C-31074, BRY C-31117, BRY C-31717, BRY C-31720, BRY C-31789, BRY C-31854, BRY C-35163, BRY C-35376, BRY C-35958, BRY C-36475

Psora cerebriformis W.A. Weber

Growth form: squamulose

Substrate: soil

Site(s): Cannonball Mesa, Buffalo Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34837, BRY C-35835, BRY C-36499

Psora decipiens (Hedwig) Hoffm.

Growth form: squamulose

Substrate: soil

Site(s): Stony Pass, Cannonball Mesa

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31665, BRY C-34840

Psora globifera (Ach.) A. Massal.

Growth form: squamulose

Substrate: soil over rock, moss

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Martinez Creek, vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29314, BRY C-31160

Psora himalayana (Church. Bab.) Timdal

Growth form: Squamulose

Substrate: soil over rock, soil

Site(s): vicinity of Kennebec Pass, Buffalo Pass, Hayden Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29232, BRY C-35838, BRY C-36421

Psora luridella (Tuck.) Fink

Growth form: Squamulose

Substrate: soil over rock

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29233

Psora nipponica (Zahlbr.) Gotth. Schneider

Growth form: squamulose

Substrate: soil over rock

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Madden Peak, vicinity of Martinez Creek, Vallecito Creek Trail, Williams Creek Trailhead, Bishop Rock

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31106, BRY C-31182, BRY C-31680, BRY C-35328, BRY C-35672b

Psora rubiformis (Ach.) Hook.

Growth form: squamulose

Substrate: soil over rock

Site(s): vicinity of Wolf Creek Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-30940

Psora tuckermanii R. Anderson *ex* Timdal

Growth form: squamulose

Substrate: soil/moss over rock

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, vicinity of Elephant Rocks, Cannonball Mesa, vicinity of Little Molas Lake, Bishop Rock, Buffalo Pass, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26792a, BRY C-26876, BRY C-26929, BRY C-29169, BRY C-31005, BRY C-31015, BRY C-33342, BRY C-33343, BRY C-34914, BRY C-35255, BRY C-35651, BRY C-35950, BRY C-35984

Psoroma hypnorum (Vahl) Gray

Growth form: squamulose

Substrate: moss, decomposing wood, soil, moss over soil, moss over decomposing wood

Site(s): vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Martinez Creek, vicinity of Wolf Creek Pass, Communications relay site above Wolf Creek Pass, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, along Quartz Creek, vicinity of Taylor Mesa, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of La Manga Pass, vicinity of Little Molas Lake, Hayden Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26685, BRY C-26746, BRY C-26751, BRY C-26752, BRY C-26800, BRY C-29235, BRY C-29324, BRY C-29377, BRY C-31169, BRY C-31177, BRY C-31575, BRY C-31799, BRY C-33379, BRY C-35282, BRY C-35994, BRY C-36536

Punctelia hypoleucites (Nyl.) Krog

Growth form: foliose

Substrate: rock

Site(s): Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35923

Punctelia stictica (Duby) Krog

Growth form: foliose

Substrate: rock

Site(s): Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35925

Punctelia subrudecta (Nyl.) Krog

Growth form: foliose

Substrate: Subalpine Fir, rock, moss/soil over rock, Acer glabrum, Doug Fir, White Fir, Alder,

Site(s): vicinity of Treasure Falls, Vallecito Creek Trail, near Needleton, Bishop Rock, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29344, BRY C-31728, BRY C-31743, BRY C-31775, BRY C-31785a, BRY C-32046, BRY C-32054, BRY C-32083, BRY C-35170, BRY C-35688, BRY C-35922

Ramalina obtusata (Arnold) Bitter

Growth form: fruticose

Substrate: rock

Site(s): The Pinnacles

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35743

Ramalina sinensis Jatta

Growth form: fruticose

Substrate: Pinyon Pine, Engelmann Spruce, Doug Fir, Subalpine Fir, Ponderosa Pine, Gambel Oak, White Fir, Acer glabrum, Limber Pine

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Chimney Rock between gate and upper parking lot, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, along Quartz Creek, vicinity of Taylor Mesa, below Kennebec Pass, vicinity of Treasure Falls, vicinity of Martinez Creek, Vallecito Creek Trail, along Mavreoso Road, Williams Creek Trailhead, Hayden Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26682, BRY C-26725, BRY C-26760, BRY C-26829, BRY C-29077, BRY C-29274, BRY C-29352, BRY C-29364, BRY C-30970, BRY C-30989, BRY C-31065, BRY C-31187, BRY C-31708, BRY C-31737, BRY C-32050, BRY C-34945, BRY C-35434, BRY C-35960, BRY C-36482

Rhizocarpon disporum (Nägeli ex Hepp) Müll. Arg.

Growth form: crustose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, Vallecito Creek Trail, Head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, near Needleton, Bishop Rock, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26745, BRY C-26796, BRY C-26899, BRY C-29183, BRY C-30987, BRY C-31685, BRY C-31844a, BRY C-32067, BRY C-32099, BRY C-33334, BRY C-33395, BRY C-34894, BRY C-34963, BRY C-35658, BRY C-35806, BRY C-35897, BRY C-36518

Rhizocarpon geographicum (L.) DC.

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Madden Peak, vicinity of Martinez Creek, Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), between La Manga Pass and Cumbres Pass, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, The Pinnacles, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: sensitive to fluoride (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26691, BRY C-26763, BRY C-29244, BRY C-29387, BRY C-31091, BRY C-31155, BRY C-31523, BRY C-31608, BRY C-31750b, BRY C-31845, BRY C-32075, BRY C-33414, BRY C-34968, BRY C-35254, BRY C-35336, BRY C-35360, BRY C-35793, BRY C-36408

Rhizocarpon macrosporum Räsänen

Growth form: crustose

Substrate: rock

Site(s): vicinity of Taylor Mesa, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Madden Peak, along U.S.F.S. road #534 (Groundhog Mountain)

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26696, BRY C-29253, BRY C-30935, BRY C-31092, BRY C-31532

Rhizoplaca chrysoleuca (Sm.) Zopf

Growth form: foliose (umbilicate)

Substrate: rock, lignum (Rocky Mountain Juniper)

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Benchmark Lookout, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, vicinity of Martinez Creek, Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, near Needleton, Bishop Rock, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: locally common

Pollution sensitivity: sensitive to sulfur dioxide; sensitive to NO_x/PAN (Ryan 1990)

Comments: lignum is an unusual substrate for this species

Deposition of specimens: (BYU Herbarium) BRY C-26934, BRY C-29161, BRY C-29311, BRY C-29383, BRY C-31139, BRY C-31522a, BRY C-31600, BRY C-31686, BRY C-31826, BRY C-32092, BRY C-33312, BRY C-33368, BRY C-33396, BRY C-34957, BRY C-35583, BRY C-35782, BRY C-35875, BRY C-36511

Rhizoplaca melanophthalma (DC.) Leuckert & Poelt

Growth form: foliose (umbilicate)

Substrate: rock, lignum (Rocky Mountain Juniper)

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, vicinity of Wolf Creek Pass, vicinity of Sheep Creek Trail, Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: sensitive to sulfur dioxide (Ryan 1990)

Comments: lignum is an unusual substrate for this species

Deposition of specimens: (BYU Herbarium) BRY C-26880, BRY C-26922, BRY C-29137, BRY C-29162, BRY C-29382, BRY C-30988, BRY C-31525, BRY C-31536, BRY C-31601, BRY C-31631, BRY C-31698, BRY C-31834, BRY C-33319, BRY C-33367, BRY C-33397, BRY C-34889, BRY C-34943, BRY C-34958, BRY C-35261, BRY C-35638, BRY C-35732, BRY C-35879, BRY C-36417, BRY C-36512

Rhizoplaca peltata (Ramond) Leuckert & Poelt

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, Cannonball Mesa

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34877

Rimelia reticulata (Taylor) Hale & Fletcher

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Bishop Rock

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35696

Rinodina archaea (Ach.) Arnold

Growth form: crustose

Substrate: lignum, Doug Fir

Site(s): Williams Creek Trailhead, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35395, BRY C-36530b

Rinodina milvina (Wahlenb.) Th. Fr.

Growth form: crustose

Substrate: rock

Site(s): Vallecito Creek Trail

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31683, BRY C-32066

Rinodina mniaraea (Ach.) Körber

Growth form: crustose

Substrate: moss over soil

Site(s): along U.S.F.S. Rd. #534 (Groundhog Mountain)

Relative abundance: rare

Pollution sensitivity: Unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31574

Rinodina turfacea (Wahlenb.) Körber

Growth form: crustose

Substrate: moss, moss over soil

Site(s): vicinity of Kennebec Pass, vicinity of Little Molas Lake

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29334, BRY C-35280

Sarcogyne regularis Körber

Growth form: crustose (absent)

Substrate: rock

Site(s): vicinity of Sheep Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31027

Solorina bispora Nyl.

Growth form: foliose

Substrate: soil

Site(s): Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31669

Solorina octospora (Arnold) Arnold

Growth form: foliose

Substrate: moss

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29282

Solorina spongiosa (Ach.) Anzi

Growth form: foliose

Substrate: moss

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29283

Spilonema revertens Nyl.

Growth form: fruticose

Substrate: rock

Site(s): Vallecito Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32028

Sporastatia testudinea (Ach.) A. Massal.

Growth form: crustose

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Kennebec Pass, Stony Pass, along U.S.F.S. road #534 (Groundhog Mountain)

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26774, BRY C-29250, BRY C-31515, BRY C-31652

Squamarina lentigera (Weber) Poelt

Growth form: squamulose (with well-developed marginal lobes)

Substrate: soil

Site(s): Cannonball Mesa

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34842

Staurothele areolata (Ach.) Lettau

Growth form: crustose

Substrate: rock

Site(s): along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Elephant Rocks, near Needleton, vicinity of Little Molas Lake, V-Rock Trailhead, Bishop Rock, Buffalo Pass, Medano Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31544, BRY C-33305, BRY C-34971, BRY C-35253, BRY C-35359, BRY C-35631, BRY C-35882, BRY C-36525

Staurothele drummondii (Tuck.) Tuck.

Growth form: crustose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Wolf Creek Pass, Cannonball Mesa, The Pinnacles, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29040, BRY C-29133, BRY C-29398, BRY C-34876, BRY C-35785, BRY C-36429

Staurothele fissa (Taylor) Zwackh

Growth form: crustose

Substrate: rock

Site(s): vicinity of Martinez Creek, between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31150, BRY C-33401

Stereocaulon rivulorum H. Magn.

Growth form: squamulose

Substrate: soil

Site(s): Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31605

Stereocaulon tomentosum Fr.

Growth form: squamulose with podetia

Substrate: detritus

Site(s): near Needleton

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35240

Sticta weigelii (Ach.) Vainio

Growth form: foliose

Substrate: moss over rock

Site(s): Buffalo Pass

Relative abundance: rare

Pollution sensitivity: sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35956

Teloschistes contortuplicatus (Ach.) Clauzade & Rondon *ex* Vezda

Growth form: foliose

Substrate: rock

Site(s): The Pinnacles

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35774

Tephromela armeniaca (DC.) Hertel & Rambold

Growth form: crustose

Substrate: rock

Site(s): vicinity of Kennebec Pass, Stony Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29249, BRY C-31651

Thamnomia subuliformis (Ehrh.) Culb.

Growth form: fruticose

Substrate: soil

Site(s): Stony Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31585

Thyrea confusa Henssen

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Head of Spring Gulch, Cannonball Mesa, vicinity of Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-32087, BRY C-34897, BRY C29166, BRY C-31083

Toninia candida (Weber) Th. Fr.

Growth form: squamulose

Substrate: soil over rock

Site(s): vicinity of Sheep Creek Trail

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31086

Toninia sedifolia (Scop.) Timdal

Growth form: squamulose

Substrate: soil

Site(s): Cannonball Mesa

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34836

Trapeliopsis granulosa (Hoffm.) Lumbsch

Growth form: crustose

Substrate: decomposing wood, humic soil

Site(s): along Quartz Creek, near Needleton, Hayden Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26674, BRY C-35224, BRY C-36439

Tremolecia atrata (Ach.) Hertel

Growth form: crustose

Substrate: rock

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29338

Tuckermannopsis coralligera (W.A. Weber) W.A. Weber

Growth form: foliose

Substrate: lignum, Bristlecone Pine

Site(s): vicinity of the Indian Cliffs dwellings along Forest Service road #065, head of Spring Gulch, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29154, BRY C-31856, BRY C-31880, BRY C-35850

Tuckermannopsis fendleri (Nyl.) Hale

Growth form: foliose

Substrate: Bristlecone Pine

Site(s): Hayden Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-36460

Tuckermannopsis subalpina (Imshaug) Kärnefelt

Growth form: foliose

Substrate: moss over soil

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29335

Umbilicaria americana Poelt & T. Nash

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of Kennebec Pass, Vallecito Creek Trail, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29333, BRY C-31677, BRY C-31704, BRY C-35903

Umbilicaria decussata (Vill.) Zahlbr.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Stony Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31660

Umbilicaria deusta (L.) Baumg.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-33384

Umbilicaria hyperborea (Ach.) Hoffm.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Wolf Creek Pass, vicinity of Martinez Creek, Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), between La Manga Pass and Cumbres Pass, near Needleton, The Pinnacles, Hayden Pass, Medano Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26780, BRY C-29386, BRY C-31142, BRY C-31512, BRY C-31513, BRY C-31531, BRY C-31599, BRY C-31654, BRY C-31678, BRY C-31699, BRY C-31703, BRY C-31838, BRY C-31839, BRY C-34976, BRY C-35777, BRY C-36407, BRY C-36514

Umbilicaria krascheninnikovii (Savicz) Zahlbr.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26782a, BRY C-29323, BRY C-29385, BRY C-36520a

Umbilicaria lyngei Schol.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of Kennebec Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29317

Umbilicaria torrefacta (Lightf.) Schrader

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): Vallecito Creek Trail, near Needleton, The Pinnacles, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-31697, BRY C-34972, BRY C-35799, BRY C-35876

Umbilicaria vellea (L.) Hoffm.

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of Kennebec Pass, between La Manga Pass and Cumbres Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29316, BRY C-33410

Umbilicaria virginis Schaerer

Growth form: foliose (umbilicate)

Substrate: rock

Site(s): vicinity of Martinez Creek, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Stony Pass, vicinity of Little Molas Lake, Medano Pass

Relative abundance: locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26772, BRY C-26782, BRY C-29322, BRY C-29384, BRY C-31141, BRY C-31598, BRY C-35262, BRY C-36520b

Usnea cavernosa Tuck.

Growth form: fruticose

Substrate: Engelmann Spruce, Subalpine Fir, Blue Spruce, Doug Fir, White Fir, Mexican White Pine, Bristlecone Pine, lignum

Site(s): Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, along Quartz Creek, below Kennebec Pass, vicinity of Treasure Falls, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of La Manga Pass, Williams Creek Trailhead, Hayden Pass

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26689, BRY C-26754, BRY C-26806, BRY C-26821, BRY C-29277, BRY C-29368, BRY C-29369, BRY C-30974, BRY C-31134, BRY C-31192, BRY C-31582, BRY C-31707a, BRY C-31709, BRY C-31722, BRY C-31731, BRY C-31793, BRY C-31850, BRY C-31881, BRY C-33373, BRY C-35397, BRY C-36443a

Usnea cirrosa Mot.

Growth form: fruticose

Substrate: Doug Fir, Acer glabrum, White Fir, Mexican White Pine, Blue Spruce

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Martinez Creek, vicinity of Treasure Falls, Vallecito Creek Trail, Williams Creek Trailhead

Relative abundance: locally common to abundant

Pollution sensitivity: unknown

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-29367, BRY C-30969, BRY C-31724, BRY C-31733, BRY C-31794, BRY C-32051, BRY C-35420

Usnea hirta (L.) F.H. Wigg.

Growth form: fruticose

Substrate: Pinyon Pine, Ponderosa Pine, Gambel Oak, Serviceberry, Subalpine Fir, Doug Fir, lignum, burned lignum, White Fir, Mexican White Pine, Bristlecone Pine, Engelmann Spruce

Site(s): vicinity of Chimney Rock between gate and upper parking lot, vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Ferris Canyon Campground, vicinity of Treasure Falls, vicinity of Sheep Creek Trail, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: common to abundant

Pollution sensitivity: sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26888b, BRY C-29069, BRY C-29081, BRY C-29093, BRY C-29102, BRY C-29210, BRY C-29353, BRY C-29365, BRY C-30966, BRY C-30973, BRY C-30990, BRY C-31040, BRY C-31119, BRY C-31136, BRY C-31718a, BRY C-31749, BRY C-31756b, BRY C-31791, BRY C-31851, BRY C-31860, BRY C-31867, BRY C-31870b, BRY C-31889, BRY C-33358, BRY C-33426, BRY C-34949a, BRY C-35164a, BRY C-35309b, BRY C-35433, BRY C-35572, BRY C-35715, BRY C-35808a, BRY C-35972a, BRY C-36465a

Usnea subfloridana Stirton

Growth form: fruticose

Substrate: Juniper, Pinyon Pine, Ponderosa Pine, Gambel Oak, Engelmann Spruce, Subalpine Fir, lignum, burned lignum, Doug Fir, White Fir, Acer glabrum, rock, Mexican White Pine, Bristlecone Pine, Rocky Mountain Maple, Limber Pine

Site(s): vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Chimney Rock between gate and upper parkinglot, vicinity of Martinez Creek, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of the Indian Cliff dwellings along Forest Service road #065, along Quartz Creek, vicinity of Ferris Canyon Campground, vicinity of Taylor Mesa, below Kennebec Pass, vicinity of Treasure Falls, Vallecito Creek Trail, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Elephant Rocks, vicinity of La Manga Pass, between La Manga Pass and Cumbres Pass, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: common to abundant

Pollution sensitivity: sensitive to intermediately sensitive to sulfur dioxide (Wetmore 1987)

Comments: rock is an unusual substrate for this species

Deposition of specimens: (BYU Herbarium) BRY C-26681, BRY C-26684, BRY C-26755, BRY C-26756, BRY C-26807, BRY C-26823, BRY C-26888a, BRY C-29070, BRY C-29082, BRY C-29092, BRY C-29190, BRY C-29211, BRY C-29276, BRY C-29366, BRY C-30965, BRY C-30972, BRY C-30991, BRY C-31041, BRY C-31064, BRY C-31121, BRY C-31135, BRY C-31193, BRY C-31555, BRY C-31583, BRY C-31707b, BRY C-31718b, BRY C-31723, BRY C-31732, BRY C-31788, BRY C-31852, BRY C-31870a, BRY C-31890, BRY C-32052, BRY C-32078, BRY C-33366, BRY C-33374, BRY C-33425, BRY C-34949b, BRY C-34993, BRY C-35313, BRY C-35398, BRY C-35482, BRY C-35735b, BRY C-35808b, BRY C-35961, BRY C-36465b

Vulpicida pinastri (Scop.) J.-E. Mattsson & M.J. Lai

Growth form: foliose

Substrate: Doug Fir, Engelmann Spruce, moss over wood, decomposing wood, lignum

Site(s): vicinity of Martinez Creek, vicinity Wolf Creek Pass, vicinity of Treasure Falls, along Quartz Creek, Vallecito Creek Trail, near Needleton, The Pinnacles, Hayden Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: sensitive to intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26688, BRY C-29356, BRY C-30950, BRY C-31108, BRY C-31716, BRY C-31725, BRY C-32049, BRY C-35218, BRY C-35754, BRY C-36441, BRY C-36538

Xanthoparmelia chlorochroa (Tuck.) Hale

Growth form: foliose

Substrate: vagrant on soil

Site(s): vicinity of Chimney Rock between gate and upper parking lot, Head of Spring Gulch, Cannonball Mesa, Buffalo Pass

Relative abundance: rare

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29064, BRY C-32085, BRY C-34922, BRY C-35832

Xanthoparmelia coloradoensis (Gyelnik) Hale

Growth form: foliose

Substrate: rock, lignum, Doug Fir, over *Selaginella densa*

Site(s): Vallecito Creek Trail, Stony Pass, Head of Spring Gulch, along U.S.F.S. road #534 (Groundhog Mountain), vicinity of Elephant Rocks, vicinity of L Manga Pass, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: lignum, bark and *Selaginella densa* are unusual substrates for this species.

Deposition of specimens: (BYU Herbarium) BRY C-31522b, BRY C-31687, BRY C-31690, BRY C-31690, BRY C-31833, BRY C-31841, BRY C-31876, BRY C-32076, BRY C-33302, BRY C-33372, BRY C-34942, BRY C-34980, BRY C-35316, BRY C-35352, BRY C-35738, BRY C-35826, BRY C-36450, BRY C-36504

Xanthoparmelia cumberlandia (Gyelnik) Hale

Growth form: foliose

Substrate: rock, moss over soil, lignum, burned lignum, decomposing wood

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Martinez Creek, vicinity of Wolf Creek Pass, vicinity of Madden Peak, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Taylor Mesa, vicinity of Treasure Falls, vicinity of Ferris canyon, campground, Vallecito Creek Trail, Stony Pass, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: common to abundant

Pollution sensitivity: sensitive to sulfur dioxide (Ryan 1990)

Comments: This species was frequently used as a sensitive indicator species for elemental analyses.

Deposition of specimens: (BYU Herbarium) BRY C-26668, BRY C-26690, BRY C-26762, BRY C-26881, BRY C-29048, BRY C-29136, BRY C-29156, BRY C-29257, BRY C-29313, BRY C-30939, BRY C-30956, BRY C-30979, BRY C-30995, BRY C-31042, BRY C-31096, BRY C-31602, BRY C-31688, BRY C-31824, BRY C-32070, BRY C-33311, BRY C-33411b, BRY C-34904, BRY C-34953, BRY C-35259, BRY C-35341, BRY C-35354, BRY C-35611, BRY C-35873, BRY C-36401, BRY C-36513

Xanthoparmelia mexicana (Gyelnik) Hale

Growth form: foliose

Substrate: rock, lignum

Site(s): Cannonball Mesa, The Pinnacles

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-34873, BRY C-35723

Xanthoparmelia novomexicana (Gyelnik) Hale

Growth form: foliose

Substrate: rock

Site(s): Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-35919

Xanthoparmelia plittii (Gyelnik) Hale

Growth form: foliose

Substrate: lignum, burned lignum, rock, Bristlecone Pine

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, Vallecito Creek Trail, Head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, The Pinnacles, Buffalo Pass, Medano Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29149, BRY C-29155, BRY C-31675, BRY C-31863, BRY C-31864, BRY C-31877, BRY C-32077, BRY C-32096, BRY C-33332, BRY C-33411a, BRY C-34907, BRY C-35730, BRY C-35849, BRY C-36519

Xanthoparmelia wyomingica (Gyelnik) Hale

Growth form: foliose

Substrate: detritus, moss, soil, rock, \pm vagrant

Site(s): vicinity of Kennebec Pass, vicinity of Wolf Creek Pass, Stony Pass, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-29304, BRY C-29390, BRY C-31590, BRY C-35834

Xanthoria candelaria (L.) Th. Fr.

Growth form: foliose

Substrate: Quaking Aspen

Site(s): Williams Creek Trailhead

Relative abundance: rare to locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide, sensitive to ozone (Ryan 1990)

Comments: this taxon is a new species record for Colorado

Deposition of specimens: (BYU Herbarium) BRY C-35412

Xanthoria elegans (Link) Th. Fr.

Growth form: foliose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Martinez Creek, vicinity of Madden Peak, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, vicinity of Wolf Creek Pass, Vallecito Creek Trail, Stony Pass, head of Spring Gulch, vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, Cannonball Mesa, vicinity of Little Molas Lake, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: rare to abundant

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26795, BRY C-26873a, BRY C-26903, BRY C-26935, BRY C-29130, BRY C-29160, BRY C-29251, BRY C-29391, BRY C-31094, BRY C-31629, BRY C-31771, BRY C-31829, BRY C-31842, BRY C-33321, BRY C-33400, BRY C-34883, BRY C-35273, BRY C-35788, BRY C-35874, BRY C-36427, BRY C-36494

Xanthoria fallax (Hepp) Arnold

Growth form: foliose

Substrate: moss, Gambel Oak, Boxelder Maple, Pinyon Pine, Engelmann Spruce, Rocky Mountain Juniper, moss over rock, rock, lignum, Blue Spruce

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Ferris Canyon Campground, vicinity of Kennebec Pass, Vallecito Creek Trail, head of Spring Gulch, vicinity of Elephant Rocks, Bishop Rock, Buffalo Pass

Relative abundance: rare to locally common

Pollution sensitivity: intermediately sensitive to sulfur dioxide; sensitive to NO_x/PAN (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26848, BRY C-26851, BRY C-26862, BRY C-26873b, BRY C-26890b, BRY C-29062, BRY C-29094, BRY C-29106, BRY C-29171, BRY C-29201, BRY C-29290, BRY C-31001, BRY C-31049, BRY C-31049, BRY C-31781, BRY C-31873a, BRY C-33316, BRY C-35594, BRY C-35948

Xanthoria polycarpa (Hoffm.) Rieber

Growth form: foliose

Substrate: Fendelaria sp., Gambel Oak, Engelmann Spruce, Doug Fir, Boxelder Maple, Pinyon Pine, Narrowleaf Cottonwood, Subalpine Fir, moss over rock, lignum, White Fir, Bristlecone Pine, Quaking Aspen, Blue Spruce, Willow, Rocky Mountain Juniper, Limber Pine

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, vicinity of Sheep Creek Trail from Forest Service road #622 to the Piedra River, vicinity of Kennebec Pass and along La Plata River below Kennebec Pass, vicinity of Sundial Indian Ruins near McPhee Reservoir, vicinity of Chimney Rock between gate and upper parking lot, vicinity of Madden Peak, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, along Quartz Creek, vicinity of Ferris Canyon Campground, vicinity of Benchmark Lookout, vicinity of Treasure Falls, vicinity of Martinez Creek, Vallecito Creek Trail, head of Spring Gulch, along U.S.F.S. Rd. #534 (Groundhog Mountain), vicinity of Elephant Rocks, between La Manga Pass and Cumbres Pass, along Mavreeso Road, near Needleton, vicinity of Little Molas Lake, Williams Creek Trailhead, V-Rock Trailhead, Bishop Rock, The Pinnacles, Buffalo Pass, Hayden Pass, Medano Pass

Relative abundance: common to abundant

Pollution sensitivity: intermediately sensitive to sulfur dioxide (Ryan 1990)

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26675, BRY C-26828, BRY C-26837, BRY C-26849, BRY C-26890a, BRY C-26912, BRY C-26919, BRY C-29063, BRY C-29095, BRY C-29202, BRY C-29360, BRY C-29370, BRY C-31002, BRY C-31050, BRY C-31097, BRY C-31098, BRY C-31188, BRY C-31558, BRY C-31561, BRY C-31563, BRY C-31566, BRY C-31753b, BRY C-31846, BRY C-31883, BRY C-32058, BRY C-33315, BRY C-33427, BRY C-34936, BRY C-34985, BRY C-35297, BRY C-35451, BRY C-35462, BRY C-35582b, BRY C-35704, BRY C-35810, BRY C-35962, BRY C-36467

Xanthoria soredata (Vainio) Poelt

Growth form: foliose

Substrate: rock

Site(s): vicinity of the Indian Cliff dwellings along Forest Service road #065, Lizard Head Wilderness Area along Cross Mountain Trail approximately 1 mile SW of Lizard Head Peak, vicinity of Kennebec Pass, Stony Pass, Williams Creek Trailhead

Relative abundance: rare to locally common

Pollution sensitivity: unknown

Comments: none

Deposition of specimens: (BYU Herbarium) BRY C-26778, BRY C-26795a, BRY C-29192, BRY C-29318, BRY C-31610a, BRY C-35347

OBSERVATIONS AND CONCLUSIONS:

1. Lichen species collected at reference sites across the San Juan and Rio Grande national forests comprise a diverse and well developed flora. From our collections at 33 reference sites across both the San Juan and Rio Grande national forests we have identified a total of 320 species in 105 genera including 45 new species records for Colorado. All growth forms are represented; however the flora is dominated by foliose species (44%, 142 species), followed by crustose species (35%, 111 species). Squamulose lichens make up 14% of the flora (46 species); while fruticose species comprise 7% of the flora with 21 species. This growth form pattern is typical of other Southern Rocky Mountain lichen floras, which are generally dominated by foliose species (this observation is based on similar studies in the Gila Wilderness Area, Chiricahua National Monument, and Chiricahua Wilderness Area). In contrast the more northern Rocky Mountain lichen communities are dominated by crustose species (e.g. 48% in the Bridger Wilderness Area, and 50% in the High Uintas Wilderness Area; while foliose species represented only 28% and 29% of the lichen floras in those wilderness areas). A similar study conducted at several sites along the Wasatch Front yielded an even higher percentage of crustose species (60.3%, 91 out of 155 total species). The abundance of macrolichens in the San Juan-Rio Grande National Forest is likely related to three factors: 1) minimal human-related development in the area, 2) the occurrence of many unique and productive microhabitats for lichens, and 3) summer monsoonal storm patterns.
2. Lichen specimens were collected from 5 basic substrates: rocks, lignum/bark, soil, moss/detritus, and the thalli of other lichens. A total of 146 species (45% of the flora) were collected from various rock substrates. Species on bark and lignum substrates were next in abundance, totaling 81 species (25% of the flora). Seventy-two species (23% of the flora) were collected from soil substrates, while 18 species (6% of the flora) were collected from moss/detritus substrates. Finally, three species (<1% of the flora) occurred on the thalli of other lichen species. Intermountain Area lichen floras are typically dominated by saxicolous (rock) species. For example, 37% (67 species) of the lichen flora from the High Uintas Wilderness Area (northeastern Utah) are from rock substrates with only 23% (41 species) from corticolous (bark and lignum) substrates. The Bridger Wilderness Area, in western Wyoming, shows a similar pattern with 51% (76 species) reported from rock substrates and only 23% (35 species) from bark and lignum. Overall, the higher number of total species along with the relatively high number of species on bark and lignum substrates suggests that the lichen flora in southwestern Colorado is richer and more diverse than other Rocky Mountain lichen floras further north. Again this phenomenon is likely related to the diversity of habitat types in the area and the summer monsoonal precipitation pattern.
3. Total species diversity (320 species in 105 genera) suggests that the lichen communities in the San Juan and Rio Grande national forests have generally not been impacted by air pollution. Furthermore, the relatively high average number of sensitive indicator species

per reference site (16 species with a range of 2-30 sensitive indicator species per reference site) further documents the general good health of the lichen communities in the San Juan and Rio Grande national forests. An interesting east-west trend in the number of sensitive indicator species per reference site was noted. The average number of sensitive indicator species per reference site west of the continental divide (essentially the San Juan National Forest) was 15.5 species, while the average number of sensitive indicator species east of the continental divide (the Rio Grande National Forest) was 19.1 species. This pattern could be simply a reflection of habitat differences between the east and west sides of the continental divide; or it could be related to the fact that there are several potentially important air pollution sources (coal-fired power plants and larger more developed human populations) west of the divide.

4. Necrotic and/or bleached thalli (typical signs of air pollution-related impact) were absent.
5. *Baseline concentrations of potential pollutant elements were determined by analyzing the tissues of at least one sensitive indicator species from each reference site (Table 1).* Overall, elemental analysis data support the conclusion that the lichen flora in the San Juan and Rio Grande national forests is generally healthy. However, a few samples suggest that concentrations of some pollutants are marginally high; and in some cases thallus concentrations exceed background levels (Figure 2). For example, sulfur concentrations in four samples exceeded .2% (.209-.259%) (it is generally agreed that thallus sulfur concentrations $\geq .2\%$ indicate significant sulfur accumulation, which may interfere with sensitive metabolic activities such as photosynthesis, cellular respiration and nitrogen fixation). Seven additional samples showed marginally high sulfur values ($\geq .15\%$ but $< .2\%$). All eleven samples with marginal and elevated sulfur values were collected from eight sites (Taylor Mesa, Benchmark Lookout, south slope of Groundhog Mountain, along Quartz Creek, near Needleton, Medano Pass, the Pinnacles, and head of Spring Gulch). All samples with elevated sulfur levels ($\geq .2\%$) were from higher elevation areas (9,300 to 10,700 feet); with three of the sites located west of the continental divide (Benchmark Lookout, Taylor Mesa, and south slope of Groundhog Mountain), and only one site (the Pinnacles) east of the continental divide. Thallus concentrations of arsenic (5.2 ppm to 8.57 ppm in 14 out of 66 samples) exceeded background levels (≥ 5 ppm) and certainly on the average exceeded values reported for most other Intermountain Area reference sites. The majority (9 out of 14) samples with elevated arsenic are from reference sites located west of the continental divide. Nickel concentrations were marginally elevated in 4 out of 66 samples, three of which were from sites west of the continental divide. Lead concentrations in 7 out of 66 samples were slightly elevated (≥ 50 ppm, 52.8 - 105 ppm). All but one of these samples were from sites west of the continental divide. Finally, there was one element ratio (Cu/Zn) that showed an unusual pattern at two sites {Treasure Falls (1.81) and near Needleton (8.0)}. More than likely this pattern is related to some local phenomenon. Typically, background Cu/Zn ratios range from .1 to .5 with any value approaching or exceeding 1 indicating unusual copper accumulation. Overall, these accumulation patterns suggest that at least some of the reference sites in the San Juan and Rio Grande national forests maybe experiencing some air pollution impact. Particularly, sites west of the continental divide (in the San Juan National Forest) appear to be most impacted. This pattern makes sense in light of the proximity of the sites west of the continental divide to several specific air pollution sources (coal-fired power plants).

RECOMMENDATIONS:

1. Usually, review of pollutant concentrations in sensitive indicator species should be performed every 5 to 8 years. In light of the intense development and urbanization this part of the state is experiencing a pattern of reviewing pollutant element concentrations in at least

TABLE #1: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Xanthoparmelia cumberlandia</i> , Kennebec Pass, Sample #207	700	0.0617	295	0.318	2.67	323	61	14.5	6.4	61.9
<i>Xanthoparmelia cumberlandia</i> , Kennebec Pass, Sample #208	1130	0.123	965	0.548	3.19	280	48.6	7	2.7	62.6
<i>Xanthoparmelia cumberlandia</i> , Sheep Creek Tr. along Piedra River at foot bridge, Sample #209	1290	0.0933	291	0.391	2.29	359	85.4	18.4	4.1	39.9
<i>Xanthoparmelia cumberlandia</i> , Sundial Ruin, Sample #210	1170	0.102	157	0.437	2.45	321	55.4	8.13	6.2	43.4
<i>Usnea hirta</i> , Indian Cliff dwelling site, Sample #211	873	0.105	200	0.429	0.956	49.5	ND	ND	ND	72.4
<i>Rhizoplaca peltata</i> , Indian Cliff dwelling site, Sample #212	739	0.0546	701	0.341	4.29	265	48.2	12.5	4.3	61.5
<i>Xanthoparmelia cumberlandia</i> , Madden Peak, Sample #213	1090	0.137	417	0.478	2.93	615	71.5	17.2	5.6	93
<i>Usnea hirta</i> , Treasure Falls, Sample #214	4670	0.0808	208	0.389	1.38	34.2	36.7	ND	4.7	181
<i>Usnea hirta</i> , First Fork Road and Horse Creek, Sample #215	512	0.0853	217	0.294	0.566	95.9	21.5	ND	2.2	66.3
<i>Xanthoparmelia cumberlandia</i> , Chimney Rock near upper parking lot, Sample #216	1070	0.129	152	0.614	2.99	1080	133	38.4	8.93	112
<i>Usnea hirta</i> , Chimney Rock near upper parking lot, Sample #217	563	0.074	309	0.264	0.98	123	33.1	ND	2.1	33.7

TABLE #1: Continued

Species and Collection Site	Elements (ppm except where indicated)										
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br	Rb	Sr
<i>Xanthoparmelia cumberlandia</i> , Kennebec Pass, Sample #207	2730	ND	4.5	10.6	21.9	21.7	3.2	ND	24.7	10.1	83.8
<i>Xanthoparmelia cumberlandia</i> , Kennebec Pass, Sample #208	2000	ND	3.31	10.5	61	18.4	2.59	ND	28.9	13.1	39.5
<i>Xanthoparmelia cumberlandia</i> , Sheep Creek Tr. along Piedra River at foot bridge, Sample #209	2900	ND	3.01	8.3	36.4	10.9	3.93	ND	11.2	11.3	44.3
<i>Xanthoparmelia cumberlandia</i> , Sundial Ruin, Sample #210	2450	ND	4.75	9.35	36	10.9	2.43	ND	14.8	9.65	52.8
<i>Usnea hirta</i> , Indian Cliff dwelling site, Sample #211	365	ND	1.06	5.68	37.4	10.1	0.78	0.62	6.95	2.45	51.2
<i>Rhizoplaca peltata</i> , Indian Cliff dwelling site, Sample #212	1790	ND	2.08	5.84	30.7	40.8	4	ND	6.62	8.95	171
<i>Xanthoparmelia cumberlandia</i> , Madden Peak, Sample #213	4500	ND	3.53	21.1	70.3	63.9	5.87	1.8	50.2	25.1	52.7
<i>Usnea hirta</i> , Treasure Falls, Sample #214	292	ND	1.55	71.8	39.5	7.17	1.2	ND	5.38	2.89	40.4
<i>Usnea hirta</i> , First Fork Road and Horse Creek, Sample #215	672	ND	1.17	3.92	18.6	4.15	0.842	ND	8.14	2.32	26.4
<i>Xanthoparmelia cumberlandia</i> , Chimney Rock near upper parking lot, Sample #216	8080	ND	5.72	15.2	47.6	ND	8.57	0.98	15.3	34.1	91
<i>Usnea hirta</i> , Chimney Rock near upper parking lot, Sample #217	663	ND	4.49	14.3	16.6	8.79	1.51	ND	10.9	ND	21.6

TABLE #1: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Xanthoparmelia cumberlandia</i> , Wolf Creek Pass Ski Area, Sample #218	1620	0.105	597	0.682	0.879	1070	149	45.2	8.4	81.6
<i>Xanthoparmelia cumberlandia</i> , Martinez Creek Drainage, Sample #219	954	0.062	248	0.401	2.4	765	91.3	32.4	3.77	189
<i>Usnea subfloridana</i> , Martinez Creek, Sample #220	1110	0.0722	340	0.319	0.419	46.2	31.3	ND	ND	109
<i>Usnea hirta</i> , Chimney Rock, Sample #325	702	0.141	577	0.381	0.824	81.8	31	ND	ND	49.3
<i>Rhizoplaca melanophthalma</i> , vicinity of Benchmark Lookout, Sample #326	2100	0.217	693	0.567	1.89	518	71.3	13.9	ND	113
<i>Xanthoparmelia cumberlandia</i> , Lone Dome across from Ferris Campground, Sample #327	1090	0.0688	408	0.484	2.88	927	101	13.7	12.2	104
<i>Rhizoplaca melanophthalma</i> , Lone Dome across from Ferris Campground, Sample #328	847	0.0765	351	0.287	5.61	410	50.6	10.7	4.57	30.9
<i>Xanthoparmelia cumberlandia</i> , Lizard Head wilderness area, along Cross Mtn. Tr., Sample #329	888	0.127	709	0.615	2.24	1200	146	39.9	13.5	169
<i>Usnea Subfloridana</i> , along Cross Mountain Trail, Sample #330	1380	0.144	702	0.574	1.21	58	64.8	ND	2.89	180
<i>Xanthoparmelia coloradoensis</i> , Communication Relay Site above Wolf Creek Pass, Sample #331	1440	0.132	812	0.798	3.66	1910	165	41.2	9.33	276

TABLE #1: Continued									
Species and Collection Site	Elements (ppm except where indicated)								
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br
<i>Xanthoparmelia cumberlandia</i> , Wolf Creek Pass Ski Area, Sample #218	6130	ND	3.73	22.4	40.2	23.1	7.57	ND	26.6
<i>Xanthoparmelia cumberlandia</i> , Martinez Creek Drainage, Sample #219	6840	ND	2.23	8	33.5	ND	7.5	ND	21.1
<i>Usnea subfloridana</i> , Martinez Creek, Sample #220	335	ND	0.832	9.41	16.2	6.5	1.58	0.64	15.3
<i>Usnea hirta</i> , Chimney Rock, Sample #325	759	ND	1.42	7.84	19.1	6.28	2.32	ND	7.78
<i>Rhizoplaca melanophthalma</i> , vicinity of Benchmark Lookout, Sample #326	3500	ND	3.06	12.2	56	17.3	2.47	ND	3.24
<i>Xanthoparmelia cumberlandia</i> , Lone Dome across from Ferris Campground, Sample #327	6380	ND	10.2	17.8	43.9	17.8	2.86	ND	10.1
<i>Rhizoplaca melanophthalma</i> , Lone Dome across from Ferris Campground, Sample #328	2480	ND	3.28	6.83	13	18.1	2.1	ND	5
<i>Xanthoparmelia cumberlandia</i> , Lizard Head wilderness area, along Cross Mtn. Tr., Sample #329	9020	ND	8.01	21.8	71.2	40.1	6.06	ND	37.5
<i>Usnea Subfloridana</i> , along Cross Mountain Trail, Sample #330	509	ND	2.76	15.6	55.9	11.8	ND	ND	10.8
<i>Xanthoparmelia coloradoensis</i> , Communication Relay Site above Wolf Creek Pass, Sample #331	13100	ND	5.6	24.5	77.1	74.5	5.61	ND	35.6

TABLE #1: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference site
Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)								
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr
<i>Rhizoplaca chrysoleuca</i> , Communication Relay Site above Wolf Creek Pass, Sample #332	748	0.0847	338	0.266	1.79	486	ND	ND	3.28
<i>Usnea hirta</i> , along USFS Rd. #684 at seasonal gate, Sample #333	1280	0.163	1830	0.415	1.24	110	91	ND	3.91
<i>Pseudevernia intensa</i> , along USFS Rd. #684 at seasonal gate, Sample #334	1490	0.163	2820	0.567	2.03	241	82.4	ND	3.72
<i>Bryoria fuscescens</i> , Head of Taylor Creek, Sample #335	771	0.161	1740	0.319	0.456	70.2	39.5	ND	ND
<i>Xanthoparmelia cumberlandia</i> , head of Taylor Creek, Sample #336	1280	0.178	2350	0.44	2.94	472	98.1	ND	6.22
<i>Evernia divaricata</i> , Head of Taylor Creek, Sample #337	817	0.259	2950	0.59	1.02	54.7	46.9	ND	ND
<i>Usnea cavernosa</i> , vicinity of Groundhog Mountain, Sample #430	916	0.209	482	0.482	1.19	109	63.4	ND	ND
<i>Xanthoparmelia cumberlandia</i> , vicinity of Groundhog Mountain, Sample #431	669	0.0478	229	0.469	2.52	953	108	23.4	11.1
<i>Rhizoplaca melanophthalma</i> , vicinity of Groundhog Mountain, Sample #432	771	0.0775	106	0.596	4.34	1370	177	28.8	10.5
<i>Rhizoplaca melanophthalma</i> , at Stony Pass, Sample #433	806	0.0935	101	0.275	9.39	348	43.8	ND	ND

TABLE #1: Continued									
Species and Collection Site	Elements (ppm except where indicated)								
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br
<i>Rhizoplaca chrysoleuca</i> , Communication Relay Site above Wolf Creek Pass, Sample #332	3060	ND	2.63	8.77	47.4	44.1	3.69	ND	4.71
<i>Usnea hirta</i> , along USFS Rd. #684 at seasonal gate, Sample #333	816	ND	2.06	7	30.3	6.18	2.74	ND	10.3
<i>Pseudevernia intensa</i> , along USFS Rd. #684 at seasonal gate, Sample #334	1750	ND	3.13	13.4	29.8	13.1	6	1.37	27
<i>Bryoria fuscescens</i> , Head of Taylor Creek, Sample #335	772	ND	1.12	7.07	25.1	12.4	1.2	ND	12.9
<i>Xanthoparmelia cumberlandia</i> , head of Taylor Creek, Sample #336	3060	ND	3.36	13.3	57	54.3	ND	ND	30.5
<i>Evernia divaricata</i> , Head of Taylor Creek, Sample #337	414	ND	0.714	5.04	31.2	12.4	1.47	ND	25.3
<i>Usnea cavernosa</i> , vicinity of Groundhog Mountain, Sample #430	685	ND	1.13	7.12	39	17.7	3.4	ND	29.1
<i>Xanthoparmelia cumberlandia</i> , vicinity of Groundhog Mountain, Sample #431	6410	ND	5.77	12.3	62.5	28	7	ND	11.7
<i>Rhizoplaca melanophthalma</i> , vicinity of Groundhog Mountain, Sample #432	11300	ND	4.35	15	48.5	52.8	6.58	ND	3.15
<i>Rhizoplaca melanophthalma</i> , at Stony Pass, Sample #433	2200	ND	1.31	5.24	25.6	25.9	ND	ND	3.11

TABLE #1: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Xanthoparmelia cumberlandia</i> , at Stony Pass, Sample #434	615	0.076	312	0.509	6.5	826	119	23.9	ND	157
<i>Cetraria nivalis</i> , at Stony Pass, Sample #435	597	0.0549	243	0.29	1.22	98.3	78.2	ND	ND	73.7
<i>Usnea subfloridana</i> , Vallecito Creek trail, Sample #436	1550	0.0724	201	0.357	1.06	102	ND	ND	2.15	132
<i>Xanthoparmelia cumberlandia</i> , Vallecito Creek trail, Sample #437	941	0.0878	412	0.594	2.46	1150	116	29.5	11.6	161
<i>Rhizoplaca chrysoleuca</i> , Vallecito Creek trail, Sample #438	799	0.0831	154	0.262	4.64	449	ND	ND	4.87	39.7
<i>Xanthoparmelia cumberlandia</i> , head of Spring Gulch along USFS rd. #600, Sample #439	1580	0.115	274	0.654	2.75	819	118	18.9	7.82	135
<i>Usnea subfloridana</i> , head of Spring Gulch along USFS rd. #600, Sample #440	2070	0.164	497	0.643	0.828	99.6	46.99	ND	2.84	199
<i>Rhizoplaca chrysoleuca</i> , head of Spring Gulch along USFS rd. #600, Sample #441	1520	0.136	307	0.482	2.2	440	ND	ND	5.15	85

TABLE #1: Continued

Species and Collection Site	Elements (ppm except where indicated)										
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br	Rb	Sr
<i>Xanthoparmelia cumberlandia</i> , at Stony Pass, Sample #434	6810	ND	4.26	13.4	40.4	63.9	ND	1.76	33.5	24.7	195
<i>Cetraria nivalis</i> , at Stony Pass, Sample #435	511	ND	0.53	2.23	26.4	10.5	ND	ND	3.19	ND	70.7
<i>Usnea subfloridana</i> , Vallecito Creek trail, Sample #436	628	ND	1.46	3.84	28.3	9.89	ND	ND	8.48	ND	30.9
<i>Xanthoparmelia cumberlandia</i> , Vallecito Creek trail, Sample #437	9500	ND	9.07	19.7	67.4	24.8	7.48	ND	26.8	40.2	91.8
<i>Rhizoplaca chrysoleuca</i> , Vallecito Creek trail, Sample #438	2940	ND	2.39	13.5	34.1	105	ND	ND	7.9	11.9	44.8
<i>Xanthoparmelia cumberlandia</i> , head of Spring Gulch along USFS rd. #600, Sample #439	5160	ND	3.93	12.1	53.2	29.1	5.2	ND	12.7	21.9	130
<i>Usnea subfloridana</i> , head of Spring Gulch along USFS rd. #600, Sample #440	694	ND	1.99	6.49	38.6	18.1	2.45	0.64	14.2	4.41	45.8
<i>Rhizoplaca chrysoleuca</i> , head of Spring Gulch along USFS rd. #600, Sample #441	2880	ND	1.9	8	65.3	76	3.89	ND	7.29	15.4	65.3

TABLE #1 con't: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Rhizoplaca melanophthalma</i> , McElmo Canyon, Sample #555	1010	0.061	140	0.17	9	660	ND	ND	3.9	38
<i>Xanthoparmelia plittii</i> , McElmo Canyon, Sample #556	660	0.043	290	0.2	2.8	700	ND	ND	5.7	67
<i>Xanthoparmelia sp.</i> , McElmo Canyon, Sample #557	1080	0.121	320	0.52	2.8	980	ND	ND	5.1	86
<i>Rhizoplaca melanophthalma</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #597	850	0.064	270	0.31	2.3	440	ND	10.6	3.4	46
<i>Xanthoparmelia sp.</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #598	1390	0.088	260	0.48	2.2	520	106	12.8	2.5	124
<i>Usnea sp.</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #599.	730	0.099	340	0.36	0.92	24	57	ND	2.2	41
<i>Bryoria sp.</i> , 0.25 miles from Needleton along USFS Rd. #504, Sample #600	870	0.164	540	0.46	0.41	63	62	ND	6	76
<i>Usnea sp.</i> , 0.25 miles from Needleton along USFS Rd. #504, Sample #601.	720	0.1	290	0.3	0.89	23	62	ND	3	90

TABLE #1 con't.: Continued

Species and Collection Site	Elements (ppm except where indicated)										
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br	Rb	Sr
<i>Rhizoplaca melanophthalma</i> , McElmo Canyon, Sample #555	3200	ND	3.2	5.2	17.8	27	5.4	ND	3.7	9.8	126
<i>Xanthoparmelia plittii</i> , McElmo Canyon, Sample #556	3300	ND	3.4	5.7	27	13.9	2.7	ND	6.6	6	99
<i>Xanthoparmelia sp.</i> , McElmo Canyon, Sample #557	5100	ND	3.3	12.7	49	31	ND	2.5	54	21	75
<i>Rhizoplaca melanophthalma</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #597	2600	ND	2.5	6.6	34	35	3.3	ND	4.6	10.3	45
<i>Xanthoparmelia sp.</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #598	3100	ND	4.3	10.1	57	16.7	1.9	ND	12.3	17.4	68
<i>Usnea sp.</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #599.	181	ND	0.51	3.1	35	7.5	ND	ND	5.4	ND	21
<i>Bryoria sp.</i> , 0.25 miles from Needleton along USFS Rd. #504, Sample #600	500	ND	1.68	5.6	69	8.4	ND	ND	5.7	5.3	26
<i>Usnea sp.</i> , 0.25 miles from Needleton along USFS Rd. #504, Sample #601.	194	ND	2.3	3.7	41	6.7	ND	ND	4.5	ND	26

TABLE #1 con't.: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Xanthoparmelia sp.</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #602	1480	0.102	760	0.48	0.81	460	69	11.2	4.4	60
<i>Rhizoplaca melanophthalma</i> , 0.25 miles from Needleton along USFS Trail #504, Sample #603	1510	0.124	550	0.43	0.99	340	ND	ND	2.5	48
<i>Xanthoparmelia sp.</i> , 0.25 miles from Needleton along USFS Trail #504, Sample #604	1510	0.088	690	0.45	1.92	250	66	ND	3.8	83
<i>Usnea sp.</i> , vicinity of Buffalo Pass, along USFS Rd. #810, Sample #629	1210	0.098	390	0.51	0.82	33	69	ND	ND	134
<i>Xanthoparmelia sp.</i> , vicinity of Buffalo Pass, along USFS Rd. #810, Sample #630	1100	0.06	430	1.02	3.2	2000	430	40	8.5	280
<i>Rhizoplaca chrysoleuca</i> , vicinity of Buffalo Pass, along USFS Rd. #810, Sample #631	1200	0.069	169	0.27	2.4	220	ND	ND	3.8	48
<i>Usnea sp.</i> , at Medano Pass, along USFS Rd. #235, Sample #632	1190	0.159	910	0.52	1.08	128	95	ND	ND	91
<i>Rhizoplaca chrysoleuca</i> , at Medano Pass, along USFS Rd. #235, Sample #633	1030	0.084	158	0.29	0.93	350	ND	ND	ND	36

TABLE #1 con't.: Continued

Species and Collection Site	Elements (ppm except where indicated)										
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br	Rb	Sr
<i>Xanthoparmelia sp.</i> , along Mavreeso Rd. (USFS Rd. #209), Sample #602	2700	ND	3.2	10.5	46	7.1	2.1	ND	22	12.3	33
<i>Rhizoplaca melanophthalma</i> , 0.25 miles from Needleton along USFS Trail #504, Sample #603	2400	ND	2.6	320	40	24	ND	ND	2.8	10.4	20
<i>Xanthoparmelia sp.</i> , 0.25 miles from Needleton along USFS Trail #504, Sample #604	1760	ND	2.3	7.7	59	22	2.5	ND	11.5	10.9	33
<i>Usnea sp.</i> , vicinity of Buffalo Pass, along USFS Rd. #810, Sample #629	230	ND	1.92	2.7	35	6	ND	ND	7.1	ND	36
<i>Xanthoparmelia sp.</i> , vicinity of Buffalo Pass, along USFS Rd. #810, Sample #630	12900	ND	7.3	15.2	67	ND	7.2	ND	18.5	38	320
<i>Rhizoplaca chrysoleuca</i> , vicinity of Buffalo Pass, along USFS Rd. #810, Sample #631	1350	ND	1.69	5.4	45	10.7	3	ND	2.6	4.9	27
<i>Usnea sp.</i> , at Medano Pass, along USFS Rd. #235, Sample #632	650	ND	1.93	7.2	39	6.2	ND	ND	6.1	ND	35
<i>Rhizoplaca chrysoleuca</i> , at Medano Pass, along USFS Rd. #235, Sample #633	2200	16.3	1.52	7.7	36	21	3.1	ND	3	7.7	23

TABLE #1 con't.: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Xanthoparmelia</i> sp., at Medano Pass, along USFS Rd. #235, Sample #634	780	0.066	240	0.59	3.4	990	350	22	7.7	99
<i>Pseudevernia intensa</i> , at Hayden Pass, along USFS Rd. #970, Sample #635	1190	0.094	1260	0.36	2.4	126	ND	ND	ND	59
<i>Usnea</i> sp., at Hayden Pass, along USFS Rd. #970, Sample #636	690	0.085	240	0.34	0.9	72	ND	ND	3	43
<i>Xanthoparmelia</i> sp., at Hayden Pass, along USFS Rd. #970, Sample #637	970	0.117	310	0.4	0.64	560	80	ND	4.1	73
<i>Rhizoplaca melanophthalma</i> , vicinity of Bishop's Rock, along USFS Rd. #28, Sample #638	856	0.0592	195	0.4636	2.4611	748	110	17	ND	93
<i>Xanthoparmelia</i> sp., vicinity of Bishop's Rock, along USFS Rd. #28, Sample #639	1100	0.059	560	0.85	2.5	1300	250	ND	7.3	370
<i>Rhizoplaca chrysoleuca</i> , vicinity of Bishop's Rock, along USFS Rd. #28, Sample #640	940	0.049	183	0.26	3.8	420	ND	ND	3.6	38
<i>Usnea</i> sp., vicinity of Bishop's Rock, along USFS Rd. #28, Sample #641	1130	0.108	153	0.37	0.79	168	75	ND	ND	115

TABLE #1 con't.: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Xanthoparmelia</i> sp., at Medano Pass, along USFS Rd. #235, Sample #634	780	0.066	240	0.59	3.4	990	350	22	7.7	99
<i>Pseudevernia intensa</i> , at Hayden Pass, along USFS Rd. #970, Sample #635	1190	0.094	1260	0.36	2.4	126	ND	ND	ND	59
<i>Usnea</i> sp., at Hayden Pass, along USFS Rd. #970, Sample #636	690	0.085	240	0.34	0.9	72	ND	ND	3	43
<i>Xanthoparmelia</i> sp., at Hayden Pass, along USFS Rd. #970, Sample #637	970	0.117	310	0.4	0.64	560	80	ND	4.1	73
<i>Rhizoplaca melanophthalma</i> , vicinity of Bishop's Rock, along USFS Rd. #28, Sample #638	856	0.0592	195	0.4636	2.4611	748	110	17	ND	93
<i>Xanthoparmelia</i> sp., vicinity of Bishop's Rock, along USFS Rd. #28, Sample #639	1100	0.059	560	0.85	2.5	1300	250	ND	7.3	370
<i>Rhizoplaca chrysoleuca</i> , vicinity of Bishop's Rock, along USFS Rd. #28, Sample #640	940	0.049	183	0.26	3.8	420	ND	ND	3.6	38
<i>Usnea</i> sp., vicinity of Bishop's Rock, along USFS Rd. #28, Sample #641	1130	0.108	153	0.37	0.79	168	75	ND	ND	115

TABLE #1 con't.: Continued

Species and Collection Site	Elements (ppm except where indicated)										
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br	Rb	Sr
<i>Xanthoparmelia</i> sp., at Medano Pass, along USFS Rd. #235, Sample #634	6400	ND	8	12.6	53	35	4.7	ND	16.6	24	177
<i>Pseudevernia intensa</i> , at Hayden Pass, along USFS Rd. #970, Sample #635	730	ND	1.55	5.8	28	15.6	ND	ND	16.1	ND	35
<i>Usnea</i> sp., at Hayden Pass, along USFS Rd. #970, Sample #636	580	ND	1.64	3.9	33	16	ND	ND	8.6	ND	14.9
<i>Xanthoparmelia</i> sp., at Hayden Pass, along USFS Rd. #970, Sample #637	3900	ND	2.4	9.5	52	37	3	ND	19.1	14	28
<i>Rhizoplaca melanophthalma</i> , vicinity of Bishop's Rock, along USFS Rd. #28, Sample #638	5053	ND	2	7	26	8	ND	ND	4	12	83
<i>Xanthoparmelia</i> sp., vicinity of Bishop's Rock, along USFS Rd. #28, Sample #639	11500	ND	4.2	10.9	58	20	5.8	ND	18.9	40	186
<i>Rhizoplaca chrysoleuca</i> , vicinity of Bishop's Rock, along USFS Rd. #28, Sample #640	2800	ND	3	6	32	17.6	ND	ND	4.6	5.3	72
<i>Usnea</i> sp., vicinity of Bishop's Rock, along USFS Rd. #28, Sample #641	1150	ND	1.6	5.9	27	ND	2.7	ND	4.4	5.2	31

TABLE #1 con't.: Mean concentrations of potential pollutant elements in sensitive indicator species from air quality biomonitoring reference sites in San Juan-Rio Grande National Forest.

Species and Collection Site	Elements (ppm except where indicated)									
	P	S%	CL	K%	Ca%	Ti	Ba	V	Cr	Mn
<i>Xanthoparmelia</i> sp., along USFS Rd. #250, at "The Pinnacles," Sample #642	1020	0.067	610	0.41	3.3	1430	156	32	ND	330
<i>Usnea</i> sp., along USFS Rd. #250, at "The Pinnacles," Sample #643	3000	0.23	340	0.78	0.88	123	66	ND	ND	118
<i>Rhizoplaca melanophthalma</i> , along USFS Rd. #250, at "The Pinnacles," Sample #644	980	0.048	123	0.27	3.1	530	ND	ND	ND	72
<i>Rhizoplaca chrysoleuca</i> , along USFS Rd. #250, at "The Pinnacles," Sample #645	1000	0.073	370	0.31	1.52	500	ND	13	ND	82

TABLE #1 con't.: Continued

Species and Collection Site	Elements (ppm except where indicated)										
	Fe	Co	Ni	Cu	Zn	Pb	As	Se	Br	Rb	Sr
<i>Xanthoparmelia sp.</i> , along USFS Rd. #250, at "The Pinnacles," Sample #642	14500	ND	1.51	10.7	44	ND	3.3	ND	41	12.3	250
<i>Usnea sp.</i> , along USFS Rd. #250, at "The Pinnacles," Sample #643	970	ND	1.37	8.1	43	7.9	3.8	ND	8.1	5.8	38
<i>Rhizoplaca melanophthalma</i> , along USFS Rd. #250, at "The Pinnacles," Sample #644	3900	ND	2.7	8.7	35	24	3.8	ND	2.4	9.1	67
<i>Rhizoplaca chrysoleuca</i> , along USFS Rd. #250, at "The Pinnacles," Sample #645	4600	ND	0.92	5	21	ND	1.78	ND	5.2	9.5	88

Fig. 2 Lichen Biomonitoring Program and Baseline

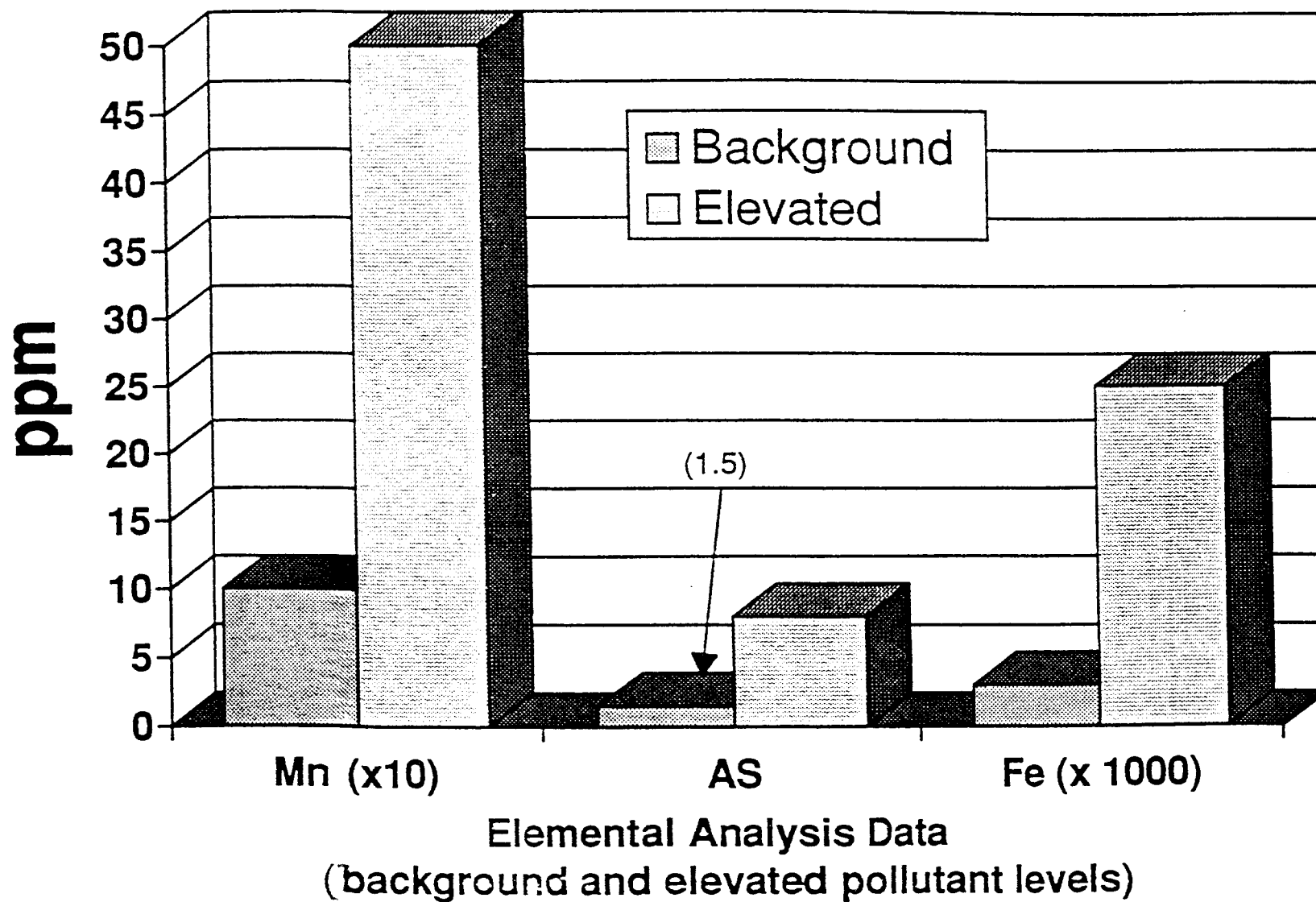


Fig. 2 cont. Lichen Biomonitoring Program and Baseline

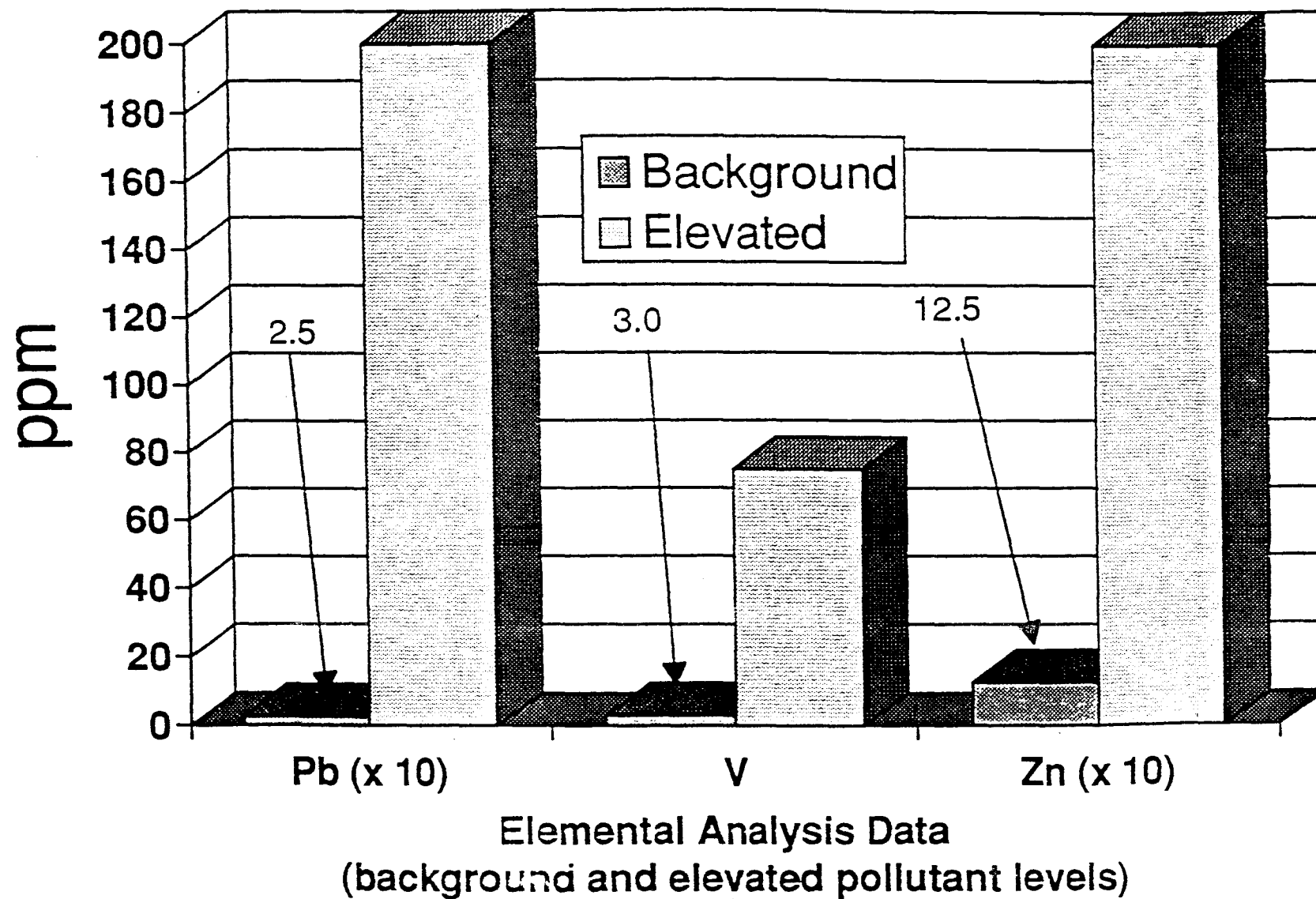
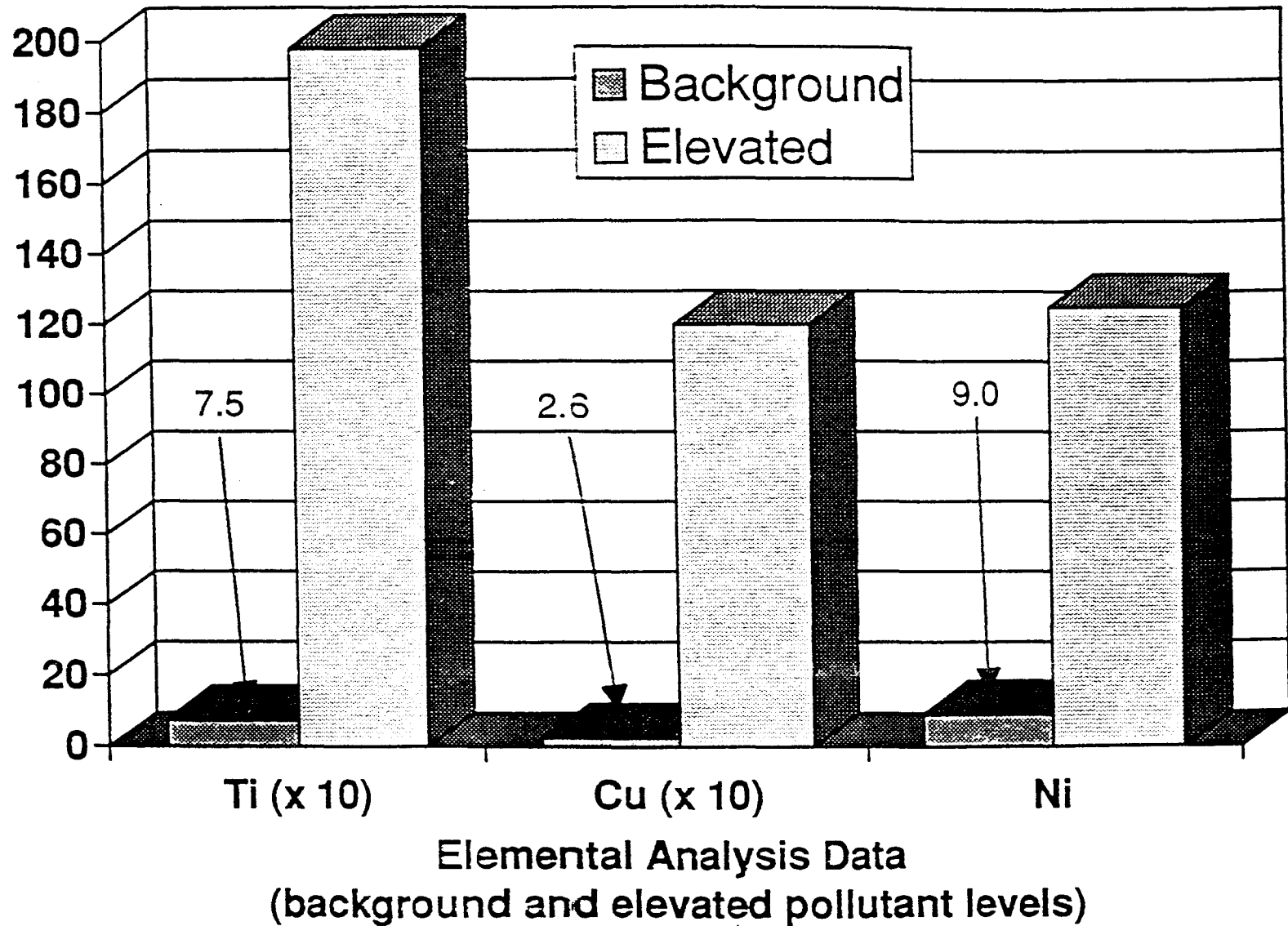


Fig. 2 cont. Lichen Biomonitoring Program and Baseline



one sensitive indicator species every five years seems most appropriate. Further development of significant point sources of pollution may require more frequent reevaluation at some reference sites.

2. Reevaluation of the lichen flora at existing reference sites is generally unnecessary, unless over time sensitive indicator species begin to show either increasing levels of pollutant elements or significant changes in relative abundance. At this point reevaluation of the lichen communities at the reference sites in the San Juan and Rio Grande national forests does not appear to be necessary.

BIBLIOGRAPHY

- Duflou, H., W. Maenhaut, and J. DeReuck. 1987. Application of PIXE analysis to the study of regional distribution of trace elements in normal human brain tissue. *Biological Trace Element Research* 13: 1.
- Fields, R.D. and L.L. St. Clair. 1984. A comparison of methods for evaluating SO₂ impact on selected lichen species: *Parmelia chlorochroa*, *Collema polycarpon*, and *Lecanora muralis*. *The Bryologist* 87: 297-301.
- Fields, R.D. and L.L. St. Clair. 1984. The effects of SO₂ on photosynthesis and carbohydrate transfer in the two lichens: *Collema polycarpon* and *Parmelia chlorochroa*. *American Journal of Botany* 71: 986-998.
- Hale, M.E. 1983. *The Biology of Lichens*. pp. 1-190. Arnold Publishers, London.
- Lawrey, J.D. and M.E. Hale. 1981. Retrospective study of lichen lead accumulation in the northeastern United States. *The Bryologist* 84: 449-456.
- Richardson, D.H.S. 1992. Pollution monitoring with lichens. *Naturalist Handbook #19*, The Richmond Publishing Co. LTD, Sough, England. 76pp.
- Rope, S.K. and L.C. Pearson. 1990. Lichens as air pollution biomonitors in a semiarid environment in Idaho. *The Bryologist* 93: 50-61.
- Rushforth, S.R., L.L. St. Clair, J.D. Brotherson, and G.T. Nebeker. 1982. Lichen community structure in Zion National Park. *The Bryologist* 85: 185-192.
- Ryan, B.D., T.H. Nash, and W. Davis. 1990. Lichens and air quality in the Mount Baldy Wilderness Area. U.S. Forest Service Technical Report.
- St. Clair, L.L. 1989. Report concerning establishment of a lichen biomonitoring program and baseline for the Jarbidge Wilderness Area, Humboldt National Forest, Nevada, U.S. Forest Service Technical Report. 15pp.
- St. Clair, L.L. and C.C. Newberry. 1995. Report concerning establishment of a lichen biomonitoring program and baseline in and near the Selway-Bitterroot Wilderness Area, Montana and Idaho. U.S. Forest Service Technical Report. 55 pp.
- Schutte, J.A. 1977. Chromium in two corticolous lichens from Ohio and West Virginia. *The Bryologist* 80: 279-283.

Wetmore, C.M. 1987. Lichens and air quality in Saguaro National Monument. Technical report submitted to the National Park Service, CX 001-2-0034.

Wetmore, C.M. 1989. Lichens and air quality on Cuyahoga National Recreation Area, Ohio. The Bryologist 92: 273-281.