

LICHENS AND AIR QUALITY
IN THE EMIGRANT WILDERNESS, CALIFORNIA:
A BASELINE STUDY

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INTRODUCTION

Little information on the lichens is available for the general area of the Emigrant Wilderness, except for the Yosemite Valley (ca. 40 km to the south). Tuckerman (1882) reported on various lichens collected in the Yosemite Valley by Bolander, and Hasse made a number of collections from that area around the year 1900. Since then, various workers, including Hale, Nash, Thiers, and Wetmore, have collected lichens from Sonora Pass or other localities in this general region of the Sierras, but have not published any information on these collections. Thus the present study will provide useful baseline data on the lichens of this area.

STUDY AREA

The Emigrant Wilderness is located to the east of the town of Sonora, and extends up to the crest of the Sierras.

All of the rocks in the Emigrant Wilderness are siliceous; most are granitic, but volcanic rocks outcrop in several areas. The involvement of lichens in primary succession on granite outcrops in the southern Sierras is described by Rundel (1975).

Vascular Vegetation

Guides to the vascular vegetation of the Sierras in general are given by Peterson & Peterson (1975) and Rundel, et al. (1977). Most of the Wilderness is Abies-Pinus forest (upper montane-subalpine type at the higher elevations, Sierran montane type at the lower elevations). A few alpine communities occur at the highest elevations, which are rather inaccessible.

Several tree species provided major substrates for lichens in this Wilderness: Abies concolor (White Fir), Abies magnifica (Red Fir), Calocedrus decurrens (Incense Cedar), Pinus jeffreyi (Jeffrey Pine), P. ponderosa (Yellow Pine) and P. contorta (Lodgepole Pine). The various shrub species (e.g., Arctostaphylos spp.) have few if any lichens on them, probably because they are covered by snow during much of the year.

Outside the Wilderness, Sierran Yellow Pine Forest (Pinus ponderosa) dominates at moderate elevations along Highway 108, and Blue Oak-Digger Pine Forest (Quercus douglasii-Pinus sabiniana) dominates at lower elevations around the town of Sonora.

Fire History and Pollution Exposure

Data on the fire history of the Sierras are presented by Wagner (1961).

The Emigrant Wilderness lies within the Mountain Counties Air Basin (previously a part of the Sacramento Valley Air Basin).

Information on acid deposition in the Sierras is presented by Lawson & Wendt (1982) and several other studies. Monitoring stations close to the Emigrant Wilderness are located in the vicinity of Yosemite National Park (California Network and National Network), installed in 1983 and operated by the National Park Service. An ARB snow survey station is located at Mammoth Mountain. The nearest "active site" for monitoring acid deposition (NADP/NTN, 1989) is also at Yosemite National Park (1408 m elevation; established in 1981), at a considerably lower elevation than the Emigrant Wilderness.

Air pollution impacts in the Emigrant Wilderness are most likely to be chronic low-level effects of acid precipitation and oxidant pollution originating primarily from major urban centers on the California coast. Some localized effects from the cities and roads in the Sonora area and Highway 108 can also be expected.

METHODS

The methods used in this study are based on those in the October 17, 1988 draft Lichen Monitoring Protocol for U.S. Forest Service Region 5, with some modifications as described in the general report.

A total of over 300 lichen specimens were collected in various localities within the Wilderness and about 350 in areas adjacent to the Wilderness, mostly between Long Barn and Sonora Pass (Fig. 1; Appendix A).

A limited number of transects and quadrats were established for long-term monitoring of the lichen vegetation. The data from transects on trees are presented in Appendix D; descriptions of quadrats on rock are given in Appendix E. Samples of Umbilicaria polyrrhiza (from locality 2) and Letharia spp. (from locality 5) were collected for element analyses.

RESULTS AND DISCUSSION

Over 90 species of lichens were found within the Emigrant Wilderness. A major portion of these were crustose species.

Distribution of Lichens by Substrate and Habitat

Species on bark or wood

About 10 species of lichens were found on bark or wood in the Wilderness. Of these, by far the most conspicuous and abundant macrolichens in most parts of the Wilderness (especially on the trunks of coniferous trees) were Letharia spp. The lower limit of Letharia spp. on the trunks (at about 1-2 m above the ground) reflects the level to which snow persists (Rundel, et al., 1977). At a few sites, Hypogymnia imshaugii was conspicuous, but mostly confined to branches in the canopy (and thus not suitable for inclusion in transects). The only pollution-sensitive corticolous species that was reasonably suitable for transect studies, Bryoria abbreviata, occurred mainly on a few trees and rarely was very abundant. Among the crustose species, Lecanora spp. dominated, especially on fir.

Several species occurred on both fir and incense cedar, (within and outside of the Wilderness): Bryoria abbreviata, Hypogymnia imshaugii, Lecanora spp., Letharia spp. and Melanelia subolivacea. Few lichens occurred on pine: Letharia spp., and (adjacent to the Wilderness) Hypogymnia imshaugii and Tuckermannopsis merrillii.

Within the Wilderness, at the Cherry Lake site, Melanelia subolivacea, Physcia biziana and Xanthoria fallax were conspicuous foliose species on oak.

Hypocenomyce spp. were found mainly on charred wood of incense cedar or other conifers.

Species on soil, moss or humus

Only a few species of lichens (15) were found on soil, moss or humus (usually in cracks in rocks). Cladonia spp., Lepraria spp., Melanelia elegantula, Peltigera rufescens, Physcia spp., Physconia spp., and Psora nipponica were abundant on soil or moss, especially in cracks of the rocks, at the edge of the Wilderness at the beginning of Kennedy Meadows, along with less abundant species such as Caloplaca sp., Phaeophyscia sp. and Toninia sp. In a few areas at the Cherry Lake site, Cladonia chlorophaea, Leptogium spp., Parmeliella cyanolepra and Peltigera sp. were found on moss over rock on steep, shaded faces.

Species on rock

By far the largest proportion of lichen species in the Wilderness were found on granitic rock. A few taxa, especially species of Aspicilia, Lecidea and Rhizocarpon, are ubiquitous

throughout the Wilderness. Other common and widespread saxicolous species include Lecanora polytropa, L. pseudomellea and L. sierrae, Umbilicaria spp. Most of the other species were more restricted, and often not very abundant.

Several groups of saxicolous species on granite occurred mainly at the highest elevations: Pseudephebe spp., Sporostatia testudinea, Some of these species, especially Acarospora chlorophana and Umbilicaria polyrrhiza, are restricted to vertical or overhanging surfaces. Umbilicaria virginis is restricted to very shaded habitats on or underneath overhanging faces of large rocks.

Other saxicolous species with definite habitat preferences include Dermatocarpon miniatum (crevices exposed to seepage, on steep faces), and Placynthium asperellum (moist, shaded surfaces). Two lichens, Staurothele fuscocuprea and Verrucaria sp., occur only on surfaces that are periodically submerged by running water.

Quite a few species that occurred on volcanic rock were not found on granitic rock, although this may be due to other features of the habitat at the volcanic rock sites rather than to substrate type per se. The only volcanic rock site examined within the Wilderness, at Cooper Peak, had a luxuriant and rich lichen flora. The conspicuous bright orange lichens, Caloplaca modesta, C. saxicola, C. trachyphylla, Xanthoria candelaria, X. elegans and X. fallax, were abundant on volcanic rocks at Cooper Peak, but appeared to be rare or absent elsewhere in the Wilderness. These species are typical of sites enriched by nitrogen and other substances from animal wastes, as is the case with the large volcanic outcrops at Cooper Peak.

Comparison with Adjacent Areas

Collections made in several areas adjacent to the Emigrant Wilderness consist of many of the same species (including most of the more common and widespread ones) found within the wilderness boundary, plus several other taxa. The diversity and abundance of lichens on trees appeared to be greater at these sites, which are mostly at lower elevations, than in the wilderness itself.

Collections made by Nash at the Fraser Flat campground off Highway 108 include several other species not found at the wilderness sites: Tuckermannopsis canadensis and Ochrolechia androgyna (on Jeffrey Pine), Bryoria fremontii, Caloplaca cerina, Candelariella xanthostigma, several Lecanora species, and Tuckermannopsis platyphylla (on White Fir). My own collections from the winter sports area a few miles southwest of Fraser Flat also included quite a few more species on bark or wood, such as

Tuckermannopsis merrillii (on White Fir), Calicium adaequatum, Candelaria concolor, Lecanora saligna, and Xanthoria polycarpa (on incense cedar), and the Physcia tenella group (on oak), in addition to Bryoria abbreviata, Hypogymnia imshaugii, and Melanelia spp. (on various trees). Other species found on fir at sites adjacent to the Wilderness include Ahtiana sphaerosporella and Buellia spp. (Crabtree Road), and Chrysothrix candelaris and Parmelia sulcata (Herring Creek. Road). A more thorough examination of trees, especially near the Cherry Lake site, is likely to show that some of these species also occur within the Wilderness.

At moderate elevations not far outside the Wilderness, several foliose lichens, including Hypogymnia imshaugii, that were not common in the Wilderness, were abundant on oaks and other trees. At the lower elevations, around Sonora, a luxuriant lichen flora, dominated by Physconia spp. and including many species not found in the vicinity of the Wilderness, such as Flavopunctelia flaventior, occurred on oak.

One volcanic rock site examined adjacent to the Wilderness, near Fraser Flat, also had a rich lichen flora with several species, such as Acarospora cf. schleicheri, that were not found on granite in or near the Wilderness. However, this site was at a lower elevation than most of the granitic areas examined within or adjacent to the Wilderness. Peltigera species (found only rarely within the Wilderness) were abundant on soil in the forest at this site. Psora californica also occurs on soil there.

Granitic rocks at moderate elevations adjacent to the Wilderness generally had a flora similar to that found within the Wilderness. However, the rocks along the edge of a creek at the Clark Fork" site were covered by several species not found within the Emigrant Wilderness, including Dermatocarpon luridum and Phaeophyscia decolor. Granitic rocks around Sonora, at much lower elevations than the Wilderness, were covered by a diverse assemblage of lichens, such as Lecanora mellea and various Xanthoparmelia species, that were not found at the higher elevations.

Due to time limitations, no collections were made from the highest elevation sites in the Emigrant Wilderness, which are located along the crest of the Sierras and are rather inaccessible. Such high elevation sites are likely to have a somewhat different lichen flora than that found elsewhere in the area, including more truly alpine species. In the vicinity of Sonora Pass, at 2800-2925 m elevation, the lichen flora on rock includes taxa such as Dermatocarpon cf. leptophyllum, Physcia dubia, Pseudephebe spp., and Rhizoplaca melanophthalma; Catapyrenium lachneum occurs there on soil.

Most of the common lichen species in the Emigrant Wilderness are widespread in the Sierra Nevada Mountains, and are also known from Sequoia National Park (Vletmore, 1985), the Eastern Brook Lakes watershed (Ryan, 1990), and the Desolation Wilderness (Ryan, unpublished). The lichen flora of the Emigrant Wilderness appears to be somewhat less diverse than that of Sequoia National Park. The comparatively low diversity in the Emigrant Wilderness is most likely due to the dry conditions and small amount of variation in habitats.

Pollution Sensitivity

Information on the pollution sensitivity of particular species is given in the general report.

Of the species found within the Emigrant Wilderness, the ones likely to be most sensitive to sulfur dioxide include: Acarospora chlorophana, Physconia spp., Rhizoplaca melanophthalma, and Xanthoria elegans. A few others can also be expected to be at least moderately sensitive to sulfur dioxide: Cladonia fimbriata, Physozia caesia, and Xanthoria fallax.

Bryoria abbreviata is likely to be most sensitive to oxidant pollutants; Cladonia spp., Leptogium californicum, and Peltigera rufescens may also be at least moderately sensitive to oxidants. None of the lichens in the Emigrant Wilderness show obvious signs of damage or deterioration that might be attributable to pollution, with the possible exception of Hypogymnia imshaugii, some specimens of which were distorted and rugose, similar to material from the Los Angeles area exposed to obvious heavy pollution. The few species in the Emigrant Wilderness that are known to be at least moderately sensitive to one or more pollutants are rather rare in this Wilderness, and several species known to be tolerant to pollutants are quite common in this Wilderness. However, at present, due to the insufficient amount of historical information on lichens in the Sierra Nevada Mountains, there is no evidence that these patterns in the lichen flora are due to pollution. Many of the more sensitive lichen taxa are characteristic of environments that are more moist than those in the Sierras.

Some idea of the lichen flora that existed in the late 1800's and early 1900's in the general part of the Sierra Nevada Mountains where the Emigrant Wilderness is located today can be gained from examination of the list of species reported from Yosemite Valley from that time period (Appendix G). Many of the species in that list occur today in the Emigrant Wilderness or vicinity.

CONCLUSIONS

The presence of several lichen species of known or probable sensitivity and the lack of obvious symptoms of pollution damage to the lichens indicates that the present level of pollution in the Emigrant Wilderness is not severe.

Recommendations for Future Long-Term Monitoring

Additional plots for long-term monitoring can be set up in several areas of the Emigrant Wilderness.

The only suitable species for transects on trees are Bryoria abbreviata, Hypogymnia imshaugii, and Letharia spp. on conifers and Melanelia subolivacea on oaks at site 5 (Cherry Lake). Letharia spp. could also be used at some of the other localities. The keys of Hale & Cole (1989) can be used for identification of these species.

Several distinctive species can probably be used for additional quadrats at site 4 (Cooper Peak): Acarospora chlorophana (bright greenyellow with pale apothecia), Caloplaca saxicola and C. trachyphylla (both bright orange lobed crusts; C. trachyphylla has broader, more flattened lobes) and Xanthoria elegans (also bright orange; lobes can be removed intact with a razor blade; apothecia usually present), Rhizoplaca melanophthalma (pale greenish foliose with bluish apothecia), and Pseudephebe pubescens (blackish fruticose). At other sites, Acarospora chlorophana, Lecanora sierrae (pale greenish lobed crust), L. pseudomellea (yellow- brown or orangish lobed crust), Pseudephebe spp., and Xanthoparmelia lineola (pale green-yellow foliose) may be suitable. Species of Umbilicaria are also suitable, though the species may be difficult to distinguish, except for U. polyrrhiza (dense mat of black holdfasts on underside) and U. virginis (upper side pale grayish, under side pinkish with scattered holdfasts) at site 2 (Burst Rock) and U. phaea (upper side medium brown, smooth) at most of the sites.

APPENDIX A:

LICHEN COLLECTING LOCALITIES

The locations of these sites are shown in Fig. 1. Accession numbers are those of Ryan.

Emigrant Wilderness

Tuolumne Co.: Stanislaus National Forest:

1. Sonora Pass quad: Edge of Emigrant Wilderness: Kennedy Meadows: Huckleberry Trail. 38°17'30"N, 119°44'W. Sec. 12 T 5N R 20E. 1950-2025 m (6500-6850 ft) elev. Granite rocks. White Fir, Jeffrey Pine, Incense Cedar. 10 August 1989 Nos. 23952-24063; 14 August 1989, Nos. 24521-24550.

2. Pinecrest NE quad: Edge of Emigrant Wilderness: Burst Rock. 38°12'N, 119°52'30"W. Sec. 15 T 4N R 19E. 2750 m (9150 ft) elev. Granite rock. Red Fir, Lodgepole Pine. 12 August 1989. Nos. 24104-24191.

3. Pinecrest NE quad: Edge of Emigrant Wilderness: Cooper Meadow. 38°14'N, 119°52'W. Sec. 3 T 4N R 19E. 2800-2825 m (8600-8700 ft) elev. Granite rocks. Scattered Red Fir and Lodgepole Pine. 15 August 1989. Nos. 24551-24556.

4. Pinecrest NE quad: Edge of Emigrant Wilderness: Cooper Peak. 38°14'N, 119°52'W. Sec. 35 T 5N R 19E. 2775-2800 m (9100-9150 ft) elev. Volcanic rocks. Juniper. 15 August 1989. Nos. 24557-24597.

5. Cherry Lake North quad: Edge of Emigrant Wilderness: Above north end of Cherry Lake. 38°02'N, 119°54'45"W. Sec. 17 T 2N R 19E. 1800-1875 m (6000-6200 ft) elev. Granite rocks. Oaks, Manzanita, Pines, White Fir, Incense Cedar. 16 August 1989. Nos. 24598-24629.

Areas Outside the Emigrant Wilderness

Tuolumne Co., Stanislaus National Forest:

Pinecrest NE quad: 0.3 miles up road from Aspen Meadow to Crabtree Camp (4N26), 3 miles ESE of Pinecrest. 38°10'30"N, 119°56'W. Sec. 25 T 4N R 19E. 2200 m (7400 ft) elev. Granite rocks. White Fir, Jeffrey Pine. Along creek, shaded. 11 August 1989. Nos. 24064-24103.

Strawberry quad: Winter Sports Area, near short paved road leading downhill from north side of Hwy 108, 3.0 miles southwest of Fraser

Flat Campground, 0.5 mi S of Bald Mountain. 38°08'N, 119°04'30"W. Sec. 3 T 3N R 17E. 1700 m (5600 ft) elev. Volcanic rocks. Ponderosa Pine, Oaks, Incense Cedar, etc. Mostly open. 13 August 1989. Nos. 24350-24455.

Pinecrest NE quad: Herring Creek Road (4N12), 4.5 miles from Hwy 108 (just before pavement ended). 38°13'N, 119°58'W. Sec. 2 T 4N R 19E. 2100 m (7000 ft) elev. Granite rocks. White Fir, Jeffrey Pine. Mostly shaded. 13 August 1989. Nos. 24456-24474.

Sonora Pass quad: Along north side of Hwy 108, near Snowcourse 345, below Sonora Pass. 38°19.9'N, 119°39.2'W. 2800 m (9200 ft) elev. Sec. 34 T 6N R 21E. Granitic rocks. 5 October 1989. Nos. 24673 -24674.

Tuolumne Co., not in Stanislaus National Forest:

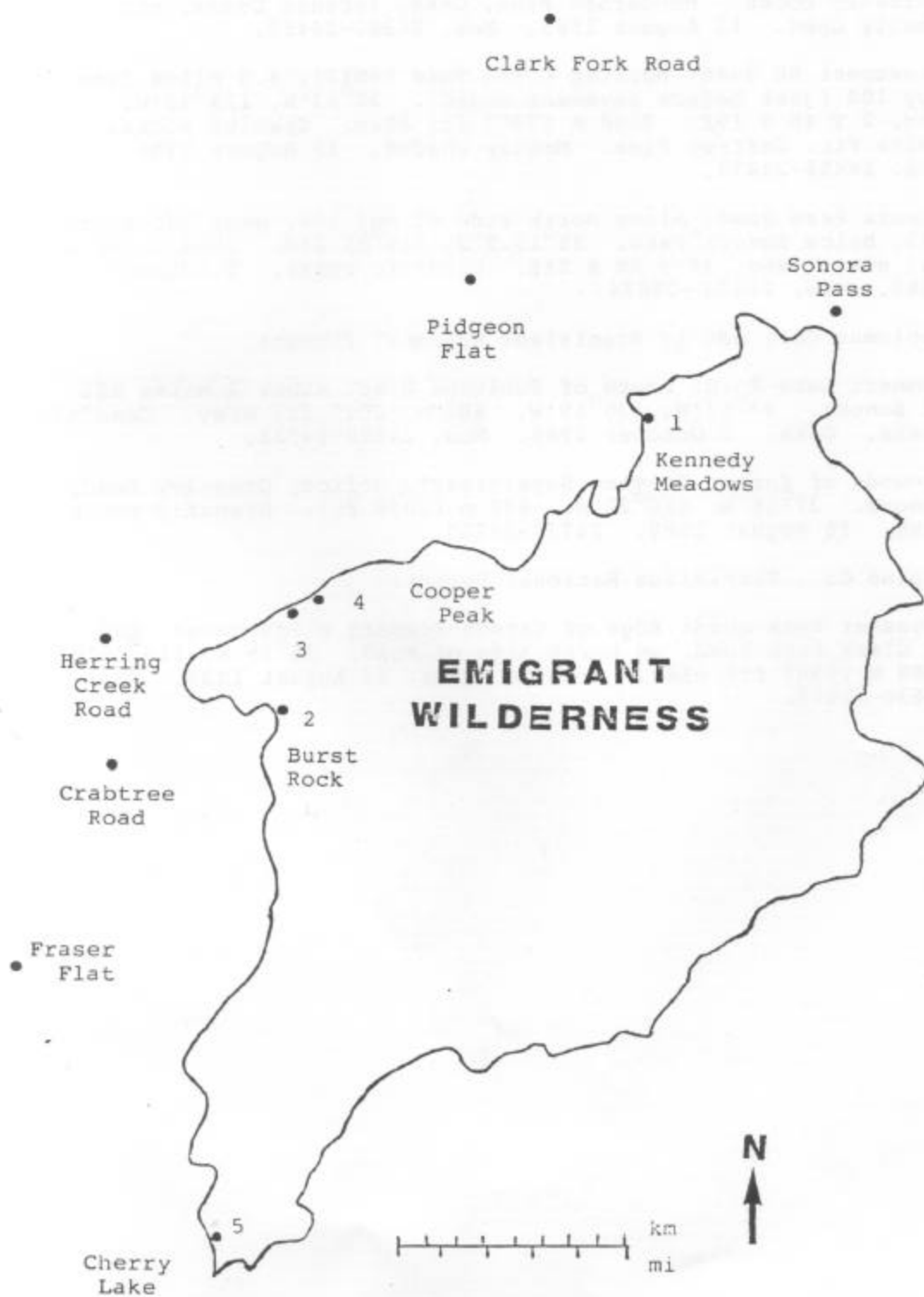
Lambert Lake Road, south of Tuolumne Road, about 3 miles ESE of Sonora. 37°57'N, 120°19'W. 600 m (2000 ft) elev. Granitic rocks. Oaks. 2 October 1989. Nos. 24690-24721.

Grounds of Forest Service Supervisor's Office, Greenley Road, Sonora. 37°59'N, 120°22'W. 600 m (2000 ft). Granitic rocks. Oaks. 16 August 1989. 24722-24730.

Alpine Co., Stanislaus National Forest:

Disaster Peak quad: Edge of Carson-Iceberg Wilderness: End of Clark Fork Road, on north side of road. 38°25'N, 119°45'W. 2000 m (6500 ft) elev. Granite rocks. 13 August 1989. Nos. 24630-24672.

Figure 1. Sampling site locations in the Emigrant Wilderness and vicinity.



APPENDIX B:

LIST OF LICHEN SPECIES IN EMIGRANT WILDERNESS

Numbers 1 through 5 after the species names refer to localities listed in Appendix A.

Acarospora chlorophana (Wahlenb. ex Ach.) Massal.--On granitic rock, 2, and volcanic rock, 4. On vertical or overhanging faces.

Acarospora fuscata (Nyl.) Arnold--On granitic rock, 1.

Acarospora thamnina (Tuck.) Herre--On granitic rock, in small crevices, 1, 2.

Acarospora sp. (brown thallus)--On volcanic rock, 4.

Aspicilia caesiocinerea (Nyl. ex Mallbr.) Arnold--On granitic rock, 2.

Aspicilia cinerea (L.) Korber--On granitic rock, 1.

Aspicilia mastrucata--On granitic rock, 1, 2.

Aspicilia spp.--On granitic rock, 1, 2, 3, 5; on volcanic rock, 4.

Bellemeria alpina (Sornmerf.) Clauz. & Roux--On granitic rock, 2.

Bryoria abbreviata (Mull. Arg.) Brodo & D. Hawksw.--On bark or wood of Abies, 5.

Buellia semitensis Tuck.--On granitic rock, 1.

Caloplaca cladodes (Tuck.) Zahlbr.--On granitic rock, 1, and on volcanic rock, 4.

Caloplaca epithallina Lynge--On other lichens, over rock, 4.

Caloplaca jungermanniae (Vahl) Th. Fr.--On moss over rock, 1.

Caloplaca cf. modesta (Zahlbr.) Fink--On granitic rock, 1; on volcanic rock, 4.

Caloplaca saxicola (Hoffm.) Nordin--On volcanic rock, on steep to vertical faces exposed to manuring, 4.

Caloplaca trachyphylla (Tuck.) Zahlbr.--On volcanic rock, on steep to vertical faces exposed to manuring, 4.

Candelariella rosulans (Mull. Arg.) Zahlbr.--On granitic rock, 1, 2;
on volcanic rock, 4.

Cladonia cf. chlorophaea (Florke ex Somrnerf.) Sprengel--On moss
over rock, shaded, 5.

Cladonia fimbriata (L.) Fr.--On soil over granitic rock, 1.

Dermatocarpon miniatum (L.) Mann--On granitic rock, 1, 3.

Dermatocarpon reticulatum Magnusson--On granitic rock, 1, 3.

Dermatocarpon sp. On granitic rock, 3.

Dimelaena thysanota (Tuck.) Hale & Culb.--On granitic rock, 1.

Hypocenomyce anthracophila (Nyl.) P. James & G. Schneider In G.
Schneider--On wood (often charred), 1.

Hypocenomyce scalaris (Ach. ex Liljeblad) M. Choisy--On wood of
Calocedrus (often charred), 5.

Hypocenomyce sp. (undescribed?)--On wood of Calocedrus, 5.

Hypogymnia imshausii Krog--On bark or wood of Abies, 5. The material
is partly atypical in morphology.

Lecanora cenisia Ach.--On granitic rock, 1, 2, and on volcanic rock,
4.

Lecanora polytropa (Hoffm.) Rabenh.--On granitic rock, 1, 2.

Lecanora cf. polytropa--On granitic rock, 2.

Lecanora "pseudomellea" Ryan ined.--On granitic rock, 1, 2, 3, 5.

Lecanora rupicola (L.) Zahlbr.--On granitic rock, 1, 2, and on
volcanic rock, 4.

Lecanora semitensis (Tuck.) Zahlbr.--On granitic rock, 1.

Lecanora "sierrae" Ryan ined.--On granitic rock, 1, 2, and on
volcanic rock, 4. This species has previously been
misidentified by many workers as Lecanora cascadenis
Magnusson.

Lecanora sp. (L. varia group)--On bark of Abies, 5.

Lecidea cf. protabacina Nyl.--On granitic rock, 2, 5; on volcanic rock, 4.

Lecidea tessellata Florke--On granitic rock, 1; on volcanic rock, 4.

Lecidea sp. (gray thallus, black fruiting bodies)--On wood of Calocedrus, 1.

Lecidea spp. (L. atrobrunnea complex)--On granitic rock, 1, 2, 3, 4, 5; on volcanic rock, 4.

Lepraria sp. (bluish white, powdery)--On granitic rock, 1.

Lepraria sp. (bluish gray, granular)--On soil, 1.

Leptogium californicum Tuck.--On soil and moss over granitic rock, 1, 5.

Leptogium furfuraceum (Harm.) Sierk--On soil over rock, steep and shaded, 5.

Letharia columbiana (Nutt.) Thomson--On bark or wood of Abies, 5.

Letharia vulpina (L.) Hue--On bark or wood of Abies, 2, 5; on Calocedrus, 5.

Melanelia elegantula (Zahlbr.) Essl.--On humus and on other lichens over granitic rock, 1, 2, and over volcanic rock, 4.

Melanelia subolivacea (Nyl. in Hasse) Essl.--on bark of Abies, Quercus, 5.

Melanelia substygia (Rasanen) Essl.--On granitic rock, 2.

Neofuscelia loxodes (Nyl.) Essl.--On granitic rock, 1.

Neofuscelia subhosseana (Essl.) Essl.--On moss over granitic rock, 1.

Neofuscelia verruculifera (Nyl.) Essl.--On granitic rock, 1.

Pannaria praetermissa Nyl. in Chyd. & Furuhj.--On moss over granitic rock, 1.

Parmeliella cyanolepra (Tuck.) Herre--On moss over granitic rock, 5.

Parmeliella sp.--On moss over granitic rock, steep and shaded, 5.

Peltigera rufescens (Weis) Humb.--On soil over granitic rock. 1, 5.

Physcia biziana (Massal.) Zahlbr.--On granitic rock, and on moss over rock, 1.

Physcia caesia (Hoffm.) Furnr.--On granitic rock, 2.

Physcia dubia (Hoffm.) Lettau--On granitic rock, 1, 2, and on volcanic rock, 4.

Physcia phaea (Tuck.) Thomson--On granitic rock and mosses over rock, 1.

Physcia sp.--On volcanic rock, 4.

Physconia detera (Nyl.) Poelt--On mosses over granitic rock, 1, and over volcanic rock, 4.

Physconia enteroxantha (Nyl.) Poelt--On mosses over granitic rock, 1.

Placynthium asperellum (Ach.) Trevisan--On granitic rock, 1.

Polysporina simplex (Davies) Vezda--On granitic rock, 1.

Pseudephebe minuscula (Nyl. ex Arnold) Brodo & D. Hawksw. --On granitic rock, 2.

Pseudephebe pubescens (L.) M. Choisy--On granitic rock, 1, and on volcanic rock, 4.

Psora nipponica (Zahlbr.) G. Schneider--On soil over granitic rock, 1.

Rhizocarpon bolanderi (Tuck.) Herre--On granitic rock, 1, 5.

Rhizocarpon geminatum Korber--On granitic rock, 1.

Rhizocarpon geographicum (L.) DC.--On granitic rock, 1, 2, 3.

Rhizocarpon grande (Florke ex Flotow) Arnold--On granitic rock, 1.

Rhizocarpon lecanorinum Anders--On granitic rock, 1, 2.

Rhizocarpon riparium Rasanen--On granitic rock, 1.

Rhizocarpon sp. (brownish thallus)--On granitic rock, 1.

Rhizocarpon sp.--On granitic rock, 1.

Rhizoplaca melanophthalma (DC. in Lam. & DC.) Leuck. & Poelt --On granitic rock, 1, 2, and on volcanic rock, 4.

Rinodina sp.--On granitic rock, 1.

Sporostatia testudinea (Ach.) Massal.--On granitic rock, 2.

Staurothele clopima Th. Fr.--On granitic rock, 1.

Thelidium sp.--On granitic rock, 1.

Toninia cinereovirens (Schaerer) Massal.--On soil over granitic rock, 1.

Umbilicaria hyperborea (Ach.) Hoffm.--On granitic rock, 1, 2.

Umbilicaria kraschenninikovii (Savicz) Zahlbr.--On granitic rock, 2.

Umbilicaria phaea Tuck.--On granitic rock, 1, 2, 3, 5.

Umbilicaria polyphylla (L.) Baumg.--On granitic rock, 1, 2.

Umbilicaria polyrrhiza (L.) Fr.--On granitic rock, on or under overhanging faces on huge rocks, 1, 2.

Umbilicaria torrefacta (Lightf.) Schrader--On granitic rock, 1.

Umbilicaria virginis Schaerer--On granitic rock, 2, and on volcanic rock, 4, on or under overhanging faces on large rocks, shaded.

Xanthoparmelia lineola (Berry) Hale--On granitic rock, 1.

Xanthoria candelaria (L.) Th. Fr.--On volcanic rock, 4.

Xanthoria elegans (Link) Th. Fr.--On granitic rock, 1, and on volcanic rock, 4. In areas exposed to manuring.

Xanthoria fallax (Hepp in Arnold) Arnold--On volcanic rock under overhang, 4; on Quercus, 5.

Xanthoria sorediata (Vainio) Poelt--On granitic rock, 1.

APPENDIX C: LISTS OF LICHEN SPECIES FOR LOCALITIES EMIGRANT
WILDERNESS AND VICINITY

1. Kennedy Meadows

Acarospora fuscata. 24012, 24038, 24040, on rock.

Acarospora thamnina. 23968(2), 23970, 24004, 24016, 24059, on rock,
in small cracks and depressions. Common.

Aspicilia caesiocinerea. 24535(2), on rock.

Aspicilia cinerea. 23964, on rock.

Aspicilia mastrucata. 24007, on rock.

Aspicilia spp. 23982, 24022, 24036, 24535(2), on rock. Common.

Buellia semitensis. 23959, 24021, on rock.

Caloplaca cladodes. 24526, on rock. Uncommon at this site.

Caloplaca jungermanniae. 24550(2), on moss over rock.

Caloplaca modesta. 24528, on rock.

Candelariella rosulans. 23983(2), on rock.

Cladonia fimbriata. 24051, on soil.

Dermatocarpon miniatum. 24522-c, on rock.

Dermatocarpon reticulatum. 24522-b, on rock.

Dimelaena thysanota. 23967, 23992, on rock.

Hypocenomyce anthracophila. 24008, 24044, 24045?, on charred wood.

Lecanora cenisia. 23957(4), on rock.

Lecanora polytropa. 24539(2), on rock.

Lecanora pseudomellea. 24002, 24533(2), on rock.

Lecanora rupicola. 23854, 24018(2), on rock.

Lecanora semitensis. 23960(3), 23963, 23979, 23990, 23995(2), 24001,
24536, on rock. Common.

Lecanora sierrae. 24530, on rock.

Lecidea tessellata. 24003, on rock.

Lecidea spp. (L. atrobrunnea complex). 23975, 23984, 23994, 23997, 23999, 24005, 24031, 24537, on rock. Common.

Lecidea sp. (thallus gray, fruiting bodies black) 24046(2), 24047, on wood of Calocedrus.

Lepraria sp. (bluish white, powdery). 24027, on rock.

Lepraria sp. (blue-gray, granular). 24056, 24545, on soil.

Lepraria sp. (greenish white, lobed). 24546, on soil.

Leptogium californicum. (24060, with Toninia), on moss over rock.

Melanelia elegantula. 24050, on soil over rock; 24547.

Neofuscelia loxodes. 23956, 23971(5), 24017, on rock.

Neofuscelia subhosseana. 24058, on moss over rock.

Neofuscelia verruculifera. 24024. on rock.

Pannaria praetermissa. 24061, on soil over rock.

Peltigera rufescens. 24048(3), 24543(2), on soil.

Phaeophyscia sp. 24548, on moss over rock.

Physcia biziana. 24522-a, 24538, 24549, on rock.

Physcia dubia. 23991, 24041(2), on rock.

Physcia phaea. 24052, 24055, on rock.

Physconia detera. 24028, 24053, on moss over rock.

Physconia enteroxantha. 24054, on moss over rock.

Placynthium asperellum. 24531, on rock.

Polysporina simplex 24540-b, on rock.

Pseudephebe pubescens. 23977, on rock.

Psora nipponica. 24049(3), on soil over rock, near beginning of trail.

Rhizocarpon bolanderi. 23961, 23965, 23969, 23976, 23993, 24009, 24011, 24013(2), 24015, 24032, 24034, 24037, 24039, 24542, on rock. Very common.

Rhizocarpon geminatum. 24020, 24521(3), 24524, 24529(2), on rock. Common.

Rhizocarpon geographicum. 23998, on rock.

Rhizocarpon grande. 23955(8), 23958, 23988(2), on rock. Common.

Rhizocarpon lecanorinum. 23972, 24023, on rock. Common.

Rhizocarpon riparium. 24532(2), on rock.

Rhizocarpon sp. (brownish thallus). 24000, on rock.

Rhizocarpon sp. 23989, on rock

Rhizoplaca melanophthalma. 24006, 24025(2), 24522.

Rinodina sp. (24537, with Lecidea sp.), on rock.

Staurothele clopima. 24523, on rock.

Thelidium sp. 23974, on rock.

Toninia cinereovirens. 24060, on soil over rock.

Umbilicaria hyperborea. 23978, 23981(2), on rock.

Umbilicaria phaea. 24019, 24026, on rock.

Umbilicaria polyphylla. 24543-a(2), on rock.

Umbilicaria polyrrhiza. 24525, on rock.

Umbilicaria torrefacta. 23985, on rock.

Umbilicaria sp. 24029, on rock.

Xanthoparmelia lineola. 23973, on rock.

Xanthoria elegans. 24042(2), 24540(2), on rock.

Xanthoria soorediata. 24527(2), on rock. Rare at this site.

Unknowns.

2. Burst Rock

(All species other than Letharia vulpina were found on rock.)

Acarospora chlorophana. 24119(4), on steep to overhanging surface, NW-facing, in crevice, shaded. Abundant.

Acarospora thamnina. 24144, 24150, 24151, 24156(2), in small cracks and depressions, exposed. Common.

Aspicilia caesiocinerea. 24170, 24173.

Aspicilia mastrucata. (24116, with Sporostatia testudinea).

Aspicilia sp. (thallus dark gray, sterile). 24188.

Bellemerea alpina. 24172(4), 24180.

Candelariella rosulans. 24122(3).

Dermatocarpon moulinsii. 24141. On steep surface, SW-facing.

Lecanora cenisia. 24105, 24128, 24143(3), on steep surfaces, somewhat shaded. Common.

Lecanora polytropa. 24106.

Lecanora cf. polytropa. 24146(3), 24174.

Lecanora pseudomellea. 24112, 24118, 24123, 24159, 24179, 24184, 24185(2), mostly on exposed surfaces. Common.

Lecanora rupicola. 24115.

Lecanora sierrae. 24168(4).

Lecidea cf. protabacina. 24111, 24117, 24155, 24189.

Lecidea spp. (L. atrobrunnea complex). 24110(2), 24126, 24130, 24169, 24175, 24176, 24186, 24187(3). Common.

Letharia vulpina. 24191, on bark of Pinus.

Melanelia elegantula. 24138(2), 24145, 24147(2). Common.

Melanelia substygia. 24149(2), 24190.

Physcia caesia. 24134, 24158.

Physcia dubia. 241.32, 24133.

Pseudephebe minuscula. 24124(5), 24178, on steep surfaces, NW-facing, exposed. Abundant.

Rhizocarpon geographicum. 24108(2), 24171(2). Common.

Rhizocarpon lecanorinum. 24107.

Rhizoplaca melanophthalma. 24125(2), 24136(2), on steep surfaces, NW-facing. Common.

Sporostatia testudinea. 24116, 24121(3), 24129, on steep surfaces, NW-facing. Common .

Umbilicaria hyperborea. 24177.

Umbilicaria krascheninnikovii. 24109, 24127(4), 24152, on steep surfaces. Common.

Umbilicaria phaea. 24166.

Umbilicaria polyphylla. 24153.

Umbilicaria polyrrhiza. 24131(2), 24157. On and under overhanging surfaces of large boulders, SW-facing, somewhat shaded. Abundant.

Umbilicaria virginis. 24120, 24140. On and under overhanging surfaces of large boulders, NW-facing, shaded.

Umbilicaria spp. 24135, 24137, 24139.

Unknowns.

3. Cooper Meadow

(All species were found on granitic rock.)

Dermatocarpon miniatum. 24551-a, along trail, in forest.

Dermatocarpon reticulatum. 24551-b, along trail, in forest.

Lecanora pseudomellea. 24555(2).

Lecidea spp. (L. atrobrunnea complex). 24552(2), 24556(2).

Rhizocarpon geographicum. 24553(2).

Umbilicaria phaea. 24554(2).

4. Cooper Peak

(All species were found on volcanic rock.)

Acarospora chlorophana. 24559(8), on steep to overhanging surfaces.
Abundant.

Acarospora sp. (brown thallus). 24585.

Aspicilia spp. 24583, 24584, 24588, 24589, 24591. Common.

Caloplaca cladodes. 24564 (with C. saxicola), under overhang.

Caloplaca epithallina. (24570-c, with Umbilicaria virginis).

Caloplaca cf. modesta 24565, 24590, under overhang.

Caloplaca saxicola. 24564, under overhang.

Caloplaca trachyphylla. 24561(3), under overhang. Abundant in one area.

Candelariella rosulans. 24573, 24574.

Lecanora senisia. 24571(3).

Lecanora rupicola. 24557(3).

Lecanora sierrae 24576(2) (with Lecidea cf. protabacina), 24578, 24579.

Lecidea cf. protabacina. 24576, 24577, 24594(2).

Lecidea tessellata. 24596(2), 24597(5). Common.

Lecidea spp. (L. atrobrunnea complex). 24581, 24582, 24586, 24595.
common.

Melanelia elegantula. 24570-b(2).

Physcia dubia. 24593-a(2)

Physcia sp. 24593-b.

Physconia detersa. 24570-b.

Pseudephebe pubescens. 24572.

Rhizoplaca melanophthalma. 24558(8), 24575. Common.

Umbilicaria virginis. 24560(3), 24570(3), on overhanging surface, shaded. Abundant in one area.

Xanthoria candelaria. 24566, 24567.

Xanthoria elegans. 24568(5) , 24569, under overhang. Abundant in one area.

Xanthoria fallax. 24562, 24563, under overhang. Unknowns.

5. Cherry Lake

Aspicilia caesiocinerea. 24605(2), on rock.

Aspicilia spp. 24600, on rock.

Bryoria abbreviata. 24622(2), on bark of Abies.

Cladonia cf. chlorophaea. 24619, on moss over rock, shaded.

Hypocenomyce scalaris. 24615-a(2), on burnt wood of Calocedrus; 24620-b, on Abies.

Hypocenomyce sp. (undescribed?). 24615-b, on burnt wood of Calocedrus; 24620-c, on Abies.

Hypogymnia cf. imshaugii. 24623(4), 24625(2), on Abies.

Lecanora pseudomellea. 24602(3), on rock.

Lecanora sp. 24626, on bark of Abies.

Lecanora sp. (L. varia group). 24628(2), 24629, on bark of Abies.
Common.

Lecidea cf. protabacina. 24606(2), on rock.

Leptogium californicum. 24607(4), on moss over rock, steep, shaded.

Leptogium furfuraceum. 24609(6), on moss over rock, steep, shaded.

Letharia columbiana. 24620-a, on Abies.

Letharia vulpina. 24621(4), on Calocedrus; 24627, on Abies.

Melanelia subolivacea. 24611(2), 24614(2), on Quercus; 24624(2), on Abies. Common.

Parmeliella cyanolepra. 24618, on moss over rock, steep, shaded.

Parmeliella sp. 24616, on moss over rock, steep, shaded.

Peltigera rufescens. 24617(2), on moss over rock, steep, shaded.

Physcia biziana. 24613, on Quercus.

Rhizocarpon bolanderi. 24598(4), 24603(2), on rock, exposed. Common.

Umbilicaria phaea. 24599(3), 24601(2), 24604, on rock, exposed.
Common.

Xanthoria fallax. 24612, on Quercus.

Unknowns.

APPENDIX D:

TRANSECTS ON TREES

APPENDIX D: TRANSECTS ON TREES

SITE NAME Cherry Lake DATE 8-1-89 (1: 00 P.M.)

TRANSECT ID Cherry Lake T-1 SURVEYOR Rocchio, Ryan

LICHEN SPECIES SUBSTRATE
Melanelia subolivacea (24611) Quercus
(olive colored leafy/lobed)

LEGAL DESCRIPTION TRANSECT TYPE
Tuolumne Co., California.
Stanislaus National Forest:
Emigrant wilderness. Longitudinal

TRANSECT LENGTH
Cherry Lake North Quad,
SE 1/4 NW 1/4 Sec. 17
T 2N R 19E 52.1 cm

ELEVATION 6005'(1825m) SLOPE ASPECT E LICHEN ASPECT W

SITE DIRECTIONS (compass bearings, landmarks, trail references)

From end of road 2N08Y, NW of Cherry Lake, hike west cross country following the contours of the land between 6000 and 6100 ft elevation (use altimeter!) to the edge of the north-south running cliff along the western boundary of the Wilderness, then go north ca. 1000 ft. This is about halfway between a small lake and the inlet to Cherry Lake. The oak tree is on the edge of the cliff, 20 ft from two ponderosa pines, 200 ft N and 10 ft downslope from Cherry Lake quadrat Q-1.

TRANSECT DESCRIPTION

Direction of reading Left to Right (Top to Bottom)

Dotiometer set points: A 6.0 cm B 73.3 cm

Transect set points: Beginning 22.8 cm, End 70.7 cm

REFERENCE PHOTOS:

- 27-29: showing Ryan standing by tree; taken from 20 ft uphill;
28 shows Cherry Lake on right; 29 shows large rust colored rock formation across from lake, on left.
- 30-33: close-up of tree with dotiometer.
- 34: looking at transect from rock 20 ft up slope.
- 35: shows Ryan at rock where 34 was taken, from Cherry Lake quadrat Q-1.

36: looking at snags. behind Cherry Lake quadrat Q-1, from
rock where 34 was taken.

COMMENTS: Use handlens to distinguish Melanelia thalli from bark.

INTERCEPT LENGTHS (in centimeters)

SPECIES	<u>Melanelia</u>	Total	SPECIES	<u>Melanelia,</u>	Total
	29.0-30.0	1.0		54.2-54.3	0.1
	31.5-32.0	0.5		55.0-55.6	0.6
	37.3-38.8	1.5		56.9-57.1	0.2
	44.6-45.0	0.4		57.4-62.2	4.8
	45.4-46.4	1.0		63.6-66.0	2.4
	46.8-47.1	0.3		66.9-67.7	0.8
	51.1-54.0	2.9		68.5-68.7	0.2
	continued next column				

TOTALS 16.7

%COVER $\frac{16.7}{52.1} \times 100\%$ 32.1%

FOOTNOTES:

COMMENTS:

APPENDIX E:
QUADRATS ON ROCKS

APPENDIX E: QUADRATS ON ROCK

SITE NAME Kennedy Meadows

DATE 8-14-89

QUADRAT ID Kennedy Q-1.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Aspicilia caesiocinerea (24535)--gray crust
Lecanora pseudomellea (24533)--yellow-brown lobed crust
Lecidea cf. atrobrunnea (24537)--brown crust
Rhizocarpon riparium (24532)--bright green-yellow crust

SUBSTRATE: Granitic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 6720' (2000m)

Tuolumne Co., California.
Stanislaus National Forest.
Emigrant Wilderness.
Sonora Pass quad.
SW 1/4 SW 1/4 Sec. 12 T 5N R 20E.

LICHEN ASPECT 60° W

CANOPY CLOSURE

Partly under tall fir tree

REFERENCE PHOTOS

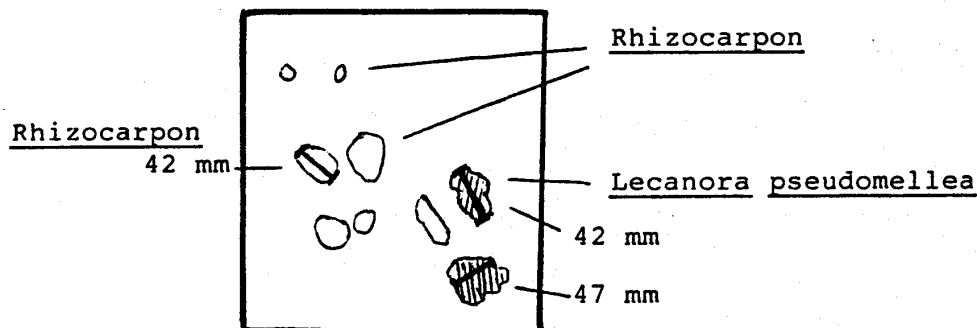
- 1-3: quadrat with lichens.
- 4: looking towards quadrat from ravine to left of trail.
- 5: looking down ravine to the north, from 18 ft W of quadrat.
- 6: looking at snag located 30 ft W of quadrat.
- 7: showing Ryan at location where 4-6 were taken, from trail.

SITE DIRECTIONS:

Follow Huckleberry Trail through Kennedy Meadow, past second footbridge. On right (western) side of trail, go up a small ravine, the top of which is 30 ft above and due south of second footbridge. Quadrat is ca. 20 ft up from trail, on left (eastern) side of the ravine in the shade of a 60 ft tall fir tree and small shrubs (oaks?), ca. 60 ft. downhill from where south end of ravine meets the trail again. Aluminum location tag is located on the trunk of the 60 ft tall fir tree just south of the quadrat.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



SITE NAME Kennedy Meadows

DATE 8-14-89

QUADRAT ID Kennedy Q-2.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Lecidea tessellata (24541)--gray crust

Rhizocarpon bolanderi (24542)--dark brown crust

Umbilicaria polyphylla (24543)--blackish leafy

SUBSTRATE: Granitic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 6800' (2050m)

Tuolumne Co., California.

LICHEN ASPECT 45° W

Stanislaus National Forest.

Emigrant Wilderness.

CANOPY CLOSURE

Sonora Pass quad.

SW 1/4 SW 1/4 Sec. 12 T 5N R 20E.

Open

REFERENCE PHOTOS

8-10: quadrat Q-2 with lichens

11: looking SW at waterfall, from trail 25 ft past top of ravine.

12: looking NW at quadrat Q-2, with Ryan facing the quadrat, from same place where 11 was taken.

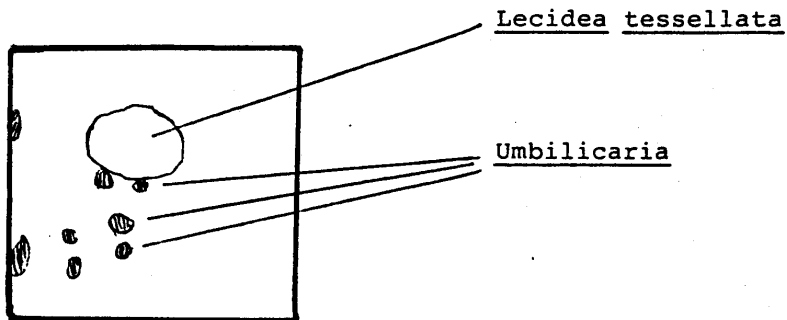
13: looking NW at quadrat Q-2, with Ryan in front of the quadrat, taken from where top of ravine meets trail.

SITE DIRECTIONS:

Go on right (western) side of Huckleberry Trail, past the second footbridge, downhill ca. 15 ft. towards Summit Creek, ca. 10 ft from top of ravine in which Kennedy Q-1 is located. Aluminum location tag is mounted with silicon on rock next to the upper left hand corner of the quadrat.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



SITE NAME Kennedy Meadows

DATE 8-14-89

QUADRAT ID Kennedy Q-3.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Caloplaca sp. (no voucher)--orange crust; small amounts

Physcia biziana (24538)--pale gray leafy/lobed

Rhizocarpon riparium (24532)--bright green-yellow crust; small amounts

Rhizocarpon geminatum (24521)--fairly dark gray crust.

SUBSTRATE: Granitic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 6850' (2075m)

Tuolumne Co., California.

LICHEN ASPECT 90°N

Stanislaus National Forest.

Emigrant Wilderness.

CANOPY CLOSURE

Sonora Pass quad.

SW 1/4 SW 1/4 Sec. 12 T 5N R 20E.

Open

REFERENCE PHOTOS

14-16: quadrat with lichens.

17: looking downhill to trail and steel machinery, from quadrat Q3.

18: looking uphill at Ryan standing near quadrat Q-3.

19: close-up of machinery next to trail.

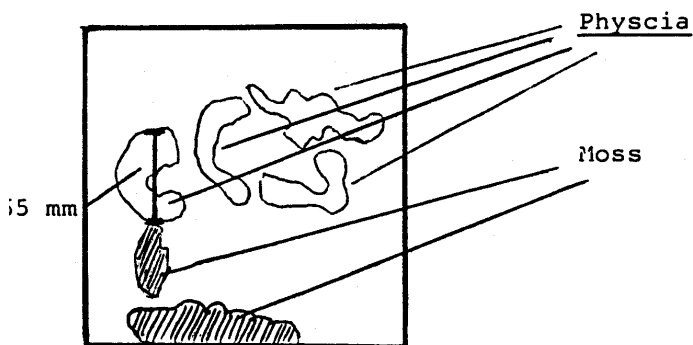
20: close-up of quadrat Q-3 on hill, with Ryan.

SITE DIRECTIONS:

Follow Huckleberry Trail, past the second footbridge, 50 ft uphill (SW) from big steel machinery on right (western, creekside) side of trail. Aluminum location tag is mounted with silicon on rock to right of the quadrat.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



SITE NAME Cooper Meadow

DATE 8-15-89 (11:00 A.M.)

QUADRAT ID Cooper Q-1.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Lecidea cf. atrobrunnea (24552)--brown crust

Rhizocarpon geographicum (24553)--bright green-yellow crust.

SUBSTRATE: Granitic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 8680' (2600m)

Tuolumne Co., California.
Stanislaus National Forest.
Emigrant Wilderness.
Pinecrest NE quad.

LICHEN ASPECT 80° NE

CANOPY CLOSURE

NW 1/4 SE 1/4 Sec. 3 T 4N R 19E.

Partly shaded by pine tree.

REFERENCE PHOTOS

21-23: quadrat with lichens.

24: shows Ryan holding quadpod at quadrat Q-1, from 10 ft away.

25: looking NE at Cooper Peak, from rock above Q-1.

26: looking SE at Ryan 5 ft from Q-1, from rock above Q-1.

30: looking at Q-2 from Q-1.

31: shows Ryan standing in clearing with rock, where you turn right from Cow & Horse Meadow to get to Q-1, from trail.

32: looking up right side of Cow & Horse Meadow.

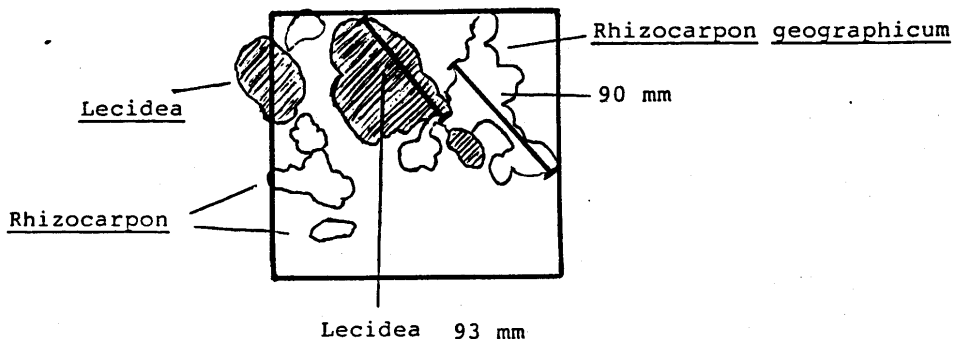
33: Looking across Cow & Horse Meadow at same rock as in 31, taken from trail.

SITE DIRECTIONS:

Follow Cooper Meadow Trail to W-NW edge of Cow & Horse Meadow. Turn right through forest and follow right (southwest) edge of the meadow ca. 250 ft to clearing in trees (notice volcanic pebbles in the ground, and large rock), to the right (south) of first small pond. Turn right (south) and follow rock ledge ca. 100 ft. to Q-1 (and Q-2) located on right face of rock. Aluminum location tag is on rock to right of Q-1.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



SITE NAME Cooper Meadow

DATE 8-15-89 (11:15 A.M.)

QUADRAT ID Cooper Q-2.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Lecanora pseudomellea (24555)--yellow-brown lobed crust (small patch).

Lecanora sp. (no voucher)--pale green-yellow crust (small patch).

Lecidea cf. atrobrunnea (24552)--brown crust

Umbilicaria phaea (24554)--brown leafy.

SUBSTRATE: Granitic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 8680' (2600m)

Tuolumne Co., California.

LICHEN ASPECT 30° S

Stanislaus National Forest.

Emigrant Wilderness.

CANOPY CLOSURE

Pinecrest NE quad.

NW 1/4 SE 1/4 Sec. 3 T 4N R 19E.

Open

REFERENCE PHOTOS

27-29: quadrat Q-2, with lichens.

30: looking east at Q-2 from Q-1.

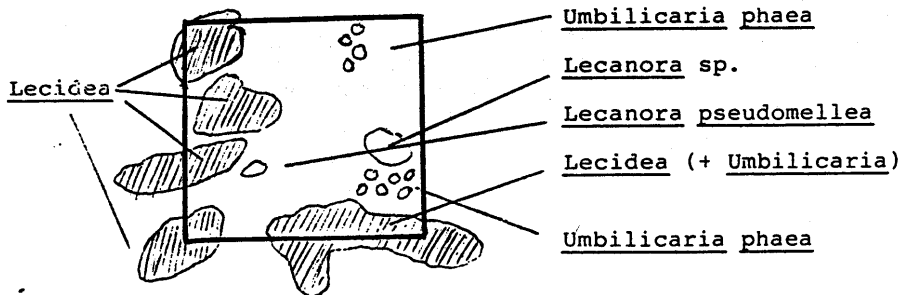
(See 31-33 on Q-1 data sheet for general location)

SITE DIRECTIONS:

Go 10 ft E from Cooper Q-1. Aluminum location tag for Q-2 is on rock above the quadrat.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



COMMENTS: Rock surface uneven.

SITE NAME Cooper Peak

DATE 8-15-89 (12:30 P.M.)

QUADRAT ID Cooper Q-4.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Acarospora chlorophana (24559)--bright greenish yellow crust
(tiny amount)

Caloplaca trachyphylla (24561)--bright orange lobed crust

Lecidea cf. protabacina (24594)--dark brown crust

SUBSTRATE: Volcanic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 9120' (2775m)

Tuolumne Co., California.
Stanislaus National Forest.
Emigrant Wilderness.
Pinecrest NE quad.
SW 1/4 SW 1/4 Sec. 35 T 5N R 19E.

LICHEN ASPECT 80° S

CANOPY CLOSURE

Open

REFERENCE PHOTOS

(See 34-36 and 14-16 on Q-3 data sheet for general location).

4-6: quadrat Q-4, with lichens

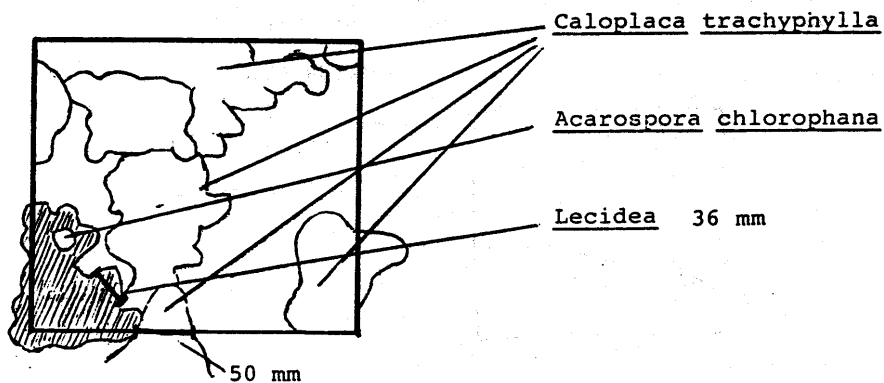
11: quadrat Q-4 from Q-3

SITE DIRECTIONS:

Go 10 ft east from Cooper Q-3, to west side of the juniper next to Q-3. Quadrat is under overhang on west face of a large outcrop.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



COMMENTS: Rock surface uneven.

SITE NAME Cooper Peak

DATE 8-15-89 (1:00 P.M.)

QUADRAT ID Cooper Q-5.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Acarospora chlorophana (24559)--bright greenish yellow crust
Candelariella rosulans (24573)--bright golden yellow crust
Lecanora sierrae (24578)--pale green-yellow lobed crust
Lecidea tessellata (24587)--pale gray crust
Lecidea cf. protabacina (24594)--brown crust
Rhizoplaca melanophthalma (24558)--pale green-yellow leafy,
with blue-black fruiting bodies.

SUBSTRATE: Volcanic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 9120' (2775m)

Tuolumne Co., California.
Stanislaus National Forest.
Emigrant Wilderness.
Pinecrest NE quad.

LICHEN ASPECT 60° NE

CANOPY CLOSURE

SW 1/4 SW 1/4 Sec. 35 T 5N R 19E.

Open

REFERENCE PHOTOS

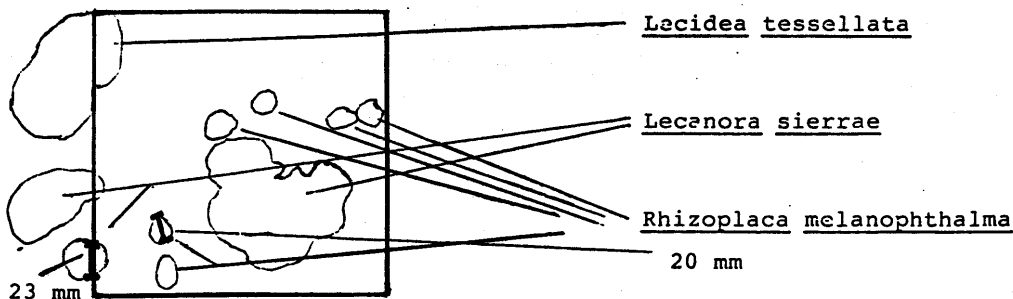
(See 34-36 and 14-16 on Q-3 data sheet for general location).
7-9: quadrat. with lichens.
12: looking at Q-5 from behind Q-4.
13: looking S at Q-3-5 from under the juniper tree.

SITE DIRECTIONS:

Go on other side of same rock as Cooper Q-4 (west side of the juniper next to Q-3 & Q-4). Quadrat Q-5 is near dry creek bed.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



COMMENTS: Rock surface uneven.

SITE NAME Cherry Lake DATE 8-16-89 (11:50 A.M.)

QUADRAT ID Cherry Lake Q-1. SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Aspicilia (24600)--gray crust
Rhizocarpon bolanderi (24598)--blackish crust
Umbilicaria phaea (24599)--brown leafy

SUBSTRATE: Granitic rock QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION ELEVATION 6010' (1825m)

Tuolumne Co., California. LICHEN ASPECT 20° SE
Stanislaus National Forest.
Emigrant Wilderness. CANOPY CLOSURE
Cherry Lake North quad
SE 1/4 NW 1/4 Sec. 17 T 2N R 19E. Open

REFERENCE PHOTOS

17-18: looking at inlet to Cherry Lake, from place on "trail"
where we headed down to Q-1.
19: looking at Ryan, with large rust-colored rock across Cherry
Lake behind him, from Q-1 area.
20: looking at inlet to Cherry Lake. from Q-1 area.
21-23: quadrat Q-1, with lichens
24: looking at Ryan next to Q-1 and two snags 25-30 ft to
south of Q-1.
25: looking east at Bruce next to Q-1. from upslope of Q-1.
26: as in 25 but shows large shear gray cliff across valley.

SITE DIRECTIONS:

From end of road 2N08Y, NW of Cherry Lake, hike west cross
country following the contours of the land between 6000 and 6100
ft elevation (use altimeter!) to the edge of the north-south running
cliff along the western boundary of the Wilderness, then go north
ca. 1000 ft. This is about halfway between a small lake and the
inlet to Cherry Lake. Pile of smaller rocks is stacked up against
the rock on which Q-1 is located.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI

COMMENTS: Rock surface uneven. Clipboard was held over the
photographer's head to produce complete shadow (flash needed);
otherwise at this time of day (11:50 A.M.) the camera produces a
partial shadow on the quadrat.

SITE NAME Cherry Lake

DATE 8-16-89 (1:26 P.M.)

QUADRAT ID Cherry Lake Q-2.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Lecanora pseudomellea (24602)--orangish brown lobed crust

Rhizocarpon bolanderi (24603)--blackish crust

Umbilicaria phaea (24601)--brown leafy

SUBSTRATE: Granitic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 6010' (1825m)

Tuolumne Co., California.
Stanislaus National Forest.
Emigrant Wilderness.
Cherry Lake North quad
SE 1/4 NW 1/4 Sec. 17 T 2N R 19E.

LICHEN ASPECT 20° NNE

CANOPY CLOSURE

Open

REFERENCE PHOTOS

1-3: quadrat Q-2, with lichens.

4: looking at Ryan and Q-2, from 10 ft upslope from Cherry Lake transect T-1.

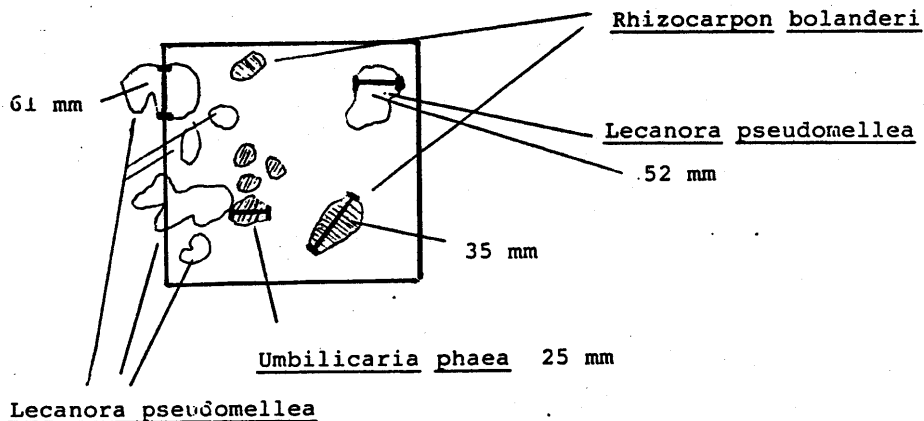
5: looking at Cherry Lake from Q-2.

SITE DIRECTIONS:

Go 20 ft SW (and upslope) from Cherry Lake transect T-1. A rock cairn (pile of stones used as a marker) is near Q-2.

DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



SITE NAME Cherry Lake

DATE 8-16-89 (2:00 P.M.)

QUADRAT ID Cherry Lake Q-3.

SURVEYOR Rocchio, Ryan

LICHEN SPECIES

Aspicilia caesiocinerea (24605)--gray crust

Lecanora pseudomellea (25602)--orangish brown lobed crust

Lecidea cf. protabacina (24606)--brown crust

Umbilicaria phaea (24604)--brown leafy

SUBSTRATE: Granitic rock

QUADRAT TYPE: 20 x 20 cm

LEGAL DESCRIPTION

ELEVATION 6050' (1850m)

Tuolumne Co., California.

LICHEN ASPECT 20° NE

Stanislaus National Forest.

Emigrant Wilderness.

CANOPY CLOSURE

Cherry Lake North quad

SE 1/4 NW 1/4 Sec. 17 T 2N R 19E.

Open

REFERENCE PHOTOS

6-8: quadrat Q-3, with lichens

9: looking towards Ryan and Q-3. from Cherry Lake Q-2.

10: looking towards Cherry Lake from Q-3.

11: looking at Q-3 and the two snags behind Q-2, from N of Q-3.

12: looking at Cherry Lake from the general area of Q-3.

13: looking N from the general area of Q-3.

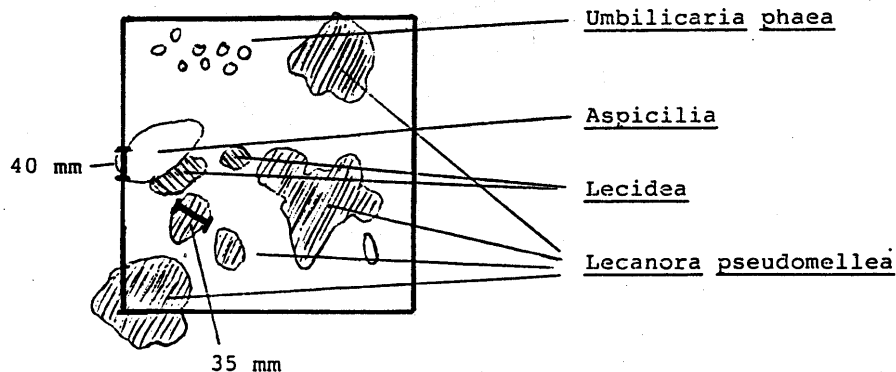
14: looking at Q-3 from 20 ft downslope.

SITE DIRECTIONS:

Go 40 ft NW (and upslope) from Cherry Lake quadrat Q-2. A rock cairn (pile of stones used as a marker) is near Q-3.

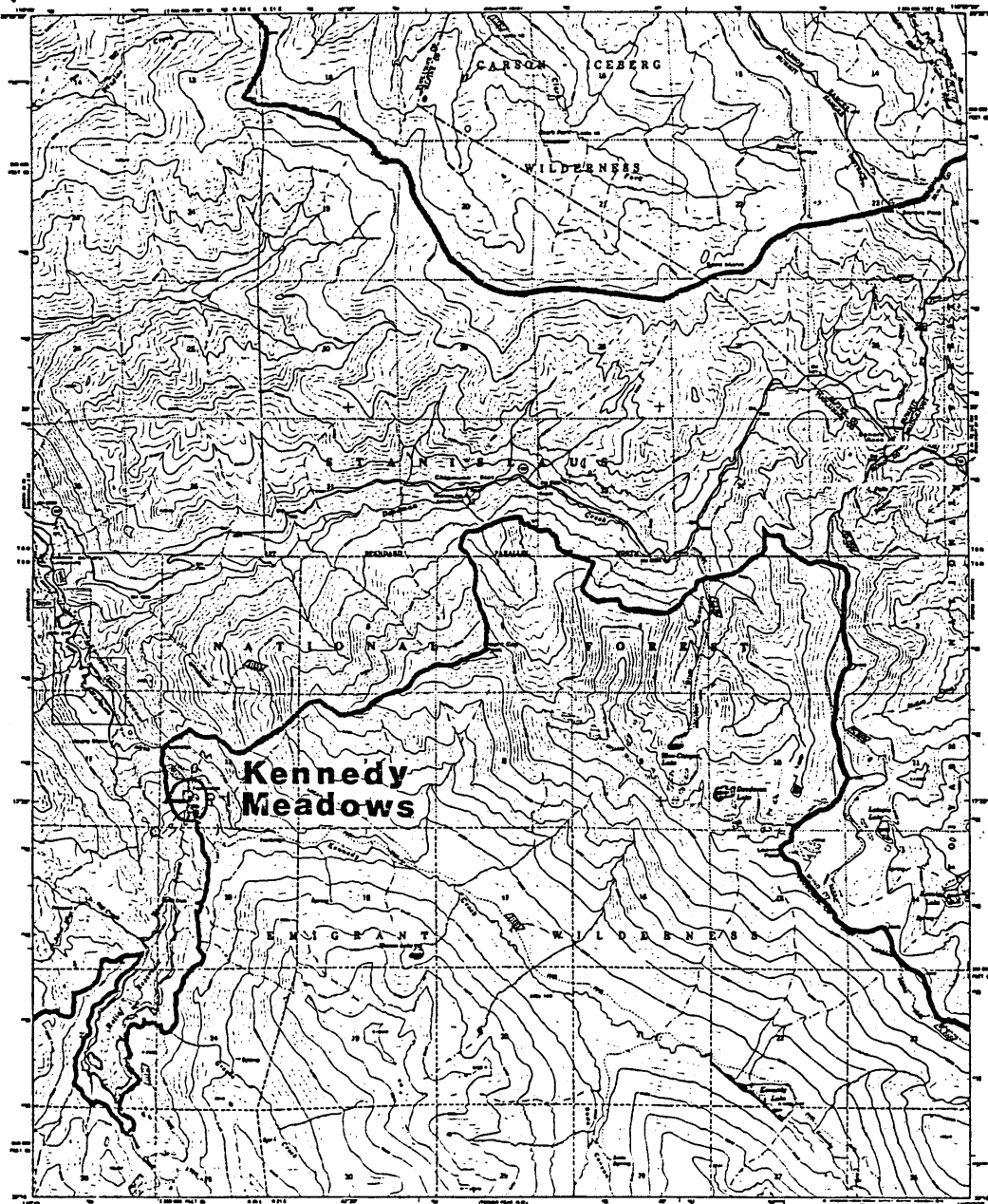
DIAGRAM OF QUADRAT

MEASUREMENTS OF SELECTED THALLI



APPENDIX F:

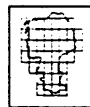
TOPOGRAPHIC MAPS SHOWING SAMPLING SITES



Notes on map and information:
1. This map is based on the 1964 USGS map of the area.
2. The map is a 15-minute scale, providing a detailed view of the terrain.
3. The map is a 15-minute scale, providing a detailed view of the terrain.
4. The map is a 15-minute scale, providing a detailed view of the terrain.
5. The map is a 15-minute scale, providing a detailed view of the terrain.
6. The map is a 15-minute scale, providing a detailed view of the terrain.
7. The map is a 15-minute scale, providing a detailed view of the terrain.
8. The map is a 15-minute scale, providing a detailed view of the terrain.
9. The map is a 15-minute scale, providing a detailed view of the terrain.
10. The map is a 15-minute scale, providing a detailed view of the terrain.

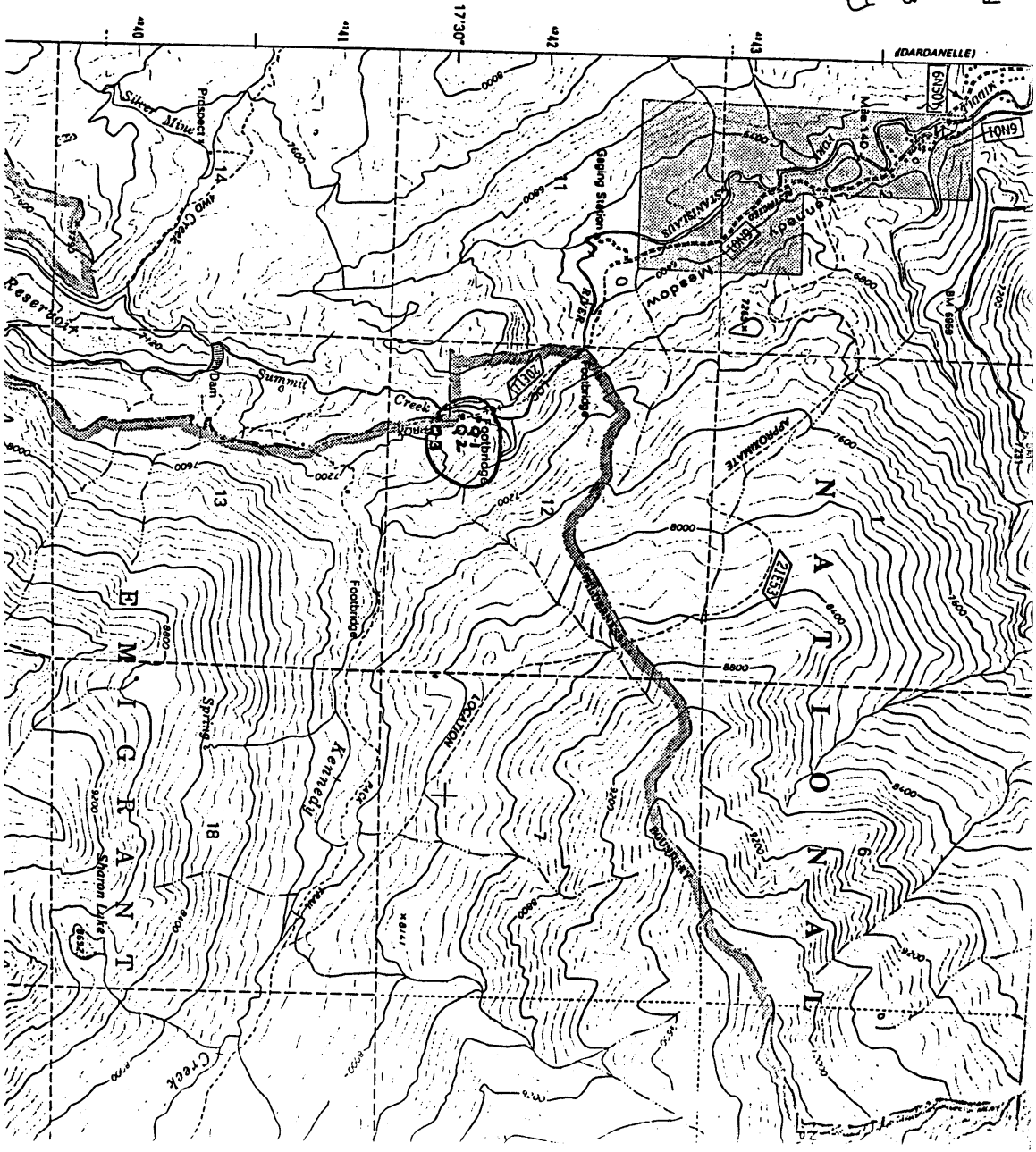


CONTOUR INTERVAL, 80 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET
ELEVATION, 1000 FEET



SONORA PASS, CALIF.
1964-1965
REVISED 1965
L.P.S. 7-1

Sonoma Pass Quad
 Kennedy Meadows
 Q-1, Q-2, i Q3
 Lichen Survey





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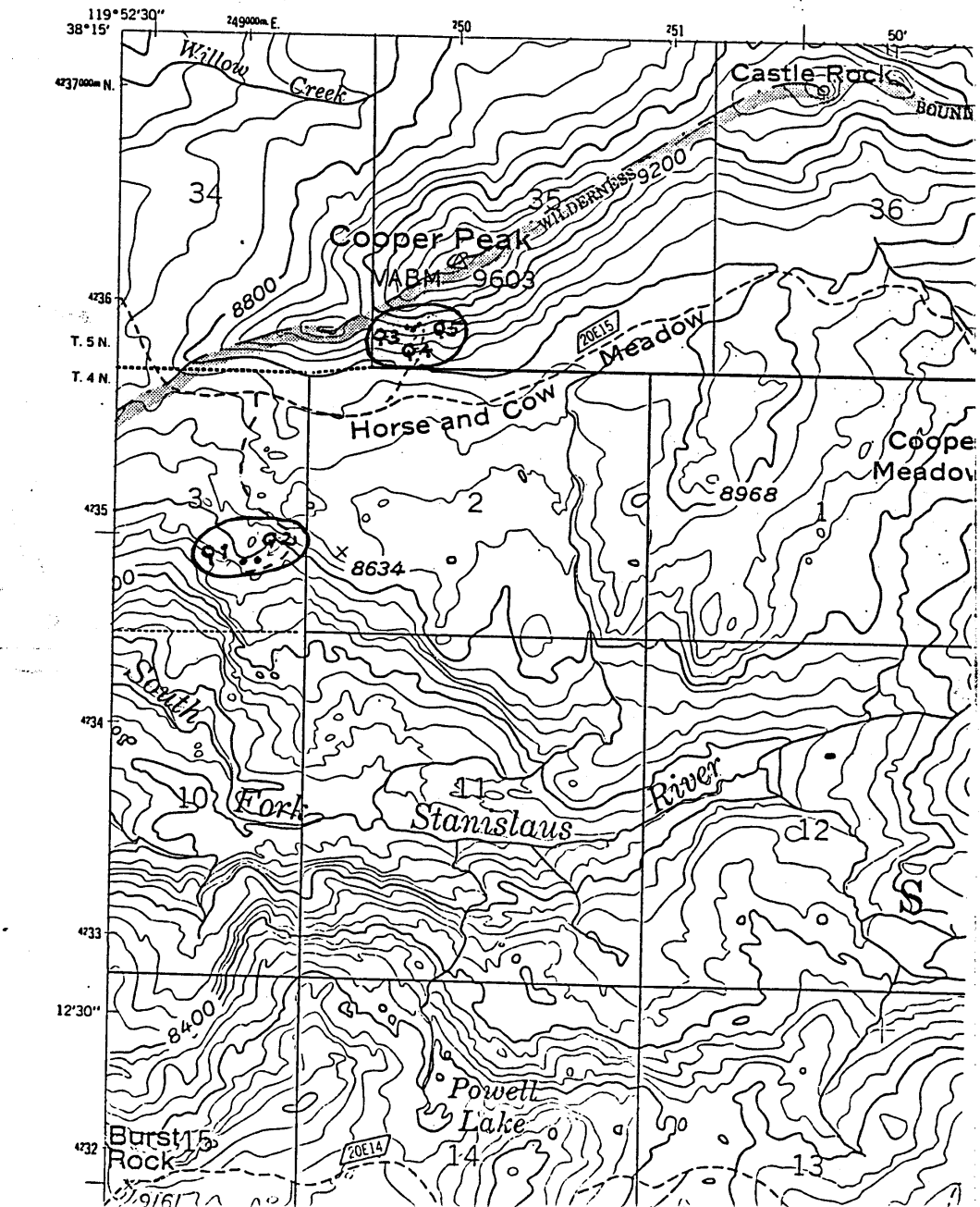


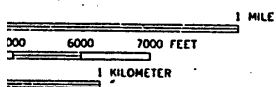
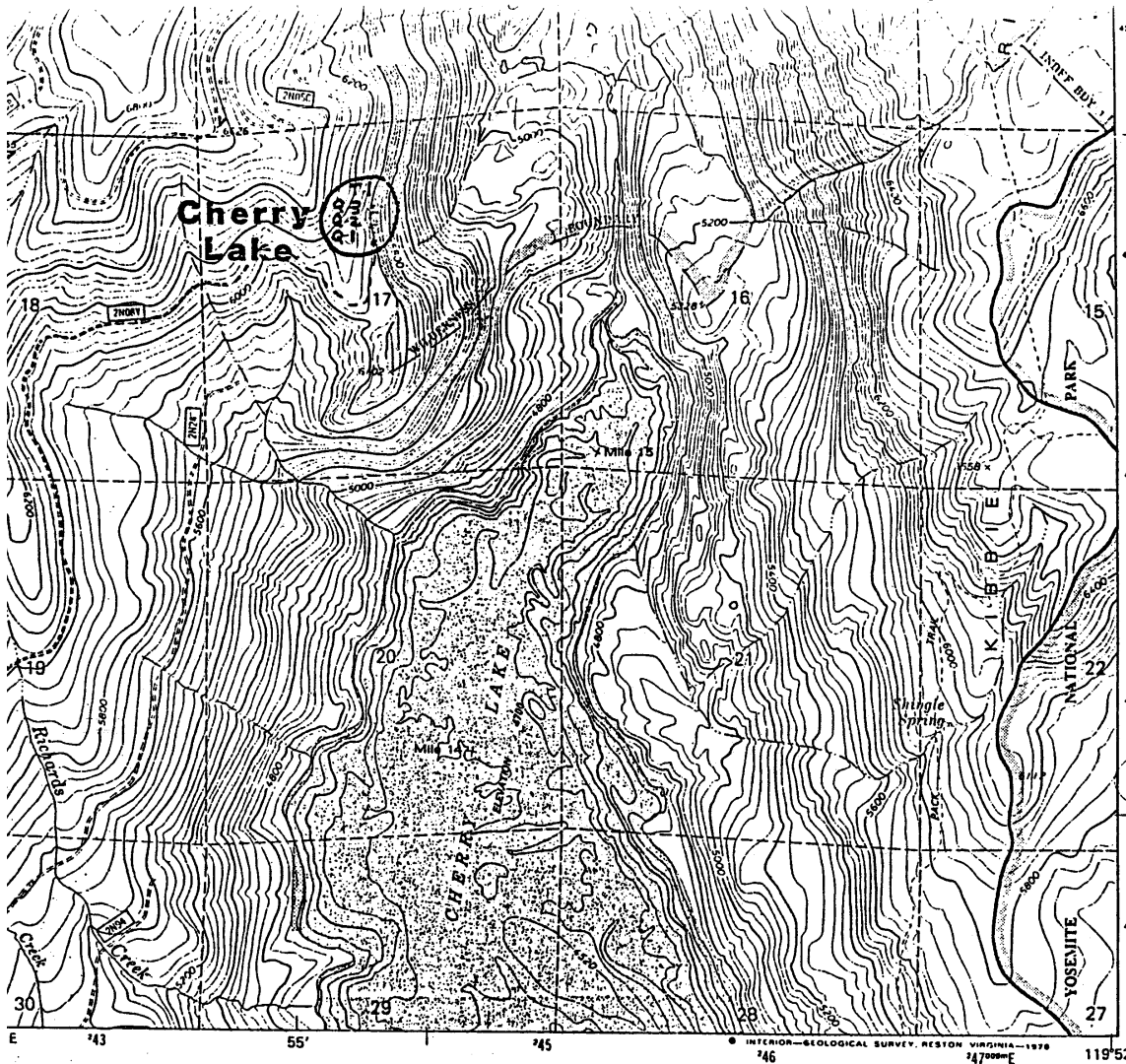
PINOCYTOSE HELICAL

04.2007 5.00 (100%) 7.5

473-1C

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
MODIFIED FOR USDA FOREST SERVICE USE

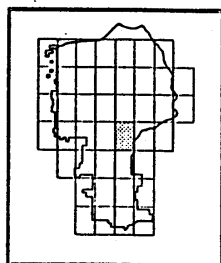




1929

way
ghway
ad
d

- U.S. Highway
- State Highway
- County Road
- Forest Highway
- Forest Road
- Forest Trail
- Barrier



STANISLAUS NATIONAL FOREST

CHERRY LAKE NORTH, CALIF.

N3800-W11952.5/7.5

1979

DMA 2060 III SW—SERIES V895