# Glacier Peak Wilderness Area
# Lichen Biomonitoring Study

Bruce D. Ryan

Department of Botany
Arizona State University
Tempe, AZ 85287-1601

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## INTRODUCTION

This study was conducted for the purposes of providing baseline data on the diversity and relative abundance of lichens in the Green Mountain area of Washington State, primarily with respect to monitoring ozone and heavy metals expected to be produced by the Tenaska generating plant near Ferndale and expected to be carried by air flow into this area. The survey plots were arranged along an elevational gradient; although the emphasis of the study is on the Glacier Peak Wilderness Area, for logistic reasons (accessibility) it was necessary to have the lower elevation plots outside the Wilderness.

The lichen flora of the Cascade Mountains, like that in most parts of western North America, is still very poorly known, with many taxonomical problems yet to be resolved, as discussed for the Green Mountain area in a separate section of this report.

## METHODS

### Floristic Surveys

1993 Fieldwork

Initial floristic surveys of plots 6901 through 6905 were made by myself in the fall of 1993, by making collections of every species that could be identified in the field or appeared to be something different; some "grab-bag" collections of substrate with mixtures of lichens were also made, to find species that might not be noticed or recognized as different in the field. At this time I did not closely examine every single tree or other substrate unit, but tried to sample a wide range of types of substrates or habitats. Since the plot boundaries were not very clearly defined in 1993, some of the collections indicated as being inside the plots were undoubtedly made outside of them. Specimens of various taxa from the same general substrate type (and same specific type in some cases) were put together in collecting bags; preliminary sorting of species into separate packets, and assigning my collection numbers to them, was done under less than ideal conditions (in a rather dimly lit motel room). Further separation of species into different packets, in the herbarium or laboratory at Arizona State University, resulted in having to add letters to the collecting numbers.

Additional collections (mostly in 1993) were made outside of plots at various localities in the general area.

1994 Fieldwork

More systematic surveys of the first five plots, and of plot 6906, were conducted in collaboration with Robin Lesher in the fall of 1994. In these surveys, an effort was made to examine each substrate unit (e.g., numbered trees, snags, stumps or logs, plus shrubs, rock outcrops, etc.) and to record specific information about where species (especially the less common ones) were found. Additional collections were made as necessary. Each species or apparently different kind of lichen was assigned consecutive "L-numbers" on field forms, and the abundance (generally used for species growing above ca. 0.5 m on trees) or % cover were estimated, according to the standard system used by the Forest Service for biodiversity plots. My initial estimates were discussed with Robin Lesher in the field, and sometimes were revised accordingly; however, there were a number of problems, as discussed in the introduction to the Results section.

1993-1995 Laboratory/Herbarium Work

Lichen identifications were made by myself in the herbarium or laboratory at Arizona State University, using standard methods of light microscopy, spot tests, and thin-layer chromatography.

## Element Analyses

The following collections were made by me in the fall of 1993 for the purpose of doing element analyses on material from roughly the same elevation as each of the plots. In most cases the collections were made in the general vicinity of the plot, but for the 1000 ft plot it was neccessary to make the collection at a somewhat lower elevation quite some distance from the plot.

**1000 ft**--Alectoria sarmentosa, Platismatia glauca, Hypogymnia entermorpha group, Platismatia herrei, Sphaerophorus globosus.
**2000 ft**--Alectoria sarmentosa, Platismatia glauca, Hypogymnia enteromorpha group, Platismatia herrei.
**3000 ft**--Alectoria sarmentosa, Platismatia glauca, Hypogymnia enteromorpha group, Bryoria spp.
**4000 ft**--Alectoria sarmentosa, Platismatia glauca, Hypogymnia enteormorpha group, Bryoria spp.
**5000 ft**--Alectoria sarmentosa, Platismatia glauca, Hypogymnia enteromorpha group (H. imshaugii), Bryoria spp.

Samples for element analyses were collected in mesh bags, and were cleaned of twigs or other contaminants in a laboratory at Western Washington University with forceps washed in distilled water. The samples were then transported to the Mount Baker-Snoqualmie National Forest Supervisor's Office.

It was not possible to collect each of four species at each elevation in sufficient quantites for element analysis.
Examination of the lists of species of Alectoria, Bryoria, and Hypogymnia found at different elevations (including ones extracted from "extra" element analysis material) shows that the collections of these genera were almost always mixtures, which varied in species composition with elevation.

It should also be noted that each collection of four genera was made in single fairly localized area to represent the elevation. Time and funding, and in some cases the abundance of the appropriate lichens, were insufficient to allow field replications, although "lab replications" (subdivision of the initial sample) are still possible. Previous studies suggest that the variation even among "lab replications" of the same species from a single area can be extreme, particularly for some elements. Therefore some caution must be used in interpreting the results of the analyses.

## STUDY SITES

### Permanent Plots

Plot locations were selected by Robin Lesher and Jan Henderson, based on the criteria of being close in elevation and location to the ozone monitors established by Tony Basabe's crew, and of being representative of relatively pure stands of the most characteristic dominant vascular vegetation on more or less north-facing slopes at each elevation. The initial selection of sites for ozone monitors was itself influenced to a large extent by accessibility, which of course was also a consideration in locating the plots themselves.

Plot numbers are given on the specimen labels as "1, 2, etc." rather than as "6901, 6902, etc."

Descriptions of the first five plots are based on initial field observations in 1993; further information on these is available from Robin Lesher, who provided the detailed description for plot 6906.

**Plot 6901 (1000 ft)** Mt. Baker-Snoqualmie National Forest, N of Road 26, ca. 15 miles (24 km) from Hwy 530, area dominated by western hemlock (Tsuga heterophylla), with some Douglas fir (Pseudotsuga menziesii) and a few vine maples (Acer circinatum), ca. 300 m. T32N,R11E,S14,NW 1/4 of NE 1/4. 48°16'N, 121°21'30"W. Proceed north (upslope), just E of culvert E of parking lot for Huckleberry Mountain Trail, following a series of orange and white diagonal ribbons.

**Plot 6902 (2000 ft)** Mt. Baker-Snoqualmie National Forest, N of Road 2680 at first switchback (turning from west to east), ca. 1.5 mi (2.4 km) from Road 26, area dominated by western hemlock, ca. 600 m. T32N,R12ES17,SE 1/4 of NE 1/4. 48°15'30"N, 121°17'W. Follow east edge of ravine upwards from the road, then turn right, near a large burnt stump. Plot center is marked by a branch stuck in the ground, with an orange ribbon on it; above the branch is a vine maple with both orange and orange and white diagonal ribbons on it.

**Plot 6903 (3000 ft)** Mt. Baker-Snoqualmie National Forest, NE of Road 2680, fifth switchback (turning from northwest to southeast), area dominated by western hemlock, with some old (2-4 ft dbh) Douglas fir and some western red cedar (Thuja plicata), just over 4 miles (6.5 km) from Road 26, ca. 900 m. T32N,R12E,S16, SW 1/4 of NE 1/4. 48°16'N, 121°15'30"W. Proceed uphill from the road through a patch of scouring rush (Equisetum laevigatum), following a series of orange and white diagonal ribbons.

**Plot 6904 (4000 ft)** Mt. Baker-Snoqualmie National Forest, W of Green Mountain Trail, shortly after crossing second creek (muddy area), are dominated by silver fir (Abies amabilis), with some Douglas fir.ca. 1200 m. T32N,R12E,S10, SE 1/4 of SW 1/4. 48°16'30"N, 121°14'30"W. Plot center is marked by an orange flag on a bent-over sapling, ca. 120-130 ft NW (downslope and up the trail) from a fire-scarred large (50 inch dbh) Douglas fir with curving base, along W side of trail, marked on side away from trail with round aluminum tag with the number 99 on it.

**Plot 6905 (5000 ft)** Glacier Peak Wilderness, S of Green Mountain Trail, after long walk through meadows, in area dominated by Alaskan red cedar (Chamaecyparis nootkatensis), with some subalpine fir (Abies lasiocarpa), ca. 1500 m. T32N,R12E,S10,NE 1/4 of SW 1/4. 48°17'N, 121°14'30"W. Center stake (marked by an orange ribbon) is near a large subalpine fir, ca. 20 ft downhill from a ca. 10 ft tall snag covered with bright green-yellow lichen (Letharia, not seen elsewhere along the trail) visible from the trail; Glacier Peak is visible across the valley to the south. The boundaries of the plot are marked by a series of orange and white diagonal ribbons, especially on the downhill side.

**Plot 6906 (6000 ft)** Glacier Peak Wilderness, off of Green Mountain Trail, after descending to the small lake and then heading quite some distance upslope to an isolated clump of trees on the meadow slope: Subalpine Fir/Sitka Valerian Plant Association, open parkland stand in meadow matrix of false hellebore and Sitka valerian, about 200 years old, with episodic establishment of trees since Little Ice Age; subalpine fir (Abies lasiocarpa) dominant tree species; herbaceous understory dominated by Sitka valerian, false hellebore and saussurea. 48°17'30"N, 121°14'W, aspect 242°, slope 49%.

## Additional Collecting Localities in the Green Mountain Area

The plot selections made no attempt to consider the representativeness, diversity, or luxuriance of the lichen flora, nor the presence or abundance of species potentially most significant as biomonitors of pollution. Therefore, lichens were also collected (mostly in 1993) at the following additional sites in the general area (except for the Sauk Road sites, these are all between Darrington and Green Mountain).

**Locality 1** Sauk Road, E of Hwy 530, just S of the Sauk-Suiattle Indian Reservation, ca. 400-420 ft. T33N,R10E,S29,SE 1/4. 48°19'N,121°33'W. Flat lands. **1a:** Back yard of home of Bill and Holley Ross, N side of the road (present site of the electronic ozone monitor). **1b:** N side of the road near the end, by the Sauk River, dominated by maples, alders and willows.

**Locality 2** Road 2600-012, S off Road 26. Flat areas away from river, dominated by Ponderosa pine (Pinus ponderosa), western hemlock, and alder. Site of element analysis samples for 1000 ft elevation. Very rich and luxurious lichen flora on trees and ground.

**Locality 3** Along Road 26, ca. 2.7 mi E of Forest boundary, near Suiattle River, ca. 1000 ft. T32N,R11E,S9,SE 1/4. 48°16'30"N, 121°22'30"W. Area dominated by western hemlock (closed canopy), with Douglas fir and alder. Epiphytic vegetation on trunks and lower dominated by bryophytes, but canopy with diverse and luxurious flora of lichens, especially Lobaria spp. and other nitrogen-fixing cyanophilic foliose kinds.

**Locality 4** Along Road 26, mile 16-17 (E of Buck Creek Campground), and unnumbered dirt road on south side. T32N,R12E,S18,SW 1/4. 48°15'30"N, 121°19'W. Indicated by a yellow ribbon (labelled "Clear Beaver") on a tree, and a tall wooden stake. Flat land away from river, along roadside and in dense stands of young to middle-aged conifer trees (mostly western hemlock and Douglas fir). Rich and luxuriant flora of Lobaria spp. and other nitrogen-fixing kinds on branches (especially in canopy) and on the ground.

**Locality 5** Wide pull-out near bottom of Road 2680, ca. 1500 ft (450 m). T32N,R12E,S16,SW 1/4. 48°15'30"N,121°15'30"W. Area dominated by large Douglas firs, with some alders.

**Locality 6** Wide pull-out on Road 2680, mile 4-5, ca. 3200 ft (950 m). T32N,R12E,S15,NW 1/4. 48°16'N,121°15'W. Area dominated by western red cedar.

Extensive collections were also made in the general vicinities of each of the plots, and additional smaller collections were made at various places along the Green Mountain Trail (especially at 3700-3900 ft, 4700-4900 ft, and 5200-5300 ft), and at a two other places (Tenas Creek and Downey Creek) along Road 26.

## RESULTS

In the species lists that follow, underlined numbers are the collection numbers of Ryan. "FS" means that the specimen is being given to the Mt. Baker-Snoqualmie National Forest (Supervisor's Office in Mountlake Terrace). Most additional specimens cited, and duplicates of many of the specimens sent to the Forest Service, are deposited in the herbarium of Arizona State University (ASU).

Species names in quotation marks are unpublished herbarium names of Ryan, used for convenience in trying to distinguish different unidentified species in large genera. Authority names of published species, and most remarks on taxonomy, are given in a separate alphabetical list of all lichen species identified from the Green Mountain area and some nearby localities.

### Data from Plots

For plots 6901 through 6905, the species identified from the plot (based on still somewhat preliminary list of 1993 collections) were listed first in alphabetical order on the field form. When species that were supposedly found in 1993 were not actually observed in the plots in 1994, they were assumed to be uncommon and were estimated to be of abundance = 1 (or cover = 0.01). In most cases the failure to detect the species in 1994 was due to the difficulty of distinguishing taxa in the field, especially during a more limited time and often poorer field conditions (e.g., rain). In a few cases (with conspicuous or distinctive taxa) it was due to the 1993 collection having been made from litterfall (the species may have still been present in the canopy in 1994, but could not be detected from the ground). In at least one case it was due to errors in the preliminary lists (species misidentified or not actually found inside the plot in 1993).

Species identified in the lab, from 1993 or 1994 collections, but not detected in the field or not assigned L-numbers on the field form in the field, were also assigned abundance = 1 (or cover = 0.01), and were given L-numbers in the lab. Taxa mistaken for lichens in the field in 1994 were given collection numbers or assigned abundance codes, but (with a few exceptions) taxa that were already known to be non-lichens were not.

Abundance and cover estimates were often extremely difficult, due especially to the difficulty of detecting or recognizing species in the field. In a few cases where the same taxon was estimated two or more times under different L-numbers, I have indicated this by adding a "+" after the estimate, followed by an explanation in brackets. Without changing the original field estimates, I have also made some comments about some of them, based on what I know about the problems in field identification, and in a few cases I have added my subjective impressions based on my 1993 field notes or consideration of the quantity of voucher specimens. I have also given suggested "dry lab" estimates for species not listed on the field forms. In all cases I have tried to be as consistent and explicit as possible about my decisions and the reasons for them.

In some cases the specimen turned out to be very poor or small, and was therefore either discarded or combined with another specimen under a different number, while in other cases the specimen was re-identified as some other taxon; these decisions were not always recorded, leading to a few missing numbers or "phantom" numbers that do not correpond to any existing specimens; this is especially true for number-letter combinations. Taxa are included in the plot lists in this document only when a voucher for their occurrence in a particular plot definitely exists, although in a very few cases where the species is unmistakable in the field, the voucher was actually collected outside of the plot, as indicated.

**Plot 6901 (1000 ft)**

In this plot the dominant epiphytes were mosses; the lichen flora was depauperate, even in the canopy. Most of the species occurred on Tsuga heterophylla. The 1994 fieldwork was conducted in the rain, and except for Graphis scripta, Icmadophila ericetorum, and Lepraria spp., the crustose lichens were too difficult to identify in the field under these conditions, and were all assigned abundance = 1, since as a group they appeared to be uncommon in the plot.

Arthonia tetramera (L-1)--On conifer bark, with Chaenothecopsis brevipes in 30589-b [FS]. An inconspicuous species unless very abundant; not recognized as such in the field in 1994. Abundance = 1. See note under A. cf. microspermella under "excluded from plot".

Calicium cf. lenticulare (L-33)--On stump, 30590-b [FS]. Not on the field form; not observed in 1994 (probably overlooked). Abundance = 1.

Chaenothecopsis brevipes (L-34)--Parasitic on Arthonia tetramera, on conifer bark, 30589-b [FS]. Not on the field form; only a very tiny amount found in 1993; not seen in 1994 (probably overlooked). Abundance = 1.

Cladonia cornuta ssp. groenlandica (L-4)--On bark of conifer (Pseudotsuga menziesii) boles (13, 35) and a conifer stump (SE part of plot near flag), 30195-b [FS]. Cover = 0.04.

Cladonia macilenta (L-30)--On conifer stump (11), 32466 [FS]; on base of Pseudotsuga menziesii bole (13), 32467 [FS]. Cover = 0.03+ (0.03 identified in the field as C. sp. + 0.02 identified in the field as C. squamosa v. subsquamosa).

Cladonia cf. squamosa v. subsquamosa (L-5)--On conifer bark (base of boles), 30195-a [FS]. The identification is tentative because the material, is atypical, at least some of the specimens from other sites in the Green Mountain area, has unusually small podetial squamules, like the specimens from at least some of the other other sites in the Green Mountain area. The specimen identified as this taxon in 1994 (32467) is actually C. macilenta. Cover = 0.01.

Graphis scripta (L-6)--On conifer bark (boles). Vouchers were collected outside of but very near plot (start of Huckleberry Trail), 30135-b, 30145 [FS], but the species was definitely observed within the plot in 1994. Abundance = 1.

Hypogymnia enteromorpha (L-7, L-9)--On conifer bark (branches in the canopy, found as litterfall), 30194-a [FS] and 30588-b (L-9: appressed morph resembling H. occidentalis; listed on field form as H. sp.) [FS], 30588-a, 30194-d, 32460 [FS]. Abundance = 1+ (1 for L-7 + 1 for L-9).

Hypogymnia imshaugii (L-35)--On conifer branches (litterfall), 32464 [FS]. Not on the field form. Abundance = 1.

Hypogymnia physodes (L-8)--On conifer bark (branches), 30587 [FS]. Abundance = 1.

Icmadophila ericetorum (L-32)--On rotting Pseudotsuga menziesii stump (37), 32468 [FS]. Mostly sterile. Cover = 0.01.

Lepraria "protocetrarica" (L-10; L-29)--On boles of Tsuga heterophylla (2 and 4) and Pseudotsuga menziesii (13) and on conifer stumps (11), 30190 [FS]. Cover = 0.05.

Lepraria "rangiformica" (L-11; L-28)--On mossy rocks, 30186 [FS]. Cover = 0.01.

Lobaria oregana (L-12)--On conifer branches in the canopy, 30189 [FS]. Abundance = 1.

Lobaria pulmonaria (L-13)--On conifer branches in the canopy (found as litterfall), 30591, 32465 [FS].

Abundance = 1.

Loxospora elatina (L-36)--On bark, 30590-a [FS]. Not on the field form. Abundance = 1.

Mycoblastus sanginarius (L-14)--On conifer bark, 30589-a [FS]. Abundance = 1.

Nephroma helveticum ssp. sipeanum (L-15)--On conifer branches in the canopy (collected as litterfall), 30197 [FS]. Not found in 1994. The lobules are poorly developed, and the specimen was originally identified as N. bellum. Abundance = 1.

Parmelia sulcata (L-17)--On bark, 30193 [FS]. Abundance = 1.

Parmeliopsis hyperopta (L-18)--On conifer bark, 30586 [FS]. Abundance = 1.

Peltigera membranacea (L-27)--On litter over rock, 32469 [FS] and on mossy log by orange flag at north end of plot, 32470 [FS]. Cover = 0.01%.

Pertusaria ophthalmiza (L-21)--On bark, 30188 [FS]. Abundance = 1.

Pertusaria subambigens (L-22)--On bark of conifers (litterfall branches), 32459 [FS]. Abundance = 1.

Platismatia glauca (L-23)--On branches of conifers (litterfall), 32462 [FS]. Abundance = 1.

Pseudocyphellaria anomala (L-24)--On branches in canopy (collected from litterfall), 30192 [FS]. Not seen in 1994. Abundance = 1.

Sphaerophorus globosus v. gracilis (L-25)--On branches of conifers (litterfall), 30191, 32461 [FS]. Abundance = 1.

Usnea "pendula" (L-26, L-31)--On branches of conifers (litterfall), 30187 (L-26) [FS], 32463 (L-31) [FS]. Abundance = 1. Not recognized as such (i.e., L-26) in the field in 1994 (L-31 specimen was misidentified in the field as Alectoria sarmentosa).

Excluded (outside of plot):

> Arthonia cf. microspermella--On bark, 30456-d [FS]. The specimen was actually collected in plot 6902; although this specimen was the original basis of L-1 in plot 6901, that number (L-1) has been reassigned to A. tetramera, which does occur in plot 6901.
>
> Bacidia laurocerasi (L-2)--On bark, 30455-c [FS]. This specimen was actually collected in plot 6902, and the species was apparently not observed in plot 6901.
>
> Caloplaca atrosanguinea (L-3)--On bark. Not observed (or at least recognized) in plot 6901 in 1994, and was erroneously included on the field form for this plot (the specimen, 30456-e, was actually from plot 6902).
>
> Ochrolechia laevigata (L-16)--On bark, 30449-a [FS]. Erroneously included on field form--specimen was collected on way to plot 6902, and the species was not observed in plot 6901 in 1994.
>
> Pertusaria leucostoma (L-20)--On bark, 30457-b [FS]. Erroneously included on field form--specimen was actually collected in plot 6902, and the species was not observed in plot 6901 in 1994.
>
> Peltigera neopolydactyla Gyelnik (L-19)--On mossy logs, 30196 (det. by B. Goffinet) [FS]. Erroneously included on field form--specimen was collected below (outside of) the plot.

**Plot 6902 (2000 ft)**

The lichen flora in this plot occurred almost entirely on Tsuga heterophylla; very few species were found on Acer spp. Again, the 1994 fieldwork was conducted in the rain, making it especially difficult to identify many of the crustose lichens (and some macrolichens) in the field (species that were not recognized in the field in 1994 are indicated as such, and were all assigned abundance = 1).

Alectoria vancouverensis (L-1, L-2)--On boles of Pseudotsuga menziesii (10, 29) and Tsuga heterophylla, 30206-a [FS]. Abundance = 2+ (common on upper boles; only occasional lower down). L-1 was erroneously listed on the field form as A. sarmentosa (based on 1993 specimens actually from plot 6903), and all Alectoria specimens from plot 6902 and vicinity that were spot-tested with C are A. vancouverensis (this is probably also true for at least some of the material used for element analysis). However, A. sarmentosa was found at other sites at both lower and higher elevations than plot 6902, and therefore may well be also present in this plot.

Arthonia cf. microspermella (L-3)--On Acer macrophyllum, 30456-d [FS]. Abundance = 1.

Bacidia laurocerasi (L-4)--On conifer bark (branches), 30455-e [FS], 30459-c [FS], 32477 [FS]. Abundance = 2, but could not be reliably distinguished in the field from B. polychroa and various other crusts.

Bacidia polychroa (L-60)--On branches of Cornus nuttallii, 32476 [FS], and on branches of Acer circinatum. Abundance = 2. See note under B. laurocerasi.

Bryoria capillaris (L-5, L-7)--On conifer bark (boles), 30462-a [FS]. Abundance = 1 (1 for L-5 + 1 for L-7). L-7 was listed on field form as B. sp., but the voucher is the same specimen as that for B. capillaris.

Bryoria glabra (L-6)--On conifer bark, 30201 [FS]. Abundance = 1.

Buellia "parvispora" (black apothecia) (L-71)--On Acer circinatum branches, 32489 [FS]. Abundance = 1. Not on field form; not recognized as such in the field.

Buellia "anomala" (pale apothecia) (L-77)--On branches, 32490 [FS]. Abundance = 1. Not on field form; not recognized as such in the field.

Calicium abietinum (L-8, L-9)--On conifer wood (long decorticate trunk ca. 15 cm diam.), 30460-e [FS]; abundant on one long decorticate bole ca. 15 cm diam. Not recognized in field in 1994. Abundance = 1.

Caloplaca atrosanguinea (L-10)--On branches of Acer circinatum and young A. macrophyllum, 30456-e [FS]. Abundance = 2, but difficult to recognize in the field.

Caloplaca cf. borealis (L-59)--On Acer circinatum branches, 32473 [FS]. Abundance = 1.

Cladonia acuminata v. acuminata (L-79)--On rotten conifer wood, 30468-d [FS], 30225-b (basal squamules only, but the chemistry matches) [FS]. Cover = 0.01. Not on field form.

Cladonia bacillaris (L-11)--On base of boles of Pseudotsuga menziesii (31) and rotting wood of a conifer log (12), 30468-b [FS]. Cover = 0.01.

Cladonia cornuta ssp. groenlandica (L-78)--On rotten conifer wood, 30468-c [FS]. Cover = 0.01. Not on field form.

Cladonia macilenta (L-12)--On rotten conifer wood, 30198 [FS]. Cover = 0.01.

Cladonia cf. squamosa v. subsquamosa (L-15)--On rotten conifer wood, 30468-a (L-14) [FS], 30199 (L-15) [FS]. Cover = 0.01+ (0.01 for L-14, + 0.01 for L-15). The material is atypical, like that found in plot

6901. L-14 was listed on field form as C. squamosa v. squamosa.

Cladonia spp. (L-13, L-16)--On rotten conifer wood. The collection that was the basis for L-13 (listed on the field form as C. rei, which apparently does not occur in the plot) was a mixture of C. acuminata and C. cornuta, plus C. squamosa v. subsquamosa. L-16 was a combined estimate for unidentified members of the genus (including ones with basal squamules only). None of the identified species were definitely recognized in the field in 1994, but were assigned cover = 0.01 because none of the patches of Cladonia in the plot were very large.

Hypogymnia enteromorpha (L-17)--On boles of Pseudotsuga menziesii (21, 29, 31), 30207-a (appressed morph, superficially similar to H. occidentalis or H. rugosa) [FS], 30463-d. Abundance = 3; this was based on the + typical, non-appressed morph; see notes under H. sp. (L-20).

Hypogymnia imshaugii (L-18)--On boles of Pseudotsuga menziesii (10, 18, 21), 30463-c [FS], 30463-b (atypical, with very narrow lobes) [FS], 30210. Abundance = 2.

Hypogymnia physodes (L-19)--On boles of Pseudotsuga menziesii (29, 31), 30205 [FS], 30207-b, 30463-a, 30454-b [FS]. Abundance = 3.

Hypogymnia rugosa (L-67)--On bole of Pseudotsuga menziesii (18), 32480 [FS]. Abundance = 1; however, see notes under H. sp. (L-20).

Hypogymnia sp. (L-20)--Abundance = 2; however, the estimate was based on a mixture of H. rugosa and appressed morphs of H. enteromorpha, since these were difficult to distinguish in the field; no specific trees or substrates were indicated on the field form, and no voucher for L-20 was collected in 1994.

Japewia tornoensis (L-21)--On bark of Pseudotsuga menziesii (18, 31), 30225-a, 30459-c [FS]. Abundance = 3-; however, this species was difficult to recognize in the field.

Lecanora pulicaris (L-22)--On branches of Acer circinatum and A. macrophyllum, 30456-a [FS]. Abundance = 2.

Lecidea "albovirida" (L-68)--On branch of conifer (litterfall), 32478 [FS]. Abundance = 1.

Lecidea "carneogrisea" (L-74)--On branches, 32491 [FS]. Abundance = 1. Not on field form.

Lecidea "glaucodisca" (L-73)--On branches, 32488 [FS]. Abundance = 1. Not on field form.

Lecidea sanguineoatra (L-72)--On moss at base of Pseudotsuga menziesii, 32485 [FS; originally called L. "brunneovirida"]. Cover = 0.01. Not on field form.

Lecidea "stygiovirida" (L-69)--On rock, 32493 [FS], 32494 [FS]. Cover = 0.01.

Lecidella euphorea (L-23)--On branches of Acer circinatum, 30454-a [FS]. Abundance = 2, but easily misidentified in the field.
Lepraria incana (L-24)--On boles of Pseudotsuga menziesii, 30214 [FS]. Cover = 0.01 (abundance = 1).

Lobaria pulmonaria (L-25)--On bole of Acer circinatum, branches of Acer macrophyllum (litterfall), 32472 [FS], and on bark of conifers, 30465 (tiny amount). Abundance = 1.

Lopadium disciforme (L-26)--On boles of Pseudotsuga menziesii (10, 31) and a conifer log (17), 30459-d [FS], 30221. Abundance = 3-.

Loxospora elatina (L-27)--On boles of Pseudotsuga menziesii (10, 29, 31), 30458-c [FS]. Abundance = 3-. Difficult to recognize in the field.

Loxospora pustulata (L-28)--On conifer bark, 30457-g [FS]. Not recognized in the field in 1994. Abundance = 1.

Micarea? sp. (L-76)--On rock, appearing to be parasitic on apothecia of Lecidea "stygiovirida", in same specimen, 32494 [FS]. Cover = 0.01. Not on field form.

Mycoblastus affinis (L-29)--On boles of Pseudotsuga menziesii or other conifers, 30459-b [FS]; on conifer wood, 30228, 30230. Abundance = 2.

Mycoblastus sanguinarius (L-30)--On boles of Pseudotsuga menziesii (18, 29) and a conifer log (12), 30459-a [FS], 30215. Abundance = 2.

Ochrolechia androgyna (L-31)--On Acer macrophyllum, 30457-d [FS]; on conifer bark, 30458-g [FS]. Abundance = 1.

Ochrolechia laevigata (L-32, L-35)--On bark, 30458-b [FS]; on young Acer macrophyllum, 30457-a; on Cornus nuttallii. L-35 was listed as "O. sp." on the field form. Abundance = 1.

Ochrolechia oregonensis (L-33; L-65)--On boles of Pseudotsuga menziesii (21, 18), 30223-b, 30222-b [FS], 30458-a [FS]; on conifer wood, 32479 [FS]. Abundance = 2.

Ochrolechia szatalaënsis (L-34)--On Pseudotsuga menziesii, 30222-a [FS]. Superficially similar to O. laevigata, and may also be present in the plot on bark of hardwoods. Abundance = 1.

Ochrolechia spp. (L-83)--On conifer bark, 30458-f [FS], 30220-b [FS]. Not on field form; these specimens are too immature to identify to species. Abundance = 1.

Parmelia saxatilis (L-36)--On Pseudotsuga menziesii (88), 30211 [FS]. Abundance = 1.

Parmelia sulcata (L-75)--On bark, 30224-a [FS]. Not on field form. Abundance = 1.

Parmeliopsia ambigua (L-37)--On bole of Pseudotsuga menziesii (88), rare, 30216-a [FS]. Abundance = 1.

Parmeliopsis hyperopta (L-38)--On boles of Pseudotsuga menziesii (10, 18, 21) and a conifer log (12), 30216-b [FS]; a small amount found once on rock, in one specimen of Lecidea stygiovirida, 32493 [FS]. Abundance (on bark or wood) = 2.

Peltigera britannica (L-39)--On mossy rocks, 30467-a [FS]. Cover = 0.01. Listed on field form as P. leucophlebia.

Peltigera membranacea (L-40; L-62)--On moss, 30200, 30466, 32486 [FS]; on mossy rocks, 30467-b. Cover = 0.01+ (0.01 + 0.01).

Pertusaria leucostoma (L-41)--On branches of Acer circinatum, 32475 [FS]; on young Acer macrophyllum, 30457-b [FS]. Abundance = 2. See note under P. sp.

Pertusaria ophthalmiza (L-42)--On young Acer macrophyllum, 30455-a [FS]. Abundance = 2.

Pertusaria subambigens (L-43)--On bark of Pseudotsuga menziesii (21, 29, 31), 30219 [FS], 30223-a [FS], 30458-e. Abundance = 3+. See note under P. sp.

Pertusaria sp. (L-44)--This was included on the field form because at the time several specimens tenatively identified as members of this genus from this plot had been not yet been identified to species; however, those specimens have now been identified (30223-a = P. subambigens, 30457-b = P. leucostoma; 30457-a and 30457-d = Ochrolechia spp.); "30223-b" and "30457-c" apparently do not

correspond to any existing specimens.

Phlyctis agelaea (L-45)--On conifer bark, 30458-d [FS]. Not recognized in the field in 1994. Abundance = 1.

Phlyctis argena (L-46)--On bole of young Acer macrophyllum, 30455-b [FS], A. circinatum, and Cornus nuttallii. Abundance = 3+.
Platismatia glauca (L-47)--On boles of Pseudotsuga menziesii (21, 29) and a conifer log (12), 30202 [FS]; on young Acer macrophyllum, 30454-c [FS]. Abundance = 2.

Platismatia herrei (L-48)--On boles of Pseudotsuga menziesii (18, 29, 31), 30204 [FS], 30461-b; on branches of Acer circinatum. Abundance = 3-.

Platismatia norvegica (L-49)--On Pseudotsuga menziesii, common on some trees, especially mossy ones, 30203 [FS], 30461-a [FS]; on the bole and branches of a conifer log (49). Abundance = 2 (cover = 0.01).

Porpidia thomsonii? (no spores found) (L-50)--On rock, 30231 [FS]. Cover = 0.01.

Rinodina "ignota" (L-51)--On branch of Acer circinatum, 30226 [FS]. Abundance = 1 (estimated in the field as 1+, but that also included R. "mysteria").

Rinodina "mysteria" (L-82)--On branches of Acer circinatum, 32492 [FS]. Not on field form; collected in 1994 but not differentiated in the field from R. "ignota". Abundance = 1 (see note under R. "ignota").

Sphaerophorus globosus v. gracilis (L-52)--On boles and branches of Pseudotsuga menziesii (2, 18), and on branch litter), 30208 [FS]. Abundance = 2.

Tuckermannopsis chlorophylla (L-53)--On boles of Pseudotsuga menziesii (18), 30464-a [FS], 30209, 30224-b [FS]. Abundance = 1+, but see note under T. orbata.

Tuckermannopsis orbata (L-54)--On Pseudotsuga heterophylla, 30464-b [FS]. Not recognized in the field in 1994 (probably confused with T. chlorophylla); "uncommon" in the plot according to 1993 field notes. Abundance = 1.

Usnea filipendula s. lato (L-55)--On conifer bark, 30206-b [FS], 30462-b [FS]. Abundance = 1.

Usnea cf. subfloridana (L-56, L-57, and L-64)--On bark, 30213-a [FS] and 30213-b [FS] (both L-56: dirty grayish greenish, coarse, 30213-b differs in having some papillae); and 30212 (L-57: pale, yellowish, fine) [FS]; on rotting wood of class II decorticate log (105), 32481 (L-64: relatively dark, grayish-greenish, fine) [FS]. Abundance = 1 (L-57 and L-64 were listed on field form as Usnea sp.; L-56 and L-57 were assigned abundance = 1, but were not actually differentiated from L-64 in the field in 1994). Most of these specimens have few or no papillae and no soredia and isidia, and differ from each other in appearance, but at present I do not know whether they are different species.

Xylographa hians (L-58)--On conifer wood, 30460-a [FS]. Abundance = 2 (cover = 0.01).

Sterile crust 1 (pale green with ocasional tiny paler bumps, without soredia; probably a species of Pertusaria or Ochrolechia) (L-63)--On bark of Vaccinium parvifolium, 32483 [FS]. Abundance = 1.

Sterile crust 2 (pale-green, non-sorediate, probably one or more species of Pertusaria or Ochrolechia) (L-70)--On boles and branches of conifers, 32487 [FS]. Abundance = 3. This may be the same as sterile crust 1.

Parasite?--On Cladonia sp., 30468-f. The apothecia resemble those of a Cladonia, but are growing on the basal parts of the podetia, rather than the tips.

Nonlichenized fungus (blackish perithecia) (L-61)--On bark (bole) of Cornus nuttallii, 32484 [FS]. Abundance = 1.

Nonlichenized fungus (order Hysteriales, with elongated black apothecia)--On conifer wood, 30460-b.

Nonlichenized fungus--On Acer macrophyllum, 30456-c.

Non-lichenized fungi--On conifer wood (blackish fruits), 30229 (blackish fruits) [FS], 30460-c [FS], 30218.

Non-lichenized fungi--On unspecified bark, 30451-d (blackish perithecia) [FS].

Non-lichenized fungus? (very tiny yellowish patches and thin smooth whitish patches) (L-66)--On bole of Pseudotsuga menziesii (31), 32482 [FS]. Abundance = 1. This may be just discolored areas of the bark.

Nonlichenized fungi? (L-79)--On conifer wood, 30227-b (originally identified in the field as a member of the Caliciales). Not recognized in the field in 1994; not on the field form. Abundance = 1.

**Plot 6903 (3000 ft)**

The lichen flora in this plot, which occurred mostly on conifer bark, was rather depauperate, even in the canopy; the few rocks were mostly barren of lichens. Overcast skies during the 1994 fieldwork increased the difficulty of identifying crustose lichens in the shade under the canopy.

Alectoria sarmentosa (L-1, L-2)--On boles and branches of Tsuga heterophylla (21), 30238-a [FS], 30678, 30549-a, 30549-b [FS]. Abundance = 2 (but see note under A. vancouverensis).

Alectoria vancouverensis (L-63)--On boles and branches of conifers, 30238-b [FS], 30238-c [FS]. Not distinguished from A. sarmentosa in the field, but judging from the number of voucher specimens identified as each species in the Green Mountain area, A. vancouverensis seems to be much less common. Abundance = 1. Not on the field form.

Arthonia "rubroreagens" (L-3)--On wood, 30574-a [FS]. Not recognized in the field in 1994. Abundance = 1.

Arthonia tetramera (L-4, L-62)--On boles of Thuja plicata (56), 30554-b [FS] and Tsuga heterophylla, 32497. Abundance = 1. L-62 was listed as "A. sp." on field form, but the voucher for it (32497) is A. tetramera; L-4 was also assigned abundance = 1, but that was because the species was not recognized as such in the field.

Bryoria capillaris (L-2, L-5)--On boles of conifers (61), 30238-d [FS], 30552, 30561-a [FS], 30561-b. Abundance = 1+ (1 for L-2, 1 for L-5). L-2 was listed on field form as "Alectoria sp.", but the specimens on which L-2 was based (30552, 30561-a, and 30561-b) are actually B. capillaris.

Bryoria fuscescens (L-6)--On boles of conifers (61, 65, 73, 75), 30564 [FS]. Abundance = 2-.

Chaenotheca furfuracea (L-7)--On roots of one large fallen cedar (25), abundant, 30254 [FS]; on conifer bark, 30557-b; on big Pseudotsuga menziesii bole (69), sterile, 30252-a [FS]. Cover = 0.02. The identity of the sterile material is uncertain, since the undetermined Chaenotheca sp. (L-31) has a similar thallus.

Chaenotheca sp. (L-31)--On burnt conifer wood, 30576-a [FS]. Abundance = 1. Listed on field form as "Lepraria? sp."; not recognized in the field in 1994. The thallus is very similar to that of C. furfuracea, but the few apothecia seen are brownish, not yellow-green.

Chaenothecopis sp. (L-8)--Parasitic on thallus presumed to be that of Chaenotheca furfuracea on bole of Pseudotsuga menziesii (69), very scanty material, 30252-b [FS]. Abundance = 1 (cover = 0.01).

Cladonia bacillaris (L-9)--On rotten conifer stump (52), 30582-a [FS]. Cover = 0.01.

Cladonia coniocraea (L-10)--On rotten conifer wood, 30257 [FS], 30582-d [FS]. Cover = 0.01. Not recognized in the field in 1994 ("uncommon" in the plot according to 1993 field notes; one of the specimens originally determined as this species, 30582-b, is actually C. macilenta).

Cladonia macilenta (L-11)--On rotten conifer wood, 30582-b [FS--originally determined as C. coniocraea], 30583-b. Cover = 0.01. Not distinguished from C. bacillaris in the field.

Cladonia squamosa v. subsquamosa (L-65)--On rotten conifer wood, 30583-a [FS]. Cover = 0.01. Not recognized in the field in 1994; not on the field form.

Cladonia sp. (basal squamules only) (L-12)--On rotten conifer wood, uncommon in the plot, 30582-c, 30583-c [FS]. Cover = 0.01.
Dimerella pineti (L-13)--On bole of conifer, 30557-a [FS], 30579-a. Abundance = 1. Not seen in 1994.

Hypocenomyce castanocinerea (L-14)--On charred bark (bole) of Pseudotsuga menziesii (69), 30578-a

[FS]. Abundance = 1.

Hypogymnia apinnata (L-15)--On branches of conifers, 30550-b [FS], 30242-b [FS]. Abundance = 1.

Hypogymnia entermorpha (L-16)--On boles and branches of conifers, 30253-b [FS], 30561-c, 30237-c. Abundance = 2.

Hypogymnia imshaugii (L-17)--On branches of conifers, 30551, 30561-d [FS], 30566-b. Abundance = 2.

Hypogymnia metaphysodes (L-18)--On branches of conifers, 30242-a [FS]. Abundance = 1.

Hypogymnia physodes (L-20)--On boles and branches of Tsuga heterophylla (53) or other conifers (75), 30241, 30248-b [FS], 30561-b [FS]. Abundance = 2.

Hypogymnia rugosa (L-19)--On branches of Tsuga heterophylla, 30242-d [FS], 30545 [FS]. Listed on the field form as H. occidentalis, but the vouchers are actually H. rugosa. Abundance = 2.

Icmadophila ericetorum (L-21)--On rotten wood of conifer stump (52), 30578-d [FS]. Cover = 0.01.

Lecanora impudens (L-68)--On boles and branches of conifers, 30243-b [FS]. Not recognized as this species in the field. Abundance = 1.

Lecanora sp. (L-60)--On branches of conifers. Abundance = 1. This taxon was apparently seen in the plot in 1993, but I can find no record of a voucher specimen for it; however the field form indicates that this taxon was seen in the field in 1994. It is probably L. pulicaris, since that species is the only Lecanora species identified from conifer branches at elevations of 3000 ft or less in the Green Mountain area, other than L. impudens, which was not recognized in the field as being a Lecanora.

Lecidea "pallidoaggregata" (L-23, L-25)--On conifer boles, 30555-c (L-25) [FS], 30547-a (L-23) [FS]. Abundance = 1 (1 for L-23 + 1 for L-25). Not recognized in the field in 1994 (but "common" according to 1993 field notes).

Lecidea "viridescoides" (L-24)--On burnt conifer bark or wood (boles), 30576-b [FS], 30580 (a few apothecia present), 30579-b; on moss over conifer bark, 30585 [FS]. Abundance = 1. Not recognized in the field in 1994.

Lecidea "viridosora" (L-70)--On Thuja plicata, 30235-d [FS--originally identified as a Lepraria]. Abundance = 1. Not on field form; not distinguished in the field from Lepraria spp. growing on Thuja plicata.

Lepraria incana (L-26)--On more-or-less burnt conifer wood, 30255-a [FS], 30578-c, 30581; on conifer branches, 30255-b; on bole of large Pseudotsuga menziesii (69); on bole and more-or-less burnt wood of Thuja plicata, 30568-c. Cover = 0.03+ (0.03 in general; + 0.01 on Thuja plicata--see below under L-30).

Lepraria "luteola" (L-27)--On bole of large Pseudotsuga menziesii (69), 30253-a [FS]. Cover = 0.02.
Lepraria "mollis" (L-28)--On boles of Thuja plicata, 30235-c [FS]. Cover = 0.01. See below under L-30.

Lepraria "protocetrarica" (L-29)--On boles of Thuja plicata, 30235-a [FS], 30574-c, 30568-d. Cover = 0.01. See below under L-30.

Lepraria spp. (L-30)--On Thuja plicata. Cover = 0.01. This is a combined estimate for L. incana, L. "mollis", and L. "protocetrarica", which could not be distinguished in the field. Lecidea "viridosora" was also included in the estimate.

Lobaria pulmonaria (L-32)--On branches of Thuja plicata, 30566-a [FS]. Abundance = 1.

Lopadium disciforme (L-33)--On boles of Thuja plicata, 30236 [FS]; on boles of Tsuga heterophylla (29, 53, 59) or other conifers (62), 30245, 30250-a [FS], 30553 [FS], 30555-b, 30565. Abundance = 2+

Loxospora elatina (L-34)--On boles of Tsuga heterophylla (5, 29, 59) or other conifers (62), 30563-c [FS], 30560. Abundance = 2+.

Loxospora pustulata (L-35)--On bole of Tsuga heterophylla (57), 30546-a [FS]. Abundance = 1.

Mycoblastus affinis (L-36)--On boles of Tsuga heterophylla (53) or other conifers (75), 30250-d, 30251-b [FS], 30249-b. Abundance = 2.

Mycoblastus sanguinarius (L-37)--On boles of Tsuga heterophylla (54) or other conifers (69, 75), 30249-a, 30251-a [FS], 30237-d [FS]; on wood, 30575-a. Abundance = 2.

Ochrolechia juvenalis (L-39)--On bole of Tsuga heterophylla (62), 30247 [FS], 30563-b, 30562-b. Abundance = 2, but difficult to distinguish from O. laevigata and abnormal O. oregonensis.

Ochrolechia laevigata (L-40)--On branches of conifers, 30561-f [FS]. Abundance = 1. See note under O. juvenalis.

Ochrolechia oregonensis (L-41, L-42)--On branches of conifers (mostly Tsuga heterophylla), 30246 (L-42) [FS], 30563-a (L-41) [FS]. Abundance = 1+ (1 for l-41 + 1 for L-42). L-41 was listed on field form as O. montana.

Parmelia hygrophila (L-43)--On boles and branches of Tsuga heterophylla (21, 53) or other conifers (75, 76), 30248-a [FS], 30567-b. Abundance = 2.

Parmeliopsis hyperopta (L-44)--On boles of Tsuga heterophylla (29, 53, 54, 59), 30556 [FS], 30335 [FS] 30237-b. Abundance = 2.

Pertusaria ophthalmiza (L-47, L-48)--On branches of Tsuga heterophylla, 30243-a [FS], 30249-c [FS], 30250-e, 30256-b, 30558; on Thuja plicata, 30571 (apothecia damaged). Abundance = 2+ (2 for L-47 + 2 for L-48). L-48 was listed on the field form as P. subambigens, but the voucher for that species (30256-b) is actually P. ophthalmiza; "30256-a" does not correspond to any existing specimen.

Phlyctis agelaea (L-50)--On conifer branches, 30546-b [FS]. Abundance = 1.

Platismatia glauca (L-51)--On boles and branches of Thuja plicata (11) and Tsuga heterophylla (21), and on a conifer log (33), 30237-a, 30561-e [FS]. Abundance = 2+.

Platismatia herrei (L-52)--On boles and branches of Pseudotsuga menziesii (19) and Tsuga heterophylla (21), and on a conifer log (33), 30239 [FS], 30679. Abundance = 2.

Platismatia norvegica (L-53)--On bole of Tsuga heterophylla (75), 30244 [FS]. Abundance = 1.

Porpidia "pallida" (L-54)--On rock, 30646-b [FS]. Cover = 0.01. Not seen in 1994 (1993 collection may have been from outside of plot).

Sphaerophorus globosus v. gracilis (L-55)--On Tsuga heterophylla (5, 21, 29, 53), Pseudotsuga menziesii (19) and Thuja plicata (11), 30240 [FS]. Abundance = 2+.

Thelotrema lepadinum (L-56)--On boles of Tsuga heterophylla, 30548; on bole of Thuja plicata, 30235-b, 30569 [FS], 30579-c [FS]. Abundance = 1.

Tuckermannopsis chlorophylla (L-61)--On boles of Tsuga heterophylla (53, 55) or other conifers (61), 32495 [FS]. Abundance = 2-.

Tuckermannopsis platyphylla (L-59)--On branches of conifers, 32496 [FS]. Abundance = 1.

Sterile crust 1 (thin, smooth, continuous, greenish, without soredia, lacking lichen substances) (L-57)--On rock, 30647-b [FS]. Cover = 0.01. Not seen in 1994 (1993 collection may have been from outside the plot).

Sterile crust 2 (olive green to dark green or brownish, finely rimose-verrucose to subsquamulose, without soredia, C-) (L-69)--On burnt conifer stump, 30576-c [FS], 30578-b [FS]. Not on field form.

Sterile crust 3 (smoothish gray-green with coarse irregularly roundish white mounds, without soredia, K-, C-, P-) (L-49)--On wood, 30575-c [FS]; on Thuja plicata, 30568-b [FS]. Abundance = 1. Listed on field form as "Pertusaria? sp."

Nonlichenized fungi--On wood, 30572 (greenish crust) [FS], 30573 (whitish crust) [FS], 30250-c (family Hysteriaceae) [FS].

Nonlichenized algae (protococcoid)--On conifer bark, 30559 [FS]; on Thuja plicata wood, 30570 [FS].

Excluded (outside of plot):

Peltigera praetextata? (L-45)--On mossy rock, 30258. The rock is just outside the plot instead of within it as thought in 1993.

Peltigera membranacea (L-46)--On mossy rock, 30259 [FS], 30584. The rock is just outside the plot, instead of within it as thought in 1993.

Lecidea "albovirida" (L-22)--Erroneously included on field form for the plot (the specimen, 30667-d, was from the general vicinity of the plot, but not from the plot itself, and the species was not seen in the plot in 1994).

Nephroma helveticum ssp. sipeanum (L-38)--The specimen, 30197, was actually collected in plot 6901, and was erroneously included on the field form for plot 6903.

Sterile crust (L-58)--The specimen, 30451-c, was actually collected on the way up to plot 6902.

**Plot 6904 (4000 ft)**

Shaded conditions under the canopy made some of the species difficult to recognize in the field.

Alectoria sarmentosa (L-1)--On Abies amabilis (104), 30262-b, 30270; on large Pseudotsuga menziesii; 30340 [FS]; on Thuja plicata, 30345 [FS]; on bark of Tsuga heterophylla (117), 30284 [FS], 30297-b. Abundance = 3.

Bryoria capillaris (L-2)--On Abies amabilis (104), 30262-a [FS], 30286 [FS]; on Tsuga heterophylla (114), Pseudotsuga menziesii (105), and Thuja plicata. Abundance = 3.

Bryoria fuscescens (L-3)--On Abies amabilis, 30304-a (atypical--unusually shiny) [FS], 30294-b [FS]; on Pseudotsuga menziesii and Tsuga heterophylla. Abundance = 1.

Bryoria glabra (L-4)--On conifer bark, 30303-a [FS]. Abundance = 1. Although my field notes from 1993 indicate that this species was "common" in the plot, it is difficult to distinguish from other Bryoria spp. in the field, and was not positively recognized in the field in 1994.

Bryoria trichodes spp. americana (L-5)--On Abies amabilis, 30297-a [FS], 30288-a, 30303-b [FS], 30303-c, 30263, 30268; on large Pseudotsuga menziesii (72), 30341-a, 30341-b; on Thuja plicata. Abundance = 3.

Calicium glaucellum (L-64)--On decorticate wood of snags of Pinus monticola (50), 32511 [FS], Pseudotsuga menziesii (15) and other conifers (one below 15, and one leaning against 27). Abundance = 3. Listed on field form only as "Caliciales", and it is possible that Chaenotheca brunneola and Chaenothecopsis pusiola were also present (and included in the abundance estimate), although the voucher for these is from a different snag; the other Caliciales species, Stenocybe major, was collected on bark rather than wood.

Chaenotheca brunneola (L-78)--On wood of conifer snag (one next to 28), a single apothecium mixed with Chaenothecopsis pusiola in 32588 [FS]. Abundance = 1. Not on field form; see notes under Calicium glaucellum.

Chaenothecopsis pusiola (L-70)--Parasitic on Chaenotheca brunneola on wood of conifer snag (one next to 28), 32508 [FS]. Abundance = 1. Not on field form; see notes under Calicium glaucellum.
Cladonia bacillaris (L-6)--On rotten conifer wood of stump (number not recorded), 30307-a [FS], 30321-b, and stump 3, 32512 [FS], (all identified in the field as C. macilenta), and stump 35, 32500 [FS] (identified in the field as C. rei). Cover = 0.01, but the species was not positively recognized as such in the field in 1994.

Cladonia chlorophaea (L-80)--On rotten wood, 30323 [FS]. Not on field form; apparently originally identified as C. pyxidata, which does not occur in the plot (see notes about that species under "excluded from plot"); C. chlorophaea was not seen in the field in 1994; it is probable that the 1993 collection was from outside the plot, since this species is not likely to be confused with the other species that were listed on the field form; however, it could be confused with C. pleurota, which was found in the plot in 1994 but also not recognized as such. Assuming C. chlorophaea does occur in the plot, the cover presumably was not more than than 0.01.

Cladonia coniocraea (L-7)--On rotten wood, 30307-b [FS]; on mossy rock; on Pseudotsuga menziesii, 30333-b. Two specimens originally identified as this species (30333-c and 32506) are actually C. macilenta. Cover = 0.01.

Cladonia deformis (L-8)--On rotten wood of conifer stump (35), 30325 [FS], 32502 [FS]. Cover = 0.01.

Cladonia macilenta (L-9)--On large Pseudotsuga menziesii, 30313 [FS], 30333-c [FS] (originally identified as C. coniocraea); on class 5 log at east edge of plot (identified on the field form as C. coniocraea),

32506 [FS], 30321-a; on conifer stumps (4, 35, and others), 32499 [FS], 32503 [FS]. Cover = 0.05 (but probably includes some C. bacillaris, which cannot be distinguished from it except by chemistry).

Cladonia "mysteria" (L-75)--On rotten conifer wood, 30329-b [FS]. Not on field form; not recognized in the field in 1994 (probably identitied as C. bacillaris or C. macilenta). Cover = 0.01.

Cladonia cf. norvegica (L-72)--On rotten conifer wood, 30309-b [FS]. Not on field form; not recognized in the field in 1994. Cover = 0.01.

Cladonia "perplexa" (L-80)--On rotten conifer wood, 30329-a [FS]. Not on field form; not recognized in the field in 1994 (probably identified as C. bacillaris, C. macilenta, or C. rei). Cover = 0.01.
Cladonia pleurota (L-79)--On bark at base of large Pseudotsuga menziesii, 30322-b (originally mixed with C. cf. umbricola) [FS] and on conifer stump (35), 32505 [FS]. Cover = 0.01. Not on field form; probably confused with other species.
Cladonia "problematica" (L-76)--On rotten conifer wood, 30311-c [FS]. Not on field form. Cover = 0.01.

Cladonia rei (L-11)--On large Pseudotsuga menziesii, 30333-a [FS]. The 1994 collection (32500) is actually C. bacillaris. Cover = 0.01.

Cladonia cf. umbricola (L-12)--On bark at base of large Pseudotsuga menziesii, 30322-a [FS]. Cover = 0.01.

Cladonia spp. (L-13)--On rotten conifer wood. Cover = 0.02. This is a combined estimate for species with basal squamules only, which can barely be distinguished in the lab, and are impossible in the field.

Dimerella pineti (L-14, L-62)--On moss on rock, 30356, 30280-a, 32498 [FS]. Cover = 0.01. L-62 was listed on the field form as "brown apo."; L-14 was also assigned cover = 0.01, but that was because the species was not recognized as such in the field in 1994.

Hypocenomyce castanocinerea (L-15)--On charred bark of large Pseudotsuga menziesii, 30342 [FS]. Abundance = 1. Not recognized in the field in 1994.

Hypogymnia apinnata (L-16)--On boles of Thuja plicata, 30346, Abies amabilis (104), 30260-b, 30277-b [FS], 32507 [FS], Pseudotsuga menziesii (105), and Tsuga heterophylla (117). Abundance = 2+, but this estimate probably includes H. rugosa.

Hypogymnia enteromorpha (L-17)--On boles and branches of Abies amabilis, 30260-a (P- strain!) [FS], 30277-a [FS], 30301, 30291-a (originally identified as H. occidentalis) [FS]. Abundance = 2.

Hypogymnia metaphysodes (L-18)--On conifer bark, 30291-b [FS]; on Abies amabilis, 30300 [FS]. Abundance = 1. Not seen (or recognized) in the field in 1994.

Hypogymnia rugosa (L-73)--On bole of Abies amabilis, 30277-a [FS], 30291-c [FS], 30301 (strange form with some lateral lobules due to regeneration; chemistry not typical) [FS]. Abundance = 1. Not on field form; probably misidentified in the field as H. apinnata or H. occidentalis. The basis for originally including H. occidentalis (L-19) on the field form was specimens 30277-a (actually H. rugosa) and 30277-b (actually H. apinnata), and 30291-a (actually H. enteromorpha).

Icmadophila ericetorum (L-20)--On rotten conifer wood just below Tsuga heterophylla tree (94), 30314 [FS]. Cover = 0.02.

Japewia tornoensis (L-21)--On conifer bark, 30302-a [FS]. Abundance = 1. Not seen (or recognized) in 1994.

Lecanora flavopunctata (L-69)--On bark of class V log 1 m upslope from Tusga heterophylla tree (32), 32509 [FS]. Not on field form; not recognized as such in the field in 1994. Abundance = 1.

Lecanora pacifica (L-74)--On bole of Abies amabilis, 30275-c [FS]. Not on field form; not noticed in the field in 1994. Abundance = 1.

Lecanora pulicaris (L-68)--On bark of conifers, 30271-a, 30279-a [FS]. Not on field form. Abundance = 1.

Lecidea "aggregata" (L-22)--On bark of class V log, 1 m upslope from Tsuga heterophylla tree (32), 30328-a [FS], 32510 [FS]. Abundance = 0.01. Not seen (or recognized) in 1994 (but "common" in the plot according to 1993 field notes).

Lecidea "phaeochlora" (L-23)--On root of rotten conifer stump, on ground, 30327-b [FS]. Cover = 0.01. Not recognized as such in the field in 1994. Listed on field form as L. "carneovirida".

Lecidea sanguineoatra (L-63)--On moss and humus, 32501 [FS]. Cover = 0.01. Listed on the field form as "Black apo."

Lecidea "viridescoides" (L-24)--On humus, 30312 [FS]. Cover = 0.01. Not seen (or recognized) in 1994.

Lepraria incana (L-25)--On bases of boles of large Pseudotsuga menziesii (105), 30344 [FS], Thuja plicata, 32514 [FS]; and Tsuga heterophylla (114); on rotten conifer wood; 30310 [FS]. Cover = 0.03.

Lepraria "problematica" (L-67)--on conifer stump (3), 32520 (greenish, somewhat darker and thinner than L. incana) [FS]. Cover = 0.01. Listed on field form as "Green powdery".

Lopadium disciforme (L-27)--On bark of Abies amabilis (104) and Tsuga heterophylla, 30285, 30302-b [FS], 30305-a, 30305-b; on large Pseudotsuga menziesii, 30338 [FS], 30339; on Thuja plicata, 30348 (form with thallus mostly absent) [FS], 30353-b. Abundance = 2.

Micarea melaena (spores + immature) (L-29)--On wood, 30315-b [FS]. Abundance = 1. Not seen (or recognized) in 1994.

Mycoblastus affinis (L-30)--On boles of Abies amabilis (104), 30272, 30296 [FS], large Pseudotsuga menziesii (105), 30331 [FS], Thuja plicata, 30355-b (damaged, abnormal), and Tsuga heterophylla (117); also present on branches of some of the trees. Abundance = 3.

Mycoblastus sanguinarius (L-31)--On boles of conifers, 30281-a, 30275-a [FS], 30275-b [FS], including Abies amabilis, 30289 [FS], large Pseudotsuga menziesii (105) (mixed with M. affinis in 30331), Thuja plicata, 30353-a, and Tsuga heterophylla. Abundance = 2.

Ochrolechia juvenalis (L-32)--On boles and branches of Abies amabilis (104), 30264, 30269-a, 30273-b, 30306-b [FS], 30299 (apothecial margin C+ yellow, whereas others are C-) [FS], 30274 [FS], Thuja plicata, 30349, Pseudotsuga menziesii, and Tsuga heterophylla (117). Abundance = 3, but see note under O. montana.

Ochrolechia montana (L-33; L-34)--On conifer bark, 30273-a (L-33) [FS]; on decorticate branch of Abies amabilis, 30290 (L-34) [FS]. Abundance = 3+ (3 for L-33 + 1 for L-34); however, the species was not recognized as such in the field in 1994; L-33 was listed on the field form as O. laevigata, and assigned an abundance of 3 because that species could not be distinguished from O. juvenalis in the field; however, the specimen originally identified as O. laevigata (30273-a) was later re-identified as O. montana. Also see note under O. oregonensis.

Ochrolechia oregonensis (L-35)--On large (ca. 2 ft dbh) Pseudotsuga menziesii, 30337 [FS]. Abundance = 1. Not recognized as such in the field in 1994; probably confused with O. montana.

Ochrolechia sp. (L-36)--On large (ca. 2 ft dbh) Pseudotsuga menziesii. Abundance = 1; however, it was included on the field form because of uncertainties about the identification of other species, and was not

recognized as something distinct in the field in 1994; the supposed voucher ("30332") was probably a poor specimen that was either discarded or else combined with material of either O. juvenalis or O. oregonensis under another number.

Parmelia hygrophila (L-37)--On boles of Thuja plicata, 30350 [FS] and Abies amabilis. Abundance = 1.

Parmeliopsis ambigua (L-61)--On boles of Pseudotsuga menziesii (72, 105, 121), 32513 [FS], and Tsuga heterophylla (30). Abundance = 1.

Parmeliopsis hyperopta (L-38)--On boles of Abies amabilis, 30283; large Pseudotsuga menziesii (105), 30335 [FS], Thuja plicata, 30351, and Tsuga heterophylla (117). Abundance = 3.
Pertusaria "mysteria" (L-42)--On Abies amabilis, 30266 [FS]; on Thuja plicata, 30354. Abundance = 1. Not recognized in the field in 1994.

Pertusaria ophthalmiza (L-40)--On boles and branches of Abies amabilis, 30267 [FS], 30269-b, 30281-b, 32517 [FS]; on Thuja plicata, 30352 [FS], 30355-a. Abundance = 1 (but "common" in the plot according to 1993 field notes, and as suggested by the 6 vouchers).

Pertusaria subambigens (L-41)--On boles and branches of Abies amabilis, 30306-a, 30273-e [FS]. Abundance = 1 (but "common" in the plot according to 1993 field notes).

Pertusaria? "anomala" sp. (L-71)--On conifer bark, 30279-c; on bole of young Thuja plicata, 32523 [FS]. Abundance = 1. Not on the field form; seen (but not recognized) in the field in 1994.

Phlyctis agelaea (L-43)--On Abies amabilis, 30273-c [FS]. Abundance = 2. The basis for this estimate is uncertain, since the species was apparently not positively recognized in the field in 1994 (no specific tree species or numbers were recorded, and no check marks were made to indicate that the it was definitely seen on a particular category of substrate).

Platismatia glauca (L-44)--On boles and branches of Abies amabilis (104), 30261 [FS], 30292 [FS], 30302-d, 30336-a, Thuja plicata, 30347, Tsuga heterophylla (117), and Pseudotsuga menziesii (105). Abundance = 2+.

Platismatia herrei (L-45)--On boles of Abies amabilis, 30293 [FS], large Pseudotsuga menziesii (121), 30336-a, and a conifer snag next to a Tsuga heterophylla tree (28). Abundance = 1.

Porpidia thomsonii? (no spores) (L-46, L-56)--On rock, 30361 [FS], 32516 [FS]. Cover = 0.03. The "x" under rock on the field form should have been a check mark, since a cover of 0.03 could not have been estimated if the species was not actually seen in the field in 1994. L-56 was listed on field form as "crust with black lecideoid apo.", but was not actually distinguished in the field in 1994, and the supposed voucher number "30360" does not correspond to any existing specimen.

Rhizocarpon badioatrum s. lato ("#2") (L-65)--On rock, northeast quadrant of plot, 32515 [FS]. Cover = 0.01. Listed on field form as "Rhizocarpon (gray)".

Rhizocarpon sp. (yellow thallus) (L-66)--On rock, northeast quadrant of plot, one small thallus, which was not collected. Cover = 0.01.
Sphaerophorus globosus v. gracilis (L-48)--On Abies amabilis, 30287 [FS]. Abundance = 1. Not seen in 1994 (1993 collection was probably either from outside the plot, or from litterfall).

Stenocybe major (L-60)--On boles of Abies amabilis (104), 32504 [FS], and Pseudotsuga menziesii (105). Abundance = 1. This species was listed on the field form only as "Caliciales" (which would include Calicium glaucellum and Chaenothecopsis pusiola); however, L-60 was found on boles of living trees, and the voucher is S. major; the other two Caliciales were found on wood of snags.

Trapeliopsis granulosa (L-49)--On rotten conifer wood, 30324 [FS]. Cover = 0.01. Not seen (or

recognized) in 1994.

Tuckermannopsis chlorophylla (L-50)--On bole of Pseudotsuga menziesii (121), 30265 [FS]. Abundance = 1.

Tuckermannopsis orbata (L-51)--On Abies amabilis, 30302-c [FS]. Abundance = 1. Not seen in 1994 (1993 specimen was probably either from litterfall or from outside the plot). The voucher for L-52, listed on the field form as T. sp., "30276" apparently does not exist; it was only a tiny fragment, and was probably either discarded or combined with material under a different number.

Xerotrema megalospora (L-53)--On conifer wood, 30320 [FS]. Abundance = 1. Not recognized in the field in 1994.

Xylographa hians (L-54; L-55?)--On conifer wood (decorticated logs), 30278 [FS], 30319-b. Cover = 0.05 (for L-54). L-55 was listed on the field form as X. sp. and was assigned a cover of 0.01, but was not actually recognized in the field in 1994 as something distinct; the supposed voucher for it ("30315-a") does not correspond to any existing specimen, may have been either discarded or combined with X. hians under another number.

Sterile crust 1 (with soredia) (L-57)--On bole of Tsuga heterophylla (48), 32519 [FS]. Abundance = 2. This estimate may be based partly on taxa other than the one represented by the 1994 voucher.

Sterile crust 2 (uneven-roughened rather deep, slighlty olive green, with discrete, slightly paler and yellower powdery soralia) (L-77)--On rotten wood, 30308 [FS], 30312, 30280-b. Although these specimens were the basis for including L-57 on the field form, L-57 was listed only for boles of living trees, not rotten wood, and the 1994 voucher for L-57 is probably a different species than these 1993 specimens are.

Pyrenomycete Fungus (loosely associated with chlorococcoid algae) (L-58)--On conifer wood, 30319-a. Abundance = 1. Not seen (or recognized) in 1994.

Nonlichenized Fungi--On Abies amabilis, 30271-b; on conifer wood, 30316, 30317 (black fruits elongated along grain of wood) [FS], 30318 (+ yellowish-brownish crust) [FS].

Nonlichenized fungi--On underside of snag leaning against Tsuga heterophylla tree (27), 32521 [FS], 32522 [FS], 32524 [FS] (these were identified in the field as being in the Caliciales, but they are not in that group).

Nonlichenized Algae (Trentepohlia sp.) (L-59)--On Abies amabilis [not collected]. [Abundance = 3].

Nonlichenized Algae (protococcoid)--On boles of large Pseudotsuga menziesii, 30343 [FS]. [Abundance not estimated].

Excluded (outside of plot):

> Cladonia pyxidata (L-10)--Although this species does occur outside of plot 6904 at somewhat lower elevations along Green Mountain trail, the basis for listing C. pyxidata on the field form for this plot was a specimen (30806) that was not even collected in the Green Mountain Area and was erroneously labelled.
>
> Leptogium lichenoides (L-26)--On moss over rock, 30358-c. Cover = 0.01. The rock is just outside the plot, not within it as thought in 1993.
>
> Massalongia carnosa (L-28)--On moss over rock, 30358-b [FS]. Same rock as above.
>
> Peltigera cf. pacifica (L-39)--On moss over rock, 30357-b [FS]. Same rock as above. Listed on

field form as Peltigera sp.

Psoroma cf. hypnorum (L-47)--On moss over rock, 30358-a [FS]. Same rock as above. The material is pale and greenish, and not typical of the species, but this may be due to the shaded conditions.

Sticta fuliginosa (L-66)--Erroneously included on field form; the specimen (31328, not 30328) was actually from California.

**Plot 6905 (5000 ft)**

Although visibility was good, this was by far the most difficult plot to do, and the time allotment was somewhat inadequate. The list of crustose species growing on rocks in this plot may not be complete, but most are very difficult to identify, especially in the field (some species are easily recognizable, but difficult to detect in the field due to their small size and inconspicuousness).

Although "x" was used on this field form for many species, this does not necessarily mean such species were not seen or recognized in the field in 1994, especially when estimates of abundance or cover more than 1 and 0.01 were made; however, in some cases (e.g., most Lecidea-like species) field identifications were difficult or impossible, and all were assigned abundance = 2 based on a general impression of these taxa as a group, and spot checks with a hand lens in a few places.

Acarospora "brunnea" (L-3)--On rock, 30422-c, 30524-b [FS], 32546 [FS]. Cover = 0.01; inconspicuous and not actually detected in the field in 1994.

Acarospora fuscata (L-1)--On rock, 30435-b [FS]. Cover = 0.01. Not actually detected in the field in 1994, but the species is often scattered and inconspicuous.

Acarospora "sterilis" (L-2)--On soil, 30415-c [FS]; overgrowing Placynthium cf. nigrum on rock. Cover = 0.01, but not inconspicuous and not actually detected in the field in 1994.

Alectoria sarmentosa (L-4)--On Abies lasiocarpa (14 and others), 30391-a [FS], 30391-b; on conifer bark, 30701, 30399-b [FS]; on Chamaecyparis nootkatensis, 30369. Abundance = 2.

Aspicilia caesiocinerea (L-113)--On rock, 32543 [FS]. Not on the field form. Cover = 0.01, but see note under Aspicilia sp.

Aspicilia sp. (L-5)--On rock, 30432-a [FS]. Cover = 0.02; however, this estimate may be based partly or even mostly on A. caesiocinerea, since the two species were not distinguished in the field.

Bellemerea cinereorufescens (L-6)--On rock, 30428, 32545 [FS]. Cover = 0.02.

Bellemerea sp. (L-7)--On rock, small mount with Rhizocarpon geographicum in 30422-d [FS]. Thallus whitish, I+ violet, K+ yellow (not red); apothecia punctiform. Cover = 0.01. Not actually detected in the field in 1994.

Bryoria spp. (combined)--Abundance = 3 (B. capillaris, B. glabra, and B. trichodes were originally estimated to be 3's; B. fremontii, B. fuscescens, and "B. spp." to be 2's).

Bryoria capillaris (L-8)--On Abies lasiocarpa (14 and others), 30392-a [FS], 30396, 30399-a, 30388-c [FS], 30705-a [FS], 30706-d [FS], 30695, 30696-a, 30705, 32527 [FS]; on Chamaecyparis nootkatensis, 30367; on Pseudotsuga menziesii. Abundance = 3.

Bryoria fremontii (L-9)--On Abies lasiocarpa, 30388-d [FS], 30392-b [FS], 32566 [FS]; on Pseudotsuga menziesii. Abundance = 2.

Bryoria fuscescens (L-10)--On Abies lasiocarpa (14), 30388-b [FS]; on Pseudotsuga menziesii; on conifer bark, 30706-f [FS]. Abundance = 2.

Bryoria glabra (L-11)--On Abies lasiocarpa (14 and others), 30388-a [FS], 30696-b, 30706-c [FS], 32529 [FS]; on Pseudotsuga menziesii. Abundance = 3.

Bryoria pseudofuscescens (L-107)--On conifer branches, 30706-e [FS]. Not on field form; not recognized as such in the field in 1994. Abundance = 1.

Bryoria trichodes ssp. americana (L-12)--On Abies lasiocarpa (14 and others), 30705-b [FS], 30388-e [FS], 30696-c; on Pseudotsuga menziesii. Abundance = 3.

Bryoria sp. (L-114)--On conifer bark, 30706-a [FS]. Not on field form; the material was originally mixed with B. capillaris, B. fuscescens, and B. pseudofuscescens; it is somewhat similar to forms of B. fremontii, but is pale and color and the branches are very smooth.

Bryoria spp. (L-13)--On conifer bark, 32578 [FS]. Abundance = 2, but the voucher is a small clump containing a mixture of several species (not enough to be worth separating into a few strands of each); the estimate was for whatever species could not be recognized in the field.

Buellia erubescens (L-14)--On conifer bark, 30543-a [FS], 30704-f; on Vaccinium membranaceum, 30387-d. Abundance = 2.

Buellia papillata (L-15)--On soil, 30415-b [FS], 30408-b. Cover = 0.01.

Candelariella vitellina (L-92)--On rock. Cover = 0.01. This species was observed in the field in 1994, but apparently no voucher collection was made (probably due to the tiny amount of material or to difficulty in finding a chisel hold on the rock).

Catapyrenium cinereum (L-16)--On soil, 30409-a [FS]. Cover = 0.01.

Cladonia chlorophaea (L-17)--On soil, 30419 [FS], 30519, 30417-a [FS], 30420. Although individual patches were very small, they were very numerous. Cover = 0.02.

Cladonia coniocraea (L-18)--On rotten wood of Chamaecyparis nootkatensis snag (27), 30539-a [FS]. Cover = 0.02.

Cladonia "enigmatica" (L-19)--On soil, 30417-b [FS]. Cover = 0.01. Listed on field form as C. deformis.

Cladonia fimbriata (L-20)--On rotten wood of Chamaecyparis nootkatensis snag (27), 30439-b, 30539-b, 30540 [FS]. Cover = 0.02.

Cladonia macrophyllodes (L-20)--On rotten conifer wood, 30416 (mostly basal squamules; a few podetia) [FS]. Cover = 0.01.

Cladonia cf. ramulosa (L-22)--On moss over soil, 32538 [FS]; on soil, 30410 [FS]. Probably not very abundant in the plot; listed on field form as C. subradiata; collected but not recognized as such in the field in 1994. Cover = 0.01.

Cladonia ssp. (L-23)--On soil, moss, or rotten conifer wood. This refers to patches of primary squamules not identifiable to species. Cover = 0.05.

Cyphelium pinicola (L-24)--On conifer wood, 30407 [FS]. Abundance = 1.

Diploschistes scruposus (L-98)--On rock (incorrectly recorded on field form as being on soil), southeast quadrant of plot, 32547 [FS]. Cover = 0.01.

Hypogymnia apinnata (L-25)--On bole of Abies lasiocarpa (14), 30394-b [FS]. Abundance = 1. Not positively recognized in the field; see note under H. rugosa.

Hypogymnia imshaugii (L-27)--On branches of Abies lasiocarpa (including 14), 32534 and Pseudotsuga menziesii (including litterfall), 30390-a, [FS], 32525 [FS]; on Chamaecyparis nootkatensis, 30368, 30370. Abundance = 3.

Hypogymnia metaphysodes (L-28)--On bole of Abies lasiocarpa (14 and others), 30390-b, 30393-a [FS],

30526, 30700 [FS], 32533 [FS], 32535 [FS], 32568 [FS]; on Chamaecyparis nootkatensis, 30363-b, 30363-c, 30373-b [FS], 30373-e [FS]. Abundance = 2.

Hypogymnia occidentalis (L-29)--On bole of Abies lasiocarpa (14), 30394-a; on wood of Chamaecyparis nootkatensis snag (27), 30379 [FS]. Abundance = 1. See note under H. rugosa.

Hypogymnia physodes (L-91)--On branches of Abies lasiocarpa (14, 32532 [FS], and on litterfall; on Chamaecyparis nootkatensis, 30363-a, 30373-g; on conifer bark, 30698-c [FS]. Abundance = 1.

Hypogymnia rugosa (L-115)--On bole of Abies lasiocarpa, 32569 [FS], 30698-b [FS], 30394-c [FS]. Abundance = 1. Not on the field form as such; probably misidentified in the field as H. apinnata or H. occidentalis; the three of these were all included under L-30, which was listed as "H.. sp.", for material that had not yet been identified to species and was assigned abundance = 1 but was not actually recognized as something distinct in the field in 1994. The specimen numbers that were the basis of including H. enteromorpha (L-26) on the list ("30395" and "30699-b") do not appear to correspond to any existing specimens; the material was probably re-identified and transferred to packets with other numbers.

Lecanora flavopunctata (L-34, L-46, L-88)--On bark of Vaccinium membranaceum, 30704-d, 30543-c [FS], 32526 (L-88) [FS], 30385-a (L-34) [FS]; on Juniperus communis, 32565 [FS]; on branches of conifers, 30542-a (L-46) [FS]. Abundance = 2. L-34 was recorded on the field form as Lecanora symmicta; L-46 was recorded on the field form as Lecidea "viridopuncta", and represents the morph with soralia predominating; L-88 was recorded on the field form as Lecidea "carneogrisea", and represents the morph with apothecia present and soralia absent or poorly developed. Abundance = 4 (2 for L-34 + 4 for L-46 + 3 for L-88).

Lecanora intricata (L-31)--On rock, 30440, 30436-b, 30441-c [FS]. Cover = 0.01.
Lecanora polytropa (L-32)--On rock, 30430, 30524-a [FS], 32560 [FS]. Cover = 0.02.

Lecanora cf. pulicaris (L-33, L-96)--On branches of Abies lasiocarpa (including 14), 30365-a, 30402-b, 30542-b, 30694, 30704-e, 30704-g, 32528 [FS], 32536 [FS], 32573 [FS], 32574 [FS]; on shrubs (Vaccinium membranaceum), 30386-a [FS], 30386-b [FS], 30386-c; on Chamaecyparis nootkatensis, very common, 30365-a, 30371-a [FS], 30371-b, 30372-a [FS], 30372-b, 30372-c [FS]; on Pseudotsuga menziesii; on conifer wood, 30403-c [FS]. Extremely variable, and not entirely typical of the species; some material approaches L. circumborealis at least externally. Abundance = 2+. Very frequent on twigs of Abies lasiocarpa, but rather inconspicuous and usually mixed with other lichens.

Lecanora "washingtonensis" (L-35)--On Abies lasiocarpa; on Chamaecyparis nootkatensis, 30373-a [FS]; on Vaccinium membranaceum. Abundance = 2.

Lecanora sp. (L-93)--On large rock, shaded, west edge of plot, 32555 [FS]. Only one small thallus was seen; the small fragment collected had only one apothecium. Cover = 0.01.

Lecidea "atrofusca" (L-48)--On rock, 32558 [FS]. Cover = 0.01.

Lecidea "atrogrisea" (L-41)--On branches of Abies lasiocarpa (including 14), 30543-b [FS], 30402-a [FS], 30387-e, 32576 [FS]. Abundance = 2.

Lecidea "brunneovirida" (L-42)--On bark, 30387-b [FS]. Abundance = 2.

Lecidea confluens (L-36)--On rock, 30521-b [FS]. Cover = 0.01. Not recognized as such in the field in 1994.

Lecidea eckfeldtii (L-37)--On rock, 30441-a [FS], 30437. Cover = 0.01.

Lecidea "griseobrunnea" (L-90)--On rock, 32557 [FS]. Cover = 0.01. Listed on field form as "Lecidea

(brown)".

Lecidea lactea (L-38)--On rock, 30434-a [FS]. Specimen is scanty and not entirely typical. Cover = 0.01. Not recognized as such in the field in 1994.

Lecidea lapicida f. lapicida (L-39)--On rock, 30436-a [FS]. Cover = 0.01. Not recognized as such in the field in 1994.
Lecidea lapicida f. oxydata (orange thallus) (L-40)--On rock, 30523 [FS]. Cover = 0.01.

Lecidea "nondescripta" (L-105)--On rock, 32552 [FS]. Cover = 0.01. Not on the field form; not recognized as such in the field in 1994.

Lecidea "pallidomarginata" (L-43)--On Vaccinium membranaceum, 30387-a [FS]. Abundance = 2.

Lecidea "stygiomargina" (L-44)--On bark of Abies lasiocarpa (including 14), 32571 [FS], 32577 [FS]; on Chamaecyparis nootkatensis, 30362-b ["30362-a" is an artifact of an error in recording the identification], 30365-b, 30373-d [FS]. Abundance = 2.

Lecidea "variabilis" (L-45)--On bark, 30403-a [FS], 30387-c. Abundance = 2.

Lecidea? sp. (whitish thallus) (L-49)--On rock, uncommon in the plot; not collected in 1993 due to lack of chisel-hold; not recognized as such in the field in 1994. Cover = 0.01. Without a voucher it is impossible to know for certain that this is actually a Lecidea.

Lecidea sp.? (L-47)--On bark. Abundance = 2; however, this estimate, like that for other Lecidea spp. on bark, was an attempt to cover the bases, since it was so difficult to actually distinguish and recognize the species in the field. L-47 was listed on the field form as "Lecidea sp. (on bark)", because at the time the form was filled out there were several 1993 specimens of Lecidea on bark that I had not decided on, but I have now identified each of them as one of the other "named" species already on the field form.

Lecidella euphorea (L-50)--On Chamaecyparis nootkatensis, and on conifer bark, 30403-d, 30374 [FS]. Abundance = 2.

Lepraria "muscicola" (L-51)--On moss, 30411 [FS]. Cover = 0.02.

Lepraria "stictica" (L-52, L-89)--On rock, 30414, 32570 [FS] (both labelled as L. cf. neglecta), 30429-a [FS], 30433-b. Cover = 0.05 (0.02 + 0.05). L-89 was listed on the field form as "White granules".

Leptogium cf. gelatinosum (L-106)--On soil, 32567-b [FS]. Cover = 0.01+ (not distinguished in the field from Placynthiella cf. oligotropha, which was estimated to be 0.02; may have also been confused in the field with L. lichenoides, also estimated to be 0.02). Not on the field form.

Leptogium lichenoides (L-53)--On moss, 30408-a, 30415-a [FS], 30422-b; on soil, 32567-a [FS]. Cover = 0.02 (but see note under L. gelatinosum).

Letharia vulpina (L-54)--On bark and wood (one thallus each, on a bole and a branch) of Abies lasiocarpa; abundant on a Chamaecyparis nootkatensis snag (27), 30378 [FS]. Abundance = 2.

Lopadium disciforme (L-55)--On bole of Abies lasiocarpa, 30553 [FS]. Abundance = 1.

Massalongia carnosa (L-56)--On moss over rock, near plot center, 30424-a [FS], 32562 [FS]. Cover = 0.01.

Melanelia sorediata (L-100)--On rock (incorrectly recorded on field form as being on soil), southeast quadrant of plot, 32548 [FS]. Cover = 0.01.

Nephroma parile (L-94)--On moss over large rock, shaded, west edge of plot, 32542 [FS]. Cover = 0.01.

Ochrolechia juvenalis (L-57)--On conifer bark, 30373-c [FS]. Abundance = 1.

Pannaria praetermissa (L-58, L-59)--On moss over rock, 30415-d, 30415-e [FS]. Cover = 0.01. Although both L-58 and L-59 were assigned cover = 0.01, L-59 was not actually recognized in the field (not surprizingly, since in fact it turned out to be the same species as L-58!).

Parmelia sulcata (L-60)--On branches of low shrubs (Vaccinium membranaceum), 30384-c [FS]; on litterfall branch. Abundance = 1.

Parmeliopsis ambigua (L-61)--On bark and wood (boles) of Abies lasiocarpa, 30400-b, 30405-b; on branches of low shrubs (Vaccinium membranceum), 30384-b; on wood of Chamaecyparis nootkatensis snag (27), 30380-a [FS]. Abundance = 2.

Parmeliopsis hyperopta (l-62)--On bark and wood (boles and branches) of Abies lasiocarpa, 30400-a [FS], 30405-a, 30541 [FS]; on branches of Vaccinium membranaceum, 30384-a; on wood of Chamaecyparis nootkatensis snag (27), 30380-b. Abundance = 2.
Peltigera didactyla (L-83)--On soil, near plot center, 32561 [FS]. Cover = 0.01. Listed on field form as "P. spuria" (a synonym of P. didactyla).

Peltigera malacea (L-97)--On soil, south end of plot, 32540 [FS]. Cover = 0.03.

Peltigera cf. pacifica (L-95)--On soil, 30537-a [FS], 32564 [FS]. Cover = 0.01. The material is not typical, and was somewhat difficult to distinguish from P. cf. rufescens in the field. Listed on the field form as Peltigera sp.

Peltigera ponojensis (L-65)--On soil, 32541 [FS]. Cover = 0.01. Listed on the field form as "P. sp. (canina complex)"; the species is very similar to P. rufescens, which also belongs to that complex, but the 1994 voucher for L-65 is P. ponojensis.

Peltigera cf. rufescens (L-63)--On soil (e.g., near plot center), 30421, 30413 [FS], 30517 [FS], 32563 [FS]. Cover = 0.05. The material is somewhat atypical (compared to specimens from its more usual habitat in xeric regions), and was difficult to reliably recognize in the field.

Peltigera venosa (L-64)--On soil, on west edge under Vaccinium membranaceum, and in southwestern quadrant, 30412 [FS]. Cover = 0.01.

Placopsis gelida (L-66)--On rock, south end of plot, 30427-c [FS]. Cover = 0.01.

Placynthiella cf. oligotropha (L-85)--On soil, 32567-c [FS]. Cover = 0.02 (but see note under Leptogium gelatinosum). Listed on the field form as "Black granules".

Placynthium cf. nigrum (L-67)--On rock, 30422-a [FS], 32553 [FS]. Cover = 0.02.

Platismatia glauca (L.) Culb. & C. Culb. (L-68)--On Chamaecyparis nootkatensis, 30366; on Abies lasiocarpa (14 and others), 30397, 30404 [FS], 30703, 32539 [FS], 30698-a; on wood of Chamaecyparis nootkatensis snag (27), 30376, 30381. Abundance = 2.

Polychidium muscicola (L-69)--On moss over rock, small amount with Massalongia carnosa in 30424-a [FS]. Cover = 0.01.

Rhizocarpon badioatrum s. lato (L-70)--On rock, 30423 [FS], 30432-b, 30525-a [FS]. Cover = 0.05. This species, R. cinereonigrum, R. eupetraeum, and R. polycarpum are rather difficult to distinguish from each other (and from some Lecidea spp.) in the field.

Rhizocarpon bolanderi (L-71)--On rock, 30525-b [FS] (it would be desirable to collect more material, especially including apothecia, as I had to remove what may be the only mature apothecium I saw in order to section it and determine it was this species!). Cover = 0.02. This species is easily distinguished from other Rhizocarpon spp. in the field, but can be confused with brown Lecidea spp.

Rhizocarpon cinereonigrum (L-72)--On rock, 30422-c [FS]. Cover = 0.03. See note under R. badioatrum.

Rhizocarpon eupetraeum (L-103)--On rock, 32549 [FS]. Cover = 0.01. Not on the field form; not recognized as such in the field in 1994. See note under R. badioatrum.

Rhizocarpon geographicum (L-73)--On rock, 30525-c [FS], 30422-d [FS], 30425-a, 30439, 32544 [FS]. Cover = 0.04.
Rhizocarpon lecanorinum (L-74)--On rock, 30435-a [FS], 30425-b; mixed with R. geographicum in 30525-c. Cover = 0.03.

Rhizocarpon macrosporum (L-75)--On rock, 30521-a [FS], 30522. Cover = 0.02.

Rhizocarpon polycarpum (L-76)--On rock, 30438-a [FS], 30441-b [FS], 30524-c [FS]. Cover = 0.05. See note under R. badioatrum.

Rinodina conradii (L-86)--On Vaccinium membranaceum, 32531 [FS]. Abundance = 1. See note under R. "problematica".

Rinodina "problematica" (L-120)--On conifer bark, 30402-b [FS]. Abundance = 1. Not on field form; not distinguished in the field from R. conradii.

Trapeliopsis granulosa (Hoffm.) Lumbsch (L-77)--On soil and rotten wood, 30518, 30538 [FS]. Cover = 0.01.

Tuckermannopsis chlorophylla (L-112)--On conifer bark, 30697 [FS]. Abundance = 1.

Tuckermannopsis orbata (L-78)--On conifer bark, 30403-b [FS], 32530; on Chamaecyparis nootkatensis, rare in the plot, 30364. Abundance = 1.

Tuckermannopsis platyphylla (L-79)--On branches of Abies lasiocarpa, 30406, 30702, 32537 [FS]. Abundance = 2-.

Umbilicaria cinereorufescens (L-99)--On rock (incorrectly reported on field form as being on soil), southeast quadrant, rare in the plot, 32550 [FS]. Cover = 0.01.

Umbilicaria deusta (L-80)--On rock, rare in the plot, 30431 [FS]. Cover = 0.01.

Umbilicaria polyphylla (L-104)--On rock, rare in the plot, 32551 [FS]. Cover = 0.01. Not on the field form.

Vestergrenopsis isidiata (L-81)--On large rock, west edge of plot, 30427-a [FS]. Cover = 0.01.

Xylographa abietina (L-82)--On wood of conifer snag (27), 30382-a [FS]. Cover = 0.04 (or abundance = 2).

Sterile crust 1 (brown-black, finely areolate-scurfy, non-sorediate) (L-84)--On rock, 32556 [FS]. Cover = 0.02. Listed on field form as "Black stuff".

Sterile crust 2 (gray, of plane to slightly convex areoles ca. 0.5 mm across on black hypothallus, with very tiny, black perithecium-like structures without hymenium or spores) (L-101)--On rock, 32554 [FS]. Cover = 0.01. Not on field form; not recognized as such in 1994.

Sterile crust 3 (green, finely granular-verrucose, becoming granular sorediate, P-, C-) (L-108)--On burnt wood of Chamaecyparis nootkatensis snag (27), 30377 [FS]. Not on field form; not recognized in the field in 1994. Abundance = 1.

Sterile crust 4 (dirty pale gray to creamy with very tiny brownish roughenings, on blackish hypothallus) (L-109)--On rock, 30427-b [FS]. Not on field form; not recognized in the field in 1994. Cover = 0.01. Possibly an Aspicilia species.

Cyphellum sp. (non-lichenized fungus with pinkish, apothecia-like basidiocarps)--On Abies lasiocarpa (14), 30389 [FS].

Non-lichenized fungus--On wood of Chamaecyparis nootkatensis snag (27), 30375.

Non-lichenized fungus?--On bark, 30373-e.

**Plot 6906 (6000 ft)**

Because this plot was examined for lichens only in 1994, there was no preliminary list to use as a guide; however, the time allotment and visibility for the lichen fieldwork were good, and the only major difficulty was in distinguishing the different species of Bryoria (and Alectoria) from each other. As expected from studies in other subalpine areas of the Cascades, the lichen flora in this plot (all on bark or wood) is mostly a somewhat species-poor version of the corticolous/lignicolous flora found at 1500 m.

Alectoria spp. (combined for A. lata and A. sarmentosa)--Abundance = 4 (probably mostly A. sarmentosa).

Alectoria lata (L-18)--On branches of Abies lasiocarpa (32, 32579 [FS], 32624 [FS], 33, 32611 [FS]).

Alectoria cf. nigricans (L-7)--On branch of Abies lasiocarpa (4), 32619 [FS]. Identified on the field form as "two-tone Bryoria". Seen only once in the plot (only part of the one large thallus was removed); abundance = 1.

Alectoria sarmentosa (L-6)--On branches of Abies lasiocarpa (4 and others), 32582 [FS].

Bryoria spp. (combined)--Abundance = 4; estimated in the field to be 40% "B. trichodes" (actually probably mostly B. fremontii, plus a small amount of B. oregana, although it is likely that B. trichodes may also be present in the plot), 40% B. glabra, and 20% B. capillaris + other species. A few strands of what may be other species (e.g., B. fuscescens) are also present in some of the packets.

Bryoria capillaris (L-20)--On bole of Abies lasiocarpa (49), 32597 [FS]; on litterfall branches, 32593 [FS].

Bryoria fremontii (L-24)--On branches of Abies lasiocarpa (32, 32624 [FS], 33, 32599 [FS], 49, 32594 [FS], litterfall, 32598 [FS], and young tree next to 5, 32585 [FS]).

Bryoria glabra (L-8)--On Abies lasiocarpa (33, 32588 [FS], 49, 32595 [FS], bole of sapling, 32583 [FS], bole of young tree next to 5, 32584 [FS]). The voucher specimen for L-8 (listed only as Bryoria sp. on field form) was actually a mixture of B. glabra (32588) and B. fremontii (32599).

Bryoria oregana (L-22, L-32)--On Abies lasiocarpa (33), 32628 [FS]). Only a tiny amount separated out from a mixture with superficially very similar material of B. fremontii.

Bryoria spp. (L-22) (very tangled mixture of several of the above species, possibly with a few strands of other, unidentified ones)--On Abies lasiocarpa (litterfall branch), 32613 [FS].

Cladonia fimbriata (L-10)--On conifer stumps (6, 32607 [FS], 7). Cover = 0.01.

Hypogymnia apinnata (L-21)--On Abies lasiocarpa (including litterfall branches), 30699-a, 32580 [FS]. Abundance = 1, but see note under H. rugosa.

Hypogymnia enteromorpha (L-28)--On branches of Abies lasiocarpa (41), 32586 [FS]. Abundance = 1. Not on the field form; not distinguished from the other two Hypogymnia spp. in the field.

Hypogymnia rugosa (L-19, L-26)--On boles of Abies lasiocarpa (32, 41), 32618 [FS], 32620 [FS]. The L-19 collection (from tree 32) was originally identified on the field form as H. occidentalis; the L-26 specimen is given a separate number because it was collected on a different tree (41) (not listed on field form). Abundance = 2, but this probably includes the similar H. apinnata.

Lecanora flavopunctata (L-2, L-14, L-23)--On Ribes howellii, 32600 [FS]; on Abies lasiocarpa (branches of trees, 32625-b [FS], branches of sapling, 32601-a, branches of young tree next to 5). Abundance = 2+ (2 + 1 + 2). L-2 was listed on field form as "yellow soralia"; L-23 was listed as "Lecideoid".

Lecanora impudens (L-25)--On bole of Abies lasiocarpa (32622 [FS], 11, 32626 [FS]). Abundance = 2. Listed on field form as "white with soralia".

Lecidea "atrogrisea" (L-27)--On branches of Abies lasiocarpa (41), 32621 [FS]. Not on the field form; not detected in the field. Abundance = 1.

Lecidea "brunneogrisea" (L-33)--On branches of Abies lasiocarpa sapling, 32601-c [FS]. Abundance = 1. Not on field form; not noticed in field, but collected accidentally.

Lecidea holopolia (L-16)--On wood of stump next to Abies lasiocarpa tree (32), 32606 [FS]. Cover = 0.01. Listed on field form as "Biatorine". Cover = 0.01 (abundance = 1).

Lecidea "pallidomargina" (L-32)--On Abies lasiocarpa, 32625-a [FS]. Not on the field form; not noticed in field. Abundance = 1.

Lepraria "mysteria" (dirty greenish powdery) (L-9)--On conifer stump (7), 32617 [FS], 32627. Cover = 0.01.

Parmeliopsis ambigua (L-3)--On bole of Abies lasiocarpa (3). No voucher was collected, but inspite of its specific epithet, the species is distinctive enough that vouchers from other areas (e.g., plot 6905) should be adequate. Abundance = 1+.

Parmeliopsis hyperopta (L-4)--On bole and branches of Abies lasiocarpa (3, 4), 32581 [FS], 32599 [FS]. Abundance = 4. Much of the material of this species in this plot is rather dark colored and dissolved into soralia and non-radiating lobes, making it less conspicuous than the more typical whitish rosettes.

Platismatia glauca (L-13)--On bole of Abies lasiocarpa (33), and on litterfall branches, 32596 [FS]. Abundance = 1+.

Xylographa abietina (L-29)--On wood of stump, 32605 [FS]. Cover = 0.01. Not on field form.

Xylographa hians (L-15)--On wood of stump next to Abies lasiocarpa tree (32), 32604 [FS]. Cover = 0.01.

Xylographa vitilago (L-11, L-12)--On wood of conifer stumps (6, 7, and others), 32602 [FS], 32603 [FS], 32608 [FS]. Cover = 0.01+ (0.01 + 0.01). L-11 was listed on field form as "Agyrium?", and represents patches of thalli where apothecia (rather than soralia) predominate.

Sterile crust 1 (dirty brownish, thin, rough, inconspicuous thallus with tiny whitish to greenish soralia which are smooth then produce granular soredia; a few tiny black perithecia of a fungus are also present in places) (L-1)--On bole of conifer snag (2), 32616 [FS], and on bark at base of a snag, 32614 [FS]. Listed as Lepraria sp. on the field form. Cover = 0.01.

Sterile crust 2 (thin, smoothish, whitish, with tiny yellowish-brownish soralia producing granular soredia (L-5)--On boles of Abies lasiocarpa (3, 5, and others), 32610 [FS]. Abundance = 1. Listed as "Strange crust" on field form.

Sterile crust 3 (dirty whitish smoothish to roughened or evanescent thallus with tiny pale green soralia producing powdery soredia) (L-31)--On branches of Abies lasiocarpa sapling, 32601-b [FS]. Abundance = 1. Not on field form. Collected accidentally with other lichens.

Non-lichenized fungus (L-17)--On stump next to Abies lasiocarpa tree (32), 32623. Cover = 0.01. Listed on field form as "Lecideine"

Non-lichenized fungus--On Abies lasiocarpa (41), 32612.

**Potential Sensitivity of Lichen Taxa in the Green Mountain Area to Ozone or Oxidants**

Little information is available for the majority of lichens that occur in the Green Mountain area. Unless specified otherwise, the sensitivity classes (sensitive, intermediate, and tolerant) given are for oxidants and are taken from a field study in southern California by Sigal & Nash (1983). In that study, ozone was assumed to be the primary oxidant affecting the lichens, but this has been questioned, and needs to be tested by fumigation studies. Further information on some species is also given by Nash & Sigal (1980), who found that lichens (even fairly tolerant ones) are almost completely eliminated from conifers in areas with more than ca. 150 ppm-h oxidant dosage (Nash & Sigal, 1980).

In addition to species for which some evidence exists regarding their sensitivity to oxidants, I have included some additional species, which are known to be particularly sensitive to various other kinds of pollution (see Peterson, et al., 1992, for more information), and which, if they are likewise sensitive to oxidants, would be useful bioindicators because they are relatively easy to recognize and study. In general, it can be predicted that foliose or fruticose lichens on bark or wood, and species containing cyanobacteria, are the ones most likely to be useful as bioindicators (partly because most of them are relatively easy to identify and study), although chronic pollution can be expected to eventually reduce the diversity and abundance of other kinds of lichens.

* = Taxa found in one or more plots.

*Alectoria sarmentosa subsp. sarmentosa--Sensitive.

*Bryoria fremontii--Sensitive.

*Bryoria spp.--No data are available for other species in the Green Mountain area, but B. abbeviata (closely related to B. oregana) is sensitive to oxidants, and B. capillaris, B. glabra, B.trichodes subsp. americana are sensitive to sulfur dioxide.

*Calicium spp.--No data are available for species in this area, but C. viride is sensitive.

*Cladonia spp.--Sensitive (in general); no information on particular species was given by Sigal & Nash, 1983. A few Cladonia spp. do persist in oxidant-polluted southern California (Ryan, 1990), but they are now uncommon and restricted to sheltered habitats. At least one species (C. rangiformis, not found in this area) may be tolerant, since Brown & Smirnoff (1978) found no significant reduction in $C_{14}$ fixation when it was fumigated with $O_3$.

Evernia prunastri--Sensitive.

*Hypogymnia imshaugii--Tolerant to intermediate. Field studies, including Nash & Sigal (1980) and Ryan (1990), show that the species is still common in areas of southern California heavily polluted by oxidants, but it shows signs of deterioration (bleaching and disintegration of the upper cortex) and morphological distortions (convolution, shortening, and broadening of the lobes, and more irregular branching). Cover of H. imshaugii remains normal in areas with oxidant dosages below ca. 150 ppm-h, but decreases to almost nothing in areas with dosages up to ca. 285 ppm-h (Nash & Sigal, 1980). Sigal & Taylor (1979) found that PAN caused reduced gross photosynthesis, and Nash & Sigal (1979) found the species sensitve to fumigation by 1600 ug/$m^3$ ozone. Although all of the studies in the late 1970's and early 1980's called this species H. enteromorpha, that species does not occur in their area, and the voucher specimens are H. imshaugii. Material of H. imshaugii in the Green Mountain area at present is rather variable, but appears to be fairly normal and healthy.

*Leptogium spp.--Although no data on the species in the Green Mountain area are available, L. californicum (very similar to and closely related to L. lichenoides) is sensitive.

*Letharia vulpina--Tolerant, to somewhat intermediate; still common in oxidant-polluted areas in California

and not showing obvious signs of deterioration, though rather small compared to specimens collected before pollution became severe. Cover of Letharia spp. remains normal in areas with oxidant dosages below ca. 150 ppm-h, but decreases to almost nothing in areas with dosages up to ca. 285 ppm-h (Nash & Sigal, 1980).

*Lobaria spp.--No data are available with regard to oxidants, but L. oregana, L. pulmonaria, and L. scrobiculata are known to be extremely sensitive to sulfur dioxide.

*Melanelia spp.--No data are available for species in this area, but M. elegantula, M. glabra, and M. subolivacea are tolerant to intermediate; they are still moderately common in oxidant-polluted southern California, although Sigal & Nash (1983) found that the percent cover of M. subolivacea showed an inverse relationship to oxidant dose estimates, and my own study (Ryan, 1990) found that Melanelia spp. frequently exhibited obvious signs of deterioration (bleaching and loss of upper cortex).

Menegazzia terebrata--Sensitivity to oxidants is unknown, but the species is known to be sensitive to sulfur dioxide.

*Nephroma spp.--No information is available on sensitive to oxidants, but N. laevigatum is sensitive to acid rain.

*Parmelia sulcata--Sensitive to intermediate; has disappeared from oxidant polluted areas in California, and is sensitive to fumigation by 960 ug/$m^3$ ozone (Nash & Sigal, 1979). Sigal & Taylor (1979) found that fumigation by PAN reduced gross photosynthesis. Other Parmelia spp. may also be ± sensitive.

Peltigera collina--Sensitive.

Peltigera didactyla--Sensitive.

Peltigera rufescens--Sensitive to intermediate; still present in oxidant polluted areas, but restricted to a few very sheltered habitats. Fumigation by PAN reduced gross photosynthesis (Sigal & Taylor (1979).

Peltigera spp.--Material determined as P. canina, which may actually be some other species, is also sensitive, as is probably the case for several other members of the genus.

Physcia tenella--Tolerant, as is P. biziana (not found in Green Mountain area).

*Platismatia glauca--Sensitive; formerly present, no longer found in oxidant polluted southern California.

*Pseudocyphellaria spp.--No data are available for species found in the Green Mountain area, but P. anthraspis is sensitive.

Ramalina farinacea--Sensitive; formerly present, but now only in trace amounts in oxidant-polluted southern California.

*Sticta spp.--No data are available with regard to oxidants, but S. limbata is sensitive to sulfur dioxide.

*Tuckermannopsis spp.--No data are available for species found in this area, but T. merrillii is sensitive to intermediate.

*Usnea spp.--Sensitive to intermediate. The study did not give data for individual species, but they probably included the U. filipendula, U. lapponica and U. subfloridana complexes. Many members of the genus are also sensitive to sulfur dioxide.

## CONCLUSIONS AND RECOMMENDATIONS

### Species Diversity

At present it is very difficult to make more than vague comparisons of species diversity for different areas, without a detailed analysis of collections from other localities, within particular elevation ranges or habitat types. However, my general impression is that the Green Mountain area (as represented by the plots and other areas I visited) is probably at least as rich in lichen species as any other area I've seen at similar elevations on the west slope of the Cascades.

The number of lichen species per plot in the Green Mountain area showed a consistent increase with elevation, except for a sharp dropoff from 5000 ft to 6000 ft. In my experience on the west slope of the Cascades, diversity is usually high at low elevations (as is the case in many parts of the Green Mountain area outside of plot 6901), then decreases, and then (above 6000 ft, in the alpine zone, not sampled in the Green Mountain area) sharply increases again. In the Summit Lake area (west slope of the Cascades, further south in Washington), the number of species per plot decreased gradually with increase in elevation between ca. 3000 and ca. 5000 ft, but (ignoring species on rock) the diversity per plot in that elevation range was on the same order as for the Green Mountain areas, i.e., ca. 50 (±25).

In the Green Mountain area, Plot 6901 is anomalous in being apparently species poor, due to the very closed and inaccessible canopy and scarcity of hardwood trees; Plot 6905 is unusually species rich, due to the abundance of rock outcrops.

### Health of the Lichen Community

Again, this is almost impossible to assess, due to the lack of specific information for comparison. About all that can really be said at present is that no obvious signs of damage to the lichens (other than that due to the natural effects of parasites or invertebrate grazing) or impoverishment of the communities (other than the depauperate community in plot 6901, which is not at all unusual in similar habitats elsewhere) were evident. The general impression I had was of normal, well-developed lichen vegetation characteristic of mature (or even old-growth) forests on the west slope of the Cascades.

Possibly some of the lichen communities (for instance, the Cladonia and Peltigera species at the lower elevations) were not as rich or luxuriant as I have seen at some other localities, but that could easily be due to differences in amount or nature of precipitation or other climate conditions, or in the diversity of substrate types or microhabitat conditions available (at least in the plots), e.g., few large rock outcrops and few hardwood trees, and no waterfalls or other sources of increased humidity.

### Rare or Endangered Species

Calicium abietinum (found in plot 6902), Chaenotheca furfuracea (found in plot 6903; identification tentative due to lack of fruiting bodies), and Calicium glaucellum, Chaenotheca brunneola and Stenocybe major (all found in plot 6904) are all on a preliminary list of rare or endangered lichens for Washington State compiled by Katie Glew and others for the Washington State Department of Natural Resources (Debra Salstrom, pers. comm., 1995). All of these are members of the order Caliciales, which tend to be closely associated with old-growth forests. Several other members of the order, Calicium cf. lenticulare and Chaenothecopsis brevipes (both found in plot 6901), undetermined species of Chaenotheca and Chaenothecopsis (both found in plot 6903), and Chaenothecopsis pusiola (found in plot 6904) are not on that list but are probably also rare or endangered in the state.

Many of the species (especially of Lecidea sensu lato and other crustose groups) in the Green Mountain plots or nearby areas are apparently undescribed or not yet reported from North America. Some of these, and some of the crustose taxa that I have at least tentatively identified to species not previously reported from Washington (e.g., Arthonia cf. microspermella and A. tetramera) may well turn out to be rare, but most of them are easily overlooked in the field, and much more study is needed to determine their actual distributions.

Three additional species, found outside of plots in the Green Mountain area, Loxosporopsis corallifera, Lobaria hallii, and Phylliscum demangeonii, are also on the list of rare or endangered lichens for the state. At least one other species found outside of plots in the area, Usnea longissima, perhaps should be added to that list.

Although none of the species have been given official status at the Federal level, at least one

(Lobaria hallii) is restricted to the Pacific Northwest, and while not as rare as once thought, it is potentially endangered throughout this range (due mainly to loss of old-growth forest, although pollution may possibly also be a threat in a few areas).

**"Missing" Species**

Certainly there are many lichen species (mostly crustose) that have been found in roughly similar habitats at similar elevations elsewhere on the west slope of the Cascades, but were not found in the Green Mountain area (e.g., Bactrospora dryina, Dimerella lutea, Lecanactis megaspora, to arbitrarily mention just a few from the Summit Lake area). However, there are also many taxa (especially the crustose ones given only "herbarium names" beyond genus) that were found in the Green Mountain area (including many within the plots) that have not yet been seen (or at least identified) at these other areas. Existing knowledge of the distribution (and factors affecting distribution) of all but the most common and easily recognized lichens in the Pacific Northwest is very limited. However, virtually all of the lichen species that I would have definitely expected to find (and many others), were present in the Green Mountain area, though not necessarily inside the plots. Possible exceptions (taxa expected but not found) might be Chrysothrix candelaris or Xanthoria polycarpa, which are common in some areas of western Washington, but are probably mostly restricted to low elevation or coastal sites, and Hypogymnia tubulosa, which occurred in the Summit Lake area but also is more characteristic of low elevation areas near the coast, and is generally not very common anyway.

**Occurrence and Relative Abundance of Pollution Sensitive Species**

As stated earlier, nothing is known about the pollution sensitivity of the vast majority of species that occur in the Green Mountain area, including many of the most common species in the plots.

Of the species known or presumed to be sensitive to oxidants, Platismatia glauca has the largest elevation range, and is present in all of the plots, with abundance of 1 or 1+ at the elevational extremes and 2 or 2+ in the other 4 plots. Alectoria sarmentosa was found in plots 6903, 6904, 6905 and 6906, with abundances of 2, 3, 2, and 4, respectively; two closely related (and probably also sensitive) species also occur: A. vancouverensis in plots 6902 and 6903, with abundances of 2+ and 1, respectively and A. lata in plot 6906 with abundance uncertain but probably 1. Bryoria fremontii occurred in plots 6905 (abundance = 2) and 6906 (abundance uncertain, but probably 2 or 3). Other species of Bryoria, which are probably also sensitive, occur in all the plots except 6901, and become increasingly abundant with higher elevations, having a combined abundance of 4 in plot 6906. Cladonia spp. occurred in all plots, but together have relatively high cover (ca. 0.1) only in plot 6905. Parmelia sulcata was found in plots 6901, 6902, and 6905, all with abundance of 1; a related species, P. hygrophila, was found in plots 6903 (abundance = 2) and 6904 (abundance = 1). Peltigera didactyla and P. rufescens were found in plot 6905, with cover of 0.01 and 0.05, respectively. Other members of the genus also occurred in that plot (with collective cover of ca. 0.1), and in plots 6901 (cover = 0.01) and 6902 (collective cover of ca. 0.02). Usnea spp. occurred in plots 6901 (abundance =1) and 6902 (abundance = 1 and 1).

There were several other species, that are not definitely known to be sensitive to oxidants, but are in the same genera as species that are. Calicium spp. occurred in plots 6901 and 6902 with abundance of 1, and in 6904 with abundance of 3. Tuckermannopsis spp. occurred in plots 6902 (abundance = 1+ and 1), 6903 (abundance = 2- and 1), 6904 (abundance = 1 and 1), 6905 (abundance = 1 and 2-). A species of Pseudocyphellaria occurred in plot 6901 (abundance = 1). Leptogium spp. occurred in plot 6905 (cover = 0.01+ and 0.02). A Melanelia species occurred in plot 6905 with cover = 0.01.

Hypogymnia imshaugii, which is more or less tolerant to oxidants but nevertheless could be a useful indicator because of the damage symptoms it can exhibit, occurred in plots 6901 (abundance = 1), 6902 and 6903 (both abundance = 2), and 6905 (abundance = 3).

Other taxa found in plots and known to be sensitive to sulfur dioxide but not necessarily to oxidants, were species of the genera Lobaria (plots 6901, 6902, and 6903, all with abundance = 1), Nephroma (plot 6903, with abundance = 1 and plot 6905, with cover = 0.01), and Sticta (plot 6904, abundance = 1). Most members of these genera (along with Pseudocyphellaria) occur mainly in the canopy, and may be more abundant than these estimates suggest; Nephroma helveticum is definitely quite abundant in some areas at low elevations outside of the plots.

The remaining 5 or so sensitive species were found only outside of the plots, and were each seen

only occasionally, in small amounts.

**Recommendations**

Because the existing plots were selected on the basis of factors other than the lichens, I recommend that several additional plots should be established in sites deliberately selected to more fully represent the lichen vegetation and especially the species known or presumed to be sensitive to pollution. It would be particularly desirable, for purposes of pollution monitoring, to have at least two or three additional plots to sample the diverse lichen communities at the lower elevations, including those in riparian areas with abundant hardwood trees, the Pinus contorta forest, or other fairly open forested areas where canopy-preferring lichens (Lobaria, Nephroma, Pseudocyphellaria) are obviously visible and collectable. Also of scientific interest, though perhaps less critical for monitoring pollution, would be additional areas with well developed lichen vegetation on soil, rocks, or both, one at low to moderate elevation and one near the lake at the base of the upper slope of Green Mountain. Additional mechanical ozone monitors may or may not be necessary to accompany these new plots.

Comprehensive surveys of plots for all lichen species provide valuable data, at least on present biodiversity and distribution, that would not be obtained otherwise. However, for future visits to the plots, unless a lichenologist will be present or at least involved in laboratory identifications, it may be better to concentrate on relatively easily identifiable species (mostly macrolichens), at least in the short term. For most crustose taxa (and some difficult macrolichens such as Bryoria), damage, reduced abundance, or loss of individual species will be difficult even for a lichenologist to detect over the short term. On the other hand, since little or nothing is known about the sensitivity of most of the species (crustose lichens are often pollution tolerant, but there are some definite exceptions), it would be desirable to eventually (perhaps 10 or even 20 years from now) involve a lichenologist in doing more comprehensive re-surveys of the plots, to see what, if any, differences there are in the crustose or other difficult species.

Further sampling for element analysis would be potentially useful; I recommend concentrating on one or two species (e.g., Platismatia glauca and Alectoria spp.) and increasing the number of field replications (separate sites) per elevation.

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**APPENDIX**
**Additional Collections of Lichens from Green Mountain Area,**
**Outside of Plots**

This list is somewhat incomplete as far as specimens cited goes, but it is designed to give an idea of the overall substrate and elevation distributions of species that also occur in the plots, and to provide information on other species that were not found (or at least not detected) in the plots, but occurred in the Green Mountain area or nearby localities.

Alectoria sarmentosa--On conifer bark, 260 m, 30721 [FS], 300 m, 30011, 600 m, 30691-b, 900 m, 30667-b, 30719 [FS], 1200 m, 30717-a, 1400 m, 30497-c, 1500 m, 30701; on Thuja plicata, 950 m, 30053 [FS]; on Abies lasiocarpa, 1800 m, 32633.

Alectoria vancouverensis--On conifer bark, 260 m, 30638-c [FS], 600 m, 30234 [FS]; on Thuja plicata, 950 m, 30048 [FS].

Arthonia radiata--On Alnus sp., 120 m, 30124 [FS]. This species is externally indistinguishable from A. microspermella, and may well occur in or near plot 1.

Arthonia tetramera--On Thuja plicata 950 m, 30054-b.

Bacidia arceutina--On Alnus sp., 328 m, 30004-c.

Bacidia laurocerasi--On bark, 600 m, 30451-b [FS].

Bacidia phacodes--On Alnus sp. boles, 300 m, 30004-d.

Baeomyces sp.--On rocks along Green Mountain Trail, occasional; mostly sterile, not collected due to lack of chisel-hold.

Bryoria capillaris--On conifer bark, 260 m, 30696-a, 600 m, 30690, 900 m, 30666-c, 30667-d [FS], 1200 m, 30710-a, 30717-b [FS], 1400 m, 30515-a (dark morph), 30515-b (coarse morph), 1450 m, 30516-b, 1500 m, 30695-a (dark morph), 30695-b, 30705; on Thuja plicata, 950 m, 30056-a, 30050.

Bryoria fremontii--On Thuja plicata, 950 m, 30056-c [FS].

Bryoria fuscescens--On Tsuga heterophylla, 1300 m, 30499-a [FS]; on conifer bark, 600 m, 30684.

Bryoria glabra--On conifer bark, 900 m, 30667-a [FS], 1100 m, 30497-a [FS], 1300 m, 30499-b, 1500 m, 30696-b; on Thuja plicata, 950 m, 30056-b [FS], 30054-f; on Pseudotsuga menziesii, 450 m, 30037 [FS].

Bryoria oregana--On conifer bark, 900 m, 30667-f [FS]; on Abies lasiocarpa, 1800 m, 32628.

Bryoria trichodes ssp. americana--On conifer bark, 600 m, 30691, 900 m, 30667-c, 1100 m, 30497-b (fertile) [FS], 1450 m, 30516-a, 1500 m, 30696-a; on Thuja plicata, 30056-b.

Buellia erubescens--On conifer bark, 1500 m, 30704-f.

Caloplaca cf. atrosanguinea--On conifer bark, 900 m, 30601-b [FS].

Cavernularia hultenii--On bark, 260 m, apparently rare, 30641-c. The species is very small and inconspicuous.

Cetrelia cetrarioides--On conifer stump, 125 m, 30104 [FS], 30101; on Alnus sp. and Acer macrophyllum, [5.5 mi E of Ranger Station], 30621.

Cladina rangiferina--On soil among mosses, very abundant, 260 m, 30645-a, 300 m, 30026 [FS].

Cladonia bacillaris--On rotten conifer wood, 125 m, 30113, 950 m, 30060-a.

Cladonia bellidiflora--On rotten conifer wood, abundant, 1050 m), 30472 [FS], 30473, 1600 m, 30533-a [FS], 30534-a.

Cladonia chlorophaea--On soil, 1600 m, 30535-a [FS].

Cladonia coniocraea--On soil, 900 m, 30659 [FS].

Cladonia cornuta ssp. groenlandica--On moss, 900 m, 30660-b.

Cladonia ecmocyna--On the ground, 1600 m, 30533-b [FS], 30535-b, 30531.

Cladonia fimbriata--On Pseudotsuga menziesii, 120 m, 30088 [FS]; on rotten conifer wood, 125 m, 30095- ; on the ground, 900 m, 30656 [FS].

Cladonia furcata--On the ground, 300 m, 30023 [FS], 900 m, 30662 [FS].

Cladonia gracilis--On rotten conifer wood, 125 m, 30095-j, 30112; on soil, 328 m, 30024 [FS].

Cladonia "ignota"--On exposed S-facing soil, 1100 m, 30490 [FS].

Cladonia macilenta--On rotten conifer wood, 125 m, 30108 [FS], 30109, 30110, 30095-i, 300 m, 30141 [FS], 450 m, 30065-a, 900 m, 30597-d [FS].

Cladonia "peculiaris"--On the ground, 925 m, 30062 [FS].

Cladonia pleurota--On soil, 1100 m, 30489 [FS].

Cladonia pyxidata--On soil, 1100 m, 30487 [FS].
Cladonia rei--On soil, 300 m, 30025, 450 m, 30064, 950 m, 30060-b.

Cladonia squamosa v. squamosa--On rotten conifer wood, 900 m, 30597, 1100 m, 30470, 30469.

Cladonia squamosa v. subsquamosa--On rotten conifer wood, 125 m, 30095-f [FS]; on soil or moss, 900 m, 30654-b [FS].

Cladonia umbricola--On rotten wood, 900 m, 30661 [FS].

Cladonia subulata--On the ground, 900 m, 30660 [FS].

Cladonia spp.--several additional specimens from various localities, that I have not yet been able to identify.

Cyphelium karelicum--On bark of Thuja plicata, 900 m, 30668 [FS]. An inconspicuous species, which should be looked for also in plot 3 and perhaps others.

Dimerella pineti--On conifer bark, 900 m, 30604-b.

Evernia prunastri--On Alnus sp., occasional, 125 m, 30094, 600 m, 30443-b, 450 m, 30072.

Graphis scripta--On Alnus sp., 125 m, 30095-e, 300 m, 30002 [FS], 30003; on Acer circinatum, 300 m, 30145; on Alnus sp., 30135-b; on bark, 300 m, 30171, 30173; on Alnus sp. and Acer macrophyllum, [5.5 mi E of Ranger Station], 30612-c.

Hypogymnia apinnata--On conifer bark, 600 m, 30442-d.

Hypogymnia enteromorpha--On conifer bark, 260 m, 30634-a [FS], 30634-c, 30637-c, 30008 [FS], 300 m, 30172, 328 m, 30008 [FS], 450 m, 30040, 30073 [FS], 600 m, 30680, 30688, 900 m, 30666-b [FS], 1500 m, 30699-b; on Alnus sp., 120 m, 30125, 300 m, 30134, 450 m, 30073; on Acer circinatum, 300 m, 30162; on Alnus sp., 30442-c [FS]. Some of the low elevation specimens could be misidentified as H. heterophylla because they look so different from H. enteromorpha at other sites, they are probably just H. enteromorpha modified by environmental factors (open, relatively dry and sunny conditions).

Hypogymnia imshaugii--30666-b. On bark, 450 m, 30070, 600 m, 30680-c; on Alnus, 600 m, 30442-b [FS], 30443-c.

Hypogymnia inactiva--On conifers, 260 m, 30634; on Abies lasiocarpa, 1800 m, 32634.

Hypogymnia metaphysodes--On Pseudotsuga menziesii, 450 m, 30039-a; on conifer bark, 900 m, 30667-b, 1200 m, 30715 [FS], 1500 m, 30700 [FS]; on Abies lasiocarpa, 1800 m, 32631.

Hypogymnia occidentalis--On Alnus and Acer macrophyllum, 150 m, 30620-b.

Hypogymnia physodes--On bark, 125 m, 30095-a [FS], 300 m, 39176, 600 m, 30680-b; on Alnus sp, 30442-a [FS]

Hypogymnia rugosa--On Pseudotsuga menziesii, 450 m, 30036; on conifer bark, 1500 m, 30698-c.

Hypogymnia vittata--On conifer bark, 900 m, 30675-c; on Thuja plicata, 950 m, 30055 [FS].

Hypotrachyna sinuosa--On Alnus sp. branches, 125 m, 30095- , 260 m, frequent, 30640, 30641, 30643-c [FS], [5.5 mi E of Ranger Station], 30612-d.

Icmadophila ericetorum--On rotten conifer wood, 950 m, 30663 [FS].

Lecanora flavopunctata--On bark, 1500 m, 30704-b [FS--as Lecidea "viridopuncta"].

Lecanora impudens--On bark, 600 m, 30449-d.

Lecanora pacifica--On Acer macrophyllum, 120 m, 30079; on boles of Alnus sp., 328 m, 30004-a [FS], 30004-b [FS].

Lecanora pulicaris--On conifer bark, 30598-a; On Abies lasiocarpa, 1500 m, 30694, 30704-g, 30704-e, 1600 m, 30527-b, 30531.

Lecidea "aggregata"--On humus, 1050 m, 30474 [FS], 1100 m, 30488-b.

Lecidea "albovirida"--On conifer boles, 900 m, 30667-d [FS].

Lecidea "atrogrisea"--On shrubs, 1500 m, 30706-a; on bark, 1500 m, 30704-c [FS].

Lecidea "atrovirida"--On Alnus sp., 420 m, 30128 [FS].

Lecidea "brunneogrisea"--On Abies lasiocarpa, 1600 m, 30527-a [FS]; on shrubs, 1600 m, 30528-a.

Lecidea "carneogrisea"--On humus, 1600 m, 30534-b [FS].

Lecidea "griseofusca"--On exposed rocks, 1100 m, 30495 [FS], 1400 m, 30505-c [FS].

Lecidea "gyrodisca"--On rock, 1400 m, 30507.

Lecidea "stygiomargina"--On bark, 300 m, 30182-b.

Lecidea "viridescoides"--On unburnt conifer wood, 30595.

Lecidea spp.--On twigs of hardwood trees, 300 m, 30182.

Lepraria incana--On burnt wood, 300 m, 30144 [FS], 30578-c.

Lepraria cf. incana--On bark, 300 m, 30593 [FS].

Lepraria "protocetrarica"--On conifer bark, 300 m, 30143 [FS].

Lepraria "thujaphila"--On Thuja plicata, 300 m, 30149 [FS].

Lepraria spp.--On conifer stump, 125 m, 30107 [FS]; on mossy rocks, 1400 m, 30505-e; on conifer bark, 300 m, 30185-a [FS], 30185-b [FS]; on Abies lasiocarpa, 1800 m, 32627.

Leptogium gelatinosum--On Thuja plicata, 300 m, uncommon, 30147-b.

Leptogium lichenoides--On moss over exposed S-facing rock, 1440 m, 30504.
Lobaria hallii--On Acer macrophyllum, 120 m, 30077 [FS].

Lobaria oregana--On Salix sp., 120 m, 30090; on dead Acer circinatum, 300 m, 30160 [FS]; on Pseudotsuga menziesii, 328 m, 30013 [FS].

Lobaria pulmonaria--On bark, 260 m, 30642, 328 m, 30012 [FS], 900 m, 30676; on Acer macrophyllum, 120 m, 30078 [FS], 30084-b, [5.5 mi E of Ranger Station], 30608-a [FS]; on Thuja plicata, 300 m, 31046 [FS].

Lobaria scrobiculata--On branches in canopy and on Acer macrophyllum branches, 300 m, rare, 30136 [FS].

Lopadium disciforme--900 m, 30604-a.

Loxospora elatina--On bark, 30590-a.

Loxospora pustulata--On bark, 900 m, 30603-b.

Loxosporopsis corallifera--On bark of Pinus contorta, 260 m, 30628.

Massalongia carnosa--On moss over ashy soil bank in partial shade, 1100 m, 30480 [FS], 30488-a, 30486.

Melanelia fuliginosa--On Acer circinatum and Alnus sp., 125 m, 30095-d [FS].

Melanelia subaurifera--On Acer circinatum and Alnus sp., 125 m, 30095-c [FS].

Menegazzia terebrata--On smooth hardwood bark (e.g., Alnus sp., Acer circinatum), below ca. 300 m, moderately common, 30123, 30179, 30611, 30096 [FS].

Mycoblastus affinis--On conifer bark, 950 m, 30054-d, 1200 m, 30711; on Thuja plicata, 950 m, 30051-a [FS]; on Abies lasiocarpa, 1800 m, 32632.

Mycoblastus sanguinarius--On conifer bark, 600 m, 30685, 900 m, 30601-a, 30594, 1100 m, 30496, 1200

m, 30711; on Pseudotsuga menziesii, 450 m, 30043-a; on Thuja plicata, 950 m, 30051; on Alnus sp., 30459-a.

Nephroma helveticum ssp. sipeanum--On branches of Tsuga heterophylla or other conifers, very common, 260 m, 30625-a [FS], 30625-b [FS], 300 m, 30005-a, 30017 [FS], 30197; on Thuja plicata, 300 m, 30147-a.

Nephroma laevigatum--On branches of Acer macrophyllum, 150 m, 30622, 300 m, 30140; on willow, 120 m, 30090-b; on Acer circinatum, 300 m, 30178-b [FS].

Nephroma parile--On moss on exposed S-facing rock, 1440 m, 30503 [FS].

Nephroma resupinatum--On Pseudotsuga menziesii twigs, 300 m, 30005; on Acer circinatum, 300 m, 30592; on Alnus sp. and Acer macrophyllum, 150 m, 30608-b [FS].

Ochrolechia juvenalis--On bark, 1200 m, 30709.

Ochrolechia laevigata--On Alnus sp., 120 m, 30122 [FS], 30126, 125 m, 30095-d, 240 m, 30133, 260 m, 30631, 30627-a, 30624-c, 450 m, 30071-a, 30071-b [FS], 600 m, 30458-b, 30449-a, 30450-a, 30450-c, 900 m, 30603-a; on Acer circinatum, 300 m, 30180; on Alnus sp. and Acer macrophyllum, 150 m, 30612-b.

Ochrolechia oregonensis--On Thuja plicata, 950 m, 30054-a; on Pseudotsuga menziesii, 450 m, 30043-b; on conifer bark, 900 m, 30674 ("typical" morph [rather uncommon in this area] with quite large apothecia and very thick, verrucose thallus).

Ochrolechia szatalaënsis--On Thuja plicata, 950 m, 30052.

Pannaria saubinetii--On twigs of conifers, 260 m, very common, 30641-a [FS], 328 m, 30032-b.

Pannaria "washingtonensis"--On mossy soil banks along Green Mountain Trail, ca. 1100 m (3500-4000 ft.), abundant in several areas, 30479-a [FS].

Parmelia hygrophila--On bark, 125 m, 30105-b.

Parmelia sulcata--On bark and wood of Acer circinatum, Alnus sp., and Pseudotsuga menziesii, 125 m, 30095-g [FS], 30105-a, 30102; on Alnus sp., 600 m, 30446; on Acer macrophyllum, 30137; on conifer bark, 900 m, 30600.

Parmeliopsis hyperopta--On shrubs, 1600 m, 30528; on Abies lasiocarpa, 1800 m, 32655.

Peltigera britannica--On moss, 260 m, 30644-a.
Peltigera collina--On steep, mossy rock surface, 450 m, 30066 [FS], 30067 [FS]; on soil, 328 m, 30031 (form with broad lobes) [FS], 30033 [FS], 30034-a; on bark, 30084-a, 30081; on Acer circinatum, 30157 (brown form); on Acer macrophyllum, 300 m, 30184 [FS].

Peltigera didactyla--On moss over ashy soil bank, 1250 m, 30498 [FS].

Peltigera horizontalis--On the ground, 260 m, 30646-a [FS], 950 m, 30061 [FS].

Peltigera leucophlebia--On the ground, 328 m, 30029 [FS], 1100 m, 30481 [FS].

Peltigera membranacea--On soil, [5.5 mi E of Ranger Station], 30607-b [FS], 260 m, 30644, 300 m, 30000 [FS], 600 m, 30452 [FS], 900 m, 30658-a (det. B. Goffinet; tomentum sparse; mixed with a thallus of P. pacifica or possibly an unusual form of P. neopolydactyla) [FS], 30605; on mossy logs, 300 m, 30169 (det. B. Goffinet).

Peltigera neopolydactyla--On mossy log, 300 m, 30196 (det. B. Goffinet).

Peltigera pacifica Vitik.--On soil or moss, 120 m, 30093 [FS], 260 m, 30648-a [FS], [Road 26, mile 16-17], 30034-b [FS]; on moss over ashy soil bank in partial shade, 1100 m, 30483 and 30482 [FS] (both det. B. Goffinet), 900 m, 30651 (det. B. Goffinet) [FS].

Peltigera venosa--On soil, 260 m, 30648-b.

Pertusaria amara--On Alnus sp., 120 m, 30095-a; on bark, 120 m, 30100, 30121.

Pertusaria leucostoma--On bark, 600 m, 30449-b, 30450-d [FS].

Pertusaria ophthalmiza--On bark, 900 m, 30599; on Alnus sp. and Acer macrophyllum, 150 m, bark, 260 m, 30641-b, 30630-a [FS], 30630-b, 950 m, 30057, 1200 m, 30713-b; on Alnus sp., 240 m, 30130-a, 30132 [FS].

Pertusaria subambigens--On large Pseudotsuga menziesii, 300 m, 30165 [FS]; on dead Acer circinatum, 300 m, 30156-a [FS].

Phlyctis agelaea--On bark, 600 m, 30450-c, 30451-a .
Phlyctis argena--On bark, 600 m, 30451-d.

Phylliscum demangeonii--On exposed S-facing rock in meadow, 1400 m, 30509 (determined by Mauro Tretiach, a specialist on cyanolichens, visiting ASU from Italy) [FS].

Physcia aipolia--On bark, 120 m, 30084-e.

Physcia tenella--On bark, 125 m, 30105-d, 30095-b [FS], 30084-c.

Pilophorus acicularis--On rocks, occasional, 328 m, 30021, 1100 m, 30494.

Pilophorus clavatus--On rocks, 1175 m, 30477.

Placopsis gelida--On more or less exposed (sunny) rocks, ca. 1000-5000 ft, very common in many areas; on exposed S-facing rock, 4750 ft, 30506 [FS].

Platismatia glauca--On bark, 125 m, 30095-c, 260 m, 30637 [FS], 450 m, 30075, 900 m, 30672-b [FS]; on Abies lasiocarpa, 1800 m, 32629.

Platismatia herrei--On conifer bark, 260 m, 30636, , 300 m, 30007, 600 m, 30683, 30689 [FS], 900 m, 30718; on Pseudotsuga menziesii, 450 m, 30046 [FS]; on Thuja plicata, 950 m, 30058; on Alnus sp., 600 m, 30445.

Platismatia norvegica--On conifer bark, 260 m, 30639, 300 m, 30015, 30019, 450 m, 900 m, 30665-b; on Pseudotsuga menziesii, 30038; on Thuja plicata, 950 m, 30049.

Porpidia thomsonii--On shaded rocks, ca. 1100-1200 m, 30476 [FS], 30475 [FS]. Both are of the form with grayish thallus only.

Pseudocyphellaria anomala--On bark, 300 m, 30161 [FS], 328 m, 30032-b; on Alnus. sp., 450 m, 30069 [FS]

Pseudocyphellaria crocata--On branches of Tsuga heterophylla, mostly in the canopy, 260 m, 30626-b, 300 m, uncommon, 30009, 30155, 328 m, 30016 [FS].

Psoroma cf. hypnorum--On moss over rock or ash, somewhat exposed, south-facing, 1100 m, 30485 [FS].

Ramalina farinacea--On Alnus sp. and other deciduous trees, 30086, 125 m, 30097 [FS], 30095-c [FS].
Rinodina spp.--On Alnus sp., 450 m, 30071-c; on conifer bark, 600 m, 30451-e.

Sphaerophorus globosus v. gracilis--On conifer bark, 260 m, very common, 30635 [FS], 30014, 300 m, 30177, 900 m, 30669; on Acer circinatum, 300 m, 30154; on Thuja plicata, 950 m, 30059; om Alnus sp. and Acer macrophyllum, [5.5 mi E of Ranger Station], 30610.

Stereocaulon alpinum--On soil or moss, 260 m, abundant, 30647-a [FS].

Stereocaulon intermedium--On rock, 900 m, 30648-c [FS].

Stereocualon sasakii v. tomentosoides--On soil, 328 m, 30027 [FS], 900 m, 30650 [FS], 1100 m, 30492 [FS], 1400 m, 30492.

Sticta beauvoisii--On conifer branches, 30625-c [FS].

Sticta fuliginosa--On branches of Tsuga heterophylla or other conifers, rare in this area, 120 m, 30076-b, 30089 [FS], 600 m, 30232-a.

Thelotrema lepadinum--On bark, 900 m, 30675-e.

Trapeliopsis granulosa--On rotten conifer wood, 900 m, 30657, 1050 m, 30471 [FS], 1100 m, 30491 1600 m, 30538 [FS], 30532 [FS].

Tuckermannopsis chlorophylla--On Pseudotsuga menziesii, 450 m, 30045.

Tuckermannopsis orbata--On bark, 600 m, 30449-c [FS], 900 m, 30677, 30670.

Tuckermannopsis platyphylla (Tuck.)--On conifers, 600 m, 30707-e [FS], 900 m, 30675-b, 1300 m, 30501 [FS], 1500 m, 30702; on Abies lasiocarpa, 1800 m, 32630. Rather uncommon in this area.

Tuckermannopsis subalpina (Imsh.)--On basal parts of shrubs, along Green Mountain Trail, 1600 m, common, 30528-b [FS].

Umbilicaria deusta--On exposed S-facing rock in meadow, 1400 m, 30505-a.

Umbilicaria polyphylla--On exposed rock, 1400 m, 30502-c [FS].

Umbilicaria torrefacta--On exposed rock, 1400 m, 30502-b [FS].
Usnea filipendula s. lato--On Alnus sp. and Acer macrophyllum, [5.5 mi E of Ranger Station], 30609 [FS]; on Pseudotsuga menziesii, 450 m, 30044-a [FS]; on Alnus sp., 600 m, 30444-a [FS].

Usnea lapponica s. lato--On Alnus sp. and Acer macrophyllum, 150 m, 30616-a [FS]; on Alnus sp., 600 m, 30044-b.

Usnea longissima--On branches of hardwood trees (e.g., Alnus sp., maples), [5.5 mi E of Ranger Station], 30623 [FS], 260 m, 30638-d; frequent and sometimes abundant below 260 m.

Usnea subfloridana s. lato--On bark and wood, 125 m, 30098-a, 30098-b [FS], 260 m, 30638-b [FS]; on Alnus sp. and Acer macrophyllum, 150 m, 30616-b.

Usnea wirthii--On bark and wood, 125 m, 30103. Apparently uncommon, but perhaps overlooked.

Usnea sp.--On conifer bark, 260 m, 30638-a.

Vestergrenopsis isidiata--On exposed S-facing rock in meadow, 1100 m, 30505-d [FS], 30510.

Xylographa hians--On conifer wood, 600 m, 30692, 1100-1200 m, 30478-a [FS].

Xylographa vitilago--On conifer wood, 1100-1200 m, 30478-b.

Sterile crusts:

Green sorediate, C+ red crust--On conifer wood, 900 m, 30595, 30579-b.

Pale greenish yellow, thin powdery crust--On conifer wood, 900 m, 30606 [FS].

Brownish-grayish, ± areolate crust--On burnt wood, 300 m, 30142 [FS].

Brownish with soralia--On bark, 30449-e.

Grayish with green soralia--On bark, 600 m, 30450-b.

Miscellaneous--On bark, 900 m, 30603-c.

**TAXONOMIC COMMENTS ON THE SPECIES**
**(COMPLETE LIST, BOTH IN AND OUT OF PLOTS)**

* = found in at least one plot

*Acarospora fuscata (Nyl.) Arnold--Characterized by ± scattered, relatively pale yellowish brown squamules ca. 1 mm across, with C+ red upper surface, on rock.

*Acarospora "brunnea" Ryan in herb.--Characterized by tiny, relatively dark brown squamules, with C- upper surface, on rock. Does not seem to key out, but the genus is desparately in need of a modern, useable treatment.

*Acarospora "sterilis" Ryan in herb.--Characterized by the brown, C- squamules on soil. This may be A. terrigena, but fertile material is needed for positive identification.

*Alectoria cf. nigricans (Ach.) Nyl.--Differs from all other members of the genus in having a mottled, grayish to blackish thallus; the nature of the mottling, the conspicuousness of the pseudocyphellae (under a lens) and the KC+ red-violet reaction help distinguish the species from Bryoria. The material from Green Mountain is atypical in that the pseudocyphellae are flush with the surface (rather than raised), and in growing on bark in the subalpine zone rather than on soil or rock in the alpine zone.

*Alectoria sarmentosa (Ach.) Ach.--Characterized by greenish yellow to pale yellow, pendulous, fruticose thallus without central cord, and C- medulla. Growing on bark or wood.

*Alectoria vancouverensis (Gyelnik) Gyelnik ex Brodo & D. Hawksw.--In my opinion this is virtually indistinguishable from A. sarmentosa except that the medulla is C+ red (briefly visible when the branches are cut) containing olivetoric acid. Growing on bark or wood.

Arthonia--The genus is characterized by the entirely marginless, often irregularly shaped ascocarps and hyaline, transversely septate spores. The species in the Green Mountain area all occur on bark, and contain the alga Trentepohlia (giving a yellowish or orangish color when the thallus is scraped). The ascocarps are ± flush with the surface of the substrate, rather than raised like those of Lecidea and similar genera. The genus is taxonomically difficult, and the North American species are badly in need of revision.

*Arthonia cf. microspermella Willey--Characterized by irregularly shaped, stellately branched blackish fruiting bodies, spores 2-septate, 9-13 x 3.5-5.5 um. My identification is tentative, since the species was originally described from Texas, and the only other report, from California, is questionable.

Arthonia radiata (Pers.) Ach.--This species is externally indistinguishable from A. microspermella, and may well occur in or near plot 1. The spores are 3-septate, ca. 15-20 x 4.5-6 um.

*Arthonia "rubroreagens" Ryan in herb.--Distinguished by the K+ magenta-red reaction of the rounded to irregular brown-black fruiting bodies, and the 1-septate spores 15-17 x 5-6 um; I have seen no mention of such a reaction in any species of this genus, although A. tumidula has a K+ violet reaction.

*Arthonia cf. tetramera (Stizenb.) Hasse--Characterized by roundish to irregular black fruiting bodies, with spores 3-septate, 11-14 x 4-5 um. The material does not fit the description very well with regard to the thallus (e.g., it is not "silvery white"), and the only other report of the species in North America is from Lonicera on the coast of southern California, whereas this material is on conifers in the Cascade Mountains.

*Aspicilia caesiocinerea (Nyl. ex Mallbr.) Arnold--Characterized by the slightly bluish tinged gray thallus of contiguous areoles, K- reaction, immersed apothecia with black disks, and spores ca. 14-30 x 7-16 um.

*Aspicilia sp.--On rock. Only a small amount of material was collected. No spores were found; the material is distinguished from A. caesiocinerea by having a distinctly whitish thallus.

Bacidia--The genus is usually not distinguishable externally from species of Lecidea s. lato; it is recognizable microscopically by the hyaline, many-septate spores. Most of the species are difficult to identify, especially in the field.

Bacidia arceutina (Ach.) Arnold--Differs from the other bark-inhabiting species (B. laurocerasi) in having the epihymenium and exciple edge brown, K+ yellowish tinge, and in having narrower spores, spores are ca. (32-)35-55(-67) x 1.5-2(-2.5) um. The apothecia are 0.2-0.6(-0.8) mm diam., pale brown to brown-black. Can grow on soil or moss in addition to bark or wood.

*Bacidia laurocerasi (Delise ex Duby) Ozenda & Clauz.--Grows on bark. Differs from B. arceutina in having the epihymenium or exciple edge brown or purplish brown, K+ purplish tinge, and the spores broader, ca. 35-70(-85) x 2.5-4 um. The apothecia are (0.2-)0.4-1(-1.2) mm diam., pinkish brown (in shade) to black;

*Bacidia phacodes Körber--Distinguished from the other two species on soil or moss by the small (0.2-0.5 mm diam.), pale beige or pale orange-pink apothecia, low hymenium (35-50 um), and small spores (ca. 30-45 x 1.5-2 um.

*Bacidia polychroa (Th. Fr.) Körber--Grows on soil or mosses; differs from B. phacodes in having larger, (0.3-)0.5-1(-1.5) mm diam., pink-brown or red-brown apothecia, which are often larger, higher hymenium (70-100 um), and larger spores, ca. (43-)50-70 x (2.5-)3-4(-4.5) um, and differs from B. laurocerasi in that the hypothecium and exciple (and often the upper hymenium) are pale yellow or reddish yellow, K+ mauve.

Baeomyces sp.--Sterile; identifiable to genus by the smooth, greenish thallus and the habitat (shaded rocks in moist montane forest); identification to species requires either apothecia or a chemical test.

*Bellemerea cinereorufescens (Ach.) Clauz. & Roux--Characterized externally by the grayish areolate thallus with + immersed to Lecanora-like apothecia with dark red-brown to blackish disks; growing on rock. The reddish disks and I+ violet medulla help distinguish the genus from Aspicilia.

*Bellemerea sp.--Only a tiny amount was collected accidentally with Rhizocarpon geographicum; I have no notes on what the characteristics of this species were, but apparently the material is different from B. cinereorufescens.

Bryoria--The genus is usually easily recognizable in the field by the grayish to brown or black, hairlike thallus. The species are often difficult to distinguish (especially in the field, and without good lighting, which is necessary to clearly see the differences in color and surface texture), and are very frequently entangled with each other (at least after dumping several specimens into the same collecting bag or packet).

*Bryoria capillaris (Ach.) Brodo & D. Hawksw.--Characterized by the usually pale grayish (to sometimes rather dark olive), K+ persistently bright yellow thallus with usually very slender branches, lacking soredia. Variable; forms with dark or coarse thalli may be confused with other species without the K test, and clumps composed primarily of other species may sometimes appear to be K+ due to mixture with B. capillaris.

*Bryoria fremontii (Tuck.) Brodo & D. Hawksw.--The material (as is frequent in many places) lacks the bright yellow soredia that are diagnostic for this species, but is usually identifiable by the rather dark, + shiny reddish to yellowish brown, K- thallus, lacking soredia (in Green Mountain material), with the rather coarse main branches irregularly and coarsely pitted and distorted. Rather variable, often difficult to distinguish from other species with which it is entangled, especially B. trichodes and B. oregana.

*Bryoria fuscescens (Gyelnik) Brodo & D. Hawksw.--Identifiable by the relatively pale, dull brownish-gray thallus, usually with whitish soralia. In this area, the species is often rather straggly, and is often mixed

with other species. It differs from the only other common sorediate species in the area, B. glabra, in the paler and duller surface, with more of a reddish or grayish rather than greenish tinge.
*Bryoria glabra (Mot.) Brodo & D. Hawksw.--Characterized by the rather dark, shiny, olive green thallus, with smooth, evenly thickened branches, usually with whitish soralia.

*Bryoria oregana (Tuck.) Brodo & D. Hawksw.--Characterized externally by the dull, distinctly red-brown surface, the narrowness of the branches, and brittleness; characterized under a compound microscope by the "jigsaw puzzle" appearance of the cortex (in contrast to the fibrous appearance of other species). The species was usually mixed in with other species, and without examining each strand under a compound microscope I find it difficult to distinguish B. oregana from forms of B. fremontii.

*Bryoria pseudofuscescens (Gyelnik) Brodo & D. Hawksw.--Characterized by the K+ yellow then red reaction with formation of needle-like crystals visible under a dissecting scope (norstictic acid). The thallus is usually darker and coarser than B. capillaris, the only other K+ member of the genus found in the area, but is often difficult to recognize without the K test.

*Bryoria trichodes ssp. americana (Mot.) Brodo & D. Hawksw.--Distinguished by the ± pale, ± reddish brown, thallus with ± uniformly very thin branches (in this subspecies) not pitted and distorted as in B. fremontii. Rather variable; can be confused with B. fremontii and others.

Buellia--The species on bark (all those found in the area except B. papillata) are not distinctive externally, resembling other taxa with (usually?) black, Lecidea-like apothecia; recognizable microscopically by the brown, 1-(to more-)septate spores.

Buellia "anomala" Ryan in herb.--Does not key out among species reported for North America; the pale apothecia are very anomalous for a Buellia, suggesting that this may be a parasite on the apothecia of another genus, suppressing spore production by the host.

*Buellia erubescens Arnold--Thallus usually K+ red (norstictic acid); apothecia black; spores 14-20 x 6-9 um.

*Buellia papillata (Sommerf.) Tuck.--Recognizable externally because it is the only species in the area with whitish thallus and black apothecia growing on soil; characterized microscopically by having 3-septate spores.

Buellia "parvispora" Ryan in herb.--Apothecia black; spores 3-septate. Does not key out among species reported for North America (spores too small). On bark.

*Calicium abietinum Pers.--Thallus immersed in wood; apothecia on slender stalks 0.6-0.9 mm tall, without pruina; stalk I-; asci 44-52 um long; spores brown, 1-septate, 11.5-15 x 5-7 um, minutely warted to minutely cracked-areolate.
*Calicium glaucellum Ach.--Thallus usually immersed in wood; apothecia on slender stalks 0.5-0.9 mm tall, usually with a faint white pruina at edge and below head; stalk I-; asci 35-41 um long; spores brown, 1-septate, ellipsoid, 9-13 x 5-6.5 um, with surface of irregular cracks. Differs from C. abietinum in the lack of pruina, shorter asci, and shorter spores.

*Calicium cf. lenticulare--Similar to C. glaucellum (not distinguishable in the field), but thallus more often visible; apothecia similar or somewhat taller; stalk I+ violet (under compound microscope); spores similar but 9-11 x 4-5 um, minutely verrucose to areolate.

*Caloplaca atrosanguinea (G. K. Merr.) Lamb--Thallus light gray; apothecia dark brown to blackish or slightly reddish; spores 12.5-18 x (5.5-)10-11 um. Not distinctive externally, unless the K+ purplish blue reaction of the apothecia (unique within the genus, and not found in externally similar Lecidea-like genera) can be seen (by cutting the apothecia in half vertically or testing them on a piece of white paper); recognizable microscopically by the colorless polarilocular spores (two cells connected by a canal). On bark. The spores of the Green Mountain specimens are more broadly ellipsoid than usual, but otherwise

the material fits the species well.

*Caloplaca cf. borealis (Vainio) Poelt--Easily distinguished in the field from all other crustose lichens found so far in the area by the bright orange apothecia, on bark. However, many of the orange-fruited species of the genus are difficult to distinguish from each other.

*Candelariella vitellina (Hoffm.) Müll. Arg.--Recognizable in the field by the yolk-yellow thallus and apothecia, growing (in this case) on rock. Since no voucher was collected, the identification to species is slightly uncertain, but C. vitellina is the only member of the genus likely to occur on siliceous rocks in Washington State.

*Catapyrenium cinereum (Pers.) Körber--Characterized by the grayish squamulose thallus on soil, with immersed perithecia visible under a lens as tiny dark dots. The spores are hyaline and non-septate.

Cavernularia hultenii Degel.--A very tiny grayish foliose lichen, easily recognized under a lens by the numerous tiny perforations on the dark underside.

Cetrelia cetrarioides (Delise ex Duby) Culb. & C. Culb.--A broad-lobed grayish foliose lichen identifable by the tiny white pseudocyphellae (just barely visible without a lens) on the upper surface.

*Chaenotheca brunneola (Ach.) Müll. Arg.--Thallus usually immersed; apothecia globose, black, on slender stalks 0.6-1.6 mm tall, epruinose; spores globose, 3.5-4.5 um diam, pale brown, non-septate. On wood.

*Chaenotheca furfuracea (L.) Tibell--Easily recognizable when fertile by the bright green-yellow-tipped heads of the tiny stalked apothecia on a bright greenish yellow powdery thallus. The typical habitat, on roots or soil on the undersides of upturned coniferous trees or under overhanging roots in soil banks, is also characteristic. The spores are globose, pale brownish, non-septate, ca. 2-3 um diam.

*Chaenotheca sp.--Thallus and spores similar to that of C. furfuracea, but apothecia brownish, not green-yellow.
*Chaenothecopsis brevipes Tibell--New to Washington State (previously reported from North America only from Maine). Apothecia very short (to 0.2 mm tall), epruinose; spores 1-septate, ca. 6.6-10.5 x 2.6-3.8 um, brownish. Parasitic on Arthonia on bark. Among other differences, Chaenothecopsis is distinguished from Chaenotheca in that the spores of the former do not form a powdery mass.

*Chaenothecopis pusiola (Ach.) Vainio--Apothecia 0.4-0.8 mm tall; spores 5.4-7.8(-9.5) x 2.2-2.7(-3) um. Parasitic on Chaenotheca brunneola.

Chaenothecopsis sp.--Growing on Chaenotheca furfuracea (I am aware of no members of the genus described as being associated with that species). Spores brownish, 1-septate, too narrow to be those of a Chaenotheca.

Cladina rangiferina (L.) Nyl.--Characterized by the grayish, K+ yellow, much-branched shrubby thallus completely lacking squamules, growing on soil or moss.

Cladonia--Although many species are readily identifiable, at least after chemical tests, others are very difficult to distinguish, especially when "fruits" in a loose sense (apothecia or pycnidia) are lacking or of uncertain color. The species found in the Green Mountain area can be grouped as follows: 1) species with soredia and + regular and flaring cups (C. pleurota, which is yellowish and has red fruits when fertile; C. chlorophaea and C. fimbriata, which are greenish and have brown fruits when fertile); 2) species with soredia and irregular and narrow cups (C. deformis and C. umbricola, which are yellowish and have red fruits when fertile; C. rei, which is greenish and has brown fruits when fertile); 3) species with soredia but without cups (C. bacillaris and C. macilenta, which have reddish fruits when fertile, C. acuminata, C. cornuta, C. coniocraea, and C. norvegica, which have brownish fruits when fertile); 4) species without soredia and without cups (C. bacillaris, which has red fruits when fertile; C. ecmocyna, C. furcata, C.

gracilis, C. ramulosa [sometimes sorediate] and C. squamosa, which have brownish fruits when fertile); 5) species without soredia, with cups (C. pyxidata); and 6) species with large basal squamules and few or no podetia, without soredia, with brown apothecia (C. macrophyllodes).

*Cladonia acuminata (Ach.) Norrlin v. acuminata--Characterized by granular-sorediate, cupless podetia, with brown apothecia when fertile, with the thallus K+ yellow then red (norstictic acid). Not easily recognizable without the K test.

*Cladonia bacillaris Nyl.--Characterized by the sorediate, cupless podetia tipped with tiny red pycnidia or occasionally with red apothecia, growing on conifer bark or wood. Some authors consider this to be a synonym of C. macilenta; the main difference is that C. bacillaris is K-, P-, without thamnolic acid.

Cladonia bellidiflora (Ach.) Schaerer--Characterized by the non-sorediate, densely squamulose, cupless podetia tipped with red apothecia. Thallus K-, P-, KC+ yellow, UV+ white (usnic and squamatic acids).

*Cladonia chlorophaea (Flörke ex Sommerf.) Sprengel--Characterized by the cup-forming, coarsely sorediate podetia, with pycnidia or apothecia (when present) brown, usually growing on the ground. Thallus K-, P+ red (fumarprotocetraric acid). Intergrades with C. pyxidata.

*Cladonia coniocraea auct.--Characterized by the cupless, powdery-sorediate podetia with pycnidia or apothecia (when present) brown, and the relatively large basal squamules. The distinctions between this and similar species are often difficult, and I am not always sure of my identifications of it. Thallus K-, P+ red (fumarprotocetraric acid).

*Cladonia cornuta (L.) Hoffm. ssp. groenlandica (E. Dahl) Ahti--Characterized by unbranched, cupless podetia, sorediate in upper part, corticate in lower part; basal squamules smaller than those of C. coniocraea; pycnidia and apothecia if present brown; thallus K-, P+ red (fumarprotocetraric acid). The soredia are typically restricted to discrete round patches towards the tips, instead of being diffused over most of the surface as in similar species.

*Cladonia deformis (L.) Hoffm.--Characterized by yellowish, sorediate podetia with narrow, ± regular cups, containing usnic acid (KC+ yellow) and zeorin, and red apothecia or pycnidia.

Cladonia ecmocyna Leighton--Distinguished by the non-sorediate, cupless podetia, with pycnidia (when present) brown, growing on the ground. Thallus K+ yellow, P- (atranorin).

*Cladonia "enigmata" Ryan in herb.--Characterized by sorediate podetia with narrow and poorly formed cups and no apothecia or pycnidia (tips of podetia mostly broken off in the specimen). Thallus K-, P-, KC+ yellow, UV- (usnic acid and zeorin). The chemistry and form of the podetia suggest C. deformis, but the podetia are not very yellow and the basal squamules are tiny and persistent. The taxon is not very distinctive morphologically; material with more intact podetia is needed.

Cladonia fimbriata (L.) Fr.--Characterized by the powdery-sorediate, cup-forming podetia with pycnidia or apothecia (when present) brown, growing on the ground, or on rotten wood or mossy rocks. Intergrades with C. chlorophaea.

Cladonia furcata (Huds.) Schrader--Distinguished by the relatively frequently branched (rather than ± simple as in other species in the area), non-sorediate, cupless podetia with the axils of the branches often opening to the hollow center, and with relatively few squamules on the surface, growing on the ground. Thallus K-, P+ red (fumarprotocetraric acid).

Cladonia gracilis (L.) Willd.--Characterized by the non-sorediate, cupless or cup-forming, unbranched, podetia, growing on the ground. Cupless forms differ from C. ecmocyna mainly in the K- reaction.

Cladonia "ignota" Ryan in herb.--Seems to key out to C. bellidiflora, but lacks usnic acid, and the podetia are small and not very squamulose.

*Cladonia macilenta Hoffm.--Distinguished by the sorediate, cupless, podetia usually tipped with red pycnidia or apothecia, growing on conifer bark or wood. Thallus K+ yellow, P+ orange (thamnolic acid).

*Cladonia macrophyllodes Nyl.--Characterized by the mats of rather coarse and scarcely divided, usually without podetia, growing on the ground at high elevations. The podetia are short, without soredia, with brown apothecia.

*Cladonia "mysteria" Ryan in herb.--Podetia sorediate, cupless. Unfortunately I did not record additional characteristics of the material before mailing it to the Forest Service.

*Cladonia norvegica Tonsb. & Holien--Thallus is similar to that of C. macilenta, but UV+ bluish white, with finely divided basal squamules; apothecia pale brown, not red. Thallus P-, K-, containing barbatic and 4-O-methylbarbatic acid.

Cladonia "peculiaris" Ryan in herb.--Podetia ca. 2 cm tall, simple or with short branches near the tips, perforated at the axils, non-sorediate, with fairly numerous very small squamules, otherwise ecorticate, brown to whitish, K-, P+ orange-red (fumarprotocetraric acid). A member of the C. furcata group; does not seem to key out to anything reported from N. America, except possibly C. macroptera (the only description I have of that species is too brief to be very useful).
*Cladonia "perplexa" Ryan in herb.--Podetia sorediate, cupless. Unfortunately I did not record additional characteristics of the material before mailing it to the Forest Service.

*Cladonia pleurota (Flörke) Schaerer--Distinguished by the yellowish, sorediate podetia with rather short and flaring, regular cups, with red pycnidia or apothecia, and K-, P-, KC+ yellow, UV-, containing usnic acid and zeorin.

*Cladonia "problematica" Ryan in herb.--Unfortunately I did not record characteristics of the material before mailing it to the Forest Service.

Cladonia pyxidata (L.) Hoffm.--Distinguished by the non-sorediate podetia forming rather short, broad, regular cups covered by relatively coarse, smooth-surfaced (corticate) appressed granule-like squamules (schizidia), and pycnidia or apothecia (when present) brown, growing on the ground or on soil or moss over rocks. Thallus P+ red, K- (fumarprotocetraric acid).

*Cladonia cf. ramulosa (With.) Laundon--Very variable; distinguished by the irregular, often inconspicuous podetia, with the surface often partly granular, rarely sorediate, mixed with brittle squamules, often with ± decorticate areasand turgid, ± xontiguous fruits, forming blunt apices. Thallus P+ red, K- (fumarprotocetraric acid). The identification is very tentative, since C. ramulosa is not included in Hammer's recent treatment of the genus in the Pacific Northwest.

*Cladonia rei Schaerer--Characterized by the unbranched, sorediate, podetia tipped with very narrow cups, and pycnidia or apothecia (when present) brown. Thallus K-, P+ red or P-, KC-, UV+ white (homosekikiaic acid, ± fumarprotocetraric acid). Often a difficult species to identify.

*Cladonia squamosa (Scop.) Hoffm. v. squamosa--Characterized by the usually weakly branched, nonsorediate, densely squamulose, K- podetia with at most indistinct cups, with axils of the branches often opening into the hollow interior, and pycnidia or apothecia (when present) brown. Distinguished chemically by containing squamatic acid (K-, P-, KC-, UV+ blue-white).

*Cladonia squamosa v. subsquamosa (Nyl. ex Leighton) Vainio--Similar to the typical variety but K+ bright yellow, P+ yellow, UV- (thamnolic acid). Material from some of the sites is atypical, with rather narrow podetia and very small squamules.

Cladonia subulata (L.) Weber ex Wigg.--Characterized by rather tall (3 cm or more), somewhat branched podetia with closed axils and partly with rather poorly formed cups somewhat wider than the podetia, ±

ecorticate and covered by powdery soredia, K-, P+ orange-red (fumarprotocetraric acid); apothecia and pycnidia brown.

Cladonia cf. umbricola Tonsb. & Ahti--Distinguished by the yellowish, sorediate, podetia with narrow, often indistinct cups, and red pycnidia or apothecia. Differs from C. deformis in lacking zeorin, and having more regular cups. The cups are taller, narrower and more irregular than those of C. pleurota. The Green Mountain material is atypical, in having soredia on the primary squamules.

*Cladonia spp.--Most specimens without podetia are difficult or impossible to identify, especially without TLC and very careful comparison of the basal squamules of those of known species with podetia. The

Cyphelium karelicum (Vainio) Räsänen--The genus is easily distinguished from Lecidea-like genera by the powdery spore mass on the disk, which rubs off on one's fingers or on paper. On bark or wood.

*Cyphelium pinicola Tibell--Differs from C. karelicum in having a yellowish thallus.

*Dimerella pineti (Schrader ex Ach.) Vezda--Easily recognizable in the field by the tiny, whitish, waxy-translucent apothecia, on a greenish thallus. The apothecia are regularly rounded and flat, which distinguish them from those of Lecidea "albovirida", and D. pineti has 1-septate spores and yellowish-orangish algae (Trentepohlia). The material from this area has apothecia consistently ca. 0.2 mm diam., whereas the literature describes the apothecia as ranging to larger sizes.

*Diploschistes scruposus (Schreber) Norman--Characterized by the unique type of apothecia, with a dark, radiately striate margin well visibl inside the pale, entire thalline margin, blackish disks, on a grayish or whitish rimose-areolate, C+ red thallus, on rock. The spores are muriform.

Evernia prunastri (L.) Ach.--Usually easily recognized by the fruticose, limp, thallus with flattened branches that are yellowish to greenish or grayish on one side and usually whitish or paler on the other side. The only species in the area with which it might be confused is R. farinacea, which often grows with it; the limpness and dorsiventrality of the thallus of E. prunastri distinguish it from that species.

*Graphis scripta (L.) Ach.--Differs from all other crustose, bark-inhabiting lichens in this list by the long, narrow, often branched black fruiting bodies. Xylographa also has long apothecia but grows on wood, has green-colored algae (not Trentepohlia), and has simple I- spores. Two other things that also have elongated black fruiting bodies and may occur in the area are Opegrapha, which has thin-walled, cubical-celled, I- spores and usually shorter apothecia) and non-lichenized fungi in the Hysteriaceae, which have short, broad, strongly raised fruiting bodies, with no thallus, growing on wood rather than bark.

*Hypocenomyce castaneocinerea (Räsänen) Timdal--Easily recognizable by the tiny (ca. 1 mm or less), brownish to greenish squamules on (often burnt) conifer bark or wood. The squamules are smaller, more appressed, and darker and browner than those of Cladonia spp. The material lacks distinct soredia and is more greenish than the species is supposed to be, but otherwise seems to fit.

Hypogymnia--The genus is easily identified by the hollow foliose to subfruticose thallus with whitish to greenish upper side and brown to black lower side, without regular round holes penetrating the upper surface. However, the non-sorediate species (all those below except H. physodes and H. vittata) are often extremely difficult to identify, especially in the field.

*Hypogymnia apinnata Goward & McCune--This species is rather variable, but is distinguished from other non-sorediate members of the genus in this area by the mostly rather broad and irregularly inflated (somewhat knobby) lobes without short lateral lobules, smooth upper surface, and especially the P- reaction and lack of substances other than atranorin (+ fatty acids). The lack of lobules distinguishes it from H. enteromorpha, which also is (almost always) P+ red, and from H. occidentalis, which has narrower, more flattened lobes and contains medullary substances; the smooth upper surface and tendency toward knobbiness distingish it from the sometimes very similar H. rugosa, which also differs in containing P+ pale yellow medullary substances.

*Hypogymnia enteromorpha (Ach.) Nyl.--This extremely variable species is distinguished from other non-sorediate ones by the rather broad, irregularly inflated and knobby lobes with lateral lobules, and usually P+ orange-red medulla. Forms with short, appressed lobes may be similar to H. occidentalis, which has narrower lobes and is P+ slowly yellow.

*Hypogymnia imshaugii Krog--This rather variable species differs from the others in this area by the completely white medulla (others, especially H. metaphysodes, are at most only partly white inside), and usually also differs from other species (except H. inactiva) by the narrow, often ± regularly dichotomous and rather loose and trailing, lobes.

Hypogymnia inactiva Krog--This species can be confused only with H. imshaugii, from which it differs in having a dark, P- medulla.

*Hypogymnia metaphysodes (Asah.) Rass.--This species, in its typical form, has narrow, appressed and flattened lobes with a distinctive, crowded branching pattern, very similar to H. physodes, from which it differs in lacking soredia, having a white medullary ceiling, and usually being P-. However, some specimens are atypical, and may externally resemble H. occidentalis or perhaps narrow-lobed forms of H. apinnata.

*Hypogymnia occidentalis Pike--This species is distinguished from H. enteromorpha by the appressed, flattened, narrow lobes, and P+ slowly yellow reaction of the medulla. It differs from narrow-lobed forms of H. apinnata in containing phenolic compounds in addition to atranorin and in having lateral lobules. It differs from H. rugosa in having lateral lobules, a smooth upper surface, and somewhat different chemistry.

*Hypogymnia physodes (L.) Nyl.--This species is one of the two sorediate members of the genus in this area, both with labriform soralia ("lip-shaped", borne on the underside of the lobe tips, reflexed backwards towards the upper side). Presorediate specimens can usually be distinguished from H. metaphysodes by the P+ reaction. The most similar species is H. vittata (see below).

*Hypogymnia rugosa (G. K. Merr.) Pike in Hale--This species usually resembles H. apinnata but has a wrinkled upper surface (not always a conspicuous or completely reliable feature) and a P+ pale yellow medulla (with substances).

Hypogymnia vittata (Ach.) Parr--Differs from H. physodes especially in having typically somewhat longer and whiter or browner lobes with a black rim conspicuous from above, and in being P-.

Hypotrachyna sinuosa (Sm.) Hale--At a quick glance this species resembles a yellowish thallus of Hypogymnia physodes, but aside from the color is easily distinguished by having flat, solid lobes with forked rhizines on the underside.

*Japewia tornoensis (Nyl.) Tonsb.--Not very distinctive externally, having red-brown, Lecidea-like apothecia, on a dark brown or evanescent thallus; easily identified microscopically by the rather large, very thick-walled spores, which distinguish it from Lecidea. Differs from Mycoblastus in that the apothecia are brown and the spores much smaller.

Lecanora--Typical members of the genus, with pale to brown or black apothecia with yellowish or whitish margins (and simple, hyaline spores), are usually recognizable as Lecanora even in the field, in this area being confusable mainly with Bellemerea spp. (which have an I+ violet medulla), or Rinodina spp., which usually have brownish or dark gray apothecial margins (and brown, 1-septate spores). However, species with immarginate apothecia, and sterile species, are mostly recognizable in the field only by becoming very familiar with their appearance and habitat. Although a few species are quite distinctive, the majority are very difficult to identify even in the lab.

*Lecanora flavopunctata Tonsb.--Characterized by tiny, discrete, yellowish (to greenish) soralia

(sometimes appearing as papillae, without the soredia) on an immersed to often superficial dark grayish (to partly pale yellowish) thallus, occasionally with some patches having tiny (mostly ca. 0.2 mm, but sometimes larger) pale brownish or yellowish, immarginate apothecia, with narrow spores (7.5-10.5 x 2.5-4 um), growing on bark (especially shrubs at higher elevations). The thalli often appear as mosaics of rather different looking patches (appearing as several species). Some specimens, especially those on Abies instead of shrubs, are especially atypical.

*Lecanora impudens Degel.--Characterized by discrete whitish, C- soralia on a whitish, K+ yellow thallus, growing on conifer bark. Only sterile material was found in the Green Mountain area (fertile material has typical Lecanora-type apothecia with red-brown disks and white margins). Without apothecia the species is difficult to identify with certainty, but it is known to occur in similar habitats in the Pacific Northwest, and the material compares well with specimens identified from other areas by presumably reliable experts.

*Lecanora intricata (Ach.) Ach.--Identifable by the pale yellowish areolate thallus with pale-rimmed, typically at least partly greenish to bluish tinged epruinose apothecia, growing on rock.

*Lecanora pacifica Tuck.--Distinguished by the pale-rimmed apothecia with at most weakly pruinose disks, which in this materail are yellowish (but can be extremely variable even on the same thallus, ranging to greenish or brownish, but not reddish), growing on bark; the apothecia are considerably larger than those of L. "washingtonensis", and the thallus and apothecial margin are K+ yellow.

*Lecanora polytropa (Hoffm.) Rabenh.--Variable, but easily recognizeable by the scattered, pale, ± yellowish epruinose apothecia (immarginate or with margins the same color as the disk and lacking algae) usually with little or no thallus, on rock. Forms with well developed thallus may be similar to L. intricata.

*Lecanora pulicaris (Pers.) Ach.--Characterized externally by pale-rimmed apothecia with epruinose discs ranging from pale to dark, ± reddish brown, with K+ yellow thallus and apothecial margins, on bark. Distinguished microscopically by the epihymenium inspersed with fine granules. The material from this area is extremely variable in disc color (only rarely the pure chestnut brown that is typical of the species), and appears to be all of the atypical chemotype with P- apothecial margins. Especially when the disks have a slightly olivaceous or blackish tinge it appears very similar to L. circumborealis, which I would have expected to be at least equally common here, especially at the higher elevations, but as far as I can tell, the apothecial cortex is thin, as in L. pulicaris, and the spores also seem to fit that species, although in one specimen they are as broad as described for L. circumborealis (to 10-11 um).
*Lecanora "washingtonensis" Ryan in herb.--Distinguished by the tiny (under ca. 0.5 mm diam.), flat, pale-rimmed apothecia with epruinose, pale slightly greenish yellow discs, on bark. Does not seem to fit anything presently reported from North America.

*Lecanora sp.--Thallus whitish; apothecia pale, with whitish margins, on rock. The single small specimen is too poor (only one apothecium) to make anatomical studies, but does not seem to likely to fit any species reported from North America.

Lecidea (s. lato)--This is one of the most difficult crustose genera, due to the sheer numbers of species and lack of adequate taxonomic studies, especially of species on bark or wood. The old genus is in the process of being split into numerous segregate genera (except where noted, most of the species in the area do not belong in Lecidea s. stricto), based on esoteric anatomical features that I find almost useless for practical identification; my repeated attempts to make a workable artificial key have been frustrating. Most of the "Ryan in herb." species do not seem to key out among species reported for North America, but even when they appear to key out, without reliably identified comparison material (scarce in any herbarium) one still cannot be sure of correct identification. The genus is even more hopeless in the field than in the lab.

The species on rock (all with black apothecia, although Porpidia "pallida" and Micarea "parasitica", with pale apothecia, also fit here) are: 1) species with distinctly brown, ± coarsely areolate thallus, on rock (L. "atrofusca", with epruinose disks, and L. "griseofusca", with pruinose disks); 2) species with gray-brown finely areolate thallus and furrowed-contorted apothecia (L. "gyrodisca"); 3) species with

grayish or whitish (or rarely orangish) thallus (L. confluens and L. lapicida, with I+ violet, K- thallus, L. lactea, with I+ violet, K+ red thallus, L. "nondescripta", with I-, K- thallus, and L. sp., not collected; Porpidia thomsonii also fits here); 4) species with dark, greenish/olivaceous thallus (L. "stygiovirida"), 4) species with little or no thallus visible (L. eckfeldtii).

The species in the Green Mountain area on soil, moss, humus, or very rotten wood are: 1) species with soralia ("L. viridescoides", C+ red; Trapeliopsis granulosa also fits here, but is more often fertile and the thallus is thicker and grayish); 2) species with greenish thallus, without soralia (L. sanguineoatra, with coarse, ± reddish brown, isolated, ± distinctly marginate apothecia on well developed green thallus, and narrowly ellipsoid spores, and L. "aggregata", with small, aggregated, convex and immarginate, dark red-brown to blackish apothecia on well developed green thallus, and ellipsoid spores); 3) species with brownish or blackish thallus, without soralia (Placynthiella cf. oligotropha fits here).

The "species" on bark or (non-rotten) wood consist of: 1) sorediate species, which are often sterile (L. "viridescoides", C+ red, and L. "viridosora", C-); 2) non-sorediate species with pure black apothecia (L. "atrogrisea", with gray thallus and globose spores, and L. "atroconvexa" with gray thallus and oblong-ellipsoid spores]; Lecidella euphorea, with loose paraphyses and broadly ellipsoid spores, also fits here); 3) non-sorediate species with whitish apothecia (L. "albovirida"); 4) non-sorediate species with ± brown apothecia (see separate breakdown below).

4-a) species on wood, with rusty red to blackish apothecia, dark, inconspicuous thallus, and ± ovoid spores (L. holopolia).

4-b) species on bark, with ± oblong-ellipsoid spores (L. "carneogrisea", with pale orange-brown apothecia with concolorous margins and gray thallus, L. "pallidoaggregata", with aggregated, pale apothecia with concolorous margins and green thallus, and L. stygiomargina, with ± yellowish brown apothecia with blackish margins and pale green thallus).

4-c) species on bark, with ± broadly ellipsoid spores (L. "brunneogrisea", with red-brown apothecia and smoothish gray thallus, L. "phaeochlora", with pale orange-brown to dark red-brown apothecia and coarsely granular-subsquamulose green thallus, and L. "glaucodisca", with pale to dark, ± bluish-grayish tinged apothecia and smoothish pale green thallus; Japewia tornoensis, with reddish brown apothecia and large, thick-walled spores, also fits here).

4-d) species on bark, with ± globose spores (L. "brunneovirida", with coarse, convex brown apothecia with soon disappearing concolorous margins and pale green thallus, and L. "variabilis", with very small, reddish brown or pale brown apothecia partly with paler margins, and whitish thallus, L. "pallidomarginata", with very small, red-brown apothecia with paler margins).

*L. "aggregata" Ryan in herb.--Convex, immarginate, dark brown to blackish apothecia ± aggregated into groups, on well developed rather deep green thallus; hypothecium dark brown; epihymenium brown; spores ellipsoid, 9-12.5 x 6 um; on humus or rotten wood. Differs from L. sanguineoatra in that the apothecia are smaller, aggregated, darker, more convex, and soon immarginate, and the spores are more broadly ellipsoid.

*L. "albovirida" Ryan in herb.--The small whitish apothecia on a green thallus, easily distinguish this species from other bark-inhabiting Lecidea spp. in the area, but the species does not seem to key out among ones reported for North America. Hypothecium, exciple and epihymenium hyaline; hymenium 30 um, I+ blue; paraphyses indistinct; ascus tips I+ dark blue; spores ellipsoid to ovoid-ellipsoid, sometimes 1-septate, 6-7 x 1.5-2 um; algae ca. 5 um diam., in clumps.

L. "atroconvexa" Ryan in herb.--Small, convex and immarginate apothecia with greenish black apothecia, on smooth whitish thallus; hypothecium green-blackish to pale dirty yellowish; epihymenium green-blackish; hymenium greenish; paraphyses indistinct, gelatinous; spores oblong-ellipsoid, 8-12.5 x 2.5-4 um. On hardwood bark. Very similar to L. "glaucodisca", but apothecia larger and darker, and thallus smoother and whiter. My earlier name for this (L. "atrovirida") is misleading, because it implies that the thallus is green, whereas I meant to describe the greenish tint of the blackish apothecia.

*L. "atrofusca" Ryan in herb.--Black, epruinose apothecia on brown, I-, K± yellow, C- thallus, on rock. Hypothecium dark brown, K-; epihymenium olive-black, K-; hymenium 80 um; spores broadly ellipsoid, 8-11.5 x 6-6.5 um. A true Lecidea; does not seem to fit species reported for North America. The epruinose apothecia help distinguish it from L. "griseofusca".

*Lecidea "atrogrisea" Ryan in herb.--Black apothecia on gray thallus, on bark of conifers and shrubs. Hypothecium hyaline; epihymenium olive-black; hymenium 45-55 um, I+ dark blue; spores ± globose, 7-9 x 6-7 um. Externally similar to L. "aggregata" (but apothecia not aggregated), Lecidella euphorea, and Buellia "parvispora".

*Lecidea "brunneogrisea" Ryan in herb.--Fairly coarse, apothecia with plane, red-brown discs and concolorous margin, on pale grayish to greenish verrucose thallus, on bark of shrubs. Hypothecium hyaline; epihymenium orange-brown; hymenium 65-75 um; spores ± broadly ellipsoid, 13-15 x 6.5-7 um. Externally similar to some morphs of L. variabilis, has larger apothecia and the spores much longer and distinctly ellipsoid, not ± globose.

*Lecidea "brunneovirida" Ryan in herb.--coarse, convex brown apothecia with soon disappearing concolorous margins and pale green thallus. On bark. Hypothecium hyaline to pale yellowish; epihymenium orange-brown; hymenium 55 um, I+ dark blue; paraphyses ± indistinct; ascus tips I+ darker blue; spores globose, 6-7 um, to subglobose, 6.5 um. Similar to L. variabilis but apothecia coarser

*Lecidea "carneogrisea" Ryan in herb.--Small, convex and immarginate apothecia with pale yellowish to orange-brown disks, on smoothish pale gray thallus, on hardwood bark. Hypothecium and epihymenium hyaline; hymenium I+ blue; paraphyses coherent, indistinct (gelatinous); asci with I+ dark blue apex, appearing to be Bacidia-type or Biatora-type; spores oblong-ellipsoid, 12-14 x 2.5-4 um. Differs from L. "brunneogrisea" in having paler apothecia and narrow spores. Differs from L. "carneovirida" in having a smooth gray thallus, smaller and soon convex and immarginate apothecia, and much narrower spores.

*Lecidea confluens (Weber) Ach.--Black apothecia on grayish, I+ violet, K- thallus, on rock. Differs from the very similar L. lapicida in having exciple blackish at outer edge and epihymenium green to brownish green or black, and containing confluentic and 2'-O-methylperlatolic acids. A true Lecidea.

*Lecidea eckfeldtii Zahlbr.--This species is a "cryptothalline" member of Lecidea s. str. recognizable by the pruinose (grayish powdery) black apothecia scattered on rock, with no distinct thallus but usually with very fine, branching black hyphae of the prothallus between the apothecia. A true Lecidea.

Lecidea "glaucodisca" Ryan in herb.--Apothecia pale to dark, convex, with ± bluish-grayish color; on pale green thallus, on bark. Hypothecium dark blue-green-black; epihymenium pale; hymenium 37.5 um, I+ blue; paraphyses coherent, indistinct; asci 40 x 12.5 um, with I+ dark blue apex, appearing to be Bacidia-type or Biatora-type, or possibly Catillaria-type; spores variable, ellipsoid to more often oblong, sometimes 1-septate, 9-14(-25) x 2.5-3 um. The blue-green tinged hypothecium, bluish cast to the apothecia, and very narrow spores distinguish it from other species on bark, except L. "atrovirida", from which it differs in having smaller, mostly paler (and "glaucous" appearing, rather than dark greenish) apothecia, and a more uneven and greenish thallus. The tendency for the spores to become 1-septate may also be a distinguishing feature of L. "glaucodisca".

Lecidea "griseofusca" Ryan in herb.--A true Lecidea, with brown, areolate, K-, I- thallus, on rock. Hypothecium dark brown; excipulum brown-black, K+ reddish; epihymenium green-black; hymenium greenish, 70-75 um; spores ellipsoid, 11-12 x 5 um. The pruinose apothecia (which help distinguish it from L. "atrofusca", combined with other characters, seem to be distinctive; it does not seem to key out among species reported for N. America.

Lecidea "gyrodisca" Ryan in herb.--Apothecia small, black, strongly furrowed and contorted, on finely areolate gray-brown thallus, on rock. Hypothecium dark brown; epihymenium dark brown; hymenium ca. 100 um, I+ green then reddish; asci I- (reddish) with I+ blue apex (appearing to be Catillaria-type); parpahyses coherent, gelatinous; spores broadly ellipsoid, 14-18 x 10-13 um. An inconspicuous species, but easily recognizable under a hand lens because of the apothecial morphology. The internal characters are also quite unusual.

*Lecidea holopolia (Tuck.) Zahlbr.--Apothecia 0.3-1.5 mm diam., with rusty red to blackish disks and thick, blackish margins; thallus inconspicuous, olive-brown to blackish, granular; hypothecium hyaline;

epihymenium red-brown; hymenium 70 um; spores 9-14 x 4-7 um, ± ovoid (to oblong-ellipsoid or subglobose). On wood. Although I have seen no comparison material, the specimen seems to key out well to this species. The immersed thallus, on wood (rather than bark), distinguishes it from other species in the area.

*Lecidea cf. lactea Flörke ex Schaerer--A true Lecidea, characterized by the whitish, K+ red thallus with I+ violet medulla and black apothecia, on rock. The scanty material I collected is rather atypical. Some recent authors synonymize this under L. lapicida, from which it differs only in the K+ red reaction.
*Lecidea lapicida (Ach.) Ach. f. lapicida--Very similar to L. lactea, but K-.

*Lecidea lapicida f. oxydata--Easily recognized by the orangish thallus; otherwise identical to the typical form.

*Lecidea "nondescripta" Ryan in herb.--Black apothecia, grayish, I-, K- thallus, on rock. Hypothecium pale; epihymenium green-black; hymenium 65 um; spores ellipsoid to oblong-ellipsoid, 8-11 x 3.5-5 um. Externally this somewhat resembles a Rhizocarpon species, due to the somewhat convex areoles, but the spores are simple. The I- medulla helps distinguish it from L. lactea, L. lapicida, and L. confluens, but much further study is needed before it can be properly distinguished from numerous similar species.

*Lecidea "pallidoaggregata" Ryan in herb.--Brownish, at least partly ± aggregated apothecia, with smoothish green thallus, on conifer bark. Hypothecium orange-brown (to blackish above due to deposits of some material); epihymenium pale; hymenium 80 um, I+ blue; ascus tips I+ dark blue; spores oblong-ellipsoid, 11-12 x 4-4.5 um. Externally similar to L. "phaeochlora", but thallus smoothish and spores narrower, and to L. sanguineoatra, but apothecia paler, less reddish, and growing on bark instead of humus or rotten wood.
*Lecidea "pallidomarginata" Ryan in herb.--Very small brown (± olive) apothecia with paler margins, on bark of shrubs. Hypothecium pale; epihymenium olive-green; hymenium 40 um; spores ± globose, 5 x 4.5 um. The paler apothecial margins are fairly characteristic; see L. "brunneovirida" and L. "variabilis" for distinctions from those species.

*Lecidea "phaeochlora" Ryan in herb.--Coarse apothecia with pale orange-brown (to dark red-brown) discs and well developed margins, on distinctly and coarsely granular (almost minutely squamulose) rather deep greenish thallus. On bark. Hypothecium pale; epihymenium pale brownish; paraphyses strongly coherent, gelatinous; spores broadly ellipsoid, 13-15 x 5-7 um. Similar to L. sanguineoatra, but thallus distinctly and coarsely granular, and spores broadly ellipsoid, and growing on conifer bark. I had formerly called this species L. "carneovirida", but in material from the Summit Lake the apothecia are quite dark, and I have already used the name L. "brunneovirida" for a quite different species. When the apothecia pale they can be externally somewhat similar to those of L. "carneogrisea", but the thallus and spores are quite different.

*Lecidea ("Mycobilimbia") sanguineoatra auct.--Red-black apothecia on smoothish green thallus, on soil, moss, or humus, or rotten wood (or sometimes bark?). Hypothecium dark reddish brown; epihymenium pale; hymenium 60-70 um; hymenium and hypothecium usually with scattered blue-violet (K+ green) granules; spores narrowly ellipsoid, (8-)9-14(-15) x 3-4.5(-4.8) um. This species is synonmized by some authors under Mycobilimbia hypnorum, but differs in having paler apothecia with more readily excluded margins and narrower spores, which are smooth and never septate; if the species, and genus, are accepted, a new combination in Mycobilimbia is needed. Differs from L. "aggregata" in that the apothecia are larger, paler, isolated, and plane and marginate when young, and the spores are more narrowly ellipsoid.

*Lecidea "stygiomargina" Ryan in herb.--Small apothecia with plane, ± yellowish disks and blackish margins, on pale green thallus, on conifer bark. Hypothecium hyaline; epihymenium olive, inspersed with fine granules (soluble in KOH) penetrating down into hymenium; hymenium 35 um; spores ± narrowly ellipsoid to ovoid-ellipsoid, 9-14 x 4-5 um. The dark apothecial margins are distinctive.

*Lecidea "stygiovirida" Ryan in herb.--Small black apothecia on poorly developed dark greenish thallus,

on rock. Hypothecium and exciple brown-black; epihymenium brown; hymenium 80 um, I+ dark blue; paraphyses strongly coherent and gelatinous; spores ellipsoid, 8-14 x 6-6.5 um. Not likely to be confused with other species in the area, if examined under a lens.

*Lecidea "variabilis" Ryan in herb.--Very small, mostly orange-brown (± pale to sometimes dark) apothecia, partly with paler margins, on conifer bark. Hypothecium hyaline; epihymenium red-brown; hymenium 70-75 um; spores ± globose, 6-8 x 5-7 um. This may be Lecanora fuscescens. Differs from L. "pallidomarginata" in having a red-brown epihymenium, higher hymenium, and slightly larger spores, from L. "brunneovirida" in having smaller, flatter, apothecia with distinct margins at least when young, and whitish thallus, and from L. "atrogrisea" in having pale apothecia and a red-brown epihymenium. Externally somewhat similar to other species with orange-brown apothecia (L. "brunneogrisea" and L. "carneogrisea"), but spores ± globose.

*Lecidea "viridescoides" Ryan in herb.--Tiny, pale yellowsih green, C+ red soralia on a continuous, smoothish, darker green thallus. On ± rotten or burnt wood, or humus. Usually sterile, and would seem to key out to Trapeliopsis viridescens, but the characteristics and anatomy of the very few apothecia found, on one specimen, do not fit that species, nor the genus Trapeliopsis. The small size of the soralia and smooth, thin, dark green thallus help distinguish the species from Trapeliopsis granulosa, which also has C+ red soralia.

*Lecidea "viridosora" Ryan in herb.--Thallus scattered, disappearing, greenish, roughened, becoming covered with powdery, paler (± glaucous-green) soredia; apothecia rare, convex and immarginate, ca. 0.5 mm diam., pale yellow-brown; hypothecium hyaline; hymenium 35 um; paraphyses gelatinous; spores oblong-ellipsoid to oblong-ovoid, becoming 1-septate, (7-)11-13 x 3-3.5 um. Thallus K-, C-, P-, containing unknown substances. On burnt wood. Similar to L. viridescoides, but C-, and soredia more bluish tinged and soon diffuse and obscuring the scattered thallus.

*Lecidella euphorea (Flörke) Hertel--Not distinctive externally (resembles a Lecidea, with black apothecia); identified microscopically by the Lecanora-type I+ blue ascus apex,loose paraphyses, and broadly ellipsoid, simple, hyaline spores. On bark of hardwoods and conifers.

*Lepraria incana (L.) Ach.--The "species" of Lepraria are distinguished mainly by chemistry, and most of the material from this area does not exactly fit the chemistry of any described species for which I presently have information. This one is an exception; chemically it is characterized as containing divaricatic acid and zeorin, ± atranorin; externally it is characterized by a powdery, typically bluish tinged thallus. Although it is supposed to occur on a wide variety of substrates, in this area material with the proper chemistry seems to be most often found on burnt wood. Most of the other "species" in this area are very similar externally, though usually differing somewhat in color (most often more of a pure pale green rather than bluish).

*Lepraria "luteola" Ryan in herb.--Thin, pale yellowish, powdery, on bark. I do not have a record of the chemistry.

*Lepraria "mollis" Ryan in herb.--Rather thick and soft, pure pale green, powdery, on bark. I do not have a record of the chemistry.

*Lepraria "muscicola" Ryan in herb.--Thin, greenish, powdery, containing atranorin, zeorin, and unknown phenolic substance (pale, $R_F$ 3 in solvent C); on moss.

*Lepraria "mysteria" Ryan in herb.--Thin, greenish, powdery, containing only an unknown phenolic substance (pale, $R_F$ 3 in solvent C); on wood.

*Lepraria "problematica" Ryan in herb.--Thin, greenish, powdery, containing only an unknown phenolic substance (orange after charring, $R_F$ 5-6 in solvent C); on wood.

*Lepraria "protocetrarica" Ryan in herb.--Thin, distinctly bluish, powdery; distinguished from L. incana

mainly by containing protocetraric acid (+ related acids) as the only substance; on bark or wood.

*Lepraria "rangiformica" Ryan in herb.--Thin, bluish-greenish, powdery, distinguished from L. incana mainly by containing rangiformic acid (as the only substance other than atranorin); on rock or moss over rock.

*Lepraria "stictica" Ryan in herb.--Morphologically identical to L. neglecta, and similar in ecology, but differs in containing stictic acid. Usually distinguishable externally by the coarsely granular thallus with a bluish gray or bluish white color, and by the growth on horizontal to gently sloping surfaces (soil, moss, or other lichens, sometimes over rock), in exposed (sunny) sites (the other Lepraria spp. in the area are powdery and all occur on steep or overhanging, shaded surfaces).

Lepraria "thujaphila" Ryan in herb.--Thallus thin, greenish, powdery, containing atranorin, protocetraric acid, an unidentified triterpenoid, and unknown phenolic substances; on bark of Thuja plicata.

Lepraria spp.--Several other members of the genus were found, but I have not attempted to name or characterize them.

*Leptogium cf. gelatinosum (With.) Laundon--The genus is distinguished by the small, dark, corticate, foliose thallus, which is dark inside and gelatinous when wet (containing the cyanobacterium Nostoc evenly distributed throughout), and the small red-brown apothecia with septate or muriform spores. This species has relatively undivided, gray lobes and supposedly numerous apothecia (the material from plot 6905 is sterile, and has unusually small lobes).

*Leptogium lichenoides (L.) Zahlbr.--Differs from L. gelatinosum in having + finely dissected lobes (sometimes appearing almost isidiate), usually with a darker color and few or no apothecia.

*Letharia vulpina (L.) Hue--The bright greenish yellow fruticose thallus of this species is unlike that of any other species in the area. This species is much more common east of the crest of the Cascades.

Lobaria hallii (Tuck.) Zahlbr.--Characterized by the relatively small and little branched foliose thallus, with smoothish, pale yellowish upper surface; medulla K+ orange. On bark.

*Lobaria oregana (Tuck.) Müll. Arg.--Characterized by the large thallus with reticulate pattern of ridges on upper side and mottling on lower side; without soredia but usually with lobules. On bark.

*Lobaria pulmonaria (L.) Hoffm.--Similar to L. oregana but usually with soredia along the ridges on upper surface; young specimens of the two species may be difficult to distinguish; L. pulmonaria tends to be more brownish rather than yellowish. On bark.

Lobaria scrobiculata (Scop.) DC. in Lam. & DC.--Somewhat similar to L. hallii but with a more grayish, ridged/pitted upper surface with pale fine tomentum, and medulla K-. On bark.
*Lopadium disciforme (Flotow) Kullhem--Usually recognizable at least with a hand lens by the olive green + squamulose thallus and the black, cup-like (concace) apothecia which are strongly constricted at the base; identifiable macroscopically by the muriform spores. On conifer bark.

*Loxospora elatina (Ach.) Massal.--Characterized by the grayish crustose thallus with greenish powdery soralia, which are K+ yellow, P+ yellow (thamnolic acid). When the soralia become confluent and cover the thallus, this species closely resembles a Lepraria. Sterile. On bark.

*Loxospora pustulata (Brodo & Culb.) R. C. Harris in Egan--Characterized by the whitish crustose thalli with tiny pustules or papillae (visible at least with a lens) and the K+ yellow, P+ yellow reaction (thamnolic acid). Sterile. On bark. The species is supposed to be common in eastern N. America; this may be the first record for the west and for Washington state.

Loxosporopsis corallifera Brodo & Henssen ined.--Whitish, covered with slender isidia; on conifer bark. I

have not seen a description of this species (which is "in press"), but the material seems to fit the brief description given to me in a conversation with Brodo.

*Massalongia carnosa (Dickson) Körber--Superficially resembles a Pannaria or Parmeliella, with a grayish-greenish squamulose thallus containing cyanobacteria, and orangish brown apothecia which have a pale proper margin and no thalline margin; on moss; distinguished microscopically by the long, 1-septate spores.

Melanelia fuliginosa (Fr. ex Duby) Essl.--Characterized by the rather dark brown foliose thallus with dense, relatively elongated isidia without soredia, and the C+ red medulla, on bark.

*Melanelia sorediata (Ach.) Goward & Ahti--Differs from the other Melanelia spp. in the area by having having soredia and lacking isidia, and by growing on rock.

Melanelia subaurifera (Nyl.) Essl.--Similar to M. fuliginosa but the isidia are much shorter and frequently break off or become sorediate, so that the thallus appears whitish in spots. On bark.

Menegazzia terebrata (Hoffm.) Massal.--Very similar to forms of Hypogymnia physodes with appressed, rosette-forming hollow thalli, but easily distinguished by the regular rounded perforations which go through the entire thallus and are visible from above. On hardwood trees.

*Micarea melaena (Nyl.) Hedl.--Not distinctive externally. The genus is lecideoid, distinguished mainly by ascus type and other esoteric microscopic characters, including the small (mostly under 9 um diam.) algal cells. The spores are hyaline, simple to several-septate. On wood. The scanty material of this species found in the area has immature spores that are only 1-septate.

*Micarea? "parasitica" Ryan in herb.--Apothecia pale, bluish, appearing to be parasitic on the apothecia of Lecidea "stygiovirida" on rock. The spores are simple.

*Mycoblastus affinis (Schaerer) Schauer--Superficially resembling Lecidea, though with experience usually recongnizable by the relatively large convex and immarginate apothecia; the pale hypothecium and distinctly bluish color of the epihymenium can be seen in vertical sections of the apothecia even under a hand lens. Easily recognized microscopically by the very thick-walled, colorless non-septate spores, which are much larger than those on other lecideoids. On conifer bark or wood.

*Mycoblastus sanguinarius (L.) Norman--Indistinguishable from M. affinis except for having a bright red area under the apothecium, which is easily seen by sectioning, and is often visible where apothecia have fallen off. On conifer bark or wood.

*Nephroma helveticum Ach. ssp. sipeanum (Gyelnik) Goward & Ahti--The genus is easily recognized when fertile by the apothecia being borne on the undersides of reflexed lobe tips. This species is characterized as follows: medulla white; underside without papillae; soredia absent; apothecia common; usually with lobules or teeth on the upper surface especially along the margins; forms with ± smooth surface and margins are difficult to distinguish from N. bellum, which may also be present in the area. On bark.

Nephroma laevigatum Ach.--Easily recognized by the yellow medulla. On bark.

*Nephroma parile (Ach.) Ach.--Characterized by the sorediate margins; the only similar-looking lichen in the area is Peltigera collina, which has a ± veined under surface. On mossy bark, rocks, or soil.

Nephroma resupinatum (L.) Ach.--Larger than N. bellum; lacks teeth and lobules; has whitish papillae on underside (visible at least with lens). On bark.

Ochrolechia--The genus is usually recognizable externally (when fertile) by the Pertusaria-like to Lecanora-like apothecia, with yellowish to pinkish-orangish disks surrounded by a usually well developed

whitish (or sometimes pinkish-orangish) margin, which often curls over the disk at least in young apothecia (making the apothecia appear to open by a pore); most of the species in the Green Mountain area (except O. szatalaënsis) have a C+ red reaction. Microscopically the genus is characterized by simple, hyaline spores and anastomosing paraphyses. The species are often very difficult to distinguish, especially in the field and without spot tests; they are frequently eaten by molluscs or other invertebrates, and the apothecia are often poorly developed or absent. The C tests must be done very carefully, with fresh C; if the reaction seems to be negative, try KC; if still apparently negative, try the reagent(s) on something you know is C+.

*Ochrolechia androgyna (Hoffm.) Arnold--Although sterile, and superficially similar to other corticolous lichens with grayish or whitish thallus and soralia, this one can be identified by the C+ red reaction of the medulla, combined with the thin, smooth aspect of the non-sorediate parts. On bark.

*Ochrolechia juvenalis Brodo--Characterized by the apothecial margin being C- while the discs are C+ red. On bark. Material from this area does not look at all like material in ASU determined as this species by Brodo, but does not key out anywhere else in his monograph, except perhaps O. subathallina, but in most specimens the thallus seems to be too well developed to belong to that species.

*Ochrolechia laevigata (Räsänen) Vers.--Characterized by the grayish or whitish (not at all orangish or pinkish), C+ red apothecial margins, small apothecia, and thin and usually rather smooth and continuous thallus. On bark. Most material from the area seems fairly typical, but some specimens are problematic. Without a C test the species is difficult to distinguish from material from this area that I have identified as O. juvenalis.

Ochrolechia montana Brodo--Apothecial margin at least partly oragnish and pinkish (but only towards the inside in the material from this area that I've tentatively placed here), and the cortex C+ red; apothecia smaller than those of O. oregonensis. Except for the color of the apothecial margin, the material I'm calling O. montana is very similar to O. laevigata. On bark.

*Ochrolechia oregonensis Magnusson--Characterized by the orangish to pinkish, C+ red apothecial margins, relatively large apothecia, and usually thick and warty thallus. The species is restricted to conifers; material of the typical morph, with a thick, uneven thallus and large (2-3 mm or more diameter) apothecia, was found on some Pseudotsuga trees, but much of the material is atypical and difficult to distinguish in the field from other species. Much of the material in this area has rather small apothecia and a rather thin and smoothish thallus, but based on spore size does not fit into O. montana, the species to which it would otherwise key.

*Ochrolechia szatalaënsis Vers.--Similar externally to O. laevigata and O. juvenalis, with small apothecia, whitish apothecial margin, and rather thin thallus; identifiable by the complete lack of any red reaction to C (there may be a C+ yellow reaction). On bark or wood.

*Pannaria praetermissa Nyl. in Chyd. & Furuhj.--Characterized by thallus composed of a mat of small, crowded brownish-grayish squamules than tend to be bluish-whitish tinged towards the tips and appear somewhat like granular isidia or soredia; containing cyanobacteria but not gelatinous. Apothecia usually rare; with thalline margin and simple spores. Can be difficult to distinguish from Massalaongia carnosa when sterile, but that species tends to be more brownish and never bluish-whitish nor isidioid-soredioid. I need to double-check my i.d. of specimens as P. praetermissa.

Pannaria saubinetii (Mont.) Nyl.--Characterized externally by the grayish squamulose thallus containing cyanobacteria, and orangish to brown, soon convex and immarginate apothecia, on bark. The color of the discs and degree of development of the thalline margin of the apothecia are rather variable.

Pannaria "washingtonensis" Ryan in herb.--Superficially similar to Massalongia carnosa but differing in having ellipsoid, simple spores. Because of the warted outer spore wall (epispore) and I+ blue hymenium, the species keys out to P. pezizoides among species reported for North America, but the apothecia are too small and the general appearance is quite different.

Parmelia hygrophila Goward & Ahti--This and the next two species are characterized by the foliose thallus with gray upper side, black, densely rhizinate lower side, moderately wide lobes (ca. 2-4 mm) and upper side with a network of elongate whitish markings especially towards lobe tips. This one is characterized by pale, dull, "soft-looking" granule-like isidia.

Parmelia saxatilis (L.) Ach.--Similar to P. hygrophila but isidia brown-tipped, ± shiny, and "hard-looking".

*Parmelia sulcata Taylor--Characterized by soredia, without isidia.

*Parmeliopsis ambigua (Wulfen in Jacq.) Nyl.--Easily recognized by the greenish yellow, tightly appressed, narrow lobed foliose thallus with soredia towards the center, on bark or wood.

*Parmeliopsis hyperopta (Ach.) Arnold--Indisitnguishable from P. ambigua except for being whitish gray. The only other somewhat similar lichen in this area (other than perhaps Hypogymnia spp. or Cavernularia, which are hollow) is Physcia aipolia, which has tiny whitish spots visible on the upper surface under a lens, lacks soredia, and has apothecia.

Peltigera--This foliose genus is usually easily recognizable by the pattern of ± raised veins on the underside; species without distinct veins can be recognized due to their otherwise very similar appearance to clearly veined species. A few species have a green upper surface (containing green algae); the other are grayish to brownish (containing cyanobacteria). The species are often very difficult to distinguish; it is necessary to have good, large specimens, and to carefully remove the substrate clinging to the underside.

Peltigera brittanica (Gyelnik) Holtan-Hartw. & Tonsb.--This species is easily recognized by the coarse green thallus (much greener when wet) with tiny blackish warts or scales (cephalodia) on the upper surface. It is distinguished from P. leucophlebia the lower surface darkening abruptly inward of the lobe tips and having at most indistinct veins, and the undersides of the apothecia being green-corticate throughout. The cephalodia of P. britannica (not very well developed in material from this area) tend to be peltate (attached mainly in the center, with free margins), eventually enlarging and falling off, leaving whitish scars; this distinguishes the species from the otherwise very similar P. aphthosa, as well as from P. leucophlebia.

Peltigera collina (Ach.) Schrader--When the marginal soralia are well developed this is an easily recognized species, but it is variable; some forms are more broad-lobed than usual. Thallus grayish or brownish, containing cyanobacteria, not green when wet. It seems to be most frequent on mossy tree trunks, where other Peltigera spp. do not occur. Nephroma parile may be similar, but lacks veins on the underside. Occasional forms with apothecia and no soralia can be identified by the black (not red-brown) color of the apothecia.

*Peltigera didactyla (With.) Laundon--In the sorediate stage (the one I found it in during the fall of 1993) this species is easily recognized by the small round patches of soralia occurring on the surface (away from the margins). Howver, the species is supposed to change during its life cycle, losing the soredia and developing apothecia; in that stage it must be compared with other members of the P. canina complex, which also have tomentum on the upper side and raised veins on the lower side; the distinguishing characteristics then are that the thallus consists mostly of fertile lobes, with the apothecia mostly under 5 mm long.

Peltigera horizontalis (Huds.) Baumg.--When fertile the species can be distinguished by the circular, plane apothecia borne horizontally on the lobe edges; when sterile, the species is likely to be confused with P. neopolydactyla, but differs in having the outermost rhizines stout, generally aligned in concentric rows (this is often a very difficult character to use!), narrower lobes, and the shallowly and coarsely pitted (rather than smooth), often somewhat shiny, upper surface. Sterile material can also be confused with P. pacifica if the lobules of that species are few or absent (as in material from this area, which can be recognized because it is fertile, with the apothecia vertically oriented and vertically folded, on the tips of

long, narrow lobes).

Peltigera leucophlebia (Nyl.) Gyelnik--A large green species distinguished from P. britannica by the lower surface darkening only gradually inward of the lobe tips, with a distinct network of veins, the undersides of the apothecia (when present) being patchy-corticate (with areas of whitish medulla visible), and the cephalodia being adpressed, convex and wartlike, never enlarging or detaching.

*Peltigera malacea (Ach.) Funck--Distinguished from other grayish or brownish species by the upper surface turning dark greenish when wet, bearing minute, erect, feltlike hairs, especially near lobe tips (these hairs are often very difficult to detect even under a dissecting scope), lower surface lacking veins or with few and very broad veins, and thick medulla.

*Peltigera membranacea (Ach.) Nyl.--A member of the P. canina complex, characterized by grayish to brownish thallus (containing cyanobacteria, not green when wet, lacking cephalodia), having the upper surface tomentose at least towards the margins (sometimes with only very sparse tomentum), thin, broad lobes, pale, raised veins, and rhizines ± with numerous fine perpendicular branches (appearing somewhat like pipe-cleaner like). If the lobes are rather small, and the tomentum is not seen, the species can be quite similar to P. pacifica.

Peltigera neopolydactyla (Gyelnik) Gyelnik--A member of the very difficult P. polydactyla complex, which is distinguished from other grayish or brownish species by the lacking tomentum on the upper surface (check very carefully with lens). Can be confused with the material identified as P. cf. pacifica, but has broader lobes (to 4 cm wide) with mostly entire and plane margins, and mostly simple (not fasciculate) rhizines. Fertile material is distinguished from P. horizontalis by the saddle-shaped apothecia on loong, narrow lobes; sterile material is distinguished by the somewhat broader lobes, the smooth, dull, occasionally pruinose upper surface, and the broader veins and scattered (not concentrically arranged) rhizines.

*Peltigera pacifica Vitik.--Typically the species is characterized by numerous distinct lobules forming along the margins and stress cracks in the upper surface, but these are few and poorly developed in some of the material from Green Mountain. Such material is distinguishable from P. neopolydactyla by the narrower (rarely over 1 cm wide) lobes with wavy and crisped margins, and by the fasciculate rhizines. Although superficially the material resembles P. rufescens, it completely lacks tomentum on the upper surface.

*Peltigera ponojensis Gyelnik--Similar to P. rufescens in appearance and ecology, but thallus thinner and more fragile, the upper surface epruinose, with the tomentum thinning toward the center, the veins pale, typically strongly raised, cordlike, and "overlapping", and the rhizines scattered, simple, and glabrous.
*Peltigera rufescens (Weis) Humb.--A member of the P. canina complex, but tomentum often sparse or apparently absent. Typical material is characterized by the rather small lobes with upward curled and wavy margins, reddish brown (to grayish) surface that is faintly tomentose (with the tomentum usually extending to the center) but more often (in material from xeric areas) partly obscured by a grayish-whitish ± amorphous material (pruina), veins on the lower side somewhat raised but flattened and not overlapping, and darkening towards the center, and rhizines abundantly branched and patchily anastomosed. It is most characteristic of much more dry and exposed habitats than most other Peltigera species tolerate (except P. ponojensis), and material from moister or more protected habitats is often atypical and somewhat difficult to identify.

*Peltigera venosa (L.) Hoffm.--A very distinctive species, easily recognized by the small, fan shaped green thallus (much greener wet), without cephalodia on the upper surface, and with round blackish apothecia along the margins.

Pertusaria amara (Ach.) Nyl.--Characterized by the relatively large white soralia which are conspicuous against the somewhat darker crustose thallus, and which have a bitter quinine-like taste and unique KC+ fleeting red-violet reaction (picrolichenic acid). Sterile. On bark.

*Pertusaria leucostoma (Bernh.) Massal.--This is a typical Pertusaria, with apothecia opening by a pore (which is very tiny and inconspicuous, in contrast to the gaping one in Thelotrema lepadinum and most Ochrolechia spp.). The pore-like apothecia of some Ochrolechia spp. (e.g., O. juvenalis) have C+ red disks. The spores of Pertusaria spp. are simple, hyaline, very thick-walled, and often very large.

*Pertusaria "mysteria" Ryan in herb.--Thallus grayish, with raised, smoothish, whitish warts (immature apothecia); no hymenium or spores found.

*Pertusaria ophthalmiza (Nyl.) Nyl.--Characterized by the pale, soredia-like roughened apothecia with indistinct and not concentrically grooved margins, on a slightly darker gray thallus, lack of positive reactions to K, C, KC and P. The material is rather variable, and specimens with poorly developed or damaged apothecia are difficult to recognize.

*Pertusaria subambigens Dibben--Somewhat similar to P. ophthalmiza, but usually very distinct because of the concentrically grooved apothecial margin, which is K-, C-, P+ orange-red.

*Pertusaria? "anomala" Ryan ined.--The spores and paraphyses seem to be those of a Pertusaria, but the species does not key out in Dibben's monograph, and the apothecia are very strange, quite unlike those of any member of the genus I am aware of, and barely recognizable as apothecia; they are barely raised, irregular, warty patches that usually have a slightly yellowish-orangish tint; at first glance they appear to be soralia, but there are no soredia, and they have normal hymenia inside.

*Phlyctis agelaea (Ach.) Flotow--Characterized externally by the pale, ± immersed, small and inconspicuous apothecia on a white, K+ red thallus, without soredia. Identified microscopically by the very large muriform spores. There is some possibility that at least some of what I've been calling by this name is P. speirea, a similar but much less known species, but I do not understand the differences well enough to distinguish the two species without seeing comparison material of P. speirea.

*Phlyctis argena (Sprengel) Flotow--Identifiable mainly by the white, papillate-sorediate, K+ yellow then soon red thallus (apothecia rare or absent). When sterile (the usual case), the red color in K is the main thing that allows the species to be distinguished from Loxospora pustulata, which is persistently K+ yellow.

Phylliscum demangeonii (Moug. & Mont. in Mont.) Nyl.--Characterized by the small (to a few mm across) blackish squamules (attached centrally by a short stalk), containing blue-green algae, and tiny immersed fruiting bodies (opening by a tiny pore and just barely visible under a lens), on rock. Not similar to anything else in the area.

Physcia adscendens (Fr.) H. Olivier--Distinguished by the narrow-lobed whitish foliose thallus with conspicuous marginal cilia and with soralia typically bursting from raised, hoodlike structures; very similar to P. tenella (see below).

Physcia aipolia (Ehrh. ex Humb.) Fürnr.--Characterized by the narrow-lobed foliose thallus with the upper side finely white-spotted (lens), lack of soredia and cilia, and frequent apothecia with usually partly bluish pruinose discs.

Physcia tenella (Scop.) DC. in Lam. & DC.--Similar to P. adscendens but thallus more appressed and soralia borne on underside of flat lobe tips, not in hoods.

Pilophorus acicularis (Ach.) Th. Fr.--Easily recognized by the globose black apothecia on the tops of unbranced stalks arising from a crustose thallus on rock.

Pilophorus clavatus Th. Fr.--Similar to P. acicularis but apothecia vertically elongated.

*Placopsis gelida (L.) Lindsay--Easily recognized by the conspicuous pinkish-brown flattened-wartlike structures (cephalodia, containing cyanobacteria) on the grayish, C+ red, ± marginally lobed crustose,

green alga-containing thallus on rock. Material in this area mostly has abundant soralia and no apothecia.

*Placynthiella cf. oligotropha (Laundon) Coppins & P. James--The material is sterile, but the dark, granular thallus with green algae, growing on soil or humus, appears to fit this species.

*Placynthium cf. nigrum (Huds.) Gray--Characterized by a dark, minutely granular-squamulose thallus containing cyanobacteria, surrounded by a conspicuous blue-black prothallus. The material is sterile, and P. nigrum is supposed to occur mainly if not entirely on calcareous rocks, so there is some possibility that this is a Pannaria or Parmeliella, but if so it is undescribed, or at least one not yet reported for North America.

*Platismatia glauca (L.) Culb. & C. Culb.--Characterized by the ± loosely attached, broad-lobed foliose thallus, which is grayish on the upper side and usually mottled dark and white on the lower side, and has soredia and/or isidia (or sometimes minutely fruticose outgrowths) on the margins. Variable; some lobes may be narrow, similar to those of P. herrei.

*Platismatia herrei (Imsh.) Culb. & C. Culb.--Similar to P. glauca but all lobes narrow (under ca. 2-3 mm) and elongated. The frequent presence of apothecia in some populations along road 2600-12 is unusual.

*Platismatia norvegica (Lynge) Culb. & C. Culb.--Similar to P. glauca but with a regular network of sharp, raised, isidia-bearing ridges across the upper surface, which tends to be more greenish. Soredia and marginal isidia are absent.

*Porpidia "pallida" Ryan in herb.--Distinguished by the brownish apothecia (not black like those of all other lecideoids on rock in this area). Except for the correspondingly pale epihymenium, the internal characters of the apothecia seem to fit P. thomsonii (see below), as does the thallus.

*Porpidia thomsonii Gowan--The genus is distinguished by esoteric anatomical features that I'm not always sure I fully understand or recognize (the gelatinous "halo" around the spores is often not very evident, and the ascus type does not seem very distinctive to me). Externally there tends to be a certain gestalt, but I've been fooled by that before. Although some forms of the species can be rusty orange, material from this area has a grayish thallus. Several specimens appear externally similar but have no spores and thus cannot be positively identified with much certainty.

*Pseudocyphellaria anomala Brodo & Ahti--A foliose lichen, usually easily recognizable by the small white spots (pseudocyphellae) and the reticulate pattern of soredia on the brownish upper surface, but some specimens are rather strange looking.

Pseudocyphellaria crocata (L.) Vainio--Easily recognized by the bright yellow pseudocyphellae and soredia.

Psoroma cf. hypnorum (Vahl) Gray--Similar to Pannaria species, but with green algae as the main photobiont. Material from this area is quite atypical, with a grayish thallus, and small apothecia with rather poorly developed thalline margins, but may be only an extreme shade form.

Ramalina farinacea (L.) Ach.--Easily recognized by the flat-lobed, uniformly yellowish-greenish, stiff fruticose thallus with soralia along the margins and occasionally surfaces of the lobes. The stiffness and uniform color distinguish it from Evernia prunastri.

Rhizocarpon--The genus is characterized by black, Lecidea-like apothecia, with usually large, 1-septate to muriform, hyaline to brown spores, surrounded by a gelatinous halo at least when young. Virtually all species are restricted to rock. The yellow species (R. geographicum, R. lecanorinum, and R. macrosporum) are easily recognized in the field as members of Rhizocarpon, because of the bright color of the thallus. The remaining species, with brownish or grayish thalli, can be confused with Lecidea spp., but many are recognizable (under a lens) as Rhizocarpon spp., due to a characteristic but difficult to

describe "look" to the thallus and apothecia. Distinguishing the individual species, especially in the field, is much more difficult.

*Rhizocarpon badioatrum (Flörke ex Sprengel) Th. Fr. s. lato--Not very distinctive externally, except that the thallus is usually more distinctly brown than the "gray" species; characterized by I- medulla and brown, 1-septate spores. The recent monograph provisionally recognizes two taxa ("sp. 1" and "sp. 2") within the broad concept of the species; "sp. 2" has thinner, more scattered, rounded, and convex areoles.

*Rhizocarpon bolanderi (Tuck.) Herre--Superficially resembling a Lecidea, but having brown, muriform spores. Usually recognizable by the thallus: areoles distinctly concave, rather dark red-brown (much darker and browner than other Rhizocarpon spp.), shiny, with blackish margins.

*Rhizocarpon cinereonigrum Vainio--A gray species, probably not distinguishable from the others in the field. Spores 1-septate. Differs from R. polycarpum in that the spores soon darken to brown, and from R. badioatrum in having the epithecium red-brown to dark brown, K+ red, not containing crystals.

*Rhizocarpon eupetraeum (Nyl.) Arnold--Probably not distinctive in the field; differs from the other gray species in the area in having muriform spores, which are dark brown.

*Rhizocarpon geographicum (L.) DC.--Distinguished from other yellow members of the genus in this area mainly by the reddish, K+ red-violet epihymenium, and rather small and few-celled spores. The species is extremely variable, and difficult to characterize by external features.
*Rhizocarpon lecanorinum Anders--Usually easily recognized by the consistently rounded areoles mostly surrounding rounded apothecia giving them the appearance of having pale margins; the color is usually a duller greenish yellow than those of at least the other two yellow species in this area.

*Rhizocarpon macrosporum Räsänen--Distinguished from R. geographicum mainly by the larger, many-celled spores; difficult to characterize externally, but the areoles tend to be larger than those of R. geographicum.

*Rhizocarpon polycarpum (Hepp) Th. Fr.--Another grayish to brown species with 1-septate spores; similar to R. badioatrum but spores pale and medulla I+ violet.

Rinodina spp.--The genus is characterized by the Lecanora-like apothecia with the algae-containing margins usually paler than the dark brown to black disc, but often brownish, greenish, or dark gray, and the brown septate spores with usually unevenly thickened walls. The apothecia are often small and inconspicuous, and easily overlooked; the genus may well be better represented in the area than my few meager collections indicate. The genus can sometimes be distinguished in the field from Lecanora by examining moistened apothecia under a hand lens to see the brown mass of spores (Sheard, pers. comm.). Existing preliminary keys to species on bark or wood in western North America are very difficult to use, partly because many of the species are still undescribed.

*Rinodina conradii Körber--Thallus medium brown, areolate; apothecia under 0.5 mm diam., with dark brown discs and thallus-colored margins. Usually easily recognized microscopicallly by the 3-septate spores, but the spores of the Green Mountain material are rather peculiar (central locules much larger than the apical ones). On bark or wood.

*Rinodina "ignota" Ryan in herb. [plot 6902]--Thallus pale green, ± continuous, smooth, K-. Apothecia under 0.5 mm diam., with dark brown disks and thallus-colored margins; hypothecium hyaline; hymenium ca. 60-65 um, not inspersed; spores 8 per ascus, 15-20 x 7-7.5 um, ellipsoid, sometimes curved, 1-septate, with roundish lumina. On hardwood bark.

*Rinodina "mysteria" Ryan in herb. [plot 6902]--Thallus pale greenish, very thin and patchy, smooth, K-. Apothecia under 0.5 mm diam., with dark brown disks and brown margins. On hardwood bark. Differs from R. "ignota" especially in that the color of the apothecial margin contrasts strongly with the color of the

thallus. Does not key out in Sheard's latest unpublished key to the genus in North America.

*Rinodina "problematica" Ryan in herb. [plot 6905]--Thallus grayish, verrucose-areolate, K-, on black hypothallus. Apothecia to ca. 1 mm diam. (larger than the other species), with dark brown disks and brown margins. On hardwood bark.

*Sphaerophorus globosus (Huds.) Vainio v. gracilis (Müll. Arg.) Zahlbr.--The genus is easily recognized by the combination of having apothecia containing a conspicuous powdery black mass of spores, on a relatively large and richly branched fruticose thallus; even when sterile, the whitish, bluish, or brownish thallus is unlike that of anything else growing on bark in this area. Material with numerous fine branches (and often no apothecia) is typical v. gracilis; they seem to somewhat intergrade with coarser, brownish specimens with apothecia, that approach the typical variety, but the latter is supposed to be a ground-dwelling arctic taxon. Material from moister, more shaded, sites at higher elevations is similar to typical v. gracilis but has a quite different appearance due to its bluish-greenish color.
*Stenocybe major Nyl. ex Körber--The genus is scarcely recognizable in the field, but easily distinguished microscopically from other stalked Caliciales by the at least partly several-septate spores, which are brown. This species is characterized by apothecial stalks 1-2 mm long, and spores 1-3-septate, 18-36 x 7-11 um. On bark.

Stereocaulon alpinum Laurer ex Funck--The genus is very easily recognized by having numerous ± bluish gray granular to scale-like or coral-like structures (phyllocladia) at least partly covering the usually whitish stalks of the fruticose thallus, and growing on soil or rock. However, the species are often very difficult to identify. The pinkish tinge to the tomentum on the undersides of the ± dorsiventral stalks of S. alpinum is fairly characteristic; the phyllocladia are verrucose to crenate-squamulose, and the cephalodia are gray-white and spherical. Growing on soil.

Stereocaulon intermedium (Savicz) Magnusson--Growing directly on rock; phyllocladia partly elongated and coralloid, partly grain-like; cephalodia bluish-gray; pseudopodetia 4-7(-8) cm tall, and (in contrast to the other two species in the area, especially S. sasakii) scarcely or not tomentose. The growth directly on rock helps distinguish the species from S. alpinum.

Stereocualon sasakii Zahlbr. v. tomentosoides Lamb--As in S. alpinum, the pseudopodetia are dorsiventral, with phyllocladia mostly on the upper surface, but the tomentum is thick and floccose rather than thin and adpressed-pubescent; apothecia (when present) are lateral rather than terminal, and smaller (under 1 mm diam.). Growing on soil or directly on rock.

Sticta beauvoisii Delise--The genus is unique among lichens in having cyphellae (distinctly recessed pores) on the underside of the foliose thallus. This species (synonymized by some authors under S. weigelii, but having a brown rather than gray upper surface, among other differences) has marginal isidioid soredia. On mossy bark.

*Sticta fuliginosa (Hoffm.) Ach.--Differs from S. beauvoisii in having isidia (without soredia) distributed over the upper surface (not confined to margins). On mossy bark.

*Thelotrema lepadinum (Ach.) Ach.--This species is unlike anything else on bark or wood in the Pacific Northwest, characterized by the volcano-like apothecia opening by a rather gaping pore, with a distinct double margin (proper margin, without algae, surrounded by but separate from an over-arching thalline margin, with algae). The spores are very large and muriform, and the pale, crustose thallus contains yellowish-orange algae (Trentepohlia).

*Trapeliopsis granulosa (Hoffm.) Lumbsch--Characterized by the ± pale grayish, rather coarsely granular-areolate thallus with greenish soralia, C+ red reaction, and growth on humus or rotting wood; the apothecia (often absent, but sometimes quite abundant) are extremely variable in color (often even on the same thallus), from pinkish-orangish to almost black, and are also C+ red. Microscopically the genus is characterized by the I- asci and simple, colorless spores.

*Tuckermannopsis chlorophylla (Willd. in Humb.) Hale--The genus (formerly treated under Cetraria) is characterized by a greenish to brownish or blackish, loosely attahced foliose to subfruticose thallus with flattened lobes that are frequently curled up at the margins and/or lifted off the substrate (bark or wood). This species, though somewhat variable in color, is easily recognizable by the marginal soralia (which are sometimes rather sparse) and elongated lobes.

*Tuckermannopsis orbata (Nyl.) Lai--This species, like the next two, lacks soralia; it has rather short and small lobes, without isidia (but often with projecting pycnidia mainly along the margins).

*Tuckermannopsis platyphylla (Tuck.) Hale--When well developed, distinguished from T. orbata by the broader lobes with isidia; however, many specimens, including most in this area, are problematic. My impression is that T. platyphylla is more characteristic of higher elevations and T. orbata is more of a lowland species.

Tuckermannopsis subalpina (Imsh.) Kärnef.--Easily distinguished by the elongated lobes, growing on shrubs in the subalpine (the other species of the genus may occur on shrubs at low elevations, but subalpine populations are usually on coniferous trees). This species could be confused with Cetraria islandica and similar species, but they grow directly on soil or moss, and at this latitude are restricted to the alpine zone.

*Umbilicaria cinereorufescens (Schaerer) Frey--The genus is usually easily recognized by the grayish, brownish or blackish, unbranched foliose thallus attached to rock by a single short stalk (umbilicus). This species is characterized by the purplish gray tinge of the smoothish upper surface, and very short and irregular, ball-tipped rhizinomorphs (root-like projections) on the underside. In contrast to U. torrefacta, the trabeculae (flat, plate-like structures) occur mainly around the umbilicus, and apothecia are often absent from the upper surface.

*Umbilicaria deusta (L.) Baumg.--Easily identified under a hand lens by the abundant blackish isidia on the dark brownish upper surface.

*Umbilicaria polyphylla (L.) Baumg.--Characterized by the smooth, blackish upper and lower surfaces, without rhizinomorphs and trabeculae. Although I have not seen it in this area, many specimens in other areas are problematic, with a wrinkled-bumpy upper surface, approaching that of U. hyperborea.

Umbilicaria torrefacta (Lightf.) Schrader--Usually characterized by having trabeculae mixed with rhizinomorphs covering the entire lower surface (however, these structures apparently can sometimes be completely absent in some specimens, at least in British Columbia), and the frequently torn and irregularly perforate margins (which, along with the abundant apothecia on the darker, more distinctly brown upper surface, help distinguish the species from U. cinereorufescens).

Usnea--The genus (at least in temperate to arctic regions) is easily recognized by the central cord (axis) that becomes exposed when the branches of the fruticose thallus are stretched. All the species in this area occur on bark or wood. In western North America most members of the genus are presently impossible to identify to species (or even group) with anything remotely approaching certainty. There are several specimens, from outside of plots, that do not appear to fit well under any of the taxa below.

*Usnea filipendula Stirton s. lato--The U. filipendula complex is characterized by the long, hanging growth form of mature thalli, but I do not see any reliable way to distinguish young thalli from large ones of U. subfloridana s. lato. The U. filipendula group differs most obviously from U. longissima in having a shorter, much-branched beardlike thallus.

Usnea lapponica Vainio s. lato--This collective species is characterized by the short, shrubby thallus, with soralia that lack isidia even when young. One form found at the lower elevations, with the thallus tending to be brownish and the cord orangish, may be a separate species.
Usnea longissima Ach.--This distinctive species (or complex if one recognizes the chemical variants as separate taxa) is easily recognized by the very long (to 2 m or more) hanging thallus with a single, rarely

branched main stem and numerous short perpendicular branchlets (fibrils); the main stem typically has a poorly developed or disappearing cortex, and the central cord is I+ blue-violet.

Usnea "pendula" Ryan in herb.--Superficially similar to U. filipendula s. lato, but with few if any fibrils, and having small, dull whitish "bumps" rather than ± shiny greenish papillae.

*Usnea subfloridana Stirton s. lato--This collective species is similar to the U. lapponica complex but the soralia tend to have at least occasional isidia at least when young. The constricted, blackened base is also supposed to be characteristic. Some specimens are rather large. One morph (L-57 and L-64 in plot 6902) tends to have few or no papillae and apparently no soredia or isidia, and may be a separate species.

Usnea wirthii Clerc--This species, though at first glance similar to the U. subfloridana or U. lapponica groups, is easily identified by the pale yellow color inside the branches. The branching also tends to be more regularly dichotomous.

*Vestergrenopsis isidiata (Degel.) E. Dahl--This species is unlikely to be confused with anything else in the area; the extremely narrow lobed, tightly appressed, olive green thallus with pale longitudinal striations on the lobe tips (lens), with isidia towards the thallus center, are quite distinctive among the lichens in the Green Mountain area (however, the species appears to be very similar to Koerberia sonomensis, which is apparently restricted to lowland coastal areas and has shorter lobes that develop laciniae marginally, and spores that are truly 1-septate [rather than pseudoseptate], when mature).

*Xerotrema megalospora Sherw. & Coppins--Not actually lichenized, but often treated with lichens. Characterized by the erumpent, roundish, brown apothecia without distinct margins, very large muriform spores, growing on wood (similar habitats as Xylographa).

*Xylographa abietina (Pers.) Zahlbr.--The genus is usually easily identified by the ± elongated apothecia on conifer wood (with the long axis along the wood grain). The apothecia are much smaller than those of non-lichenized hysteriaceous fungi, and are ± immersed level with the surface, not projecting. This species is characterized by the more distinctly elongated, mostly pure black apothecia.

*Xylographa hians Tuck.--Similar to X. abietina and perhaps sometimes intergrading with it, but usually differs in having shorter, paler (pinkish or brownish, sometimes mottled), often irregularly shaped apothecia. Some forms of the species (including a paratype in WS) have very distorted apothecia that scarcely resemble those of a typical Xylographa.
*Xylographa vitilago (Ach.) Laundon--Apothecia ± similar to those of X. hians, but usually rare or absent, and then the species is identifiable by the soralia, which also tend to be elongated along the axis of the wood grain.

Sterile crusts--Most of these are impossible to identify, at least at present; I've briefly characterized ones in the lists for the plots, but it is probably futile to attempt a comprehensive catalog of them here. Several of the named species in this list are also usually sterile, but are recognizable mostly by their appearance or chemistry combined with characteristic occurrence in particular habitats; these include: Lecanora flavopunctata, Lecanora impudens, Ochrolechia androgyna, Pertusaria amara, Phlyctis argena, and Xylographa vitilago.