key groups

5. KEY ECOLOGICAL GROUPS

Due to changes in my understanding during-preparation of this report, I have treated ecological groups and functional groups separately; As I am treating them, "ecological groups" are aggregates of species more or less associated with particular substrates and environmental conditions, but not necessarily sharing the same functions, while "functional groups" (treated in detail in the separate section on them) are sets of species, some of which may also be ecological groups, that have certain functions in common.

However, many species are treated under several different groups'of each type, and information on both function and ecology is presented the "Ecological Groups" documents (see below), as it occurred to me, at each level of specificity in the hierarchies. To draw attention to "key" groups (which I interpret to mean groups associated with'or including "major" or "special" ecological or functional categories), I have summarized my conclusions in the tables and in brief summaries below.

A. ECOLOGICAL GROUPS

ORGANIZATION OF TEE INFORMATION; AND GENERAL COMMENTS

Information on known or presumed ecological groups (in the loose sense of species or.communities of lichens. found together on similar substrate types and in one or more localities that are known or inferred to share certain ecological features), is summarized in various tables, which are extracted from a.series of long documents providing various types and levels of detail. This is done in three separate "Ecological Groups" documents, for each main substrate group (I. Corticolous / Lignicolous, II. Terricolous / Muscicolous, and III. Saxicolous). The information is mostly sorted first by habitat (substrate type, then various levels of zones or communities of vascular plants, or special habitats) then by province. Variations on this organization were sometimes used to deal with particular problems or -situations.

Organization within "Ecological Groups" documents: Within each substrate group, general information applicable to the group as a whole; and to taxa or communities that occur over a wide range of major zones, is presented first. Likewise, within each zone and level of community the information is nested, starting with the most general and proceeding towards the most specific. Information on species occurrences in these documents was in turn extracted from the even more specific information on collections at each locality, presented in the document "Collecting Data".

Reasons behind the organization of'the information: Although these methods of organizing and interpreting the information resulted in bulky documents with a fair amount of redundancy, they seemed to be necessary because of the variable and often problematic nature of the information. The purpose was to show the various levels of detail and reliability of the information

key groups

on which generalizations, inferences.. or speculations were based, at each level. .I separated the two sets of documents for each main substrate type from each other because my initial attempts at combining the generalized remarks and information on vascular plant zones and communities with all the detail from collecting data were leading, to even more bulky and complex documents. Also, in the -Ecological Groups documents I wanted to use full sentences, which I did not do in the Collecting Data documents.

Problems in treatment of information from some localities: Due to various difficulties encountered during the process, there are some inconsistencies among the various documents. Because the documents for each substrate type were prepared- separately, and because of the vagueness and ambiguity of both the data and maps, species from the same locality may be treated under different zones, communities, or provinces in different documents;. In some cases my interpretation of the data changed, as I cross-checked among the documents; e.g., in dealing with the saxicolous taxa from a-locality I may have assumed the site was in a grassland, but when I looked at data on corticolous taxa I released it was actually in a forest. . Although this may be cycling reasoning, in some cases the lichen floras themselves influenced my interpretation of the site (e.g., I interpreted site with numerous characteristically alpine terricolous lichen species under the alpine zone, rather than under subalpine, even when some corticolous species were also listed for the site, because collectors often lump collections made on the way up to the alpine zone under the same locality). In the "Ecological Groups" documents, vague or ambiguous data are mostly dealt with in the more generalized parts at the beginning of each level.

Elevations: Some errors or discrepancies in elevations.are also present, due to confusion resulting from constantly switching between meters and feet and between maps with different contour intervals. Although I have not had time to catch and correct all of these problems, I.do not expect them to seriously affect the conclusions.

Since no lists of GIS attributes were sent to me, and most of the data are vague, I have presented whatlimited data are available and made broad-.generalizations based on my.own experience.

KEY ECOLOGICAL GROUPS

Saxicolous lichens in aquatic/se&-aquatic habitats: These include Hvmenelia lacustris, Hvdrothvria venosa and some species of Aspicilia, Dermatocaroon, Staurothele, and Verrucaria. They occur especially in forests or woodlands, and up into the subalpine or alpine zones.

Saxicolous lichens on exposed, weakly to moderately enriched vertical or overhanging cliffs: Acarosoora "chlorophana" is characteristic of this habitat in all zones.

Saxicolous lichens on strongly enriched surfaces

(including some parts of exposed cliffs): Caloplaca saxicola and Xanthoria spp. are usually dominant; Physcia spp., some Lecanora spp., and Rhizoplaca spp. are dominants in somewhat less strongly enriched areas.

Corticolous lichens on enriched bark in dry to moist deciduous woodlands: These are mostly foliose (including Physcia spp., Xanthoria spp.) and crustose (e.g., species of CaloDlaca and' Lecanora).

Corticolous lichens in moist, later stage deciduous woodlands: Large nitrogen-fixing genera such as Lobaria) are especially characteristic in this group.

Terricolous/muscicolous lichens of **grassland-savannah** (steppe and shrub-steppe): These include some species that. are restricted to dry, open habitats at low to moderate elevations (e.g., Acarospora schleicheri, most Psora spp., and vagrant forms of Dermatocarpon spp.), and others that also occur in forests or the alpine zone (e.g., Cladonia chlorophaea group, Diploschistes spp., Megaspora verrucosa, and the nitrogen-fixers Leptochidium albociliatum, Leptogium spp., Peltisera rufescens).

Corticolous/lignicolous lichens of dry coniferous forests: These generally consist of communities of fruticose lichens (dominated by Letharia spp. in the drier or lower zones, and Bvroria spp. in the moister, higher zones, or also Alectoria sarmentosa in the highest forest zones), foliose lichens (dominated by various combinations of species Hypogymnia, Melanelia, Parmelia, Platismatiq, Tuckermannopsis, and Vulpicida, or sometimes also other genera, such as Parmeliopsis spp.), and crustose lichens (various genera, including Hypocenomyce spp. on burnt substrates, and most members of the Caliciales, in later stage, moister communities).

Terricolous/muscicolous lichens of dry coniferous forests: Species of Cladonia or Peltigera generally form dominant communities; various other genera of macrolichens and crustose species also occur.

Saxicolous lichens of **dry** coniferous forests: Umbilicaria species may be among the more characteristic macrolichens on rocks in forests.

Corticolous/lignicolous lichens of subalpine areas: Ahtiana sphaerosporella is characteristic on conifers, although Alectoria sarmentosa and Brvoria spp. are more often the dominant taxa; Tuckermannopsis subalpina is essentially restricted to subalpine shrubs.

Terricolous/muscicolous lichens of alpine areas: At least in the North Cascades, the dominants are often either Lepraria nealecta or Cetraria spp., with various other taxa abundant in a few kinds of communities. Most of the species, except some species of Cladonia and Peltiaera, are restricted to or characteristic of the alpine zone.

k e y groups

.Saxicolous lichens of alpine'areas: Many of the taxa more or less restricted to the alpine zone (e.g., Allantoparmelia, Brodoa, Ophioparma, and Sporastatia, and some.species of Umbilicaria), plus Pseudephebe spp., which are much more abundant in this zone than in lower ones.

Miscellaneous:

Environmental factors

6. KEY ENVIRONMENTAL FACTORS

Information on environmental factors for major or special concern species, and for various levels of ecological groups, is presented in the documents dealing with those topics, respectively. Data on climate and soil-come primarily from cited reports on the vascular vegetation (mainly Franklin & Dyrness, 1973). Information on other factors consists mainly of data from labels, plus my own opinions, as influenced by my experience and reading (mostly not cited, except where it is based on studies in the Columbia Basin region).

I. HIERARCHICAL CATALOGS OF FACTORS: The first three parts of this summary consists of: A. CATALOG OF "ULTIMATE" FACTORS (physical, chemical, or biological variables that directly affect the lichens, but interact with each other in complex-ways, and are sometimes difficult or impossible to observe or measure directly and may have to be inferred). B. CATALOG OF "OBSERVABLE OR MEASURABLE PARAMETERS" (characteristics or processes of the habitat, and influences on these, that affect the lichens more or less indirectly through effects on one or more of the ultimate factors; more specific considerations about of some ultimate factors such as substrate and herbivory are also included). C. CATALOG OF ANTHROPOGENIC AND HUMAN-ASSISTED DISTURBANCE FACTORS (because these relate directly to management options, they are treated separately; human-assisted factors are ones that are caused directly by natural factors also treated under "observable or measurable factors", but can be indirectly influenced by human activities).

Format and conventions for the catalogs: These outlines attempt to include virtually all possible observable or measurable parameters that affect the distribution, abundance, or other conditions of lichens in general, certain ecological or functional groups, or particularspecies. 'Examples or groups of examples of specific factors (even very specific or trivial ones), are separated to indicate that the importance, management options, or other considerations differ considerably.

The factors are arranged in rough order of probable importance in the Columbia Basin, within each level of the hierarchy, although many factors are essentially equivalent in importance. "Key" factors, namely those most likely to be especially important in the region, are indicated by asterisks (*), on a crude scale of *** (very important, or moderately important but for many or all lichens, regardless of their ecology), ** (moderately important, or important at least for some ecological groups) * (important mainly for certain taxa or in certain situations). A question mark after the item or the asterisks indicates insufficient information from which to determine probable importance. Factors that are presumed to be rare or trivial, at least in the Columbia Basin, are not starred

Environmental factors

(nuclear war, impacts of celestial bodies, and similar effects are scarcely to be mentioned; although hardly trivial, hopefully they are extremely rare, or none of this will matter!)

II. MATRICES. The second part consists of tables showing relationships between factors and particular groups of lichens.

III.-- MODELS: The third part consists of diagrams that hypothesize interactions and causal relationshipsbetween the factors and the lichens.

Environmental factors

A. CATALOG OF "ULTIMATE" FACTORS

Virtually all of these (except external source of photobiont, for some groups) are critical to all functional groups and special habitat/special concern taxa.

1. PHYSICAL FACTORS (partly modifiable by physical, biogenic, or anthropogenic factors)*** 'The effects of these are often difficult to distinguish from each other. The amount of light affects the amount of heat, which in turn affects the amount of water, and because conditions that affect these variables can also affect air (wind), which in turn affects water and sometimes heat. In addition, the effects on lichens depend on the timing of combinations of the factors '(e.g., to be physiologically active, the lichens need to have sufficient amounts of both light and available water at the same time, which may occur infrequently because increased light means increased heat, which may directly interfere with photosynthesis, but decreases water availability or retention, except when it melts snow or ice).

a. Light***

1) Availability and quantity of input actually reaching the lichen (presence or absence; total and average amount; seasonal fluctuations, including the effects of precipitation; leaf loss, litterfall, etc. and diurnal variations, including day length, and timing of input as affected by slope, aspect, or impediments to light)***

2) Quality of input (wavelengths directly or indirectly absorbable and useable for photosynthesis or other processes; harmful wavelengths, i.e., UV, due to destruction of the ozone layer)***?,

b. Heat***

1) Quantity of input (average amount; extremes that may be either harmful or beneficial to the lichens; seasonal and diurnal factors, including'those affected by factors that affect light; global warming)***

2) Quantity of heat loss (same parameters as for input, except that global cooling,.which will probably occur at least eventually, in the next ice age, not to mention as the sun finally burns out)***

c. Water-(physical properties)+**-

1) Input available for survival and metabolism and in states useable by the particular kind of lichen '(usually either liquid, vapor, or both, rather than direct input of solid snow or ice)***

2) Water loss through evaporation***

3) Blockage of exchanges of air, heat, light, or nutrients, by precipitation or accumulations of water (liquid or frozen)***

4) Mechanical effects (abrasion or removal of lichens or

substrate) by moving water or snow (or materials carried by them)***

d. Air (direct effects of wind on fragmentation'and dispersal; 'interactions with other physical factors, and with chemical/nutrient factors)***

e. Substrate (presence, absence, or quantity of materials that are required or preferred (or at least tolerated) due to their chemical/nutrient, features and/or their properties with regard to other physical factors)***

2. CHEMICAL FACTORS (partly modifiable by physical, biogenic, or anthropogenic sources)***

a. Oxygen***
b. Carbon dioxide***
c. Nitrogen*** (must be available'to all lichens, whether it needs to be fixed or not)
d. Other major elements or substances required for metabolism***
e. Trace elements***
f. Other necessary substances (e.g., 'vitamins or other'organic compounds)***?,
g. Toxins***
h. Carbon (other than directly from carbon dioxide absorbed by, the photobiont)*?
i. (calcium, copper, iron, magnesium, or other metals, in more than trace amounts)*?
j. Nuclear radiation*? (damage to'cells or hyphae; mutagenesis; likely to be important only in some localities; unless there's a nuclear war or major meltdown)

3. DISPERSAL-RELATED FACTORS***, and SYMBIOSIS-RELATED FACTORS** (both kinds modifiable by physical, biogenic, or anthropogenic factors)

a. Availability of agents aiding in dispersal (factors such as wind, liquid or frozen water, or animals or humans, any *of* which can promote fragmentation or actual-dispersal)***
b. Availability of photobionts from external sources (free-living, or from other lichens)** (note: in Endocarpon and Staurothele, photobionts are dispersed with the spores;. lichens rarely or never producing spores, at, least viable ones, are exempt from the need for externalsources of photiobiont, and "allied fungi", other than parasymbionts, do not require a:. photobiont)

4. DIRECT DAMAGE, DESTRUCTION, CR REMOVAL OF 'LICHENS OR THEIR SUBSTRATES (DUE TO PHYSICAL, BIOGENIC, OR ANTEROPOGENIC CAUSES) ***

Environmental factors

Environmental factors

B. CATALOG OF 'OBSERVABLE OR MEASURABLE PARAMETERS"

At least the higher level categories in the hierarchy, where the number or letter is not followed by a parenthesis affect all functional groups and special habitat/concern taxa.

1. SUBSTRATE TYPE***
   a. General***'
      1). Texture**
      2). Surface features**
      3). Chemistry/nutrition content**
      4). Stability**
      5). Consistency (moisture retention qualities)**
      6). Color (light/heat reflection/absorption properties)*
   b. Bark and wood**
      1). General type (gymnosperm vs. angiosperm, tree or shrub, deciduous vs. evergreen, bark or wood, more acidic vs. less acidic bark)**
      2). More specific type or characteristics*
      3). Condition or state of decomposition**
      4). Burned* vs. unburned**
   c. Soil, moss, etc.**
      1). General type (soil; moss, humus, etc.)**
      2). Soil characteristics (chemistry, particle size, degree of consolidation, etc.)*
      3). Species, or general type or characteristics, of bryophytes** (or spike moss)
      4). Characteristics of humus** or dung
      5). Location (over rocks, over plants, or directly on the ground)*.
   d. Rock, etc.**
      1). Chemical composition (siliceous** vs. calcareous* or ultramafic* or other special types*)
      2). General type (volcanic, metamorphic, or sedimentary)**
      3). Type of formation (cliffs, outcrops, boulders, pebbles/gravel)*
      4). Size*
      5). Specific type or specific physical or chemical characteristics*
      6)s Stage of weathering**

2. OVERALL CLIMATIC CONDITIONS***
   a. Precipitation (amounts, timing, nature, and other non-chemical properties)***
      1). Average annual**
      2). Average. summer**
      3). Minimum summer***
      4). Average winter**

5). Maximum winter*?
6). Rain* (timing, frequency, and amount of falling**; intensity'or other characteristics*?)
7). Fog/clouds*?
8). Dew*?
9). Frost?
10). Snow (timing, frequency, and amount of falling, location and depths of accumulation, timing and amount of melting)**

b. Temperature***
1). Average annual**
'2). Average summer**
3). Maximum summer**
4). Average winter**
5). Minimum winter**
6). Diurnal maxima** or minima**

c. Wind (speed, timing, frequency, direction, etc.)**?

3. TOPOGRAPHICAL/PHYSICAL FEATURES'OF THE SITE**
a. General type of landform(s) (mountain, hill, butte, plateau, basin, valley, canyon, plain, variations on these, or mixtures)**
b. Overall slope**
c. Overall aspect**
d. Overall relation to more or less major bodies of water**
e. Overall relation to moisture/precipitation movement (rainshadow effect; channels and directions for movement of moist air)**
f. Overall relation to airflow**
g. Overall dustiness*?
h. Sources of physical destruction or removal (avalanches, rockslides, rock falls, mudflows, volcanic eruptions, strong winds or flooding)***

4. BIOLOGICAL FEATURES OF THE SITE**
a. Vascular plant vegetation** (this partly'has to do with substrate, for some groups, but also reflects other factors)
1). General type (forest/woodland, shrubs, steppe-meadow, or little or none)**
2). Deciduous, evergreen, or mixed**
3). Gymnosperm vs. Angiosperm**
4). Zone, association or community**
5). Spacing/density**
6). Canopy structure*
7). Local distribution
8). Successional stage (including disturbance history)
9). Specific species composition (other than dominants)*

b. Non-vascular vegetation other than lichens
1). Bryophytes**

Environmental factors

2). Algae or cyanobacteria (especially ones that can be photobionts)**
3). Fungi or microbes (at least ones that damage or decompose lichens)***

c. Animal life (presence, kinds, abundance, local distribution, ecology,, and behavior)**
1). Sourdes of manuring (dung, urine, or other excretions from vertebrates or invertebrates)**
2). Sources of grazing or trampling by larger vertebrates)**
3). Herbivory by invertebrates or other small animals***?

5. MICROHABITAT***
a. Relation to topographical/physical or biological features of the site***
1). Relation to landform (top, sides, bottom, or beneath)**
2). Local slope**
3). 'Local aspect**
4). Proximity to bodies of water**
5). Relation to other topographical/physical features**
6). Position relative to vascular plants (away from, adjacent to, partly under, completely under,' on the surface of)**
7). Exposure to litterfall**
a). Quantity**
b). Persistence (removal by fire, wind, water, biogenic, or anthropogenic factors)
c.) Decomposition (rates, processes, timing, etc.)
d). Timing**?
e). General type (branches; needles or leaves)*?
f). Specific type (plant genus or species)*?

b. Overall structure of the substrate***
1). Factors applicable to corticolous or lignicolous lichens**
a). Canopy structure**.
b). Trunk size/age**
c). Position of branches/twigs (high, low, etc.)**
d). Size/age of branches/twigs**
2). Factors applicable to terricolous, muscicolous, or saxicolous lichens**
a). Position relative to top and bottom*?

c. Substrate surface***
1). Slope**
2). Aspect**
3). Microtopography**
4). Other?

6. NATURAL DISTURBANCE FACTORS***

Environmental factors

All of the following can affect lichens directly or indirectly; severe effects on lichens as a whole (***) are likely only if the disturbances are major, frequent, or prolonged.

- **A. PHYSICAL FACTORS*****
  - **1. Fire*****
  - **2. Drought*****
  - **3. Flooding*****
  - **4. Freezing***?.**
  - **5. Abrasion or burying (avalanches, rockslides, mudflows, rock falls, and volcanic eruptions)*****
  - **5. Blowing (windstorms)****
- **D. BIOLOGICAL FACTORS****
  - **1. Herbivory by vertebrate wildlife****
  - **2. Trampling by vertebrate wildlife****
  - **3. Herbivory by invertebrates**?**
  - **4. Infection by pathogens*****

Environmental factors

C. CATALOG OF ANTHROPOGENIC OR HUMAN-ASSISTED DISTURBANCE FACTORS

Unless specified otherwise, all of these factors can be deliberate or unintentional, complete or partial, and direct or, indirect.' Most of the effects are detrimental to lichens at least in the short term, although some effects may be beneficial in the long term for some species or groups; Severe effects on all lichens (***) 'are only if the destruction or alteration is major, frequent, or prolonged

1. Direct physical destruction or alteration of'habitat by human activites***

A) . Construction/paving***
rural***
buildings*&*
roads***
urban**
industrial**
water related (see further breakdown below)**

B). Modification of topography, microtopography, or substrate availability (by removal, addition, or other movement of rock, soil, debris, etc., during other activities)***
1) construction or paving***,
2) logging**
3) conversion of land for agricultural uses**
4) mining**
5) other activities (e.g., rock-collecting, soil-sampling, etc.)

B). Flooding (damming and creation of reservoirs)***

C). Bombing, missile testing, etc.**

D). Miscellaneous (airplane or helicopter crashes, etc.)**

2. Alteration of habitat, and direct or indirect effects on lichens, due to introduction, modification, destruction, 'or removal of organisms, including lichens, by human or human-facilitated physical factors***

A). Fire (controlled; accidental; arson; indirectly assisted or inhibited by other activities or processes)***
1) forest fires***
2) steppe or shrub-steppe fires***
3) other***

B). Human-assisted physical factors affecting habitat or organisms (including lichens)***
1) drought***
2) flooding or oversaturation with rain***
3) freezing***
4) windfall of trees**

C). Deliberate removal of plants or parts of them by humans***
1) Logging or clearing***

Environmental factors

2) Mowing**
3) Thinning or weeding**
4) Collecting of plants other than lichens**
5) Harvesting or collecting of lichens (with or without their substrate)***
6) Pruning; picking of flowers, fruits or seeds*?

D). Trampling/crushing of plants or lichens by humans or vehicles**
1). Vehicles (cars, trucks, etc.; agricultural equipment; motorbikes; bicycles)**
2). Humans (campers; hikers, joggers, etc.; agricultural or other workers; collectors or researchers)**

F). Direct, human-caused or facilitated effects on availability of space or substrate, or other alterations of habitat because of introduced plants (introduced deliberately, accidentally, or as a result of other actions)**
1). Forest Trees**
-2). Agricultural (or horticultural) crops (trees, shrubs, herbs, or grass)**
3). Aquatic weeds**
4). Bryophytes (substrates, competitors, or microhabitat modifiers)**
5). Algae or cyanobacteria (photobionts, competitors, or microhabitat modifiers)***
6). Non-lichenized fungi (pathogens, saprophytes on plants**; mycorrhizae**; parasites or parasymbionts on lichens***; some species traditionally included with "lichens" are actually non-lichenized)
6). Lichens (competitors, microhabitat modifiers, substrates, epiphytes)***

G). Direct, human-caused or -facilitated effects of deliberate or accidental introduction of animals, producing direct or indirect effects on other factors***
1) grazing or trampling of plants by livestock** or pack animals*?
3) herbivory or-other use by introduced. wildlife**?
4) herbivory by stocked fish**?
5) herbivory'by invertebrates**
6) herbivory or trampling by pets

H) Indirect effects on habitat. due to various factors
1) replacement of native vegetation by alien or weedy plants, or other alterations in composition of plant communities, due indirectly to other activities or proceses (e.g., introduction or removal of herbivores)**

Environmental factors

1). Annual grasses**
2). Other?

2) modification of physical conditions (light, temperature, precipitation; flowing or standing water, snow accumulation, snowmelt, wind, and evaporation)***

3) erosion, accumulation, or modification of quantity or composition of soil or humus**

4) covering of lichens or their substrates by plant debris, gravel, sand, soil, mud, silt, or dust***

5) modification of 'non-chemical aspects of water (increases or decreases in levels and flow rates, turbidity, etc.)**,

4. Direct modification (increase, decrease, or other changes) of water parameters or quality (other than chemical pollution or eutrophication)**

A) Location, amount, frequency, timing, or speed of water inputs. (draining or removal of water; damming; diversion or channeling; construction of canals or ponds; irrigating)**'

B) Direct inputs of sediment**

C) Direct thermal pollution**

D) Freezing*?

5. Direct modification (increase, decrease, or other changes) of light and heat, wind, precipitation, or evaporation**

A) complete or partial alteration '(removal, introduction, or movement) of major landforms, rock formations, or vegetation***

B) urban or industrial development***.

C) placement or removal of shelter (walls*; fences*; tarps, screens, or roofs)

2. Pollution (other than eutrophication/alkalinization), affecting substrate, precipitation, or organisms (including direct and indirect effects on lichens)***? (uncertainties are due to my lack of knowledge about the extent and severity of the pollution'in eastern WA/OR, and about the sensitivities of most crustose lichens and some macrolichens

A). Air pollution. (sulfur dioxide**?; oxidants (ozone, nitrous oxides, etc.)**?; fluoride**?;.heavy metals?; etc.)

B). Acid (or other?) pollution of precipitation**?

C). Water.pollution (excluding pollution of precipitation)**

D). Water acidification (other than acid precipitation)**

E). Agricultural or horticultural chemicals, herbicides, fungicides, or other pesticides)**?

F). Industrial or household chemicals**?

G). Runoff from paved areas or buildings**?

H). Heaters for fruit orchards?

Environmental factors

3. **Eutrophication/alkalinization*****
   A). Manuring from livestock **(direct**?, or indirect**?) pack animals*?, introduced wildlife*?, or pets?)**
   B). Direct application of agricultural or horticultural 'fertilizers&*? or dust from them?**
   C). Alkaline dust from mining or construction?**
   D). Human‘excretions or'urine (indirect*?, or direct?)

4. Nuclear radiation? This could be a problem arount nuclear facilities, such as that around Hanford, WA.**

5. Miscellaneous*?**
   A). Dust from vehicles**?,** livestock**?, **humans**?, or other animals*?**
   B). Dumping/littering (especially in excessive amounts)**?**
   C). Inadverntant destruction for art (e.g., petroglyphs) or vandalism (e.g., graffiti)*?
   D). Deliberate mechanical or chemical destruction and removal of lichens (ones that cause deterioration or perceived disfiguration of natural or artificial substrates)*?

Environmental factors

MATRICES

There are many difficulties inpreparing these, and I am not very satisfied with the results. The main difficulties, are the lack of information, and the problems of presenting complex and variable things with limited space and only a few symbols. The broad ecological and functional groups mostly consist of quite diverse species each of which have different requirements, sensitivities, etc. The matrices for the individual species are somewhat better, but again there are problems (especially where I have treated entire genera rather than particular species). As elsewhere in this report, there is a lot of inference and speculation involved.

Environmental factors

Table 1. Habitat factors (other than disturbance) affecting major ecological groups of lichens, and special habitats groups (indicated by *). + = high amount of the factor is beneficial; - = low amount of the factor is beneficial.

LICHEN GROUP	HABITAT FACTOR								
	Substr. Avail.	Sun-light	Heat	Rain	Dew/ mist	Snow	Wind	Dust	N
CORTICOLOUS in general	++	+/-	+/-	+/-	++	+/-	+/-	+/-	+/-
Corticolous old-growth*	++	+/-	+/-	++/-	+	?	+/-	-	-
Corticolous woodland	++	+/-	+/-	++	+	-?	+/-	+/-	+/-
Corticolous subalpine	++	+/-	-	++	+	+/-	+/-	+/-	?
Corticolous dry conifer	++	+/-	+/-	+/-	++	+/-	+/-	+/-	?
Corticolous shrub-steppe	++	+/-	-	+	++	+/-	+/-	+	+
TERRICOLOUS in general	++	+/-	-	+/-	++	+/-	+/-	-	+/-
Terricolous bunchgrass*	++	+/--	-	+/-	++	+/-	+/-	-	+/-
Terricolous shrub-steppe*	++	+/--	-	+/-	++	+/-	+/-	-	+/-
Terricolous old-growth*	++	+/--	-	+	+	?	+/-	-	-
Terricolous alpine	++	+/-	+/-	+	++	+/-	+?	-	?
SAXICOLOUS in general	++	+/--	+/--	+/-	++	+/-	+/-	-	+/-
Saxicolous aquatic*	++	+/--	-	+/-	?	?	?	-	-
Saxicolous alpine	++	+	+	+	++	+/-	+	-	+/-

Environmental factors

Environmental factors

Table 2. Habitat factors (other than disturbance) affecting major functional groups of lichens. + = high amount of the factor is beneficial; - = low amount of the factor is beneficial.

LICHEN GROUP	HABITAT FACTOR								
	Substr. Avail.	Sun-light	Heat	Rain	Dew/ mist	Snow	Wind	Dust	N
Interceptors	++	+/-	-	+	++	+/-	+/-	-	+/-
N-fixers	++	+/--	-	+	++	+/-	+/-	-	-
Caribou food	++	+/-	-	+	++	+/-	+/-	-	+/-
Squirrel nest	++	+/-	-	+	++	+/-	+/-	-	+/-
Other organism nutrient/habitat	++	+/-	+/-	+/-	++	+/-	+/-	+/-	+/-
Soil enhancers	++	+/--	+/--	+	++	+/-	+/-	-	+/-
Inhibitors	++	+/-	+/-	+	++	+/-	+/-	-	+/-
Rock weatherers	++	+/-	+/-	+/-	++	+/-	+/-	+/-	++/-
Human benefitters	++	+/-	+/-	+/-	++	+/-	+/-	+/-	+/-

Environmental factors

Table 3. Habitat factors (other than disturbance) affecting particular major corticolous/lignicolous species of lichens (* = also of special concern). + = high amount of the factor is beneficial; – = low amount of the factor is beneficial.

LICHEN GROUP	HABITAT FACTOR								
	Substr. Avail.	Sun-light	Heat	Rain	Dew/ mist	Snow	Wind	Dust	N
Alectoria sarmentosa*	++	+/--		++	++	++/-	+/-	-	+
Brvoria abbreviata	++	++/-	+/-	+	++	+/-	+/-	+/-	+
Brvoria fremontii*	++	+/--		++	++	++/-	+/-	-	+
Candelaria concolor	++	++/-	+/-	+	++	+/-	+/-	+	++
Hypocenomyce spp.	++	+/--	+/-	+ +	++	+/-	+/-	?	+
Hypogymnia imshauaii	++	+/-	+/-	+/-	++	+/-	+/-	+/-	+
Letharia spp.	++	++/-	+/---	+/--	++	+/-	+/-	+/-	+
Melanelia elesantula	+ +	++/-	+/-	+/-	++	+/-	+/-	+/-	+
Melanelia subolivacea s.l.	++	++/-	++/-	+/-	++	+/-	+/-	+/-	+
Parmelia spp.	++	+/-	+/-	+ +	++	+/-	+/-	+/-	+
Parmelioosis spp.	++	+/-	+/-.	+/-	++	+/-	+/-	+/-	+
Phvscia spp.	++	+/-	+/-	+/-	++	+/-	+/-	+/-	++
Platismatia slauca	++	+/--	+/--	++/-	++	+/-	+/-	-	+
Tuckermannoosis merrillii	++	++/-	+/-	+/--	++	+/-	+/-	+/-	+
Tuckermannopsis platyphylla	+ +	+/--	+/--	+/-	++	+/-	+/-	+/-	+
Vuloicida canadensis	++	++/-	+/--	+/--	++	++/-	+/-	+/-	+
Xanthoria spp.	++	++/-	+/-	+/-	++	+/-	'+/-	+/-	

	Environmental factors								
	+++								
Xyloqrapha spp.	++	+/-	--	++	++	+/-	+	-	+

Environmental factors

Table 4. Habitat factors (other than disturbance) affecting particular major terricolous/muscicolous species of lichens (* = also of special concern). + = high amount of the factor is beneficial; - = low amount of the factor is beneficial.

LICHEN GROUP	HABITAT FACTOR								
	Substr. Avail.	Sun-light	Heat	Rain	Dew/ mist	Snow	Wind	Dust	N
Caloolaca spp.	++	++/-	+/-	+/-	++	+/-	+	+/-	++
Cetraria islandica	++	++/-		+/-	++	++/-	+		+
Cladonia pyxidata	++	++/-	+/-	+/-	++	+/-	+	+/-	+
Cladonia spp.	++	+/--	+/-	+/-	++	+/-	+		+
Diploschistes spp.	++	+/-	+/-	+/-	++	+/-	+	+/-	+
Leoraria neslecta s.l.	++	+/-	+/-	+/-	++	+/-	+	+/-	+
Leoraria spp.	++	+/--		+/--	++	+/-	+	--	+
Leptochidium albociliatum*	++	+/-	+/-	+/-	++	+/-	+	+/-	-
Leptosium lichenoides s.l.*	++	+/-	+/-	+/-	++	+/-	+	+/-	-
Megaspora verrucosa	++	+/-	+/-	+/-	++	+/-	+	+/-	+
Ochrolechia unsaliensis	++	+/-	+/-	+/-	++	+/-	+	+/-	+
Peltisera aphthosa s.l.*	++	+/--		++	++	+/-	+/-		
Peltigera canina s.l.*	++	+/-	+/-	+/-	++	+/-	+/-	+/-	-
Peltisera venosa*	++	+/--		++/-	++	+/-	+/-		
Peltisera spp.*	++	+/--		++/-	++	+/-	+/-	--	-
Phvsconia spp.	++	+/-	+/-	+/-	++	+/-	+/-	+/-	+
Psora spp.	++	++/-	+/-	+/-	++	+/-	+	+/-	+

	Environmental factors								
Solorina crocea*	++	+/-	++/-	++	++/-	+	-	-	
Trapeliopsis granulosa	++	+/-	++/-	++	++/-	+	-	+	

Environmental factors

Table 5. Habitat factors (other than disturbance) affecting particular major saxicolous species of lichens (* = also of special concern). + = high amount of the factor is beneficial; − = low amount of the factor is beneficial.

LICHEN GROUP	HABITAT FACTOR								
	Substr. Avail.	Sun-light	Heat	Rain	Dew/ mist	Snow	Wind	Dust	N
Acarosoora "chlorophana"	++	+/-	+/−	--	++	+/−	+	+/−	+
Aspicilia spp.	++	+/-	+/−	+/−	++	+/−	+	+/−	+
Caloolaca saxicola +++	++	+/-	+/−	+/−	++	+/−	+	+/-	
Candelariella spp.	++	+/-	+/−	+/−	++	+/−	+	++/-	++
Dermatocarpon miniatum s.l.	++	+/--	+/−	+	++	+/−	+	+/−	+
Lecanora muralis	++	+/-	+/−	+/−	++	+/−	+	+/−	++
Lecanora phaedroohthalma	++	+ / -	+/−	+/−	++	+/−	+	+/−	++
Lecanora rupicola	++	+/-	+/−	+/−	++	+/−	+	?	+
Lecidea "atrobrunnea"	++	+/-	+/−	+/−	++	+/−	+	+/−	+
Lecidea tessellata	++	++/-	++/−	+/−−	++	+/−	+	+/−	+
Neofuscelia spp.	+ +	++/-	++/−	+/−−	++	+/−	+	+/−	+
Parmelia spp.	++	+/--	+/−	+/−	++	+/−	+/−	+/−	+
Phvscia spp.	++	+/-	+/−	+/-	+ +	+	+	+/−	+-
Pseudeohebe spp.	++	+/-		+/−	++	++/-	+	+/−	+
Rhizocarpon spp.	++	+/-	+/−	+/−	++	++/−	+	+/−	+
Rhizoplaca spp.	++	+/-	+/−	+/−	++	+/−	+	+-	+-
Staurothele spp.	++	+/-	+/-	++/-	++	++/-	+	+/−	+
Umbilicaria spp.	++	+/-	+/−-	+/−	++	+/−	+/−	+/−	+

	Environmental factors									
Xanthoparmelia spp.	++	++/-	++/-	+/--	++	+/--	+/-	+/-	+	
Xanthoria spp.	+ + +++	++/-	+/-	+/-	++	+/-	+	+/-		

Rare

Environmental factors

Table 6. Habitat factors (other than disturbance) affecting particular rare or uncommon species of special concern). + = high amount of the factor is beneficial; - = low amount of the factor is beneficial.

LICHEN GROUP	HABITAT FACTOR								
	Substr. Avail.	Sun-light	Heat	Rain	Dew/ mist	Snow	Wind	Dust	N
Aspicilia spp. (fruticose)	++	++/-	+/-	+	++	+/-	+/-	+/-	+
Bryoria friabilis	++	+/--	-	+	++	+/-	+/-	-?	+
Bryoria tortuosa	++	+/--	-	+	++	+/-	+/-	-?	+
Collema spp.									
on soil	++	+/--	+/-	+/-	++	+/-	+/-	?	-
on bark	++	+/--	-	+	++	+/-	+/-	-?	-
Dactylina arctica	++	+	-	+/-	++	++/-	+/-	?	+
Endocarpon ssp.	++	+/--	+/-	+/-	++	+/-	+/-	?	+
Haematomma sp.	++	+/--	+/-	+	++	+/-	+/-	?	+
Hydrothyria venosa	++	+/--	-	++/-	?	+/-	?	-	-
Hymenelia lacustris	++	+/--	-	++/-	?	+/-	?	-	+
Lecanora laatokkaensis	++	+/-	+/-	+	++	+/-	+/-	+/-	+
Leptogium spp.	++	+/--	+/-	+/-	++	+/-	+/-	+/-	-
Lobaria spp.	++	+/--	-	++	++	+/-	+/-	-	-
Nephroma spp.	++	+/--	-	++	++	+/-	+/-	-	-
Pannaria spp.	++	+/--	-	++	++	+/-	+/-	-	-
Pseudocyphellaria anthraspis	++	+/--	-	++	++	+/-	+/-	-	-
Rinodina sp. nov.	++	+/--	-	+/-	++	+/-	+/-	-	+
Texasporium sancti-jacobi	++	+/-	+/-	+/-	++	+/-	+/-	+/-	+
Thelomma									

	Environmental factors								
~~occidentale~~	++	+/-	+/-	+/-	++	+/-	+/-	+/-	+
Other Caliciales	++	+/--	-	+/--	++	+/-	+/-	+/-	+

Sensitivity — To groups

Environmental factors

Table 7. Sensitivity of major ecological groups of lichens, and special habitats groups (indicated by *), to various kinds of disturbance. S = sensitive, I = intermediate, T = tolerant, - = not applicable, ? = uncertain.

LICHEN GROUP	DISTURBANCE				
	Air/water pollut.	Agric. chem.	Logging/ clearing	Grazing/ trampling	Fire
CORTICOLOUS in general	S to T	S to -	S	-	S
Corticolous old-growth*	S	S to -	S	-	S
Corticolous woodland	S to I	S to -	S	-	S
Corticolous subalpine	?	-?	S	-	S to -
Corticolous dry conifer	S to T	S to -	S	-	S
Corticolous shrub-steppe	S to T	S to T	S to -	-	S
TERRICOLOUS in general	I to T	S to I	S to -	S	S to -
Terricolous bunchgrass*	I to T	S to I	- to I	S	S to -
Terricolous shrub-steppe*	I to T	S to I	- to I	S	S to -
Terricolous old-growth*	S to I	S to -	S	S	S to I
Terricolous alpine	S to T	-	-	S	- to I
SAXICOLOUS in general	T to S (air)	S to T	S to -	- to I	S to -
Saxicolous aquatic*	S to I (water)	S to I	S to -	- to I	- to I
Saxicolous alpine	S to T	-	-	- to I	- to I

Environmental factors

Environmental factors

Table 8 Sensitivity of major functional groups of lichens to various kinds of disturbance. S = sensitive, I = intermediate, T = tolerant, – = not applicable, ? = uncertain.

LICHEN GROUP	DISTURBANCE				
	Air/water pollut.	Agric. chem.	Logging/ clearing	Grazing/ trampling	Fire
Interceptors	S - I	?	S		s to –
N-fixers	S	s to 'I	S	s to –	s to –
Caribou food	S	?	S		s
Squirrel nest	s to I	?	S		S
Other organism nutrient/habitat	S to T	S to T	s to –	s to –	s to –
Soil enhancers	I to T	s to I	s to –	S	S to –
Inhibitors	I to T	s to I	s to –	S	s to –
Rock weatherers	T to I	T to I	s to –	I to –	s to –
Human benefitters	S to T	S to T	s to –	s to –	s to –

Environmental factors

Table 9. Sensitivity of major corticolous/lignicolous species of lichens (* = also of special concern) to various kinds of disturbance. S = sensitive, I = intermediate, T = tolerant, - = not applicable, ? = uncertain.

LICHEN GROUP	DISTURBANCE				
	Air/water pollut.	Agric. chem.	Logging/ clearing	Grazing/ trampling	Fire
Alectoria sarmentosa*	S	?	S	-	S
Bryoria abbreviata	S	?	S	-	S
Bryoria fremontii*	S	?	S	-	S
Candelaria concolor	?	?	S to -	-	S
Hypogymnia imshaugii	I	?	S to -	-	S
Letharia spp.	T to I	?	S to -	-	S
Melanelia elegantula	I?	?	S to -	-	S
Melanelia subolivacea s.l.	I	?	S to -	-	S
Parmelia spp.	I?	?	S to -	-	S
Parmeliopsis spp.	?	?	S to -	-	S
Physcia spp.	I?	?	S to -	-	S
Platismatia glauca	I?	?	S	-	S
Tuckermannopsis merrillii	S	?	S	-	S
Tuckermannopsis platyphylla	S?	?	S	-	S
Vulpicida canadensis	?	?	S	-	S

	Environmental factors			
Xanthoria spp.	?	?	S to –	– S

Table 10. Sensitivity of major terricolous/muscicolous species of lichens (* = also of special concern) to various kinds of disturbance. S = sensitive, I = intermediate, T = tolerant, - = not applicable, ? = uncertain.

LICHEN GROUP	DISTURBANCE				
	Air/water pollut.	Agric. chem.	Logging/ clearing	Grazing/ trampling	Fire
Caloplaca spp.	?	?	- to S	- to S	- to S
Cetraria islandica	?	-	-	- to S	- to S
Cladonia pyxidata	T to I?	?	- to I?	S to -	- to S
Cladonia spp.	?	?	S to -	S to -	- to S
Diploschistes spp.	?	?	- to I?	S to -	- to S
Lepraria neglecta s.l.	T?	?	- to I?	S to -	- to S
Lepraria spp.	T	?	S	S to -	- to S
Leptochidium albociliatum*	S	S	- to S	S to -	- to S
Leptogium lichenoides s.l.*	S	S	- to S	S to -	- to S
Megaspora verrucosa	?	?	- to I?	S to -	- to S
Ochrolechia upsaliensis	?	?	- to I?	S to -	- to S
Peltigera aphthosa s.l.*	S	S	S to -	S to -	- to S
Peltigera canina s.l.*	S	S	S to -	S to -	- to S
Peltigera venosa*	S	S	S	- to S	- to S
Peltigera spp.	S	S	S to -	S to -	- to S
Physconia spp.	I?	?	- to I?	S to -	- to S
Psora spp.	?	?	- to I?	S to -	- to S
Solorina crocea*	S?	-	- to S	- to S	- to S

	Environmental factors				
Trapeliopsis granulosa	?	?	- to ?	s to -	- to s

Table 11. Sensitivity of major saxicolous species of lichens (* = also of special concern) to various kinds of disturbance.'S = sensitive, I = intermediate, T = tolerant, – = not applicable, ? = uncertain.

LICHEN GROUP	DISTURBANCE				
	Air/water pollut.	Agric. chem.	Logging/ clearing	Grazing/ trampling	Fire
Acarosoora "chlorophana"	S?	?	– to S?	–	– to s
Aspicilia spp.	T	?	S to T	– to S?	– to s
Caloplaca saxicola	?	?	– to S?	–	– to s
Candelariella spp.	?	?	– to s'	– to s	– to s
Dermatocaroon miniatum s.l.	?	?	– to s	– to s	– to s
'Lecanora muralis	T to I	?	– to T?	– to S?	– to s
Lecanora phaedronhthalma	?	?	– to T?	–	– to s
Lecanora ruoicola	?	?	S to –	–	--to s
Lecidea "atrobrunnea"	T?	?	s-to –	–	– to s
Lecidea tessellata	?	?	– to T?	–	– to s
Neofuscelia spp.	?	?	– to T?	–	– to s
Parmelia spp.	I ?	?	s to I?	–	--to s
Phvscia spp.	I?	?	s to I?	–	– to s
Pseudephebe spp.	I?	?	– to I?	–	– to s
Rhizocaroon spp.	?	?	– to I?	–	– to s
Rhizoolaca spp.	S?	?	– to I?	–	– to s
Staurothele spp.	?	?	– to s	–	– to s
Umbilicaria spp.	I?	?	-'to s	–	– to s
Xanthoparmelia	I?	?	– to I?	–	– to s

	Environmental factors							
spp.								
Xanthoria spp.	I?	?	- to	I?	-		- to	S

Environmental factors

Table 12. Sensitivity of rarer special concern species to various kinds of disturbance. S = sensitive, I = intermediate, T = tolerant, - = not applicable, ? = uncertain.

LICHEN GROUP	DISTURBANCE				
	Air/water pollut.	Agric. chem.	Logging/ clearing	Grazing/ trampling	Fire
Aspicilia spp. (fruticose)	T?	?	S to -	S	S
Bryoria friabilis	S?	?	S	-	S
Bryoria tortuosa	S?	?	S	-	S
Collema spp.					
on soil	S	S	S to -	S	T to S
on bark	S	S	S	-	S
Dactylina arctica	?	-	-	S	-
Endocarpon ssp.	?	?	S to -	S	S?
Haematomma sp.	?	?	S	-	S
Hydrothyria venosa	S	S	S to -	?	S to -
Hymenelia lacustris	S?	-?	S to -	?	S to -
Lecanora laatokkaensis	?	?	S to -	-	S to -
Leptogium spp.	S	S	S to -	S to -	S to -
Lobaria spp.	S	S	S	-	S
Nephroma spp.	S	S	S	S to -	S
Pannaria spp.	S	S	S	-	S
Pseudocyphellaria anthraspis	S	S	S	-	S
Rinodina sp. nov.	?	?	S	S to -	S
Texasporium sancti-jacobi	?	?	-	S	S to -
Thelomma	?	?	-	-	S

	Environmental factors			
occidentale				
Other Caliciales	?	?	S	S

Environmental factors

MODELS

Since no example of a model was enclosed with the materials sent to me, I have improvised. -The models below are only for functional groups or special habitat/special concern lichens, and they show only a few of the components, processes, and interactions that are known or likely to be at least moderately important. The amount of detail is limited by the lack of space and difficulties of the method of making the diagrams, but hopefully it at least suggests some of the complexity of the considerations involved.

Figure 1. Model of lichen ecosystems in general. Arrows indicated direction of causal relationships. **Bold** indicates stronger or more important factors or effects.

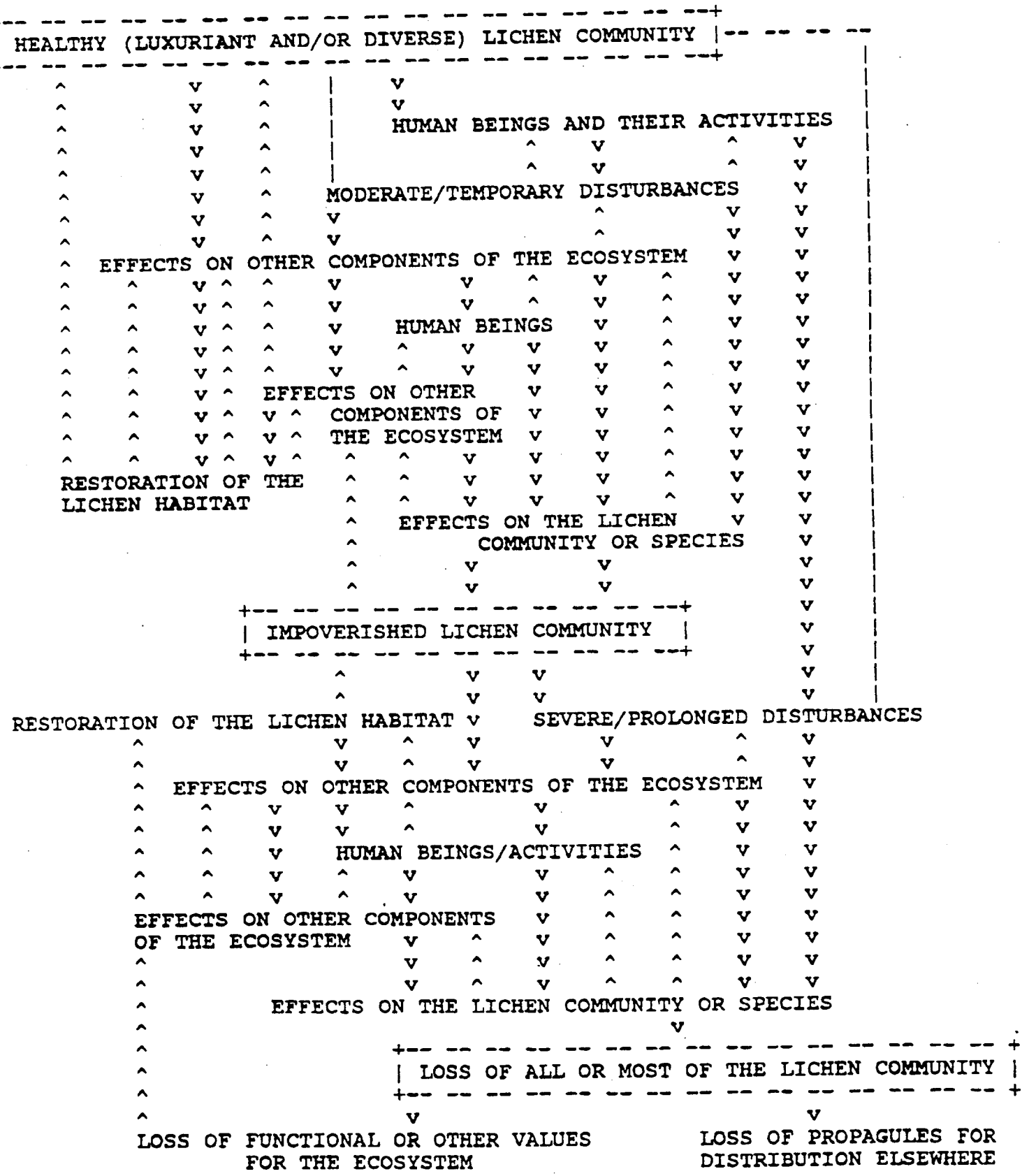


Figure 2. Model of aquatic saxicolous lichen ecosystems. Arrows indicated direction of causal relationships. Bold indicates stronger or more important factors or effects. DISTURBANCES are: elimination of habitat (blocking light or air by covering by sediments, solid materials, or huge amounts of water; removal of rocks or water), alteration of conditions (changes in abrasion, aeration, sedimentation or turbidity, due to changes in movement or flow-rate, by channeling or by increased inputs due to erosion after logging, fire, overgrazing, paving, etc.; increase of heat and evaporation due to removal of vegetation in or near the water, or in area as a whole; changes in presence or abundance of other organisms due to such changes or to pollution or eutrophication), and direct destruction or removal of the lichens (chemical, nutrient, or thermal pollution; herbivory; direct destruction or removal by humans). "SEVERE" = the damage drastically affecting all or most of the habitat or lichens in the area being considered, making restoration to the healthy state difficult or impossible at least in a reasonable amount of time.

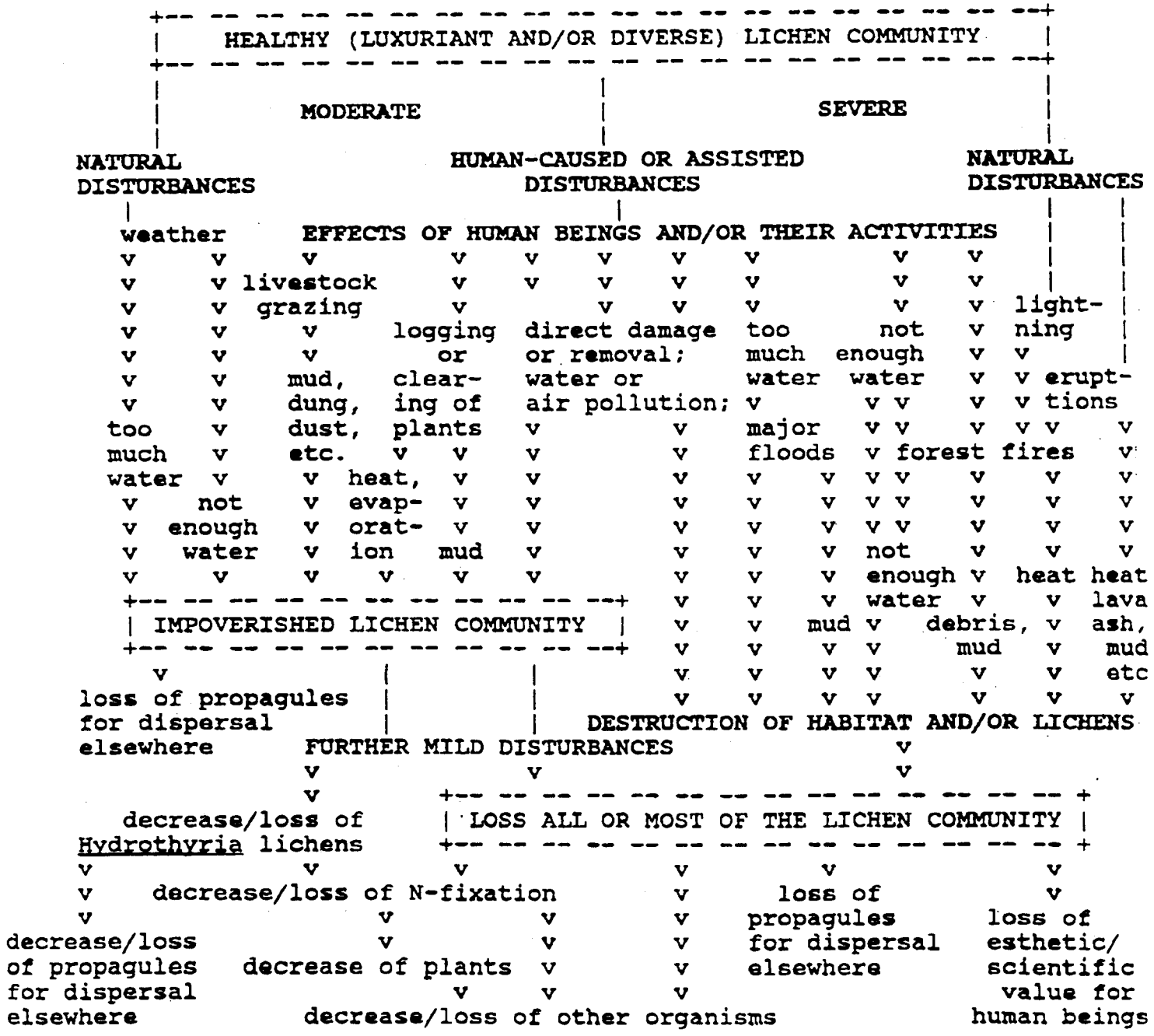


Figure 3. Model of moist old-growth forest/woodland lichen ecosystems. Arrows indicated direction of causal relationships. Bold indicates stronger or more important factors or effects.

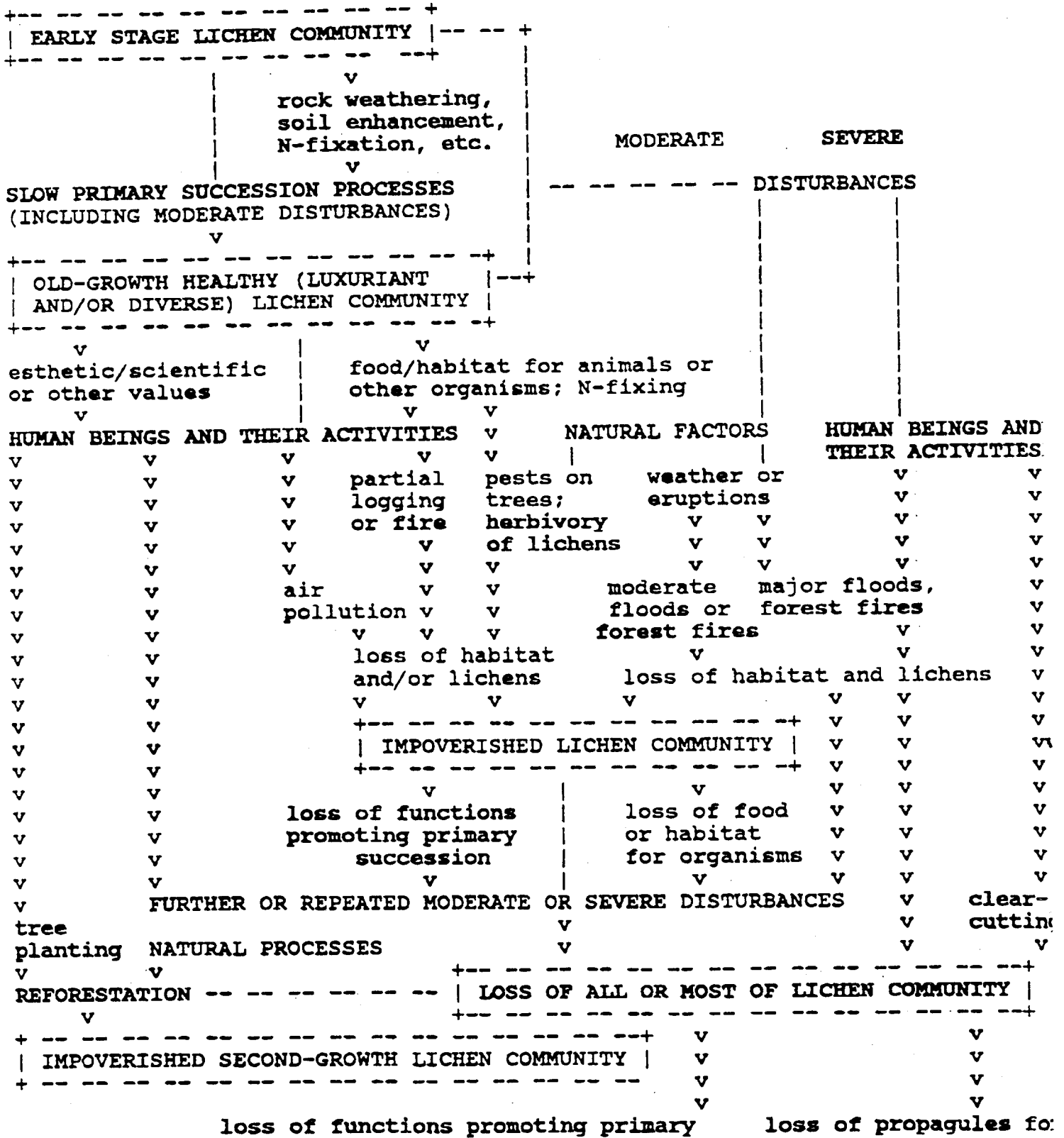
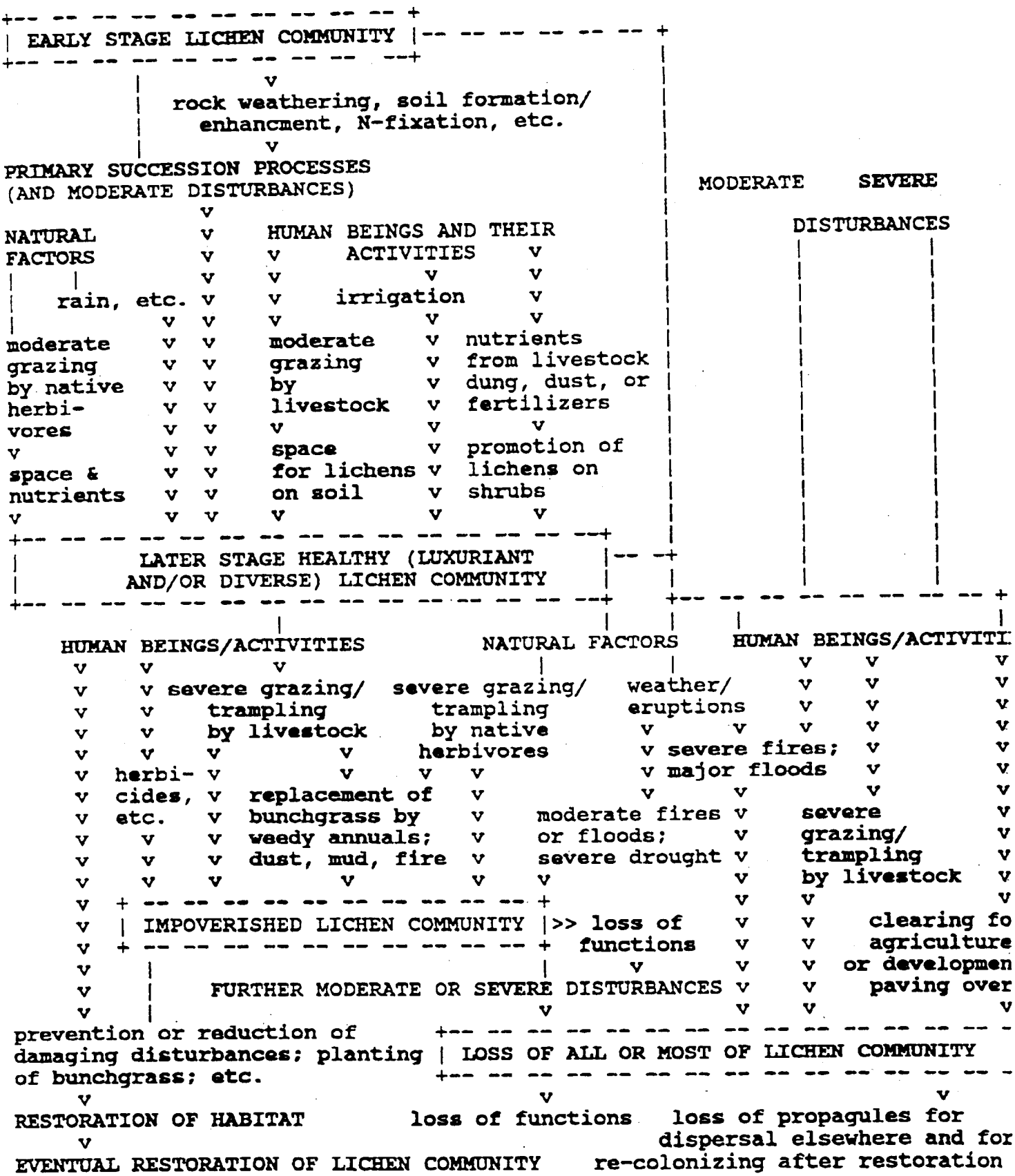


Figure 4. Model of shrub-steppe or steppe lichen ecosystems. Arrows indicated direction of causal relationships. Bold indicates stronger or more important factors or effects. Clearing for agriculture is major in steppes.



Functions

7. ECOLOGICAL FUNCTIONS

Under this topic I am including some "negative" effects of lichens, in addition to the mostly "positive" contributions, because the same quality or process can be interpreted either way,, depending on one's values or interests, and many of the effects can be beneficial for some situations or ecosystem components and damaging to others. I have also included uses by humans and human-managed organisms or systems, because we are, after all; a component of both natural and artificial ecosystems,' and human interests are obviously also a major concern to land managers (often too much so).

The ecological functions (referred to as "Role(s)" in this document), where known or presumed, are referred to under each major and special concern species, in that section, and in the three "Ecological Groups" sections.

The functional groups are summarized and further discussed in this section. I have lumped some rather diverse functions together under some categories, because the lichens involved are probably mostly the same ones, and the processes interact with each other or-contribute to the same-overall results.

Possible effects on ecosystems, of altering distribution or abundance of functionally significant lichens: As to how . . . alterations in lichens influence the diversity and productivity of their ecosystem, at present I can mostly only make very general speculations. Obviously increases or decreases in lichens that are "good", "bad", or both (depending on the lichen, its affects on various ecosystem components, and the value placed on those), will affect productivity, and/or biodiversity (especially of lichens themselves) in various ways and to differing degrees. The quantitative consequences of the alterations depend on how abundant and significant the groups or species are in the particular areas or ecosystems.

Changing the distributions of some groups or taxa of course also alters their abundance directly and by modifying sources of propagules:. I suspect the elimination of, particular taxa would be critical mainly in areas where certain critical taxa (e.g., Alectoria, or nitrogen fixers) are necessary for the function (as opposed to the case of functions where almost any similar lichen will do the same thing). This might be especially important in localities or provinces where such taxa are presently uncommon but could become more common in the future (e.g., if the mostly -second-growth forests, are allowed to become old-growth ones). It could also be important in areas that are major sources of propagules for other areas, particularly areas with disjunct occurrence of the species and its habitat, including areas that provide links between other disjunct occurrences.

A. INTERCEPTORS OF WATER, LIGHT, HEAT, AIR, NUTRIENTS AND TOXINS

Lichens most important in regard to this set of interacting

functions are probably the larger, dominant macrolichens on trees or shrubs, although crustose kinds and small or large macrolichens on logs or stumps., rocks (especially cliffs or large outcrops), soil, or moss may also be important, especially if they are very abundant. Details and quantitative data that can be considered to be relevant to the WA/OR Columbia Basin, and especially to the contributions of particular species occurring there, is minimal, because the studies on this-function dealt mostly with ecosystems and lichen communities rather different from those in this region. However, the general considerations derived from other studies still apply, at least qualitatively.

Key functions: Lichens in effect increase.the surface area of the canopy (especially on dead plants and in winter on plants with deciduous leaves) and increase or modify the surface of the trunk (especially on smooth bark or wood). The lichens intercept and partly absorb precipitation (dew or fog, rain, or snow), water flowing down the trunk or main branches, and water vapor, other gasses and particulate matter from the air (from natural or anthropogenic sources). The nutrients and toxins accumulated in these ways, those that may absorbed from the substrate, carbon fixed by photosynthesis, and nitrogen fixed by cyanobacteria (either in or on the surface of lichens) all enter the nutrient cycle, either by'leaching from the lichens or when the lichens are consumed or decomposed by other organisms. Lichens, especially when abundant, and particularly in certain situations, can also absorb or reflect light and heat, which also affects moisture conditions, Thick masses of large macrolichens lichens impede airflow directly over their substrate, and in extreme cases might even reduce wind movement. -The important effects of these various processes on soil are mostly discussed separately under that topic.

1. Reduction of the amount of water and particulate matter (including nutrients and toxins contained in these) reaching the' ground or lower parts of plants or rocks. These effects, which are tied into the others below, may be persistent (in the case of the various states of water) or temporary, as mentioned below, for nutrients and toxins, which sooner or later are leached out or enter the ecosystem as the lichens are consumed or decomposed.

2. Absorption and retention of water and modification of evaporation conditions and other aspects of water cycling.

Provision of water'for other organisms: These effects are potentially very important in several situations (ecosystems, places, habitats, or time periods) in which liquid water is absent or minimal, such as in shrub-steppes receiving dew or frost but not rain, and forests or other ecosystems receiving only snow in the winter. In these 'situations the lichens (or water under them that is prevented from evaporating as rapidly as 'it would otherwise) provide water for organisms that consume or decompose them; at times this may be a primary source of water for caribou, other ungulates (including livestock), squirrels,

and birds.

Melting of snow or frost on lichens in the canopy (or high rock surfaces): This releases liquid water for lichens or other organisms growing at lower heights, and to organisms on the ground. This could be important, because snow or 'frost on lichens growing-in exposed, sunny situations in the canopy or on rocks will-melt sooner than under the canopy. These effects vary to some extent with the darkness or lightness of the lichens, as discussed further under the topic of light/heat Interception. Gelatinous, cyanobacteria-containing lichens (Collema, Lentochidium, Leptogium, and others),'and to a lesser extent other macrolichens.and squamulose lichens that formthick "beards", mats,.or cushions are more likely to be good at absorbing.and retaining water and preventing it from evaporating.

Facilitation or promotion of decomposition and loss of substrate materials or organisms: Especially in already very moist forest or.woodland situations, 'water absorption by lichens can.have additional.effects. Huges masses of lichens (and water retained under them) can increase the weight load on surfaces, in extreme cases causing them to collapse, fall apart, or slide. This might include effects on branches, loosely flaking or decomposing bark or rotting wood, loosely attached and unconsolidated-bryophytes, plant debris,, or soil, and crumbling or exfoliating rocks. Probably more frequent and important, massive absorption and retention of water (and also water under the lichens) also contributes more directly to the decomposition and eventual loss of bark, wood, plant debris, and possibly bryophytes, by facilitating or promoting invertebrates or... microorganisms, and physico-chemical processes, that decompose the substrate. Water in or under lichens also aids in weathering rocks, as discussed under that topic.

3. Absorption and cycling of nutrients. Because they lack the cuticle, found 'in higher plants', and few ways of controlling what goes in or out of them, lichens in general are good absorbers'and concentraters of many kinds of organic and inorganic substances.

Effects with nutriehts from dust: The main inputs of nutrients from dust are probably'through leaching, or decomposition rather than by consumption of the lichens (at least by vertebrates). Lichens characteristic of surfaces enriched by fertilizer, agricultural dust, or excretions, may concentrate nitrogen, phosphorous or calcium, but the most characteristic of these taxa (Caloplaca, Candelaria, Candelariella, and Xanthoria) are too thin or.closely attached to be eaten by vertebrates, and the bright green-yellow to orange'or red pigments probably make the lichens unpalatible, if not actually poisonous. Letharia and Vulnicida are abundant in dusty areas and are easily removable, but contain vulpinic or pinastric acid, making them unpalatable and 'poisonous,

Effects with nutrients from water: On the other hand, most

of the lichens that do serve as important food sources for vertebrates in the region (Alectoria and Brvoria) usually grow in areas exposed to reiatively small amounts of dust, but will absorb nutrients from precipitation or stemflow.

4. Absorption and cycling of toxins (including heavy metals and radioactive elements). In the short term this may be a beneficial function for organisms living below the lichens. However, the long term effects are potentially quite dangerous to the ecosystem (and potentially to humans), because rather than being diffused into the ecosystem at low levels, these substances can accumulate to high concentrations in the lichens, and eventually enter the food web when the lichens are consumed by animals or decomposers. In the case of lichens such as Alectoria or Brvoria, the toxins may become still more concentrated in the tissues of caribou or other ungulates.

5. Modification of pH (acidity or alkalinity):

Lichens absorb acid rain (and fog, snow, etc.); although this'may at least temporarily reduce the acidity entering the rest of the ecosystem, the. acidity to varying degrees hastens the death of the lichens, and sooner or later acidic water leaches from the'lichens. Tony Basabe (pers. comm., 1994) has found that lichens (e.g., Alectoria sarmentosa) lower the pH of water flowing over or through them, at least in one site in the WA Cascades; I plan to test our hypothesis that this effect is due to acids produced by the lichens, but another explanation might be that it is due to absorption of acid rain. Although the characteristic "lichen acids" have relatively low solubility in water, increased acidity from these acids, from common organic byproducts such as oxalic acid, or absorbed acidic precipitation, may be important in some cases, either negatively by adding to the acidity of already acidic water or surfaces, or positively or negatively by moderating the effects of alkalinity, whether these conditions are due to natural or anthopogenic sources.

6. Absorption or reflection of light and heat: Dark colored lichens (e.g., most cyanobacteria-containing genera, and Brvoria, Cetraria, and most Peltisera spp., Pseudephebe, Umbilicaria, and dark brown species of Acarospora, Lecanora, and Lecidea, plus Rhizocarpon bolanderi and species of Staurothele and Verrucaria) may also absorb more heat than plants or bare soil or rock. The increased heat absorption of dark lichens will also promote loss of water due to evaporation. 'The reverse situation may be true of pale or bright lichens, although some light/heat is absorbed by lichen substances (especially pigments) and photobionts.

B. DIRECT PROVIDERS OF FOOD OR OTHER BENEFITS FOR NON-HUMAN VERTEBRATES:

In the Columbia Basin, as far as known with any certainty, these are primarily large fruticose lichens on coniferous trees, especially Alectoria sarmentosa and Brvoria spp. as food for caribou, and Brvoria spp. as both food and nesting material for

flying squirrels. However, as I have speculated elsewhere in this report, various -other macrolichens such as Umbilicaria spp. might also be eaten or otherwise used. As discussed above, in addition to the uses below, lichens are also likely to be a source of water for various animals.

1. Food for caribou: As discussed in the document on corticolous/lignicolous "Ecological Groups", except'for a couple of brief statements (on one label, and in conversation with a forest botanist) that Alectoria (and possibly Brvoria) are. "important winter food" for caribou in N.E. Mountains, WA, I have no information on this specifically for the Columbia Basin.

2. Possible food for other native ungulates: No'definite evidence or information on this is 'available for eastern WA/OR, but studies elsewhere '(including the west side and Idaho) suggest it could be 'important at least in a few places or situations.

3. Possible food for livestock (or possibly also pack animals): Although this is not a function for a natural ecosystem (except perhaps slightly in an indirect way when lichens 'are being eaten instead of other plants), rangelands, 'pastures, etc. are still ecosystems, even though they 'are artificially manipulated. Whether lichens are actually eaten by these animals in eastern WA/OR, which species are used, and to what extent, are unknown.

4. Food and nests for flying squirrels, and to some extent other squirrels (and probably at least one or the other, for other kinds of small mammals): Information on this from Hayward & Rosentreter (1994) is summarized in the document on corticolous/lignicolous "Ecological Groups".

5. Probable use in nests (and possible use as food) for birds: No data are available on this for eastern WA/OR, but lichens undoubtedly get incorporated at least occasionally and incidentally on twigs used in bird nests.

6. Possible benefits for other vertebrates: It is conceivable that dense growths of Hvdrothvria could provide shelter or hiding places, and possibly food, for small fish or amphibians. The same might also be true for various non-large, non-aquatic macrolichens, and various terrestrial or arboreal vertebrates.' For example, large masses of pendulous Alectoria, Brvoria, or Usnea might shelter bats (as the analogous vascular plant epiphyte Tilandsia usneoides does at least occasionally, based on my experience in Florida). Evidence from California, where oak'trees are covered by-masses of pendulous and other macrolichens suggests that lichens may provide or at least-modify habitat for lizards (in trees, but probably also on rocks or the ground). Large, thick, loosely attached masses of ground-inhabiting macrolichens might possibly provide cover or shelter at least occasionally for a wide range of other vertebrates such as snakes and small reptiles or amphibians.

C. PROVIDERS OF NUTRITION, WATER, OR HABITAT FOR OTHER TYPES OF

Functions

ORGANISMS

No specific information on this category is available for eastern WA/OR, but based on my own experience and reading, it is undoubtedly one of the most important sets of functions of all -lichens almost everywhere.they occur, because it promotes total biodiversity and nutrient cycling through consumption or decomposition-of organic material (including the lichens themselves).

1. Nutrition or habitat for lichenicolous (parasitic, pdrasymbiotic, or epiphytic) fungi or lichens: This is quantitatively significant only to the extent that death and decomposition of the host lichens are; however,-it can be extremely important in terms of total biodiversity, because there may be hundreds of taxa (both hosts and-lichenicolous taxa) involved, 'even in a fairly small area or ecosystem. Only a few of the'numerous lichenicolous taxa found in the Columbia Basin have been identified, and many are probably still undescribed or not yet reported for North America; some (e.g., certain members of the Caliciales) may be old-growth species, and are likely to be rare and endangered.

2. Nutrition or habitat, or both, for invertebrates: Again this is significant for total biodiversity, but it is also likely to be very important for processes affecting both the lichens and their substrate. A very wide range of invertebrates (many probably undescribed genera or.species) can occur on the surfaces of the lichens, underneath them, or in water.on or below them. Some kinds of insects or larvae even deliberately'stick lichens onto their backs, for camoflauge. Insects, spiders, mites, worms, and many other very tiny invertebrates are almost uniquitous on lichens, especially in moister, more temperate ecosystems. Some invertebrates (e.g., some kinds of mites or others, especially ones that are camoflauged to look like lichens or carry lichens on their backs) require lichens in general or particular kinds, and may be rare or endangered.

3. Nutrition or habitat, or both, for protists or bacteria: Although little is known about this (especially the biodiversity aspect); most of the considerations applicable to invertebrates also apply, and it is undoubtedly at least as important in decomposition processes.

4. Habitat for cyanobacteria (including nitrogen fixers): Cyanobacteria are commonly associated with lichens, in cryptogamic soil crusts in fairly dry areas, and also on or among lichens on various substrates in aquatic or other moist habitats. Although these organisms probably have deleterious effects on lichens when abundant, due to competition for substrate or blocking of air and light, in some situations they may provide moisture or fixed nitrogen for the lichens, and especially for, other organisms. In some situations, e.g., when they occur on the surface of abundant non-cyanobacterial canopy lichens in moist forests, this could be an important-source of inputs to the

ecosystem.

5. Interactions with microcolonial fungi: As discussed under weathering of rocks, below and in one place in the document on saxicolous "Ecological Groups", the nature and possibly considerable significance of these interactions remains to be clarified.

6. Habitat for lichenicolous (epiphytic) bryophytes an& true algae: Although few if any of these organisms occur obligately in lichens.or derive direct benefit from them except perhaps moisture, their use of lichens as substrates might be significant in a few situations.

D. PROVIDERS OF VARIOUS DIRECT BENEFITS TO HUMANS

It is important to note that-these'benefits are also potential threats to lichens (and therefore to ecosystem biodiversity or functions), due to overharvesting, especially for certain species, including both rarer ones and some of the 'commonest ones.

1. Arts and crafts, especially dyes for wool or cloth: Alectoria, Bryoria, Letharia, and other conspicuous macrolichens are especially likely to be used in dyeing, although many other lichens also produce dyes. I do not know how often lichens are collected for this purpose in eastern WA/OR, but on the west side there are a fair number of people interested in this. Most other arts and crafts uses are probably trivial (at least in the Columbia Basin at present), but some examples are use of bushy lichens (usually Cladina, but in the Columbia Basin more likely Letharia) for miniature trees or shrubs in railroad layouts, and use of various lichens in Christmas wreaths (Ramalina is used in California, but Alectoria, Letharia, or others might be used in the Columbia Basin).

2. Antibiotics: Species containing usnic acid (Alectoria, and others) are likely to be harvested for commercial production of ointments or salves sold in Europe. Although many other lichen substances have antibiotic properties, they have not yet been exploited to any significant degree.

3. Scientific or technological values:' As evident throughout this report, lichen taxonomy, biogeography, and ecology are extremely fertile fields forfuture research. This is also true of the numerous other aspects of.lichenology, including the use of lichens as model biological systems. Even the results from "pure" research may soon become more important for applied uses (e.g., medicine), because of new technology (genetic engineering and tissue culture) that makes commercial exploitation.! potentially more feasible.

4. Esthetic or spiritual values: Although lichens are often ignored, or even thought to be disfiguring, at least for some people (aside from lichenologists, of course), consciously or subconsciously, the more conspicuous or attractive lichens, or the patterns they make, contribute to esthetic enjoyment of

scenery, especially in cases such as cliffs mottled with bright green-yellow Acarospora "chlorophana" or bright orange Caloplaca or Xanthoria, and in forests where the trees are covered with bright green-yellow Letharia, or with festoons of Alectoria or Brvoria. Even if people have no idea,that these are lichens, and have not paid attention to them in the past, 'if the lichens disappeared, people who have seen them over.many years are likely to notice.that something has changed if the lichens disappeared. 'Although I have no information on this for the Columbia Basin, my experience elsewhere suggests that Native Americans at'least traditionally were aware of and valued lichens, if for no other reason simply because they are a conspicuous part of.the natural world revered by these people.

5. Miscellaneous: Again, as discussed elsewhere in this report, at least some Native people in the region probably made use of lichens (especially Brvoria spp.) for a wide variety of purposes. Although the list of major or minor uses to which lichens have been put by various people around in the world is extensive and fascinating (from human food and beverages to the production of perfume,),' I will refrain from further enumerating them'and speculating on which ones, if any might be potentially significant in the Columbia Basin.

E. NITROGEN FIXERS:

These include a range of taxa occurring at least indirectly on all substrates, but inmost parts of the Columbia Basin are likely to be mainly terricolous/muscicolous species, especially of Collema, Leptochidium, Leptogium, and Peltigera.

1. Fixing nitrogen: This is necessary for most kinds of plants (other than alders and legumes), and is probably one of the most important functions of lichens, as discussed in many articles on field and laboratory studies done elsewhere. However, in my admittedly limited experience (mostly in drier, rockier areas unsuitable for most nitrogen fixers), except perhaps Peltigera spp. or occasionally others, this'functional group isnowhere near as abundant in eastern WA/OR as in the moister areas to the east or west. It is a complex subject, and unfortunately at present I do not have enough information directly related to this in eastern WA/OR to comment further on it here. Some additional references to the subject are made elsewhere in this report.

F. WEATHERERS/SOIL FORMERS:

This is the major function of probably all lichens on rock, as discussed in more detail in the section on Succession. Beyond this, little or no information is available, at least for the Columbia Basin.

1. Weathering of *rock:* Crustose lichens are generally the most important ones, especially in the earlier stages of weathering, but in many cases they continue to be important past

the gradual transition into formation of soil. Some macrolichens may also be important weatherers in.certain situations.

2. Formation of soil: Macrolichens are more likely to contribute to the later stages, and beyond decomposing the rock,. they also add to the.bulk-and composition of the soil, by falling off; whether they take substrate with-them.-or not. .

G. SOIL **ENHANCERS/MODIFIERS, AND PROMOTERS'OF 'ESTABLISHMENT-OF VASCULAR PLANTS:**

These include most kinds of lichens growing directly on soil,- and..are probably most important in steppe and shrub-steppe communities (see detailed discussions in the terricolous/muscicolous "Ecological Groups" document), and' possibly also in the alpine zone: Informatipn on the contributions of specific taxa is limited, but most or all nitrogen fixers (also treated above as a separate category), Cladonia spp., and many genera of foliose and crustose lichens fit in this category; Lumped together here are various more specific functions listed below. Although this is probably one of the most important sets of functions'in certain ecosystems, I do not have a lot of additional information or ideas about it, partly because in most of the areas I've visited in eastern WA/OR (generally dry, rocky ones, with little or no ground vegetation, or with annual grasses having replaced native bunchgrasses, or else moister communities completely dominated by grasses, herbs, or shrubs,. or bryophytes) lichens were not a conspicuous part of the vegetation directly on soil.

1. Soil **binding/consolidation,** and **erosion** prevention:, This is important especially'in areas with sandy, silty; or otherwise loose and unstable soils, including freshly disturbed soils, in dry, windy areas, and also in moist situations, especially on slopes or in concavities, where it also affects habitat for aquatic organisms.

2. Moisture absorption/retention: This is important obviously in all but the, wettest ecosystems.

3. **Nutrient** enrichment: Aside from nitrogen;, lichens contribute other elements or substancesto the humus and soil, through leaching or decomposition.

4. Proyiding a **seedbed on surfaces normally** unsuitable for most vascular plants: This might be important on rocks., rocky-'or unstable soil, and logs..

H. INHIBITORS OF ESTABLISHMENT OR GROWTH OF **VASCULAR '(OR OTHER) PLANTS,.. FUNGI, OR OTHER KINDS OF ORGANISM-S:**

Although this set of functions 'is related to the previous one, much less is known about its nature and sigriicance, and it may involve some rather different considerations because of the. negative nature of the some of the consequences of the effects. I have mentioned below and elsewhere that some lichens or "allied fungi" may directly damage their substrates, but-at present there

is no reason to believe that this is potentially significant. enough to be listed as a 'separate function.

1. 'Physical inhibition of various organisms: Although, as discussed above, lichens can provide a substrate for vascular plants or other organisms, a cover of lichens may also block some kinds of organisms (e.g., plants unable to grow on or among lichens', earthworms or other soil invertebrates, and others) from occurring in the occupied space, with mixed positive and negative results.

2. Chemical inhibition of pathogenic or saprophytic fungi or microbes: The (presumably inhibitory) effects of lichens on wood-destroying.fungi were investigated by Henningson & Lundström (1970), but unfortunately I have not yet seen this article.' Since lichens must often compete-with such fungi,. and many lichens contain antibiotic substances it seems likely that this could be an important function, although some of the crustose fungi traditionally treated as lichens are themselves actually saprophytes or even pathogens; At least one lichen (an inconspicuous species' in the Caliciales, not yet discovered in eastern WA/OR but likely to be present'in old-growth forests) even grows directly on bark- or wood-destroying shelf fungi. Antibiotic effects on bacteria or other microbes are also a potenitally important function, but no data on this directly applicable to eastern WA/OR are available.

3. Chemical inhibition of grass seed germination or seedling development: Undetermined substances in aqueous extracts from. terricolous/muscicolous species of Peltigera are known to be capable of doing this, which (along with their relatively rapid growth rate) accounts for the fact that these lichens are among those more successful in colonizing grassy areas. The inhibitory action is beneficial to the ecosystem because Peltiaera spp. are also among .the most important nitrogen fixers, soil modifiers, etc.; at least in some situations, inhibition of grasses (e.g., weedy aliens) may have other benefits also.

4. Chemical **inhibition of mycorrhizal** fungi: Various species,' such as Cetraria islandica, have-been found to inhibit mycorrhizal fungi. Since many lichens (especially Cladonia spp.) contain fumarprotocetraric acid (the causal substance in C. islandica), and many more containother substances known or presumed to have antifungal.properties, this could be a significant function in some ecosystems. Cetraria islandica is common in alpine areas; Cladonia spp. are almost ubiquitous in terrestrial ecosystems except in the driest ones, and many other potentially inhibitory lichens are abundant-in all ecosystems. The effects could be positive, in impeding establishment of weedy or unwanted grasses or shrubs,, or negative, in retarding growth of desired plants, especially trees. Beyond that, nothing is known that-is. directly applicable to the Columbia Basin;

5.: Miscellaneous: As mentioned in item A, above, lichens may also be a concentrated source of absorbed toxic substances that

F u n c t i o n s

could be inhibitory when released.

Table, 7-l. Major corticolous/lignicolous lichen species and their roles in ecosystems.

LICHEN SPECIES	ROLE				
Caribou	Nitrogen fixation	Precip. modific.	Nutrient cycling	Squirrel nest	food
Alectoria sarmentosa					+++
Brvoria canillaris					
Bryoria fremontii				+++	
Bryoria fuscescens s.l.				++	
Brvoria oregana				+++	
Brvoria pseudofuscescens				++	
Brvoria spp.					++
Hypogymnia imshaugii		+			
Letharia ssp.					
Platismatia alauca		+			

Functions

Table 7. Minor corticolous/lignicolous lichen species and their roles in ecosystems.

LICHEN SPECIES	ROLE			
	Nitrogen fixation	Precip. modific.	Squirrel nest	Caribou food
Collema.. spp.	+			
Lobaria hallii	+			
Lobaria oregana	+			
Lobaria pulmonaria	+			
Nephroma spp.	+			
Pseudocyphellaria anthraspis	+			
Usnea spp.				+

Functions

Table 7.3 Major terricolous/muscicolous lichen species and their roles in ecosystems.

	ROLE				
LICHEN SPECIES	Nitrogen fixation	Soil binding	Inhibit grasses	Inhibit Mycorrh.	Food Ungulate
Candelariella spp.		+			
Cetraria islandica				+	+
Cladonia spp.		+			
Collema spp.	++	+			
Diploschistes spp.		++			
Lepraria nealecta		++			
Leotochidium albociliatum	++	++			
Leptogium spp.	++	++			
Megaspora verrucosa		+			
Peltiaera aphthosa s.l.	+				
Peltiaera canina s.l.	+++		++		
Peltiaera collina	++				
Peltiaera polydactyla s.l.	++		++		
Peltiaera venosa	+				

Functions

Functions

Table?. 4 Minor terricolous/muscicolous lichen species and their roles in ecosystems.

LICHEN SPECIES	ROLE			
	Nitrogen fixation	Soil binding	Inhibit grasses	Inhibit Mycorrh.
Caloplaca spp.		+		
Nephroma parile	+	+		
Psora spp.				
Solorina crocea	+	++		
Stereocaulon spp.	+			
Xanthoparmelia spp.			+	

Table 7-1. Major corticolous/lignicolous lichen species and their roles in ecosystems.,

LICHEN SPECIES	ROLE				
	Nitrogen fixation	Precip. modific.	Nutrient cycling	Squirrel nest	Caribou food
Alectoria sarmentosa		+?	++	+?	+++
Bryoria capillaris		+?	++	+?	+?
Brvoria fremontii			++	+++	+?
Bryoria fuscescens s.l.		+?	++	++	+?
Brvoria oreuana			++	+++	+?
'Bryoria pseudofuscescens			++	++	+?
Brvoria spp.		+?	++	+	+
Hypogymnia imshausii		+?	++		
Letharia ssp.		+?	++		
Platismatia slauca		+	+		

Table 7.2 Minor corticolous/lignicolous lichen species and their roles in ecosystems.

LICHEN SPECIES	ROLE				
	Nitrogen fixation	Precip. modific.	Nutrient cycling	Squirrel nest	Caribou food
Collema spp.	+		+		
Lobaria hallii	+		+		
Lobaria oregana	++	+?	++		
Lobaria pulmonaria	++	+?	++		
Nephroma spp.	+		++		
Pseudocyphellaria anthraspis	+		++		
Usnea spp.		+?	+		+

Table?.-' Major terricolous/muscicolous lichen species and their roles in ecosystems.

LICHEN SPECIES	ROLE				
	Nitrogen fixation,	'Soil binding	Inhibit grasses	Inhibit Mycorrh.	Ungulate Food
Candelariella spp.		+		I	
Cetraria islandica				+	+
Cladonia spp.		+			
Collema spp.	++	+			
Diploschistes spp.		++			
Leoraria neslecta		++			
Leotochidium albociliatum	++	++			
Leptogium spp.	++	++			
Meaaspora verrucosa		+			
Peltiaera aphthosa s.l.	+				
Peltiaera canina s.l.	+++	++	++		
Peltiuera collina	++				
Peltisera polvdactvla s.l.	++		++		
Peltisera venosa	+	+			

Table 2. Minor terricolous/muscicolous lichen species and their roles in ecosystems.

LICHEN SPECIES	ROLE			
	Nitrogen fixation	Soil binding	Inhibit grasses	Inhibit Mycorrh.
Caloplaca spp.		+		
Nephroma parile	+	+		
Psora spp.		+		
Solorina crocea	+	++		
Stereocaulon spp.	+			
Xanthoparmelia spp.			+	

8. SPECIAL HABITATS

Information on "special habitats" in the sense of unusual, uncommon, or disjunct, ones, whether known to be threatened or not, is presented (not always explicitly under this heading) in detail in the "Ecological Groups" documents. I have also summarized some of them below, to include lichens on all more than substrate types together when necessary, and to put more emphasis on the ones most likely to be of greater concern to federal land managers.

A; AQUATIC/SEMI-AQUATIC HABITATS (ESPECIALLY NEAR TEE COLUMBIA GORGE, AND IN VARIOUS FOREST/WOODLAND AREAS .-ESPECIALLY LIKELY TO BE HEAVILY POLLUTED OR OTHERWISE DISTURBED)

Chemical pollution, thermal pollution, eutrophication, and sedimentation (all partly also influenced by air pollution), and changes in water levels, patterns, or flow rates are all major potential threats to the lichens in these habitats. Logging, clearing, construction, paving, and ranching or farming activities all have negative influences on these factors.

Habitat for Hydrothyria is probably rare for this potentially important and sensitive species, especially in eastern WA/OR, where it is presently known only from near the Columbia Gorge. Chemical pollution, and the indirect effects of logging or clearing are probably the major threats.

Habitat for most other genera (other than perhaps Hymenelia lacustris and others apparently confined to high mountain areas) is much more common and widespread, but is especially likely, to be impacted by agricultural or forestry practices.

B. LATER STAGE CONIFER FORESTS/DECIDUOUS WOODLANDS IN MOIST AREAS (NEAR TEE COLUMBIA GORGE, IN N.E. MOUNTAINS OF WA, AND TO A PROBABLY LESSER EXTENT ELSEWHERE)

Logging or clearing, especially clearcutting, are major potential threats, directly to corticolous lichens and indirectly to others. In some areas, air pollution may also become an important threat, especially to the more sensitive species, which include some of the most functionally important ones (Alectoria, Bryoria, and nitrogen fixers). Although the sensitive and functionally critical species may presently be common at least in some areas, little or nothing is really known about their distribution or abundance in eastern WA/OR, making it especially important to preserve habitats in areas where they are most likely to occur.

C. BUNCHGRASS COMMUNITIES (ESPECIALLY HABITATS DIRECTLY ON SOIL), WITH OR WITHOUT TREES OR SHRUBS (ESPECIALLY IN OR NEAR COLUMBIA PLATEAU, WA, AND AT LEAST THE NORTHERN OR WESTERN PARTS, OF E. PLATEAU8 & HILLS, OR)

Especially for lichens growing directly on soil, bunchgrass

Special habitats

habitat is already mostly destroyed or drastically altered, in most of the Columbia Basin, except perhaps the sparsely inhabited parts of southeastern OR (if it occurs there). The cryptogamic crusts that fix nitrogen and enhance soil properties are particularly vulnerable to many disturbances, of which conversion to cropland, and the direct and indirect effects of livestock grazing are probably the most widespread and destructive. Other results of human activities (e.g., pollution, especially- by herbicides or other pesticides) probably also threaten soil (or other) lichens. Although nutrient enrichment from agricultural or other human activities is -beneficial for many lichens on trees, 'shrubs, or rocks in these areas, it may be harmful to others, especially to nitrogen fixers on soil or moss.

Areas with habitat suitable for Texasoorium (as described and discussed under that species'under "Species of Special Concern" are especially critical', and must be protected'or restored (e.g., by keeping out livestock and planting bunchgrasses).

9. SPECIFIC ISSUES FOR ANALYSIS

I am not sure what is meant by this category of instructions for preparing this report; as far as I can tell I have presented enough information and ideas under other sections to point out plenty of specific issues that need to be analyzed "within the scope of the Eastside Assessment process" for lichens.

Information lacking

10. AREAS OF UNKNOWN INFORMATION AND WHAT NEEDS TO BE DONE

Although I have mentioned the insufficiency of present data in the introduction and under the discussions of many topics, the comments below summarize the areas that are especially in need of further work.

For most lichens in most areas of the WA/OR 'part of the Columbia Basin, information on everything other than the general distribution and major habitat occurrences of the more common and readily collected and identified species (mostly-macrolichens) is usually lacking, or at best vague and speculative or extrapolated from other studies (mostly ones conducted in Idaho, Montana, the west side, or worse, from general review articles or studies elsewhere in the country or world). Even basic, casual field observations are few, and quantitative studies (which, ideally should include comparative and long-term investigations, and coordination of field and lab data) are completely lacking.

TAXONOMY OF LICHENS: Inspite of the numerous collections from many areas, the most critical source of inadequate information on the vast majority of lichens in the Columbia Basin is the lack of sufficient taxonomic work, which is the essential foundation for drawing meaningful conclusions about particular taxa in connection with any of the other topics. There are undoubtedly many thousands of specimens from the region including those in the very few herbaria examined during this study, that are 'unexamined, or incompletely or incorrectly identified. A large proportion (probably as much as 25-50%) of the identifications in most North American lichen herbaria and literature (except hopefully the monographs) are undoubtedly erroneous. Although these statements are particularly true of all but a few crustose lichen genera, they also apply to many macrolichen genera, including some of the most common and widespread taxa in the region. While identification of less common or less ecologically significant species may seem unimportant, it is vital for efforts to preserve biodiversity and conserve rare species.

WHAT NEEDS TO BE DONE: Although monographic or at least synoptic revisions of particular genera are ideal, even the much more basic work of simply going through herbaria making relatively easy determinations of barely examined material and correcting at least the grosser misidentifications, using current taxonomic knowledge, are desparately needed. Unfortunately, most of the relatively few lichen taxonomists throughout the world are overloaded with backlogs of specimens they do not have time to study or identify, because most universities at present no longer encourage or allow taxonomic research of any kind. On the other hand, most federal land management officess currently do not have funding available for hiring taxonomists, nor do they have the

Information lacking

space or facilities adequate for taxonomical research on lichens. Taxonomists at most insitutions depend largely on contracts or grants from federal agencies. If federal agencies want meaningful ecological and phytogeographical datas, they must help provide funding that also supports some of the essential taxonomic and floristic work. One way in which this might be.' accomplished has been suggested to me by Paula DePriest (pers. comm., 1994), who says the Smithsonian Institution has expressed an interest insupporting some sort 'of "major" research project on lichens, preferrably with an orientation towards biodiversity or environmental issues, and involving collaboration with federal land management agencies. Protection of biodiversity in old-growth forests of the Pacific Northwest (both on the west side -and in the Columbia Basin) would be an ideal subject for such a project.. .

A. MAJOR SPECIES AND SPECIES OF SPECIAL CONCERN: As discussed in the introduction to Section 2, the lists are highly subjective. Initially the only obvious choices were the almost ubiquitous and conspicuously dominant taxa (e.g., Acarospora "chlorophana", Letharia spp. and Xanthoria spp., and especially taxa well known to be both particularly important ecologically and especially sensitive to disturbance, such as Alectoria sarmentosa, Brvoria spp., and Peltiuera spp. and other nitrogen fixers), plus one well-studied rare species (Texasoorium sancti-jacobi). The very time-consuming compilation of summaries of. distributional information on virtually all species for' which data were recorded ("Master Species List" and "Collecting Data") suggested many additional species. However, the insufficiency of data related to other considerations.(discussed below), and the lack or unreliability of data on the less oftencollected or identified taxa, still make it difficult to know which species are really important or threatened. For example, should distinctive, conspicuous species be considered major just because they have been collected and identified from many provinces or localities? Are species of special concern just because have rarely been 'collected or identified from the region?

WHAT NEEDS TO BE DONE: These questions can be addressed to some extent by further compilation or analysis of existing collections, and by visits to a range of sites in the region, to gather impressions or preferably quanitative data.

B. HABITAT ASSOCIATIONS, PROCESSES AND-REQUIREMENTS: Detailed information on most of the locations, their features, and their lichen vegetation is generally absent.

Relationships of lichens to-vascular plant zones or communities and environmental conditions: Many labels and. literature reports give only vague localities,' or specific ones -but without latitude and longitude, township, range, etc., and sometimes even elevation. With a very few exceptions, most label

Information lacking

data and literature reports present little or no specific details on ecological factors (except mostly very general substrate type, e.g., "bark" or "conifers"). While.1 have already spent a lot of. time trying (not always successfully or very reliably) to locate collecting sites on broad-scale topographic maps (Washington Atlas & Gazateer, 1992, and Oregon Atlas and Gazateer, 1991), estimating elevations (including conversion of the ones for OR to meters), making educated guesses about associated vascular plant communities from the broad-scale map in Franklin & Dyrness (1973)I and using this information to make inferences about habitat coniditons, these efforts are still incomplete.and of limited usefulness at present.

Associations among lichen species: The sporadic, haphazard, and incomplete nature of most collecting (and also, the often very incomplete identification of the material) provide little or no idea of the floristic composition of the lichens at particular sites, and usually no idea of the relative frequency or abundance of specific taxa or lichens as whole.

Processes of succession: as discussed in the section.on Succession, although it is possible to make some hypotheses and speculations, virtually no definite information on this 'is available for the WA/OR part of the Columbia Basin.

WHAT NEEDS TO BE DONE: Careful mapping of localities and species occurrences in relation to the detailed vegetation overlay I just received would require further time, and would enhance the usefulness of much of the existing data. Close study of detailed geological maps might also be useful in some cases. However; aside from the dangers of error involved in these procedures, they still provide no additional information on substrates, microhabitats, or other important ecological factors. Especially for crustose taxa, recording of label data from additional specimens (after they have been properly identified), and specimens from additional herbaria should be done, but unless funding, is sufficient to also support the taxonomic work and the kinds of map'studies just mentioned, 'efforts should probably be concentrated on specimens that are reliably identified and provide fairly specific site and ecological information. Extensive additional collections (mainly of macrolichens), with detailed ecological data, will presumably be made in the region in connection with the EMAP program,. which hopefully will' continue to support taxonomists to identify the specimens. I- hesitate to recommend extensive additional collections; except perhaps for a few crustose or special interest species, mainly because that will just add to the crowding and backlog in herbaria. What I do suggest is visits to certain sites or areas of potentially special interest or importance (including re-visits to some areas), as discussed in the section on Biogeography, for the purpose of making notes, with collections made only when essential for identification of certain species. Although long-term studies of succession would be'desirable,

Information lacking

because of the enormous time periods involved, it is much more feasible to make inferences from comparative studies of sites in different stages. To better answer questions about habitat requirements, comparative or relatively short-term field studies with measurements of environmental variables, and experimental studies of ecophysiology, are needed.

c. **DISTRIBUTION:**

As discussed in the section on Biogeography, reltively few definite conclusions can be made from the available information. The occurrences, by province and county, are recorded for almost all species in the "Master Species List" files, and more specific locality data can be extracted from the "Collecting Data" and "Localities" files. For some of the major species, the existing data are probably adequate for the purposes of this.project (e.g., it is not necessary to have a lot of additional.data on Letharia spp.), but for most species, especially the apparently rare ones, the data are insufficient. In addtion, the files are very incomplete and undoubtedly contain errors, because of the small number of collections examined and the probably large number of unidentified or misidentified specimens.' These documents also have problems because of difficulties or mistakes in locating collecting sites or determining in which provinces or land management areas they occur. In some cases the different documents contradict each other because each document was prepared separately, and unfortunately I did not have time to cross-check and proof-read them.as much as I would have liked.

Although I initially attempted to-also describe the known over-all distributions, for most species this would have required an incredible amount of additional time searching for and analyzing such information, even to express it in general terms (e.g., "circumboreal"). Since this report is limited to WA and OR, I forced myself to ignore the numerous collections by other people that.1 saw from other parts of the Columbia- Basin, which would have supplemented the data being supplied by other specialists contributing to this project as a whole.- However, I am making available my own collecting data from Idaho and Montana, and‘also my summaries of the data from the Idaho plots studied by Cooke (1955).

What needs to be done: As explained in the section entitled "Tables and Maps", distribution maps of major and special concern species still need to be made. Some of the gaps and errors in locality data can be corrected by further study of maps and gazeteers, and cross-referencing among the various documents. However, the information should be put into a true data base system (and probably printed directly from that); unfortunately this was not feasible for me to do during preparation of this report. Efforts to find more data on the species (especially the special concern ones), and visits and

collections should be made in several potentially interesting or important areas, where the lichen flora is inadequately known. If information on overall distributions is important, that data also needs to be compiled.

D. ROLE (FUNCTION) IN THE ECOSYSTEM. Information presented in this report is mostly very generalized and tentative, based on my own speculations.and extrapolations from a few studies dealing with particular functions studied mainly in adjacent areas, studies done in other parts of the country or world, and some general review articles.

WHAT IS NEEDED: Direct observations and measurements made in the areas under consideration, and experimental studies, preferrably quantitative, are needed. More solid data should be gathered on the processes as weathering, soil formation or enhancement, nitrogen fixation, use by wildlife, and effects on grass or mycorrhizal fungi. It is also necessary to acquire much more information on the abundance, distribution and ecology of the species or groups of lichens involved in these processes, to determine the extent to which their contributions are likely to be significant in particular areas.

E. SENSITIVITY TO DISTURBANCE. Again, the information on this, especially 'for factors other than air pollution, is mostly lacking, vague, or speculative. Although I am providing a document that attempts to compile information and references on sensitivity of particular, lichens to various air pollutants, it is at best a very rough draft, and none of the cited studies were conducted in the Columbia Basin. Virtually nothing can be said about the potential response to different management practices.

WHAT NEEDS TO BE DONE: Investigations of responses to pollution, fire, logging, grazing, and other disturbances, and comparative or long-term studies of such things as clear-cutting vs selective 'logging, prescribed burning, or variation of extent or timing of grazing.

F. POPULATION TRENDS: I have mentioned population trends only in a very few cases, because for most species virtually nothing is known about this, except perhaps in genera.1 terms (e.g., the habitat is threatened or even already mostly destroyed).

WHAT NEEDS TO BE DONE: Somewhat speculative inferences might be made by careful study of collections or reports made in certain localities or areas during various time periods, as has been done in studies of air quality in southern California (Sigal & Nash, 19 , Ryan, 19). However, in those studies many of the changes (e.g., total loss of many species and even genera from all of southern California) were dramatic and obvious. Another study, on the Olympic Peninsula of WA (Rhoades, 19), was able to draw some conclusions by comparing the present lichen

vegetation in various localities with those collected in an earlier previous study, but encountered many difficulties in doing so. I have recommended elsewhere that the studies of Cooke (1955) and Rossman (1992, but the data was collected much earlier) be followed up. Perhaps the best solution, though long-range and not without its own problems and uncertainties, consists of establishing baseline studies now, using plots or transects, as is already being done in the EMAP program in other areas and in other kinds of studies (including ones in forests west of the Cascades). Baseline studies using photographs of permanent plots are'also .to be encouraged.'

11. PEER REVIEW

Comments from Janet Marsh are enclosed with this report, and I have attempted to incorporate her suggestions. Although the contract specifications recommended selection of a reviewer by the president of the national society, I had Janet do the review for two reasons: 1) She is a competent lichenologist, who, as author of the lichen treatment in Vitt, et al. (1988) she is familiar with the lichens of the northwestern part of North America. 2) It was not feasible to go through that process and get the report reviewed and returned by someone at another institution in the time alotted, and Janet graciously agreed to be the reviewer on short notice with no compensation.

email rrosentr@dsc.blm.gov

Dr. Bruce Ryan
Dept. of Botany
Arizona State University
Tempe, AZ 85287

October 31, 1994

Dear Bruce:

Enclosed are some comments on your draft of the East side Ecosystem management contract report.

Your report is excellent! The detail and documentation is impressive, I would like to thank you for the outstanding effort you have put into this effort.

I assume that I am suppose to send this draft back to you, it will follow a day or two behind this letter which I plan to send federal express mail to your home address. Please call me if this is wrong.

I Like how you addressed the report using the number of each contract specification. However, those sections could be more clearly numbered and titled. Each section could be improved'by numbering using the "decimal classification system" along with the excellent headings and subheadings you have already used. eg.
1. HEADING
1.1. Subheading
1.1.2. sub-subheading
etc.

2.
2.1
3.
3.1.
3.1.2.
Without these numbers I eventually get lost in the pages and pages of data reported. Please revise section 2. it is great, except you are not committing your expert opinion on much. Give us your opinion!!!!! Especially where you have been leaving blanks or "unknown" we want your opinion. You are the **EXPERT** and we want to hear from you! eg. 1. sensitivity to disturbance------ --- yes, no, how, and why, **2. role** in the ecosystem? soil binding, N2 fixing, etc. 3. population trend? slightly decrease, habitat is decreasing severely due to invasion of cheatgrass, decreasing, and why.

Rare species.
Why are these-species of concern?
Where do they occur ecologically?

How do we protect these species?

Parts 2-4 do tend to repeat themselves. If you like combine them in one treatment.

Please number the individual page numbers, at least by sections or individual files.

I will send Dan Mayer a letter requesting a modification of the contract and see if we can get you some more dollars. I am hopeful we can.

later,

Roger Rosentreter

cc: Kurt Nelson
Lisa Croft

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

Nov. 18, 1994

Roger Rosentreter
Bureau of Land Management
3380 Americana Terrace
Boise, Idaho 83706-2500

Dear Roger,

I sent 2 diskettes, with the East Side report and supplemental materials, to you by Federal Express yesterday.

Included with this FAX that I'm sending you are the "peer review" (which I hope is O.K., since Janet didn't have a lot of time to do it). Unfortunately to get the diskettes to you by today I had to mail them before I got Janet's critique, but most of her criticisms are fairly minor. You can easily change the spelling errors with global replace commands. I've covered the synonomy bit in the Master Species List. The "microbiotic plants" thing is a quote from you, so you known what you mean. I interpreted Alan Bahn's "excellent range conditions" as meaning that the sites had not been overgrazed, but it's true that could also mean that they could still become impacted in the future.' I'll deal with. her other comments in the "additions & corrections" documents I'll Fed-ex to you next week.

Also included with this FAX are printouts of the ecological model diagrams in the Environ.fac document. (to show you how they're supposed to look; you may have to'monkey with them to get them to print correctly, as I had to). Unfortunately I did not get around to putting page'numbers on most of the documents, but that should be easy enough for you to do. You also might want to use the "headers" option (shift F8: 2) to put headers with the title of the section on each page of that section.

If possible, you also might want to concentrate on the more general discussions, etc. first, and wait before using or printing the longer documents that have a lot of detailed data (ecological groups, localities, collecting data, master species list) and tables dealing with particular species, etc.), because there will be some additions and corrections I'll send you for those, and I will encorporate those in the tables (60me of which are presently set up but not filled in, or filled in off the top of my head instead of by looking at the data). I'll send the additions/corrections on diskette, 6.0 you can incorporate them directly into the documents if you wish.

Well, sorry for the length and redundancy in the documents, and lots of luck wading through them; I hope they'are useful.

Sincerely,

Bruce

Bruce D. Ryan

Notes on **Ecological** *Assessment* of Lichens of the Columbia Basin of Oregon and **Washington**. Report submitted by Dr. Bruce Ryan.

Following are comments on the report submitted by Dr. Bruce Ryan for the East Side Contract. I hope you can find the reference to these comments as there were no page numbers **on my** copy,

On the whole, I thought the report was well written and very complete ie. all available lichen information for the area was incorporated, even if all lichen collections that have ever been made, could not 'be observed. This, report is **probably** the most complete overview of the ecological lichen community, of such a large area, that exists in the country!

I Biogeography: Hood River County, Columbia Gorge area. This area may have had few lichen collections, but this past summer, 11 'people on a field trip with Dr. Thomas H. Nash, Arizona State University, collected extensively in some of the habitats on the Washington and Oregon sides of the the Columbia River Gorge. These data (list of lichen species for each collecting. site) **will** be availble (especially when the UNIX system lichen **catalogue** is completed) at the Lichen Herbarium of Arizona State University -and can be appendixed to the, **report.**

Baker County: What does "excellent range conditions" imply? cattle?? If so, **you** might address the -fact that soil and shrub lichens would be impacted.

Results and Discussion, Part 2

Maybe add that invertebrates use/eat lichens, but'not much data are available as' few studies have been done, especially in the Columbia Basin area.

2A. Major Lichen Species.

Acarospora "chlorophana" group. The high elevation *Acarospora chlorophana* specimens could be separated into' the revised *Pleopsidium* genus as described by Hafellner (1993).

Cetraria aculeata=Cornicularia aculeata
Tuckermannopsis=Cetraria (brown, arboreal)
Vulpicida=Cetraria (yellow)
Synonyms of recent changes for these genera that appear frequently throughout the report, may assist anyone who reads the report. All nomericlature appearing in the report is current.

I. Ecological Groups. Corticolous/Lignicolous
Tsuga heterophylla series:

Abies grandis/Pachystima, not "i" and throughout the manuscript.

Terricolous/Musicolous
Habitat: An overview description of sites with high cover such as forest clearings etc. would define the sentence better.

II. Grassland/Savannah
Role(s)
The use of the word "microbiotic" plants is confusing - are they vascular plants or mosses or both?

Key Ecological Groups.
Problems in treatment of information from some localities

released > realized

Much effort has been put into the Tables. These summarize the data very well, in a succinct way, and will probably be the most useful and used portion of this report.

It was enjoyable to read about the ecology of the northwest lichens and all the more so because I collected lichens at sites located in the Columbia Basin on the field trip this past summer.

Janet Marsh
Arizona State University
Tempe, AZ 85287-1601
November 17, 1994

12. TABLES AND MAPS

Format and interpretation in the tables

Hypothesized patterns for selected species in relation to particular communities, successional stages, etc. are summarized in a series of tables, based mainly on the information given in the text. Since the information is often vague and occasionally contradictory, I have used my own experience to interpret-the information. Few species are truly restricted to one category or another. For example, in the tables on Succession, although species most characteristic of later stages rarely if'ever occur in early stages, colonizing species are likely to persist in areas of secondary succession within the later stages; I have indicated species found in "second-growth" forests as occurring in both early and intermediate stag&, and species found in "mature forests" or "near-climax" forests as being in both intermediate and late stages. Where additional information suggests that a species is restricted to or more common or important in one category, I have added another "+" for the species under that category. For species especially likely to be strongly associated with a particular category, I have used extra "+" signs under that category, 'to indicate this, because the absence of "+" signs under other categories does not necessarily mean that the species never has any relation to those categories.

Distribution Maps:

The base maps and overlays were not sent to me in time to utilize them in making distribution maps. This is unfortunate, because I spent a major part of the very limited time alotted for preparation of this report compiling distributional data and struggling to organize and interpret it in relation to provinces, vegetation types, and land management. It would be highly desirable to provide additional funding in the future to allow time to make better use of these materials and my efforts.

13. LITERATURE REVIEW

References to the literature are" scattered through many parts of-this report, but a brief summary and overview of previous studies, including some not cited elsewhere in the report, is presented below.

Floristic treatments: Information mainly on the geographical distribution of particular species of lichens in the region was found in various types of.publications or reports. Douglas" (1974), Eyerdam (1960), Howard (1937, 1950, 1955), Magnusson (1932), Merrill (1913), and Ryan (1985) list.species found.in WA. Magnusson (1939), Miller-.,& Shushan (1964), Pike (unpublished) deal with lichens in OR, and Imshaug (1957) presented data-on alpine lichens from both states. Thomson (1984) and Vitt, et al. (1988) provided distributional and ecological information on species for both WA and OR. Information on one species came from Tonsberg (1993).

Taxonomic treatments: In addition, distributional or other data were searched for in the following taxonomic works'(mostly monographs.or synoptic treatments) on particular genera or families, for North America: Brodo (1984, 1991), Brodo & Hawksworth (1977), Culberson & Culberson (1968), Degelius (1974), Dibben (1980), Esslinger (19 , 1973, 1977, 19), Gowan (1989), Goward (19 , 19' , 19), Goward & Ahti (1986), Goward & McCune (1993), Hammer (1993), Imshaug & Brodo (1966), Poelt & Nash, (1993), Sheard (1974,' 1992), Sierk (1964), Thomson'(1950, 1963, 1967, 1968, 1976, 1987, 1989, 1991), Timdal (1986), Wetmore (1960), and Wright (1992). Although I also examined a few world-wide treatments (e.g., Timdal, 1991), the.distributional data in most of these appeared to be to generalized to be of much use. Of the treatments that gave fairly specific information (more than just that the species occurred somewhere in WA or OR), most listed collections from the west side or from Idaho or Montana, but few cited specimens from eastern WA or OR. I also of course consulted my own publications and unpublished manuscripts; among my published taxonomic treatments, only Ryan & Nash, 1993a,b) gave information on species in eastern WA or OR.

Ecological studies including sites in eastern WA or OR: Only in a few areas of the Columbia Basin of OR and WA, have the lichens been studied intensively from an ecological perspective. The only. previously published attempt to group lichens of this region into associations is the study by Cooke (1955) in Spokane, Stevens, and Whitman Counties of WA. Only a few other studies in this region, mainly those by Douglas and Bliss (19) in the north Cascades of WA, Palmer, et al. (1990) in Baker Co., OR, and Rossman (1992), in the Lawrence Memorial Grassland in Wasco County, OR, provide'enough detailed information to relate particular lichen species to particular vascular plant communities or habitat types.. Information on lichens in relation to air quality in the Pacific Northwest is given by Peterson, et al. (1992).

Studies based mainly on other. parts of the Columbia Basin **region:** Ecological studies dealing primarily or exclusively with Idaho, but providing data relevant to eastern WA and OR, include

those by McCune (1992) and Rosentreter (1992, 199). Information on particular taxa was presented by DeBolt (1992), McCune (1992), Rosentreter & McCune (1992). Information on ethnobotany of lichens in parts of British Columbia adjacent to eastern WA is presented by Turner, et al. (1980).

Studies of lichen ecology and distribution in other parts of the country or world: A relatively small-number of these are cited under particular topics in various parts of this report. Due to-time limitations'it was not feasible for me to make exhaustive searches and citations of the thousands of references to lichen ecology based on other regions. However, many of the ideas expressed simply as my opinion were influenced by my 'earlier readings of many'of these studies.

Other relevant reports on lichens, not seen by me: There are several reports from additional studies on lichens in the Columbia Basin region that I have not yet seen. Unpublished reports include a study, of the lichens of Kamiak Butte (Whitman co., WA) by Kathleen Sayce, studies on lichens as caribou forage in the Colville National Forest, WA by Amy Snow, a study of lichens in eastern WA for which only the abstract has been publisehd (Neuchterleim, 1976), and a manuscript on lichens of WA by Foster (cited by Howard, 1950). Two published reports I did not see were a study of the "Danthonia-lichen-moss community" in WA (not necessarily in the Columbia Basin), by, Denack (1959), and a report on collectionsmade by Suksdorf (Weber, 1944).

Studies on vascular plants and environmental features of the Columbia Basin: I have relied particularly on the treatment of vegetation of OR and WA by Franklin & Dyrness (1973). Otherwise. it was not feasible for me to examine more than a small sampling of other reports, which are cited under the relevant topics.

14. BIOINDICATORS

A. INDICATORS OF POLLUTION

Air pollution: The use of lichens as indicators of air quality in wilderness areas in the Pacific Northwest is discussed in more detail by Peterson, et al. (19).

Species'sensitive to oxidants:' The following species are at least moderately sensitive to oxidant pollution (presumed to be ozone, unless noted otherwise) and are widely distributed and often abundant in eastern WA or OR: Alectoria sarmentosa, Brvoria abbreviata, B. fremontii, B. glabra, Cladonia spp., Collema spp., Leptochidium albociliatum, Leptogium californicum, Parmelia sulcata, Peltiaera canina, P. collina, P. didactvla, P. rufescens, Platismatia alauca, Rhizoplaca chrysoleuca (sensitive to nitrous oxides/PAN), Tuckermannopsis merrillii, Vulpicida canadensis, Xanthoria candelaria, and possibly X. fallax (sensitive to nitrous oxides/PAN, but apparently not to ozone). Several other species are also sensitive to oxidants, but are probably too rare or restricted in distribution in the WA/OR part of the Columbia Basin to be of much use as indicators: Calicium viride, Evernia Drunastri, Melanelia subaurifera, Phaeophyscia orbicularis, P. sciastra, Pseudocyphellaria anthraspis, Ramalina farinacea, and Usnea spp.

Species sensitive to sulfur dioxide: The following species are at least moderately sensitive to sulfur-dioxide, and are common in the region: Acarospora "chlorophana", Brvoria capillaris, Candelaria concolor, Cladonia fimbriata, Phvsconia detersa, Rhizoplaca chrvsoleuca, R. melanophthalma, Tuckermannopsis chlorophylla, Xanthoparmelia cumberlandia, Xanthoria fallax, and X. polycarpa. Additional species that are sensitive to sulfur dioxide; but probably not common enough in eastern Washington and Oregon to be useful as indicators are: Brvoria implexa, B. trichodes ssp. americana, Cladina ransiferina, Cladonia bellidiflora, Lobaria oregana, L. pulmonaria, Usnea filipendula, and U. subfloridana

Species sensitive to fluoride: The-following species are at least moderately sensitive to fluoride and are common in the region: Brvoria capillaris, Candelaria concolor, Cladonia fimbriata, Hypogymnia Dhvsodes, Parmelia saxatilis, P. sulcata, Peltisera canina, Phvscia adscendens, P. aipolia, P. dubia. Other species sensitive to fluoride, but probably not common enough in the-region to be useful as indicators, are: Evernia prunastri, Phaeophyscia orbicularis, Phvscia tenella, Ramalina farinacea, Usnea subfloridana.

Bioindicators

Water quality, conditions, or amount: Lichens characteristic of permanently or periodically inundated rocks in the Columbia Basin include Aspicilia spp., Dermatocaroon spp., Hymenelia lacustris, Hydrothyria venosa, Staurothele spp., and Verrucaria spp. n addition to some species of Rhizocarpon (which probably tolerate, more than require, periodic submersion, and definitely occur in the Columbia Basin), other crustose taxa, which occur on wet rocks on the west side and are likely to be found on the east side include Bacidia inundata, -and various species of Ionasois, Lecidea, Porina, Poroidia, and Trapelia. Although no definite information is available on their response to water pollution, -various observations suggest that these taxa are likely to be useful bioindicators of water quality, as discussed below.

Species sensitive to eutrophication: According to Richardson (19 , Vanishing Lichens), at least some aquatic or semi-aquatic lichens (such as Dermatocarpon luridum) are probably very sensitive'to water pollution, as they are only found in fast-flowing upland streams where there has been little enrichment (eutrophication) from man's activities.. James, et al. (1977) point out that aquatic lichens are particularly vulnerable to organic fertilizers, which promote growth of cyanobacteria and green algae that smother the lichens by covering them and competing with them for gases. This is especially applicable to crustose lichens, but nitrogen-fixers such as Hydrothyria are also likely to be affected, since they are probably adapted for living in-nitrogen-poor conditions; Dense growth of cyanobacteria, green.algae, or higher plants floating on the surface prevents light from reaching the lichens..

Species sensitive to 'changes in **pH** due to pollutants: In most areas of the Columbia Basin where aquatic lichens occur, conditions.are somewhat acidic already because of the rock type. If the lichens require such conditions, alkaline pollutants could be damaging; however, increased acidity due to acid rain or chemicals' flowing into the water is also likely to be detrimental.' Nitrogen fixers such as Hydrothyria are likely to be especially, sensitive to toxic substances that interfere with nitrogenase activities;

Species sepsitive to other changes in water quality or. conditions: Water-inhabiting lichens are also likely to be affected by various kinds of toxic chemicals from agriculture, industry; or other human -activities. 'Removal of trees or shrubs along waterways, by logging, clearing, or fire, will increase the water temperature and also introduce sediments. and debris, which deprive the lichens of air and light. Hydrothyria, Hymenelia, the more strictly aquatic species of Dermatocarpon and Staurothele, and at least some aquatic species of Verrucaria, are restricted to water that is cold and clear, and although lichens sometimes grow in oligotrophic lakes, especially in subalpine or alpine areas, they more typically occur inrapidly moving water, 'or at least in pools having steady flows of water into and out of

Bioindicators

them.

Species sensitive to changes in the' amount of water: The truly aquatic lichens show abnormal respiration if dessicated for quite short periods, suggesting that they may sensitive to changes in environmental conditions in general (Richardson 19). In the Columbia Basin, at least one lichen,, Hydrothyria, definitely requires being constantly submerged, but lichens also need to be close enough to the surface to have sufficient light. Thus either-lowering or raising of lake levels, diversion of water from streams and rivers for hydroelectric projects or other uses, and formation of reservoirs, all have a notable impact on aquatic lichen communities (James, et al., 1977). Removal of 'trees overhanging.the water may also reduce water levels due to increased evaporation. On the other hand, activities that significantly raise water levels (e.g., formation of reservoirs) obviously will also drown numerous species of non-aquatic or semi-aquatic saxicolous and terricolous/muscicolous lichens.

Agricultural chemicals

The following species are at least moderately sensitive to, one or more types of herbicides, fungicides, or fertilizers: Candelariella vitellina, Peltiaera aphthosa s. lato, P. canina s. lato, Peltiaera oraetextata, and Phvscia caesia, and to a lesser extent Hypogymnia phvsodes, Lecanora muralis, Pannelia sulcata, and Rhizocarpon geographicum.

B. INDICATORS OF ECOSYSTEM CONDITIONS

Old-growth forests

More detailed information on the occurrence of various lichens in particular successional stages on each major kind of substrate is presented and discussed in Section 4.

In the moister, cooler forests (montane to subalpine areas, and along the Columbia River), a well developed flora and vegetation of the following main groups of lichens is probably a good indicator of old growth conditions: cyanobacterial genera, e.g., species of Nephroma, Peltiaera (other than the common, drought-tolerant members of the P. canina complex), and, in moister forests, Lobaria and Pseudocwhellaria, crustose members of the order Caliciales (e.g., Calicium and Chaenotheca), and perhaps Alectoria (e.g., A. sarmentosa), Brvoria (other than B. abbreviata), and Cladonia (species other than the common, drought-tolerant members of the C. chlorophaea group). There are undoubtedly other species particularly associated with these types of forests in eastern WA and OR.

For the drier, warmer forests (e.g., ponderosa pine), there is even lesss information on what species or groups of lichens might be characteristic of old-growth. However, the abundance of the dominant foliose and fruticose lichens (Brvoria, Hypogymnia, Letharia, Tuckermannoosis and Vulpicida), and diversity of species, probably give some idea of the age of the forests..

Bite characteristics and potential biomass productivity in shrub-steppes

Rosentreter (1990) suggests that (at least in Idaho), high cover by lichens (particularly Xanthoria spp.) on Artemisia tridentata may be a useful indicator of low potential productivity (slow eccentric stem growth, open canopies, and dieoff) of the shrubs at the site, and it reflects long-term environmental conditions (e.g., very dry soils, and dustiness) rather than an individual year's moisture. However, since lichen cover may also be increased by agriculture-related nutrient enrichment (which might have a positive effect on the vascular plants at the site), some further study would be desirable. My own observations (e.g., in Yakima Co., WA) suggest that the bright greenish yellow Candelaria concolor is also likely to be a useful indicator in sagebrush communities, in addition to the orange Xanthoria.

Range conditions (in relation to fire and livestock grazing)

In general, a well developed crust or vegetation of ground-inhabiting lichens is probably a useful indicator of "healthy" ecosystems.

Texasporium sancti-iacobi is potentially valuable as an indicator species for sagebrush steppe communities (McCune, 1992). Its presence may serve as an indicator of extended

periods without fire and overgrazing. Howver, much more must be learned about the dynamics of biotic crusts and their resilience to various types of disturbance before we can understand Texasporium's place in arid ecosytems.

Other ground-inhabiting lichens that have been found at localities described as having "pristine" or "excellent" range conditions include: Caloplaca sp., Candelariella "citrina", C. terrigena, Catapyrenium lachneum, Diploschistes "muscorum", Leptogium burnettiae v. hirsutum, Psora "rubiformis", Toninia ruginosa, and Xanthoparmelia plittii.

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APPENDICES

'LOCALITIES

Use a global replace command to change "WSU" to "WS" (the correct acronym for that herbarium).

OREGON

CROOK CO.: Maury Mountains, SE of of Prineville, 1/5 m,i N of Colby Springs, 1350 m, L. Pike (OSC). 6 mi E of Redmond, M. Dotv (OSC).

DESCHUTES CO.: Near Redmond, F. Sine (OSC). Road between Sisters and Redmond, F. Sipe and 0. Ireland (OSC). Bluffs of Big Green Lake, Three Sisters, L. Henderson (OSC). Near Doris Lake, Three Sisters Wilderness, 1605 m, L. Pike (OSC).

HARNEY CO.: Bend-Burns Highway near, Burns, Sipe (OSC)

HOOD RIVER CO. (E. Slope of Cascades, OR): Hood River Meadows, 1350 m, J. Davis. Laurance Lake, 900 .m, "R9E, T1S", S27, J. Davis. Viento State Park, 30 m, T3N, R9E, S34, J. Davis. Ruthton Park, 120 m, T3N, R10E, S29, J. Davis.

JEFFERSON CO.: 3 mi W of Cold Spring Camp, L. 'Pike (OSC). Metiolus River near Camp Sherman, A. Sweetser (OSC).

LAKE CO.: Picture Rock Pass, near Silver Lake, 1350-1440 m, J. Davis.

UNION CO.: Hilgard Junction State Park, 10 mi W of La Grande, 960 m, J. Davis. Whitman National Forest: Starkey Experimental Unit, 1245 m, J. Davis. Locality?, 1350 m, J. Davis

WASCO CO.: Rowena, 150 m, 'J. Davis.

WASHINGTON

KLICKITAT CO.: Locality?, 600 m, J. Davis

E. Slope of Cascades: Brooks Memorial State Park, 810 m, T5N, R17E, S3, J. Davis. N of S.R. 14, milepost 70.4, 90-150 m, T3N, R11E, S35, J. Davis. Major Creek, 120 m, T3N, R12E, S30, J. Davis. W. Major Creek, 600 m, T4N,R11E, S34, J. Davis. Catherine Creek, 90-180 m, T3N, R11E, 525, open land to mixed oak-ponderosa pine, J. Davis. Ice Caves, 840 m, T6N, R9E, S36, J. Davis. Locke Lake, 30 m, R3N, T11E, S35, J. Davis., Glenwood Road,.480 m, R6N, T13E, S14, J. Davis. Timber Valley Road,-630 m, T3N, R12E, S2, J. Davis. 'Balsh Road, near cemetery, S29, J. Davis.

Columbia Plateau: SR 14, milepost 98.2,.180 m, T2N, R15E, "S15?" J. Davis. S.R. 14, milepost 85.2, Horsethief Lake State P&k,.120 m, T2M, R13E, S24, J..Davis. John Day Dam to Towal, SR 14, milepost 108-111.8, 105-150 m, J. Davis,

WHITMAN CO.: 1/4 mi up the Palouse River from Glenwood, 6 mi NE of Colfax, Waaner (OSC). Hillside across from city field, Pullman, Wagner (osc).

Localitiy data

EAST SIDE CONTRACT

LOCALITIES AND COLLECTORS

STATE?

Salmon Arm, J. R. Anderson

OREGON.

Blue Mountains, W. Cusick (OSC).

BAKER CO.:' Powder River Mountains, C. V. Piper. Province 41-9: (See labels for lat., long., elev.'). Magpie Peak, 20 km NE of Baker, 1200 m (4000 ft), on schist, F. Palmer. 44o48'30"N, 117°43'30"W, Flagstaff Hill, 7 mi NE of Baker, N of Oregon Hwy 86, basalt, 1100 m (3600 ft), F. Palmer. 44°55'N, 117°55'W, Coyote Point, NE of Haynes, near Baker', granite, sagebrush, 1035 m (3400 ft), B. Rvan. Upper Bayhorse Creek, N of Ontario, 675 m (2200 ft), stiff sage habitat, R. Rosentreter.

CLACKAMAS CO./HOOD RIVER CO. (Province 39/40): Mt. Hood National Forest: Top of Mt. Hood, 4200 m (11235 ft), F. Rhoades (OSC).

CROOK CO.: Province 42-l: 44^19'30"W, 120°35'30"W, ca. 30 mi SW of Mitchell, S side of Hwy 126, 12.5 mi W of Wheeler Co. line and summit, just W of Ochoho Nat. Forest, Pinus oonderosa and basalt outcrops, 1005 m (3300 ft), B. Ryan. Province **41:** Juniper desert in shade of rimrock, in "plateau area" specific locality not recorded, 1350 m (4500 ft), L. Pike.

DESCHUTES CO.: Locality not recorded, 1006 m, Christv (OSC). Locality not recorded; dry open ponderosa pine forest, in shade on N side of lava rock, 1200 m, L. Pike (OSC). Locality not recorded, 1300 m, McCune (herb. Rosentreter).

'Province 40: Deschutes National Forest: 0.5 km SW of Indian Ford Campground, open ponderosa pine forest with aspen, 990 m, L. Pike (OSC). Unspecified, W. Dunlap (OSC). 1 mi E of McKenzie Pass, 2425 m (8000 ft), L. Eslick. McKenzie Pass (Dee Wright Observatory), F. 'Rhoades. Doris Lake W of Elk Lake, E of the Cascade Divide, 1300 m, L. Pike (OSC). 4 mi W of Sisters off Route 242; 1050 m (3500 ft), R. Rosentreter. Sisters, 900 m (3000 ft), F. Rhoades (OSC). Rill into Big Green Lake, on South Sister, L. Henderson (OSC). Small stream which feeds into Golden Lake from the SE, 15 mi from the lake, 2000 m (6350 ft), Collector not recored (OSC).

Province 41-4: Juniper Wayside, ca. 7 mi E of Sisters, Juniper-sage desert, 875-900 (2900-3000 ft), W. Denison;F. Rhoades;L. Pike;L. Pike & A. Rossman; D. Wagner (OSC). Near

Localitiy data

Redmond, K. Whited. 44°17'30"N, 121°24'30"W, along US Hwy 126, 13 mi W of Redmond, 7 mi E of Deschutes River State Park, E of town of Sisters, juniper-sagebrush, andesite; 875 m (2900 ft), B. Rvan. 40 km W of Bend, S. Sundberq. 8 mi W of Sisters on Hwy' 126, Juniper.-desert community, 960.m (3200 ft), J. Koutsky (OSC). Lower Bridge Road, ca. halfway betweeen Sisters and Redmonds, W. Schofield.. E of Sisters, Denison. Top of Pine Mountain, in high desert, Pike (OSC). 9 mi E of Bend, W. Lawrence: (OSC). Deschutes National Forest: Lava Fields ca. 16 mi SE of Bend, I. & E. Simmons.

Province 41-7: Deschutes Natiohal Forest: Paulina Lake' Trail, NE side of Paulina Lake in Newberry Crater S of Bend, 1600 m (5350 ft), L. Pike (OSC) .

GILLIAN CO. (Province 41-2): N of Condon, 825 m (2700 ft), 12-14' precipitation, loamy soil, excellent range'condition, A. Bahn. I-84 milepost 134.6, 2 mi W of Arlington, halfway between the Dalles and.Pendleton, relict sagebrush habitat, R. Rosentreter.

GRANT CO. (Province 42): Tygh Valley, John Day region, M. A. Flinn. John Day Fossil Beds National Monument, 11 km NW of Dayville, T. Goward. John Day River (erroneously labeled as' being in the Monument), 12 km NW of Mitchell; T. Goward. Locality not recorded, stiff sage community, 120 m (400 ft), R. Rosentreter. 20 miles N of John Day, near the Blue Mountains, junction of stream and U.S. Hwy 395, R. Rosentreter. Ferris Creek Cap Rock, 960 m (3200 ft), R. Rosentreter. 44°39'N, 118°25'W, intersection of Hwy 7 between John Day & Sumpter, and the road going W to Greenhorn, 11 mi E of Greenhorn. Scattered rocks among pines & grass; S-facing gentle hill,. 1550 m (5100 ft), B. Ryan. 44°26'N, 119°17'30"W, 13 mi E of Dayville, 0.1 mi up Fields Road (exhibit of Mascall Formation diatomite) S of US Hwy 26, W-facing outcrop, and loose basalt rocks above it, open, grassy area, 800 m (2650 ft), B. Rvan. Between Strawberry and Little Juniper drainage; A. Bahn.

Province 42-3: Malheur Nationai- **Forest:** S of Prane City, S. & S. Sharnoff. Blue Mountains, 1575 m (5125 ft), top of high ridge, W. E. Lawrence. 'Blue Mountains, V. J. Krajina. Province **42-6: Malheur National** Forest: Above Strawberry Camprgound, S of Prairie City; [ca. 1525-1825 m (5000-6000 ft)], S. & S. Sharnoff (herb. Rosentreter).

HARNEY Cd. (Province 41): (Mostly Bureau of Land Management lands): Specifics not recorded, L. Pike. Specific locality not recorded,' 1400 m, stiff sage habitat with scattered juniper, B. McCune. NE of Oakerman Lake, T22S, R28E, S31, A. V. Bahn.

Province 41-15: Alvord Desert, F. Rhoades. Big Alvord Creek Canyon, F. Rhoades., Little Alvord Creek, F. Rhoades.

Localitiy d a t a

Province 41-8: Stinking Water Pass, 6 mi E of Buchanan, stiff sage habitat, R. Rosentreter. 2 mi E of Buchanan, off Hwy 20, R. Rosentreter. 4 mi E of Buchanan, 1150 m (4800 ft), stiff sage habitat, R. Rosentreter. Diamond Craters, F. Rhoades. Young lava beds NW of Diamond, [ca. 1100 m (3600 ft)], "little vascular vegetation, but heavy cryptogam cover**, L. Pike (OSC). 3 mi N of Frenchglen, juniper-sage desert, [ca'. 1100 m (3600 ft)], L. Pike (OSC). Ridgetop 1.2 mi W of Frenchglen, juniper-sage desert, L. Pike (OSC). 9 mi E of Burns, W. E. Lawrence) 10 mi S of Burns on Hwy 205, juniper-sage desert, L. Pike (OSC). Wright's Point, W of Malheur Lake', 10 mi S of Highway 78, S of Burns, S. Sundberg. Drinkwater Pass, 1260 m (4212 ft), R. Rosentreter. Malheur Field Station, 15 mi S of Burns, 1050 m (3500 ft), sagebrush shrub: steppe, R. Rosentreter. Hat Butte, 25 mi SE of Burns, 1325 m (4400 ft), R. Rosentreter. Malheur National Wildlife Refuge, [1000 m (3600 ft)], H. Chambers (OSC).

Province 41-13/14: Summit of Steens Mountain, '3000 m (9900 ft), L. Pike (OSC).

Province 42-4?: Locality not recorded, 2400 m' (7800 ft), aspen zone, C. G. Hansen.

HOOD RIVER CO.: Locality not recorded, Lloyd (OSC).

Province 40: Mitchell's Point, a rocky prominence along the Columbia 'River, 5 mi E of Hood River, 350 m (1170 ft), Suksdorf. Viento State Park, ca. 7 mi W of Hood River, D. Jaques (OSC). Lower Hood River, Hood River Garden Club (OSC).

Province 40: Mt. Hood National Forest: Mt. Hood, Roe11 (Müller, 18). Cloud Gap, northeast slope of Mount Hood, 1950 m (6300 ft), Shushan (Miller.& Shushan, 1964). Cooper Spur Ski area, J.-Davis.

JEFFERSON CO.: Specific locality not recorded, L. Pike. Specific locality not recorded, H. Chambers. Specific locality not recorded, 1050 m (3500 ft), ponderosa pine forest, J. Koutsky. 900 m (3000 ft), J. Hickman (OSC). 900 m, M. Averill (OSC).

Province 40: Willamette National Forest: 2 mi SW of Camp Sherman, 900 m (3000 ft), open ponderosa pine woodland, H. Chambers (OSC). 3 mi N of Hwy 20, off road to Camp Sherman, ponderosa pine woods, H. Chambers (OSC). 1 km W of Camp Sherman, open western larch-ponderosa pine forest, 910 m, L. Pike (OSC). 0.5 mi W of Camp Sherman, ponderosa pine forest, 900 m (3000 ft), Pike & Rossman (OSC). Camp Sherman [labels say "Deschutes Co.**], Llovd, OSC. Near Camp Sherman, 44°30'N, 121°40'W, F. Rhoades. 15 mi NW of Redmond, 2400 ft, pristine habitat, R. Rosentreter. Santiam Pass, Little Nash Sno-Park, 60 km NW of Bend, 5400 ft, R. Rosentreter,: Near source of Metolius River, F. Rhoades; W. B. Schofield & J. H. Lyford. Mt. Jefferson Wilderness, Carl Lake, open Douglas fir forest, A. Rossman (OSC). S shore of Suttle Lake at the Forest Camp [off Hwy 203, fir-douglas fir forest,

Localitiy data

3440 ft, L. Pike (OSC). Suttle Lake [labels say "Deschutes Co."], Llovd (OSC).

KLAMATH CO.: No data, J. Koutskv (OSC).

Province 40-2: Rest area on Hwy 97, S of La Pine, 1500 m; L. Pike (OSC). Province 40-2: Deschutes -Nation+ Forest: Rosary Lake shore near Ode11 Lake [label says Deschutes Co.?], F. Sine (OSC). Province 40-3: Along the "Dalles-California Highway", E of.-Crater Lake, Sipe (Magnusson, 19).

Province 40-3: Crater Lake" National Park: 7.000 ft, No data, F. Sine (OSC; Magnusson, 19__, Western American Lichens, mainly from Oregon); Castle Creek, F. Sine (OSC). Mazama Rock area, Sipe (OSC).

Province 40-3: Winema National Forest: Brown Mountain Lava Field, S side of-Hwy 140, 3 mi W of Lake of the Woods, 1635 m, B. Rvan (ASU, OSC).

'Province 41-10: Winema National Forest: Hwy 140, 2 'mi S of junction with Sprague River Road, 1400 m, basalt,. scattered ponderosa pine, B. Rvan (ASU, OSC).

Province 41-10: Fremont National Forest: Near bunkhouse, ca. 5 mi WNW of Bly, 1450 m, pine forest, B. Rvan (ASU, OSC). Swing Field, NE side of Road 335, near Road 127, 1400 m, B. Rvan (ASU, OSC). Rocky Flat, W side of Road 335 near junction with Road 025, 1430 m, B. Rvan (ASU, OSC). Devils Garden, S 'side of Road 34,' W of Road 335, ca. 4.5 mi NE of Bly, 5600 ft, B. Rvan. Sprague River Picnic Area, N of Hwy 140, E of Bly, 1350 m, B. Rvan (ASU, OSC). Pooch Timber Sale, just N of Otto Boye Flat, 1700 m, B. Rvan (ASU, OSC). Road 3678, just S of Road 119, 6 mi W of Bly, 1500 m, B. Rvan (ASU, OSC). Whiskey Timber Sale, N side of Road 14, 1500 m, B. Rvan (ASU, OSC). 42°23'N, 121°22'30"W, 3 mi NE of Bly Summit, Oregon Hwy 140, 37 mi E of Klamath Falls, Douglas fir zone, andesite, 1340 m (4400 ft), B. Rvan. Gearhart Wilderness: Beyond unnumbered road off road 028, near Sheepy Creek, W part of wilderness, 2000 m, B. Ryan (ASU, OSC). Beyond end of road 043, NW part of wilderness, 1950 m, B. Rvan (ASU, OSC).

LAKE CO.

Locality not recorded, 4800 ft, J. 'Davis. Locality not recorded,, basalt cliffs, 4500 ft, Pike (OSC) and South end of Silver Lake, high desert, Pike (OSC)--same locality? (both Dimelaena oreina).

Province 41-10: Near Fort Rock, 1350 m, L. Pike (OSC). 42°13'N, 119°04'W, along Hwy 140, 26.5 mi E of Lakeview, just W of Adel, sagebrush, basalt, 1650 m (5500 ft), B. Rvan. Milepost' 34, 5 mi S of Horse Ranch on Hwy 31, 1400 m, high desert with sagebrush, juniper and pine, L. Pike (OSC). Lower end of Bullard Canyon, E edge of town of Lakeview, 1535 m, B. Rvan (ASU, OSC). Rimrock ca. 3 mi N of town of Silver Lake, 4400 ft, L. Pike

Localitiy data

(OSC). Abert Rim, I. & E. Simmons. Valley' Falls, S end of Abert Rim,. I. & E. Simmons.

Province 41-11: 9 mi N and 4 mi E of Plush (NE of Lakeview), towards Hart Mountain Antelope Refuge, K. Young.

Province 41-10: Fremont Nat. Forest (Bly District): 42°17'N, 120°45'30"W, 5 mi E-of Quartz Mtri summit, near Drews 'Creek, along Hwy 140 between Lakeview & Klamath Falls, pines, basalt, B. Ryan. Along Buckboard' Creek, 1600 m, B. Ryan (ASU, OSC). Jack Creek, near junction with S Fork of Sprague River; 1730 m, B. Ryan (ASU). N side of Fishhole Mountain, W of Road 019,. 1800 m, B. Ryan (ASU, OSC). Between Heart Lake and Big Swamp Reservoir, 1650 m, B. Ryan (ASU, OSC). SW side of Road 012, just S of Gearhart' Wilderness, near Lookout Rock, 1930 m, B. Ryan (ASU, OSC). S Fork of Sprague River, near where Road 34 crosses it, 1750-m, B. Ryan (ASU, OSC). (Paisley District): Road 3315, ca. 7 mi SW of Paisley, juniper-sagebrush, B. Ryan (ASU, OSC). Gearhart Wilderness: Palisade Rocks, SE part of Wilderness;- 1950 m; B. Ryan (ASU, OSC). Trail to Palisade Rocks, B. Ryan (ASU, OSC). S Fork of Sprague River, SE part of Wilderness, 1825 m, B. Ryan (ASU, OSC). Dairy Creek, 1915 m, B. Ryan (OSC). First mile of trail to Blue Lake, NE part of Wilderness, 2000 m, B. Ryan (ASU, OSC). 0.5 m N of northern end of Road 095, S part of Wilderness, 2000 ft, B. Ryan (ASU, OSC).

MALHEUR CO. (Mostly Bureau of Land Management lands): Locality not recorded, 910 m, McCune. Near Coal Mine Basin Badlands; shadscale habitat, T27S, R46E, S24, R. Rosentreter.

Province 41-9. Just N of' the Wolf Creek overpass of I-84, N of Ontario, pristine habitat, R. Rosentreter.

Province 41-15 5 mi W of Rome just N of U.S. Hwy 95, [ca. 1325 m (4300 ft)], shadscale and winterfat habitat, R. Rosentreter. Just E of Rome, 2600 ft, R. Rosentreter. Succor Creek Fossil Beds, NW of Jordan Valley, 1200 m (400 ft), sagebrush grassland, K. Larsen (herb. Rosentreter). Leslie Gulch area, 910 m (3000 ft) and 1225 m (4000 ft), R. Rosentreter. 10 mi W of Harper (50 mi W of Vale), 9-11 inches precipitation, R. Rosentreter. ,

MORROW co. : Province 41-2: E side of Boardman Bombing Range, sandy soil, 8-10 inches precipitation'zone, 180 m (600 ft), grassland, excellent range condition, A. B. Bahn.

UMATILLA CO.:

Province 41-2:' Hat Rock State Park, F. Rhoades (OSC).

Province 42-2: Umatilla National Forest: Blue Mountains, Tollgate, R. Swena.

UNION CO. (Province 42): Specific locality not recorded, 960 m (3200 ft), 1250 m (4100 ft) and 1350 m (4500 ft), J. Davis.

Localitiy data

Province 42-2: Umatilla National Forest: Blue Mountains, 20 mi W of La Grande, 1097 m, shallow scablands over basalt, R. Rosentreter. 10 mi W of La Grande, Blue -Mountains, 1000 m, R. Rosentreter.

Province 42-10. Wallowa-Whitman National Forest: 15 mi E of La Grande, Wallowa Mountains [one label says **edge of Blue Mountains"], sheltered canyon, basalt cliffs and Doug fir forest, 914 m, R. Rosentreter.

UNION CO./WALLOWA CO.: Province 42-10: Wallowa-Whitman National Forest: Eagle Cap Wilderness Area: Eagle Cap (Imshaug, 1957).

WALLOWA CO.:

Province 42-10: Wallowa-Whitman National Forest: Wallowa Mountains, 710 m (2000 ft), mixed Douglas fir forest, R. Rosentreter. Eagle Cap Wilderness: Hurricane Creek between Falls Creek Forest Camp and Granite Creek, 1825 m (6000 ft), mixed conifer forest, L. Pike (OSC). Upper Lostine River Valley [some labels add "S of Lostine"], 1050-1525 m (3500-5000 ft), S. Hammer (herb. Rosentreter). Frazer Lake, 2200 m (7100 ft), Giese (OSC). Trail above Wallowa Lake, Hammer (herb. Rosentreter).

Province 42-11: Wallowa-Whitman National Forest: Road to Hat Point, 2 mi E of Imnaha, [ca. 900 m (3000 ft)], S. Hammer. Roadside 4.6 mi E of Imnaha, [ca. 1525-1700 m (5000-5500 ft)], S. Hammer. Summit Springs Forest Camp N of the town of Wallowa, 1325 m (4400 ft), closed-canopy, mixed conifer forest, L. Pike (OSC). 50 mi S of Lewiston, ID, 300 m (1000 ft), R. Rosentreter.

Province 42-12: Wallowa-Whitman National Forest: Doug Bar on the Snake River, Hell's Canyon National Recreation Area, 775 m (2600 ft), grassland and basalt rocks, R. Rosentreter.

Province 42-13: Minam State Recreation Area, Hammer (herb. Rosentreter). Just S of Slickfoot [**Slick Rock**] Creek, 1575-1825 m (5025-6000 ft), mixed conifer forest, L. Pike (OSC). Flora (a ghost town), and 1 mi E of it, 45°50′N, 117°20′W, M. Monahan. E of bridge crossing Wallowa River at Minam on Hwy 82, E of road, open ponderosa pine forest, N. Fredericks (OSC).

WASCO CO. : Specifics not recorded, 150'm (500 ft), J. Davis.

Province 40-l: Western part of county, Suksdorf. Near Mt. Hood, F. Sipe (OSC). The Dalles, R. A. Darrow. Mayer State Park, W of Rowena, near junction of Old Columbia Gorge hwy and hwy 80, Garry oak stand, C. Fellows (OSC). Near viewpoint'in Rowena Loops area of Mayer State Park, C. Fellows (OSC).

Province 41-l: Lawrence Memorial Grassland Preserve, 4 km SW of Shaniko, 1150 m (according to labels; 990–1050 m according to Rossman, 1992), Pike, et al. 48 km N of Madras between Shaniko and Antelope along Ward Creek, 1150 m, biscuit scabland, A. Rossman; L. Pike, et al. (OSC). Near confluence of the Columbia and John Day Rivers, 1/4 mi S of the freeway, S. Sundberg.

Localitiy data

WHEELER CO.: Province 41-1: John Day Fossil Beds National Monument: Painted Hills "State Park" [sic], R. Fogel (OSC). Province 42-3: 44°33'N 120°03'W, 5 mi E of Mitchell (31 mi W of Dayville), N side of US Hwy 26, junipers, basalt, 1325 m (4400 ft); B. Ryan. Along US Hwy 26, 25 mi W of Dayville, 1200 m (3900 ft); 44°31'30"N, 119°57'N, B. Ryan. 4 mi E of John Day River, 1225 m (4000 ft), sagebrush grassland, R. Rosentreter.

Localitiy data

'WASHINGTON.

Bay Springs ("Eastern Washington"), L. M. Alderson. Gate, Foster, Blue Mountains (Asotin, Columbia, or Garfield Co., Province 36), S. Ciavton. Blue Mountains, 1050 m (3500 ft) ["Whitman Co.", but the Blue Mountains do not extend that far northeast], G. Howard. Locality? (Plant Ecology field trip to Columbia Basin, Artemisia riqida-Eriogonum thvmoides community) (Province 36), B. Rvan. Locality?. ("Eastern Washington"), M. Monahan. "Box Canyon" (Yakima Co.?), B. Rvan. Eastern slope of the Cascades, Brandegee (FH).

ADAMS CO./WHITMAN CO. (Province 36): 46°47'N, 118°07'W, along Hwy 26, 11 mi E of Washtucna, 2 mi E 'of Hooper, lava rocks, 365 m (1200 ft), [labels say "Whitman Co."], B. Rvan.

ASOTIN CO. (Province 36): Asotin,' 'F. L. Picket Buffalo Rock, Snake River Canyon, G. N. Jones. Fields Springs State Park, [ca. 1100 m], S. Hammer; 46°24'30"N, 117°15'30"W, 11 mi W of 'Clarkston, E of Alpowa Summit; along Hwy 12, horizontal surfaces at base of S-facing cliff, lava rock, 365 m (1200. ft), B. Rvan. . . 46°25'30"N, 117°07'30"W, 3.5 mi' W of Lewiston, along Hwy 12, across road from (S of)-Snake River, N-facing cliff, lava rock. 2425 m (8000 ft), B. Rvan.

Province 36: Umatilla National Forest: Wenatchee Ranger Station, Blue Mountains; G. N. Jones.'

CHELAN CO. (Province 34): Sahale Arm, [ca. 2000 m], _____ (see Douglas, 1974). Merritt, 740 m (2186 ft), G. Howard.' Near Merritt Springs Inn, G. Howard.. Beaver Summit, 850 m (2800 ft), G. Howard. Flick Creek Drainage, 47°29'N, 120°18'30"W, White. Rock Camp, 650 m (2200 ft), G. Howard. Zena, 800 ft, Howard.. Dirty Face Mountain, 900 m (3000 ft), G. Howard. Wenatchee Lake, 550 m (1800 ft), G. Howard, M. Anderson.

Lake Chelan area: Chelan Valley, B. Stuntz. Chelan Butte, 600 m (2000 ft), G. Howard: E. Martin; N shore of Lake Chelan, S. Klavinf Entiat, 240 m (800 ft), G. Howard.

Wenatchee area: Wenatchee, below Ohme Gardens, 210 m (700 ft)I B. Rvan. 47°30'N, 120°20'W, Rocky Reach Viewpoint and vicinity, ca. 10 mi N.of Wenatchee, 3000 m (1000 ft), B. Rvan.

Wenatchee National Forest:. Icicle Creek, near Leavenworth (8 Mile Lake Trail); G. Howard. West Stevens Pass, Alpine Baldy Mountain, H. Price. U.S. Highway 2, near Wenatchee River,' a few miles N of Leavenworth, G. Baker. Lake Chelan National. Recreation Area: Stehekin Valley,. 350 m (1140 ft), G. Howard. Rainbow Trail, 1150 m (3800 ft), G. Howard. Rainbow Creek, G. Howard. Lake Chelan Sawtooth Wilderness: Hoodoo Pass, [ca. 2200 m], _____ (see Douglas, 1974).

Localitiy data

CHELAN CO./XITTITAS CO. (Province 34): S side of Blewitt Pass, near Iron Creek, G. Howard. Blewitt Pass Region, J. M. Grant.

COLUMBIA CO. (Province 36): New Hope,'450 m (1500 ft), G. 'Howard. N. of Dayton, G. Howard.. Dayton, 510 m (1700 ft). G. Howard.' NE-facing columnar basalt, Highway 12, along Snake River, 46°30'N, 118°0'W, M. Monahan.

Umatilla National Forest: Blue Mountains, 1050 m (3500 ft), 1500 m (5000 ft), -and 1925 m (6300 ft), G. Howard.

DOUGLAS CO.: (Province 36) Lower Grand Coulee, 330 m (1100 ft), G. Howard; Upper Grand Coulee, 460 m (1550 ft), Howard.

FERRY CO. (Province 35):

(Edges of Colville National Forest): Laurier, 495 m (1644 ft), G. Howard. Between Curlew and Danville, 495 m (1644 ft) and 540 m (1773 ft), G. Howard. Republic area: Republic, 800 m (2650 ft)I Foster: G. Howard: G. K. Merrill. N of Republic, 770 m. (2600 ft), G. Howard. Maye's Butte near Republic, Foster: (Howard; 1950). Showers Butte near Republic, Foster (Howard, 1950). Mt. Gibraltar, near Republic, 940 m (3100 ft), G. Howard. Hillside near Sanpoil Lake, 700 m (2360 ft), G. Howard,:Republic, near Sanpoil River, Foster (Howard, 1950).

Colville Indian Reservation: Keller, 600 m (2000 ft), G. Howard.

GARFIELD CO. (Province 36)': Pomeroy, 560 m (1860 ft); G. Howard. 46°27'30"N 117°28'30"W along Hwy 12, 25 mi W of Clarkston, W of Alpowa Summit, S-facing grassy hill, lava rock, 715 m (2360 ft), B. Rvan.

Umatilla National Forest: Blue Mountains, near Pomeroy, E. R. Boquach & L. Mullen. .

GRANT CO. (Province 36): Blackwater Lake, G. N. Jones. Steamboat Rock, 'G. N. Jones. 11.8 mi SW of Ellensburg, B.' & B. Tucker. Frenchman's Coulee (Canyon), Just E of Columbia River, 40 mi E of Ellensberg, B. Tucker; R. Rosenteter. Soap Lake, J. M. Grant; Foot'of Dry Falls, near Couleee Dam, J. W. Thomson. 47°12'N, 119°59'W, Crescent Bar Recreation Area, 7 mi W of Quincy, near river, 300 m (1000 ft), B. Ryan. 47°35'30"N, 119°22'30"W, Lenore Caves, near Sun Lakes State Park, Hwy 17, N of Ephrata, 360 m (1200 ft), X. Glew (herb. Glew, at WTU--data recorded only for Lecanora nseudomellea). 47°09'N, 119°55'W, Stan Coffin Lakes, Quincy Wildlife Preserve, W of Ephrata, 360 m (1200 ft)I K. Glew (herb. Glew, at WTU--data recorded only for Lecanora pseudomellea). Grand Coulee, on rock walls of the coulee, Nash (ASU). Shore of Moses Lake, Everdam.

KING CO./KITTITAS CO. (Province 33/34): Snoqualmie Pass, 905 m

Localitiy data

(3010 ft), Howard.

XITTITAS CO..: Specifics not recorded, L. Pike. Locality not recorded, stiff sage-grassland, 450 m, R. Rosentreter. Ross Lake (NE shore), M. Anderson. Near Lake Naches, R. Jenkins. Rocky Run, R. Weimer & K. LaBounty.

Province 36: 47°10′N, 120°35′W, Reecer Creek Road, NW of Ellensburg, 900 m (3000 ft), B. Ryan. "Cascade Mountains ad Ellensburgh" [sic], Roe11 & Dieck (Müller, 18.; Howard, 1950). Ellensburg, Central Washington State University, B. Ryan. I-90, 15 mi W of Ellensburg, ponderosa pine-Doug fir, L. Pike (OSC). 8 mi S of Ellensburg, along river, cottonwood-ponderosa pine, L. Pike (OSC). Vantage Bridge, Scholander (Howard, 1950). Near Vantage, Eyerdam. Near Vantage, B. Ryan. Yakima River Canyon, 25 km N of Yakima;' T.' Goward. 8 mi S of Ellensburg, L. Pike, Wymer; 20 mi NW of Yakima, sagebrush, basalt, L. Pike (OSC). Frenchman' Canyon, 40 mi E of Ellensburg, sagebrush grassland, 300 m, R. Rosentreter.

Province 34: 47°15′N, 121°15′W, Lake Easton State Park, Snoqualmie Pass highway, .700 m (2300 ft), B. Ryan. 47°10′N, 120°55′W, W. side of Cle Elum, 600 m (2000 ft), B. Ryan. Just S of Cle Elum, H. Klett & D. E. Stuntz. 4 mi W of Cle Elum (wide side road to Roslyn), G. Howard. Yakima River near Roslyn, R. W. Becking. **Cascade of Bosyln [sic]", Roe11 (Miiller, 18__). Roslyn, 850 m (2800 ft), G. Howard. Just W'of Easton, 640'm (2168 ft), G. Howard. Easton, Roe11 (Miiller, 18__). Cle Elum, 675 m (220.0 ft), G. Howard. South Cle Elum, 900 m (3000 ft), G. Howard. U.S. 97 between Teanaway Junction and V. Virdin, G. Howard. Mustange Mine (1/2 mi S of Liberty Cafe), M. Anderson. Cle Elum River, Wasner (OSC).

Snoqualmie National Forest [Wenatchee National Forest?]: Lion Rock, M. Anderson.' Redtop Mountain, M. Anderson. 46°56′30"N, 121°03′30"W, across from *'Whistling Jacks", Cliffdell, N side of Spring Creek Road parallel to and N of Hwy 410, Douglas fir and pine, lava rock, 760 m (2500 ft), B. Ryan. Near. Whistling Jack's Resort, Cliffdell, Hwy 410,. 760 m, B. Ryan. Road.along Little Naches River, 3 mi NW of Hwy 410, 7 mi NW of Cliffdell, hemlock forest, 775 m (2600 ft), B. Ryan. Lake Cle Elum, 660 m (2200 ft), G. Howard. Near Cle Elum, Salmon La Sac 'Road, L. Johnson.

? National Forest: West Side Road (USFS Road 2009), 3 mi from Nelson Diding Road, T20, R14, S34, B. Tucker.

KLICKITAT CO;: Several localities (specifics not recorded), 30 m (100 ft), 90 m (300 ft), 105 m (350 ft), 120 m (400 ft), 150 m (500 ft), 180 m (600 ft), 480 m (1600 ft), 640 m (2100 ft), 825 m (2700 ft), J. Davis'. Locality not recorded, 300 m, rocky savanna and grasslands with Garry oak and bigleaf maple, B. McCune. Columbia' River (not further specified), Suksdorf. Fisher Hill

Localitiy data

Road, 2000 ft, J. Davis. Acme Road, 640 m (2100 ft), J. Davis.

Province 36:

Xlickitat River, 20 km N of the Dalles, Goward.

Bickleton area: Ferguson's Ranch, near Bickleton, G. Howard. Spring Canyon, near Bickleton, G. Howard. Bickleton, 900 m (3000 ft) and 960 m (3200 ft), G. Howard.

Goldendale area: 45°50'N, 120°48'W, W side of Hwy 97, 1.6 mi N of junction with Hwy.142 and-city limits of Goldendale,, lava rock; oaks, 550 m (1800 ft), B. Rvan. 45°59'N, 121°0'W, Simcoe Mountains, NW of Goldendale, 800 m (3000 ft), L. Blanchard. 10 mi W of. Goldendale, J. Kennison. 20 km NE of Goldendale, Goward. Goldendale, 600 m (2000 ft), G. Howard: G. X. Merrill. 0.6 mi N of Satus Pass on the old highway 15 mi N of Goldendale, 940 m (3100 ft), Ponderosa pine,, Garry oak, Doug fir, L. Pike (OSC). SE Goldendale, G. N. Jones.

Along the Columbia River (east of Lyle): Horsethief Lake State Park, 0.5 mi S of State Hwy 14, 2.5 mi E of Hwy 197, lava rock, grassland, 60 m (200 ft) on Ryan labels (120 m (400 ft) on Davis labels], B. Rvan; J. Davis. 45°39'N, 121°10'W, 2.2 mi E of Horsethief Lake' State Park, between Maryhill and White Salmon (ca. 5 mi E of Lyle), 130'm (400 ft), B. Rvan. 45°42'30"N 120°49'W, ca. 2 mi N of Maryhill, N side of Hwy 97, lava outcrops among sagebrush, 300 m (1000 ft), B. Rvan.

Along the Columbia River, in the Bingen area: Bingen (formerly called White Salmon), Suksdorf. "Bingen Mountain'* or "Blumberg" (now Burdoin's Mountain), a steep hill on the northeast edge of Bingen, Suksdorf. *'Worm Brook** (now called Jewet Brook), near Bingen, Suksdorf. 45°42'30"N, 121°27'W, Bourdoin Road, just E. of Bingen, lava rock, 90°W, grassy area, 60 m (200 ft), B. Rvan.

Province 34:

Along the White Salmon River: [Big] 'White Salmon River (also called "Larm River**), Suksdorf. Near (S of) Husun, a town on the White- Salmon River and north of Bingen. Suksdorf. Gilmer, a small town 3 mi E of the White Salmon River and north of Bingen, Suksdorf. Cameron's Sawmill, on the White Salmon River, ca. 5 mi NW of White Salmon, Suksdorf.

Falcon Valley area: Falcon Valley, a swampy plateau near the southeastern base of Mt. Adams (includes the towns of Funda, Laurel and Glenwood and is bounded on the northeast by the deep canyon of the Xlickitat), Suksdorf. Guler, a town north of White Salmon, northwest part of the county, Suksdorf. Near Trout Lake, a small lake in the northwest part of the county, Suksdorf. Near "Warner's place** (exact location unknown, probably near Bingen), Suksdorf; Between Falcon Valley. and the valley of Rattlesnake Creek (a tributary of the lower White Salmon River), Suksdorf. "Kühleborn", a cold spring in Falcon Valley, north of Funda,

Localitiy data

Suksdorf.

Vicinity of Mt. Adams: "Kleethal" (Clover Valley), a small valley on the southeast slope of Mt. Adams in the vicinity of Bird Creek Meadows, Suksdorf.

LINCOLN CO. (Province 36): Creston (Washington Water Power Co. Site), Z. P. Tammer. Midway between Creston and Pavenport, T. Goward. 5 mi E of .Creston, 1200 m (4000 ft), R. Rosentreter, 0.5 mi N of Harrington (40 mi SW of Spokane), stiff sage habitat, R. Rosentreter. Davenport, 750 m (2450 ft), G. Howard.

OKANOGAN CO.: Carlton, T. C. Frve. Cedar Creek Trail, 1000 m, S. Hammer.

Goat Peak, [2134 m], Douglas. Joe Mills Mountain, (2354 m], Douslas. Ollalie Creek, [ca. 1900 m], Douglas. Star Peak, [2400 m], Douglas.

Province 35: 1 mi W of of Waucunda, 48°43'N, 119°02'W, 1100 m (3600 ft), M. Monahan. Gulch near Tonasket, 450 m (1500 ft), G. Howard. Tonasket, 360 m (1200 ft), G. Howard. Near Tonasket, 300 m'(lOOO ft)?, 48°45'N, 119°30"W (?) , M. Monahan.

Okanogan National Forest: Near Bonaparte Lake, L. Bogle. Horseshoe Mountain, [ca. 1700 m], Douglas. Waucunda Summit, 1300 m (4310 ft), G. Howard.

Province 34:

North Shore of Columbia River: Brewster, 265 m (878 ft), G. Howard.

Twisp area: Twisp Summit, 1860 m (6066 ft), G. Howard. 16 miles up Twisp Summit Road, E. Martin. Twisp State Trail, 1200 m (4000 ft), G. Howard. Butte near Twisp, 520 m (1700 ft), G. Howard. 48°02'N, 119°56'W, Alta Lake Park, just S of Pateros, near Twisp, 360 m (1200 ft), B. Rvan. Buck Pass area,, between Okanogan and Twisp, H. Price. Top of Lincoln Butte, near Twisp Pass, H. Price.

Winthrop area: Ridge above Sun Mountain Lodge near Winthrop, F. Rhoades. Hough Homestead, near Winthrop, _____.

Area NW of Palmer Lake: Snowshoe Mountain, [2200 m], Doualas.' Chopaka Mountain, [2400 m], Doualas.

Okanogan National Forest: Roger Lake Trail, along E side of Lake, in montane conifer forest and meadows, 1775 m (5880 ft), G. Howard; B. Rvan. Boulder on E side of FS Road 39, W of Roger Lake, 1825 m (5960 ft), B. Rvan. Exposed rock outcrops on S side of FS Road 39, N of Roger Lake, 1925 m (6360 ft), B. Rvan. Petroglyph site, FS Road 800; ca. 19 mi N of Winthrop, 753 m (2470 ft) B. Rvan. Tiffany Mountain (Imshaug, 1957). 15 mi NW of Newhalem, 960 m (3200 ft), R. Rosentreter. North Navaree Peak (Thomson, 1963). Mazama, [ca. 700 m], Douglas. Loup Loup Summit,

Localitiy data

Hwy 20, '[Not Xittitas Co.], M. Anderson. East Fork of Buttermilk Creek, [ca. 900 m], Douglas.

Paysayten Wilderness: Arnold-Peak, [ca. 1700 m], Douglas. Rock Mountain, [ca. 2000 m], Douglas. Windy Peak (Imshaug, 1957). Trail to Windy Peak, J. Price. Paysayten Ridge, [ca. 2100 m], Douglas. McLeod Mountain, [2464 m], Douglas. Haystack Mountain, [ca. 2200 m], Douslas. Slate Peak (Imshaug, 1957).

PEND OREILLE CO. (Province 35): Phannessa Grotto, Collector? River Canyon, Collector? Holiday Trail Fen, Collector? Roosevelt Cedars Trail, Granite Creek-Stagger Inn Campground, [Ca. 1100 m (3600 ft)], S. Hammer. Metaline Falls, 800 m (2600 ft)I G. Howard.

Colville -National Forest: (various localities), B. Zonora (UBC). Sullivan Lake, hemlock/pachistima community, 800 m (2600 ft) and 815 m (2650 ft), E. F. Layser (WSU). Tiger Hill, 960 m (3200 ft), hemlock/pachistima community, 35 year old stand, T. Howes U) . Muddy Creek, 1060 m (3500 ft), E. F. Layser (WSU). Salmo Basin [and?--same locality?] South Fork Salmon River Basin, hemlock/pachistima community, 1320 m (4700 ft), E. F. Layser (WSU). Locality not recorded, 1780 m (5500 ft), subalpine fir/menziesia community, E. F. Layser (WSU). Watch Lake, subalpine fir/menziesia community, 1800 m (6000 ft)+, E. F. Layser. Sullivan Mountain, 1800 m (6000 ft), E. F. Layser (WSU). Locality'not recorded, subalpine fir/menziesia community, 1890 m (6300 ft), E. F. Layser (WSU). Salmo Pass,, subalpine fir/menziesia community, 1860 m (6200 ft), E. F. Layser (WSU). Locality not recorded, 1950 m (6500 ft), subalpine fir/meznziesia community, E. F. Layser (WSU). Locality not recorded, 80-120 year old stand, 960 m (3200 ft), E. F. Layser (WSU).
Xaniksu National Forest: North Baldy Mountain, 1760 m (5800 ft), P. Milleran.

PIERCE CO./YAKIMA CO.: (Province 39/40):
"Naches Pass" [Naches Peak?], J. M. Grant. Near "Naches Pass** [Naches Peak], Chinook Pass, 1660 m (5440 ft), G. Howard.

William 0. Douglas Wilderness: 46°54'N, 121°30'W, Sourdough Gap (slightly W and slightly E of the gap), 2.5 mi N of Chinook Pass, near Mt. Rainier, alpine, 1950 m (6400 ft), B. Ryan. 46°54'N, 121°30"W, Trail to (east of ["S of"]) Sourdough Gap, 2 mi N of Chinook Pass, subalpine firs, 1890 m (6200 ft), B. Ryan. Cascade Crest trail to Dewey Lake, G. Howard.

SPOKANE co.: Dartford, Collector?.

Province 35: Near Mt. Spokane, 1760 m (5808 ft), G. Howard. Spokane (Minnehaha Hill, NE part of city), Collector?. Spokane (unspecified), C. V. Piper; T. A. Bonser; M. Loretta. Mt. Carlton, T. A. Bonser. Spokane (Indian Canyon), Collector?; Spokane, near the Natatorium, T. A. Bonser. Deep Creek Canyon, T.

Localitiy data

A. Bonser. Spokane River, T. A. Bonser.

Province 36: Waverly, a town 34 mi SE of Spokane, Suksdorf. Liberty Lake, T. A. Bonser. Liberty Creek, T. A. Bonser. Liberty Falls near Spokane, G. Howard. Just W of Spokane along "Hwy 10" [= Hwy 2?], 590 m (1950 ft), G. Howard. 10 mi S of Spokane, Wagner (OSC). Tyler, G. N. Jones. 2.2 mi N of the Northern Pacific Railroad overpass north of Spangle on E side-of U.S. Hwy 195, open climax forest on a gravelly till plain, T23N, R43E, S17, 600 m (2000 ft), Cooke (Plot PaN--Cooke, 1955). Along California Creek near Valley Ford, 0.2 mi SE of the Palouse Hwy, moderately open climax forest in a shallow valley, T24N, R44E, S33, 600 m (2000 ft), Cooke (Plot PsN--Cooke, 1955).

STEVENS CO. (Province 35): Cedonia, Upper Clark Creek, M. E. Dennis. Tacoma Divide, Hwy 20, S. Hammer. Near Kettle Falls, N end of Roosevelt Lake, Hwy 395 along Columbia River, 410 m (1600 ft)I 48°37'N, 118°05'W, M. Monahan. 1 mi E of Springdale, .SW side of U.S. Hwy 395, dense, near-climax forest on a NE-facing slope, T30N, R40E, S35, 660 m (2200 ft), Cooke.(Plot GN--Cooke, 1955). Boyds, 440 m (1470 ft), Howard.

WALLA WALLA CO. (Province 36): Blue Creek, J. Wier. Columbia River near Walla Walla River, Weveth (Thomson, 1969). Wallula, G. Howard.

WHITMAN CO.. (Province 36):

Northern Part of County: Rock Lake, D. Preston. Steptoe Butte, 1130 m (3700 ft), G. Howard. Tekoa Mountains, 870 m (2900 ft)I G. Howard. Rosalia, G. Howard. South side of **State Route 3" [= Hwy 271], 0.2 mi E of U.S. Hwy 195 at Donahue near Rosalia, steep north-facing slope, T20N, R43E, S26, 690 m (2300 ft), Cooke (Plots FN and SN--Cooke, 1955).

Along N shore of the Snake River: Rocks above Wawawai, LaFolette Grade, H. C. Aase. Granite Creek, Snake River, Aase. Central Ferry.[State Park], 180 m (600 ft), G. Howard.

Vicinity of Pulmman: Xamiak Butte, 11 mi NW of Pullman, T16N R45E S19,20 X. Sayce; E. R. Bouuach; G. N. Jones (WSU); W. B. & V. G. Cooke (OSC). 46°43'N, 117°10'W, Moscow-Pullman Highway, 720 m (2400 ft), B. Rvan. 1/4 mi S of Pullman, D. Wagner (OSC). Glenwood Station, 10 mi N of Xamiak Butte, D. Bialev; D. Wagner (OSC). 6 mi NE of Colfax, Waqner (OSC). Albion (formerly Guy), R. X. Beattie. S side of a county road approximately 0.5 mi SE of Fischer's ranch on a tributary of Union Flat Creek, moderately open climax forest on a north-facing slope, T15N, R44E, S31, 750 m (2500 ft), Cooke (Plot PsC--Cooke, 1955).

Pullman: (unspecified), 765 m (2550 ft), C. V. Piper; G. N. Jones; J. S. Cotton, R. K. Beattie; G. Howard. Pullman (near Paradise Creek), D. Waqner. Pullman (Magpie Forest N of Fillmore Inn Apartments), D. Bialev. Pullman (woods near country club),

Localitiy data

Collector?. 46°44'N, 117°10'W, Pullman (near Washington State University botany fieldhouse), B. Ryan. 46°44-45'N, 117°05-10'W, Pullman (WSU campus), B. Ryan. East edge of WSU campus, south-facing slope, T14N, R45E, S5, 750 m (2500 ft), Cooke (Plots FC and SC--Cooke, 1955).

YAKIMA CO.:

Province 36:

East of Yakima: Rattlesnake Hills, Eyerdam.

West of Yakima: 46°33'N, 120°52'W, N side of Lower Ahtahnum Road, 4.8 mi E of Tampico, sagebrush, a few-pines, lava rock, 635 m (2100 ft), B. Ryan.

North of Yakima: 3-4 mi N of Yakima, E of Selah, grassland, L. Pike (OSC). Lower Naches (Gulch near Gleason's Ranch). [just NW of Yakima], 410 m (1350 ft), G. Howard. Near Naches Ranger Station [town of Naches?], G. Howard. 46°43'N, 120°40'W, 1.5 mi E of Naches, 1/2 mi E of junction of Naches-Wenas Road and Allen Road, sandstone, 480 m (1600 ft), B. Ryan. 46°43'N, 120°30'W, Rest Stop, Selah Crest, above Selah Creek,' 5 mi N of Selah, 600 m (2000 ft), B. Ryan. 46°55'N, 120°40'W, Umptahnum Road, along. Umptahnum Creek, ca. 10 mi SW of Ellensburg, 750 m (2500 ft), B. Ryan. 48°50'N, 120°30'W, viewpoint ca. 10 mi S of Ellensburg, 900 m (3000 ft); B. Ryan. 46°50'N, 120°33'W, Lt. Murray Wildlife Refuge, Umptahnum Ridge/Umptahnum Canyon, ca. 15 mi S of Ellensburg, 600 m (2000 ft), B. Ryan.

South of Yakima (mostly on the Yakima Indian Reservation): Satus Road, 315 m (1054 ft), G. Howard. 46°10'N, 120°00'W, U.S.' Hwy 9, 33.6 mi N of Goldendale, lava rock, 385 m (1300 ft), B. Ryan. S side of Ahtahnum Ridge, W of the Union Gap, sagebrush, lava rock, 395-460 m (1300-1500 ft), B. Ryan. 46°20'N, 120°30'W, Circle R Ranch (J. Ryan), 3 mi W and 1 mi S of Wapato, 270 m (900 ft), B. Ryan. 46°31'N, 120°30'W, James B. Ryan Ranch, 301 Highline, Dr., just S of the Union Gap, 390 m (1300 ft), B. Ryan. 46°30'N, 120°30'W, Thorpe Road, town of Union Gap, sagebrush, lava rock,. 345 m (1100 ft), B. Ryan. 46°30'N, 120°30'W, N-facing slope with cliffs., SE of town of Union Gap, 330 m (1100 ft)I B. Ryan. Fort Simcoe, Eyerdam.

Yakima: C. V. Piper: Collector?. 46°40'N, 120°30'W, Yakima Ave., 300 m (1000 ft), B. Ryan.

Province 34:

Yakima Indian Reservation: Mt. Adams: (unspecified), Prinale (Howard, 1950), Suksdorf; ("Paddo", a Native American name for the mountain) 900-1200 m (3000-4000 ft); 1200-1500 m-(4000-5000 ft)I Suksdorf. "Wodan's Vale" (now called Hell Roaring Canyon), On southeast slope at the base of the Mazama Glacier (but-some labels say **on N slope; Bench Lake**), Suksdorf. (Upper Bird Creek Meadow, near Woden's Vale), subalpine, southeast slope,

Localitiy data

Suksdorf. Bird Lake in Bird Creek Meadows, G. Howard. Bird Creek Camp, G. Howard. Bird Creek Trail, R. Svihla. "Luschsenbach" (Lynx Creek), probably in Donner's Vale, on the east slope, Suksdorf. (Hell Roarding Trail), G. Howard. Little Mt. Adams ("Rotkegel"), a-red volcanic cone on the southeast slope, Suksdorf. "Aschberg" (Ash Hill), a hill of volcanic material west of Gilmer, now known as Mt. Adams orchard, Suksdorf- (WSU).

Wenatcdee National Forest (according to Washington Atlas and Gazette; Snoqualmie National Forest according to Rand McNally. Road Atlas):.

Along Hwy 410: Upper Naches River region, Grant (Magnusson, 1932). Boulder Cave [ca. 1.5 mi W of Cliffdell], 900 m (3000 ft), G. Howard. Deadhorse Hill [N of Hwy 410 near border with Kittitas Co.], 1200 m (4000 ft), G. Howard. Lodgepole Pine Camp (border between Norse Peak Wilderness and William 0. Douglas Wilderness), G. Howard. American River Camp, 850 m (2800 ft), G. Howard. Dewey Lake, G. Howard. 46°54'N, 121°00'30"W, W side of Hwy 410, in town of Squaw Rock (4.5 mi SE of Cliffdell), lava rocks, pines, 665 m (2200 ft), B. Rvan. 46°53'30"N, 120°58'W, 0.8 mi (1.3 km) up Rock Creek Road, 0.3 mi E of Squaw Rock, NE of Hwy 410, exposed rock flow, pines and Douglas firs, 730 m (2400' ft)I B. Ryan. 2.5 mi E of Eagle Rock, W of Naches, N side of Hwy 410, pines, basalt, 575 m (1900 ft), B. Rvan. 46°50'N. 121°0'W, Naches Highway (State Road 410), pull-off on river side of road, 1200 m (4000 ft), B. Rvan. 46°46'30"N, 120°50'W, Mud Lake, 0.3 mi N of Hwy 410, between Pass Junction and Eagle Rock, volcanic rock, sagebrush, 650 m (2200 ft), B. Rvan. 0.5 mi up Bald Mtn Road, just E of Squaw Rock, 0.2 mi from Hwy 410, sagebrush and a few pines, lava rock flow, B. Rvan. 46°48'N, 120°53'30"W, 2.5 mi E of Eagle Rock, W of Naches, N side of Hwy 410, pines, basalt, 575 m (1900 ft), B. Rvan. Little Naches River, 760 m (2557 ft), G. Howard.

Along Hwy 12: Indian Creek Forest Camp, **State Hwy 5" [= Hwy 12], G. Howard. Clear Lake, E of White Pass, 900 m (3000 ft), mixed ponderosa pine forest, L. Pike (OSC). Dog Lake, E of White Pass, 1260 m (4200 ft), L. Pike (OSC). Dog Lake Campground, 2 mi E of White Pass, 1290 m (4300 ft), D. Anderegg & N. Schroeder (OSC). 46°41'N, 121°23'W, Dumbbell Lake, 3 mi N of Dog Lake (hwy 12)I 3 mi E of White Pass, 1585 m (5200 ft), firs, basalt, B. Rvan. 46°37'N, 121°13'W, N side of Rimrock Lake, 900 m (3000 ft), B. Rvan. 46°41'N, 120°57'W, between Oak Creek Road and.Trout Lodge, on short dirt road parallel and very close to Hwy 12, about 9 miles E of town of Rimrock, lava rocks, 660 m (2200 ft), B. Rvan. 46°41'30"N, 120°54'W, 0.5 mi E of Tieton River, N side of Hwy 12, E of Windy Point Campground, lava rock, 630 m (2100 ft)I B. Rvan.

Along road to Bumping Lake, s of Hwy 410: Bumping Lake, 46°45'N, 121°20'W, 1020 m (3400 ft) [according to Howard; 1200 m

(4000 ft) on Ryan labels--perhaps from hills above the lake], G. Howard: B. Rvan. 47°35′N, 121°25′W, Cougar Lakes, 1500-1680 m (5000-5600 ft), B. Rvan. 46°58′30"N, 121°11′W, N side of Hwy 410, 1.8 mi W of Bumping River Road to Goose Prairie, near Pine Needle Camp, 1.8 mi W of Bumping River, lava boulder flow, Douglas firs, 900 m (3000 ft), B. Rvan. 47°50′N, 121°20′W, Where Swamp Lake trail crosses Bumping River, B. Rvan. 47°50′N, 121°20′W, S end of Swamp Lake, 1500 m (5000 ft), B. Rvan. 47°50′N, 121°20′W, near parking lot at beginning of Swamp Lake Trail, B. Rvan.

[ca. 35 mi W of Wapato]: Rattlesnake Canyon, 600 m (2000 ft), G. Howard.-

Between Hwy 12 and Hwy 410: 46°46′N, 121°09′W, Timberwolf Lookout, 1940 m-(6350 ft), B. Ryan. 46°43′N, 121°07′W, Bethel Ridge Road, between McDaniel Lake and Hwy 12, 6 mi above.Hwy 12 (3.5 mi NE of Rimrock), large lava outcrops, 1700 m (5600 ft), B. Rvan. 46°43′N, 121°07′W, Bethel Ridge Road, W edge of canyon, just after going toward Hwy12 from road to McDaniel Lake, 1700 m, B. Rvan. 46°48′30"N, 120°05′30"W, road to McDaniel Lake, (1 mi E of the lake), 2 mi above turnoff to Rattlesnake Springs, 22 mi from Hwy 12, 11 mi from Hwy 410, lava boulders, open growth pine and Douglas fir, 960 *m* (3200 ft), B. Rvan. NPK Canyon, Oak Creek Road (USFS Road 1904), Oak Creek Recreation Area, lava rocks, sagebrush and grass, 675 m (2200 ft), B. Rvan. 46°44′N, 120°53′30"W, 1 mi past Hoover Canyon, Oak Creek Road (USFS Road 1905)' Oak Creek Recreation Area, lava rock, pine-oak woodland, 750 m (2500 ft); B. Rvan.

Northwesternmost corner of the county: 47°02′N, 121°20′W. Ravens Roost Lookout' (just E of Norse Peak Wilderness), exposed andesite rocks, alpine, 860 m (6100 ft), B. Rvan.

YAXIMA CO.? XITTITAS CO.? 46°50′N, 120°30′W, Ellensburg Canyon, B. Rvan.

Localitiy data

EXCLUDED LOCALITIES (WEST SIDE)

OREGON:

CLACKAMAS co. : Near Timberline Lodge, Mt. Hood, 1800 m (6000 ft), scattered clumps of subalpine fir and mountainhemlock, L. Pike (OSC). Near Government Camp, Mt. Hood, F. Sipe (OSC).

HOOD RIVER CO.: Cascade Locks, Suksdorf. Yeon State Park, 5 km SW of Bonneville, T. Goward.

WASHINGTON:

PIERCE CO.: Hwy 410 between Greenwater and Chinook Pass, 600 m (2000 ft), B. Ryan. White River R.D., FS Road 1853, just N of Mt. Rainier National Park, 1200-1350 (4000-4500 ft), 47°05'N, "122°40'W", [Labels say Yakima Co.; the latitude and longitude given on the labels put the locality at the west edge of Pierce Co. just SW of Tacoma; 12°40'W puts it near the White River N of Mt. Rainier, but in Pierce Co., but the road number seems to put it in Yakima Co,.], G. Rvan. 46°54'N, 121°30'W. W side of Crystal Peak, W of Sourdough Gap, east boundary of Mt. Rainier Nat. Park, 2.5 mi N of Chinook Pass, alpine, siliceous rock, 1950 m (6400 ft)I B. Rvan.

SKAMANIA CO./YAKIMA CO.: Gifford-Pinchot National Forest: Mt. Adams Wilderness, 1380 m (4600 ft), J. Rilev (OSC).

2. EAST SIDE CONTRACT

Master Species List

Names in bold are accepted ones. Synonyms are given only for names not listed by Egan (1987).

Citations of Thomson (1984) are based on large scale maps, and it is not always clear in which county (or sometimes which state) the localities belong.

Acarospora badiofusca (Nyl.) Th. Fr.--WA: Okanogan Co.- (34) (Rhoades, WWB). 910 m. On rock.

Acarospora bullata Anzi--WA: Yakima Co. (36) (Rvan, ASU). 480 m. On concrete.

Acarospora "chlorophana" (sensu Weber)--OR: Baker Co. (Palmer, and Ryan, ASU). Deschutes Co. (Denison, Pike, and L. Pike & A. Rossman, OSC; Rhoades, WWB). Grant Co. (Rosentreter). Harney Co. (Rhoades, WWB). Klamath Co. (Rvan, ASU). Lake Co. (Ryan, ASU). Malheur Co. (McCune). WA: Chelan Co. (Rvan, WWB). Klickitat Co. (Suksdorf, WSU; Ryan, ASU). Okanogan Co. (Douglas, 1974). Whitman Co. (Piper, WSU--as A. flava). Yakima Co. (Howard, WTU [as A. flava]; Rvan, ASU, WWB). 430-6800 ft.; 130-2050 m. On vertical to overhanging rocks (andesite, basalt, schist, etc.) Juniper-sage desert; alpine. This complex of taxa, which includes A. oxytona, and others, is taxonomically problematic; material from the Columbia Basin (with the possible exception of alpine material) does not belong to A. chlorophana s. str. (= Pleoosidium chloronhanum).

Acarospora complanata Magnusson (Syn. A. obscura)--WA: Yakima Co. (Suksdorf, WTU, WSU--det. Magnusson as A. obscura).

Acarospora fuscata (Nyl.) Arnold--OR: Crook Co. (Pike, OSC). Deschutes Co. (41) (McCune). Grant Co. (Rosentreter). Malheur Co. (McCune). Wasco Co. (Rossman, 1992; including A. bullata). WA: Chelan Co. (Howard, 1950). Kittitas Co. (Pike, OSC). Klickitat Co. (Davis, herb. Davis). Okanogan Co. (Howard, WTU; det. Magnusson). Whitman Co. (Sayce, WSU). Boreal. On exposed basalt outcrops. Dry sagebrush slopes. 600-4500 ft.; 180-1350 m. Doug fir/ponderosa pine; Artemisia-grassland.

Acarospora nitida Magnusson--OR: Baker Co. (Palmer, ASU). 1200 m. On schist outcrops.

Acarospora schleicheri (Ach.) Massal.--OR: Harney Co. (Pike, OSC; Rhoades, WWB; McCune). Union Co. (Davis, herb. Davis). Wasco Co. (Rossman, 1992). WA: Ferry Co. (Howard, WTU; Merrill, UBC).

Master species list

Yakima Co. (36) (Ryan, WWB). 1400-4100 ft; 425-1225 m. On bare soil and plant debris. Sagebrush; mound communities in biscuit scabland. Although many North American authors have followed Weber in lumping all yellow, non-lobed Acarospora spp. under this name, at present I am restricting its use to material on soil, and even at that there may be more than one species involved.

Acarospora sinopica (Wahlenb. in Ach.) Körber--OR: (Ryan notes from Fremont N.F., 1994?). WA: Yakima Co. (36) (observed by Ryan, but not collected). On rock (basalt),. 1400 m. Artemisia tridentata/Bromus tectorum.

Acarospora thamnina (Tuck.) Herre--OR: Klamath Co. (Ryan, ASU). Malheur Co. (McCune). 4300 ft; 910-1300 m. In small cracks or crevices in basalt rocks.

Acarospora washinstonensis Magnusson--WA: Yakima Co. (Howard,. WTU; det. Magnusson). 1350 ft; 400 m.

Acarospora spp. --OR:

Ahtiana sphaerosporella (Müll. Arg.) Goward--OR: Lake Co. (Ryan, ASU). WA: Yakima Co. (Ryan, WWB). 5300-6350 ft; 1600-1900 m. On Abies concolor, Pinus monticola.

Alectoria imshausii Brodo & D. Hawksw.--OR: Grant Co. (Brodo & Hawksworth, 1977). Hood River Co. (Davis, herb. Davis). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Union Co. (Brodo & Hawksworth, 1977). Wallowa Co. (Pike, OSC). Wheeler Co. (Brodo & Hawksworth, 1977). WA: Asotin Co. (Brodo & Hawksworth, 1977). Chelan Co. (Brodo & Hawksworth, 1977). Kittitas Co. (Anderson, WTU; Ryan, ASU). Klickitat Co. (Davis, herb. Davis). Pend Oreille Co. (Brodo & Hawksworth, 1977). Spokane Co. (Brodo & Hawksworth, 1977). Stevens Co. (Brodo & Hawksworth, 1977). Whitman Co. (Brodo & Hawksworth, 1977). Yakima Co. (Pike; OSC; Brodo & Hawksworth, 1977). 2600-6700 ft; 775-2300 m. On Abies concolor, Pinus ponderosa, Pseudotsusa menziesii, Tsusa and other conifers. Coniferous forest.

Alectoria lata (Taylor) Lindsay--OR: Deschutes Co. (40) (Geiser, herb. Geiser). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Kittitas Co. (Brodo & Hawksworth, 1977). Yakima Co. (Ryan, ASU). Mainly west side. 5300-6700 ft'; 1600-2025 m. On bark of conifers (Abies concolor, A. lasiocarpa); or occasionally on rock. Krumholz; alpine.

*Alectoria nigricans (Ach.) Nyl.--WA: Okanogan Co. (Imshaug, 1957; Thomson, 1984). Yakima Co. (Ryan, ASU). Arctic-alpine. Habitat (Thomson, 1984): On soil, humus, and gravels; sometimes on lower branches of Picea; in boulder trains between the

boulders. 6400 ft; 1950 m.

Alectoria sarmentosa (Ach.) Ach. ssp. sarmentosa--OR: Deschutes Co. (Pike, OSC; Brodo & Hawksworth, 1977). Jefferson Co. (Rosentreter). Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). WA: Kittitas Co; (Weimer & LaBounty, WTU; Wagner, OSC). Klickitat Co. (Pike, OSC; Suksdorf, WSU). Okanogan Co. (Ryan, ASU). Pend Oreille Co. (Layser, WSU--"very abundant" at several localities; "May form staple diet of wintering woodland caribou.in this area."). Stevens Co. (Cooke, 1955). Yakima Co. (Howard, WTU). 2200-6200 ft; 940-1900 m. On trunks and lower dead branches of Abies lasiocarna, Picea enslemannii; Pinus, Pseudotsusa menziesii, and other conifers. 10-30 ft from foest floor. Western hemlock-Doug fir-Grand fir forest; subalpine fir forest; Abies lasiocarpa/Menziesia; Tsuga/Pachistima.

Allantoparmelia alpicola (Th. Fr.) Essl.--WA: Gifford-Pinchot N.F., Mt. Adams Wilderness, J. Rilev (OSC). Okanogan Co. (Imshaug, 1957; Thomson, 1984). Yakima Co. (Rvan, ASU). Arctic-alpine to boreal. On andesite or other volcanic rocks, sometimes on vertical surfaces. 4600-6100 ft.

Amandinea punctata '(Boffm.) Scheidegger (Syn. Buellia punctata, B. mvriocarpa)--WA: Klickitat Co. (Suksdorf, WSU). OR: Deschutes Co. (Rhoades, OSC). Wasco Co. (Rossman, OSC). 3000 ft.; 990-1150 m. On dead twigs of Juniperus occidentalis; on wooden fences; on old grass clumps and cow dung. At bottom of ravines and in mound community, biscuit scabland with Artemisia riaida, Festuca idahoensis, etc.

Arthonia carneorufa Willey--WA: Klickitat Co. (Suksdorf, WSU). Yakima Co. (Suksdorf, WSU). On Pseudotsuaa and conifer wood.

Arthonia qlebosa Tuck. --OR: Deschutes Co. (Eslick, herb. Rosentreter). Grant Co. (Rosentreter). Wasco Co. (Rossman, 1992). WA: Klickitat Co. (Suksdorf, WSU). Temperate. 3200-8000 ft; 990-1050 m. On bare soil (mesic, clay/loamy). Mound'community in biscuit scabland; Artemisia tridentata spp. tridentata/Agropyron spicatum. May be confined to grasslands.

Arthonia patellulata Nyl. --WA: Klickitat Co. (Suksdorf, WSU).

Arthonia radiata (Pers.) Ach.--WA: Klickitat Co. (Suksdorf, WSU). On Alnus rubra.

"Arthopyrenia punctiformis"--OR: Hood River (Suksdorf, WSU). WA: Klickitat Co. (Suksdorf, WSU). Yakima Co. (Suksdorf, WSU). On Crataecrus douslasii, Cornus nuttallii; on Abies lasiocarna. North Americanrecords are probably based on misidentifications (Egan, 1987).

Master species iist

Asnicilia caesiocinerea (Nyl. ex Mallbr.) Arnold (s. lato)-- Probably common throughout the Columbia Basin; but most. identifications cannot be trusted. . . .

Aspicilia "calcarea"--Many, if not-all, reports of this species from North America. (certainly reports- from siliceous rocks) .are based on misidentifications.

Asnicilia cinerea (L.)' **Körber (s.** lato) --Probably widely' distributed, but many reports may be based on misidentifications.

Asnicilia **desertorum** (Krempelh.) **Mereschk.--OR:** Harney Co. (Rhoades, WWB). WA: Grant Co.. (Rvan, WWB). On rock, often on small stones or desert agates.

Aspicilia gibbosa (Ach.) **Körber (s.** lato) --Probably widely distributed, but most identifications cannot be trusted:,,

Asnicilia hispida **(Mereschk.)** --OR: Wasco Co. (Rossman, 19921. WA: Yakima Co. (Rvan, WWB). 750-1050 m. On bare soil. Mound community in biscuit scabland.

Aspicilia reptans (Looman) Wetmore--WA: Chei'an Co.' '(Rvan, WWB). Yakima Co. (Rvan, WWB). 1000-2000 ft. On soil or decaying clumps of bunchgrasses, at the edges of ravines or depressions. Sagebrush.

Aspicilia supertegens Arnold--WA: Okanogan Co. (Douglas, 1974).

Aspicilia sp. (undescribed; fruticose)--OR: Klamath Co. (Rvan, ASU). 5100 ft. On soil among basalt boulders, edge of ponderosa pine forest.

Asnicilia spp.' (A. cinerea/A. sibbosa group) --Throughout the' region in both Oregon and Washington.

Bacidia bauliettoana **(Massal. &** De Not.' **in Massal.)** Jatta--OR: Wallowa Co. (Rosentreter). 2000 ft. Mixed Doug fir forest.

Bacidia herrei Zahlbr.--OR: Hood River Co. (Jacques, OSC). On bark of old rotting Doug fir stump at top of a ridge.:-

Bacidia naeuelii (Hepp) **Zahlbr.--WA:** Klickitat Co. (Suksdorf, WSU) On Prunus emarginata.

Bacidia polychroa (Th. Fr.) **Körber--WA:** Klickitat Co. (suksdorf, WSU). On Cornus nuttallii.

Bacidia rubella (Hoffm.) **Massal.--WA:** Klickitat Co. (Suksdorf, WSU). Yakima Co. (Suksdorf, WSU). On Alnus rubra; on Abies

arandis.

Bellemerea alpina (Sommerf.) Clauz. & Roux (Syn. Lecanora. applegatei)--OR: Klamath Co. (Herre, OSC--paratypes). Lake Co. (Ryan, ASU). Wallowa Co. (Pike, OSC). WA: Okanogan Co. (Ryan, ASU). Yakima Co. (Ryan, ASU). 3200-6400 ft. On rocks (basalt, etc.). Open spruce-Doug fir stand; open-canopy pine-Doug fir forest; alpine.

Bellemerea cinereorufescens (Ach.) Clauz. & Roux--OR: Lake Co. (Rvan, ASU). WA: Kittitas Co. (Ryan, WWB). Okanogan Co. (Rhoades, WWB). 2000-6400 ft; 910-1835 m. On rock.

Bellemerea sanguinea (Krempelh.) Hafellner & Roux--WA: Yakima Co. (Suksdorf, WSU--det. Magnusson).

Biatora sphaeroides (Dickson) Körber (Syn. Bacidia sphaeroides)--WA: Klickitat Co. (Suksdorf, WSU).

Biatora varians (Syn. Lecidea varians)--WA: Klickitat Co. (Suksdorf, WSU). Spokane Co. (Cooke, 1955). Yakima Co: (Suksdorf, WSU). 2000 ft. On Pinus albicaulis and other conifers..'

Biatorella hemispherica Anzi (Syn.: B. fossarum for N. American records) --OR: Lake Co. -(Pike, OSC). WA: Klickitat Co. (Suksdorf, WTU, WSU). 1400 m. On basalt outcrops, and on the ground. High desert with sagebrush, juniper, and ponderosa pine.

Brodoa oroarctica (Krog) Goward--WA: Okanogan Co.' (Imshaug, 1957'; Thomson, 1984). Yakima Co. (Rvan, ASU). Mainly arctic-alpine. On rocks and over mosses in places with winter snow cover. 1950 m.

Brvoria abbreviata (Mull. Arg.) Brodo & D. Hawskw.--OR: Baker Co. (Brodo &.Hawksworth, 1977). Deschutes Co. (Waaner, OSC; Rosentreter). Klamath Co. (Ryan, ASU). Lake Co. (Rvan, ASU). Union CO. (Brodo & Hawksworth, 1977). WA: Ferry CO. (Brodo & Hawksworth, 1977). Kittitas Co. (Anderson, WTU; Rvan, ASU). Klickitat Co. (Pike, OSC--as "B. oregana"; Davis, herb; Davis; Goward, UBC). Okanogan Co. (Rhoades, WWB; Rosentreter--as B. oreoana). Spokane Co. (Cooke, 1955, as Alectoria oresana). Whitman Co. (Biolev, WWB; Boguach, WSU; Sayce, WSU--as B. oresana). Yakima Co. (Rvan, ASU). 2000-7000 ft; 300-2100 m. On Abies concolor, Pinus contorta, P. ponderosa, Pseudotsusa, Tsuga; Pine forest. Mixed pine-Doug fir forest; Ponderosa pine-Garry oak-Doug'fir stand, on N-facing slope.

Brvoria capillaris (Ach.) Brodo & D. Hawksw.--OR: Klamath Co. (Rvan, ASU--partly as B. oseudofuscescens). Union Co. (Rosentreter). WA: Co.? (Monahan, WWB). Klickitat Co. (Pike; OSC-

-det, Brodo; Davis, herb. Davis). Pend Oreille Co.? (Thomson, 1984--dot is on Idaho border). Whitman Co.? (Thomson, 1984; dot is on Idaho border). Mainly boreal, to temperate-montane'and subarctic. 6400 ft. 914-1635 m. On Pinus ponderosa, Pseudotsuaa menziesii; Mainly in humid areas. Ponderosa pine-Garry oak-Doug fir stand, on N-facing slope; Doug fir forest..

Bryoria fremontii (Tuck.) Brodo & D. **Hawksw.--OR:** Crook Co. (Pike, WTU). Grant Co. (Lawrence, OSC). Klamath Co. (Ryan, ASU; Brodo & Hawksworth, 1977). Lake Co. (Ryan, ASU--partly as B. trichodes ssp. americana). Union Co. (Davis, herb. Davis; Rosentreter).: Wallowa Co. (Pike, OSC--det. Brodo). **WA:** Asotin Co. (Brodo & Hawksworth, 1977). Chelan Co. (Howard, 1950). Klickitat Co. (Pike, OSC--det. Brodo). Okanogan Co. (Bosle, UBC--det. Brodo; Rosentreter; Rvan, ASU; Howard, 1950; Douglas, 1974). Spokane Co. (Cooke, 1955--"ssp. eriksonii"). Whitman Co. (Sayce, WSU). 2000-6840 ft; 1000 m. On Cercocarpus ledifolius, Purshia tridentata, Larix occidentalis, Picea enalemanii, P. sitchensis, Pinus contorta, P. oonderosa, Pseudotsuqa menziesii. Juniper desert; Ponderosa pine-Garry oak-Doug fir stand, on N-facing slope; mixed conifer forest.

Bryoria friabilis Brodo & D. **Hawksw.--WA:** Klickitat Co. (Brodo & Hawksworth, 1977).

Brvoria fuscescens (Gyelnik) Brodo & **D. Hawksw.--OR:** Jefferson Co. (Rosentreter). Klamath Co. (Rvan, ASU). Lake Co. (Ryan, ASU). Wallowa Co. (Giese, OSC--det. Brodo; Thomson, 1984). WA: Kittitas Co. (Brodo & Hawksworth, 1977--v. positiva). Klickitat Co. (Pike, OSC). Pend Oreille Co. (Hone, and Lavser, WSU). Whitman Co. (Thomson, 1984). Boreal-subarctic, to temperate-montane. 3200-6500 ft; 1600 m. On bole and branches of Abies concolor, A. lasiocarpa, Larix, Picea enqlemanii, Pinus contorta, Pseudotsuqa menziesii. Ponderosa pine-Garry oak-Doug fir stand, on N-facing slope; Tsuaa/Pachistima; Abies lasiocarpa/Menziesia.

Brvoria qlabra (Mot.) **Brodo & D. Hawksw.--OR:** Klamath Co. (Brodo & Hawksworth, 1977). Lake Co. (Rvan, ASU). Umatilla Co. (Thomson, 1984). WA: Asotin Co.? (Thomson, 1984--dot is on border with Idaho and with Whitman Co.). Garfield Co. (Boguach & Mullen, WSU--in packet of Letharia columbiana). Kittitas Co. (Anderson, WTU). Okanogan Co. (Rhoades, WWB; Rvan, ASU). Spokane Co. (Thomson, 1984); Whitman Co. (Jones, WSU). Yakima Co. (Suksdorf, WSU). Boreal-montane, to.subarctic. 6000 ft; 900-1850 m. On bark or wood of Abies concolor, Pinus and other conifers; including dead snags, and old fences. Identification of some specimens needs checking.

Brvoria implexa (Hoffm.) Brodo & **D. Hawksw.--WA:** Chelan Co.

(Grant, WTU). Kittitas Co. (Brodo & Hawksworth, 1977). Stevens Co. (Cooke, 1955). Whitman Co. (Brodo & Hawksworth, 1977). 2200 ft; 700 m.

Bryoria lanestris (Ach.) Brodo & D. **Hawksw.--OR:** Klamath Co. (Brodo & Hawksworth, 1977). Wallowa Co. (Pike, OSC). WA: Douglas Co. (Thomson, 1984). Okanogan Co. (Martin, WWB; Bogle, UBC--det. Brodo). Spokane Co. (Cooke, 1955). Stevens Co. (Cooke, 1955). Whitman Co. (Brodo & Hawksworth, 1977). Yakima Co. (Ryan, WWB). Boreal, to arctic. 2000-6350 ft. On Pinus monticola, Pseudotsuga menziesii, and other conifers. 'Mixed conifer forest.

Bryoria oregana (Tuck. ex Willey)'Brodo & D. **Hawksw.--OR:** Deschutes Co. (Pike, WTU). Jefferson Co. (Rosentreter). Klamath Co. (Brodo & Hawksworth, 1977). WA: Okanogan Co. (Douglas, 1974--may be B. abbreviata). Pend Oreille Co. (Brodo & Hawksworth, 1977). 5400-7100 ft. On Pinus contorta, Pseudotsusa menziesii.

Bryoria pseudofuscescens (Gyelnik) Brodo & D. **Hawksw.--OR:** Baker Co. (Thomson, 1984). Deschutes Co. (Pike, OSC; Brodo & Hawksworth, 1977). Jefferson Co. (Rosentreter). Klamath Co. (Ryan, ASU; Brodo & Hawksworth, 1977). Union Co. (Brodo & Hawksworth, 1977; Thomson, 1984; Rosentreter). Wallowa Co. (Giese, and Pike, OSC--det. Brodo; Rosentreter). WA: Spokane Co. (Thomson, 1984). Temperate-montane. 2000-7100 ft; ,914 m. On Picea enalemanii, Pinus contorta, Pseudotsuga menziesii. Mixed conifer forest; mixed Doug fir forest.

Bryoria simplicior (Vainio) Brodo & D. **Hawksw.--OR:** Klamath Co. (Ryan,U) . WA: Klickitat Co. (Pike, OSC). 3100-6500 ft. On Pseudotsusa menziesii. Ponderosa pine-Garry oak-Doug fir stand, on N-facing slope.

Bryoria tortuosa (G.K. Merr.) Brodo 6 D. Hawksw.--WA: "White River" (Grant, OSC). Kittitas Co. (Pike, OSC--det. Brodo). Klickitat Co. (Davis, herb. Davis). Okanogan Co. (Brodo & Hawksworth, 1977). 500 ft. On Pinus nonderosa. Mixed Doug fir stand.

Bryoria trichodes ssp. americana' (Mot.) Brodo & D. **Hawksw.--OR:** Lake Co. (Ryan, ASU--check identification). WA: Okanogan Co. (Ryan, ASU). 5880 ft; 1750-1775 m. On bark of conifers. Montane forest. West coast species.

Bryoria sp. **("Alectoria jubata** f. **prolixa")** --WA: Stevens Co. (Cooke, 1955). 2290 ft.

Buellia badia '(Fr.) Massal.--WA: Klickitat Co. (Suksdorf, WTU, WSU; Davis, herb. Davis). 400 ft. On W-facing basalt cliff, or thin soil over basalt. ,

Master species list

Buellia discifomis (Fr.) Mudd--WA: Klickitat Co. (Suksdorf, WSU). On Alnus rubra.

Buellia elegans Poelt--WA: Okanogan Co. (Douglas, 1974--as B. eniqaea).

Buellia erubescens Arnold--WA: Okanogan Co. (Douglas, 1974);

Buellia glaucomarioidea Willey--WA: Klickitat Co. (Suksdorf, WSU). On Prunus emarginata. This species name is not in Egan (1987):

Buellia lauricassiae (Fée) Mull. Arg.--WA: Klickitat Co.": (Suksdorf, WSU). On old wooden fences.

Buellia oidalea (Nyl.) Tuck.--OR: Hood River Co. (Suksdorf, WSU). On Quercus garryana.

Buellpapillata (Sommerf.) Tuck.--OR: Deschutes Co. (W. Denison, and Christy, OSC). Harney' Co. (Pike, OSC). Malheur Co. (Rosentreter--identification very doubtful!). Wasco Co. (Rossman, 1992). 2.900. ft. 990-1050 m. On moss (especially Homalothecium aeneum), plant debris (including decomposed Festuca culms), and dung. Under Artemisia, in Juniper-sage desert; Artemisia tridentata spp. tridentata/Agropyron spicatum. Basalt cliffs in.ravine community in biscuit scabland.'

Buellia polyspora (Willey) Vainio--WA: Klickitat Co. (Suksdorf, WSU). On Alnus.,

Buellia retrovertens Tuck.--OR: Wasco Co. (Rossman, 1992). 990-1050 m. On rocks (medium and large), including those of stone rings, 'in biscuit scabland.

Buellia triphramioides Anzi--OR: Deschutes Co. (I. Pike & A. Rossman, OSC). Wasco Co. (Pike, et al., OSC; Rossman, 1992). 1150 m. On dead twigs of Artemisia riqida and Juniperus occidentalis. Biscuit scabland.

Buellia sp. (undescribed)--OR: Wasco Co. (Rossman, 1992--det. Sheard). 990-1050 m. On rock. Biscuit scabland.

Calicium abietinum Pers.--OR: Jefferson Co. (Pike, OSC). WA: Yakima Co. (Pike, OSC). 3000-4200 ft. Fir,-Doug fir forest.

Calicium adaequatum Nyl.--OR: Jefferson Co. (Pike, OSC). WA: Yakima Co. (Pike, OSC). 3000-3440 ft. On Alnus rhombifolia stems. Fir-Douglas fir forest, along edge of lake.

Calicium adspersum Pers.--WA: Klickitat Co. (Suksdorf, WSU).

Master species list

Calicium viride Pers.--OR: WA: Klickitat Co. (Davis, herb. Davis; Suksdorf, WSU--as Acolium hyperellum). 1600 ft. On base and trunk of Pseudotsuaa menziesii.

Calicium sp.

Caloplaca ammiospila (Wahlenb. in Ach.) H. Olivier--OR: Deschutes Co. (41) (McCune). 1340 m.

Caloplaca approximata (Lynge) Magnusson--OR: Wasco Co. (Rossman, 1992). 990-1050 m. On old, weathered bones. Biscuit scabland.

Caloplaca cascadensis Magnusson--OR: Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). 1950-2000 m. On basalt.

Calonlaca cerina (Ehrh. ex Hedw.) Th:Fr.--CR: Klamath Co., (Ryan, ASU). 4560-5400 ft; 1400-1635 m. On bark of Populus trichocarpa. Howard's reports of this species are mostly based on misidentifications..

Caloolaca cinnabarina (Ach.) Zahlbr.--WA: Klickitat Co. (Suksdorf, WSU).

Caloplaca citrina (Hoffm.) Th. Fr.--OR: (Ryan collections from Fremont N.F.)

Caloolaca decipiens (Arnold) Blomb. & Forss.--WA: Yakima Co. (Ryan, ASU). 480 m. On vertical face of sandstone cliff.

Caloplaca epithallina Lynge--OR: Crook Co. (Pike, OSC). Deschutes Co. (Pike & Rossman, OSC; 'Rhoades, WWB; (41) McCune). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC). Wasco Co. (Rossman, 1992). 3000-4500 ft; 990-1400 m. On Lecidea spp., Rhizoplaca melanonhthalma, and other lichens. Biscuit scabland; juniper-sage desert; Doug fir-ponderosa'pine.

Caloplaca ferruginea (Huds.) Th. Fr.--WA: Klickitat Co. (Suksdorf, WSU). On Acer macrophvllum, Alnus rubra, etc.

Caloplaca,cf. flavorubescens (Huds.) Laundon--OR: Malheur Co. (McCune). 910 m.

Calonlaca fraudans (Th. Fr.) H. Olivier--WA: Okanogan Co. (Rhoades, WWB). 910 m. On sandstone boulder. This is treated by Arup (in press) as a coastal species; identification of Rhoades' collection needs checking.

Caloolaca holocarpa (Hoffm.) Wade--WA: Okanogan Co. (Dougias, 1974). This species,. or at least this complex, is probably widespread and common in the Columbia Basin.

Master species list

Caloplaca iunuermanniae (Vahl)' Th. Fr.--OR: Harney Co. (Pike, OSC--as "cf."). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Malheur Co. (Rosentreter). Wasco Co..(Rossman, 1992). WA: Klickitat Co. (Suksdorf, WSU). Okanogan Co. (Douglas, 1974). Yakima Co. (Ryan, ASU). 2600-6200 ft; 990-1950 m. On moss and plant debris, or soil, over basalt. Mound community in biscuit scabland; N-facing rock wall in juniper-sage desert; N-facing canyon slopes, Artemisia tridentata/Agropyron spicatum; sometimes near waterfalls.

Caloplaca microphvllina (Tuck.) Hasse--OR: Harney Co. (Rhoades, WWB). On sagebrush. Identification needs checking; this may be Xanthoria fulva.

Caloplaca pollinii (Massal.) Jatta--OR: Hood River Co. (Suksdorf, WSU). WA: Klickitat Co. (Suksdorf, WSU). On Cornus nuttallii and Fraxinus.

Caloplaca saxicola (Hoffm.) Nordin--OR: Baker Co. (Ryan, ASU). Deschutes Co.' (pension, OSC; Rhoades, WWB). Harney Co.. (Rhoades, WWB). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC; Ryan, ASU). WA: Ckanogan Co. (Rhoades, WWB; Douglas, 1974). Whitman. Co'. (Ryan, ASU). Yakima Co. (Ryan, ASU, WWB). 1400-6800 ft; 365-910 m. On basalt, on vertical faces (rimrock), or on granite. On bird perches, in the most manured part, inside Phvscia dubia zone. 'Sagebrush, sometimes with ponderosa pine; juniper-sage desert. Often associated with urine deposits of Neotoma.

Caloplaca stillicidiorum (Vahl) Lynge--OR: Harney Co. (Pike, OSC). Malheur Co. (Rosentreter). Wasco Co. (Rossman, 1992). WA: Okanogan Co. '(Douglas, 1974). Arctic-boreal. 990-1050 m. On plant debris and moss, or soil. Mound community in biscuit scabland; juniper-sage desert; N-facing canyon in Artemisia tridentata spp. tridentata/Agropyron spicatum.

Caloplaca tiroliensis Zahlbr.--OR:' Deschutes Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Okanogan Co. (Ryan, ASU). 2900-5500 ft.; 1650-1775 m. On moss over basalt or andesite, sometimeson vertical surfaces. Pinyon-juniper-sage; sagebrush areas; montane forest.

Caloplaca tominii Savicz--OR: Deschutes Co. (Eslick, herb. Rosentreter). Malheur Co. (Rosentreter). WA: Lincoln Co. (Rosentreter). 8000 ft. On soil. N-facing canyon slope, Artemisia tridentata spp. tridentata/Agropyron spicatum; Artemisia rigida habitat.

Caloplaca trachyphylla (Tuck.) Zahlbr.--OR: Malheur Co. (Rosentreter; McCune). 3000 ft. 910-915 m. On ash soils surrounded by Artemisa arbuscula steppe.

Caloplaca spp. (**C. holocarpa** group)--OR: Deschutes Co. .(Pike, and Pike & Rossman, OSC). WA: Klickitat Co. (Pike, OSC; Davis, herb. Davis; Suksdorf, WSU--as C. aurantiaca and as C. cerina). Whitman Co. (Beattie, WSU--as C. aurantiaca). 400-6000 ft; 990 m. On Alnus, Picea, Populus, Pseudotsuga, Quercus; on moss over basalt. Ponderosa pine-Garry oak-Doug fir stand, on N-facing slope; cottonwood or aspen stands near creeks; mixed conifer forest; oak woodland.

Caloplaca sp. (**C. squamosa** group?)--WA: Klickitat' Co. '(Davis, herb. Davis). On basalt.

Caloplaca spp.

Candelaria concolor (Dickson) B. Stein--OR: Deschutes Co. (40) (Geiser, herb. Geiser). Klamath Co. (Ryan, ASU). Malheur Co. (Rosentreter). Wasco Co. (Rossman, 1992). WA: Klickitat Co. (Ryan, ASU; Davis, herb. Davis). Spokane Co. (Cooke, 1955). Whitman.Co. (Bislev WWB; Cooke, 1955). Yakima Co. (Ryan, WWB). 400 ft. On Artemisia tridentata or other shrubs, or on Juniperus occidentalis, Pinus ponderosa, Quercus qarryana or other trees; on wooden fenceposts; occasionally on burnt stumps; occasionally on steep faces of rock (basalt). 200-2000 ft.; 990-1050 m. Grassland; oak woodland; biscuit scabland; Artemisia tridentata ssp. tridentata/Stipa comata.

Candelariella aurella (Hoffm.) Zahlbr.--OR: Malheur Co. (McCune; identification may need checking). WA: Okanogan Co. (Douglas, 1974). Yakima Co. (Ryan, ASU). 480 m. On sandstone and concrete.

"Candelariella citrina B. de Lesd."--OR: Morrow Co. (Bahn, herb. Rosentreter). 600 ft. On sandy soil. Stipa comata/Poa sandberaii. Identification needs checking.

Candelariella efflorescens R. C. Harris & Buck--OR: Malheur Co. (Rosentreter). On bark of Artemisia. Artemisia tridentata ssp. tridentata/Stipa comata.

Candelariella rosulans (Müll. Arg,) Zahlbr.--OR: Deschutes Co. (41) (McCune). Lake Co. (Pike, OSC). Malheur Co. (McCune).. Wasco Co. (Rossman, OSC). WA: Klickitat Co. (Davis, herb. Davis). Yakima Co. (Ryan, ASU). 400 ft; 910-1860 m. On moss'or thin soil over over rock' (e.g., basalt or andesite; sandstone);? occasionally on old bones; on tops of exposed basalt cliffs. Biscuit scabland with Artemisia riqida, Festuca idahoensis, etc.; alpine.

Candeldriella cf. terriuena Räsänen--OR: Harney Co. (Pike, OSC). Jefferson Co. (Rosentreter). Klamath Co. (Ryan, ASU). Lake Co.

(Ryan, ASU). Malheur Co; (Rosentreter). WA: Lincoln. Co. (Rosentreter). Okanogan Co. (Douglas, 1974). Yakima Co. (Ryan, WWB). 1400-6480 ft; 1375-1950 m. On dung, plant remains, or soil. Sagebrush; juniper-sage'desert; lava beds; 'Artemisia riaida' habitat; Artemisia tridentata ssp. wvominsensis mixed with Agropyron spicatum and Festuca idahoensis; Artemisia tridentata spp. tridentata/Agropyron spicatum.

Candelariella vitellina (Hoffm.) Müll. Arg.--OR: Baker Co. (Palmer, ASU). Deschutes Co. (Pike, OSC). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC; Ryan, ASU; Davis, herb. Davis). Union Co. (Davis, herb. Davis). WA: Grant Co. (Rosentreter). Klickitat Co. (Davis, herb. Davis; Suksdorf, WSU). Whitman Co. (Ryan, WWB). Lincoln Co. (Rosentreter). Yakima Co. (Ryan, ASU). 350-6800 ft; 300-1950 m. On rock (basalt; schist); on dead wood, twigs of Artemisia rigida; on conifer wood; on bone; sometimes on other lichens (Peltigera). Biscuit scabland; juniper-sage desert; N-facing cliffs in sagebrush-grassland; cottonwood-ponderosa pine woodland along river.

Candelariella xanthostiwa (Ach.) Lettau--OR: Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). 4500-5640 ft. 1450-1730 m. On Cercocarpus ledifolius. Pine forest.

Candelariella sp.--OR: Wasco Co. (Rossman, 1992--as "C. aurella"). 990-1050 m. On soil and plant debris. Mound and intermound communities in biscuit scabland. Perhaps the same as "C. cf. terrigena"

Candelariella sp. --WA: Klickitat Co. (Suksdorf, WSU--as "C. aurella"). On hardwood bark.

Carbonea vitellinaria (Nyl.) Hertel--OR: Union Co. (Davis, herb. Davis). 4100 ft. Parasitic on Candelariella vitellina over basalt.

Catapvrenium lachneum (Ach.) R. Sant. (Syn. DermatocarPon hepaticum)--OR: Deschutes Co. (Eslick, herb. Rosentreter). Harney Co. (Pike, OSC). Klamath Co. (Ryan; ASU--may be C. suuamulosum). Malheur Co; (Rosentreter): OR: Wasco Co. (Rossman, 1992). Arctic-boreal. 3600-8000 ft; 990-1050 m. On bare soil. Mound community in biscuit-scabland. Juniper-sage desert on E-facing slope. on ridgetop; Artemisia tridentata ssp. tridentata/Festuca idahoensis.

Catapyrenium plumbeum (B. de Lesd.) Thomson--OR: Wasco Co. (Rossman, 1992). 990-1050 m. On small stones at ground level. Inter-mound community 'in biscuit scabland.

Catapyrenium squamosulum (Ach.) Breuss (Syn. DermatocarPon

henaticum) --OR: Harney Co. (Pike, OSC). Klamath Co. (Ryan, ASU). Malheur Co. (Rosentreter--det. Breuss). 2600-3600 ft.; 1400 m. On soil, in flat, wind-swept, gravelly areas, juniper-sage desert on gentle E-facing slope; N-facing canyon slopes in Artemisia tridentata spp. tridentata/Agropyron spicatum.

Catinaria atropurpurea (Schaerer) Vezda & Poelt (Syn. Catillaria atropurpurea)--WA: Klickitat Co. (Suksdorf, WSU).

Cetraria aculeata (Schreber) Fr. (Syn. Coelocaulon aculeatum)--OR: Wallowa Co. (Rosentreter). WA: Chelan Co. (Douglas, 1974). Ferry Co. (Thomson, 1984). Okanogan Co. (Imshaug, 1957; Douglas, 1974; Thomson, 1984). Arctic-alpine. 2600 ft. On sandy soil or among mosses at the edge of frost boils, sometimes over rocks with thin soil, occasionally at the base of shrubs. Grassland.

Cetraria californica--Reports of this species are apparently misidentifications of Tuckemrannopis merrillii.

Cetraria commixta (Nyl.) Th. Fr.--WA: Okanogan Co, (Imshaug, 1957; Douglas, 1974). On rock. Alpine.

Cetraria ericetorum Opiz--WA: Ferry Co. (Thomson, 1984). Okanogan Co. (Douglas, 1974). Boreal to arctic-alpine. On soil and humus, especially among mosses, in dry or moist habitats.

Cetraria hepatizon (Ach.) Vainio--WA: Okanogan Co. (Imshaug, 1957; Thomson, 1984). Yakima Co. (Ryan, ASU). Arctic-alpine to boreal. On exposed dry rocks and gravel. 1950 m.

Cetraria islandica (L.) Ach.--WA: Chelan Co. (Douglas, 1974). Okanogan Co. (Imshaug, 1957; Douglas, 1974). Pend Oreille Co. (Lavser, WSU--det. Hale). Yakima Co. (Ryan, ASU). 6000+ ft; 1950 m. Alpine. Abies lasiocarpa/Menziesia

Cetraria muricata (Syn. Coelocaulon muricatum)--WA: Yakima Co. (Ryan, ASU). 1950 m. On rocks or soil. Alpine.

Chaenotheca furfuracea (L.) Tibell--OR: Klamath Co. (Ryan, ASU). Union Co. (Rosentreter). 5400 ft. 914-1635 m. Edge of Douglas fir forest.

Chaenotheca spp.--Several collections of this genus, not identified to species, have been made in the Columbia Basin of Oregon and Washington (OSC; herb. Davis).

Chromatochlamys muscorum v. octospora (Nyl.) Mayrh. & Poelt--OR: Grant Co. (Rosentreter). Jefferson Co. (Rosentreter). 2400-3200 ft. On mesic clay/loamy soil. Artemisia tridentata ssp. wyominsensis mixed with Agropyron spicatum and Festuca

idahoensis; Artemisia tridentata spp. tridentata/Agropyron spicatum.

Cladina mitis (Sandst.) Hustich--WA: Ferry Co. (Howard, 1950). Okanogan Co. (Imshaug, 1957; Douglas, 1974; Yakima Co. (Ryan, ASU). Arctic-alpine. 1 9 5 0 m .

Cladina ranuiferina (L.) Nyl.--OR: Hood River Co. (Sipe, OSC). WA: Yakima Co. (Ryan, ASU). On soil, sometimes on rock slides. 1585 m. Fir forest.

Cladonia asahinae Thomson--OR: Wallowa Co. (Hammer, herb. Rosentreter). 3600-5500 ft. On moss on thin soil over dead wood; on compressed duff,' sometimes along roadsides.' A member of the C. chloroohaea complex, distinguished mainly by chemistry.

Cladonia bacillaris Nyl.--OR: Klamath co. (Ryan, ASU). 5400 ft; 1635 m. On base of.Pseudotsuqa menziesii and on logs or stumps. Mixed conifer forest.

Cladonia-bellidiflora (Ach.) Schaerer--WA: Kittitas Co. (Howard, WTU). Pend Oreille Co. (Hammer, herb. Rosentreter). Yakima Co. (B. Ryan, OSC).

Cladonia borealis--OR: Wallowa Co. (Hammer, herb. Rosentreter). WA: Okanogan Co. (Price, WTU--det. Hammer). 3500-5000 ft. On compressed duff.

Cladonia cariosa (Ach.) Sprengel--OR: Hood River Co. (Suksdorf, WSU). Klamath Co. (Ryan, ASU). Wallowa Co. (Thomson, 1984; Pike, OSC; Hammer, herb. Rosentreter). WA: Chelan Co. (Howard, WTU; Douglas, 1974). Ferry Co. '(Howard; WTU--det. Hammer). Kittitas Co. (Howard, WTU--det. Hammer). Klickitat Co. (Suksdorf, WSU). 'Okanogan Co. (Hammer, herb. Rosentreter; Ryan, ASU; Douglas, 1974). Spokane Co. '(Cooke, 1955; Thomson, 1984). Whitman Co. (Howard, WTU). Yakima Co. (Howard, WTU; Suksdorf, WSU). Arctic to temperate. 2000-6000 ft; 1000-1775 m. On soils, especially those rich in humus, sometimes on trail cuts; on'thin soil "and compressed duff; sometimes over rock; in exposed or relatively shaded areas. Mixed conifer forest.

Cladonia carneola (Fr.) Fr.--OR: Wallowa Co. (Thomson, 1984; Hammer, herb. Rosentreter). Boreal-arctic. On soil rich 'in humus, and on rotting wood; on compressed duff over granite; on thin soil. Mixed conifer forest.

Cladonia cenotea (Ach.) Schaerer--OR: Union Co. (Hammer, 1993). Wallowa Co, (Hammer, herb. Rosentreter; Hammer, 1993). WA: Ferry Co. (Thomson, 1984; Hammer, 1993). Okanogan co. (Ryan, ASU). Pend Oreille Co. (Hammer, 1993). Spokane Co. (Hammer, 1993). Stevens

Co. (Cooke, 1955--specimen at WIS verified by Hammer (Hammer, 1993); Thomson, 1984). Boreal-arctic. 2200-5000 ft. On 1775 m. soil rich in humus, on ecorticate, rotting wood, on stumps, occasionally on thin humus over rocks; usually in north-facing situations. Montane forest.

Cladonia cervicornis (Ach.) Flotow ssp. cervicornis--WA:'Stevens Co. (Hammer, herb. Rosentreter). On thin soil under young pines.

Cladonia cervicornis ssp. verticillata (Hoffm.) Ahti--OR: Wallowa Co. (Thomson, 1984).

Cladonia dhlorophaea (Flörke ex Sommerf.) sprengel--OR: Deschutes Co., (Eslick, herb. Rosentreter). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Wallowa Co. (Hammer, herb. Rosentreter). WA: Ferry Co. (Howard, 1950). Klickitat Co. (Suksdorf, WSU). Okanogan Co. (Hammer, herb. Rosentreter; Ryan, ASU). Pend Oreille Co. (Thomson, 1984). Spokane Co. (Cooke, 1955--partly as f. simplex and f. carpophora; Thomson, 1984). Whitman Co. (Cotton, WSU; Cooke, 1955; Thommson, 1984). Low arctic to temperate. 2000-8000 ft; 1000 m. On soil, tree bases, rotting wood, or thin soil over rock.

Cladonia coccifera (L.) Willd. --OR: Hood River Co'. (Suksdorf, WSU). WA: Klickitat Co.. (Davis, herb. Davis; Suksdorf, WSU). Okanpgan Co. (Douglas, 1974). 400 ft. On mossy rock bank.

Cladonia coniocraea auct.--OR: Deschutes Co. (Eslick, herb. Rosentreter). Lake Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). WA: Chelan Co. (Howard, 1950). King Co./Kittitas Co. .(Howard, 1950). Pend Oreille Co. (Lavser, WSU). Spokane Co. (Cooke, 1955; Thomson,: 1984). Stevens Co. (Cooke, 1955; Thomson, 1984). Whitman Co. (Cooke, 1955). Boreal to temperate. On humus, rotting logs, tree bases, and over rocks in moist places. 2000-8000 ft; 990-1050 m. On soil and on mossy, rotten wood. Mound community in biscuit scabland; Tsuga/Pachistima.

Cladonia cryptochlorophaea Asah.--WA: Ferry Co./Stevens Co.. (Thomson, 1984). Boreal to temperate. Habitat (Thomson, 1984): On soil and the bases of trees.

Cladonia deformis (L.) Hoffm.--WA: Yakima Co. (Suksdorf, WSU).

Cladonia diuitata (L.) Hoffm.--WA: Spokane Co: (Cooke, 1955; Thomson, 1984). Whitman Co. (Cooke, 1955; Thomson, 1984). Boreal-temperate. 2000-2200 ft. On soil rich in humus, on old logs and on bases of trees (Thomson, 1984).

Cladonia ecmocvna Leighton (ssp. ecmocvna?)--WA: Chelan Co. . (Douglas, 1974). Okanogan Co. (Ryan, ASU; Douglas, 1974). On

soil: 1775 m. Montane forest.

Cladonia ecmocyna ssp. intermedia (Robb.) Ahti--WA: Pend Oreille Co. (Hammer, herb. Rosentreter). On compressed duff.

Cladonia fimbriata (L.) Fr. (Syn. C. major)--OR: Deschutes Co. (W. Dunlap; L. Pike, OSC; Eslick, herb. Rosentreter); Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Wallowa Co. (Hammer, herb. Rosentreter). Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Chelan Co. (Howard, WTU--det. Hammer). Garfield Co. (Bosuach & Mullen, WSU). Kittitas Co. (Anderson, WTU). Klickitat Co; (Suksdorf, WSU). Okanogan Co. (Hammer, herb. Rosentreter; Ryan, ASU). Spokane Co. (Cooke, 1955; Thomson, 1984, partly as C. major). Whitman Co. (Cooke, 1955; Thomson, 1984). Yakima Co. (Suksdorf; WSU).' Habitat (Thomson, 1984): on soil and rotting wood. Boreal to temperate. 2000-8000 ft; 990-1915 m. On earth, rotting logs; tree bases, and on'thin soil over rock. Sometimes in very shaded habitats. Ponderosa pine forest with aspen; biscuit scabland:

Cladonia furcata (Huds.) Schrader spp. furcata--OR: Wasco Co. (Darrow, WTU--det. Hammer, with "cf."). WA: Kittitas.Co.. (Anderson; WTU; Ryan, WWB). Klickitat Co. (Suksdorf,' WSU--as v. pinnata). Whitman Co. (Bialey, WWB). Yakima Co. (Piper, WSU). 2300 ft. Moist woodland, with moss and ferns; ponderosa pine-Doug fir forest.

Cladonia glauca Flörke--WA: Spokane.Co. (Cooke, 19.55). 2000 ft.

Cladonia gracilis (L.) Willd.--WA: Chelan Co. (Douglas, 1974). Kittitas Co. ~~(Anderson~~, WTU). Klickitat Co. (Davis,, herb: Davis; Suksdorf; WSU--as "v. hispida"). Okanogan Co. (Howard, WTU--det. Hammer; Ryan, ASU; Douglas, 1974). 400 ft. On duff; on mossy rock bank. Moist forest..
Cladonia uracilis ssp. nigripes (Nyl.) Ahti--WA: Yakima Co. (Ryan, ASU). 900 m. Douglas fir forest.

Cladonia uracilis ssp. turbinata (Ach.) Ahti--WA: Stevens Co.' (Hammer, herb. Rosentreter). On thin soil along roadside.

Cladonia macilenta Hoffm.--WA: Klickitat Co. (Suksdorf, WSU). Yakima Co. (Anderega & Schroeder,, OSC).4300 ft. Mixed conifer forest-with predominance of Doug fir.

Cladodia macrophyllodes Nyl.--OR: Wallowa Co. (Hammer, herb. Rosentreter). On thin soil and compressed duff over boulders.

Cladonia multiformis G. K. Merr.--WA: Pend Oreille Co. (Hammer, in herb. Rosentreter). Spokane Co. (Cooke, 1955--"f. simulata"); Thomson, 1984). Stevens Co. (Hammer, in herb. Rosentreter).

Mainly boreal. 2000 .ft; 1100 m. On thin soil, among mosses, and on 'rotting logs. In moist habitats, e.g., under pine trees.

Cladonia ochrochlora Flörke--OR: Wallowa Co. (Hammer, in herb. Rosentreter). 3500-5000 ft. On thin soil and duff over ecorticate rotten logs.

Cladonia phyllophora Ehrh. ex Hoffm.--WA: Okanogan Co. (Douglas, 1 9 7 4) ; .

Cladonia pleurota (Flörke) Schaerer--WA: Okanogan Co. (Ryan, ASU). On soil 1775 m. Montane forest.

Cladonia pocillum (Ach.) 0. Rich--OR: Grant Co. (Rosentreter). Wallowa Co. (Hammer, herb. Rosentreter). WA: Lincoln Co. (Rosentreter). On thin soil. Artemisia rigida habitat. Sometimes forming balls.

Cladonia polydactvla (Flörke) Sprengel--OR: Jefferson Co. (Pike, OSC). WA: Klickitat Co. (Suksdorf, WSU). Yakima Co. (Pike, OSC). 4200 ft; 910 m. On rotting logs. Open western larch-ponderosa pine forest.

Cladonia pyxidata (L.) Hoffm.--OR: Deschutes Co. (Eslick, in herb. Rosentreter). Deschutes Co./Lane Co. (Imshaug, 1957). Hood River Co. (Suksdorf, WSU). Wallowa Co.' (Hammer, -herb. Rosentreter). Wasco Co. (Rossman, 1992). WA: Asotin Co. (Thomson, 1984). Okanogan Co. (Rhoades, WWB; Imshaug, 1957; Douglas, 1974). Whitman Co. (Cooke, 1955). Yakima Co. (Ryan, ASU). Arctic-boreal to temperate (+ cosmopolitan). 2000-8000 ft. 900-1050 m. Usually on acid mineral soils, but may also be found on (ecorticate) rotting logs, the bases of trees, and on rocks, in open to shaded sites. Douglas fir forest; mound community in biscuit scabland.

Cladonia ramulosa (With.) Laundon (Syn. C. anomaea)--WA: Spokane Co. (Thomson, 1984). Mainly temperate. Habitat (Thomson, 1984): on earth, tree bases, and rotten wood.

Cladonia rei Schaerer--WA: Stevens Co. (Hammer, in herb. Rosentreter). On thin soil along roadside.

Cladonia scabriuscula (Delies ex Duby) Leighton--WA: Spokane Co. (Cooke, 1955--"f. surrecta"). 2000-2200 ft.

Cladonia sincrularis Hammer--WA: Kittitas Co. (Hammer, 1993). Skamania Co. (Type: On moss or thin soil over lava, 600 m, Big Lava Bed) (Hammer, 1993). Also on rotting wood.

Cladonia squamosa (Scop.) Hoffm. v. squamosa--OR: Hood River Co.

(Hammer, 1993). WA: Yakima Co. (Thomson, 1984). Arctic to temperate. On earth, over rocks with small accumulations of soil, on rotting logs, occasionally on sandy soils. On doff, often on rotting ecorticate logs.

Cladonia sulphurina (Michaux) Fr.--OR: Wallowa Co. (Hammer, herb. Rosentreter). WA: Okanogan Co. (Ryan, ASU; Douglas, 1974). Yakima Co. (Howard, WTU--det. Hammer). 2557-5880 ft. On ecorticate decaying logs.

Cladonia symphycarpa (Ach.) Fr.--WA: Klickitat Co. (Suksdorf, WSU--one specimen as "v. epiphylla"). On stones or soil.

Cladonia trariscendens (Vainio) Vainio--OR: Jefferson Co. (Pike, OSC). Washington: Klickitat Co. (Davis, herb. Davis--identification needs checking). 1600 ft; 910 m. On rotting logs and base of Pseudotsuaa. -Open western larch-ponderosa pine forest.

Cladonia verruculosa (Vainio) Ahti--OR: Wallowa Co. (Hammer, herb. Rosentreter). WA: Stevens Co. (Hammer, herb. Rosentreter). On moss over thin soil and compressed duff, sometimes along roadsides.

Cladonia spp.

Collema nicrrescens (Huds.) DC.--WA: Klickitat Co. (Pike, osc; Suksdorf, WSU). 3100 ft. On puercus qarryana and other trees. Ponderosa pine-Garry oak-Doug fir stand on N-facing slope.

Collema tenax (Swartz) Ach.--OR: Deschutes Co. (Eslick, herb. Rosentreter). Wasco Co. (Rossman, 1992). WA: Klickitat Co. (Suksdorf, WSU). 8000 ft; 990-1050 m. On bare soil and moss. Mound community in biscuit scabland.

Collema sp. ("C. xerica Goward ined.")--OR: Jefferson Co. (Rosentreter). 2400 ft. On soil. Artemisia tridentata ssp. wominaensis with Agropyron spicatum and Festuca idahoensis.

Collema spp.--OR:

Cornicularia normoerica (Gunn.) Du Rietz--WA: 'Okanogan Co. (Imshaug, 1957; Thomson, 1984). Arctic-alpine. On cliffs and boulders, often in very exposed, windy'sites.

Cyphelium inquinans (Sm. in Sm. & Sow.) Trevisan--OR: Jefferson Co. (Pike, OSC). Wasco Co. (Rossman, 1992). WA: Klickitat Co. (Suksdorf, WSU). Yakima Co. (Howard, WTU; Pike, OSC). 2000-3440 ft; 990-1050 m. On bark of trees (Abies, Pinus ponderosa, Thuia plicata), and on wooden fenceposts. Biscuit scabland;' fir-Doug

fir forest.

Cyphelium tisillare (Ach.) Ach.--OR: Deschutes Co. (Pike, OSC). On dead branches of Juninerus occidentalis. Juniper-sage community.

Cyphelium sp. --OR: Klamath Co. (Ryan, ASU). 5400 ft; 1635 m. On bark. Mixed conifer forest.. May be C. inquinans.

Dactylina arctica (Richardson) Nyl.--WA: Okanogan Co. (Imshaug, 1957,; Douglas, 1974; Thomson, 1984). Arctic-alpine. Generally prefers areas just above snowbanks in areas with late snowmelt (Thomson, . 1984):

Dermatocarpon arnoldianum Degel.--OR: Deschutes Co. (Rhoades, WWB). On basalt rimrock. Juniper-sage. Identification needs checking.

Dermatocarpon intestiniforme (Körber) Hasse (syn. D. polyphyllum)--WA: Yakima Co. (Howard, WTU). 2800 ft.

Dermatocarpon luridum (With.) Laundon (syn. D. fluviatile, D. weberi) --OR: Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Wasco Co. (Thomson, 1984). WA: Klickitat Co. (Suksdorf, WSU; Davis, herb. Davis). Yakima Co. (Howard, WTU). Mainly boreal to temperate. 400-6400 ft. On rocks next to streams or lakes, occasionally inundated or exposed to seasonal seepage.

Dermatocarpon miniatum (L.) Mann--OR: Deschutes Co. (Thomson, 1984). Harney Co. (Rosentreter). Klamath Co. (Rvan, ASU). Lake Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). WA: Chelan Co., (Howard, WTU). Ferry Co. (Howard, WTU). Kittitas Co. (Johnson, and Howard, WTU). Klickitat Co. (Howard, WTU; Davis, herb. Davis). Lincoln Co. (Rosentreter).. Okanogan Co. (Howard, WTU). Whitman Co. (Howard, WTU). Yakima Co. (Howard, WTU; Ryan, ASU). Arctic, to temperate. 500-4800 ft; 2000 m. On rocks often containing or exposed to some calcium, often in very dry habitats with much sunlight (Thomson, 1984), but often in channels exposed to occasional seepage or runoff. On basalt, and sandstone-conglomerate, sometimes on large,, exposed boulders. 1644-5100 ft; 760-1915 m. Pine-oak woodland; biscuit scabland; Artemisia riaida habitat, sometimes with Poa sandbersii. Including v. complicatum and v. fulvofuscum.

Dermatocarpon miniatum "f. vagans"--OR: Grant Co. (Rosentreter). Harney Co. (Rosentreter). WA: Lincoln Co. (Rosentreter). 4000 ft.' Artemisia risida communities, sometimes with Poa sandberaii.

Dermatocarpon moulinsii (Mont.) Zahlbr.--OR: Deschutes Co. (Sine, OSC). WA: Chelan Co. (Grant, WTU). Okanogan Co. (Rvan, ASU). 700-

1925 m. On rock. Subalpine.

Dermatocarnon'muhlenbersii--WA:' Yakima Co. (Howard, WTU). At edge of lake. This species name is not in Egan (1987).

Dermatocarpon reticulatum Magnusson--OR: Deschutes Co. (Pike, OSC; Eslick, herb. Rosentreter; McCune). Harney Co. (Pike, OSC; McCune, and Rosentreter;). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC; Ryan, ASU). Malheur Co. (Rosentreter; McCune).' Wasco Co. (Rossman, 1992). *WA:* Grant Co. (Ryan, WWB). Kittitas Co. (Pike, C) . Klickitat Co. (Davis', herb. Davis). Lincoln Co. (Rosentreter). Yakima Co. (Ryan, WWB). 600-8000 ft; 910-1400 m. On rock (basalt, rhyolite, etc.), including "large, exploded boulders", vertical walls (sometimes in deep crevices, or partly shaded), and exposed NW-facing slope of basalt flows. Biscuit scabland; juniper-sage-ponderosa pine; sagebrush; Artemisia riaida habitat, sometimes with Poa sandbergii and Junioerus occidentalis; Artemisia tridentata spp. tridentata/Stipa comata.

Dermatocarpon reticulatum **"f. vagans"--OR:** Klamath Co.: Ryan, ASU). 4800-5100 ft. Sagebrush and Juniper-sage scabland, on soil among basalt pebbles in intermittent stream beds.

Dermatocarpon rivulorum (Arnold) **Dalla Torre & Sarnth.--WA:** Klickitat Co. (Davis, herb. Davis).. 500 ft. On rock along seasonal seepage.

Dermatocarpon sp. --

Dimelaena oreina **(Ach.)** Norman--OR: Baker Co.. (Ryan, ASU). Harney Co. (Sheard,. 1974). Lake Co. (Pike, OSC: Ryan, ASU). WA: Kittitas Co. (Martin, WWB). Okanogan Co. (Rhoades, WWB). 3400-6800 ft; 910-1700 m. On rock (basalt, granite) outcrops, large boulders used as woodchuck lookouts or bird perches.-(away from direct source of nitrogen), and-vertical walls of NW-facing basalt cliffs. Juniper-sage desert.

Dimelaena thysanota (Tuck.) Hale **& Culb.--OR:** Baker Co. -(Palmer, and Ryan, ASU). Deschutes Co. (L. Pike & A. Rossman, and Wagner, OSC). Lake Co. (Pike, OSC--det. Sheard; Sheard, 1974). Malheur Co. (McCune). Union Co. (Sheard, 1974). WA: Chelan Co./Douglas Co. (Sheard, 1974). Ferry Co. (Sheard, 1974). Kittitas Co. (Sheard, 1974). Klickitat Co. (Ryan, ASU). Yakima Co. (Ryan, ASU). 200-3600 ft; 910-1400 m. On outcrops (basalt, schist). Juniper-sage desert; grassland; cottonwoods.

Diploschistes gypsaceus (Ach.) **Nyl.--OR:** Wasco Co. (Rossman, 1992). 990-1050 m. On rock in ravine. Biscuit scabland.

Master species list

Diploschistes muscorum (Scop.) R. Sant.--OR: Baker Co. (Ryan, ASU). Crook Co. (Pike, OSC--as D. scrunosus). Deschutes Co. (Pike, and Wagner, OSC--as "D. scruposus"; Rhoades, WWB--as D. scrunosus). Gillian Co. (Bahn, in herb. Rosentreter). Harney Co. (Pike, OSC; Rhoades, WWB--as D. scruoosus). Klamath Co. (Ryan, ASU). Malheur Co. (Rosentreter--as D. muscorum). Wasco Co. (Rossman, 1992, as D. scrunosus). WA: Asotln Co. (Ryan, ASU). Chelan Co. (Howard, WTU, as ~~D. actinostomus)~~. 'Ferry Co.' (Foster, WTU, as D. scruposus; Howard, WTU, as D. actinostomus). Garfield Co. (Howard, WTU, as D. scrunosus),. Klickitat Co. (Merrill, UBC--as D. actinostomus; Suksdorf, WSU--as D. scruposus; Ryan, ASU; Davis, herb. Davis). Lincoln Co. (Rosentreter). Whitman Co. (Bialev, WWB--as D. scrunosus; Cooke, 1955, as D. actinostomus). Yakima Co. (Howard, WTU, as D. scrunosus; Rvan, WWB). 400-8000 ft.; 990-1300 m. On soil or moss, sometimes among basalt outcrops, lava flows, etc.; on stabilized soil at edges of stone rings among the moss Tortula ruralis. Sagebrush; biscuit scabland; .juniper-sage desert, sometimes with Doug fir and ponderosa pine;. Agropyron spicatum/Poa sandbergii, sometimes with Festuca idahoensis; Artemisia tridentata spp. tridentata/Agropyron spicatum; Artemisia rigida habitat; When growing directly on soil, the thallus may form thick inverted cones or roll into balls. Some of the collections.may be D. diacansis, or possibly even D. scruoosus. According to Lumbsch (1989); D. diacansis grows on soil and calcium-high rock, and has been collected in California and Utah, while D. muscorum occurs on soil, moss, and Cladonia, prefers calcareous substrates, and has been collected in Oregon and-Washington, and D. scruposus, grows both on siliceous rocks and soil, and ha been collected in Oregon. All collections of Dioloschistes species growing on soil or moss need to be studied carefully to determine which species they really are.

Diploschistes scruposus (Schreber) Norman--OR: Klamath Co. (Ryan, ASU). WA: Chelan Co. (Grant, and Howard, WTU). Klickitat Co. (Ryan, ASU). Klickitat'Co. (Davis, herb. Davis). Whitman Co. (Aase, WSU). Yakima Co. (Ryan, ASU, WWB). 200-4500 ft. On' basalt. Open-canopy pine-Doug fir forest; grassland; sometimes near creeks. Specimens cited here are only ones growing directly on rock.

Diplotomma penichrum (Tuck.) Szat.--WA: Chelan Co. (Douglas, 1974). Klickitat Co. (Suksdorf, WSU). Okanogan Co. (Ryan, ASU). Yakima Co. (Pike, OSC; Suksdorf, WSU). 3000-5880 ft. On conifer bark; on Alnus rubra, Prunus emarsinata, Pseudotsuaa menziesii. Ponderosa pine/mixed conifer stand. Montane forest.

Endocarpon pulvinatum Th. Fr.--OR: Harney Co. (McCune, and Rosentreter). Wasco Co. (Rossman, 1992). 4400 ft; 990-1400 m. On bare soil. Bottom of ravine in biscuit scabland. Artemisia

tridentata spp. tridentata/Agropyron spicatum; Artemisia rigida/Poa sandbersii grassland with scattered junipers' below basalt cliffs..

Esslinseriana idahoensis (Essl.) Hale & Lai--OR: Deschutes Co. (Eslick, herb. Rosentreter). Jefferson Co. (Pike, OSC).'Hood River Co. (Lloyd, OSC). Lake' Co. (Ryan, ASU). WA: Klickitat, Co. (Pike,' OSC; Suksdorf; WSU). 3'100-8000 ft.; 1600 m. On bark of Abies concolor, Pseudotsusa menziesii, Tsuga, and other conifers. Fir-Doug fir forest; Ponderosa pine-Garry oak-Doug. fir stand on N-facing slope.'

Evernia prunastri (L.) Ach.--OR: Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU).WA: Klickitat Co'. (Ryan, ASU; Davis, herb.. Davis). Yakima Co. (Piper, WSU). 400-5300 ft; 550 m. On Abies concolor, Pinus ponderosa, Quercus garryana. Oak woodland.

Evernia thamnodes = E. mesomorpha

Flavocetraria cucullata (Bellardi) Kärnef. & Thell--WA: Okanogan Co. (Imshaug, 1957; Douglas, 1974; Thomson';' 1984). Arctic-alpine, to boreal. Prefers sheltered spots and areas with late snow cover (Thomson, 1984).

Flavocetraria nivalis (L.) Kärnef. & Thell--WA: Chelan Co." (Douglas, 1974); Okanogan Co. (Price, WTU; Imshaug, 1957; Douglas, 1974; Thomson, 1984). Arctic-alpine, to boreal. On soil or betwen mosses on soil.

Flavoparmelia caperata (L.) Hale--OR: Wallowa Co. (Rosentreter--as Xanthonarmelia sp.). 2600 ft. On rock.

Flavopunctelia flaventior (Stirton) Hale--OR: Wallowa Co. (Rosentreter--as Parmelia sp.). 2600 ft. On rock.

Graphis elegans (Sm. in Sm. & Sow.) Ach.--WA: Klickitat Co. (Suksdorf; WSU). On branches of trees.

Graphis scripta (L.) Ach. --WA: Klickitat Co. (Suksdorf, WSU). On 'bark.

Haematomma sp.--WA: Klickitat Co. (Suksdorf, WSU--as "H. elatinum"). On bark. This 'material, with bright red apothecia, needs study; it probably belongs to a species that has' not been previously recorded from the Pacific Northwest and may even be new to North America or undescribed.

Hydrothyria venosa J. Russell--OR: Deschutes Co. (Henderson, OSC). Klamath Co. (Sine, OSC--Crater Lake National Park). 6850 ft; 2000 m. Small streams or rills feeding into lakes.

Hymenelia lacustris (With.) Poelt & Vezda--WA: Yakima Co. (Ryan, ASU). 1585 m. On rock, submerged in lakes and streams. Montane.

Hypocenomyce friesii (Ach. in Liljeblad) P. James & G. Schneider--WA: Klickitat Co. (Pike, OSC). 3100 ft. On charred wood. Ponderosa pine-Garry oak-Doug fir stand on N-facing slope.

Hypocenomyce scalaris (Ach.' ex Liljeblad) *M.* Choisy--OR: Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Kittitas Co. (Pike, OSC). Klickitat Co. (Suksdorf, WSU). Spokane Co. (Cooke, 1955). Yakima Co: (Suksdorf, WSU). 2000-6480 ft; 1635-1925 m. On Pinus contorta, P. nonderosa; on burnt wood. Mixed cottonwood-ponderosa pine stand along river; mixed conifer forest.

Hypogymnia austerodes (Nyl.) Räsänen--OR: Wallowa Co. (Pike, OSC). *WA:* Kittitas Co. (Ryan, WWB). Okanogan Co. (Ryan, ASU). Yakima Co. (Ryan, ASU). 2000-6100 ft. On Picea, wood, or sometimes on rock. Ponderosa pine; mixed conifer forest; alpine.

Hypogymnia bitteri (Lynge) Ahti--WA: Yakima Co. (Ryan, ASU). 1950 m. On bark or rock. A l p i n e .

Hypogymnia "enteromorpha"--WA: Spokane Co. (No collector aiven, WTU). Yakima Co. (No collector given, WTU). These collections are probably either H. occidentalis or H. ruqosa. However, it is conceivable that true H. enteromornha may also occur in the Columbia Basin

Hypogymnia imshausii Krog--OR: Deschutes Co. (Pike & Rossman, and Sine, OSC; Sundberq, WTU). Hood River Co. (Pike, OSC). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Union Co. (Rosentreter). Wasco Co. (Rossman, 1992). WA: Colville National Forest (Zamora, UBC). Garfield Co. (Boquach & Mullen, WSU). Kittitas Co. (Anderson, Johnson, and Tucker, WTU; Pike, OSC; Rvan, WWB). Klickitat Co. (Pike, OSC; Blanchard, WWB; Suksdorf, WSU). Okanogan Co. (Monauhan, and Rhoades, WWB; Ryan, ASU). Pend' Oreille Co. (Hone, WSU). Spokane Co. (Wasner, OSC; Piper, and Sayce, WSU). Whitman Co. (Cooke & Cooke, OSC, WSU; Wagner, OSC; Bialey, WWB; Boquach, and Jones, WSU). Yakima Co. (Ryan, ASU). 2400-7100 ft., 600-2100 m. On branches of Abies concolor, Juninerus occidentalis, Pinus oonderosa, P. monticola, Pseudotsuaa menziesii, Tsusa mertensiana and other conifers; on branches of Cercocarnus ledifolius, Quercus qustadoualasii; on logs or rarely soil. Ponderosa pine forest; krumholz areas with fir and hemlock;-Ponderosa pine-Garry oak-Doug fir stand on N-facing slope;. ponderosa pine-Doug fir forest; ponderosa pine; biscuit scabland; Pseudotsuga/Physocarpus malaceus community. Material in WSU identified by Howard as "Parmelia vittata" is mostly H. imshauqii.

Master species list,

Hypogymnia metaphysodes (Asah.) Rass.--OR: Wallowa Co. (Pike, OSC). WA: Garfield Co. (Boquach & Mullen, WSU). 5025-6000 ft. On Picea. Mixed conifer forest.

Hypogymnia occidentalis Pike:-OR: Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Kittitas Co. (Ryan, WWB). Okanogan-Co. (Ryan, ASU). 600-1775 m. On Abies concolor and other conifers. Ponderosa pine; mixed coniferous forest.

Hypogymnia physodes (L.) Nyl. --WA: Okanogan Co. (Ryan, ASU). Pend Oreille Co. (Lavser, WSU). Spokane Co. (Cooke, 1955; Thomson, 1984). Stevens Co. (Cooke; 1955); Whitman Co. (Bialey, WWB). Arctic to temperate. 2000-5880 ft. Usually on twigs or branches of woody plants (e.g., Crataeous doualasii; Pseudotsuaa menziesii); occasionally on soil, moss, or rocks. Pseudotsuaa/Pachistima-community.,

(Hypogymnia rugosa K. Merr.) Pike in Hale--OR: Lake Co: (Ryan, ASU--may be ~~H. occidentalis~~)

Hypogymnia tubulosa (Schaerer) Havaas--WA: Klickitat Co. (Davis, herb. Davis). Spokane Co. (Cooke,, 1955). Whitman Co. (Bigley, WWB). 400-2200 ft. On Pinus ponderosa;

Hypogymnia sp.--WA: Pend Oreille Co. (Lavser, WSU--as H. enteromornha). 4700-6300 ft. On bark of Abies lasiocarpa, Pinus monticola, and Tsuga. This resembles H. aninnata, but may be H. ruaosa; closer study is needed.

Icmadophila ericetorum (L.) Zahlbr.--WA: Okanogan Co. (Douglas, 1974).

Japewia tornoensis (Nyl.) Tonsb. (Syn. Lecidea tornoensis)--WA: Klickitat Co. ~~(Suksdorf~~, WSU). On bark of conifers.

Lecania dubitans (Nyl.) A. L. Sm. (Syn. L. dimera)--WA: Klickitat Co. (Suksdorf, WSU). On bark.

Lecania fuscella (Schaerer) Körber--OR: Malheur Co. (McCune). 910 m.

Lecania cf. 'koerberiana--OR: Malheur Co. (McCune). 910 m. This name-is not listed by Egan '(1987).

Lecanora argopholis (Ach.) Ach. (Syn. L. frustulosa, L. oregana)--OR: Wallowa Co., (Pike, OSC). Wasco Co: (Rossman, 1992). WA: Yakima Co. (Ryan, ASU). 5025-6000 ft; 990-1700 m. On basalt outcrops. Open Doug fir stand. Biscuit scablands.

Lecanora bicincta Ramond--WA: Yakima Co. (Ryan, ASU). Alpine.

1860-1950 m. On exposed rocks (andesite and other acidic types), steep to overhanging surfaces.

Lecanora carpinea (L.) Vainio--OR: Union Co. (Davis, herb. Davis). WA: Klickitat Co. (Suksdorf, WSU--det. Imshaug & Brodo; orignally as L. pallida). Spokane Co. (Imshaug & Brodo, 1966). Whitman Co. (Ryan, WWB). 3200 ft. On Rosa sp.

Lecanora cenisia Ach.--OR: Crook Co. (Rvan, ASU). Harney Co.. (Rhoades, WWB--identification needs checking). Lake Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). WA: Okanogan Co. (Ryan, ASU). Whitman Co. (Sayce, WSU). On basalt or other rocks, sometimes on steep surfaces under trees, sometimes on large boulders. 990 1950 m. Ponderosa pine forest; biscuit scabland; montane forest.

Lecanora circumborealis Brodo & Vitik.--OR: Klamath Co. (Rvan, ASU). Lake Co. (Ryan, ASU). WA: Klickitat Co. (Suksdorf, WSU--as L. subfusca v. argentata). Okanogan Co. (Rvan, ASU). Yakima Co. (Rvan, ASU). 730-2000 m. On twigs of Abies concolor, Pseudotsuoa, and other conifers;. Mixed conifer forest.

Lecanora demissa (Flotow) Zahlbr. (s. lato)--WA: Asotin Co. (Rvan, ASU). Klickitat Co. (Ryan, ASU). 130-2525 m. On shaded but dry, vertical to overhanging rock surfaces. Oak woodland.

Lecanora dispersa (Pers.) Sommerf.--WA: Yakima Co. (Ryan, ASU). 480 m. On concrete.

Lecanora epibryon (Ach.) Ach. --WA: Okanogan Co. (Douglas, 1974).

Lecanora flowersiana Magnusson--OR: Malheur Co. (McCune). 910 m.

Lecanora fuscescens (Sommerf.) Nyl. in Norrlin--WA: Okanogan Co. (Douglas, 1974).

Lecanora gangaleoides Nyl.--WA: Yakima Co. (Ryan, WWB). 1400 ft. On basalt., -Sagebrush.

Lecanora garovaglii (Körber) Zahlbr. (s. lato) (including L. cascadensis Magnusson non auct., -and L. nevadensis)--OR: Baker Co. (Hale, US). Deschutes Co. (McCune). Grant Co. (Andereag, ID: Ryan, ASU). Harney Co. (Rhoades; WWB). Klamath Co. (Herre, LAM). Lake. Co. (Pike, OSC; Rvan, ASU). Malheur Co.. (Rosentreter; McCune): Wheeler Co; (Ryan, ASU). WA: Asotin Co. (Rvan, ASU). Garfield Co. (Rvan, ASU). Grant Co. (Rvan, WWB). Okanogan Co. (Will-Woolf., COLO). Yakima Co. (Bird, UAC; Rvan, ASU). Throughout most of the western U.S. (mainly between the Sierras and the Rocky Mountains), to southwestern Canada and northern *Mexico.* 1300-8000 ft. 910-1340 m. On basalt, sometimes extending onto mosses;. occasionally on- soil and then greatly distorted.and

usually sterile, with terete lobes, becoming almost vagrant. Pinyon-juniper community; grassland; sagebrush areas; pine woodland.

Lecanora hagenii (Ach.) Ach.--OR: Wasco Co. '(Rossman', 1992). WA: Chelan Co. (Howard, 1950). Klickitat Co. (Suksdorf, WSU). Whitman Co.' (Beattie, WSU; Ryan, WWB--spores smaller than usual). 990-1050 m. -Usually on bark. (e.g.-, Crataeous douglasii, Populus trichocarna, Quercus uarrvana, Rosa sp.) or wood; sometimes on old'bones.. . Biscuit scabland; Palouse grassland; oak woodland.

Lecanora hypoptoides (Nyl.) Nyl.--OR: Deschutes Co. '(Pike & Rossman, OSC--det. Brodo). Wasco Co. (Rossman, 1992). 3000 ft; 990-1050 m. On Juninerus occidentalis and wooden fenceposts; also'expected on plant debris. Juniper-sage.desert; biscuit scabland.

Lecanora laatokkaensis (Räsänen) Poelt--OR: Grant Co'., (Ryan, ASU). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Yakima Co. (Rvan; ASU). 3200-4500 ft. On basalt or other rocks,. exposed to somewhat sheltered. Often epiphytic and perhaps parasitic on other crustose lichens (e.g., Aspicilia spp., Candelariella spp., brown Lecidea spp, and Rhizocaroon spp.). Pine woodland/grassland;pen-canopy pine-Doug fir.

Lecanora melaena (Hedl.) Fink--WA: Yakima Co. (Rvan, ASU). Alpine. 1860 m. On exposed rocks (andesite, 'etc.), sometimes on vertical surfaces.

Lecanora muralis (Schreber) Rabenh. (s. lato)--OR: Baker Co. (Ryan, ASU). Crook Co. (Pike, OSC; Ryan, ASU). Deschutes Co. (Anderegg, ID; Rhoades & Pike, WWB; Ryan, ASU). Grant Co. (Anderegg, ID; Ryan, ASU). Harney Co. (Davison, WIS). Klamath Co. (Rvan, ASU). Lake Co; (Pike, OSC; Rvan, ASU). Malheur Co. (Rosentreter). Wasco Co. (Rossman, COLO, MIN; Rossman, 1992). Wheeler Co. (Anderegg ID; Ryan, ASU). WA: Asotin Co. (Rvan, ASU). Chelan Co. (How&d, 193'7) . Douglas Co: (Howard, WTU). Garfield Co. (Ryan, ASU). 'Grant Co. -(Evans, US; Everdam, LAM; Ryan, WWB; Nash, ASU). Kittitas Co. (Everdam, COLO; Ryan, ASU). Klickitat Co. (Suksdorf, WSU; Ryan, ASU). Spokane Co. (Bonser, MIN). Okanogan Co. (Rhoades, WWB). Whitman Co. (Aase, -and Bigley, WSU; Esslinger, WIS; Ryan, ASU). Yakima Co; (Everdam, WIS; Rvan, ASU). Boreal to temperate, throughout large areas of North America except the southeastern coastal plain; in the Pacific NW it is'mostly on the east side, except for a few coastal localities. 200-5500 ft; 130-1915 m. On rock outcrops (basalt, andesite; sandstone, conglomerate) in open areas, sometimes on steep faces shaded by trees, sometimes on flat surfaces in the open on top of cliffs; occasionally on concrete; rarely on wood (roof shingles). Ponderosa pine woodland/grassland; grassland;

pinyon-juniper; sagebrush areas; Doug fir zone; cottonwoods.

Lecanora nicfromarainata Magnusson--OR: Deschutes Co. (Ryan, ASU). Klamath Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). Wheeler Co. (Ryan, UPS--holotype; Ryan, ASU). WA: Kittitas Co. (Ryan, ASU). Yakima Co. (Grant, ASU). 2100-4400 ft; 990-1340 m. On basalt or andesite rocks, often on vertical surfaces. Pinyon-juniper community; sagebrush; Doug fir zone; pine-Doug fir; biscuit scabland. The identifications of specimens other.than those from the vicinity of the type locality (Yakima Co., WA) are tentative.

Lecanora novomexicana Magnusson ("L. thomsonii Magnusson" form)--WA: Yakima Co. (Ryan, ASU). 1950 m. On rock, on overhanging surface. Alpine.

Lecanora pacifica Tuck. --OR: Wasco Co. (Fellows, OSC). On Quercus garryana. Oak woodland.

Lecanora cf. pallida (Schreber) Rabenh.--WA: Klickitat Co. (Suksdorf, WSU). On Populus tremuloides. The material is Pd-, whereas L. pallida (which does occur in western Washington, according to Imshaug & Brodo, 1966) is supposed to be Pd+ red.

Lecanora phaedrophthalma Poelt (syn. L. christoi W. Weber)--OR: Baker Co. (Palmer; and Ryan, ASU). Deschutes Co. (Rhoades, WWB; Waaner, OSC; Weber, COLO; Ryan, ASU; McCune). Grant Co. (Ryan, ASU). Klamath Co. (Ryan observation; not collected). Lake Co. (Ryan, ASU; Pike, OSC). Wasco Co. (Rossman, US; Rossman, 1992). Wheeler Co. (Ryan, ASU). WA: Ferry Co. (Weber, COLO). Garfield Co. (Ryan, ASU). Kittitas Co. (Everdam, WTU; Ryan, ASU). Klickitat Co. (Ryan, ASU). Yakima Co. (Ryan, ASU). s h Columbia to California; east to Alberta, south to Arizona'. 200-4600 ft. 990-1400 m. On andesite, basalt, schists, and other acidic rocks; also on bones according to Rossman (1992). On tops of outcrops. Sagebrush areas; pinyon-juniper community; pine-oak woodland; grassland; pine-Doug fir; bicuit scabland.

Lecanopolytropa (Hoffm.) Rabenh. (s. lato) --OR: Three Sisters Wilderness Area (F. Rhoades, OSC). Lake Co. (Ryan, ASU). WA: Okanogan Co. (Ryan, ASU; Douglas, 1974). Yakima Co. (Ryan, ASU). 3200-6480 ft; 1700-1950 m. On rocks (basalt, etc.). Montane to alpine.

Lecanora populicola (DC. in Lam. & DC..) Duby--OR: Klamath Co. (Ryan, ASU). Malheur Co. (McCune). 4560-5400 ft; 910-1635-m. On bark of Populus trichocarpa.

Lecanora prinslei (Tuck.) Lamb--OR: Deschutes Co./Lane Co. (Miller' & Shushan, 1964). Hood River Co. (Imshaug, MSC). Klamath Co. (OSC-- Crater Lake National Park). WA: Chelan Co.

(Imshaug, MSC). Okanogan Co. (Imshaug, MSC). Yakima Co. (Ryan, ASU). California to Washington, east to Alberta, south in the Rocky Mountains to New Mexico (Rocky Mountain material has been treated as a separate species, "Lecidea brandegei"). 8345 ft; 1860-2525 m.' Alpine, to subalpine. On exposed rocks (andesite and other acidic rocks). Often on steep to overhanging surfaces.,

Lecanora pseudomellea Ryan--OR: Baker Co. (Palmer, and Ryan, ASU). Crook Co: (Waaner, OSC). Klamath Co. (Rvan, ASU). Lake Co. (Ryan,U) . WA: Garfield Co. (Rvan, ASU). Grant Co. (Glew, and Tucker, WTU). Kittitas Co. (McCune, herb. McCune). Klickitat Co. (Ryan, ASU). Yakima Co. (Everdam, WTU; Rvan, ASU). 3400-6480 ft; (385-?)1175-1585(-1950?) m. Washington to California; with scattered populations eastward in the Great Basin. On hard acid rocks (basalt, schist,. granite), 'usually on exposed, small rocks on gently sloping surfaces (intermittent stream beds?);. sometimes on vertical faces under trees.' Sagebrush areas; sagebrush-grassland;' pine woodland; pine-Doug fir forest; oak woodland.

Lecanora rugosa--WA: Spokane Co. '(Cooke, 1955). 2000-2200 ft. This name is not listed by Egan.

Lecanora rupicola (L.) Zahlbr.--OR: Deschutes Co. '(Pike, OSC). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC; Ryan, ASU). Wasco Co. (Rossman, OSC). WA: Kittitas Co. (Rvan, ASU). Klickitat Co. (Ryan, ASU). Okanogan Co. (Douglas, 1974). Whitman Co. (Piper, and Sayce, WSU). Yakima Co. (Rvan, ASU). '4500-6480 ft; 550-2000 m. On basalt rocks, usually on vertical faces, sometimeson tops of exposed cliffa. Biscuit scabland with Artemisia riaida, Festuca idahoensis, etc.; sagebrush areas; oak woodland; high desert; alpine.

Lecanora saliqna (Schrader) Zahlbr.--OR: Lake Co. (Ryan, ASU). Wasco Co. (Rossman, OSC). 1150-1930 m. On wood (branches) of conifers; on old cow dung.

Lecanora semitensis (Tuck.) Zahlbr.--OR: Crook Co. (Ryan, ASU). Deschutes Co. (Weber, COLO). Grant-Co. (Ryan, ASU). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Garfield Co. (Ryan, ASU). Klickitat Co. (Ryan, ASU). Yakima Co. (Rvan, ASU). Primarily in the Sierras and Cascades, from California to British Columbia, with scattered populations in the Rocky Mountains. 4500-5800 ft; 550-1950 m. On basalt, andesite, and other rocks. Pine.. woodland; grassland; Doug fir zone; sagebrush; oak woodland.

Lecanora sierrae Ryan & Nash--OR: Baker Co. (Ryan, ASU). Klamath Co. (Sipe, OSC; Rvan; ASU). Lake Co. (Ryan, ASU). Okanogan CO. (Rhoades, WWB). 900-2500 m. Primarily a Californian species, with scattered populations in mountains-of the Great Basin and Cascades. On basalt or other hard siliceous rocks (usually

granite or other metamorphic kinds). On exposed to rather shaded, often steep or vertical faces. In the Columbia Basin, most often in pine and fir forests, occasionally in sagebrush areas.

Lecanora subrucrosa Nyl.--WA: Spokane Co. (Cooke, 1955). 2000-2200 ft.

Lecanora varia (Hoffm.) Ach.--Most if not all reports of-this corticolous/lignicolous species in western N. America (e.g., Rossamn, 1992) are misidentifications, of one of several apparently undescribed species.

Lecanora cf. weberi Ryan--OR: Crook Co. (Rvan, ASU). Klamath Co. (Ryan, ASU). WA: Asotin Co. (Rvan, ASU). Kittitas Co. (Ryan, ASU). Klickitat Co. (Rvan, ASU). Yakima Co. (Ryan, ASU). 1200-4400 ft; 1005-1340 m. On basalt, sometimes on horizontal surfaces. Doug fir zone; ponderosa pine woodland; oak woodland. The species was originally known only from the Rocky Mountains, and material from the Pacific Northwest is often not typical; this may be a complex rather than a single species.

Lecanora spp. (L. subfusca group)--WA: Klickitat Co. (Suksdorf, WSU). On Acer circinatum, A. macrophyllum, Alnus, Prunus emarsinata.

Lecanora sp. --WA: Lincoln Co. (Rosentreter--as "Lecanora christoi"). Loose on soil. Artemisia riuida habitat.

Lecanora spp.

Lecidea atrobrunnea (Ramond in Lam. & DC.) Schaerer (s. lato)--This group appears to be common on a wide variety of hard siliceous rocks at various elevations and in various habitats throughout much of the region, but until the taxonomy is better worked out it is not possible to give a meaningful description of its distribution.

Lecidea'carnulenta (Tuck.) Fink--WA: Klickitat Co. (Suksdorf, WSU). On Prunus emarsinata.

Lecidea cascadensis Magnusson--Probably a common species in the Columbia Basin, but at present not readily distinguishable from numerous other, probably undescribed brown taxa on rock.

Lecidea confluens (Weber) Ach.--WA: Okanogan Co. (Douglas, 1974).

Lecidea continua--WA: Klickitat Co. (Suksdorf, WSU). On rocks; sometimes "in a brook". = Pornidia sp.

Lecidea holopolia (Tuck.) Zahlbr.--WA: Klickitat Co. (Suksdorf, WSU--a syntype of the species). On wood.

Lecidea hypomela Nyl. --WA: Klickitat Co. (Suksdorf, WSU). On Prunus emaruinata..

Lecidea lapicida (Ach.) Ach.--OR: Wasco Co.. (Rossman, 1992). 990-1050 m. On small stones. Biscuit scabland.

Lecidea leucothallina Arnold--WA: Okanogan Co. (Ryan, ASU). On rock. 1775 m. Montane forest.

Lecidea lurida Ach. --WA: Okanogan Co; (Howard, 1950).

Lecidea mannii Tuck---OR: Malheur Co. (McCune). On basalt. 910 m.

Lecidea myriocarpioides Nyl.--WA: Klickitat Co. (Suksdorf, WSU). On dead, prostrate tree trunks.

Lecidea paddensis (Tuck.) Zahlbr.--OR: Deschutes Co.. (Pike & Rossman, OSC). Wallowa Co. (Pike, OSC). WA: Klickitat Co.. (Suksdorf, WSU). Yakima Co. (Suksdorf, WSU--including a syntype of the species). 3000-5000 ft. On old wood; on Abies grandis, Larix occidentalis, Picea enslemaniii, and other conifers. Ponderosa pine forest; closed-canopy, mixed conifer forest.

Lecidea paupercula Th. Fr.--WA: Yakima Co. (Rvan, WWB).. 5000-5600 ft. On acidic rocks. Probably widespread and common in the Columbia Basin. A member of the L. atrobrunnea complex.

Lecidea plana (Lahm in Körber) Nyl.--OR: Harney Co. (Chamber, OSC; identification needs checking). Wasco Co. (Rossman, 1992). WA: Okanogan Co. (Douglas, 1974). 990-1050 m. On basalt. Biscuit scabland.

Lecidea protabacina Nyl. --WA: Yakima Co. (Ryan, WWB; Suksdorf, WSU). 1400 ft. On basalt rock..Sagebrush zone.

Lecidea pumicicola Magnusson--OR: Deschutes Co. (Pike, OSC). Klamath Co. (holotype). 6350 ft. On pumice.

Lecidea tessellata Flörke (Syn.: L. cyanea)--OR: Baker.Co. (Rvan, ASU). Crook Co. (Rvan, ASU). Deschutes Co. (Pike & Rossman, OSC). Harney Co. (Rhoades, .WWB). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC; Ryan, ASU). Umatilla Co. (Rhoades, 'OSC). Wasco- Co. (Rossman, 1992). Wheeler Co. (Rvan, ASU). WA: Co.? (Ryan; WWB). Chelan Co. (Howard, WTU). Kittitas Co. (Everdam, WTU; Rvan, ASU). Klickitat Co. (Suksdorf, WTU). Whitman Co. (Aase, WSU). Yakima Co. (Rvan, WWB). Arctic-boreal. 1400-5100 ft.; 760-2000 m. On

basalt outcrops and large boulders, often on flat tops of' rocks in the open; sometimes on steep.surfaces under trees. Juniper-sage desert; Ponderosa pine woodlands; pine-Doug fir; sagebrush areas; biscuit scabland; Artemisia rigida.-Eriogonum thymoides community.

Lecidea turgidula Fr.--WA: Yakima.Co. (Suksdorf; WSU). 4000-5000 ft. On Tsuga mertensiana and other'conifers.

Lecidea spp. --Numerous species of Lecidea s. lato occur in the Columbia Basin; most have not been identified to species. Numerous specimens have been identified as L. darasema, a name which is too ambiguous to interpret consistently. Other names that have been'applied are L. caesioatra (Suksdorf, WSU--does not belong to that species), L. enteroleuca (an ambiguous name), and "L. caesianeria" (Savce, WSU--this species. is not in Egan's list, and I have not yet found any'other reference to it).

Lecidella carpathica Körber--OR: Klamath Co. (Ryan, ASU). Lake Co. (Rvan, ASU). Wasco Co. (Rossman, 1992). 6480 ft. 990-1950 m. On rock (basalt), often on large boulders. Biscuit scabland.

Lecidella elaeochroma (Ach.) M. Choisy--WA: Spokane Co. (Cooke, 1955). 2000-2200 ft.

Lecidella euphorea **(Flörke)** Hertel--OR: Wasco Co. (Rossman, 1992). WA: Klickitat Co. (Davis, herb. Davis). Whitman Co. (Savce, WSU). Arctic-boreal. 500 ft; 990-1050 m. On twigs and bark of Juninerus occidentalis, Prunus virainiana and Artemisia risida; on rotten log. Biscuit scabland; open areas;

Lecidella stiwatea (Ach.) Hertel **& Leuck.--OR:** Wasco Co. (Rossman, 1992). WA: Okanogan Co. (Douglas, 1974). Arctic-boreal. 990-1050 m. On small stones. In stone rings and in mound and intermound communities of biscuit scabland.

Lecidella sp. **--WA:** Klickitat Co. (Suksdorf, WSU). Near awaterfall.

Lepraria neglecta (Nyl.) Lettau **(s. lato)**--OR: Klamath' Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). WA: Okanogan Co. (Ryan, ASU; Douglas, 1974). Whitman Co. (Savce, WSU--as L. membranacea). 4300-6000 ft; 990-1925 m. On moss (Grimmia montana and G. ovalis) over basalt bedrock. Ravines in biscuit scabland; juniper-sage desert; lava field in mixed conifer forest; montane forest. Material from the Pacific Northwest differs chemically from true L. nealecta.

Lepraria (s. lato) **spp.**--Common throughout the Columbia Basin, but most identifications cannot be trusted.

Leprocaulon subalbicans (Lamb) Lamb--WA: Okanogan Co. (Imshaug, 1957).

Leprocaulon spp.--WA: Kittitas Co. (Ryan, ASU). Yakima Co. (Ryan, ASU). 1950 m. On soil or moss over rock. Pine-Doug fir; alpine. Most or all material identified by Rosentreter as belonging to this genus is Lenraria neslecta or unidentified sterile crustose lichens.

Leptochidium albodiliatum (Desmaz.) M. Choisy--OR: Deschutes Co. '(Pike & Rossman, OSC). Grant Co. (Goward, UBC; Rosentreter). Harney Co. -(Pike, OSC). Hood River Co. (Goward, UBC). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC--det. Sierk; Ryan, ASU). Malheur Co. (McCune). Wasco Co. (Pike, et al., OSC; Rossman, '1992). WA: Chelan Co. (Howard; WTU). Kittitas Co. (Goward, UBC). Klickitat Co. (Suksdorf, WTU, WSU; Howard, WTU; Ryan, ASU; Davis; herb. Davis). Whitman Co. (Thomson, 1984). Yakima Co. (Ryan, ASU, WWB--det. Degelius). Boreal-temperate. 400-6200 ft; 20-1950 m. Among mosses (over rock or soil) in moist habitats '(Thomson, 1984), but'also over disturbed and exposed soil, or soil over rock, in rather dry habitats,. Sometimes on steep surfaces, N-facing or under trees. Mound and intermound communities in biscuit scabland. Oak woodland; hemlock forest; big sagebrush steppe; juniper desert.

Leptogium byssinum (Hoffm.) Zwackh ex Nyl.--OR: Wasco Co. (Rossman, 1992); *North temperate to Arctic. 990-1050 m. On bare soil. Mound community in biscuit scabland.

Leptouium californicum Tuck.--OR: Deschutes Co. (Pike & Rossman, OSC). Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Chelan Co. (Howard; WTU--det. Sierk). Kittitas Co. (Ryan, ASU). Klickitat Co. (Howard, WTU--det. Sierk). Whitman Co. (Howard, WTU; Sayce, WSU). 2186-3500 ft; 760-1150 m. On moss over basalt; among mosses, stones, and soil, in rock ring; on branch of Artemisia riaida. Mound and intermound communities of biscuit scabland; Juniper-sage desert; sometimes' on ridgetops.' This taxon can be easily confused with L. lichenoides, and may not be truly distinct'from it.

Leptogium c fdenticulatum Tuck.--Washignton: Yakima Co. (Ryan, WWB). 1400 ft. Sagebrush..

Leptogium hirsutum Sierk (Syn. L. burnettiae v. hirsutum)--OR: Jefferson Co. (Rosentreter). WA:.Klickitat Co. (Davis, herb. Davis). 400-2400 ft. On soil over rock. Frequently closely associated and intermixed with Leptochidium albociliatum. Artemisia tridentata ssp. wyomingensis with Agropyron spicatum and Festuca idahoensis.

Leptogium lichenoides (L.) Zahlbr.--OR: Crook Co. (Ryan, ASU). Harney Co. (Pike, OSC). Jefferson Co. (Rosentreter).. Klamath Co. (Ryan; ASU). Lake Co. (Ryan, ASU). Malheur Co: (McCune). Wallowa Co. (Rosentreter).. Wasco Co. (Rossman, 1992). WA: Chelan Co. (Howard, 1950). Klickitat Co. '(Suksdorf, WSU). Yakima Co. (Howard, WTU--det. Sierk; Ryan, WWB). Arctic-boreal. 2000-6480 ft; 990-1950 m. On moss over basalt outcrops, or on soil,.; sometimes on steep surfaces under trees. Among scattered ponderosa pine; mound and intermound communities of biscuit scabland. Artemisia tridentata ssp. wyominsensis with Agropyron spicatum and Festuca idahoensis; Douglas fir forest; juniper-sage desert.

Leptogium saturninum (Dickson) Nyl.--OR: Rlamath Co. (Ryan, ASU). Wallowa Co. '(Thomson, 1984). Arctic to temperate. On rocks, and bases of woody plants (Thomson, 1984). 1930-2000 m.

Leptogium tenuissimum (Dickson), Körber--OR: Lake Co. (Pike, ASU). 1400 m. On moss (e.g., Grimmia montana) on basalt flows. Juniper-sage desert.

Leptogium sp. ("L. schraderi (Ach.j Nyl.")--WA: Klickitat Co. (Davis, herb. Davis). 400 ft. On soil and moss. According to Egan (1987), reports of L. schraderi from North America are based on misidentifications.

Leptogium sp. (subg. Mallotiwn)--WA: Klickitat Co. (Suksdorf, WSU--as Sticta fulisinosa). This may be L. saturninum.

Leptogium spp.

Letharia columbiana (Nutt.) Thomson--OR: Powder River Mountains' (Piper, WSU). Deschutes Co. (Simmons & Simmons, WTU; Denison, Pike & Rossman, Pike, Lawrence, and-Whited, OSC). Harney Co. (Hansen, OSC; Rosentreter). Jefferson Co. (Schofield & Lvford, UBC). Klamath Co. (Rvan, ASU). Wallowa Co. (Pike, OSC). WA: .Garfield Co. (Boguach & Mullen; WSU). Kittitas Co. (Johnson, WTU; Howard, UBC--as L. vulpina). Klickitat Co. (Pike, o s c ; Davis, herb. Davis; Goward, UBC; Suksdorf, and Jones, WSU). Lincoln Co. (Tammer, WSU). Okanogan Co. (Rhoades, WWB). Spokane Co. (Jones, WSU). Walla Walla Co. (Weveth--type collection, cited by Thomson, 1969). Whitman Co. (Jones, UBC, WSU; Sayce, and Boguach, WSU).'Yakima Co. (Rvan, ASU, WWB; Suksdorf, WSU). 400-7800 ft; 300-900 m. On Alnus, and Cercocarous ledifolius; on dead branches of Junioerus'occidentalis, Pinus albicaulis, P. contorta; P. ponderosa, Pseudotsuoa menziesii, etc.; rarely on rock (basalt). Sagebrush; Ponderosa pine forest; juniper woodland; Ponderosa pine-Garry oak-Doug fir stand, on N-facing slope; mixed conifer forest; juniper-sage;' aspen woodland; krumholz; 'sometimes along ridgetops.

Letharia vulpina (L.) Hue--OR: Blue Mountains (Krajina, UBC). Powder River Mountains (Piper, WSU). Deschutes Co. (Sundberg, WTU). Grant Co. (Flinn, WSU). Jefferson Co. (Chambers, and Koutsky, OSC; Rhoades, WWB). Klamath Co. (Ryan, ASU). Lake Co. (Pike, OSC). Union Co. (Rosentreter). Wasco Co. (Pike-; et al., OSC: Rossman, 1992). WA: Colville National Forest (Zamora, UBC). Chelan Co. (Stunz, WTU; Martin, WWB). Grant Co. (Jones, and Scheffer, WSU). Kittitas Co. (Howard, and Anderson, WTU; Ryan, and Martin, WWB; Pike; OSC), Klickitat Co. (Blanchard; WWB; Pike, OSC; Davis, herb. Davis; Goward, UBC; Jones, UBC, WSU). Lincoln Co. (Rosentreter). Okanogan Co. (Rhoades, WWB; Ryan, ASU; Douglas, 1974). Pend Oreille Co. (Lavser, WSU). Spokane Co. (Bonser, and No collector aiven, WTU; Cooke, 1955). Stevens Co.. (Dennis, WTU; Cooke, 1955). Whitman Co. (Bialev, WWB; Boquach, WSU--mixed with L. columbiana; Sayce, WSU; Cooke, 1955). Yakima Co. (Howard, and No collector qiven, WTU; Rvan, ASU, WWB; Svihla, herb. Rosentreter; Suksdorf, WSU). 400-8000 ft.; 990-2125 m. On limbs and trunk of Abies concolor, A. lasiocaroa, Pinus albicaulis, P. monticola, P. oonderosa, Pseudotsuaa menziesii, and other conifers; on branches of Artemisia riqida, A. tridentata, Cercocarpus ledifolius; on fenceposts (including "cedar" ones); rarely on rocks (basalt cliff outcrops), moss, or soil. Sagebrush; biscuit scabland; Ponderosa pine; pine-oak woodland; open canopy pine-Doug fir; Pseudotsuga/Physocarpus malaceus community; open mixed forest; krumholz; Abies lasiocarpa/Menziesia; Abies/Pachistima. Older reports (e.g., Cooke, 1955) may be based at least partly on L. columbiana; the specimens of Letharia for which herbaria are cited were sorted according to species by Ryan.

Lobaria hallii (Tuck.) Zahlbr.--WA: Klickitat Co. (Suksdorf; WSU). On Acer macrophyllum.

Lobaria linita (Ach.) Rabenh.--OR: Deschutes Co. (Thomson, 1984). WA: Yakima Co. (Rvan, ASU). Arctic,-boreal. On tree bases, rocks or earth, often among mosses (Thomson, 1984). Alpine. 1950 m.

Lobaria oreqana (Tuck.) Müll. Arg.--WA: Yakima Co. (G. Rvan, WWB). 4000-4500 ft.

Lobaria pulmonaria (L.) Hoffm.--WA: Klickitat Co. (Suksdorf, WSU--one specimen with large black apothecia-like parasite). Pend Oreille Co. (Layser, WSU). Yakima Co. (Piper, WSU). 4700 ft. On Acer macroohvllum; on dead limbs of Tsusa. Tsuga/Pachistima.

Lobothallia "alphoplaca" (Wahlenb. in Ach.) Hafellner (Syn. Aspicilia alphoplaca)--OR: Deschutes Co. (McCune). Malheur Co. (McCune). 910-1340 m. These are probably L. oraeradiosa.

Lobothallia praeradiosa (Nyl.) Bafellner (Syn. Aspicilia

praeradiosa) --OR: Lake Co. (Rvan, ASU). WA: Yakima Co. (Rvan, ASU). Temperate; most common in the Great Basin region. 5100 ft; 760 m. On basalt rock. Pine-oak woodland.

Lopadium disciforme (Flotow) Kullhem--WA: Klickitat- Co. (Suksdorf, WSU--as L. oezizoides).' On Pseudotsuqa menziesii. Massalonsia carnosa (Dickson) **Körber--OR:** Grant Co. (Rosentreter). Harney Co. (McCune, herb. Rosentreter). WA: Lincoln Co. (Rosentreter). Yakima Co.' (Thomson, 1984). Arctic-alpine, to boreal-montane. 3200 ft; 1400 m. Over mosses (e.g., Grimmia) and humus, on boulders and rock faces, rarely on soil (mesic clay-loamy). Artemisia tridentata spp. tridentata/Agropyron spicatum; A. riaida habitat, sometimes with Poa standbersii and scattered junipers.

Megaspora verrucosa (Ach.) Hafellner (Syn. Lecanora verrucosa, Aspicilia verrucosa, Pachvspora verrucosa)--OR: Deschutes Co. (Waqner, OSC). Grant Co. (RR). Hood River Co. (Suksdorf, WSU). Klamath Co. (Rvan,' ASU). Malheur Co. (Rosentreter)'. Wasco Co. (Rossman, OSC). WA: Kittitas Co. (Ryan, ASU; Rosentreter). Klickitat Co. (Davis, herb. Davis; Suksdorf, WSU). Yakima Co. (Rvan, ASU, WWB). 400-4800 ft; 600-1150 m. On moss (e.g., Tortula ruralis), or Selasinella; over 'soil or'rock; on puercus aarrvana; on branches of Artemisia riqida. Juniper-sage desert; biscuit scabland with Artemisia riaida, Festuca idahoensis, etc.; Artemisia tridentata spp. tridentata/Agropyron spicatum; oak woodland; alpine; sometimes near waterfalls.

Melanelia elesantula (Zahlbr.) Essl. (Syn. M. incolorata)--OR: Deschutes Co. (Thomson, 1984; Pike & Rossman, OSC). Harney Co. (Sundberg, WTU). Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU; Pike, OSC). Malheur Co. (Thomson, 1984). Wallowa Co. (Thomson, 1984). Wallowa Co. (Monahan, WWB; Pike, OSC). Wasco Co. (Pike. et al., OSC; Rossman, 1992). WA: Asotin Co. (Thomson, 1984) Ferry Co./Stevens Co. (Thomson, 1984). Grant Co. (Nash, ASU). Klickitat Co. (Davis; herb. Davis). Spokane Co. (Thomson,* 1984). Whitman Co. (Cooke, 1955; Thomson, 1984; Ryan, WWB--det. Esslinger). Yakima Co. (100-6000B)f Arctic to bdreal-montane. . ; 1150-1400 m. On rocks, soil over rocks, over mosses, and on bark (including Populus trichocarpa, Quercus sarrvana, twigs of' Juniperus occidentalis, Artemisia riaida, and A. tridentata, Rosa sp., and on old wood. Juniper-sage desert, sometimes with ponderosa pine; mixed conifer forest. Biscuit scabland; Palouse grassland; mixed conifer forest.

Melanelia exasperatula (Nyl.) **Essl.--OR:** Lake Co. (Ryan, ASU). **WA:** Klickitat Co. (Goward, UBC). Stevens Co. (Cooke, 1955). Whitman Co. (Thomson, 1984; Biqlev WWB; Sayce, and Beattie, WSU). Arctic to boreal-montane. GO-2000 m. Mainly on bark and twigs (e.g., of Abies concolor; Acer; Crataegus douqlasii),

rarely on rocks.' Mixed forest; sometimes along ridgetops.

Melanelia fulisinosa (Fr. ex Duby) Essl. (Syn. M. glabratula)--WA: Asotin Co.? (Thomson, 1984; dot is'on border with Idaho and Whitman Co,), Temperate, to arctic. On bark or rock.

Melanelia aranulosa (Lynge) Essl. (Syn. Melanelia disiuncta)--WA: Klickitat Co. (Thomson, 1984). Okanogan Co: (Rhoades, WWB; Ryan, ASU). On rock. 5880-6360 ft; 910-1925 m. Arctic-boreal. On rocks, rarely on old wood'or bark.

Melanelia infumata (Nyl.) Essl.--OR: Malheur Co. (McCune). WA: Okanogan Co.' (Imshaug, 1957; Thomson, 1984). Arctic to boreal-montane. 910 m. On rocks, usually in the open but with moist surroundings (Thomson, 1984).

Melanelia'multisnora (A. Schneider) Essl.--OR: 'Jefferson Co. (Pike, OSC). Union Co. (Rosentreter). Wasco Co. (Fellows, OSC; Rossman, 1992). WA: Chelan Co. (Howard, 1950). Kittitas Co: (Klett & Stuntz, UBC). Klickitat Co. (Davis, herb,. Davis'; Suksdorf, WSU)... Whitman Co. (Ryan, WWB; Beattie, WSU). Yakima Co. (Pike, OSC; Ryan, ASU). 400-3000 ft; 990-1050 m. *On bark or wood, including Alnus rubra, Crataecus douglasii, "Pyrus rivularis", Pinus Donderosa, twigs of Juniperus occidentalis, Artemisia rigida, and Rosa sp. Ponderosa pine/mixed conifer stand; cottonwoods; fir-Doug fir; biscuit scabland; ponderosa pine flats;, Palouse grassland; oak woodland.

Melanelia panniformis (Nyl.) Essl.--WA: Chelan Co. (Howard, 1950; Thomson, 1984). Low arctic to boreal. On rocks in open areas.

Melanelia sorediata *(Ach.)* Goward & Ahti (Syn. M. sorediosa)--WA: Chelan Co. (Thomson, 1984). Klickitat/Skamania Co. (Thomson, 1984). Arctic-boreal. On acid rocks, rarely bark.,

Melanelia subaraentifera (Nyl.) Essl.--OR: Harney Co. (Pike, OSC). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Klickitat Co. (Davis, herb. Davis). 300-5080 ft; 1350 m. On rock in niche in cliff; on trunk of Quercus aarrvana. Pine forest.

Melanelia subaurifera (Nyl.) Essl.--OR: Klamath Co. (Ryan, ASU). WA: Grant Co. (Rosentreter). Spokane Co. (Thomson, 1984). Boreal-temperate. 4300 ft. On bark, or sometimes rocks (N-facing cliffs). Sagebrush-grassland.

Melanelia subelegantula (Essl.) Essl.--OR: 'Lake Co. (Ryan, ASU). WA: Kittitas Co. (Rosentreter). 450 m. On Artmesia rigida. Artemisia rigida-Poa grassland.

Melanelia subolivacea (Nyl. in Hasse) Essl.--OR: Blue Mountains

(Cusick, OSC). Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). WA: Kittitas Co. (Rvan, WWB). Klickitat Co. (Pike, OSC; Davis, herb. Davis).' Whitman Co. (Bialey, WWB; Cooke, 1955, as "Parmelia olivacea"--may be M. multisoora). 100-6480 ft; 1650-2000 m. On Abies concolor, Pinus contorta, and other conifers; on twigs of Quercus sarryana; on bark of Betula papyrifera, Cercocarous ledifolius. Ponderosa pine-Garry oak-Doug fir-stand on N-facing slope; N- and W-facing pine slopes.

Melanelia substygia (Räsänen) Essl.--WA: Douglas Co. (Thomson, 1984). Grant Co. (Thomson, 1984). Okanogan Co. (Thomson,, 1984; one dot is on border with British Columbia). Arctic to boreal-montane. On acid rocks.

Melanelia sp.--**WA:** Whitman Co. (Cooke & Cooke, WSU--as "Parmelia exasperata"; Cooke, 1955--as "Parmelia aspera"). 2000 ft. On branches of Pinus oonderosa. Melanelia exasperata is restricted to eastern North America according to Esslinger (1977).

Melaspilea proximella (Nyl.) Nyl. ex Norrlin--WA: Klickitat Co. (Suksdorf, WSU). On root (wood) of Pseudotsuga.

Micarea prasina **Fr.--WA:** Klickitat Co. (Suksdorf, WSU). On dead wood.

Microthelia aterrima--WA: Yakima Co. (Suksdorf, WSU). On stones in a creek, often submerged in water from melting snows. = Lichenothelia scopularia

Microthelia micula--WA: Yakima Co. (Suksdorf, WSU). On Abies lasiocaroa. = Kirschsteiniothelia aethiopsa for most North American records.

Multiclavula corynoides (Peck) R. Petersen--OR: Grant Co. (Sharnoff, in herb. Rosentreter--det. Ahti). 5000-6000 ft.

Multiclavula sp. --OR: Malheur Co. (Rosentreter). '4300 ft. On soil;' Schadscale and winterfat habitat.

Mycobilimbia berengeriana (Massal.) [Hafellner?] (Syn. Lecidea berenaeriana) --OR: Wallow Co. (Pike, OSC). 5025 ft. On humus. Open canopy spruce stand.

Mycobilimbia hypnorum (Lib.) [Eafellenre?] (Syn. Lecidea sancuineoatra --WA: Klickitat Co. (Suksdorf, WSU). Yakima Co.. (Suksdorf, WSU). On soil

Mycoblastus affinis (Fr.) **Kernst.--WA:** Yakima Co. (Rvan, WWB). 5000-5600 ft. On'bark or wood of conifers. Montane forest.

Mycocalicium subtile (Pers.) Szat.--OR: Jefferson Co. (Pike, OSC). 910 m. On Abies. Open western larch-pinus ponderosa pine forest; fir-Douglas fir forest.,,'

Mycocalicium sp.--OR: Lake Co. (Ryan,' ASU). 5300 ft; 1600 m. On Abies concolor.

Neofuscelia loxodes (Nyl.) Essl.--OR: Union Co. (Davis, herb. Davis). Wheeler Co. (Fosel, OSC). 4500 ft. On rock:

Neofuscelia subhosseana (Essl.) Essl.--OR: Deschutes Co. (Ryan, ASU; Denison, OSC). Malheur Co. (McCune). Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Garfield Co., (Ryan, ASU). Yakima Co. (Ryan, ASU, WWB--det. Esslinger). 1400-2900 ft; 910-1150 m. On andesite, basalt. Sagebrush; pinyon-juniper-sage; cottonwoods; grassland; mound and intermound communities (especially in stone rings) of biscuit scabland.

Neofuscelia' verruculifera (Nyl.) Essl.--OR: Baker Co. (Palmer, and Ryan,.ASU). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Union Co. (Rosentreter --det.. Essl.). Wheeler Co. (Ryan, ASU). WA: Chelan Co. (Ryan, WWB). Klickitat Co. (Ryan; ASU). Yakima Co. (Ryan, ASU, WWB--det. Esslinger). 1000-6800 ft; 130-1700 m. On outcrops (basalt, schist, granite). Sometimes on horizontal surfaces. Juniper-sagebrush desert; pinyon-juniper community; sagebrush steppe; sheltered canyon in Doug.fir forest.

Nenhroma bellum (Sprengel) Tuck.--OR: Hood River Co. (Wetmore, 1969).

Nephroma helveticum ssp. sipeanum (Gyelnik) Goward & Ahti--OR: Hood River Co. (Wetmore, 1960). WA-Klickitat Co. (Suksdorf, WSU; Wetmore, 1960). On Acer macrophyllum.

Nephroma parile (Ach.) Ach. --OR: Jefferson Co. (Pike, OSC). Wallowa 'Co. '(Pike, OSC; Rosentreter). WA: Asotin Co. (Thomson, 1984). Chelan Co. (Wetmore, 1960; Thomson, 1984). Ferry Co./Stevens Co. (Thomson, 1984). Pend Oreille Co. (Thomson, 1984) . Whitman Co. (Sayce, WSU).. Boreal to temperate. On moist, shaded; mossy rocks and trees, exposed roots of Pseudotsuaa, old wood. 2000-6000 ft. Fir-Doug fir forest; mixed conifer forest.

Nephroma resupinatum (L.) Ach.--OR: Wallowa Co..(Thomson, 1984). WA: Chelan Co. (Wetmore, 1960; Thomson, 1984). Klickitat Co. (Suksdorf, WSU). Mainly boreal. On rocks and tree bark in cool, moist, shady places.

Normandina pulchella (Borrer) Nyl.--WA: Klickitat Co. (Suksdorf, WSU).

Ochrolechia androgyna (Hoffm.) Arnold--OR: Klamath Co. (Rvan, ASU). Lake Co. (Ryan, ASU). WA: Okanogan Co. (Rvan, ASU). 5300-6500 ft; 1600-200 m. On bark or branches of Abies concolor or other conifers.

Ochrolechia farinacea Howard--WA: Klickitat Co. (Davis, herb. Davis; McCune, herb. Rosentreter). 300 m. On trunk of Quercus sarrvana. 'Rocky savana and'grasslands with oak and bigleaf maple.,-

Ochrolechia qowardii Brodo--OR: Klamath Co. (Rvan, ASU). WA: Klickitat Co. (Pike, OSC). 3100 ft; 2000 m. On bark of Abies, Pinus Donderosa. Ponderosa pine-Garry oak-Doug fir stand on N-facing slope.-

Ochrolechia iuvenalis Brodo--OR: Klamath Co. (Rvan, 'ASU). 1700 m. On bark.

Ochrolechia oregonensis Magnusson--WA: Klickitat Co. (Suksdorf, WSU--as 0. pallescens)

Ochrolechia subathallina Magnusson--OR: Deschutes Co. (Pike, OSC). Jefferson Co. (Pike, OSC). Klamath Co. (Sipe, OSC).. 3440 ft; 1300 m. On bark of conifers. Fir-Doug fir forest.,

Ochrolechia upsaliensis (L.) Massal.--OR: Deschutes Co. (Pike & Rossman; Pike; and J. Christy, OSC; Rvan, ASU; Rhoades,' WWB). Wasco Co. (Fellows, OSC; Rossman, '1992). WA: Asotin 'Co.' (Rvan, ASU). Ferry Co. (Howard, WTU). Grant Co. (Nash, ASU). Kittitas Co. (Howard, WTU; Rvan, ASU). Klickitat Co. (Davis, herb. Davis). Okanogan Co. (Douglas, 1974). Whitman Co. (Bislev, WWB). Arctic-alpine to boreal. 400-8000 ft; 990-1150 m. On moss (including Grimmia spp.) *or* Selaginella, over basalt or andesite outcrops or over soil among talus blocks; in cracks in rimrock; on pine needles. Juniper-sage desert; cliffs in ravines of biscuit scabland; pine-Doug fir; ponderosa pine forest. My own collections from soil, moss, etc., identified as 0. szatalaensis, are included here; Brodo had originally applied that name to such material, but recently (Brodo, pers. comm., 1994) he seems to have gone back to using 0. uosaliensis (I do not understand this at present).

Ochrolechia sp. --WA: Kittitas Co. (Howard, WTU, as "O. upsaliensis"). On sandstone ledges (growing directly on rock).'

Ochrolechia sp.--WA: Whitman Co.' (Cotton, WSU--as 0. pallescens). On thin soil over rocks. This is not 0. upsaliensis s. lato.

Ochrolechia sp. --WA: Klickitat Co. (Suksdorf, WSU--as O. pallescens). On bark.

Master species list

Ochrolechia sp.--WA: Klickitat Co. (Suksdorf, WSU--as O. tartarea). On Alnus, Prunus emarainata.

Opegrapha protuberans Zahlbr. --WA: Klickitat Co. (Suksdorf, WSU). On rotted, prostrate tree trunk'

Ophioparma lapponicum (Räsänen) Hafellner & Rogers (Syn. Haematomma lapponica)--OR: Deschutes Co. (Rhoades, WWB).' WA: Chelan Co. (Douglas, 1974). Yakima Co. (Ryan, ASU). Alpine. 1860 m. On exposed'rocks (andesite and other acidic'types').

Pannaria praetermissa Nyl. in Chyd. & Furuhj.--OR: Lake Co. (Ryan, ASU). WA: Chelan Co. (Howard, 1950). 1930 m. On mosses over steep rock faces.

Pannaria sp. --WA: Chelan Co. (Howard, 1950--as P. rubiainosa). Klickitat Co. (Suksdorf, WSU--as P. rubisinosa).

Parmelia hygrophila Goward & Ahti--OR: Lake Co. (Ryan, ASU). 1930-2000 m. On.basalt rock (steep face).

Parmelia omphalodes (L.) Ach.--WA: Yakima Co. (Ryan, ASU). 1950 m. On rock. Alpine.

Parmelia saxatilis (L.) Ach.--OR: Deschutes Co. (Pike, OSC). Klamath Co. (Ryan, ASU). Wallowa Co.' (Pike, OSC). Co. (Rossman, 1992). WA: Chelan Co. (Howard, WTU). Ferry Co. (Howard, WTU). Grant Co. (Nash, ASU). Klickitat Co. (Davis, herb. Davis). Okanogan Co. (Imshaug, 1957; Thomson, 1984; Ryan, ASU). Spokane CO. (No collector aiven, WTU). Whitman Co. (Bigley, WWB; Sayce, and Cotton, WSU). Arctic-boreal., 400-6400 ft. 990-1200 m. On basalt or other acid'rocks, less often on trees (e.g., Pinus ponderosa, Pseudotsuaa menziesii), and over mosses, soil, or. old wood. Ravines of biscuit scabland; open ponderosa pine woodland.

Parmelia sulcata Taylor--OR: Blue Mountains (Cusick, 'OSC). Deschutes Co. (Pike, OSC). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Wallowa Co. (Pike, OSC; Rosentreter.). Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Asotin Co.? (Thomson, 1984; dot is on border with Idaho). Chelan Co., (Howard, WTU). Ferry Co., (Howard, WTU). Okanogan Co. (Ryan, ASU). Stevens Co. (Cooke,. 1955)'. Whitman Co.? (Thomson, 1984; dot is on border with Idaho). Whitman Co. (Bislev, WWB). Yakima Co. (Ryan, WWB). Arctic to temperate. 1000-6000 ft; 990-1150 m. On rocks. (basalt; etc.),. bark (including Abies concolor, Betula papvrifera, Cercocarous ledifolius, Crataegus douglasii, Populus trichocaroa, Pseudotsuaa menziesii), moss, humus and soil. Ravines of biscuit scabland; open ponderosa pine forest near a stream; mixed conifer forest.

Parmelia (s. lato) sp. (apparently undescribed)--OR: Deschutes Co. (Pike & Rossman, OSC). Annotated by Pike as "sp. nov." but apparently never published; it may belong to one of the genera now segregated from Parmelia. 3000 ft. On basalt outcrop. Juniper-sage desert.

Parmeliella cyanolepra (Tuck.) Herre--OR: Grant Co. (Rosentreter). WA: Klickitat Co. (Suksdorf, WSU). 3200 ft. Artemisia tridentata spp. tridentata/Agropyron spicatum.

Parmeliopsis ambigua (Wulfen in Jacq.) Nyl.--OR: Deschutes Co. (Sundberg, WTU). Klamath Co. (Ryan, ASU). Lake Co. (Rvan, ASU). Umatilla Co: (Swena, WTU). Union Co. (Rosentreter). Wallowa Co. (Pike, OSC: Thomson, 1984). WA: Colville National' Forest (Zamora, UBC). Kittitas Co. (Howard, WTU; Rvan, WWB). Klickitat Co: (Suksdorf, WSU). Okanogan Co. (Price, WTU; Rvan, ASU). Spokane Co. (Cooke, 1955). Whitman Co. (Howard, WTU; Sayce, WSU). Yakima Co. (Rvan, ASU, WWB). Arctic-boreal. 2000-6480 ft; 853-2125 m. On twigs and bark or wood, usually of conifers (Abies lasiocarpa, Larix, Pinus albicaulis, P. monticola, Pseudotsuaa menziesii,' and others); sometimes on burnt wood; scabland/ponderosa pine. Mixed conifer forest, sometimes along creeks; Pseudotsuga/Physocarpus community.'

Parmeliopsis hyperopta (Ach.) Arnold--OR: Deschutes Co. (Sundberg, WTU). Hood River/Wasco Co. '(Thomson, 1984). Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). WA: Colville National Forest (Zamora, UBC). Kittitas *Co.* (Howard, WTU; Rvan, WWB). Okanogan Co. (Rvan, ASU). Whitman Co. (Howard, WTU). Yakima Co. (Howard, WTU). Arctic-boreal. 600-2125 m. On twigs and bark (including Abies, Pinus, Pseudotsuga, Prunus), old stumps, burned logs, and old wood. .Ponderosa pine; Pseudotsuga/Physocarpus community; mixed conifer forest.

Peltisera aphthosa (L.) Willd. (s. lato)--OR: Hood River Co. (Suksdorf, WSU; Thomson, 1950). Wallowa Co. (Pike, OSC). Wasco Co: (Suksdorf, WSU; Thomson, 1984). WA: Asotin/Columbia Co. (Blue Mountains): Clavton, WSU. Ferry Co. (Thomson, 1950--v. variolosa). Kittitas Co. (Rvan, WWB). Okanogan Co. (Rvan, ASU; Douglas, 1974). Spokane Co. (Piper, WSU; Thomson, 1950--v. variolosa). 'Whitman Co. (Bialev, WWB). Yakima Co. (Thomson, 1950--V. variolosa). Arctic to'temperate. 2300-6000 ft. On earth, rotting logs and stumps, on humus, and on rocks, usually in moist places (Thomson, 1994); on moss' on rocks. Mixed conifer forest. Most of these records are probably based on P. leucoohlebia, but some may be based on other species in this complex.

Peltigera canina (L.) Willd. (s. lato)--OR: Deschutes Co. (Pike, OSC). Harney Co. (Bahn, herb. Rosentreter--det. Vitikainen). Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). Union Co.

(Rosentreter). Wallowa Co. (Thomson, 1950--v. albescens; Imshaug, 1957). WA: Granite Creek, Snake River (Aase, WSU). Kittitas Co. (Ryan, WWB). Klickitat Co. (Suksdorf, WSU; Thomson, 1950--v. albescens; Thomson, 1984). Okanogan Co. (Rhoades, WWB; Rvan, ASU; Douglas, 1974). Pend Oreille Co. (No collector given, WWB). Spokane Co. (Thomson, 1984). Whitman Co. (Cooke, 1955--"v. spongiosa"; Thomson; 1984; Cotton, WSU--partly as "v. spongiosa"; Sayce, WSU). Cosmopolitan. 2200-6400 ft; 900-1915 m. On soil, rocks, rotten logs, and bases of trees, in moist, rather shaded habitats (Thomson, 1984) ; Ponderosa pine-Douglas fir; ponderosa pine; aspen woodland; bogs; near mouth of a limestone cave. Thomson's concept of the species is very broad, including P. didactyla, P. oraetextata, P. rufescens, and others, although he does treat P. membranacea as separate., Many of the. specimens of, "P. canina" in the herbaria I examined may belong to these or other segregate species; although at least a few appeared to me (at a quick glance) to be P. canina s. str.

Peltiuera collina (Ach.) Schrader--OR: Deschutes Co: (Pike; OSC; Thomson, 1984). Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). Union/Wallowa Co. '(Thomson, 1984). Wasco Co. (Thomson, 1984): **WA:** Kittitas Co. (Howard, WTU). Klickitat Co. (Howard, WTU; Suksdorf, WSU; Thomson, 1984). Spokane Co. (Howard, WTU; Thomson, 1950, 1984). Whitman Co. (Thomson, 1950). Yakima Co. (Suksdorf, WSU). Arctic-boreal. 4300-6480 ft; 990-1950 m. On mosses, bark, rocks, and rotting logs. In my experience (at least on the west side of the Cascades), the species occurs rather frequently on trees, unlike other species of Peltisera. Open ponderosa pine with cottonwoods, near creek.

Peltiuera didactyla (With.) **Laundon--OR:** Deschutes Co. (Pike, OSC). Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). **WA:** Chelan Co. (Baker, and Howard, WTU; Ryan, WWB; Thomson,' 1950). Ferry Co.. (Howard, WTU). Yakima Co. (Howard, WTU; Suksdorf, WSU;.Thomson, 1950). 650-5860 ft; 990-1650 m. On soil, often disturbed; sometimes in somewhat boggy areas along lake shores.

Peltigera horizontalis (Huds.) **Baumg.--WA:** Klickitat Co; (Thomson, 1950--v. typica; 1984). 'Spokane Co. (Piper, WSU). Boreal to temperate. On soil, among mosses, 'on fallen logs and over rocks in moist places. Identifications need to be checked.

Peltigera kristinssonii Vitik.--WA: Okanogan Co. (Rvan, ASU). On soil or moss. 5880 ft; 1775 m. Identification needs to be checked.

Peltiuera lepidophora (Nyl. ex Vainio) Bitter--WA: Okanogan CO. (Imshaug,, 1957).

Peltiuera leucophlebia (Nyl.) **Gyelnik--OR:** Wasco Co. (Thomson,

1984). WA: Spokane Co. (Cooke, 1955; Thomson, 1984). Whitman Co. (Sayce, WSU). Arctic to temperate. 2000 ft. More. common southward and in somewhat drier areas than P. aphthosa- (Thomson, 1984).

Peltiuera malacea (Ach.) Funck--WA: Chelan Co. (Howard, 1950). Ferry Co. (Thomson, 1950, 1984). Okanogan Co. (Rvan, ASU). Yakima Co. (Rvan, ASU). Arctic-alpine to boreal-montane. On soil and among mosses, particularly among shrubby vegetation (Thomson, 1984). 1775 3950 m.

Peltiuera membranacea (Ach.) Nyl.--OR: Hood River Co. (Thomson, 1984). Umatilla/Union Co. (Thomson,- 1984). Wallowa Co. (Thomson, 1984). Wasco Co. (Sipe, OSC). WA: Chelan Co. (Thomson, 1950). Okanogan Co. (Rvan, ASU). Spokane Co. (Thomson, 1984). Whitman Co. (Thomson, 1950). Boreal to temperate, with "oceanic tendencies" (Thomson, 1984). 1775 m. On earth, rotting logs, stumps,, over-humus and rocks. Moist stream banks.

Peltiuera polydactylon (Necker) Hoffm. (s. lato)--OR: Umatilla/Union Co. (Thomson, 1984). Wallowa Co. (Pike, OSC). Wasco Co. (Thomson, 1984). WA: Klickitat Cp. (Suksdorf, WSU). Yakima Co. (Thomson, 1984). Cosmopolitan. 5025-6000 ft. On soil; moss, logs, rocks, and bases of trees in moist woods. Identifications need to be checked.

Peltiuera Ponoiensis Gyelnik--OR: Deschutes Co. (Pike, OSC). 3000 ft. On sandy, desert soil, with Artemisia tridentata and Chrvsothamnus visicidiflorus.

Peltiuera Praetextata (Flörke ex Sommerf.) 'Zopf--OR: Deschutes Co,. (Pike, OSC). Hood River Co. (Hood River Garden Club, OSC). Klamath Co.' (Sipe, OSC). WA: Kittitas Co. (Anderson, WTU). Spokane Co. (No collector uiven, WTU). 990 m. On rock. Open ponderosa pine forest with aspen, along edge of creek. The' identity of these specimens'needs to be verified.

Peltigera rufescens (Weis) Humb.--OR: Deschutes Co. (Sundberg, WTU; Pike & Rossman, OSC). Hood River Co. (Thomson, 1984). Klamath Co. (Thomson,-1950, 1984; Rvan, ASU). Lake Co. (Thomson, 1984; Ryan, ASU). Union Co. (Thomson, 1950). Wallowa Co. (Thomson, 1984). Wasco Co. (Rossman, 1992). WA: 'Columbia Co.. (Thomson, 1950, 1984). Chelan Co. (Howard, WTU; Thomson, 1984). Klickitat Co. (Thomson, 1950, 1984; Pike, OSC). Okanogan Co. (Price, WTU; Imshaug, 1957; Douglas, 1974). Spokane Co. (No collector uiven, WTU; Cooke, 1955; Thomson, 1950, 1984). Walla Walla Co. (Thomson, 1984). Whitman Co. (Cooke, 1955; Thomson, 1950, 1984). Yakima Co. (Howard,. WTU; Rvan, WWB). Arctic to temperate...: In drier, more highly insolated habitats than P. canina (Thomson; 1984). 1400-6480 ft; 990-1950 m. On soil,

including sandy soil, deep loess, and occasionally rock. Sagebrush; Juniper-sage desert; Ponderosa pine-Garry oak-Doug fir stand on N-facing slope; all communities in biscuit scabland, but especially in'mound community.

Peltigera venosa (L.) Hoffm.--OR: Baker Co. (Thomson, 1984). Sherman Co. (Thomson, 1984). Deschutes Co. (Thomson, 1984). Umatilla/Union-Co.' (Thomson, 1984). **WA:** Asotin Co. (Jones, WSU; Thomson, 1950, 1984). Chelan Co. (Howard, WTU). Klickitat Co. (Suksdorf, WSU; Thomson, 1950, 1984). Okanogan Co. (Howard, 1950). Pend Oreille Co. (Thomson, 1984). Spokane Co. (No collector uiven, WTU; Thomson, 1950, 1984). Stevens Co. (Cooke, 1955). Whitman Co. (Cotton, and Sayce, WSU; Thomson, 1950, 1984). Yakima Co. (Suksdorf, WSU; Thomson, 1984). Arctic-alpine to boreal. 2200 ft. On moist soil and rocks with calcareous seepage, on moist'cliffs, talus slopes, edges of tussocks, edges of animal burrows and like microhabitats (Thomson,-1984); this' description does not fit well with my experience of the species on the west side of the Cascades,. where I have usually seen it on disturbed soils in moist forests.' 'It is a distinctive species that cannot be confused with anything else; I am surprized it has been found in so many areas in the Columbia Basin..

Peltiuera sp. --WA: Okanogan Co. (Rvan, ASU). On soil'and mossy rocks. 1775 m.

Peltigera spp.

Peltula euploca (Ach.) Ozenda & **Clauz.--OR:** Jefferson Co. (Rosentreter). 2400 ft. On basalt cliffs. Artemisia tridentata ssp. wyominqensis with Aqroovron soicatum and Festuca idahoensis.

Pertusaria cf. **amara** (Ach.) **Nyl.--WA:** Klickitat Co. (Davis, herb. Davis). 300-1600 ft. On Quercus uarrvana.

Pertusaria leucostoma (Bernh.) Massal. (Syn. P. leioplaca)**--WA:** Klickitat Co. (Suksdorf, WSU). On bark.

Pertusaria ophthalmiza (Nyli) **Nyl.--WA:** Klickitat Co; (Suksdorf, WSU--as P. multiouncta. On bark.

Pertusaria sp.--WA: Klickitat Co. (Suksdorf, WSU--as P. velata). On bark.

Pertusaria sp. --WA: Klickitat Co. (Suksdorf,'WSU--as P. pertusa). On bark; This may be P. leucostoma.

Pertusaria sp.--WA: Klickitat Co. (Suksdorf, WSU--as-P. pustulata). On Abies qrandis.

Phaeophvscia'decolor (Kashiw.) Essl.--OR: Deschutes Co. (Pike & Rossman; Pike; Wauner, OSC). Klamath Co. (Rvan, ASU). Lake Co. (Pike, OSC; Rvan, ASU). WA: Whitman Co. (Wauner, OSC). Yakima Co. (Thomson,- 1950-.-f. lithodes; Thomson, 1984; Rvan, WWB). Arctic-alpine to boreal. 290076480 ft.; 600-1950 m. On rocks (e.g., base of basalt outcrops, on vertical walls in crevices). and among mosses over rock, rarely on tree bases. Sagebrush; Juniper-sage desert; sometimes with ponderosa pine. Rvari 8767. Although Egan (1987) follows Moberg in synonomizing this under P. endococcinea, I prefer to keep them separate.

Phaeophyscia niuricans (Flörke) Moberg--OR: Malheur Co. (McCune). 910 m.

Phaeoohvscia orbicularis (Necker) Moberg--OR: Union Co. (Davis, herb. Davis). WA: Klickitat Co. (Davis, herb. Davis). 100-3200 ft. On bark of Quercus uarrvana; on'basalt.

Phaeoohvscia sciastra (Ach.) Moberg--OR: Harney Co. (Pike, OSC). Klamath/Lake Co. (Thomson, 1984). Klamath Co. (Rvan, ASU). Lake Co. (Pike, OSC). Malheur Co. (McCune). WA: Pend Oreille Co. (Thomson, 1984). Spokane Co. (Thomson., 1984). Arctic to temperate. 4000-4300 ft. 910 m. On basalt or other acidic rocks (e.g., NE-facing vertical walls), on mosses over rocks, and occasionally over mosses.

Phaeophyscia sp. --WA: Klickitat Co. (Suksdorf, WSU, as "Physcia ciliata"). Yakima Co. (Thomson, 1963, as "Physcia ciliata"), On rock.

Phaeorrhiza sareptana (Tomin) Mayrh. & Poelt--OR: Harney Co. (Pike, OSC).

Phvlliscum demanueoni (Moug. & Mont. in Mont.) Nyl.--WA: Klickitat Co. ~~(Suksdorf~~, WTU, WSU). On rock.

Phvscia adscendens (Fr.) H. Olivier--OR: Wallowa Co. (Pike, OSC). WA: Klickitat Co. (Pike,'OSC; Suksdorf, WSU). Whitman Co. (Thomson, 1963, 1984; Ryan, and Bigley, WWB). Mainly boreal-temperate. 3100 ft. Mainly on the trunks and branches of trees and shrubs, both hardwood (e.g., Acer macrophyllum, puercus garryana, Rosa sp.) and coniferous; occasionally also on old wood, rocks, and concrete., Palouse grassland; Ponderosa pine-Garry oak-Doug fir stand, on N-facing slope; pine slopes.

Physcia aipolia (Ehrh. ex **Humb.) Fürnr**.--OR: Hood River/Wasco Co. (Thomson, 1984). Jefferson/Wheeler Co. (Thomson, 1984). Wasco Co. (Fellows, OSC). WA: Asotin Co. -(Thomson, 1984). Chelan Co. (Thomson; 1963). Ferry Co. (Thomson, 1963; partly f. anthelina). Klickitat Co. (Davis, herb. Davis; Thomson,, 1963--partly f.

anthelina). Okanogan Co. (Thomson, 1963, 1984). Pend Oreille/Spokane Co. (Thomson, 1984). Walla Walla Co. (Weir, WTU). Whitman Co. (Biulev, WWB; Thomson, 1963). Yakima Co. (Howard, WTU; on rock). Boreal-temperate. 100 ft. On deciduous trees (e.g., puercus uarrvana) and shrubs, sometimes on conifers, more rarely on rocks (Thomson, 1984); Rvan p212

Physcia biziana (Massal.) Zahlbr. --**OR:** Harney Co. (Pike, OSC). Lake Co. (Rvan, ASU). Malheur Co. (McCune). WA: Ferry C. (Thomson, 1963). Klickitat Co. (Rvan, ASU; Davis, herb. Davis). Okanogan Co. (Thomson, 1963). Whitman Co. (Sayce, WSU). 400-6480 ft; 550-1950 m. On rocks, at base of cliff, under trees. Oak woodland.

Phvscia caesia **(Hoffm.) Fürnr.--OR:** Grand Co:(Rosentreter). Klamath Co. (Rvan, ASU). Malheur Co. (McCune). Wasco Co. (Rossman, 1991)0 **WA:** Whitman Co. (Wauner, OSC). 4300 ft; 1950 m. On basalt or other rocks, or moss or thin soil over rock; Ravines in biscuit scabland.

Physcia callosa Nyl.--OR: Lake Co. (Pike, OSC). 1400 ft. On tops of exposed basalt cliffs, in crevices near urine deposits of Neotoma. Juniper-sage desert.

Phvscia **cascadensis** Magnusson--**OR:** Deschutes Co.. (Pike & Rossman, OSC). Lake Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). **WA:** Chelan Co. (Thomson, 1963). Upper Naches River (Grant, TYPE). 3000-6480 ft; 990-1950 m. On moss over basalt. In ravines in biscuit scabland.

Phvscia dimidiata (Arnold) **Nyl.--OR:** Deschutes Co. (McCune; identification tentative). Klamath Co. (Ryan, ASU). Lake Co. (Rvan, ASU). 1900-1950 m. On Abies; on rock:

Phvscia **dubia** '(Hoffm.) **Lettau--OR:** Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Wallowa Co. (Thomson, 19507-partly as P. teretiuscula; Imshaug, 1957--partly as P. teretiuscula; Thomson, 1984). **WA:** Chelan Co. (Thomson, 1963,--as P. teretiuscula). Ferry Co. (Thomson, 1984). Okanogan Co. (Imshaug, 1957--partly as P. teretiuscula; Douglas, 1974;. Thomson,. 1963--partly as P. teretiuscula; Thomson 1984; Rhoades, WWB). 'Pend Oreille Co. (Thomson, 1984). Whitman. Co. (Wauner, OSC) . Yakima Co. (Ryan, OSC). Arctic to temperate. 395-2000 m. On rocks (basalt, etc.), old bones, weathered boards, and characteristically in places manured by birds (Thomson, 1984), but outside the highly manured area dominated by Caloplaca saxicola. Sagebrush.
Phvscia **magnussonii** Frey--OR: Klamath Co; (Ryan, ASU). On basalt. 4300-5000 ft.

Physcia phaea (Tuck.) Thomson--OR: Wasco co. (Rossman, 1992). WA:

Klickitat Co. (Davis, herb. Davis). Okanogan Co. (Rvan, ASU). Yakima Co. (Rvan, ASU). 300-500 ft; 1700-1925 m. On soil or moss among basalt outcrops, or directly on rock. Ravines in biscuit scabland; subalpine.

Physcia stellaris (L.) Nyl.--**OR:** Union Co. (Davis, herb. Davis). WA: Chelan Co. (Howard, WTU). Ferry Co. (Howard, WTU). Garfield Co. (Howard, WTU). Klickitat Co: (Suksdorf; WSU--partly as "v. hispida"). Spokane Co. (Thomson, 1960). Whitman Co. (Howard, WTU; Beattie, WSU). Yakima Co. (Howard, WTU). 1054-3200 ft. On bark or twigs of Populus trichocarpa, Quercus uarrvana; on moss, soil, or rock (including sandstone-conglomerate).

Phvscia subtilis **Degel.--WA:** Spokane Co. (Thomson, 1963--atypical, and species is otherwise Eastern N. Am.)

Phvscia tenella (Scop.) DC. in Lam. & DC.--OR: Harney Co. (Pike, OSC). Klamath Co. (Rvan, ASU). WA: Spokane Co. (Cooke, 1955; Thomson, 1963). 2000-4300 ft. On N-facing rock wall.

Physcia tribacia (Ach.) Nyl.--**WA:** Chelan Co. (Howard, WTU). Okanogan Co. (Howard, WTU). Yakima, Co. (Howard, WTU). On rock. 1700-2000 ft.

Phvscia sp. --OR: Wasco Co. (Rossman, 1992). 990-1050 m. On moss (particularly Homalothecium aeneum and Grimmia spp.), in ravines in biscuit scabland.

Physcia sp.--WA: Whitman Co.' (Beattie, WSU). On bark of Populus trichocarpa.

Physica spp.

Physconia detersa (Nyl.) Poelt--OR: Deschutes Co. (Rhoades, WWB; Eslick, herb. Rosentreter). Grant Co. (Rosentreter). Harney Co. (Sundberg, WTU). Klamath Co. (Rvan, ASU). Lake Co. (Thomson, 1984; Rvan, ASU). Wasco Co. (Rossman, 1992). **WA:** Benton/Walla Walla Co. (Thomson, 1984). Chelan Co. (Howard,' WTU; Thomson, 1984). Okanogan Co. (Thomson, 1984). Spokane Co. (Thomson,' 1984). Yakima Co. (Rvan, WWB). Boreal-temperate. 1400-8000 ft; 990-1050 m. Mainly on the trunks of broad-leaved and coniferous trees but also on rocks (basalt, etc.) and over moss (e.g., Grimmia). Sagebrush; ravines of biscuit scablands. According to Thomson (1984), this species presents some taxonomic problems.

Physconia distorta (With.) Laundon--OR: Lake Co. (Simmons & Simmons, WTU). WA: Chelan Co. (Howard, WTU). Columbia Co. (Howard, WTU). Klickitat Co. (Howard, WTU; Suksdorf, WSU; Thomson, 1963--partly as f. superfusa and f. arqyphaea and f. venusta). Yakima Co. (Howard, WTU). 800-4309 ft. On bark, of

Quercus aarrvana; on moss, soil, or rock (e.g., granite, basalt).

Phvsconia enteroxantha (Nyl.) Poelt--ORi Deschutes Co. (Waaner; Pike, OSC). Grant Co. (Goward, UBC). Harney Co. (Sundberq, WTU; Pike, C). Klamath Co. (Rvan, ASU). Lake Co. (Pike, OSC). Malheur Co.. (McCune). WA: Klickitat Co. (Rvan, ASU; Goward, UBC). Whitman Co. (Wagner, OSC). Yakima Co. (Rvan, WWB). 1400-4300 ft.; go-1950 m. On moss (e.g., Grimmia montana) over rock; on bark of Juniperus, Quercus sarrvana; at-base of Artemisia, and on rock, on N-facing rock walls (tops or sides), in crevices, in shade of overhanging rocks. Sagebrush; juniper-sage desert; oak woodland; mixed forest;.in volcanic canyon, N-facing slope, Festuca grassland in juniper zone.

Phvsconia cf. grisea (Lam.) Poelt--WA: Klickitat Co. (Davis, herb. Davis).. 500 ft. On moss and thin soil. Thomson '(1963) also reports "Physcia grisea" from WA: Chelan Co., Ferry Co., Grant Co., Whitman Co. (also cited by Cooke, 1955) and Yakima. co., but these-may. be P. detersa or some other species..

Phvsconia isidiigera (Zahlbr.) (Syn. Physcia grisea 'f. isidiisera--OR: Deschutes Co. (Waqner, OSC). WA: Douglas Co.' (Thomson, 1963). Whitman Co. (Waaner, OSC). 2900-3000 ft. On bark of juniper or various trees. Juniper-sage desert. This name is not in Egan (1987).

Phvsconia muscigena (Ach.) Poelt--OR: Grant Co. (Goward & Knight, UBC; Rosentreter). Harney Co. (Pike, OSC). Jefferson Co. (Thomson, 1984). Lake Co. (Rvan, ASU). Wheeler. Co. (Thomson, 1984). WA: Ferry Co. (Howard, WTU). Okanogan Co. (Imshaug, 1957; Thomson, 1963--partly f. alpina; Thomson, 1984). Whitman Co. (Thomson, 1984; Rvan, WWB). Yakima Co. (Thomson, 1963, 1984; Grant, WTU--as Phvscia'grisea; Ryan, ASU, WWB; Howard, WTU). Arctic-alpine to boreal. 1350-5300 ft; 300-2000 m. On rocks (usually over mosses?, sometimes on N-facing cliffs) and humus soils; calciphilous and nitrophilous (Thomson, 1984). On moss on N-facing rock walls; sometimes on bark? Sagebrush; sagebrush-grassland;- volcanic canyon, N-facing slope, Festuca grassland in Juniper zone; krumholz.

Phvsconia perisidiosa (Erichsen) Moberg--OR: Deschutes Co.'" (Waaner, OSC). Harney Co. (Pike, OSC). Klamath Co. (Rvan, ASU). Lake Co. (Pike, OSC; Rvan, ASU). Malheur Co. (McCune). WA: Klickitat Co. (Pike, OSC). 2900-3100 ft.; '1400-1835 m. On moss over basalt outcrops; on vertical rock faces in crevices, and on Juniperus occidentalis, Quercus qarrvana. Juniper-sage desert; among scattered ponderosa pines; Ponderosa pine-Garry oak-Doug fir stand on N-facing slope.

Phvsconia sp. ("P. americana"--an apparently unpublished

herbarium name of Pike)--WA:. Klickitat Co. (Pike, OSC). 3100 ft. On Quercus carrvana. Ponderosa pine-Garry oak-Doug fir stand on N-facing slope.

Pilophorus acicularis (Ach.) Th. Fr.--WA: Klickitat Co. (Suksdorf, WSU--as P. cereolus). On rock.

Placopsis elida (L.) Lindsay--WA: Klickitat Co. (Suksdorf, WSU). Yakima Co,. (G. Ryan, WWB). 4000-4500 ft. On rock.'

Placvnthiella ulicrinosa (Schrader) Coppins L'P. 'James--OR: 'Lake Co. (Ryan, ASU). Union Co. (Rosentreter--verif. by Wetmore). Wasco Co. (Pike, et'al., OSC; Rossman, 1992). WA: Klickitat Co. (Suksdorf; WSU--identification needs checking). 6300-6400 ft; 1000-1150 m. On plant debris and dung, and on old wood. ' I n mound community of biscuit scabland.

Platismatia qlauca (L.) Culb, & C. Culb.--OR: Hood River/Wasco Co. (Thomson, 1984). Klamath Co. (Rvan, ASU). Lake Co. (Ryan, ASU). Union Co. (Thomson, 1984)'. WA: Colville National Forest (Zamora, UBC). Chelan Co. (Price, and Howard, WTU; Kittitas Co. (Howard,. WTU). Okanogan Co. (Ryan, ASU). Pend Oreille Co. (Lavser, and Hope, WSU). Pend Oreille Co. (Lavser, WSU). Pend Oreille/Stevens Co. (Thomson; 1984). Spokane Co: (No collector given, WTU; Cooke; 1955; Thomson, 1984). Stevens Co. (Cooke, 1955). Whitman Co. (Cooke, 1955;. Thomson, 1984.; Bialev, WWB; Sayce, WSU). Yakima Co. (Rvan, ASU). 'Boreal-temperate. 1850-6400 ft; 853 m. On lower dead limbs of mostly coniferous trees (Abies lasiocarpa, Picea enslemannii) Pinus contorta, P. ponderosa; Tsusa); or occasionally rocks (overhanging face in shaded crevice) and rarely soil. Krumholz. Abies lasiocarpa/Menziesia. Tsusa/Pachistima; Abies/Pachistima.

Platismatia stenophylla (Tuck.) Culb. & C. Culb.--WA: Klickitat Co. (Pike, OSC). Spokane Co. (Cooke, 1955). Stevens Co. (Cooke, 1955). Whitman Co. (Cooke, 1955). 2000-3100 ft.' On Pseudotsuca menziesii. Ponderosa pine-Garry oak-Doug fir stand on N-facing slope.

Polvchidium muscicola (Swatz) Gray--OR: Grant Co. (Rosentreter). Klamath Co. (Rvan, ASU). Union Co. (Rosentreter). Wasco Co. (Rossman, 1992). WA: Klickitat Co. (Suksdorf, WSU). 3200-6200 ft; 990-1950 m. On moss and dark lichens on soil, and among moss, or (rarely) over Lepraria lichens on alder. Mound' and intermound communities in biscuit scabland.

Porpidia qlaucophaea (Körber) Hertel & Knoph--WA: Okanogan Co. (Douglas, 1974).

Poruidia ap. --WA: Klickitat Co. (Suksdorf, WSU)--as Lecidea

platycarpa).

Protooarmelia badia (Hoffm.) Hafellner--WA: Grant Co. (Nash, ASU). Okanogan Co. (Rvan, ASU). On rock. 1775 m. Montane forest.

Protoparmelia ochrococca Jorg., Rambold & Hertel (syn. Lecanora phaeobola)--WA: Klickitat Co. (Suksdorf, WSU). On bark-of Pseudotsuga menziesii

Pseudephebe minuscula (Nil. ex Arnold), Brodo & D. Hawksw.--OR: Hood River-Co. (B&H; Thomson; 1984). Lake Co. (Rvan, ASU). Wallowa Co. (Thomson, 1984). WA: Okanogan Co. (Imshaug, 1957; Thomson, 1984). Pend Oreille Co. (Brodo & Hawksworth, 1977). Spokane Co: (Thomson, 1984). Whitman Co. (Thomson, 1984). Arctic-alpine. On rock faces, boulders, and windswept gravels; seems to prefer drier locations than P. pubescens (Thomson, 1984). Considering the distribution reported by Thomson (1984), it is s&prizing that I did not see more specimens of.this from the Columbia Basin in any of the herbaria I examined.

Pseudephebe pubescens (L.) M. Choisy--OR: Crook Co. (Thomson, 1984). Deschutes Co. (B&H; Pike, OSC; Rhoades, WWB; Thomson, 1984). Deschutes Co./Lane Co. (Imshaug, 1957). Hood River Co. (B&H). Klamath Co. (Rvan, ASU). Lake Co. (B&H; Thomson, 1984; Ryan, ASU). Wallowa Co. (Imshaug, 1957; Thomson, 1984). Wasco Co. (Rossman, 1992; Davis, herb. Davis). WA: Chelan Co. (Howard, 1950). Klickitat Co. (Thomson,, 1984; Davis, herb. Davis). Okanogan Co. (Brodo & Hawksworth, 1977; Imshaug, 1957; Douglas, 1974; Thomson, 1984; Rhoades, WWB; Rvan, ASU)'. Spokane Co. (Thomson, 1984). Whitman Co. (Sayce, WSU). Yakima Co. (Rvan, ASU, WWB; Suksdorf, WSU). Arctic-alpine; 500-6480 ft; 600-1950 m. On rocks (andesite, basalt, and other acidic types), on rock faces. (including crevices in rimrock), boulders and gravels; rarely-on wood. In the Columbia Basin it sometimes occurs at rather-low elevations in dry areas.. Ravines in biscuit scabland; juniper-sage desert; lava fields in mixed conifer forests; alpine.

Pseudocyphellaria anthraspis (Ach.) Magnusson--WA: Klickitat Co. (Suksdorf, WSU). On bark.

Psora cerebriformis W. Weber--OR: De&chutes Co. (McCune). Harney Co. (Sipe, OSC). 1340 m.

Psora decipiens (Hedwig) Hoffm.--WA: Yakima co. (Ryan, ASU). 1400 ft. Sagebrush.

Psora globifera (Ach.) Massal.--OR: Crook Co. (Rvan,.ASU). Deschutes Co. (Pike, OSC; Rvan, ASU). Malheur Co. (McCune). Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Grant Co.

(Rosentreter--identification needs checking). Klickitat Co. (Davis, herb. Davis; Suksdorf, WSU). Yakima Co. (Rvan, ASU). Arctic-boreal. 350-3300 ft; 300-1150 m. On soil, sometimes over basalt. Sometimes on steep surfaces, shaded on pines. Juniper-sage desert; deep soil community in biscuit scabland; ponderosa pine woodland; Agropyron spicatum/Poa sandbersii.

Psora luridella *(Tuck.)* Fink--OR: Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Yakima Co. (Rvan, WWB). 1400 ft; 1150 m. On exposed soil. Sagebrush; mound'community in biscuit scabland.

Psora montana Timdal--OR: Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). 4500-5100 ft.

Psora nipponica (Zahlbr.) G..Schneider--OR: Crook Co. (Ryan, ASU). Deschutes Co. (Denison; Pike & Rossman, OSC; Rhoades, WWB). Harney Co.' (Pike, OSC). Klamath Co. (Rvan, ASU). Lake Co. (Ryan, ASU). WA: Kittitas Co. (Rvan, ASU). Klickitat Co. (Rvan, ASU; Davis, herb. Davis). Yakima Co. (Rvan, ASU, WWB). 500-6480 ft.; 550-1950 m. On soil (including sandy soil), and on moss over basalt, andesite, etc. Often in cracks on steep or vertical surfaces. Sagebrush; juniper-sage desert; ponderosa pine woodland; pine-Doug fir; sagebrush steppe; hemlock forest; oak woodland; alpine.

Psora rubiformis (Ach.) *kook.--WA:* Okanogan Co. (Douglas, 1974).

Psora tuckermannii R. Anderson ex Timdal--OR: Harney Co. (Rhoades, WWB; Pike, OSC). Lake Co. (Rvan, ASU). Malheur Co. (Rosentreter; identification needs checking). 2600 ft; 1535 m. On soil, often among basalt pebbles. Artemisia tridentata ssp. tridentata/Agropyron soicatum; barren gravelly slopes with scattered herbaceous vegetation.

Psoroma hypnorum (Vahl) Gray--OR: Deschutes Co. (Thomson, 1984). Klamath Co. (Rvan, ASU). Wallowa Co. (Pike, OSC). WA: Okanogan Co. (Douglas,. 1974; Thomson, 1984; Rvan, ASU). Yakima Co. (Howard, WTU; Suksdorf, WSU). Arctic-boreal. 4800-6000 ft. On mosses and soil,. occasionally on the bases of woody plants, usually on much humus, rarely on barks higher-up (Thomson, 1984). Open-canopy spruce stand in-mixed conifer forest; lava fields in mixed conifer forest.

Psorula rufonigra *(Tuck.)* G. Schneider--WA: Okanogan Co.' (Douglas, 1974).

Pyrrhospora cinnabarina (Sommerf.) Hafellner (Syn.: Lecidea cinnabarina) --OR: Deschutes Co. (Dunlap,, OSC). WA: Klickitat--Co. (Davis, herb. Davis; Suksdorf, WSU). Yakima Co. (Suksdorf, WSU). 2000 ft. On Pinus oonderosa (sometimes on young trees),

Pseudotsusa menziesii and other conifers;-on Prunus emarainata.

Ramalina farinacea' (L.) **Ach.--OR:** Lake Co. (Rvan, ASU). WA: Klickitat Co. (Suksdorf, WSU). 5300 ft; 1600 m. On Abies concolor.

Rhizocarpon **bolanderi (Tuck.) Herre v.** bolanderi--OR: Baker Co. (Ryan, ASU). Deschutes Co. (Pike & Rossman, OSC). Klamath Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). WA: Chelan Co. (Rvan, WWB). Klickitat Co. (Howard, WTU; Suksdorf, WSU). Yakima Co. (Howard, WTU). 1000-5400 ft. On basalt outcrops. Juniper-sage. desert; biscuit scabland; lava fields with mixed conifer forest.

Rhizocarpon bolanderi v. sulphurosa (Tuck.) **Zahlbr.--OR:** Klamath Co. (Rvan, ASU). WA: Klickitat Co. (Rvan, ASU). 4300 ft; 550 m. On basalt or other rocks. Oak woodland; ponderosa pine forest.

Rhizocaruon **cookeanum** Magnusson--WA: Garfield Co. (Rvan, ASU). Whitman Co. (Rvan, WWB; Aase, WSU--as R. seosraohicum). 2400 ft; 715 m. On basalt. Grassland.

Rhizocaruon disporum (Naeg. ex Hepp) **Müll. Arg.--OR:** Lake Co. (Ryan, ASU). Wasco Co. (Rossman, 1992). WA: Okanogan Co. (Howard, 1950). Arctic-boreal to temperate-montane. 990-1650 m. On basalt. Sometimes on vertical faces. Sagebrush areas; biscuit scabland. Identifications, need to be checked; some may be R. qeminatum.

Rhizocarpon **qeminatum Körber--OR:** Baker Co. (ASU). Deschutes Co. (Denison, OSC; McCune). WA: Yakima Co. (Rvan, ASU). 2900-6100 ft; 885-1340 m. On basalt; andesite, etc., granite, sometimes on vertical faces. Juniper-sage desert; alpine. Identifications need to be checked;, some may be R. disoorum.

Rhizocarpon qeographicum (L.) DC.--OR: Klamath Co. (Rvan, ASU). Lake Co. (Rvan, ASU). Malheur Co. (McCune). Union Co. (Rosentreter). Wallowa Co. (Pike, OSC). Wasco.Co. (Rossman', 1992). **WA:** Klickitat Co. (Suksdorf, WSU). Okanogan Co. (Douglas, 1974; Rvan, ASU). Whitman 'Co. (Piper, WSU). Yakima Co. (Rvan, ASU). 5025-6480 ft; 914-1950 m. On rocks (andesite, basalt, etc.). Open areas (including lava fields) in fir-Doug fir stands; biscuit scabland; alpine.

Rhizocarpon qrande (Flörke ex Flotow) **Arnold--OR:** Deschutes Co. (Pike & Rossman, OSC). Wasco Co; (Rossman, 1992). WA: Klickitat Co. (Suksdorf, WSU). 3000 ft; 990-1050 m. On basalt outcrops. Juniper-sage desert; biscuit scabland.

Rhizocarpon lecanorinum Anders--OR: Klamath Co. (Rvan, ASU). 5000 ft; 1500 m. On rock outcrops. Pine'forest; fir forest.

Rhizocaruon macrosporum Räsänen--WA: Okanogan Co. (Douglas, 1974). Whitman Co. (Sayce, WSU).

Rhizocarpon riparium Räsänen--WA: Klickitat Co. (Rvan, ASU). Yakima Co. (Rvan, 'ASU). 130-1860 m. On rock (andesite, etc.). Alpine. Purvis, et al..synonymize this under R. geographicum.

Rhizocarpon sphaerosporum Räsänen--WA: Klickitat Co. (Rvan, ASU; Davis, herb. Davis). 350 ft; 130 m.

Rhizocarpon sp. (widescribed?) --OR: Jefferson Co. (Rosentreter--det. Poelt). On Diploschistes "muscorum". 2400 ft. Artemisia tridentata ssp. wvomingensis with Agropvron spicatum and Festuca idahoensis.

Rhizocaruon sp. (undescribed?)--WA: Okanogan Co. (Rvan, ASU). On rock. A species-with gray thallus and 1-septate spores; 'does not key out among species reported for North America.

Rhizocaruon spp.

Rhizoplaca chrvsoleuca (Sm.) Zopf--OR: Baker Co. (Ryan, ASU). Crook Co. (Sine, OSC; Rvan, ASU). Deschutes Co. (Rhoades, WWB; Thiers, SFSU;.McCune). Lake Co. (Rvan, ASU; Davis, herb. Davis; Simmons & Simmons, WTU). Harney Co. (Tavares & Chisaki, UC; Sundberg, WTU). Lake Co. (Rvan, ASU; Pike, OSC). Malheur Co. (McCune). Wallowa Co. (Rvan, WWB; Monahan, WWB). Wasco Co. (Rossman, OSC; J. Hale, US). Wheeler. Co. (Ryan, ASU). WA: Chelan Co. (Howard, WTU; Rvan, WWB). Columbia Co. (Howard, WTU). Garfield Co. (Rvan, ASU; Howard, WTU). Grant Co. (Nash, ASU). Klickitat Co. (Rvan, ASU; Davis, herb. Davis; Suksdorf, WSU). Okanogan Co. (Howard, WTU; Rhoades, WWB; Douglas, 1974). Yakima Co. (Howard, WTU; Rvan, ASU). 400-6800 ft; 675-1700 m. On rock (basalt) outcrops, N- or W-facing rocks, sometimes on vertical surfaces. Sagebrush areas; grassland; juniper-sage desert; pinyon-juniper community; biscuit scabland with Artemisia riaida, Festuca idahoensis, etc.; ponderosa pine woodland.

Rhizoplaca melanophthalma (DC. in Lam. & DC.) Leuck. & Poelt--OR: Baker Co. (Palmer, and Rvan, ASU). Deschutes Co. (Sipe, and Denison, OSC; Rhoades, WWB; Thiers, SFSU; Sherwood & Pike, US; McCune). Grant Co. (Hale, US). Harney Co. (Pike, and Hickman, OSC; Rhoades, WWB; Hale, US) . 2900-9900 ft. Hood River-Co. (Miller & Shushan, 1964). Klamath Co. (Ryan, ASU; Sipe, OSC; Brown, WTU). Lake Co. (Pike, and Waaner, OSC; Rvan, ASU; Davis, herb. Davis; Young, WTU). Malheur Co. (Rosentreter--on soil, becoming vagrant; as Xanthooarmelia sp.; Tavares & Chisaki, H; McCune). Wasco Co. (Rossman, 1992; Rossman, US; J. Hale, FH). Wheeler Co. (Rvan, ASU). WA: Benton Co. (Foster, WS). Chelan Co. (Howard, 1087--on soil;, Howard, WTU). Columbia Co. (Howard, WTU).

Garfield Co. (Rvan, ASU). Grant Co. (Tucker, WTU).' Kittitas Co. (Eyerdam, and Howard, WTU. Rvan, ASU). Klickitat Co. (Suksdorf, WS: Howard, 1910--on soil; Rvan, ASU). Okanogan Co: (Monahan, and Rhoades, WWB; Rvan, ASU; Douglas, 1974). Whitman Co. '(Cooke, US; Piper, and Sayce, WS; Wagner, OSC). Yakima Co. (Howard, WTU; Suksdorf, WSU; Ryan, ASU). 2200-6800 ft.; 385-1950 m. On volcanic rock, andesite, basalt, schist, granite, sandstone; sometimes (rarely in Oregon or Washington; frequently in south-central Idaho), on soil, becoming vagrant. Often on tops of outcrops, but also on vertical faces; usually exposed. Juniper desert; sagebrush- areas; grassland; Doug fir zone; alpine. Forms on soil have been found in Atriolex confertifolia habitat.

Rhizopeltata (Ramond) **Leuck. &** Poelt--OR: Lake Co. (Rvan, ASU). Wasco Co. (J. Hale, M). **WA:** Asotin Co. (Esslinger, WIS). Douglas Co. (Collector?, WWB). Ferry Co. (Foster, US). Grant Co. (Nash, ASU). Kittitas Co. (Pike, OSC). Klickitat Co. (Rvan; ASU; Suksdorf, WSU). Yakima Co. (Rvan, ASU; Bird, US; Kroq, 0). 400-5100 ft. On exposed basalt outcrops, and on vertical cliff faces. Dry sagebrush slopes; cottonwoods.

Rhizoplaca subdiscreuans **(Nyl.)** R. **Sant.** (s. lato: **"R.** ocrinaeta Ryan in herb.")--**OR:** Baker Co. (Ryan, ASU). WA: Okanogan Co. (Rvan, ASU). Yakima Co. (Rvan, ASU). 2200-6360 ft. On basalt. Open-canopy pine-Doug fir forest; pine forest. This form, with at least partly blue-black discs, may or may not be distinct from true R. subdiscreoans.

Rimularia insularis **(Nyl.) Rambold &** Hertel--OR: Union Co. (Rosentreter). Wasco Co. (Rossman, OSC). Parasitic on Lecanora rupicola on basalt rocks. 1097-1150 m. Biscuit scabland.

Rinodina bolanderi Magnusson--WA: Okanogan Co. (Rvan, ASU). 1775 m. On soil. Montane forest.

Rinodina confrasosa **(Ach.) Körber--WA:** Klickitat Co. (Suksdorf, WSU). On bark. Identification needs to be checked..

Rinodina exigua **(Ach.) Gray--WA:** .Klickitat Co. (Suksdorf, WSU). On Fraxinus. Identification needs to be checked.

Rinodina hallii Tuck.--OR: Hood River Co. (Suksdorf, WSU). WA: Klickitat Co, (Suksdorf, WSU). On Cornus nuttallii.

Rinodina mniarea (Ach.) **Körber--WA:** Okanogan Co. (Douglas, 1974).

Rinodina mucronatula **Magnusson--OR:** Wasco Co. (Rossman, 1992--det. by Sheard). Arctic-boreal. 990-1050 m. On plant debris and soil: Mound and intermound communities in biscuit scabland.

Master species list

Rinodina sp. (undescribed?)--WA: Okanogan Co. (Rvan, ASU). On soil. 1775 m. Montane forest. Thallus with bright yellow, K+ purple medulla. Does not key out.

Rinodina sp. (undescribed?) --WA: Okanogan Co. (Rvan, ASU). , On soil.. 1775 m. Montane forest. Does not key-out among species presently reported for North America.

Rinodina Sp. --WA: Okanogan Co. (Ryan, ASU). On rock. '6360 ft; 1925 m.

Solorina crocea (L.) Ach.--WA: Chelan Co. (Thomson, 1984); Okanogan Co. (Imshaug, 1957; Douglas, 1957; Rvan, ASU). Yakima Co. (Rvan, ASU; Suksdorf, WSU). Arctic-alpine. 1775-1950 m. Prefers moist seepage areas, below late snowbanks, in spring seepages, over clay soils, but may also be found on frost boils and in drier limestone barrens (Thomson, 1984). On north side of shaded rock. In one site in the Columbia Basin where I have seen it (Okanogan Co., WA), it was abundant on, disturbed soils-in a montane forest.

Sphaerophorus globosus v. gracilis (Müll. Arg.) Zahlbr.--WA: Klickitat Co. (Suksdorf, WSU).

Sporastatia testudinea (Ach.) Massal.--OR: Lake Co. (Rvan, ASU). WA: Yakima Co. (Rvan, ASU). 1860-1950 m. Alpine. On acidic rocks (basalt, andesite), on steep to overhanging surfaces.

Squamarina lentigera (Weber) Poelt (s. lato)--OR: Wasco co. (Rossman, 1992). 990-1050 m. On bare soil. Mound community in biscuit scabland. May include the "P+ yellow strain", which may be same as S. kansuensis Magnusson '(from central Asia; not yet reported from North America);

Staurothele clopimoides (Arnold) Steiner--OR: Harney Co. (Rosentreter). On pebbles. Artemisia risida'habitat. This may be the same as the "Staurothele sp." reported from ravine bottoms in biscuit scabland in Wasco Co., Oregon by Rossman (1992).

Staurothele cf. drummondii (Tuck.) Tuck.--OR: Klamath Co. (Ryan, ASU). Lake Co. (Rvan, ASU). 4000-6000 ft. On basalt.

Staurothele fissa (Taylor) Zwackh. (Syn. S. lithina) --OR: Klamath Co. (Ryan, ASU). Lake Co'. (Rvan, ASU). WA: Klickitat Co. (Suksdorf, WSU). Yakima Co. (Suksdorf, WSU). 4000-6200 ft. On rocks in creeks, 'at least periodically submerged.

Staurothele fuscocuprea (Nyl.) Zsch.--WA: Okanogan Co. (Howard, 1950; Douglas, 1974).

Staurothele spp.

Stenocybe major Nyl. ex Körber--WA: Klickitat Co. (Suksdorf, WSU--as Calicium eusporum). Yakima Co. (Ryan, WWB). 5000 ft. On wood.

Stereocaulon alpinum Laurer ex Funck--WA: Chelan Co. (Howard, 1950). Okanogan Co. (Imshaug, 1957).

Stereocaulon botrvosum Ach. --OR: Deschutes Co./Lane Co. (Imshaug, 1957).

Stereocaulon condensatum Hoffm.--WA: Okanogan Co. (Douglas, 1974). Yakima Co. (Suksdorf, WSU).

Stereocaulon glareosum (Savicz) Magnusson--OR: Deschutes Co./Lane Co. (Imshaug, 1957'). WA: Okanogan Co. (Imshaug, 1957).

Stereocaulon tomentosum Fr.--OR: Wasco Co. (Suksdorf, WSU). WA: Okanogan Co. (Ryan, ASU). Yakima Co. (Suksdorf, WSU). On soil or mossy rocks. 1775-1825 m. Montane to alpine. Sometimes growing near glaciers.

Stereocaulon vesuvianum Pers. v. denudatum--OR: Hood River Co. (Suksdorf, WSU).

Stereocaulon sp. --WA: Klickitat Co. (Suksdorf, WSU--as S. paschale).

Strancrospora moriformis (Ach.) B. Stein (Syn. Biatorella moriformis) --WA: Klickitat Co. (Suksdorf, WSU). On rotted, prostrate tree trunk.

Teohromela armeniaca (DC.) Hertel & Rambold--WA: Yakima Co. (Ryan, ASU). 1950 m. On rock, on vertical face. Alpine.

Tephromela atra (Huds.) Hafellner--WA: 'Klickitat Co.' (Davis, herb. Davis; Suksdorf, WSU). 1600 ft. On basalt..,

Texasporium sancti-jacobi (Tuck.) Nádv.--OR: Jefferson Co.- (Rosentreter). On the ground.- 2400 ft. Agropyron spicatum/Festuca idahoensis grassland.

Thamnolia subuliformis (Ehrh.) Culb.--WA: Okanogan Co. (Douglas, 1974). Yakima Co. (Ryan, ASU). '1860-1950 m. Alpine. On soil or rock.

Thamnolia vermicularis (Swartz) Ach. ex Schaerer--WA: Chelan Co. (Douglas, 1957). Okanogan Co. (Imshaug, 1957; Douglas, 1957). Yakima Co. (Ryan, ASU). 1860-1950 m. Alpine. On soil or rock.

Thelomma ocellatum (Körber) Tibell--OR: Union Co. (Davis, herb. Davis; Rosentreter). WA: Kittiats Co. 4100 ft; 450 m. On wooden fenceposts (including ones made from Larix). Ponderosa pine; Artemisia rigida/Poa grassland.

Toninia aromatica (Turner ex Sm.) **Massal.--OR:** Deschutes, Co. (Pike & Rossman, OSC). 3000 ft... On moss. Juniper-sage desert.

Toninia ruginosa (Tuck.) Herre--OR: Harney Co. (Pike, OSC). Jefferson Co. (Rosentreter). Union Co. (Davis, herb. Davis). WA: Chelan Co. (Howard, '1950). Klickitat Co. (Suksdorf, WSU). 2400-4500 ft. On soil over rock, sometimes on rock walls. Artemisia tridentata ssp. wyominoensis with Agropyron spicatum and Festuca idahonesis.

Toninia sedifolia

Toninia **sp. ("will** be' described'by R. Anderson", but has not been; may have been described by **Timdal)--OR:** Wasco Co'. (Rossman, 1992). 990-1050 m. On bare soil. Mound community in biscuit scabland..

Toninia **spp.**

Trauelia-sp --WA: Klickitat Co. (Suksdorf, WSU), On rock.'

Trapeliopsis granulosa (Hoffm.) **Lumbsch--OR:** Deschutes Co, (Dunlap, OSC; Eslick, herb. Rosentreter). Klamath Co, (Ryan, ASU). Lake Co., (Rvan, ASU). WA: Chelan Co. (Douglas, 1974). Klickitat Co. (Pike, OSC; Davis, herb. Davis; Suksdorf, WSU). Okanogan Co. (Rvan, ASU; Douglas; 1974). Yakima Co. (Suksdorf, WSU). 500-8000 ft. On soil, rotten wood or logs, bark of' Pseudotsusa menziesii, burnt stumps or logs, or sometimes on wood, including fenceposts.. Ponderosa pine-Garry oak-Doug fir stand-on N-facing slope; montane forest'.

Trapeliopsis cf. wallrothii **(Flörke ex** Sprengel) Hertel **& G.** Schneider --OR: Jefferson Co. (Rosentreter). WA: Klickitat Co. (Davis; herb. Davis; Suksdorf, WSU). 400-2400 ft.: On moss or 'thin soil over basalt, soil, or rocky ground. Artemisia tridentata ssp. wyominqensis with Agropyron soicatum and Festuca idahoensis; This material is quite different from that found on the California coast, which is typical T. walirothii according to Nimis (pers. comm., 1993).

Tremolecid atrata (Ach.) Hertel--WA: Yakima Co. (Rvan, ASU). 900 m. On basalt boulders, on gentle surfaces. Douglas fir:

Tuckermannopsis chlorophylla (Willd. in **Humb.)** Hale--OR: Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). **WA:** Chelan Co. '(Howard,

1950). Kittitas Co. (Ryan, WWB). Klickitat Co. (Pike, OSC; Davis, herb. Davis; Suksdorf, WSU--in packet with T. platyphylla). Spokane Co. (Cooke, 1955; Thomson, 1984). Stevens Co. (Cooke, 1955; Thomson, 1984). Whitman Co. (Cooke, 1955; Thomson, 1984; Bigley, WWB; Sayce, WSU). Boreal-temperate. 400-6400 ft.; 1925-1930 m. Usually on twigs of various trees, including Abies concolor, Juniperus occidentalis, Pinus ponderosa, Pseudotsuga menziesii; sometimes on wooden fenceposts;, occasionally on rock (steep faces). Ponderosa pine-Garry oak-Doug fir stand on N-facing slope; ponderosa pine-Doug fir; fir-Doug 'fir forest;

Tuckermannopsis fendleri (Nyl.) Hal&-WA: Yakima Co: (Ryan, WWB). 3000 ft. On bark of Pinus.

Tuckermannopsis merrillii (Du Rietz) Hale--OR: Deschutes Co. (Lloyd, Pike, OSC; Eslick, and Rosentreter). Jefferson Co. (Rhoades, WWB). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Union Co. (Rosentreter). Wasco Co. (Rossman, 1992). WA: Chelan Co. (Howard, WTU). Ferry Co. (Howard, WTU). Kittitas Co. (Becking, and Howard, WTU; Ryan, ASU). Klickitat Co. (Davis, herb. Davis; Pike, OSC; Goward, UBC; Suksdorf, WSU). Okanogan Co. (Rhoades, WWB). Spokane Co. (Suksdorf, WSU; Cooke, 1955--as Cetraria californica). Whitman Co. (Howard, WTU; Cooke, 1955--as Cetraria californica). Yakima Co. (Howard, WTU; Ryan, WWB). 400-8000 ft; 300-1950 m. On twigs of Abies concolor, Juniperus occidentalis, Larix, Pinus contorta, P. ponderosa, Pseudotsuga menziesii, Tsuga, and other conifers. Ponderosa pine-Garry oak-. Doug fir stand on N-facing slope; open mixed forest; biscuit scablands; ponderosa pine with Ceanothus velutinus understory.

Tuckermannopsis orbata (Nyl.)' Lai--OR: Lake Co. (Ryan, ASU). WA: Ferry Co'. (Howard, WTU--as Nephromopsis ciliaris). Klickitat Co. (Pike, OSC). Okanogan Co. (Monahan, 'WWB). 3100~6200 ft.' On Pseudotsuga menziesii. Ponderosa pine-Garry oak-Doug fir stand on N-facing.slope.

Tuckermannopsis pallidula *(Tuck.* **ex** Riddle) **Hale--WA:** Kittitas Co'. (Howard, WTU; Ryan, ASU). Klickitat Co. (Davis, herb. Davis; Goward, UBC;'Suksdorf, WSU). Yakima Co. (Ryan, ASU). 2000-3200 ft; 90 m.,. On Pinus ponderosa, Pseudotsuga and other conifers. Open canopy pine-Doug fir; ponderosa pine.

Tuckermannopsis platyphylla (Tuck.) Hale--OR: Deschutes CO. (Llovd, OSC). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). WA: Colville National Forest (Zamora, UBC). Ferry Co. (Howard; WTU). Kittitas Co. (Anderson, WTU; Pike, OSC; Ryan, WWB). Klickitat Co. (Howard, WTU; Suksdorf, WSU). Pend Oreille Co. (Hope, WSU). Spokane Co.' (Wagner, OSC; Cooke, 1955). Stevens Co. (Cooke, 1955). Whitman Co. (Wagner, OSC; Bigley; WWB; Cooke, 1955). Yakima Co. (Ryan, ASU,.WWB). 2000-5808 ft. 730-2000 m. On

Abies amabilis, A. concolor, Larix and Pinus contorta (lower dead limbs of 8-10' trees in 35 year old stand); on Pinus ponderosa, Pseudotsuaa, and other conifers; on Crataeuus douslasii; on wood, including fenceposts. Mixed ponderosa pine-Doug fir forest; open Crataegus communities) Pseudotsuga/Physocarpus malvaceus communities.

Tuckermannopsis subalpina--WA: Okanogan Co. (Douglas, 1974). Yakima Co. (Rvan, WWB; Suksdorf, WSU). 5000-5600 ft. On shrubs (probably Vaccinium sp.).

Umbilicaria americana Poelt & Nash--OR: Lake Co. (Rvan, ASU--determined by Poelt & Nash).' WA: Pend Oreille Co. (Poelt & Nash, 1993). Boreal to temperate. Montane Forest. See notes under U. vellea.

Umbilicaria anqulata Tuck.--WA: Okanogan Co. (Imshaug, 1957). Spokane Co.? (Thomson, 1984; dot is on border with Idaho). Boreal to temperate. On very exposed, dry rocks.

Umbilicaria cf. caroliniana Tuck. --WA: Okanogan Co. (Rvan, ASU). On boulder. 5060 ft; 1825 m. Montane forest.

Umbilicaria decussata (Vill.) Zahlbr.--OR: Hood River/Wasco Co. (Thomson, 1984): Lake Co. (Rvan, ASU). Wallowa Co. (Imshaug 1957; Thomson, 1984). **WA:** Okanogan Co. (Imshaug, 1957; Thomson, 1984). Arctic-alpine. 6480 ft. Prefers bird perches, etc. (Thomson, 1984).

Umbilicaria deusta (L.) Baumg.--OR: Hood River/Wasco Co. (Thomson, 1984). WA: Chelan Co. (Howard, 1950). Ferry Co. (Thomson, 1984). Okanogan Co. (Ryan, ASU). Boreal-arctic.. 1775 m. On acid'rocks particularly in rills or water channels on the rock face, in the open or in partial shade (Thomson, 1984). Montane forest..

Umbilicaria hirsuta (Swartz ex Westr.) Hoffm.--WA: Grant Co. (Nash, ASU). On basalt.

Umbilicaria hwerborea **(Ach.) Hoffm.--OR:** Baker Co. (Rvan, ASU). Deschutes Co. (Sundberg, WTU; Rvan, ASU). Harney Co. (Sunberg, WTU; Rhoades, WWB). Hood River/Wasco Co. (Thomson, 1984). Klamath Co. (Rvan, ASU). Klamath/Lake Co. (Thomson, 1984). Lake Co. (Rvan, ASU; Davis, herb. Davis--typical form + "U. intermedia" form). Wallowa Co. (Imshaug, 1957; Thomson, 1984). Wasco Co. (Rossman, 1992). WA: Chelan Co. (Klavin, WWB; Howard, 1950). Ferry Co. (Howard, WTU; Thomson, 1984). Lincoln Co. (Thomson, 1984; Rosentreter). Okanogan Co. (Price, WTU; Monahan, and Rhoades, WWB; Rvan, ASU; Imshaug, 1957). Spokane Co. (Howard, WTU). Whitman Co. (Howard, WTU, UBC; Sacye, WSU; Thomson, 1984).

Arctic-alpine to boreal. 2900-6975 ft; 910-1050 m. On andesite, basalt, or other acid rocks; usually on larger boulders or outcrops, but occasionally on small rocks. Pinyon-juniper-sagebrush; ravines in biscuit scabland; ponderosa pine-big sagebrush; Artemisa riqida habitat;-Artemisia tridentata ssp. vasevana/Festuca idahoensis; lava fields in mixed conifer forest; sometimes on'ridgetops. Much of'the material from the Cascades is small and atypical, approaching U. polyphylla; the name "U. intermedia" has been applied to such specimens.

Umbilicaria kraschenninikovii (Savidz) Zahlbr.--OR: Baker Co. (Palmer, ASU). Deschutes Co. (Dunlap, OSC). Harney Co. (Rhoades, WWB). Hood River/Wasco Co. (Thomson, 1984). Lake Co. (Ryan, ASU). Lake/Harney Co. (Thomson, 1984). Klamath/Lake Co. (Thomson,. 1984). Lake Co. (Davis, herb. Davis). Wallowa Co. (Imshaug, 1957; Thomson,. 1984). WA: Chelan Co. (Martin, WWB). Ferry Co. (Thomson, 1984). Grant Co. (Nash, ASU). Spokane Co. (Thomson, 1984). Yakima Co. (Rvan, ASU, WWB). Arctic-alpine. 3800-6350 ft; 1200-1860 m. On basalt, andesite, schist, or other acid rocks, on horizontal to vertical surfaces. Sagebrush steppe; alpine.

Umbilicaria phaea *Tuck.* --OR: Baker Co. (Palmer, and Ryan, ASU). Deschutes Co. (Koutskv, OSC). Harney Co. (Rhoades, WWB). Klamath Co.. (Thomson, 1984; Rvan, ASU). Lake Co. (Thomson, 1984; Ryan, ASU). Wasco Co. Sundberq, WTU; Thomson, 1984; Rossman, 1992). WA: Asotin Co. (Jones, WTU; Thomson, 1984). Chelan Co,. (Howard, WTU; Thomson, 1984). Columbia Co. (Howard, WTU). Ferry Co. (Thomson, 1984). Grant Co. (Tucker & Tucker, WTU). Klickitat Co. (Suksdorf, WSU; Davis, herb. Davis--unusally large thallus; Thomson, 1984). Spokane Co. (Thomson, 1984). Walla Walla Co. (Thomson, 1984). Whitman Co., (Howard, WTU; Waqner, WSU; Thomson, 1984). Yakima Co. (Howard, WTU; Rvan, WWB). Boreal to temperate. 400-6800 ft; 600-1050 m. On exposed, hot, dry rocks (basalt, etc.). On stones in the stone rings and .on boulders, in Artemisia tridentata/Agropyron soicatum community in biscuit scabland; juniper'desert; sometimes near creeks.

Umbilicaria polyphylla (L.) Baumg.--OR: Klamath Co. (Rvan, ASU). WA: Chelan Co. (Thomson, 1984). Klickitat Co.? (Thomson, 1984; dot is on border with Oregon). Klickitat Co. (Suksdorf, WSU). Spokane Co. (Thomson, 1984). Whitman Co. (Thomson, 1984). Yakima Co. (Howard, WTU). Arctic-alpine to boreal. 6200 ft; 1900 m. On acid rocks, preferably along rills. Montane forest.

Umbilicaria polyrhhiza (L.) Fr.--OR: Klamath Co. (Rvan, ASU). WA: Klickitat Co. (Howard, WTU; Davis, herb. Davis; Thomson, 1984). Okanogan Co. (Rvan, ASU). Pend Oreille Co. (Thomson, 1984). Spokane Co. (Thomson,' 1984). Arctic to temperate. 400-6360 ft. On acidic rocks. Subalpine.

Umbilicaria proboscidea (L.) Schrader--WA: Okanogan Co. (Imshaug, 1957; Douglas, 1974).

Umbilicaria torrefacta (Lightf.) Schrader--OR: Klamath Co. (Thomson, 1984; Rvan, ASU). Lake Co. (Thomson, 1984; Rvan, ASU). WA: Chelan Co. (Howard, WTU). Ferry Co. (Howard, WTU; Thomson, 1984). Klickitat Co. (Davis, herb. Davis; Suksdorf, WSU). Okanogan Co. (Imshaug, 1957; Monahan, WWB; Rvan, ASU). Yakima Co. (Gleason, WTU; Rvan, WWB). Arctic-alpine. 400-6480 ft. On basalt or other acid rocks in exposed places. Montane forest.

Umbilicaria vellea (L.) Ach. --OR: Hood River/Wasco Co. (Thomson, 1984). Wheeler Co. (Ryan, ASU). WA: Chelan Co. (Howard, 1950; Thomson, 1984). Ferry Co. (Thomson, 1984). Grant Co. (Nash, ASU). Okanogan Co. (Douglas, 1974; Thomson, 1984; Dube, and Rhoades, WWB). Pend Oreille Co. (No collector aiven, WTU, WWB; as U. mammulata). Spokane Co. (Howard, WTU). Whitman Co. (Thomson, 1984). Arctic to temperate. On either open or shaded cliffs, often near shores (Thomson, 1984); on basalt, or soemtimes conglomerate rock. 4400 ft; 910-1600 m. Pinyon-juniper community; pine woodland. Many of these, especially from lower elevations, are likely to 'be U. americana; true U. vellea is arctic-alpine, and apparently occurs mostly east of the Rocky Mountains, although it has been found in the high Sierras of California (Poelt & Nash, 1993).

Umbilicaria virginis Schaerer--OR: Deschutes Co./Lane Co. (Imshaug, 1957). Harney Co. (Pike, OSC). Wallowa Co. (Imshaug, 1957; Thomson, 1984). WA: Klickitat Co. (Thomson, 1984). Okanogan Co. (Imshaug, 1957; Thomson,. 1984). Spokane Co. (Thomson, 1984). Walla Walla Co. (Thomson, 1984). Yakima Co. (Suksdorf, WSU--det. Llano; Thomson, 1984; Rvan, ASU). Arctic-alpine. 9900 ft; 1950 m. On rocks: In my experience, at least in California, the species is confined to dry but very shaded/sheltered habitats (e.g., under overhanging cliffs or boulders) in the alpine. Thomson's records need to be confirmed, because'many of these counties would appear to have only rather low elevation steppes or grasslands.

Usnea cavernosa Tuck.--OR: Hood River/Wasco Co. (Thomson, 1984). Boreal-temperate. On trees, mainly conifers but also on hardwoods; prefers conditions with high'atmospheric humidity. The identity and locality of the material cited by Thomson need to be checked.

Usnea filipendula Stirton (s. lato)--OR: Klamath Co. (Thomson, 1984). Umatilla Co. (Thomson, 1984). WA: Asotin Co. (Thomson, 1984). Boreal-temperate. On conifer and hardwood trees.

Usnea lapponica Vainio--OR: Klamath Co. (Rvan, ASU). 4600 ft.

On Cercocarous ledifolius. The taxonomy and nomenclature of this complex is currently a mess.

Usnea substerilis Mot.--**WA:** Walla Walla Co. (Thomson, 1984'). Boreal-temperate., On trees and.shrubs. Egan (1987) treats this as a synonym of U. lapponica, but that may not, be the case.

Usnea sp. (U. subfloridana group)--**WA:** Klickitat Co. (Suksdorf, WSU--as U. ceratina). On trees.

Verrucaria aquilella Nyl.--WA: Klickitat Co. (Suksdorf, WSU). On small stones on the ground. Identification needs to be checked.

Verrucaria sp.--**WA:** Yakima Co. (Ryan, WWB). 4000 ft. On submerged rock.

Verrucaria nigrescens Pers.--**OR:** Wasco Co. (Rossman, 1992). **WA:** Klickitat Co. (Suksdorf, WSU). 990-1050 m. On small stones at ground level. Mound and intermound communities in biscuit scabland. Identification needs to be checked.

Verrucaria spp.

Vulpicida canadensis (Räsänen) --OR: Deschutes Co. (Llovd, OSC). Jefferson Co. (Chambers, Hickman, and Averill, OSC; Rhoades, WWB; Schofield & Lyford, UBC--verif. by Mattsson). Klamath Co. (Koutskv, OSC; Rvan, ASU). Lake Co. (Rvan, ASU). Union Co. (Davis, herb. Davis). Wallowa Co. (Fredricks, OSC). WA: Chelan Co. (Howard, WTU--as "Cetraria juniperina"). Kittitas Co. (Howard, Jenkins, Johnson, Anderson, and Thomson, WTU; Pike, OSC; Rvan, ASU, WWB). Klickitat Co. (Blanchard, WWB; Davis, herb. Davis; Suksdorf, WSU). Pend Oreille Co. (No collector aiven, WWB; Hope, WSU). Spokane' Co. (No collector qiven, WTU; Wagner, OSC, UBC; Piper, WSU; Cooke, 1955--as "Cetraria juniperina"). Stevens Co: (Cooke, 1955--as "Cetraria juniperina"). Whitman Co. (Wagner, OSC; Bialev, WWB). Yakima Co. (Howard, WTU; Pike, OSC; Rvan, ASU). 400-5880 ft.; 600-1750 m. On twigs or branches of Larix and Pinus contorta (lower dead limbs and branches of 8-10" dbh trees'in 35 year old stand), P. ponderosa, Pseudotsuga menziesii, Tsuaa and other conifers; on twigs of Salix; on fence posts. Open ponderosa pine woodland; mixed ponderosa pine-Doug fir. forest; ponderosa-lodgepole pine forest; Tsuga/Pachistima.

Vulpicida pinastri (Scop.) --WA: Okanogan Co. (Imshaug, 1957; Thomson, 1984). Boreal-temperate. On bark or wood, usually of conifers.

Xanthoparmelia coloradoensis Hale--**OR:** Harney Co. (Pike, OSC). 3600 ft. On soil. Flat, wind-swept, gravelly areas, juniper-sage desert on gentle, E-facing slope.

Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale (s. lato, including "v. isidiata")--Although it is possible that this species in the current restricted sense may well occur in the Columbia Basin, most older collections are probably other species; the isidiate ones (e.g., from Yakima Co., Washington, collected by Howard) are probably X. mexicana or X. plittii.

Xanthoparmelia cumberlandia (Gyelnik) Hale--OR: Grant Co. (Goward, UBC). Rlamath Co. (Ryan, ASU). Wheeler Co. (Goward, UBC). WA: Kittitas Co. (Goward, UBC). Klickitat Co. (Ryan, ASU; Davis, herb. Davis). Lincoln Co. (Goward, UBC). 350-400 ft; 60-1300 m. On basalt outcrops; sometimes spreading onto soil or moss. Festuca grassland; Artemisia-Atriolex-grassland; big sagebrush steppe; volcanic scabland. Although this species might very rarely occur on wood or bark (on or near the ground), it is primarily saxicolous (to occasionally muscicolous or terricolous). The report of this species as being common on juniper and sagebrush in all communities of biscuit scabland (Rossman, 1992) seems very suspicious and needs to be confirmed.

Xanthoparmelia mexicana (Gyelnik) Hale--OR: Klamath Co. (Ryan, ASU). WA: Asotin Co. (Rvan, ASU). Columbia Co. (Rvan, WWB). Klickitat Co. (Rvan, ASU). 4300 ft; 365-550 m. On basalt, sometimes on horizontal surfaces, sometimes on NE-facing.columnar cliffs. Oak woodland.

Xanthoparmelia norchlorochroa Hale--OR: Malheur Co. (DeBolt, herb. Rosentreter). On soil. 1768 in.

Xanthoparmelia Dlittii (Gyelnik ex D. Dietr.) Hale--OR: Baker Co. (Palmer, ASU). Deschutes Co. (Rvan, ASU). Grant Co. (Rvan, ASU). Harney Co. (Pike, OSC). Jefferson Co. (Rosentreter). Malheur Co. (Rosentreter). Wasco Co. (Rossman, 1992). WA: Klickitat Co. (Davis, herb. Davis). 300-4000 ft; 990-1050 m. On gravel and larger rocks (andesite, basalt, schist, and other acidic rocks). Juniper-sage desert; biscuit scabland; grassland;. Artemisia tridentata ssp. wyomingensis with Agropyron spicatum and Festuca idahoensis.

Xanthoparmelia somloensis (Gyelnik) Hale--WA: Asotin Co. (Rvan, ASU). 2425 m. On basalt.. Identification needs to be checked.

Xanthodarmelia taractica (Krempelh.) Hale--OR: Wasco Co. (Rossman; 1992). WA: Garfield/Whitman Co. (Thomson, 1984). Klickitat Co.? (Thomson, 1984; dot is'on border with Oregon). Lincoln Co. (Rosentreter). Pend Oreille Co.? (Thomson, 1984; dot is on border with Idaho). Arctic to temperate. 990-1050 m. On basalt or other acid rocks in-full sun. Biscuit scabland; Artemisia risida habitat. Identification needs to be checked.

Xanthoparmelia sp. (described by Hale, first collected from Montana in 1977)--OR: Wasco Co. (Rossman, 1992). 990-1050 m. On rock in biscuit scabland.

Xanthoria candelaria (L.) Th. Fr. (s. lato)--OR: Baker/Wallowa Co. (Thomson, 1984). De&chutes Co. (Pike, OSC). Harney Co. (Rosentreter--as "X. fallax v. candelaria"). Klamath Co. (Ryan, ASU). Lake Co. (Ryan, ASU). Malheur Co. (Rosentreter). Wallowa Co. (Pike; OSC). Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Asotin Co: (Thomson, 1984). Columbia Co. (Howard, WTU). Ferry Co. (Howard, WTU). Garfield Co., (Howard, WTU). Grant Co. (Thomson; and Tucker & Tucker, WTU). Kittitas Co. (Johnson, WTU). Klickitat Co. (Howard, WTU; Davis, herb. Davis--X. fulva; (Suksdorf, WSU--as "X. candelaria v. pygmaea"). Okanogan Co. (Frve, WTU). Spokane Co. (Howard, WTU; Thomson, 1984). Whitman Co. (Howard, .WTU; Cooke, 1955; Thomson, -1984). Yakima Co. (Howard, WTU; Ryan, WWB). Probably mainly boreal-temperate, to arctic. 900-6000 ft; 990-1150 m.' On hardwood'trees (including "Carolina poplar", Acer neaundo, Amelanchier, Populus trichocarpa, Quercus aarryana, Robinia pseudacacia) and gymnosperms (Juniperus occidentalis, Pseudotsusa menziesii, Thuia plicata), shrubs (including Artemisia, and Gravia spinosa), wood (including old fenceposts), rocks (including tombstones, and basalt cliffs), and over mosses; sometimes on cow dung; sometimes on bone; sometimes on rock. Artemisia tridentata ssp. tridentata/Agropyron spicatum shrub-steppe; Sarcobatus/Grayia/Artemisa shrub-steppe; biscuit scabland; mixed conifer forest; open ponderosa pine-cottonwood woodland. Most of these records are probably based on X. fulva, but careful study is required.

Xanthoria elegans (Link) Th. Fr.--OR: Baker Co. (Palmer, ASU). Deschutes Co. (Thomson, 1984; Rhoades, WWB). Harney Co'. (Sundberg, WTU; Pike, OSC). Hood River/Wasco Co. (Thomson, 1984). Klamath Co. (Ryan, ASU). Lake Co. (Davis, herb. Davis; Ryan, ASU). Thomson, 1984). Malheur Co. (Rosentreter; McCune). Wheeler Co. (Thomson, 1984). WA: Grant Co. (Tucker, WTU). Kittitas Co. (Anderson, WTU). Klickitat Co. (Suksdorf, WSU). Okanogan Co. (Howard, WTU; Rhoades, WWB; Douglas, 1974). Yakima Co. (Howard, WTU; Ryan, ASU, WWB; Suksdorf, WSU). Arctic to temperate. 1054-6800 ft; 130-1860 m. On siliceous rocks (e.g., basalt, andesite, schist) and calcareous rocks, often on outcrops or cliffs enriched by bird or mammal excretions; on old bones, and occasionally on old wood; sometimes on mosses. On horizontal to vertical surfaces. Sagebrush areas; juniper-sage desert; Artemisia arbuscula site; alpine.

Xanthoria fallax (Hepp in Arnold) Arnold--OR: Crook Co. (Thomson, 1984). Deschutes Co. (Rhoades, WWB; Eslick, herb. Rosentreter). Harney Co. (Sundberg, WTU). Lake Co. (Ryan, ASU). Malheur Co.

(McCune). Wheeler Co. (Rosentreter). WA: Grant Co. (Rosentreter). Kittitas Co. (Pike, OSC: Ryan, WWB). Okanogan Co. (Rhoades, WWB). Whitman Co. (Ryan, WWB). Yakima Co. (Howard, WTU; Ryan, WWB). Boreal-temperate. 1054-8000 ft; 900-910 m. On trees (Populus tremuloides [partly on "bird scars"], and P. trichocaroa), shrubs (Artemisia; Celtis reticulata) and rocks, occasionally on moss or old wood. Mixed cottonwood-ponderosa pine forest.

Xanthoria fulva (Hoffm.) Poelt & Petuschnig--Many, if not all, records of X. candelaria from the Columbia 'Basin (and Great Basin) may be this species; specimens from Idaho and Nevada in herb. Rosentreter was determined as X. fulva by Poelt. The species seems to be intermediate in general appearance-between X. candelaria and X. fallax, but can also be fertile (at a glance resembling X. polycarpa).

Xanthoria polycarpa (Hoffm.) Rieber (s. lato)--OR: Baker Co. (Rosentreter). Deschutes Co. (Pike & Rossman, OSC). Grant Co. (Rosentreter). Harney Co. (Rhoades, WWB). Lake Co. (Young, WTU; Davis, herb. Davis; Ryan, ASU). Umatilla/Wallowa Co. (Thomson;' 1984). Union Co. (Davis, herb. Davis; Rosentreter). Wasco Co. (Pike, et al., OSC; Rossman, 1992). WA: Chelan Co. (Howard, WTU). Franklin/Garfield Co. (Thomson, 1984). Kittitas Co. (Johnson; WTU). Klickitat Co. (Suksdorf WSU). Lincoln Co. (Rosentreter). Spokane Co. (Thomson, 1984). Whitman Co. (Rvan, WWB; Bislev, WWB; Beattie, WSU; Cooke, 1955). Yakima Co. (Loretta, WTU; Ryan, WWB). Boreal to subtropical. 2000-5300 ft; 600-1050 m. On stems and branches '(living or dead) of Alnus, Crataegus douslasii, Juniperus occidentalis, coniferous trees (Abies concolor, Pseudotsuaa menziesii) and hardwood trees (Populus tremuloides,' P. trichocarpa) and shrubs (Artemisia risida, A. tridentata, Rosa sp., and others)'; on wood. Biscuit scabland; Palouse grassland. Artemisia tridentata ssp. tridentata/Agropyron soicatum; Artemisia tridentata. ssp. vaseyana/Festuca idahoensis; A. riqida habitat. This-may be a complex of species.

Xanthoria sp. ("X. adscendens" Davis in herb.) --OR: Lake Co. (Davis, herb. Davis). 4800 ft. On moss on basalt. This may possibly be a "somatic hybrid" between Xanthoria sp. and Phvscia adscendens, arising through sharing of algae during early development.

Xanthoria sp. --WA: Grant Co. (Jones, WSU--as "Teloschistes lychneus"). On Artemisia tridentata and Grayia spinosa; "common". This taxon is similar to X. polycarpa but with very minute lobes.

Xylographa abietina (Pers.) Zahlbr.--OR: Lake Co. (Ryan, ASU). WA: Klickitat Co. (Suksdorf, WSU). 4000 ft; 2000 m. Okanogan Co. (Ryan, ASU). Yakima Co. (Howard, WTU). 1775 m. On rotting

conifer wood (Abies concolor), old prostrate oak trunks, bleached sticks. Montane forest.

Xylographa hians Tuck.--OR: Lake Co. (Ryan, ASU). WA: 2000 m. On wood of, Abies concolor. A Suksdorf specimen from Klickitat Co., Washington, .in WSU, labelled "co-type" (syntype) appears quite different from the species as it has been described in the literature, and in fact does not look like' a Xylographa at all! However, the species has not been lectotypified,. and there may be other syntypes that more closely fit the type description.

Xylographa vitilago (Ach.) Laundon--WA: Okanogan Co. (Ryan, ASU). On conifer wood. 1775 m. Montane forest.

major species

Additions to the

MASTER SPECIES LIST

In the introduction to this document, state that "Nomenclature generally follows Egan (1989-1991)".

In this list, I 'did not convert all of the elevations to meters, and I also did not get around. to putting in province numbers, but I cannot afford to spend any more time on this. Most of the information on elevations and provinces is available in the "Collecting Data" documents.

Use a global replace command to change "WSU" to "WS" (the correct acronym for that. herbarium).

Taxa not previously on the list are in bold; the other changes are corrections or additions to information about taxa already on the list. I have concentrated on adding new taxa, new counties, and new substrates, rather than detailed information on habitat, or additional localities or collectors from the same counties.

Ahtiana sphaerosporella--OR: Deschutes Co. (Pike, OSC). WA: Okanogan Co./Whatcom Co'. (Glew, unpublished). On Pinus contorta; preferred host is Pinus albicaulis according to Goward; also found on Abies lasiocarpa and Larix lyallii according to Vitt, et a l . (1 9 8 8) :

Bellemeyea subsorediza (Lynge & Schol.) R. Sant.--WA: Okanogan co.: Slate Peak (Glew, unpubl.) . On rock. Alpine.

Bryoria abbreviata--WA: Okanogan Co./Whatcom Co. (Glew, unpubl.) . Subalpine.

m - - W A : O k a ń o g a n Co./Whatcom C o . (Glew, u n p u b l .) . Subalpine.

Bryoria trichodes ssp. americana--WA: Okanogan Co.: Slate Peak (Glew, unpublished). Subalpine.

Caloplaca tiroliensis--WA: Okanogan Co.: Slate Peak (Glew, unpublished).

Candelaria concolor--On Purshia tridentata.

Cladina ciliata f. tenuis (Flörke) Ahti--WA: Okanogan Co.: Slate Peak (Glew, unpublished). On soil. Alpine.

Dermatocarpon luridum--WA: Okanogan Co./Whatcom Co. (Glew, unpubl.) . Alpine.

major species

Dermatocarpon reticulatum--WA: Okanogan Co./Whatcom Co. (Glew, unpubl.). Alpine.

Euopsis granatina (Sommerf.) Nyl.--WA: Yakima Co. (Howard, 1950). On rock. 2557 ft.

Gyalecta jenensis (Batsch) Zahlbr.: WA: Yakima Co.: Boulder Cave (Howard, 1950). On rock.

"Haematomma pacificum Hasse"--According to Egan (1987), the identity of this taxon is "uncertain". OR: Hood River Co. (J. Davis). On Pseudotsuga. 120 m.

Hypogymnia rugosa--Delete (the one record is based on misidentification of H. occidentalis).

Japewia tornoensis--WA: Yakima Co. (Pike, OSC). 900 m. Mixed conifer forest with Pinus ponderosa.

Lecanora circumborealis--N.E. Mountains, WA (several localities shown by Brodo, 1984).

Lecanora intricata (Ach.) Ach.--WA: Okanogan Co./Whatcom Co. (Glew, unpubl.). On rock. Alpine.

Lecanora pacifica--Columbia Plateau, WA (Brodo, 1984--probably Whitman Co.)

Lecidea atromarginata Magn.--WA: Okanogan Co.: Slate Peak (Glew, unpubl.). On rock. Alpine.

Lepraria neglecta--OR: Crook Co. (Pike, OSC). Deschutes Co. (Christy, and Pike, OSC).

Leprocaulon subalbicans (Lamb) Lamb & Ward--WA: Okanogan Co./Whatcom Co. (Glew, unpubl.). On soil, etc. Alpine.

Leptogium californicum--OR: Lake Co. (Pike, OSC). On Grimmia and Tortula. 1400 m.

Letharia columbiana--OR: Lake Co. (Andrews, OSC). On old boards, and on Tsuga mertensiana.

Letharia vulpina--On Juniperus occidentalis.

Melanelia elegantula--OR: Crook Co. (Pike, OSC). WA: Kittitas Co. (Pike, OSC). On Purshia tridentata.

Melanelia exasperatula--WA: Kittitats Co. (Pike, OSC).

major species

Melanelia sorediata--WA: Okanogan Co.: Slate Peak (Glew, unpubl.). Alpine.

Melaspilea proximella (Nyl.) Nyl. ex Norrlin--WA: Klickitat Co. (Suksdorf, WS). On root (wood) of Pseudotsuga.

Mycoblastus sanguinarius (L.) Norman--OR: Deschutes Co. (Pine Mountain) (Eaker, Jefferson Co. (3 mi W of Cold Spring Camp) (Pike, OSC). Pinus ponderosa forest..

Mycocalicium subtile--WA: Yakima Co. (34) (Pike, OSC). On Pseudotsuga.

Neofuscelia loxodes--OR: Crook Co. (Pike, OSC). Lake Co.' (Pike, OSC). 1400 m. High desert (Juniperus occidentalis, etc.).

Neofuscelia subhosseana--OR: Lake Co. (Pike, OSC).

Peltigera didactyla--OR: Jefferson Co. (Topik, OSC).

Peltigera praetextata--WA: Okanogan Co.: Slate Peak (Glew, unpubl.). Alpine.

Phaeophyscia sciastra--Juniper-sage desert.

Physcia adscendens--WA: Kittitas Co. (Pike, OSC). On Populus trichocarpa.

Physcia aipolia--OR: Lake Co. (pike, OSC). 1400 m.' On Crataegus. High desert with sagebrush, juniper and ponderosa pine.

Physcia callosa--"1400 ft" should be "1400 m".

Physcia cascadensis--WA: Whitman Co. (Wagner, OSC).

Physconia detersa--On Purshia tridentata.

Rhizocarpon bolanderi--OR: Lake Co. (Pike, OSC). 1400 m.

Rhizocarpon geographicum--OR: Deschutes Co. (Pike, OSC). 6730 ft.

Rhizocarpon grande--OR: Lake Co. (Pike, OSC). 1400 m.

Rinodina confragosa--OR: Lake Co. (Pike, OSC). On rock. 1400 m.

"Thermutis velutina (Ach.) Fries"--I am not sure about these particular records, but I do know that at least some of what

major species

Howard identified as this species is actually Pseudephebe pubescens. WA: Ferry Co.: Boyds (Howard, 1950). Yakima Co.: Dewey Lake (Howard, 1950). On rock. 1470-4800 ft.

Umbilicaria arctica (Ach.) Nyl.--WA: Okanogan Co.: Slate Peak (Glew, unpubl.). On rock. Alpine.

Umbilicaria cylindrica (L.) Del.--WA: Okanogan Co.: Slate Peak (Glew, unpubl.). On rock. Alpine.

Umbilicaria havasii Llano--WA: Okanogan Co.: Slate Peak (Glew, unpubl.). On rock. Alpine.

Umbilicaria phaea--WA: Kittitas Co. (Pike, OSC). 1400 m.

Umbilicaria phaea **v. coccinea Llano**--OR: Crook Co. (Pike, OSC). On vertical and horizontal surfaces on N-facing slope. High desert with Juniperus, Pinus ponderosa, and Pseudotsuga.

Xanthoparmelia plittii--OR: Lake Co. (Pike, OSC). 1400 m

Xanthoria "candelaria"--2900 m.

Xanthoria fallax--On Purshia tridentata.

3. COLLECTING DATA (AND ECOLOGICAL GROUPS)

The additions are mostly from collections by John Davis (which I did not include before because I was waiting for locality data that I just received from him), and one set of collections from OSU (which.1 just discovered my notes on by accident, misfiled under grazing of Collomia in California!). Some of these.OSU collections are probably already in the original document, since many of them. are duplicates, but others are not.

These-documents still don't include all'collections I've seen or read about, but, I have to stop somewhere.

Likewise, I have made only a preliminary attempt to integrate the added, collections into the system of zones'and communities I used in the original documents.

*Elevations:' A few elevations of localities from OR that are given in Ecological Groups documents but not in Collecting Data document may be incorrect. See notes at beginning of each of the three main subsections below; you can use "search" for the localities to fill in the missing info. The info. needs to be cross-checked among the three docs, and also with Ecological 'Groups and Localities doc. In most cases the discrepancies are slight, and don't matter much unless you need to cross-check between Ecological Groups docs and Collecting Data docs. That's about all I can do about this problem for the moment. I have most of the localities circled on my Atlas & Gazeteers for WA and OR.

*Interpretation of veuetation: Generally in the Ecological Groups documents I treated mixed communities under the higher elevation zone (e.g., Juniperus-Artemisia under Juniperus), but also mentioned species found on lower-zone species' (e.g., Artemisia) under the lower zone.

Elevations pencilled in on my printout:
Malheur Game Refuge, 1440 m. Gilmer, 500 m. White Salmon, 60 m. Bingen, 60 m. Mitchell's Point, ca. 100 m [This is actually on West Side, and should be deleted]. Mayer State Park, 200 m. 10 mi W of Harper, 900 m. 5 mi E of Creston, 600 m. Pomeroy, 700 m. Pullman, 750 m. "Aschberg", 430 m. Rosalia, 780 m. Dayton, 500 m. Magpie Forest, 750 m. Wright's Point, 720 m. 9 mi E of Bend, 720 m. Near Redmond, 720 m. Cle Elum River, 700 m.. Rattlesnake Canyon, 800-1100 m. Glenwood Station, 750 m. Near Albion, 700 m. Top of Chelan Butte, 1170 m. Salmon La Sac Road, 800 m. Just W of Easton, 700 m. Just W of Cle Elum, 700 m. 4 mi W of Cle Elum, 500 m. near Roslyn, 800 m. Indian Creek Forest CAmp, 900 m. Cooke's northern plot for P. ponderosa/Agropyron, 600 m. 8 mi S of Ellensburg, 500 m. Sthekin Valley, 400 m. Rosary Lake, 1800 m. Ode11 Lake, 1710 m. Boulder CAve, 1000 m. Lodgepole Pine Camp, 1100 m. S of Cle Elum, 700 m. Cooke's northern plot for . . Pseudotsuga/Physocarpus, 600 m. Jack Creek, 1680 m. Wodan's Vale, 900-1600 m. Bench Lake, '1500 m.

Xylographa hians at White Salmon is on oak.

"canadenssi" should be "canadensis".

"Physcia-Xanthoria" should be "Physcia-Physconia-Xanthoria".

Buellia punctata should be Amandinea punctata.

VEGETATION?

E. Slope of Cascades, WA

(Balsh Road, 120 m, Hlickitat Co.)
On old fencepost: Chaenotheca sp. (very unusual one, which I borrowed from John but have not had time to identify yet)

(Locality?, 600 m, Klickitat Co.)
On conifers: Brvoria capillaris .

(Blewitt Pass region, Chelan Co.--Magnusson, 1932)
On logs: Cladonia bellidiflora v. hookeri

Columbia Plateau, WA

(1/4 mi up the Palouse River from Glenwood, 6 mi NE of Colfax, Whitman Co.)
On bark: Parmelia sulcata

(Hillside across from city field, Pullman, Whitman Co.)
On bark: Phvscia adscendens
On Crataegus douslasii: P. aipolia

(S. side of Ahtahnum Ridge, Yakima Co.)
On Artemisia tridentata: Candelaria concolor (dominant), and Xanthoria fallax (abundant)
On Purshia tridentata: Candelaria concolor (on branches), Phvsconia detersa (towards base of trunk),' Xanthoria fallax (on branches)

E. Slope of Cascades, OR

(Viento State Park, 30 m, Hood River Co.)
On tree trunk: Phvsconia detersa

(Crater Lake National Park, Klamath Co.--Magnusson, 1939)
On bark or wood: Brvoria sp. ("Alectoria jubata--blackish, non-soredite. On various twigs")

E. Plateaus & Hills, OR

(Picture Rock Pass, near Silver Lake, 1350-1440 m, Lake Co.)
On twigs (unspecified): Xanthoria polycarpa

N.E. Mountains, OR

(1245 m, Union Co.):
On old fencepost: Thelomma ocellatum
On wood: Buellia disciformis
On conifer: Brvoria fremontii

DECIDUOUS WOODLANDS

Populus trichocarpa woodlands:

N.E. Mountains, OR

(960 m, Union Co.):
On Populus trichocarpa:, Xanthoria. polycarpa
On bark (unspecified): Lecanora carninea, L. sp., Phvscia stellaris

Quercus garryana woodlands:

E. Slope of Cascades, WA:

(90-150 m, Klickitat Co.)
On Quercus: Phaeophyscia orbicularis, Xanthoria fallax

(90-180 m, Klickitat Co.)

On Quercus: Melanelia subargentifera, Pertusaria sp.

(30 m, Klickitat Co.j
On puercus: Melanelia- eleaantula, M. subolivacea, Phaeophvscia orbicularis, Phvscia aipolia

(90 mm, Klickitat Co.)
On Quercus: Ochrolechia farinacea (i.d.?), Pertusaria sp.

GRASSLAND-SAVANNAH

(look at map for veg. type)
Columbia Plateau, WA:
(Horsethief Lake State Park, 120 m, Klickitat Co.)
On twigs (unspecified): Letharia vulpina, Melanelia multispora, Phvscia adscendens

Artemisia tridentata "High desert"

Province?, OR:
(1400 m, Lake Co.)
On Artemisia tridentata: Melanelia elesantula

DRY CONIFER FORESTS

Unspecified vegetation:

E. Slope of Cascades, OR?:
(Pine Mountain, Deschutes Cc.)
On conifers: Mvcoblastus sancuinarius

E. Plateaus & Hills, OR:
(1400 m, Lake Co.)
On bark or wood: Letharia vulpina

N.E. Mountains, OR:
(Eagel Cap Wilderness, 2130 m, Wallowa Co.)
On trees: Letharia columbiana

Unspecified conifer forests (probably Abies grandis)

E. Slope of Cascades, OR:
(1350 m, Hood River Co.)
On conifers: Brvoria sp., Mvcoblastus sanguinarius

Unspecified conifer forest
E. Plateaus & Hills, OR:
(Abert Rim, N of Lakeview, Lake Co.)
On trees: Letharia columbiana

Mixed conifer forest:

N.E. Mountains, OR:

(1510-1800 m, Wallowa Co.)
On bark: Melanelia eleaantula

(1320 m, Wallowa Co.)
On old wood: Lecidea paddensis

Mixed conifer forest with Pinus sp.

E. Slope of Cascades, OR
(Wildwood Camp, Metiolus River at Camp Sherman, Jefferson Co.)
On Pinus sp. and other conifers: Letharia columbiana

Pinus contorta-P. monticola-Abies lasiocarpa forest

E. Slope of Cascades, OR:
(Three Sisters Wilderness, 1605 m, Deschutes Co.)
On conifers: Letharia columbiana

Abies-Pseudotsuga forest

E. Slope of Cascades, OR:
(1030 m, Jefferson Co.)
On Alnus rubra at edge of lake: Melanelia multispora

Juniperus occidentalis Zone

Unspecified

E. slope of Cascades, OR/E. Plateaus & Hills, OR:

(near Sisters, Deschutes Co.)
On dead limbs of Juniperus occidentalis: Letharia vulpina

(2900 m, Deschutes Co.)
On bark at base of Juniperus occidentalis: Xanthoria "candelaria"

"Open dry juniper woods"
E. Slope of Cascades, OR:'
(highway between Sisters and Redmond, Deschutes Co.)
On dead limbs of Juniperus occidentalis: Letharia columbiana

"Juniper-sage desert"

E. Slope of Cascades, OR:

(Juniper Wayside, 900 m, Deschutes Co.)
On Juniperus occidentalis: Letharia columbiana (on dead limbs), Melanelia elegantula, Xanthoria fallax

(740 m, Deschutes Co.)
On bark of Juniperus occidentalis: Xanthoria "candelaria"

"High desert with Artemisia, Juniperus and Pinus ponderosa":

(5 mi S of Horse Ranch, 1400 m, Lake Co.)
On old boards: Letharia columbiana

"Juniperus occidentalis desert with Pseudotsuga and Pinus ponderosa in shade of basalt rimrock"

Province?, OR
(Maury Mountains, 1350 m, Crook Co.)
On Purshia tridentata: Melanelia elegantula

Pinus ponderosa Zone

Vegetation not specified; probably Pinus ponderosa forest:

"Lake Cle Elum" in original document should be 660 m, not 6600 m.

"Dead Horse Hill", in original document should be under Montane Forests.

Pinus ponderosa forests (unspecified):

E. Slope of Cascades?, WA:
(Locality?, 150 m, Klickitat Co.)
On Pinus ponderosa: Bryoria tortuosa

Columbia Plateau, WA:
(Glenwood, Whitman Co.)
On bark: Melanelia exasperatula

(10 mi S of Spokane)
On Pinus ponderosa: Letharia columbiana, L. vulpina, Platismatia glauca

E. Slope of Cascades, OR
(900 m, Deschutes Co.)
On bark: Lecidea paddensis

(3 mi W of Cold Spring Camp, Jefferson Co.)
On bark: Letharia columbiana, Mvcoblastus sanouinarius

(900 m, Jefferson Co.)
On branches of Pinus ponderosa: Letharia columbiana

Pinus ponderosa-Ouercus garryana woodlands:.
E. Slope of Cascades, WA

(120 m, Klickitat Co.)
On branches of puercus: Nephroma helveticum
On trunks of Quercus: Mesaspora verrucosa, Phvscia biziana
On fenceposts: Letharia vulpina
On branches of Pinus ponderosa: Evernia prunastri, Hypogymnia imshauaii, H. tubulosa, Parmelia sulcata, Tuckermannoosis chloroohvlla, T. merrrillii, Vulpicida canadensis

(90-180 m, Klickitat Co.)
On old trunk of Quercus: Caloolaca sp.
On rotten log in open area: Lecidella slomerulosa
On old fencepost: Traoeliopsis sranulosa
On Pinus ponderosa: Candelaria concolor, Evernia prunastri, Hypogymnia tubulosa, Letharia vulpina, Parmelia saxatilis, P. sulcata, Platismatia glauca, Tuckermannoosis chloroohvlla, T. merillii, Vulpicida canadensis

(810 m, Klickitat Co.)
'On Pinus ponderosa: Alectoria imshaugii, Letharia columbiana, L. vulpina
On bark of Quercus: Caloolaca sp., Evernia prunastri, Lecanora sp., Megaspora verrucosa, Melanelia multispora
On twigs of Quercus: Phvscia adscendens

Open Pinus ponderosa forest with Populus tremuloides:
E. Slope of Cascades, OR:
(990 m, Deschutes Co.)
On bark: Xanthoria "candelaria"

Pinus ponderosa-Populus trichocarpa community along river:
Columbia Plateau, WA:
(8 mi S of Ellensburg, Kittitas Co.)
On Populus trichocarpa: Phvscia adscendens, Xanthoria "candelaria"

Pinus ponderosa/Symphoricarpos albus

Cooke's northern plot, in original document, should be 600 m, not 6000'm; "Lecidea olivacea" = Lecidella elaeochroma.

Kamiak Butte and Steptoe Butte, in original document under Festuca/Symphoricarpos, go here instead.

MONTANE FOREST ZONES

Delete info on Ledum oroenlandicum

"barK" -should be "bark"

"Vulpcida" should be "Vulpicida"

Miscellaneous montane forests:

Pinus monticola

Although Ahtiana sohaerosoorella does occur on Pinus monticola, that is based on a Ryan collection; Goward should not be cited under P. monticola, but rather under P. albicaulis.

Mixed montane forests:

"Parmeliopsia" should be "Parmeliopsis"

"pseudofuscens" should be "pseudofuscescens"

The first two mixed forests with Pseudotsuoa are probably in the Pseudotsuga/Physcoarpus Association.

Pinus contorta Zone

E. Plateaus & Hills, OR:
(Paulina Mountains near top of dome, Deschutes Co.)
On branches of **Pinus contorta**: Ahtiana sohaerosoorella

Pseudotsuga Zone:

The unspecified forests in N.E. Mountains of WA and OR are probably Pseudotsuga/Physocarpus

"Hypogymnia-Melanelia-..." for Cooke's northern plot should be "Hypogymnia-Platismatia-..."

E. Slope of Cascades, WA:

(840 m, Klickitat Co.)
On Pseudotsusa: Alectoria imshauoii

(600 m, Klickitat Co.)
On Pseudotsuga: Pyrrhospora cinnabarina

(Acme Road, 630 m, Klickitat Co.)
On branches of Pseudotsuga: Tuckermannoosis pallidula

(Dog Lake, E of White Pass,. 1260 m, Yakima Co..)
On Pseudotsuga (old wood of fire scar): Mvcocalicium subtile

Pseudotsuga-Pinus ponderosa forest

E. Slope of Cascades, WA

(630 m, Klickitat Co.)
On **Pseudotsuga:** Ochrolechia sp.
On **Pinus** oonderosa: Brvoria abbreviata

(Fisher Hill Road, 600 m, Klickitat Co.)
On Pseudotsuaa: Pvrrhosoora cinnabarina
On **Pinus** ponderosa: Pvrrhospora cinnabarina, Tuckermannoosis pallidula

(15 mi W of Ellensburg, Kittitas Co.)
On **bark** or wood: Letharia vulpina, Melanelia exasoeratula

Pseudotsucra-Quercus community:
E. Slope of Cascades, WA:
(480 m, Klickitat Co.)
On base of Pseudotsusa: Calicium viride, Cladonia transcendens (i.d.?)
On **Quercus:** Pertusaria sp.

E. Slope of Cascades, OR:
(120 m, Hood River Co.)
On puercus: Megaspora verrucosa, Melanelia elesantula, M. exasoeratula, M. multisoora, Ochrolechia farinacea (i.d.?), Parmelia sulcata, Phvsconia detersa, P. distorta
On Physconia **detersa:** "Buellia pulverulenta"
On Pseudotsuga: Haematomma "pacificum"

Abies forest
E. Slope of Cascades, OR
(Cooper Spur Ski area, 1170 m, Hood River Co.)
On **Abies** sp.: Alectoria imshauaii

Abies **concolor** Zone

Boulder Spring' Trail is Klamath Co.

Blue Lake Trail is ± riparian.

SUBALPINE

Trail to Bird Creek could be low elev.

"pseudofuscens" should be "pseudofuscescens"

Tsuga mertensiana Zone

Mt. Adams, on Picea, could be montane.

E. Slope of Cascades, OR:
(Bluffs'of Big Green Lake, Three Sisters)
On trunks and branches of Tsuga mertensiana:
Letharia columbiana ("used by Klamath Indians as a yellow dye for porcupine quills which are then made into baskets")

ALPINE ZONE

Slate Peak collections on bark/wood are subalpine.

Elevations pencilled in on mv printout:
Kamiak Butte, 1110 m. Pullman, 750 m. Steptoe Butte, 1700 m. Pomeroy, 700 m. 40 mi SW of Spokane, 700 m. Wolf Creek overpass of I-84, 900 m. Spokane, 700 m. Indian Canyon, 700 m. Rainbow Creek, 500-1500 m. Lake Chelan, 400 m.

C. multiformis f. simulata should be C. simulata

"Near where Hwy 410 crosses Sprague River" is in E. Plateaus & Hills, OR (not WA).

E. Slope of Cascades, WA

(Upper Naches River region, Yakima Co.--Magnusson, 1932)
On soil: Phvsconia muscisena

Columbia Plateau, WA
(1/4 mi up the Palouse River from Glenwood, 6 mi NE of Colfax, Whitman Co.)
On moss ovdr rock: Peltigera collina

E. Slope of Cascades, OR
(Laurance Lake, 900 m, Hood River Co.)
On soil, moss, or humus: Baeomyces rufus, Cladonia gracilis, C. sp., Psoroma hypnorum, Trapelioosis sranulosa

E. Plateaus & Hills, OR.

(Picture Rock Pass, near Silver Lake, 1350-1440 m, Lake Co.)
On moss over rock: Xanthoria fallax

(Young lava beds NW of Diamond; Harney Co.)
On moss over rock: Leptogium cf. lichenoides

N.E. Mountains, OR

(960 m, Union Co.):
On moss over soil: Peltiaera canina

(1245 m, Union Co.):
On soil: Acarosoora schleicheri

(1350 m, Union Co.):
On soil over rock: Toninia ruainosa

DECIDUOUS WOODLANDS

Oak Woodland:
E. Slope of Cascades, WA:
(90-150 m, Klickitat Co.)

On Selasinella: Ochrolechia uosaliensis
On moss: Phvscia phaea
On thin soil over rock: Melanelia infumata, Psora alobifera

SAVANNAH-GRASSLAND:

(look at map for veg. type):
Columbia Plateau, WA

(SR 14, T2N, R15E, 180 m, Klickitat Co.)
On moss over rock: Cladonia pyxidata, Trapeliopsis cf. wailrothii

(Horsethief Lake State Park, 120 m, Klickitat Co:)
On moss: Leptogium sp., Ochrolechia uosaliensis, Peltiaera membranacea, Trapeliopsis cf. wallrothii
On moss on soil: Diploschistes muscorum
On soil: Leotochidium albociliatum, Leotoaium hirsutum, L. sp.
On thin soil over basalt: Buellia cf. badia, Candelariella rosulans, Peltiaera membranacea
On Selasinella: Ochrolechia uosaliensis

(John Day Dam to Towal, 105-150 m, Klickitat Co.)
On moss and thin soil: Candelariella rosulans, Phvsconia srisea

(Glenwood, Whitman Co.)
On moss: Leotochidium albociliatum

(1/4 mi S of Pullman, Whitman Co.)
On moss over rock: Leotochidium albociliatum

Artemisia -communities:

E. Plateaus & Hills, OR:
(Bend-Burns Highway near Burns, Harney Co.):
On soil among sagebrush: Psora cerebriformis

Artemisia tridentata communities:

Goldendale is Festuca-Hieracium Assoc..

"Hat Butte" should be "Hatt Butte"

Chrysothamnus viscidflorus community:

E. Plateaus & Hills, OR:
(900 m, Deschutes Co.) .
On moss on NW-facing slope below basalt

cliff: Leoraria nealecta

Festuca/Symphoricarpos

Kamiak Butte and Steptoe Butte are Pseudotsuga-Pinus ponderosa.

Auropyron-Festuca

"Phqsconia distorta" should be "Phvsconia distorta"

Biscuit scabland

"Buellia punctata" should be "Amandinea punctata"

Scabflat/grassland...

This should be under Bunchgrass Zone

Volcanic **scabland**

This should be under Artemisia tripartata/Festuca

COMMUNITIES INTERMEDITATE BETWEEN ZONES

Pinus oonderosa-Junioerus occidentalis-Artemisia should end with "/Artemisia/Festuca"

DRY CONIFER FOREST:

Juniperus occidentalis Zone:

"high desert" (unspecified):
E. Plateaus & Hills; OR:
(3 mi N of town of Silver Lake, Lake Co.)
On moss on NE-facing vertical walls of **rimrock:** Leotochidum albociliatum, Phvsconia "grisea"

"high desert" with Artemisia, Juniperus, and Pinus ponderosa:
E. Plateaus and Hills, OR
(5 mi S of Horse Ranch, 1400 m)
On moss on tops of basalt cliffs: Leoraria neulecta
On moss (on Grimmia and Tortula) on rock, and on soil: Leptogium californicum
On moss (Grimmia montana) on basalt flows: Leptogium tenuissimum

Juniperus-Artemisia desert

E. Plateaus & Hills, OR

(Juniper Wayside, Deschutes Co.)
On sandy soil in flat area by rimrock: ~~Peltiaera~~ cf. rufescens
On humic soil in crevice near top *of* rimrock in area of scattered junipers: Peltigera rufescens
On moss (Grimmia): ~~Lepraria~~ neglecta Leptogium californicum
On lichens (Leptogium californicum): Lepraria neulecta

(10 mi S of Burns, Harney Co.)
On soil on N-facing rock wall of rimrock: ~~Psora~~ nipponica
On moss on N-facing rock wall of rimrock: Leotochidium albociliatum

Juniperus desert with Pinus ponderosa and ~~Pseudotsuua~~:

E. Plateaus & Hills, OR
(Maury Mountains, 1350 m, Crook Co.)
On moss in shade of basalt rimrock: Lepraria neulecta

Pinus ponderosa Zone

Wenatchee Ranger Station and Blue Mountains near Pomeroy are probably with Symphoricarpos

Just W of Easton, and Roslyn, are definitely ~~P. ponderosa~~, and probably with A. soicatum (or cheatgrass)

Pinus ponderosa-Populus tremuloides goes under Riparian

Pinus ponderosa-Quercus uarrvana woodland:
E. Slope of Cascades, WA:
(90-180 m, Klickitat Co.)
On moss and thin rocky soil on ground: Dioloschistes muscorum, Trapeliopsis cf. ~~wallrothii~~
On mossy rock bank: Cladonia cervicornis v. verticillata, C. coccifera

MONTANE FORESTS

Stehekin River and several others are riparian.

Entiat is Bunchgrass.

Laurier, Sanpoil Lake, and Republic are probably riparian grasslands.

Pinus contorta-Larix occidentalis forest:
E. Slope of Cascades, OR:

(895 m, Jiefferson Co.)
On soil, in depression amongst forbs: Peltisera didactyla

Pseudotsuua-Ouercus community:
E. Slope of Cascades, WA:
(480 m, Klickitat Co.)
On moss over boulder: Ochrolechia uosaliensis

Abies concolor Zone

Sites with creek, river, or lake in the name are riparian

ALPINE ZONE

Sites without typical alpine lichens may be subalpine.

"Thmanolia" should be "Thamnolia".

2730 m'site is Ridge from North Sister to Little Sister.

2915 m site is Summit of Eagle Cap.

SAXICOLOUS

Elevations oencilled in on mv printout:
Near Vantage, 200 m. Hat Rock State Park, 960-990 m. Soap Lake, 450 m. Naches, 480 m. Painted Hillls, 900 m. SE of Harrington, 650 m. Asotin, 300 m. Buffalo Rock, 300 m. Confluence of Columbia and John Day Rivers, 400-600 m. N of Dayton, 400-600 m. Pullman, 765 m. Above Wawawai, 500 m. 10 mi S of Burns, 900 m. 3 mi N of Frenchglen, 900-1000 m. Diamond Craters, 900 m. Wright's Point, 800 m. 3 mi N of town of Silver Lake, 1.000-1100 m. S end of Silver Lake; 1000-1100 m. Klickitat River, 500-700+ m. Salmon La Sac Road,, 800 m. Usk, 600 m. Dewey Lake, 1500 m. Summit of Tiffany Mountain, 2482 m. Harts Pass/Grasshopper Pass, 2000 m. Crater Lake National Park, 1883 m. Mazama Rock area, 2392 m. Summit of S. Sister, 3175 m [Deschutes Co.].

E. Slope of Cascades, WA

(Upper Naches River Region, Yakima' Co.--Magnusson, 1932)
on volcanic rock: Acarosoora "chlorophana" (as A. "oxytona"), Dioloschistes scrunosus, Lecanora rupicola, Lecidea tessellata, Rhizocarpon cf. distincturn, Rhizoplaca melanoohthalma

(Blewitt Pass region, 1050 m, Chelan Co.--Magnusson, 1932)
On rock: Dermatocaroon miniatum v. papillosum

Columbia Plateau, WA
(1/4 mi up the Palouse River from Glenwood, 6 mi NE of Colfax, Whitman Co.)
On rock: Parmelia saxatilis, Physcia cascadensis

E. Slope of Cascades, OR

(Laurance Lake, 900 m, Hood River Co.)
On rock: Cetraria commixta, Umbilicaria hyperborea

(Viento State Park, 30 m, Hood River Co.)
On basalt: Parmeliopsis ambiqua (?), Phaeoohvscia orbicularis, Phvsconia detersa, P. distorta

(Locality?, 1905 m, Deschutes Co.)
On pumice: Pseudeohebe pubescens

(Locality?, 6300 m, Deschutes Co.)
On rocks of a large obsidian flow: Pseudeohebe pubescens

(Locality?, 2020 m, Deschutes Co.)
On volcanic rocks: Rhizocarpon geographicum

(Locality?, 2000 m)
On-rocks on exposed S-facing slope: Umbilicaria hvoerborea, U. kraschennikovii

(road between Sisters and Redmond, Deschutes Co.)
On rock: Umbilicaria hvoerborea ("U. intermedia form", cited incorrectly in Llano's monograph'as being from Crater Lake)

(Crater Lake National Park, 2100 m, Klamath Co.--Sipe collections cited by Magnussbn, 1939, except for U. torrefacta--specimen in OSC)
On rock: Bellemerea sanguinea, Lecidea cascadensis, Pseudeohebe nubescens, Rhizocarpon aeminatum, R. geographicum, Rhizoolaca melanoohthalma, Umbilicaria torrefacta, Xanthoria elesans.

(Along the Dalles-California highway, east of Crater Lake, Klamath Co.'--Magnusson, 1939).
On pumice: Polvsnorina simplex

E. Plateaus & Hills, OR

(150 m, Wasco Co.):
On rock: Pseudeohebe oubescens

(Picture Rock Pass, near Silver Lake, 1350-1440 m, Lake Co.)
On basalt: Candelariella vitellina, Rhizoolaca chrvsoleuca; R. melanoohthalma, Umbilicaria hvoerborea, U. kraschennikovii, Xanthoria eleaans

(Locality?, 1350 m, Lake Co.)
On exposed top of basalt cliffs: Pseudeohebe oubescens
On rocks at edge of lava flow: Rhizoolaca chrvsoleuca
On vertical facc of basalt cliffs: Rhizoplaca chrvsoleuca

(2515 m, Lake Co.)
On loose pebbles on hillside: Rhizoplaca melanoohthalma

(3 mi N of Silver Lake, Lake Co.)
On rock walls: Xanthoria "candelaria"

(6 mi E of Redmond, Crook Co.):
On rock: Rhizoplaca chrvsoleuca

(Near Redmond, Deschutes Co.):
On rock: Rhizoolaca melanoohthalma

N.E. Mountains, OR

(960 m, Union Co.):

On basalt: Phaeophyscia decolor, P. orbicularis,

(1245 m, Wallowa? Co.):
On basalt boulder: Buellia retrovertens
On Candelariella vitellina (presumably on'rock): Carbonea vitellinaria

(1350 m, Union Co.):
On rock: Neofuscelia loxodes

DECIDUOUS WOODLAND:

Oak woodland,:
E. Slope of Cascades', WA
(90-150 m, Klickitat Co.):
On basalt: Caloolaca sp., Candelariella vitellina, Lecanora rupicola, Xanthoparmelia plittii
On basalt boulders: Lecidea tessellata
On basalt boulder hear creek: Diploschistes scruposus
On s-facing basalt cliff: Acarospora "chlorophana"

SAVANNAH-GRASSLAND:

NPK Canyon is oak woodland. Near Goldendale is grassland.

"veruculifera" should be "verruculifera"

"Sprague River Picnic Area?" is not that locality; delete the stuff under that heading with the ?, but keep the stuff under the heading above without the ?

"Near confluence of Columbia and John Day Rivers"--could be Sherman or Gillian Counties, instead of Wasco Co.

Steptoe Butte and Kamiak Butte are P. oonderosa.

(look at map for veg. type):
Columbia Plateau, WA

(SR 14, T2N, R15E, 180 m, Klickitat Co.)
On basalt: Acarospora fuscata, Dermatocarpon reticulatum, Dimelaena oreina, D. thysanota, Lecanora muralis, L. rupicola,

(Horsethief Lake State Park, 120 m, Klickitat Co.)
On basalt:- Acarospora "chlorophana", Evernia prunastri, Lecanora muralis, Parmelia saxatilis, Pseudephebe pubescens, Rhizoplaca chrysoleuca, R. melanoohthalma, Umbilicaria cf. phaea (giant purplish thallus), U. torrefacta, Xanthoparmelia cumberlandia

(John Day Dam to Towal, 105-150 m, Klickitat Co.)
On vertical basalt outcrop: Lecanora sp.
On basalt outcrops (unspecified): Phvscia phaea, Psora nipponica, Xanthooarmelia spp.
On basalt boulders: Xanthooarmelia spp.

(1/4 mi S of Pullman, Whitman Co.)
On *rock:* Rhizoplaca melanophthalma

(Beside Paradise Creek, Pullman, Whitman Co.)
On rock: Umbilicaria phaea

Artemisia tridentata communities:

Columbia Plateau, WA:
(Wymer, Yakima Co.)
On rock: Umbilicaria phaea

DRY CONIFEROUS FOREST:

"High desert"
E. Plateaus & Hills, OR
(2000 m, Deschutes Co.)
On rock: Lecidea tessellata

Juniperus occidentalis-Artemisia desert
E. Plateaus & Hills, OR:

(lb mi S of Burns, Harney Co.)
On N--facing rock wall of rimrock: Phaeoohvscia sciastra, Phvscia biziana

(Juniper Wayside, Deschutes Co.):
On rock: Rhizocarpon arande

(3 mi N of Frenchglen,' Harney Co.)
On basalt in flat, wind-swept, gravelly areas: Xanthoria eleuans

"High desert with Artemisia, Juniperus occidentalis and Pinus ponderosa"
E. Plateaus & Hills, OR:
(5 mi S of Horse Ranch, 1400 m, Lake Co.)
On basalt outcrop in shade: Neofuscelia loxodes, N. subhosseana
On rocks in shade at edge of basalt flow: Rinodina confrasosa
On basalt outcrops (unspecified): Lecidea tessellata, Phvscia aipolia, Rhizoolaca melanoohthalma
On vertical walls in deep crevices: Melanelia eleaantula, M. subaruentifera, Parmelia sulcata, Phvscia callosa, P. cascadensis

On vertical walls in shade of overhanging rocks: Physcia cascadensis

On bird roost rock: Physcia callosa

On basalt in cracks in tops of exposed cliffs: Phvscia callosa, P. cascadensis (near urine deposits of Neotoma)

On exposed rimrock: Pseudephebe pubescens, Rhizocarpon bolanderi, R. arande

On tops of exposed cliffs: Lecidea tessellata (rare here),. Umbilicaria hyperborea

On w-facing vertical walls of basalt cliffs: Umbilicaria phaea, U. torrefacta

On exposed basalt cliffs along pathways of water flow: Xanthooarmelia plittii

"Juniperus occidentalis desert'with Pseudotsuga and Pinus ponderosa in shade of basalt rimrock"

Province?,'OR

(Maury Mountains, SE of of Prineville, 1/5 m,i N of Colby Springs, 1350 m, Crook Co.)

On horizontal faces on rimrock: Neofuscelia loxodes, Umbilicaria ohaea v. coccinea ,

PInus ponderosa Zone

"Caloplaca lichenoides" should be "Caloplaca epithallina".

Squaw Rock and Salmon La Sac are P. ponderosa/Agropyron.

Glenwood is P. ponderosa/Symphoricarpos

p. ponderosa/Pseudotsuga is to be treated under Pseudotsuga Zone.

Pinus ponderosa-Quercus garryana woodlands:

E. Slope of Cascades, WA

(90-180 m, Klickitat Co.):

On w-facing ledge on basalt cliff (120'm): Buellia badia

On basalt cliff: Dimelaena oreina, Rhizoplaca chrvsoleuca (w-facing cliff)

On vertical face of large boulder: Rhizoolaca melanoohthalma

On basalt on n-facing slope: Umbilicaria polyrrhiza

On talus slope: Umbilicaria f a c t a

On rock in open rocky soil area: Aspicilia sp., Lecanora ruoicola, Lecidea atrobrunnea, L. tessellata, L. sp., Rhizocarpon riparium, Umbilicaria ohaea, Xanthoparmelia cumberlandia

On rock along seasonal seepage: Dermatocaroon luridum, D. rivulorum
On rock by seasonal creek: Leptogium californicum
On basalt (unspecified): Rhizocarpon sphaerosoorum

(810 m, Klickitat Co.)
On rock: Lecidea sp.

Pinus ponderosa-Quercus-Pseudotsuua community:

Columbia Plateaum, WA:
(Klickitat Co.)
On bark: Melanelia subolivacea

Pinus ponderosa-mixed conifer forest:

E. Slope of Cascades, WA:
(Clear Lake, E of White Pass, 900 m, Yakima Co.)
On conifers: Japewia tornoensis

MONTANE FORESTS

"pumicola" should be "pumicicola".

1925 m site near Roger Lake is subalpine.

Palisade Rocks may also be subalpine.

Pseudotsuua-Quercus community:
E. Slope of Cascades, WA:
(480 m, Klickitat Co.)
On basalt: Teohromela atra

E. Slope of Cascades, OR:
(120 m, Hood River Co.)
On basalt boulder: Umbilicaria polyphylla, U. polvrrhiza

SUBALPINE ZONE

Dewey Lake may be montane.

Haystack Mountain and Hoodoo Pass may be alpine.

ALPINE ZONE

Trail to Windy Peak is Douglas, 1974.

Harts Pass may be subalpine

"Coelocaulons" should be "Cetraria".

E. Plateaus & Hills, OR:

(Near summit of Steens Mountain, 2970-3000 m, Harney Co.) :

On rock: Rhizoplaca melanophthalma, ~~Umbilicaria~~ Umbilicaria virsinis

4. Collecting Data - Idaho and Montana Data

IDAHO Summer 1985

13634-13662
IDAHO: NEZ PERCE CO.: 46°20'N, 117°0'W. Coyote Grade, SE of Lewiston. (Trip w/ Anderegg). On basalt. Exposed. Grassland/broadleaf evergreen shrubs. 610 m (2000 ft). 3 July 1985.

13634-13638 On rock, 90^W.

13634 (2) Candelariella spraquei
13635 Lecanora muralis
13636 Dermatocaroon rivulorum
13637
13638 Staurothele

13639-13645 On moss or soil, 90^W.

13639(3) **Psora alobifera BRATT, CANL.**
13640 Psora globifera
13641
13642
13643
13642
13643 Lecanora muralis
13644
13645

13646-13647 On rock, ± 0^, bird-manured

13646 Lecanora muralis
13647

13648-13650 On moss, ± 0^, bird-manured

13648 Lecanora muralis
13649 Leptogium .
13650

13651-13662 On rock, unspecified

13651 Phvscia biziana
13652 Gonohvmenia
13653 Leotochidium albociliatum
13654 Lecanora muralis ASU
13655 Lecanora muralis
13656 Xanthooarmelia cumberlandia
13657 Xanthonarmelia olittii
13658
13659 Lecanora muralis ASU
13660 Lecanora muralis
13661
13662 Lecanora muralis

19375-19383
IDAHO: IDAHO CO.: 45^38'30"N, 116^17'W. 19 mi N (7 mi S???) of Riggins, on Slate Creek Road, just E of Hwy 85 S of Grangeville. Sagebrush. W-facing cliff. Basalt. 490 m (1600 ft). 28 July 1 9 8 6

19375-a Neofuscelia
19375-b Lecanora muralis
19376 Lecanora muralis ASU
19377 Toninia caeruleoniaricans
19378 Catanvrenium
19379 Dioloschistes muscorum
19380
19381 Phaeonhvscia sciastra
19382 Lecanora sarovaalii
19383 Xanthoparmelia cumberlandia

19384-19397
IDAHO: IDAHO CO.: 45^32'N, 116^18'30"W. Dirt road, E side of Hwy 95, 8.5 mi N of Riggins. Grass, scattered sagebrush. On rock. Volcanic rock. 550 m. 28 July 1985

19384-19394 On rock, unspecified

19384 Caloplaca cascadensis
19385 Aspicilia
19386 Xanthoparmelia Dlittii
19387 Rhizonlaca melanonhthalma
19388 ( ) Lecanora muralis ROSENTRETER, ASU
19389 Lecanora muralis ASU
19390 Melanelia substvsia
19391 Lecanora argopholis
19392 Phaeophyscia orbicularis
19393 Rhizonlaca melanonhthalma
19394(2) Rhizonlaca chrvsoleuca CANL

19395-19397: ± 0^, exposed

19395 Xanthoparmelia cumberlandia
19396 Lecanora cf. oniniconensis
19397 Rhizocaroon cookeanum
19398 Lecanora muralis A S U

19398-19420
IDAHO: IDAHO CO.: 46^09'N, 115^55'30"W. 0.5 (LABEL SAYS 1.5 MI) mi up Harris Ridge Road, 3 mi E of Kooksia, between Lowen and Kooksia, N of Hwy 12. S-facing slope. Cheet grass (Bromus tectorum). On rock. Siliceous rock. 170 m (560 ft). 28 July 1985.

19398-19400 On rock, 0^

19399 Lecanora muralis ASU
19400 Lecanora muralis ASU

19401-19405 On rock, unspecified

19401 ( ) Lecanora muralis BRATT, ASU
19402 Lecanora muralis
19403 Lecanora muralis
19404 Rhizocarpon (yellow)
19405 Lecanora phaedrophthalma

19406-19420 90^W

19406
19407
19408 Asdicilia
19409 Lecanora muralis ASU
19410 Lecanora muralis
19411 Diploschistes muscorum
19412 Lecanora semitensis
19413 (2?) Rhizocarnon aeminatum
19414 Lecanora semitensis GZU
19415
19416
19417
19418
19419
19420

19421-19493
IDAHO: BOISE CO.: (See labels for lat., long, elev.). 2.6 mi N of Horseshoe Bend, along Hwy 55, N of Boise. 29 July 1985

19421-19435 90^N cliff, N-facing hill, E of highway.

19421 (2) Lecanora muralis ROSENTRETER, ___
19422 Lecanora muralis
19423
19424 Rhizoplaca chrysoleuca
19425 Rhizoplaca melanophthalma
19426 Aspicilia
19427 Lecidea (brown)
19428 Lecidea (brown)
19429
19430
19431 Neofuscelia verruculifera
19432
19433
19434
19435

19436-19442 Bank of river, W side of highway

19436 Rhizocarnon bolanderi
19437-a Lecanora muralis ASU
19437-b Rhizocarpon bolanderi?
19438 Lecanora muralis ASU

19439 Rhizoplaca melanonhthalma
19440
19441
19442 Lecideoid

19443-19444 120^W overhang, S-facing hill, E side of highway

19443 Neofuscelia verruculifera
19444 Lecanora weberi

19445-19455 ± 0^, E side of highway

19445 Lecanora phaedrophthalma
19446
19447 'Lecanora muralis
19448
19449 Rinodina
19450 sterile crust
1 9 4 5 1 Diploschistes muscorum
19452 Rhizoplaca melanoohthalma
19453 Rhizocarpon bolanderi?
19454 (4) sterile crust
19455-a Lecanora muralis ASU
19445-b Rhizocarpon bolanderi?

19456-19466 90^S

19456
19457 Lecanora muralis
19458 Lecanora muralis
19459 Lecanora muralis
19460 Lecanora muralis
19461 Lecanora muralis
19462 Lecanora muralis
19463 Rhizoplaca chrvsoleuca
19464
19465 Rhizoplaca melanoohthalma Rhizoplaca COMMON
19466 Aspicilia

19467-19490 ± 0^, E side of highway

19467
19468
19469
19470 Lecanora muralis ASU
19471 Lecanora muralis
19472 Lecanora muralis ASU
19473 Lecanora muralis
19474 Lecanora muralis
19475 Lecanora muralis ASU
19476 Lecanora muralis ASU
19477
19478 Aspicilia
19479 Toninia'

19480 US
19481
19482 Lecideoid
19483 Cyan0
19484
19485 MOSS
19486 Lecideoid
19487 Lecanora novomexicana
19488 Rhizocarpon bolanderi?
19489
19490 Lecanora phaedrophthalma NEB

19491-19493 75^NE, W side of highway

19491 Rhizocarpon (gray)
19,492 Lecanora muralis
19493 Lecanora muralis ASU

19494-19513
IDAHO: IDAHO CO.: 46^28'N, 114^46'30"W. Colgate Licks Elk. Trail, just N of Hwy 12, Clear-water Nat. Forest, 25 mi W of Lolo Pass. Firs. Granite. Open area surrounded by forest. 945 m (3100 ft). 28 July 1985.

19494-19495 On granite

19494 Lecanora muralis ASU
19495 Lecanora muralis ASU: 2 packets

19496 On wood, under stump

19496 (2) Chaenotheca furfuracea BRATT

19497-19498 On wood

19497 Rinodina
19498 Lecanora

19499-19513 On log

19499(2) Parmelioosis ambiqua BRATT
19500
19501( ) Haematomma californicum NEB, ASU
19502 Hvoocenomvce scalaris
19503
19504 Pertusaria.
19505 MOSS
19506 Caliciales
19507 Psoroma hypnorum
19508 Cyphelium inquinans BRATT
19509 Nephroma parile
19510 Cladonia
19511 Cladonia
19512 Cladonia

19513 Cladonia

19514-19555
IDAHO: BLAINE CO.: 43^20'N, 114^11'W. US Hwy 26, 17 mi W of Carey, between 'Richfield and Carey. Scattered outcrops among sagebrush, +/-horizontal. On lava rock. 1475 m (4900 ft). 30 July 1985.

19515-19520 90^NE

19514
19515 (2) Lecanora nevadensis CANL
19516 Rhizoplaca melanophthalma
19517 Lecanora muralis ASU
19518
1 9 5 1 9
19520

19521-19555 Unspecified

19521 Psora
19522 RhizoDlaca melanophthalma
19523 Acarospora
19524'
19525 Lecanora sarovaalii
19526 Lecanora garovaglii
19527 Lecanora garovaglii
19528 Lecanora muralis ASU
19529 Lecanora muralis ASU
19530 Lecanora muralis
19531 Lecanora muralis ASU
19532
19533 Lecanora phaedrophthalma ROSENTRETER
19534
19535
19536
19537
19538
19539
19540
19541 (3) Acarospora
19542 Aspicilia
19543
19544 Lecanora cf. niaromarsinata
19545 Rhizoplaca melanophthalma
19546 (2) Lecanora nevadensis WTU
19547 (2) Lecanora garovaglii
19548 (3) Lecanora nevadensis ROSENTRETER
19549 Lecanora garovaglii
19550 Lecanora nevadensis
19551 Lecanora garovaglii
'19552 Lecanora muralis
19553 Lecanora muralis
19554 Lecanora muralis ASU

19555 Lecanora muralis ASU

19556-19590
IDAHO: BONNEVILLE CO.: 43^19'30"N, 111^11'30"W. 15.7 mi NW of Alpine (Wyoming),, on SW side of Hwy 26, NE side of Palisades Reservoir, S of Palisades Dam. Sagebrush and mixed trees. About 100 ft above water. 1750 m (5760 ft). 30 July 1985.

19556-19580 On rock, unspecified

19556
19557
19558
19559
19560
19561 Rhizoplaca chrysoleuca ASU
19562
19563 Lecanora garovaglii
19564(2) Rhizoolaca melanoohthalma DIBBEN
19565-a(2) Rhizoolaca melanoohthalma WWB, CBG
19565-b Lecanora cf. weberi
19566 Rhizoolaca melanoohthalma
19567 Rhizonlaca melanoohthalma
19568 Xanthoparmelia plittii
19569 Asoicilia
19570 Lecidea (brown)
19571 Xanthoria elesans
19572 Lecideoid
19573 Lecideoid
19574 (3) Aspicilia
19575(2) Rhizoolaca melanophthalma US
19576 Lecanora phaedrophthalma ROSENTRETER
19577-a Lecideoid (crypto)
19577-b Lecanora rupicola
19578
19579 Lecanora cf. semitensis
19580-a Lecanora cf. semitensis (+ Lecanora cf. weberi)
19580-b Lecanora weberi

19581-19582 On rock, 90^W, under tree

19581 (2) Lecanora garovaglii
19582 Lecidea (brown)

19583-19586 On bark

19583 Melanelia incolorata ASU
19584 Melanelia incolorata ROSENTRETER
19585 Melanelia incolorata
19586

19587-19590 On rock., under tree

19587

19588 Lecanora weberi?
19589-a Lecanora muralis ASU
19589-b (2) Endocarpon
19590 Lecanora weberi?

19591-19655
IDAHO: BLAINE CO.: 8.5-12 mi W of W boundary of Craters of the Moon Nat. Monument. Huge exposed lava field. Sagebrush/desert scrub. 30 July 1985

8.5 mi W: 43^23'N, 113^43'W. 1580 m (5200 ft).
12 mi W: 43^22'N, 113^47'W. 1525 m (5000 ft).

19591-19592 90^W, on 2 m diam. rock, 2 m deep in 10 m wide hole; 12 mi w of boundary

19591
19592 Lecidea (brown)

19593-19595 0^, on 2 m diam rock 2 m deep in 10 m wide hole. 12 mi w of boundary

19593
19594 Lecanora ohaedrophthalma NEB
19595 Lecanora phaedrophthalma FH

19596-19598 90^W cliff. 12 mi w of boundary

19596(2) Rhizoolaca melanophthalma ROSENTRETER
19597 Rhizoolaca melanophthalma
19598

19599-19630 Unspecified. 8.5 mi w of boundary

19599 Aspicilia
19600 (2) Lecanora argopholis ID
19601 Lecidea (brown)
19602 Aspicilia
19603
19604 Candelariella rosulans
19605 Aspicilia Draeradiosa
19606
19607 Lecanora "columbiana" Ryan in herb.
19608
19609 Lecanora muralis ASU
19610 (3) Lecanora muralis ID, US, ASU
19611 Candelariella
19612
19613
19614 Rhizocarpon (gray)
19615(2) Rhizoplaca melanophthalma
19616 Rhizoolaca chrysoleuca ASU
19617 Rhizoolaca melanoohthalma
19618 Phaeoohvscia

19619-a(4) Rhizoolaca melanophthalma NEB, OSC, WWB
19619-b Rhizoplaca oeltata
19620-a(8) Rhizoplaca melanonhthalma US
19620-b Lecanora novomexicana
19620-c. .Lecidea .(brown)
1 9 6 2 1
19622 (3) Asoicilia
'19623 (2) Lecidea (brown)
19624 Rhizoplaca chrysoleuca ASU
19625
19626
1 9 6 2 7
19628
19629
19630

19631-19640 90^SW cliff

19631 Rhizonlaca melanoohthalma
19632 Rhizoolaca chrysoleuca
19633 Lecanora muralis
19634 Rhizoolaca melanophthalma
19635 Lecanora garovaglii
19636 Rhizoolaca melanoohthalma
19637
19638
19639
19640

19641-19645 30^E wall of 10 m wide hole

19641
19642 Rhizoolaca melanophthalma
19643 Rhizonlaca melanophthalma MIN
19644 Lecanora phaedrophthalma ID
19645

19646-19648 90^N

19646-a Rhizoolaca melanoohthalma
19646-b Lecanora muralis ASU
19647 Neofuscelia verruculifera
19648

19649-19654 Unspecified

19649 Asoicilia
19650 Xanthooarmelia
19651 Neofuscelia verruculifera
19652-a Rhizoplaca oeltata
19652-b (3) Lecidea (brown)
19653 Rhizoolaca chrysoleuca
19654 Lecanora Dhaedroohthalma ESSLINGER

19655 90^W under small overhang in 10 m wide hole

19655 Rhizocarpon aeminatum

28934-28939
IDAHO. ADA CO. 47°25'30"N, 116°17'30". NW Sci stop A. Pleasant Valley Road, ca. 12 mi S of Boise. Disturbed rangeland with Chrysothamnus nauseosus and Poa sandbergii. March 20, 1991. 2780 ft.

28934 Aspicilia cf. reptans
28935 Thrombium epigaeum (det. Rosentreter; looks quite different from material I've collected in western WA)
28936 Chromatochlamys muscorum v. octosporum
28938 Psora
28939 Lecanora cf. muralis

28940-28946
IDAHO. ADA CO. 47°25'30"N, 116°17'30". NW Sci stop B. Pleasant Valley Road, 8 mi S of Boise, near junction with Kuna Mora Road. Artemisia tridentata ssp. wyomingensis/Agropyron spicatum Association. March 20, 1991.

28940 Texasporium sancti-jacobi
28941 Aspicilia
28942 Psora
28943 Aspicilia (fruticose)
28944 Lecanora muralis
28945 Thrombium?
28946

28947
IDAHO. ADA CO. NW Sci Stop 1. March 3/23/91 (see Rosentreter letter for description of locality)

28947(1) Trapeliopsis "rosentreteri" Ryan ined.

28948-28964
IDAHO. ADA CO. NW Sci Stop 2. March 3/23/91 (see Rosentreter letter for description of locality)

28948 Texasporium sancti-jacobi
28949 Aspicilia (fruticose)
28950 (2) Lecidioid
28951 (5) Aspicilia
28952 (4) Psora
28953 Thrombium?
28954 black stuff
28955 (3) Acarospora schleicheri
28956 Mix
28957 ?
28958 Pink-gray stuff
28959 Candelariella terrigena
28960 Leptogium?
28961 Green stuff
28962 Peltigera rufescens
28963 Diploschistes

IDAHO (trip with Roger Rosentreter) June 20-21, 1987
Lemhi Co. is misspelled as Lemhi Co. on most labels.' ROGER, IGNORE THE IDENTIFICATIONS AND NAMES OF VAGRANT RHIZOPLACAS IN THESE LISTS, WHICH HAVE NOT BEEN UPDATED.

21784-21798
IDAHO: Lemhi Co.: 44^15'N, 113^00'W. 53 km S of Leadore. 2011 m. Windswept gravelly calcareous benches, with Tanacetum nuttallii. 20 June 1987. Type locality of "Rhizoplaca idahoensis" along W side of hwy 28. (see Rosentreter's manuscript. On soil. PHOTOS of Chicken Sage (Tanacetum nuttallii) and habitat.

21784 (2) Rhizoplaca "idahoensis" Rosentreter & McCune ined. (= Rhizoolaca "tubulosa" BLUM, ASU
21785-a (2) Rhizoolaca melanophthalma f. "crispa" Rosentreter. ined. B L U M
21785-b Rhizoolaca havdenii ASU
21786 (2) Rhizoplaca havdenii BLUM, ASU
21787 Rhizoolaca havdenii f. "arbuscula" Rosentreter & Ryan ined. (old labels say f. "globosa") ASU
21788 RhizoDlaca sp. "cavicola" Ryan & Rosentreter ined. 'ASU
21789 Rhizoolaca sp. "cavicola" ASU
21790 Rhizoplaca sp. "cavicola" ASU
21791 (2) RhizoDlaca melanophthalma B L U M
21792
21793 Candelariella
21794
21795 Psora cerebriformis
21796(2) Rhizoplaca peltata On rock. ASU
21797 Aspicilia (subfruticose)
21798

21799-21803
IDAHO: Clark Co.: W side of Hwy 28, __km (__mi) S of Leadore (3.5 mi S of Lone Pine). "Massacre Campground". T9N, R30E, Sect. 5. On soil. 20-21 July 1987.

21799 (2) ASU
21800 Aspicilia desertorum
21801-A RhizoDlaca melanopthalma f. "strange crispa" Rosentreter in herb.
31801-b Rhizoolaca idahoensis
21802 Rhizoolaca havdenii
21803 Rhizoolaca sp.—"crispa"

21804-21805
IDAHO: Lemhi Co.: 44^20'N, 113^05'W. W side of Hwy 28, 45 km (28 mi) S of Leadore (10 mi N of Lone Pine). "Sheep Sheds". T11N, R29E, Sect. 5. 2000 m (6700 ft). 20-21 July 1987. Winter grazing area for sheep; Rhizoplaca spp. grazed; Xanthooarmelia norchlorochroa not grazed.

21804

21805 Rhizoolaca havdenii v. arbuscula

21806-21807
IDAHO: Clark Co.: 2 mi up Long Canyon, E of Hwy 28, 6.5 mi S of Lone Pine. T9N, R30E, SE corner of Sect. 10. 20-27 July 1987. On soil. 1500 m (5000 ft.)

21806 Rhizoolaca havdenii A S U
21807 Rhizoolaca melanophthalma f. "crispa" BLUM

21808-21814
IDAHO: Lemhi Co.:. Keg Gulch Road, 1 mi W of Hwy 28, NW corner of "The Junction". 44^15'N, 113^00'W. 2000 m. Gravelly calcareous soil, with Artemisia tridentata. 52 km S of Leadore. On soil, flat. T11, R29E, Sect. 18. 20-21 July 1987.

21808
21809(5) Rhizoolaca idahoensis Rosentreter & McCune ined. (= Rhizoolaca "tubulosa") Rhizoplaca COMMON, GZU, US, ASU
21810-a(2) Rhizoolaca "corniculata" Ryan & Rosentreter ined. ID
21810-b (2) Rhizoplaca melanoohthalma f. "crispa" Rosentreter in herb. GZU
21811 Rhizoplaca melanoohthalma f. "crispa" Rosentreter in herb.
21812-b Rhizoolaca "cavicola" Ryan in herb. ASU
21813-a Rhizoolaca havdenii
21813-b (5) Rhizoolaca havdenii v. "arbuscula" Ryan & Rosentreter ined. BLUM, GZU, US, ASU
21814 Xanthoparmelia norchlorochroa (labels say X. chlorochroa).

21815-21826
IDAHO: Lemhi Co.: Keg Gulch Road, 3 mi W of Hwy 28. T11N, R29E, SW 1/4 of Sect. 18. 20-21 July 1987.

21815-21822 On soil.

21815 Aspicilia fruticulosa
21816 Catapvrenium lachneum
21817 Collema
21818
21819 Caloplaca tominii
21820 (5) Rhizoolaca havdenii Rhizoplaca COMMON, ESSLINGER, MIN, GZU, ASU
21821
21822

21823-21826 On rock (± calcareous).

21823 Lecanora garovaglii
21824 Lecanora nevadensis ASU
21825 Phaeoohvscia kairamoi
21826 Teloschistes contortuolicatus

21827921829
IDAHO: Clark Co.: E side of Hwy 28, 3 mi N of Lone Pine. T10N,

R29E, SW corner of Sect. 2. 6500 ft. Base of lava rock flow, with Big Sage (Artemisia tridentata ssp. tridentata) and Great Wild Rye (Elymus cinerea). Lecanora aarovaalii in more moist and shaded area than Lecanora nevadensis. Lecanora christoi observed but not collected. Rock high in Magnesium. 20-21 July 1987

21827 (2) Rhizoplaca melanophthalma
21828 Lecanora garovaglii
21829 Rhizoplaca melanophthalma

21830-21837
IDAHO: Lemhi Co.: Mouth of Meadow Canyon, off Hwy 28, N of Lone Pine. T11N, R28E. On +/- steep calcareous rock faces. 20-21 July 1987.

21830 Phaeophyscia
21831 Aspicilia
21832 Lecidea
21833 Rinodina
21834 Caloplaca decipiens
21835 Caloplaca
21836 Teloschistes contortuplicatus
21837 Endocarpon Dulvinatum

21838-21844
IDAHO: Lemhi Co.: 44^15'N, 113^00'W. 53 km S of Leadore, 7 km (4.5 mi) N of Lone Pine. On graveily clacareous soil on windswept bench. 2000 m (6518 ft). Roadcut on Hwy 28, S of Keg Gulch ("Junction"), T11N, R29E, Sect. 27. PHOTOS of me and Roger with lichens sticking to our beards.

21838 (3) RhizoDlaca "cavicola" Ryan & Rosentreter ined. BLUM, GZU, ASU: 2 packets
21839-a (2) RhizoDlaca melanophthalma f. "crispa"
21839-b(3) RhizoDlaca "corniculata" Ryan & Rosentreter ined. ASU, GZU
21839-c. RhizoDlaca havdenii
21840 (2) RhizoDlaca havdenii v. arbuscula Ryan & Rosentreter ined. BLUM
21841
21842 Rhizoplaca melanopthalma
21843 Aspicilia (subfruticose)
21844

21845-21848
IDAHO: Clark Co.: 44^15'N, 113^00'W. 59 km S of Leadore, 2.5 km (1.5 mi) S of Lone Pine. 1800 m. On gravelly calcareous soil on a windswept bench. Along Hwy 28; at Pass Creek. T10N, R30E, Sect. 30. RhizoDlaca "subidahoensis" in habitats similar to that of RhizoDlaca "idahoensis", i.e. on top of windswept benches.

21845 On rock (basalt).

21845 RhizoDlaca melanopthalma.

21846-21848 On soil

21846 Rhizoplaca haydenii **ASU**
21847 Rhizoplaca **sp. "cerebriformis"**
21848-a (3) Rhizoplaca "cavicola" **BLUM, GZU, ASU**
21848-b Rhizoplaca "cavicola" **A S U**

IDAHO Summer 1985

22127-22128
IDAHO: IDAHO CO.: 45^32'N, 116^18'30"W. Dirt road, E side of Hwy 95, 8.5 mi N of Riggins. Grass, scattered sagebrush. 550 m. Volcanic rock. 28 July, 1985.

22127 Rhizocarpon bolanderi?
22128

IDAHO Summer 1985

22148-22151
IDAHO: BLAINE CO.: 43^20'N, 114^11'W. US Hwy 26, 17 mi W of Carey. between Richfield and Carey. Scattered outcrops among sagebrush, ± horizontal. Lava rock. 30 July, 1985.

22148 Lecidea (brown)
22149 Lecidea tessellata
22150 Asoicilia
22151

IDAHO Summer 1985

22162
IDAHO: IDAHO CO.: 45^32'N, 116^18'30"W. Dirt road, E side of Hwy 95, 8.5 mi N of Riggins. Grass, scattered sagebrush.. 550 m. Volcanic rock. 28 July, 1985: On ± horizontal rock faces, exposed.

22162 Xanthonarmelia cumberlandia

IDAHO Summer 1985

22174-22176
IDAHO: Nez Perces Co.: 46^20'N, 117^0'W. Coyote Grade, SE of Lewiston. Basalt. Exposed. Grassland/broadleaf evergreen shrubs. 610 m (2000 ft). 3 July, 1985.

22174 Rhizocarnon cookeanum
22175
22176 Staurothele

IDAHO Summer 1985

22195-22197
IDAHO: BLAINE CO.: 43^22'N, 113^47'W. 12 mi W of Craters of the Moon National Monument. 1525 m (5000 ft). Huge exposed lava field. Sagebrush desert/scrub. On rock ± shaded by shrub. 30 July, 1985.

22195 Lecanora phaedrophthalma MEXU
22196 Aspicilia
22197 Lecidea (brown)

MONTANA Summer 1985

20867-20909
MONTANA: CARBON CO.: 45^02'N, 109^25'W. Hwy 212, 15 mi (25 km) N of Wyoming/Montana border: S of Red.Lodge, Montana. S-facing hill, +/- scattered boulders. Sagebrush and pine. 2440 m (8000 ft). 3 Aug. 1,985

20867-20869 60^W

20867 Lecanora novomexicana
20868 Rhizoolaca melanonhthalma
2 0 8 6 9

20870-20872 75^NE

20870-a Rhizoplaca melanonhthalma
20870-b Lecanora sarovaalii
20871 Rhizocarnon seminatum
20872 Asoicilia

20873-20883 On rock, unspecified

20873 Xanthooarmelia conspersa
20874
20875 Dimelaena oreina US
20876
20877
20878 Lecanora novomexicana
20879
20880
20881 Rhizoolaca ocrinaeta Ryan ined.
20882 Rhizoolaca melanoohthalma
20883

20884-20885 80^S

20884 Lecanora novomexicana
20885 Asnicilia

20886-20909 On rock, unspecified

20886
20887 Xanthooarmelia
20888
20889 Rhizoplaca chrysoleuca A S U
20890 Rhizoplaca melanonhthalma
20891 Umbilicaria
20892 (2) Dimelaena oreina ASU, MEXU
20893 Asoicilia
20894 Asnicilia
20895 Rhizoolaca melanoohthalma
20896
20897

20898 Dimelaena oreina ASU
20899 Lecanora novomexicana
20900 Asoicilia
20901 Lecanora novomexicana
20902
20903
20904 Lecidea (brown)
20905 Rhizoolaca melanonhthalma
20906 Umbilicaria
20907 Lecanora novomexicana
20908 Xanthooarmelia
20909 Aspicilia

20910-20925
MONTANA: FLATHEAD CO.: 48^02'N, 114^13'30"W. Along Hwy 93, 1.3 mi N of Lakeside. Douglas fir. 945 m (3100 ft). 27 July 1985

20910-20911 60^NE

20910 (2) Lecanora muralis ASU, __
20911(2) Phaeophvscia niaricans BRATT

20912-20913 10^W, ± under douglas fir

20912 Lecanora muralis
20913 Lecanora muralis ASU

20914-20916 20^E

20914 Lecanora muralis
20915 (2) Lecanora muralis ASU, __
20916 Lecideoid

20917-20919 On wood

20917 ( ) Lecanora muralis GUZMAN, ASU
20918 Lecanora muralis ASU
20919 Rhizoplaca melanoohthalma ASU numbering wrong?

20920 On rock, 60^W

20920 Lecanora muralis ASU

20921-20925 On rock, 60^E, ± under douglas fir

20921 Aspicilia
20922 Rhizocaroon intermedium
20923.
20924 Lecanora muralis ASU
20925 Asoicilia

20926-20943
MONTANA: GALATIN CO.: 45^05'N, 111^13'W. W side of hwy 191, 54.4 mi S of Bozeman. First. E-facing talus (boulders ca. l'ft

diam.). 2000 m (6560 ft). 2 Aug. 1985

20926-20936 On rock

20926 Lecanora novomexicana
20927 Lecanora novomexicana
20928(5) Lecanora novomexicana UPS, WTU, H
20929 Lecanora argopholis
20930 Rhizocarnon geminatum
20931 Xanthonarmelia cumberlandia
20932 Lecideoid (crypto)
20933 (2) Lecidea (brown)
20934 Rhizoolaca melanoohthalma
20935-a Rhizonlaca melanonhthalma
20935-b Rhizonlaca melanoohthalma
20936 Aspicilia

20937-20938 On moss

20937
20938 Caloolaca

20939-20943 On rock

209'39 Lecanora novomexicana
20940 Lecanora'semitensis GZU
20941 Lecanora semitensis
20942
20943

20944-20977
MONTANA: MISSOULA CO.: 46^45'15"N, 114^29'45"W. N side of hwy 12, 2.8 mi (4.5 km) E of Lo10 Hot Springs. S-facing hill. Scattered pines. 1230 m (4040 ft). 28 July 1985

20944 75^W

20944-a(2) Rhizoplaca melanonhthalma US
20944-b Lecanora nigromarginata

20945-20962 75^E

20945
20946 Aspicilia
20947 (2) Rhizoolaca ocrinaeta Ryan ined. ASU
20948 Lecanora semitensis
20949
20950 Lecanora muralis
20951
20952
20953
20954 Lecanora muralis
20955 Lecanora muralis
20956 Rhizoplaca melanonhthalma (+ Lecanora nigromarginata)

20957 Rhizoolaca melanoohthalma
20958-a Rhizoplaca melanophthalma
20958-b Lecanora muralis
2 0 9 5 9
20960-a: Rhizonlaca melanophthalma
20960-b Lecanora cf. weberi
20961 Lecanora muralis ASU.
20962 Lecanora muralis ASU

20963-20965 On wood

20963
20964 Lecanora muralis
20965 Brvoria

20966-20968 On rock; 30^S

20966-a Lecanora muralis
20966-b Lecanora (Placodium) sp.
20967 Rhizonlaca melanonhthalma
20968 (2) Lecanora muralis

20969-20976 60^NE

20969 Lecanora muralis
20970 Acarosnora
20971 Lecanora muralis
20972 Hhizoplaca chrysoleuca ASU
20973 Rhizoolaca chrvsoleuca
20974(2) Rhizoplaca chrvsoleuca ASU
20975
20976 Lecanora semitensis

20977 On pine bark

20977 Vulnicida canadensis

20978-20984
MONTANA: CARBON CO. : 45^03'N, 109^20'W. Hwy 212, 6 mi N of Wyoming/Montana border, at site of a USGS benchmark. 8639 ft. Igneous/metamorphic siliceous rock. 2680 m (8800 ft). 3 Aug. 1985

20978-20981 On rock, unspecified

20978 (3) Lecanora novomexicana US, MIN
20979(5) Lecanora novomexicana CANL, M, 0
20980 Rhizocaroon geographicum ASU
20981 Asoicilia

20982-20983 On underside of horizontal thin piece of rock lying loose on top of boulder

20982 Lecanora muralis

20983 Lecanora novomexicana

20984 On small rock at bottom of 1 ft deep crevice between boulders

20984 Lecanora novomexicana

20985-21015
MONTANA: GALLATIN CO.: 45^17'N, 111^14'W. Hwy 191, 39 mi S of Bozeman, N of Big Sky. Firs. 180 m (600 ft). 2 Aug. 1985

20985-20986 45^W base of cliff, E side of highway

20985 (2) Rhizoolaca melanonhthalma
20986

20987-21011 W-facing talus slope

20987
20988 Asnicilia
20989 Asnicilia
20990
20991 Caloolaca
20992 (2) Rhizocarnon geminatum CBG
20993 Dimelaena oreina
20994 Aspicilia
20995
20996'
20997 Xanthoparmelia
20998
20999(2) Rhizoplaca melanoohthalma US
21000 Lecideoid
21001 Rhizoplaca chrysoleuca ASU
21002 Umbilicaria
21003 Asnicilia
21004 Lecidea (brown)
21005
21006 Rhizocarnon lecanorinum
21007 Lecideoid (crypto)
21008 Rhizoplaca melanoohthalma
21009 Lecidea (brown)
21010 Xanthoparmelia mexicana
21011 Rhizoolaca melanoohthalma

21012-21015 On soil or moss

21012 Dioloschistes muscorum
21013
21014 Caloplaca
21015

21016-21031
MONTANA:, GALLATIN CO.: 45^26'N, 111^13'30"W. W side of Hwy 191, 26 mi S of Bozeman. Firs. E-facing talus. On rock. 1660

m (5440 ft). 2 Aug. 1985

21016-21030 On rock, unspecified

21016 Rhizonlaca melanoohthalma
21017 Rhizoplaca melanoohthalma
21018 Lecanora cf. semitensis (+ Lecanora cf. weberi)
21019
21020 Lecanora cf. semitensis
21021 Xanthonarmelia
21022
21023 Umbilicaria hyperborea
21024
21025 Lecanora phaedrophthalma
21026 Lecanora semitensis GZU
21027 Xanthooarmelia
21028
21029
21030

21031 90^N

21031 Lecanora cf. semitensis

21032-21039
MONTANA: MISSOULA CO.: 46^42'N, 114^32'30"W. N side of Hwy 12, 4.5 mi E (LABEL SAYS N) of Lo10 Pass, W of Lo10 Hot Springs. Douglas firs and pines. On rock. 1300 m (4260 ft). 28 July 1985

21032-21037 75^S, exposed

21032 Lecanora cf. semitensis
21033(5) Lecanora cf. semitensis US, GZU
21034 sterile crust
21035 Psora nipponica
21036 Leoraria
21037. Cyano

21038-21039 0^ niche in cliff

21038
21039 Lecidea (brown)

21040-21052
MONTANA: FLATHEAD CO.: 48^59'N, 114^12'W. W side of hwy 93, 18.5 mi N of Elmo, S of Lakeside, 34 mi N of Poulson. E-facing hill. Boulders. Pseudotsusa. (3200 ft). 27 July 1985

21040-21048 On soil or moss, 45^E

21040
21041(2) Phvsconia muscisena ONE TO ASU
21042 Leptogium lichenaides

21043 Phaeophyscia constipata ASU
21044 Phaeophvscia ciliata
21045
21046 Cladonia pyxidata
21047 Peltisera rufescens
21048 Lecanora muralis

21049-21052 On rock,' 45^E

21049 Rhizonlaca melanonhthalma
21050 Dinloschistes scruposus
21051 Lecanora muralis ASU
21052 Dermatocarpon reticulatum

21053-21092
MONTANA: GALLATIN (LABEL SAYS GALATIN) CO.: 44^03'30"N, 111^10'W. Start of Teepee Creek Trail, off Hwy 191, just S of Galatin River Crossing, just W of Yellowstone Nat. Park, 57.4 mi S of Bozeman. On rock. 2010 m (6700 ft). 2 Aug. 1985

21053-21060 On rock, unspecified

21053 Rhizoplaca melanoohthalma
21054 Rhizoolaca melanoohthalma
21055 Rhizoolaca melanoohthalma
21056 Asoicilia
21057
21058
21059 Lecideoid
21060 Candelariella vitellina

21061 On bone

21061

21062-21064 75^N, in crevice

21062
21063
21064 Lecanora garovaglii ASU

21065-21067 30^N

21065 Umbilicaria
2 1 0 6 6
21067, Rhizoolaca chrysoleuca

21068 90^N face of boulder, in 1 m.wide crevice between it and another boulder

21068

21069-21070 90^E, next to soil

21069 Lecanora novomexicana
21070 Rhizoolaca melanonhthalma

21071-21075 30^W

21071
21072 Rhizoplaca chrysoleuca ASU
21073(2) Rhizocarnon intermedium
21074 Rhizoolaca melanoohthalma
21075(2) Rhizoolaca melanophthalma MIN

21076-21084 45^S

21076 Lecideoid
21077 Lecidea (brown)
21078 Rhizocaroon disporum
21079, Melanelia substvsia
21080 Lecanora muralis ASU
21081 (2) A S U
2 1 0 8 2 Rhizoplaca melanophthalma
21083 Rhizonlaca melanoohthalma
21084

21085-21088 20^E

21085-a Lecanora muralis
21085-b Lecanora sarovaslii
21086 Rhizonlaca chrvsoleuca
21087 Rhizonlaca melanonhthalma
21088 Calonlaca eoithallina

21089-21092 On rock, unspecified

21089 Rhizonlaca melanonhthalma
21089-a Rhizoplaca melanonhthalma
21089-b Rhizoplaca melanoohthalma
21090
21091
21092 Staurothele areolata

21093-21144
MONTANA: SWEETGRASS CO.:' 45^44'N, 110^13'W. 0.5 mi up gravel road, 16 mi (26 km) W of Big Timber, S of I-80, at Springdale turnoff. S-facing hill.. Pinyon-Juniper and Sagebrush. On rock. 1275 m (4240 ft). 2 Aug. 1985

21093-21096 45^S

21093 Lecideoid
21094 (2) Lecanora nevadensis LSU
21095 Lecanora aarovacrlii
21096 Lecanora nevadensis

21097 45^W

21097(2) Lecanora phaedrophthalma UC

21098-21125 On rock, unspecified

21098 (2) Lecanora muralis ASU, _____
21099 Lecanora garovaglii

21100-a Rhizoplaca subdiscrepans ESSLINGER
21100-b(4) Lecanora nevadensis FERRARO, FH, TRTC
21101
21102 Lecanora aarovaalii
21103 Rhizonlaca melanoohthalma
21104
21105 Lecanora (Placodium) sp.
21106 Candelariella rosulans ASU
21107 Lecanora garovaslii
21108 Neofuscelia verruculifera
21109 Lobothallia alphoplaca?
21110 Aspicilia praeradiosa
21111 Lecanora garovaslii
21112
21113 Lecanora garovaglii
21114 Lecanora garovacflii
21115 Staurothele
2.1116 Polysnorina
21117 Rhizoplaca chrysoleuca ASU
21118 Rhizoolaca melanonhthalma
21119 Xanthooarmelia mexicana
21120 Lecanora garovaglii A S U
21121 Lecanora aarovaalii
21122 Lecanora garovaalii
21123 Lecanora aarovaslii
21124 Lecanora garovaglii
21125 Lecanora garovaslii

21126 On bark

21126

21127-21129 On.rock, unspecified

21127(2) Rhizoplaca peltata WIS
21128 Physcia dubia
21129

21130-21141 45^E

21130 Xanthoria elegans
21131 Lecanora garovaglii
21132
21133
21134 Candelariella rosulans
21135 Rhizoplaca chrysoleuca
21136 Lecideoid

21137 Lecanora sarovaalii
21138 Caloolaca trachvohvlla
21139
21140 Xanthoria eleoans
21141(4) Rhizoolaca ocrinaeta Ryan ined. GZU, COLO, ASU

21142-2144. 90^E
I..
21142 Lecanora garovaglii ASU
21143, Lecanora (Placodium) sp.
21144 Lecanora garovaglii

21145
MONTANA: CARBON 'CO. : 45^03'30"N, 109^24'30"W. Hwy 212, turnoff to Sundance, S of Red Lodge, 20 mi N of Wyoming/Montana border. Sagebrush and pines. 2195 m (7200 ft). 3 Aug. 1985

21145

MONTANA/WYOMING Summer 1985

21146-21180
CARBON CO. (MONT)/ PARK CO. (WYO): 45^00'N, 109^25'W. Just N of Beartooth Pass, border of Montana and Wyoming, along Hwy 212. Alpine meadow. Igneous/metamorphic siliceous rock. 3300 m (10940 ft). 3 Aug. 1985

21146-21165 On rock, unspecified,

21146 (3) Lecanora novomexicana
21147 Lecanora novomexicana
21148 Lecanora novomexicana
21149 Lecanora- novomexicana
21150 'Lecanora novomexicana
21151. Hhizoplaca chrysoleuca ASU
21152
21153
21154 Rhizonlaca melanoohthalma
21155-a(2) Rhizoplaca melanoohthalma US, ASU
21155-b
21156 Lecanora novomexicana -C-, P-
21157
21158 Pseudenhebe pubescens
21159 Umbilicaria
21160-a
21160-b Lecidea (brown)
21161 Dimelaena oreina ASU
21162-a
21162-b Umbilicaria krascheninnikovii
21163 Lecanora polytropa
21164 Tenhromela armeniaca
21165 Snorastatia testudinea ASU

21166-21169 On soil

2 1 1 6 6
21167 Ochrolechia unsaliensis
21168 Cetraria islandica
21169 Coelocaulon muricatum

21170-21180 On rock, unspecified

21170 Lecideoid (crypto)
21171
21172
2 1 1 7 3
21174
21175
21176
2 1 1 7 7
21178
21179
21180

MONTANA Summer 1985

21181-21187
MONTANA: CARBON CO. : 45^03'N, 109^20'W. Hwy 212, 6 mi N of Wyoming/Montana border, at site of a USGS benchmark. 8639 ft. Igneous/metamorphic siliceous rock. 2680 m (8800 ft). 3 Aug.. 1985 (see 20978-20984).

2 1 1 8 1
21182 Aspicilia
21183 Lecidea (brown)
21184 Aspicilia
'21185 Rhizocarpon geographicum
21186 Lecidea (brown)
21187 Rhizocarpon seminatum

MONTANA Summer 1985

21223-21229
MONTANA: CARBON CO. : 45^03'N, 109^20'W. Hwy 212, 6 mi N of Wyoming/Montana border. 2680 m. Igneous/metamorphic siliceous rock. 2680 m (8800 ft). 3 Aug. 1985 (See 20978-20984 and 21181-22187).

21223(3) Lecanora novomexicana UC SFSU
21224 Lecanora novomexicana
21225 Lecanora novomexicana
21226 Lecanora novomexicana
21227 Lecanora novomexicana C-, P+ yellow
21228-a Lecanora novomexicana C-, P+ yellow
21228-b Lecanora novomexicana C-, P-
21229-a Lecanora novomexicana C-, P+ yellow
21229-b Lecanora novomexicana C-, P-