Cryptogams of the Cedar River Watershed

Prepared for:
The Cedar River Watershed

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September 2001

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Introduction

An understanding of the biological diversity in the Cedar River Watershed could assist in the planning of an ecologically sound management strategy. This study focuses on the species of mosses, liverworts, and lichens (also called cryptogams) found in the Watershed during a two-month sampling regime and discusses the role cryptogams play in the various habitats at Cedar River. Many investigations have been conducted in the Pacific Northwest in attempt to address current management and cryptogam diversity issues; i.e., how to promote diversity in young stands, is diversity and abundance a product of stand age or stand structure (Pipp et al. 2001; Hyvarinen 1992; Lesica et al. 1991; McCune 1993), what is the relationship between diversity and large scale forest stand characteristics such as remnant large trees and canopy gaps (Rambo 1998; Neitlich and McCune 1997), etc. Studies thus far have revealed that abundance and diversity generally do increase with stand age (Nadkarni 1997; Esseen et al. 1992; Kuusinen 1994b; McCune 1993; Neitlich 1993). Conversely, one study showed that the lichen, *Lobaria*, typically associated with old-growth stands, can establish and grow in clear-cuts and young forests and the slow development of this species was attributed to dispersal limitations (Sillitt et al. 2000). It is these types of research that will generate creative, environmentally sensible solutions to the decisions The Cedar River Watershed is currently facing, but a good knowledge of the species and habitats that exist within the watershed must come first.

Bryophytes and lichens both play a critical role in ecosystem nutrient dynamics (Pike 1978; Callaway and Nadkarni 1991). Mosses serve as receptacles that capture and then leach nutrients back into the ecosystem. Certain species of lichens, called cyanolichens, house blue-green algae and are responsible for the input of usable forms of nitrogen back into the soil. One genus in particular, *Lobaria*, dominates the lichen biomass in the PNW and contributes significant amounts of nitrogen and other nutrients back to the soil (Pike 1978; McCune 1994). It is believed that depletion of these cryptogams can contribute to nutrient deficits. Additionally, cryptogams (mainly lichens) have been shown to provide food and shelter for flying squirrels, deer, caribou, and invertebrates (Edwards et al. 1960; Pettersson 1995; Rominger 1989;).

Methods

Cryptogams were inventoried at 32 permanent plots throughout the Cedar River Watershed. Potential sites were initially identified using the Watershed's GIS layer maps according to the following cover types: 1) early seral forest, 2) mid-seral forest, 3) late successional/old-growth, 4) rock/talus, 5) wetland, and 6) streamside. Additionally, these cover types were divided further into three elevation classes: 1) <1500', 2) 1500'-3000', and 3). >3000'. Table 1 depicts all survey locations.

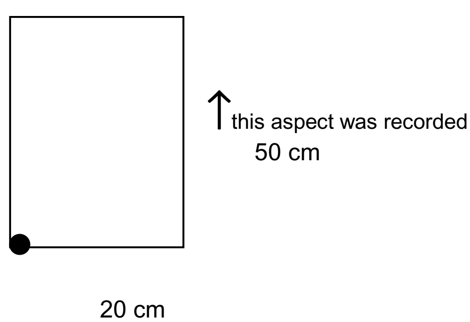
Table 1 Survey site locations for the Bryophyte and Lichen Study

Cover type	Elevation class	Locality	Watershed subbasin	Stand age and elevation	Plot
I. Early Seral	<1500'	intersection of roads 11 and 11.1	Lower Cedar River	20-29 yrs, ~1000'	11a, 11b
	>3000'	intersection of roads 112 and 112.4, near Mt. Washington	Damburat Ck*	20-29 yrs, ~4300'	112/112.4a
	>3000'	intersection of roads 155, 155.5, 155.6	Upper Cedar River	20-29 yrs, ~3600'	155/155.5a, 155/155.5b
II. Mid-Seral	<1500'	east of the intersection of roads 10, 30, and 54	Lower Cedar River	30-79 years ~800'	10/30/54a, 10/30/54b
	<1500'	intersection of roads 10 and 16	Rock Ck*	30-79 yrs, ~800'	10/16a, 10/16b
	1500'-3000'	intersection of roads 70 and 72, near Snoos Junction	Taylor Ck	30-79 yrs, ~1600'	70a, 70b
	1500'-3000'	intersection of Rd 22 and 22.1	Steele Ck*	60-69 yrs,~1900'	22a, 22b
III. Late-Seral/Old Growth	1500'-3000'	Intersection of road 800 and Lost Ck (historic)	Chester Morse	190+ yrs, ~2800'	800a, 800b
	>3000'	old-growth stand .2 mile past gate on road 155; next to talus slope; east side of road	Bear Ck*	190+ yrs, ~4000'	155a, 155b
IV. Rock	>3000'	Laws Ledge	Lower Cedar River	~3300	800 rock-a
	>3000'	talus slope .2 mile past gate on road 155; east side of road	Bear Ck*	~3700'	155 rock-a
	>3000'	talus slope on the west side of Findley Lake	Findley Ck*	~3700'	320 rock-a
V. Wetland	<1500'	road 18, north side, or intersection of roads 18 and 18.1(south end of Walsh Lake)	Walsh Lake Ditch	~800'	18 wetland-a, 18 wetland-b
	1500'-3000'	intersection of roads 800 and Lost Ck (historical); roadside seep	Chester Morse	~2800 Technically not a wetland, but representative of some of those species	800 seep-a
	>3000'	east side of road 155, just prior to intersection of roads 155, 155.5, and 155.6	Upper Cedar River	~3500' Seasonally saturated	155 wetland-a, 155 wetland-b
	>3000'	eastside of Findley Lake	Findley Ck*	~3700'	320 wetland-a, 320 wetland-b
VI. Streamside	<1500'	intersection of road 10 and Webster Ck	Walsh Lake Ditch	~800'	10 Webster Ck-a
	<1500'	intersection of road 60 and Taylor Ck	Taylor Ck	~1000'	53/60 stream-a
	<1500'	intersection of road 10 and Steele Ck	Steele Ck*	~1000'	10 stream-a
	1500'-3000'	Lost Ck tributary; intersection of Lost Ck (historic) and road 800; follow trail on the north side to the bridge	Walsh Lake Ditch	~2800'	800 stream-a
	1500'-3000'	On road 155 at the 155.1 milepost	Roaring Ck*	~3000'	155 stream-a

*** denotes a minor hydrologic subbasin**

Methods (continued)

A field visit followed the initial site identification and specific microplot locations were selected subjectively according to desirable microhabitats that would lend the greatest diversity; i.e. tree bases and boles, wet/submerged rocks, dry rock, newly fallen trees, wetlands, CWD of differing classes, etc. PVC (painted red) was installed at all plots in all three stages of forest type and at wetlands to indicate plot “center”. No PVC was installed at either rock or stream plots, but all 32 locations were flagged and documented using a Trimble GPS. At the forest and wetland plots two different types of surveys were implemented: 1) a 20 cm X 50 cm daubenmire frame for terrestrial and tree bole species and, 2) a 2 meter radius plot for epiphytic litterfall species (developed by McCune 1994). The 20 cm X 50 cm frame was situated with the PVC in the left lower corner (figure 1a) and the aspect of the frame was recorded. All terrestrial lichens and bryophytes that were affixed within in this plot, as well as any that were affixed to tree boles, CWD, or rocks (up to 1 meter above the ground) inside the 20 cm X 50 cm frame were recorded. A tape measure was then attached to the PVC and a 2 meter radius round plot (figure 1b) was used to sample all epiphytic cryptogams that fell as litter from the canopy. This entire procedure was repeated as a second microplot at the same site if time permitted (2 hour maximum). Plots were named according to the road number next to the site, followed by either an ***a*** or ***b*** depending on the number of microplots at a given site (i.e.: 2 plots on road 155 would be 155a and 155b). At the streamside and rock/talus plots, a “two hour meander method” was employed in order to encounter a representitive population of those habitat types. All species found within this time limit were recorded.



Figures not to scale
Figure 1a

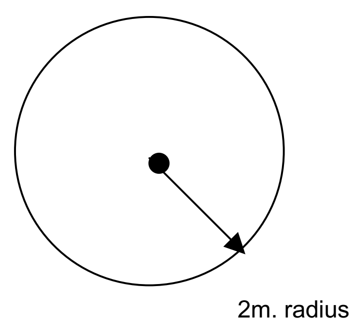


Figure 1b

The following site attributes were recorded (survey form is figure 2 in the *Figures and Photos* section): plot number, detailed location, cover type, stand age, elevation, aspect (frame and hillside), stand structure, habitat, topographic moisture, and notes on associated vascular plant species. For each plot, the species section contained species names (or unknown codes), substrate, abundance per area (listed only as sparse, medium, dense), and notes on collections. Collections were put into specially made paper

Methods (continued)

envelopes, labeled, and then submitted to both the Watershed Headquarters and to the University of Washington Herbarium. Identification of lichen and bryophytes took place in the laboratory and followed standard chemical and microscopic procedure. Identification utilized and nomenclature follows McCune (1997); Christy and Wagner (1996); Goward, McCune, and Meidinger (1994); Schofield (1992); Vitt et al. (1988), Hitchcock and Cronquist (1973); and Lawton (1971). Data analysis was limited to species richness calculations per cover type, elevation class, and topographic moisture category. Data was entered and is housed in both an Access database (replicates the field survey form) and in a series of Excel worksheets. A final document, maps, database information, and voucher collections have all been submitted to The Cedar River Watershed.

Results and Discussion

The two months of survey work and 32 plots yielded 105 identified bryophytes and 38 lichen species (Table 2; this includes the corresponding voucher identification number). At the end of the project there were some species that had yet to be identified.

Table 2

Bryophytes of The Cedar River Watershed | **Lichens of The Cedar River Watershed**

Species Name	Voucher No.	Species Name	Voucher No.
Andreaea spp.	1	*Alectoria sarmentosa*	1
Antitrichia curtipendula	2	*Bryoria capillaries*	2
Aulocomnium androgynum	3	*Bryoria fuscescens*	3
Aulocomnium palustre	4	*Bryoria glabra*	4
Barbilophozia hatcherii	5	*Bryoria pseudofuscescens*	5
Bazzania ambigua	6	*Cavernularia lophyrea*	6
Blepharostoma trichophyllum	7	*Cetraria chlorophylla*	7
Brachythecium rivilare	8	*Cetraria orbata*	8
Brachythecium frigidum	9	*Cetrelia cetrarioides*	9
Bryum capillare	10	*Cladonia bellidiflora*	10
Bryum pseudotriquetrum	11	*Cladonia carneola*	11
Buxbaumia piperi	12	*Cladonia coniocraea*	12
Calliergon stramineum	13	*Cladonia cornuta*	13
Calypogeia spp.	14	*Cladonia ecmocyna*	14
Calypogeia muelleriana	15	*Cladonia furcata*	15
Calypogeia sphagnicola	16	*Cladonia sulpherina*	16
Campylium stellatum	17	*Cladonia transcendens*	17
Cephalozia lunifolia	18	*Cladonia umbricola*	18
Ceratodon purpureus	19	*Evernia prunastri*	19
Claopodium bolanderi	20	*Hypogymnia apinnata*	20
Claopodium crispifolium	21	*Hypogymnia enteromorpha*	21
Climacium dendroides	22	*Hypogymnia imshaugii*	22
Conocephalum conicum	23	*Hypogymnia inactiva*	23

Figure 2 (continued)

Dendroalsia abietina	24	*Hypogymnia physodes*	24
Dichodontium pellucidum	25	*Hypotrachyna sinuosa*	25
Dicranella palustris	26	*Menegazzia terbrata*	26
Dicranoweisia crispula	27	*Parmelia sulcata*	27
Dicranum fuscescens	28	*Parmeliopsis ambigua*	28
Dicranum pallidisetum	29	*Parmeliopsis hyperopta*	29
Dicranum scoparium	30	*Peltigera collina*	30
Dicranum tauricum	31	*Peltigera membranacea*	31
Diplophyllum albicans	32	*Peltigera venosa*	32
Diplophyllum taxiphyllum	33	*Platismatia glauca*	33
Eurhynchium oreganum (also called Kindbergia oreganum)	34	*Platismatia herrei*	34
Eurhynchium praelongum (also called Kindbergia praelongum)	35	*Ramalina farinacea*	35
Eurhynchium pulchellum var. pulchellum	36	*Usnea filipendula*	36
Fissidens spp.	37	*Usnea laponica*	37
Fissidens taxifolius	38	*Usnea wirthii*	38
Fissidens ventricosus	39		
Fontinalis antipyretica var. oregonensis	40		
Grimmia spp.	41		
Gyrothra underwoodiana	42		
Heterocladium macounii	43		
Homalothecium fulgescens	44		
Homalothecium nevadense	45		
Hookeria lucens	46		
Hygrohypnum spp.	47		
Hylocomium splendens	48		
Hypnum spp.	49		
Hypnum circinale	50		
Isopterygium elegans (also called Pseudotaxiphyllum elegans)	51		
Isothecium stoloniferon (also called I. Myosuroides)	52		
Jungermannia spp.	53		
Lepidozia reptans	54		
Leucolepis menziesii (also called L. acanthoneuron)	55		
Lophozia porphyrolenca	56		
Marchantia polymorpha	57		
Marsupella emarginata var. emarginata	58		
Metaneckera menziesii	59		
Mnium lycopodioides	60		
Neckera douglasii	61		
Oligotrichum aligerum	62		
Orthotricum lyellii	63		

Figure 2 (continued)

Addendum to Stout (2001) - redetermination by Martin Hutten of bryophyte specimens collected by Tammy Stout in 2001.

Stout Number	Submitted by T. Stout	Updated by M. Hutten	Update Action[1]	Comment
1	*Andraeae sp.*	*Andraeae rupestre*	D	
5	*Barbolophozia hatcheri*	*Barbolophozia floerkei*	D	
112	*Calypogeia fissa*	*Chilocyphus polyanthos*	D	
15	*Calypogeia muelleriana*	*Lophocolea heterophylla*	D	
16	*Calypogeia sphagnicola*	*Calypogeia suecica*	D	
19	*Ceratodon?*	*Kiaeria starkei*	D	
20	*Claopodium bolanderi*	*Claopodium crispifolium*	D	
29	*Dicranum pallidesetum*	*Dicranum scoparium*	D	
30	*Dicranum scoparium*	*Dicranum howellii*	D	sensu Norris & Shevock, using Lawton 1971 this would key to D. scoparium. Lawton's concept is out of date
33	*Diplophyllum taxifolium*	*Diplophyllum obtusifolium*	D	
36	*Eurynchium pulchellum*	*Eurynchium praelongum*	D	
41	*Grimmia cf. alpestris*	*Grimmia sp. (but NOT alpestris)*	D	in a Grimmia group where fertile characters are needed with present keys
42	*Gyrothyra underwoodiana*	*Nardia scalaris*	D	
47	*Hygrohypnum sp.*	*Hygrohypnum ochraceum*	D	
110	*Hypnum cupressiforme*	*Hypnum dieckii*	D	
56	*Lophozia porphyroleuca*	*Lophozia longiflora*	N	
60	*Mnium lycopodioides*	*Mnium ambiguum*	N	
63	*Orthotrichum lyellii*	*Orthotrichum papillosum*	ND	taxon has been split ORPA is most common
65	*Pellia sp.*	*Pellia neesiana*	D	
67	*Plagiochila asplenioides*	*Plagiochila porelloides*	D	
83	*Racomitrium canescens*	*Racomitrium elongatum*	ND	
85	*Racomitrium heterophyllum*	*Racomitrium occidentale*	D	
87	*Racomitrium sudeticum var. alpestre*	*Racomitrium sudeticum var. sudeticum*	ND	(sensu Frisvoll 1988)
95	*Scapania americana*	*Scapania undulata*	D	
99	*Scleropodium obtusifolium*	*Platyhypnidium riparioides*	D	**RARE!**
101	*Sphagnum sp.*	*Sphagnum mendocinum*	D	

[1] D = determined; N = nomenclature update only; DN = both

Addendum to Stout 2001 - verification by Katie Glew of voucher specimens collected and identified by Tammy Stout in 2001 from Cedar River Watershed.

Alectoria sarmentosa
Alectoria sp.
Bryoria capillaris
Bryoria fuscescens
Bryoria glabra – no voucher
*Bryoria implexa**
Bryoria pseudofuscescens
[*Cavernularia lophyrea*]
Cavernularia is in the watershed, but this specimen is a *Hypogymnia*
*Cavernularia hultenii**
Cetraria chlorophylla
Cetraria orbata
*Cetrelia cetrarioides**
Cladina rangiferina
Cladonia sp.1
Cladonia sp.2
Cladonia bellidiflora
Cladonia brown tip
Cladonia carneola – no voucher
Cladonia chlorophaea
Cladonia coniocraea – incorrect ID
*Cladonia cornuta** – no voucher
Cladonia ecmocyna – incorrect ID
Cladonia forked
*Cladonia furcata** – no voucher
*Cladonia ochrochlora**
Cladonia red tip
Cladonia rangiferina*
Cladonia scabriuscula – incorrect ID
Cladonia squamosa
*Cladonia sulphurina**
Cladonia transcendens
Cladonia umbricola – no voucher
Cladonia sp.
Evernia prunastri
Hypogymnia sp. 1
Hypogymnia sp. 2
Hypogymnia apinnata – incorrect ID
Hypogymnia enteromorpha
Hypogymnia imshaugii – incorrect ID

Hypogymnia inactiva
*Hypogymnia occidentalis**
Hypogymnia physodes
Hypogymnia rugosa – incorrect ID
Hypogymnia tubulosa
Hypotrachyna sinuosa – incorrect ID
Lichen (unidentified)
Lichen 2 (unidentified)
Lichen 3 (unidentified)
Menegazzia terebrata
Parmelia hygrophila
Parmelia saxatilis – incorrect ID
Parmelia sp.
Parmelia sulcata
Parmeliopsis ambigua
Parmelia hygrophylla – no voucher
Parmeliopsis hyperopta – too small to ID
*Peltigera collina** – no voucher
*Peltigera horzontalis**? – small sample
Peltigera membranacea – no voucher
*Peltigera neopolydactyla**
*Peltigera venosa** – no voucher
Peltigera sp.
Platismatia glauca
Platismatia herrei
Ramalina farinacea
Sphaerophorus globosus
*Stereocaulon tomentosum**
Stereocaulon sp.
*Usnea cornuta**
Usnea filipendula
Usnea lapponica
Usnea sp.
Usnea subfloridana – incorrect ID
Usnea flavocardia

*also in collections, but not listed on packet or Tammy's list

Results and Discussion (continued)

Detailed analysis of the data was beyond the scope of this project, mainly due to the time constraint and the varied nature of the habitats surveyed. Basic evaluation of the findings in the watershed revealled that, species richness decreased across cover type in the following order: late successional/old-growth, streamside, mid-seral, talus, wetland, and early-seral (Table 3). A plot by plot analysis of number of species is also illustrated (Table 4).

Table 3
Average Richness per Cover Type

Cover Type	Avg Of Richness
Late Successional /Old-growth	28.8
Streamside	22.2
Mid-Seral	16.8
Talus Slope	16.3
Early Seral	6.0
Wetland	5.0

Table 4
Richness per plot

Plot Name	Cover Type	Richness
800-a	Late Successional/Old-growth	45
70a	Mid-Seral	29
10 stream-a	Streamside	27
800 stream-a	Streamside	26
800-b	Late Successional /Old-growth	24
155-a	Late Successional /Old-growth	23
155-b	Late Successional /Old-growth	23
70b	Mid-Seral	22
53/60 stream-a	Streamside	21
155 stream-a	Streamside	20
22-b	Mid-Seral	20
800 rock-a	Rock/Talus	20
10/16-a	Mid-Seral	18
10 WebsterCk-a	Streamside	17
10/16-b	Mid-Seral	15
320 rock-a	Rock/Talus	15
155rock-a	Rock/Talus	14
22-a	Mid-Seral	13
800 seep-a	Wetland	11
CRW Headquarters	Varied	11
10/30/54a	Mid-Seral	10
112/112-4-a	Early Seral	10

Table 4 (continued)
Richness per plot

Plot Name	Cover Type	Richness
10/30/54b	Mid-Seral	7
11-a	Early Seral	6
320 wetland-a	Wetland	6
320 wetland-b	Wetland	6
11-b	Early Seral	5
155/155.5-b	Early Seral	5
155 wetland-a	Wetland	4
155/155.5-a	Early Seral	4
155 wetland-b	Wetland	3
18 wetland-a	Wetland	3
18 wetland-b	Wetland	2

Elevationally, richness was the greatest in elevation class 2, followed by class1 and lastly, by class 3 (Table 5). The topographic moisture with the highest richness was the wet category and decreased in the following order: moist mesic, mesic, extremely dry (rock/talus), very dry, standing water, and dry/well drained (Table 6).

Table 5
Average Richness by Elevation Class

Elevation Class	Avg Of Richness
2	23.3
1	11.9
3	11.1

Table 6
Average Richness by Topographic Moisture

Topographic Moisture	Avg Of Richness
Wet	20.0
Moist Mesic	19.9
Mesic	18.1
Extremely Dry	17.5
Very Dry	14.0
Standing Water	10.0
Dry/Well Drained	6.3

These basic results concur with other studies undertaken in the Pacific Northwest but should be fortified with additional investigations that focus on a narrower

Results and Discussion (continued)

range of habitat types—i.e., comparisons of the three seral stages, comparisons of only wetlands in the three elevation classes, or comparisons of streamsides in different aged stands.

Hypnum circinale was encountered in the greatest number of total survey plots, followed by *Eurhynchium oreganum* and *Isothecium stoloniferon*. This too concurs with previous studies undertaken on bryophytes in the Pacific Northwest. Tables 7a-7f list the ten most common species found (bryophyte and lichen combined) per cover type. Table 8 depicts the ten most frequently occuring species across all plots.

Table 7a

Ten of the Most Frequently Occurring Species by Cover Type

Early Seral	
Species Name	**Number of Plots**
Cladonia sp.	4
Dicranum fuscescens	2
Dicranum tauricum	2
Eurhynchium oreganum	2
Hypnum circinale	2
Hypogymnia imshaugii	2
Polytrichum juniperinum	2
Scapania bolanderi	2
Isopterygium elegans	1
Plagiothecium undulatum	1

Table 7b

Ten of the Most Frequently Occurring Species by Cover Type

Mid Seral	
Species Name	**Number of Plots**
Isothecium stoloniferon	8
Eurhynchium oreganum	7
Hypnum circinale	7
Hypogymnia physodes	6
Platismatia glauca	6
Cetraria orbata	5
Plagiothecium undulatum	5
Hypogymnia inactiva	4
Rhytidiadelphus loreus	4
Scapania bolanderi	4

Table 7c

Ten of the Most Frequently Occurring Species by Cover Type

Old growth/late successional	
Species Name	**Number of Plots**
Cladonia sp.	5
Platismatia glauca	5
Alectoria sarmentosa	4
Dicranum scoparium	4
Hypnum circinale	4
Ptilidium californicum	4
Rhytidiopsis robusta	4
Scapania bolanderi	4
Hypogymnia inactiva	3
Rhytidiadelphus loreus	3

Table 7d

Ten of the Most Frequently Occurring Species by Cover Type

Streamside	
Species Name	**Number of Plots**
Dichodontium pellucidum	5
Bryophyte (unidentified)	4
Bryophyte 2 (unidentified)	4
Calypogeia muelleriana	4
Eurhynchium praelongum	4
Leucolepis menziesii	4
Schleropodium obtusifolium	4
Bryophyte 3 (unidentified)	3
Racomitrium aciculare	3
Rhizomnium glabrescens	3

Table 7e

Ten of the Most Frequently Occurring Species by Cover Type

Talus Slope	
Species Name	**Number of Plots**
Bryophyte (unidentified)	3
Cladonia sp.	3
Racomitrium heterostichum	3
Barbilophozia hatcheri	2
Bryophyte 2 (unidentified)	2
Bryophyte 3 (unidentified)	2
Bryophyte 4 (unidentified)	2
Pleurozium schreberi	2
Racomitrium canescens	2
Philonotis fontana	1

Table 7f
Ten of the Most Frequently Occurring Species by Cover Type

Wetland	
Species Name	**Number of Plots**
Philonotis fontana	6
Eurhynchium praelongum	3
Aulocomnium palustre	2
Hygrohypnum sp.	2
Rhytidiadelphus squarrosus	2
Bryophyte (unidentified)	1
Eurhynchium oreganum	1
Plagiomnium insigne	1
Polytrichum juniperinum	1
Rhytidiadelphus loreus	1

Table 8
Ten Most Frequent Species Across All Plots

Grand Total	
Species Name	**Number of Plots**
Hypnum circinale	15
Cladonia sp.	13
Eurhynchium oreganum	13
Isothecium stoloniferon	12
Platismatia glauca	12
Scapania bolanderi	11
Bryophyte (unidentified)	10
Rhytidiadelphus loreus	10
Plagiothecium undulatum	9
Calypogeia muelleriana	8

Conclusions and Recommendations

Clearly, the most obvious step would be to enhance this knowledge base with more research. The total number of species encountered in this study most likely represents only a fraction of the population of the species that exist at The Cedar River Watershed. It is believed that there are 900 mosses, 1200 lichens, and 250 liverworts in Northwest America (Vitt et al. 1988). Investigating the following habitat types more closely could fill the largest gaps in the species list:

- Rock outcrops
- Streamside
- CWD in the forests
- Forest canopies
- Wetlands

The wetland cover type in particular should receive extra care in specific site selection. In this study, the wetlands with low total species had a thick vascular plant understory density, but those with less understory cover and year-round water had a higher species richness. Additionally, a more focused survey and analytical comparisons of the different forest stages in the watershed would reveal valuable data that could assist the land managers of this diverse ecosystem. Habitat specific surveys would lend insight into the status of the Survey and Manage species that exist in the watershed; the scope of this study didn't allow the time for that specialized of survey techniques. Incorporation of cryptogam study plots within larger scale, long term ecological study plots would integrate knowledge of these types of life forms with other disciplines (i.e,. mammal, amphibian, ornithological) as well as provide a platform to monitor forest change and health.

This unique watershed is extremely diverse with its large elevational gradient and multitude of habitat types. This study has provided only a primary, albeit valuable, set of data and information that can now be used as a basic building unit for the research to come.

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Tables and Figures

Figure 2
Survey Form

name:		**date and time:**
plot number:	**GPS file name:**	**location:**
cover type:		**stand age:**
elevation:	**aspect:**	**slope:**

stand structure (tree regeneration, canopy structure, snags and downed wood):

habitat (canopy cover overstory density, canopy cover understory density, landform (talus, alluvial valley, scree, etc) moisture, light, wir

topographic moisture: **extremely dry (rocky ridgetop)** **very dry** **dry-well drained** **dry mesic** **mesic** **moist mesic** **wet** **standing water**

species	substrate	abundance per general area	specimen collected	notes

additional notes: (plant association, lichen line, etc…)

Figure 3
Plot photos

Plot 11-a Early Seral

Plot 10/30/54b Mid-Seral

Figure 3 (continued)

Plot 800a Late Successional/Old-growth

Plot 800a Late Successional/Old-growth Tree base

Figure 3 (continued)

Plot 800 seep-a wetland

Plot 320 wetland-a Findley Lake wetland

Figure 3 (continued)

Plot 10 stream-a Streamside (Steele Ck)

Plot 53/60 stream-a Streamside (Taylor Ck)

Figure 3 (continued)

Plot 155 rock-a rock/talus

Figure 4
Map of Survey Locations in the Cedar River Watershed
At this scale the individual plots are difficult to see.