

**SURVEY PROTOCOLS**  
**FOR**  
**PROTECTION BUFFER**  
**BRYOPHYTES**

**version 2.0**

## TABLE OF CONTENTS

### SECTION I: SURVEY PROTOCOLS

I.	INTRODUCTION	
A.	Protocol Objectives	1
B.	Trigger for the Survey Protocol	1
II.	SURVEY METHODS	
A.	Prefield Review	2
B.	Field Survey	3
C.	Extent of Surveys	3
D.	Timing of Surveys	3
III.	DATA COLLECTION and DOCUMENTATION	
A.	Documenting the Presence of Protection Buffer Bryophyte Species	4
B.	Documenting the No Detection of Protection Buffer Bryophyte Species	4
C.	Additional Information to Collect	4
IV.	DATA MANAGEMENT	5
A.	Data Quality Assurance	5
B.	Data Storage	6
V.	SURVEYOR QUALIFICATIONS and SKILLS	6
VI.	REFERENCES	7

### SECTION II: SPECIES INFORMATION

I.	<i>Brotherella roellii</i>	8
II.	<i>Buxbaumia viridis</i>	11
III.	<i>Rhizomnium nudum</i>	14
IV.	<i>Schistostega pennata</i>	17
V.	<i>Tetraphis geniculata</i>	20
VI.	<i>Ulota megalospora</i>	25

### APPENDICES

- Appendix A: Field Form for documenting presence/no detection for Protection Buffer bryophytes
- Appendix B: Additional field forms for Habitat and Population Data
- Appendix C: Field Methods and Data Dictionary
- Appendix D: Cryptogam Packet Form for Voucher Specimens

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## SECTION I

### SURVEY PROTOCOLS for PROTECTION BUFFER BRYOPHYTES

#### I. INTRODUCTION

The Protection Buffer provisions were incorporated from the Scientific Analysis Team Report (Thomas *et al.* 1993) to address those species that were considered to be at risk under the Northwest Forest Plan. The Northwest Forest Plan standards and guidelines for Protection Buffer species require that surveys be completed prior to ground-disturbing activities within the known or suspected ranges and within the habitat types or vegetation communities occupied by these species according to the implementation schedule for Survey and Manage component 2. For bryophyte species, the schedule is for ground-disturbing activities that will be implemented in FY99 or later. If new sites are discovered during the surveys, and with appropriate verification and documentation, they become “known sites” and should be managed according to the current recommendations that the Regional Ecosystem Office has transmitted for that species.

##### A. Protocol Objectives

The objectives of this survey protocol are to:

- document the presence or no detection of Protection Buffer bryophyte species in proposed project areas
- describe the size of the local population, and delineate population boundaries
- collect habitat data to refine definitions of suitable habitat.

The survey protocol will provide information needed to implement the Survey and Manage standard and guideline and Protection Buffer species requirements in the Record of Decision (USDA and USDI 1994). Development of habitat information for protection buffer species will contribute to our management of the species, and successful implementation of the Protection Buffer provision in the Northwest Forest Plan. Refining definitions of suitable habitat will assist in the management of these species by finding additional populations, and directing surveys to areas with “a high likelihood of locating occupied sites” (USDA and USDI 1994: C-27), thereby reducing the area where future surveys will be required. In addition, this habitat information will contribute to the development of appropriate management recommendations for these species, including evaluating the effects of indirect impacts on the habitat and species populations.

##### B. Trigger for the Survey Protocol

The survey protocol will be implemented if the proposed ground-disturbing activity will directly or indirectly impact populations of the Protection Buffer bryophyte species, and if any of the following four criteria are met:

1. A known site for a Protection Buffer bryophyte species exists in the proposed project area.

2. A Protection Buffer bryophyte species has been reported within the 5<sup>th</sup> field watershed where the project is located.
3. A Protection Buffer bryophyte species has been reported within an adjacent 5<sup>th</sup> field watershed.
4. The area under consideration occurs within the known or suspected range of a Protection Buffer bryophyte species, and there is a high probability of suitable habitat for that species in the proposed project area.

## **II. SURVEY METHODS**

### **A. Prefield Review**

A prefield review will be done to determine if known sites are present in or adjacent to the proposed project area, and to determine if probable suitable habitat for Protection Buffer bryophyte species exist in the proposed project area. Consult available information, such as the interagency known site database, GIS layers and data available for the area of interest to determine if Protection Buffer bryophyte species are known to occur in the area. Evaluate the available information to determine the location and habitat of populations of the target bryophyte species. Mark the locations of known and reported sites on topographic maps such as a 7.5 minute USGS topographic map and on aerial photos to be used in the field survey.

Evaluate available information to determine if suitable habitat for Protection Buffer bryophyte species may exist in the proposed project area. Habitat conditions for each bryophyte species is described in Section II of this document, and the current known site database. To determine if these habitat conditions exist in the proposed project area, consult information sources such as GIS layers of potential or current vegetation, stand age maps, stand exam data, ecology program databases, Current Vegetation Survey (CVS) data, botany program survey records, predictive habitat models (if available), and individuals knowledgeable of the project area and the ecological requirements of the target bryophyte species. Delineate the areas of probable suitable habitat for the Protection Buffer species on topographic maps and aerial photos to be used in the field survey.

The prefield review will identify known and reported sites of Protection Buffer bryophyte species and areas of suitable habitat for these species within the proposed project area. These are the areas where the survey will be conducted. Field surveys are required if the species is known to exist in the proposed project area or in the vicinity, or if it is determined that suitable habitat for Protection Buffer bryophyte species is likely to exist in the proposed project area. Documentation of the prefield review will become part of the administrative record.

## **B. Field Survey**

The objective of the field survey is to document the presence/no detection and location of Protection Buffer bryophyte species, to describe and delineate the local population boundary and to describe the habitat conditions where the target species occurs. This data will contribute to our knowledge of the distribution and ecological requirements of the Protection Buffer bryophytes throughout the area of the Northwest Forest Plan. Better habitat and distribution information may result in significantly reducing the area considered potential suitable habitat and thus requiring survey in future years.

Field surveys will be conducted in a way as to ensure a high likelihood of locating occupied habitat. There are two different situations for field surveys. One is to visit and document a known site that is reported from or adjacent to the proposed project area. The other situation is to survey the proposed project area in areas identified as suitable habitat to determine if the Protection Buffer species is present

Conduct the field survey by traversing through and around the proposed project area, visiting areas delineated on the topographic map and aerial photos as known sites or probable suitable habitat for the target bryophyte species. Search suitable habitat and substrates for the presence of the species. Delineate on the field map and aerial photos the areal extent of the field survey and the route traversed.

The field survey will be performed at a scale and resolution fine enough to ensure a high likelihood of locating the species if it occurs in the area. Field survey for bryophyte species occurs at a fine scale, given the relatively small size of these organisms. It is necessary to look at the habitat and substrates at this level to determine the presence or no detection of the target species.

## **C. Extent of Surveys**

For the purpose of this protocol, the survey area is defined as the area on the ground anticipated to receive direct or indirect impacts from the ground-disturbing activity to the habitats or populations of the Protection Buffer bryophyte species. Direct impacts are those that cause physical disturbance to the target bryophyte species, suitable substrate or plant community within the area of a local population. Indirect impacts do not directly impact the occupied substrate or the target species, but may affect the quality of the habitat and include, but are not limited to, changes in the amount of sunlight reaching the forest floor, changes in the hydrologic regime, or other changes in the microclimatic conditions (Chen *et al.* 1995; Harris 1984).

## **D. Timing of Surveys**

In general, timing is less restrictive for bryophyte surveys than for vascular plants, although, for most of the species in this protocol, reproductive structures need to be present to positively identify the species. Surveys should be conducted during the growing season (snow free period) in order to facilitate safe and efficient field work.

### **III. Data Collection and Documentation**

#### **A. Documenting the Presence of Protection Buffer Bryophyte Species**

If populations of Protection Buffer bryophyte species are found, precisely delineate the population on 1:24,000 (or larger) scale USGS quadrangle map, or equivalent GIS generated map, and optionally on aerial photos. Complete the field form for documentation of a known site of the species, including location, and basic population and habitat information (Appendix A or equivalent form). The location will be recorded as UTM coordinates with the highest precision available, with an estimate of the degree of error associated with the location. The UTM coordinates will represent the point of the population, or the center of a polygon that represents the population. UTM coordinates may be obtained with a GPS unit, or from digitizing the location into a GIS layer. Submit this documentation for the administrative record and store in the interagency corporate database. Also, submit a copy of the completed form and map to the Regional Interagency Bryologist. A voucher specimen may be collected to verify the identification and to document the presence of the species (Appendix D), but do not collect a voucher if removal of specimens will impact the population (observe the “1 in 20 rule”).

#### **B. Documenting the No Detection of Protection Buffer Bryophyte Species**

If Protection Buffer bryophyte species were not encountered in the field survey, then document the apparent absence or no detection of the species within the survey area on Appendix A or equivalent form. Documentation should include description of survey activity sufficient to determine that an adequate areal survey at the scale of resolution needed to locate the Protection Buffer bryophyte species has been conducted within and adjacent to known site locations, and in probable suitable habitat within the proposed project area. Include in this documentation the areal extent of the survey delineated on topographic maps and optionally on aerial photos, and a record of the different habitat and ecological conditions that were searched for the species. Submit this documentation for the administrative record and file accordingly.

#### **C. Additional Information to Collect**

Collection of ecological and population data is highly recommended, and will contribute to our knowledge of the species, its ecological requirements and population trends, and will assist in our management of the species. When the objective is to collect habitat data to refine the definition of suitable habitat, then use the field forms and methods in Appendix B and C for documentation of Protection Buffer bryophyte populations. Provide a detailed description of the site location so the population of the Protection Buffer bryophyte can be easily relocated. Include an accurate delineation of the population and area surveyed on a topographic map and aerial photos (Appendix D). Record surveyor name, plot number, and date of survey. Designate plot locations with an cross (+) and unique plot number (see Appendix C for assigning plot number) on the field map. Document the ecological and habitat characteristics, abundance and extent of the population of the Protection Buffer bryophyte by installing a plot according to the methods in Appendix C, and complete field forms in Appendix B. If multiple populations are

found, install a plot in each representative habitat. If a large population is found (areal extent too big for a single plot), install a plot in the portion of the stand that is representative of the population. If significantly different habitats are encountered within a single population, install multiple plots to document the different habitats. It is important to record habitat data to describe the plant community where the species occurs, as well as data for the microsite occupied by the Protection Buffer bryophyte species.

Field data should be recorded that provides a detailed habitat description (Appendix C). Data to collect include plant association, stand age, successional stage, stand structure, average diameter of trees, canopy closure of the overstory, understory canopy cover, percent cover of tree species and dominant vascular plant species, site variables including elevation, aspect, slope, lichen line, topographic moisture (Henderson *et al.*, 1992, see pg. 8), landform, macroposition, microposition, bedrock, parent material (regolith), and condition of the habitat (*e.g.* disturbance). Specific microsite habitat attributes for the bryophyte species should include substrate information such as species, size class, decay class (if snag or down log) and bedrock type (if epiphytic on rock). Population information should include abundance of the bryophyte species, *e.g.*, actual area of the species (ft<sup>2</sup>), and extent of the population (number of trees, logs or area covered (acres). In addition, record data on vigor (*e.g.*, individuals appear healthy, stressed, declining, diseased, browsed), and threats (apparent or perceived) to the population. Optional photographs may be taken of the taxon, habitat or site. If appropriate, voucher specimens should be collected, verified, curated properly and deposited at an appropriate location.

### **1. Referencing the Site and Population**

If the objective for the known site is to be able to revisit and monitor the population and the habitat conditions, then the known site needs to be accurately and precisely located and permanently referenced (see Henderson *et al.* 1989, or R6 USFS CVS plot protocol 1997). Three elements of the plot need to be referenced: the plot location, the plot center, and the Protection Buffer bryophyte population. The plot location is referenced to an accessible landmark (suitable marked and with a GPS location), with a horizontal distance and azimuth to the plot center. The plot center is a point on the ground at the center of the plot that is referenced with at least 2 permanent points (*e.g.*, trees, rocks ) with measured slope distance and azimuth. The population of the Protection Buffer bryophyte is referenced with a slope distance and azimuth from the plot center. These three references will allow relocation of the plot, the plot center and the bryophyte population.

## **IV. DATA MANAGEMENT**

### **A. Data Quality Assurance**

A designated data steward for the administrative unit will be responsible for the quality and completeness of the survey data, including the prefield review and the field survey information. This includes adequate and accurate data collection, prompt and accurate data entry into the corporate database, and data storage in electronic and hard copy formats. This is an important



aspect of the protocol to ensure credibility of the interpretations, analysis or management direction based on these data. Data quality will be assured at the local level, and adhere to regional standards for implementation of the Protection Buffer provision in the Northwest Forest Plan.

## **B. Data Storage**

Data will be stored at the administrative unit (National Forest headquarters, BLM District Resource Area), and be available in a corporate database for local and regional use according to policy developed for Protection Buffer taxa and the interagency corporate database. Site locations for the Protection Buffer bryophytes will be available in a GIS layer that is linked to a database with supporting information. Electronic and hard copies will be maintained and accessible to agency personnel requiring this information to successfully implement the Northwest Forest Plan. The hard copy file will include documentation of the prefield review, field survey data, field form and field notes, topographic maps and aerial photos with survey and population locations delineated, photographs, voucher specimen location and all other supporting information.

## **V. SURVEYOR QUALIFICATIONS AND SKILLS**

The following qualifications and skills are necessary to ensure that surveys are conducted in a safe and professional manner. Personnel conducting surveys for bryophytes need to be experienced with the following:

- skilled in the recognition and identification of the Protection Buffer bryophytes and similar species, including
  - collecting methods used for bryophytes,
  - micro-techniques used for identification including the ability to make microscope slides of leaves, sporophytes, cross-sections of stems and leaves,
  - ability to distinguish different species that are often growing together,
  - ability to use the dichotomous bryological keys for the Pacific Northwest.
- experienced in field techniques to be able to locate and document the locations surveyed for and occupied by Protection Buffer bryophytes.
- education and/or experience in plant taxonomy and plant ecology within the range of the Northwest Forest Plan
- ability to accurately identify associated species and characterize the ecological conditions of the local population.
- competence in off-trail navigation using topographic maps, compass, and aerial photos.
- ability to perform surveys on steep, rugged, densely vegetated terrain.

## VI. REFERENCES

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## SECTION II SPECIES INFORMATION

### I. *Brotherella roellii* (Ren. & Card. in Roll) Fleisch.

#### A. Introduction

*Brotherella roellii* was not rated by the Forest Ecosystem Management Assessment Team (FEMAT) bryophyte viability panel because it was poorly known (USDA Forest Service and USDI Bureau of Land Management 1994a). It was listed in the Record of Decision Table C-3 as a Strategy 1 and 3 species, with direction to manage known sites and conduct general inventories (USDA Forest Service and USDI Bureau of Land Management 1994b). This species was also referenced in Mitigation Measure Step 5 from the Scientific Analysis Team Report (Thomas *et al.* 1993) and was included as a “Protection Buffer Species”. Other designations include Washington Natural Heritage Program State ranking S2 (Imperiled in Washington because of rarity or because it is vulnerable to extinction or extirpation; typically 6 to 20 occurrences) and The Nature Conservancy Global Rank 3 (rare, uncommon, or threatened, but not immediately imperiled, typically with 21-100 occurrences) (Washington Natural Heritage Program 1997).

#### B. Morphology and Reproduction

*Brotherella roellii* is a shiny golden yellow-green moss with ovate-lanceolate, slightly curved, concave leaves. It can be confused with *Hypnum circinale*, a similar species that may grow in association with the *Brotherella*. *Hypnum circinale* is a slightly larger moss, dull grayish-blue-green color, with longer, linear falcate or circinate leaves. Microscopic characteristics must be used to distinguish between the two species. In *H. circinale*, the alar cells (marginal cells in the bottom lower corners of the leaves) are few, quadrate to rectangular and slightly inflated. In *B. roellii*, the alar cells are strongly inflated, and usually there is a row of enlarged cells that extend across the leaf base. The cortical cells (cells on the outside of the stems) are small and thick-walled in *H. circinale*, and inflated in *B. roellii*. To observe the cortical cells, cross-sections of the stems need to be made.

Technical description: Plants are irregularly pinnate, 0.5-3 mm long, with branches 0.5-1 mm wide when dry. Leaves are 0.8 - 1.2 mm long, ovate-lanceolate, acuminate, concave and often secund (leaves directed or twisted toward one side of the stem). The costa is lacking, or double and very short. The alar cells are strongly inflated and often a row of enlarged cells extends across the leaf base. The cortical cells are inflated and larger than the interior cells.

*Brotherella roellii* is autoicous with the capsule produced on a 0.6 - 1 cm long seta. The capsule is erect to somewhat inclined, straight or slightly zygomorphic, 1- 1.5 mm long. The operculum (lid to the capsule) is long and narrow. References which provide assistance in identifying this species include Christy and Wagner 1996, Lawton 1971.

### **C. Habitat**

*Brotherella roellii* forms small glossy, golden yellow-green mats on rotten logs, stumps and the bases of red alder (*Alnus rubra*) trees in mixed deciduous and coniferous forests, usually at low elevations on slopes, stream terraces and swampy floodplains (Christy and Wagner 1996). According to Schofield (pers. comm.) it appears to prefer old rotten big-leaf maple (*Acer macrophyllum*) logs. On rotten logs it often occurs with the following bryophyte species: *Hypnum circinale*, *Tetraphis pellucida*, *Lepidozia reptans*, *Blepharostoma trichophyllum* and *Cephalozia media*.

*Brotherella roellii* grows at low elevations and forms mats on rotten logs, stumps and the bases of red alder trees in open, mixed coniferous and deciduous forest, on slopes, stream terraces and swampy floodplains (Christy and Wagner 1996). It does not appear to be closely associated with old-growth forest.

### **D. Range of *Brotherella roellii***

#### **1. Known Range**

*Brotherella roellii* is endemic to the Pacific Northwest and is known only from southwestern British Columbia and Washington. There are five historic records from Washington. One of the sites occurs on federal land on the Olympic National Forest (Jefferson County). The other four records occur in Pierce, Skagit, and Pacific counties, and may or may not be on federal land (Figure 1).

#### **2. Suspected Range**

*Brotherella roellii* is suspected to occur along the coast and low elevation valley bottoms of the Olympics and Cascades of Oregon and Washington, south through the Willamette Valley (Christy and Wagner 1996). Additional surveys in these areas are needed to determine the extent of its range.

### **E. Timing of Surveys**

In general, timing is less restrictive for bryophyte surveys than for vascular plants, given the presence of bryophytes year round, and ability at any time of year to accurately identify *Brotherella roellii*. However, surveys should be conducted when the bryophytes are visible. Sporophytes aid in identification of this species, but do not need to be present to identify this species.

### **F. Threats**

Because this species inhabits lowland areas and occurs on lower tree bases and rotten wood, it is vulnerable to special forest product harvest, such as moss or firewood gathering. Additional threats to this species include logging, road building and trail construction which might alter the microhabitat conditions necessary for this species.

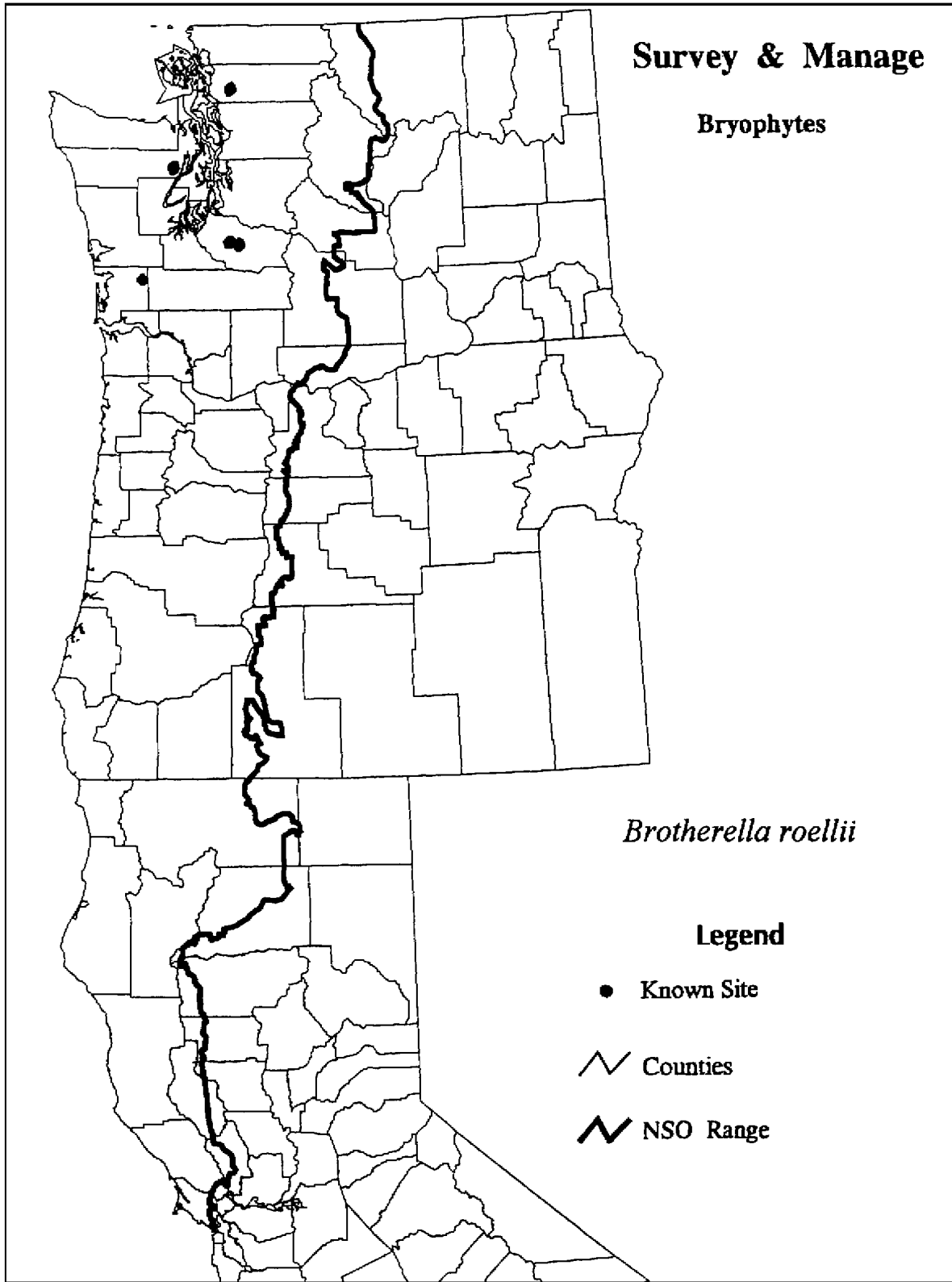


Figure 1. Known sites of *Brotherella roellii* (includes all known sites as of Nov. 1, 1998).

## II. *Buxbaumia viridis* (DC.) Moug. & Nestl.

### A. Introduction

*Buxbaumia viridis* was included in the list of species covered by Mitigation Step 5 of the Scientific Analysis Team Report (Thomas *et al.* 1993). The panels convened by the Forest Ecosystem Assessment Team (FEMAT) included *B. viridis* in the group of less common decaying wood species (USDA Forest Service and USDI Bureau of Land Management 1994a). Their viability ratings under the original Option 9 indicated a high level of confidence that species within this group would remain well distributed throughout their range. However, in the Record of Decision, the species referenced in the Mitigation Measure Step 5 from the Scientific Analysis Team Report were included as “Protection Buffer Species” (USDA Forest Service and USDI Bureau of Land Management 1994b). Other designations include Washington Natural Heritage Program state ranking SU (Status uncertain; additional information is needed) and The Nature Conservancy Global Rank 5 (demonstrably widespread, abundant, and secure) (Washington Natural Heritage Program 1997).

### B. Morphology and Reproduction

*Buxbaumia viridis* is a small annual bryophyte that develops a sporophyte from an ephemeral protonema (Crum and Anderson 1981, Christy and Wagner 1996). Because a gametophytic generation is reduced and not persistent, identification of this species depends on the presence of a mature sporophyte. Young sporophytes are green. Mature sporophytes are yellow-brown to brown and have the peristome teeth exposed.

To distinguish between *B. viridis* and *B. piperi* mature sporophytes must be present. The primary feature used to separate these species is the cuticle on the upper surface of the capsule. In *B. piperi*, the cuticle peels back around the “mouth” of the capsule, while in *B. viridis* the cuticle tears the full length of the capsule and peels back along the margins of the urn. *Buxbaumia aphylla*, a rare species that occurs on nutrient-poor soil in exposed places also has a cuticle that peels back from the mouth of the capsule (Christy and Wagner 1996).

Technical Description: The seta is 5-8 mm long with a slightly swollen base. The capsule is 5-6 mm by 2.3-3 mm in size, flattened on the dorsal side and rounded on the ventral, not glossy, green when young and yellowish-brown to brown when mature. In mature capsules, the cuticle on the upper surface splits down the length of the urn and peels back along the margins.

*Buxbaumia viridis* is dioicous. Male plants are minute, located on the protonemal mat, and consist of a single clam-shell shaped bract containing a single antheridium. Female plants, also on the protonemal mat, usually consist of a single archegonium. The operculum (lid) is bluntly conic, and the peristome teeth are strongly papillose. References which provide assistance in identifying this species include Christy and Wagner (1996), and Lawton (1971).

## **C. Habitat**

*Buxbaumia viridis* occurs on very well rotted logs (decay class three, four, and five) and peaty soil and humus, in coniferous forests, from low elevation to subalpine. It is found on very well rotted logs (decay class four and five) on the west slopes of the Cascades. On the eastern slopes of the Cascades it occurs on logs that are extremely decayed and appear to have “melted” into the soil (Holmberg, pers. comm.). It occasionally occurs on peaty soil and humus. Associated species occasionally found on rotten logs with *B. viridis* include *Buxbaumia piperi*, *Tetraphis geniculata*, *T. pellucida*, *Hypnum circinale*, *Ptilidium californium*, and *Lepidozia reptans*.

## **D. Range of *Buxbaumia viridis***

### **1. Known Range**

*Buxbaumia viridis* is known from 45 records from 18 locations in Washington, Oregon and California. Sites on federal lands include: Willamette National Forest (Lane, Linn counties), Winema National Forest (Klamath County), Deschutes National Forest (Deschutes County), Mt. Hood National Forest (Hood River or Wasco counties), Rogue River National Forest (Jackson County), Roseburg District BLM, (Douglas County), Eugene BLM (Lane and Linn Counties), and Salem District BLM (Lincoln County) in Oregon; Gifford Pinchot National Forest (Skamania County), Olympic National Park (Clallam County), Mt. Rainier National Park (Pierce County), Mt. Baker-Snoqualmie National Forest (Whatcom County) in Washington. One site reported from northern California in Mendocino County needs to be verified (Figure 2).

### **2. Suspected Range**

*Buxbaumia viridis* is suspected at low to middle elevations from northern California into Washington throughout the range of the Northwest Forest Plan.

## **E. Timing of Survey**

Surveys must be conducted when mature sporophytes are visible. Timing of maturity of sporophytes depends on location and other factors. Mature sporophytes must be present before you can determine which species of *Buxbaumia* you have found (see section II B, Morphology and Reproduction for species identification information). When green sporophytes are found, the area needs to be marked and re-visited. Because we do not know how long it takes a green sporophyte to mature it will take multiple visits back to the site to determine which species is there. Another reason that it is often difficult to determine which species is present is that something often eats the sporophytes. When this occurs, it is not possible to determine if *Buxbaumia viridis* is present or absent, thus additional visits to the location would be needed the following year.

## **F. Threats**

Removal of large coarse woody debris would eliminate substrate for rotting wood-inhabiting bryophytes in harvested stands. Harvest of moss as a special forest product from logs could lead to the destruction of populations.

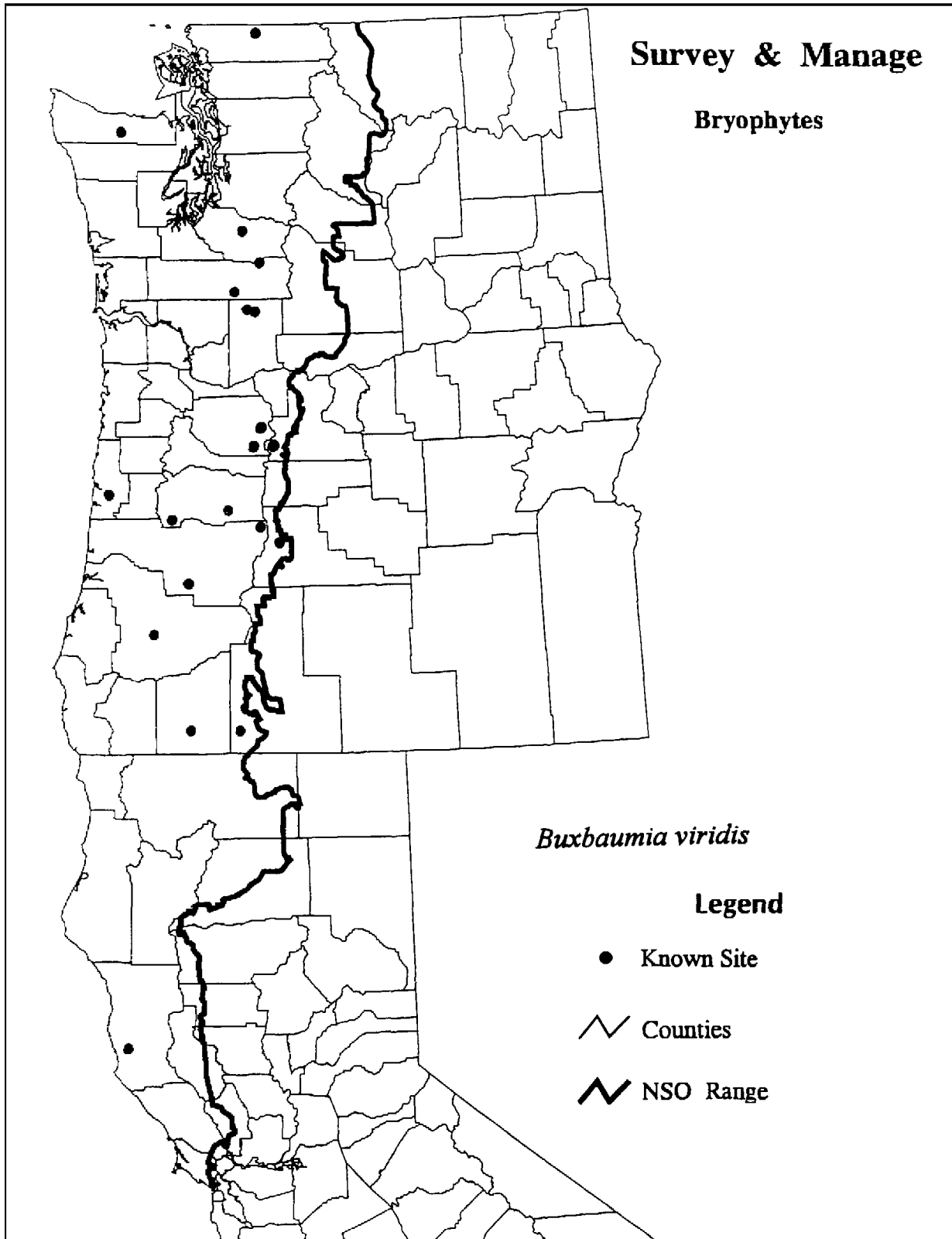


Figure 2. Known sites of *Buxbaumia viridis* (includes all known sites as of Nov. 1, 1998).



### III. *Rhizomnium nudum* (Britt. & Williams) Kop.

#### A. Introduction

*Rhizomnium nudum* was included in the list of species covered by Mitigation Step 5 of the Scientific Analysis Team (SAT) Report (Thomas *et al.* 1993). In the Record of Decision, the species referenced in the Mitigation Measure Step 5 from the SAT Report were included as “Protection Buffer Species” (USDA Forest Service and USDI Bureau of Land Management 1994b). Other designations include The Nature Conservancy Oregon State Rank S1 (critically imperiled in Oregon because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences), Global Rank 4 (contains taxa which are of conservation concern but are not currently threatened or endangered), and List 3 (more information is needed before status can be determined, but may be threatened or endangered in Oregon or throughout range (Oregon Natural Heritage Program 1998), and BLM Oregon, Washington Tracking Species (USDI Bureau of Land Management 1998).

#### B. Morphology and Reproduction

*Rhizomnium nudum* is a fairly large, robust, dark green moss with broadly elliptic leaves, up to 8 mm long. The color darkens in dried specimens. The stems are naked with rhizoids confined to the base of the stem.

*Rhizomnium nudum* is distinguished from *R. glabrescens*, *R. magnifolium* and *R. pseudopunctatum* by making leaf cross-sections and looking for the marked thickenings on the end of the cell walls. These triangular thickenings combined with the absence of rhizoids on the stem separates *R. nudum* from the three species listed above.

Technical description: Plants are 1-5 cm tall with naked reddish-brown stems, the rhizoids are confined to the base. Leaves are 3-6 by 4-9 mm, obovate to nearly circular in outline, obtuse, and lack an apiculus. The costa is broad at the base, and usually ends before the apex. Median leaf cells are large, hexagonal, 50-60 x 85-150  $\mu$ m; cross-sections reveal triangular thickenings at each end of the cell wall. Leaf margins are bordered by 2-4 rows of long, narrow cells. Plants are glossy and not contorted when dry. References which provide assistance in identifying this species include Christy and Wagner (1996), Lawton (1971), and Koponen (1973).

*Rhizomnium nudum* is dioicous with numerous antheridia (mixed with orange paraphyses) in a terminal disk-like head. Capsules are pendent, single and exerted on a seta 1-2.5 cm long. Peristome teeth are greenish-yellow.

## C. Habitat

*Rhizomnium nudum* occurs on moist forest humus or soil, in coniferous forests mostly at mid to high elevation, sometimes near seepage areas. It extends into alpine sites with late-persisting snow beds (Schofield 1976).

Information regarding associated vascular plant species is very limited. One site on the Mt. Baker-Snoqualmie National Forest at Barlow Pass occurs in the Pacific Silver Fir/Devil's Club-Alaska Huckleberry (*Abies amabilis*/*Oplopanax horridum*-*Vaccinium alaskaense*) plant association in a patch of devil's club and ladyfern (*Athyrium filix-femina*). Two sites are reported from Boulder Ridge in the Baker Lake basin; one within a patch of devil's club and the other in a salmonberry (*Rubus spectabilis*) thicket. Another site on the Mt. Baker-Snoqualmie National Forest was found under a patch of salmonberry, also in the Pacific silver fir zone. These sites are all in small canopy gaps within the context of old-growth forest.

## D. Range of *Rhizomnium nudum*

### 1. Known Range

*Rhizomnium nudum* is known from 54 sites in Washington and several sites in Oregon. Most of the sites are located on federal land and include: Olympic National Park (Clallam and Jefferson counties), Mt. Rainier National Park (Pierce County), Gifford Pinchot National Forest (Lewis and Skamania counties), Mt. Baker-Snoqualmie National Forest (King, Snohomish and Whatcom counties), Willamette National Forest (Linn County), and Mt. Hood National Forest (Clackamas and Wasco counties). There is one non-federal land site in Snohomish County, Washington (Figure 3).

### 2. Suspected Range

Suspected range for *R. nudum* is the Pacific Silver Fir Zone and higher elevations in Washington occurs on the Olympic Peninsula and along the west slope of the Cascades above 200 m (650 ft). The range in Oregon is above 975 m (3200 ft) in the vicinity of the Cascade crest. It appears to be more abundant in Washington but this may result from lack of collecting in other locations.

## E. Timing of Survey

In general, timing is less restrictive for bryophyte surveys than for vascular plants, given the presence of bryophytes year round, and ability at any time of year to accurately identify *R. nudum*. However, surveys should be conducted when the bryophytes are visible.

## F. Threats

The major concern for *R. nudum* is loss of populations due to management activities that impact the habitat or the populations. Threats to this species include logging, road building and trail construction which might alter the cool, moist microclimatic conditions necessary for this

species. Harvest of moss as a special forest product could impact this species by incidental collection.

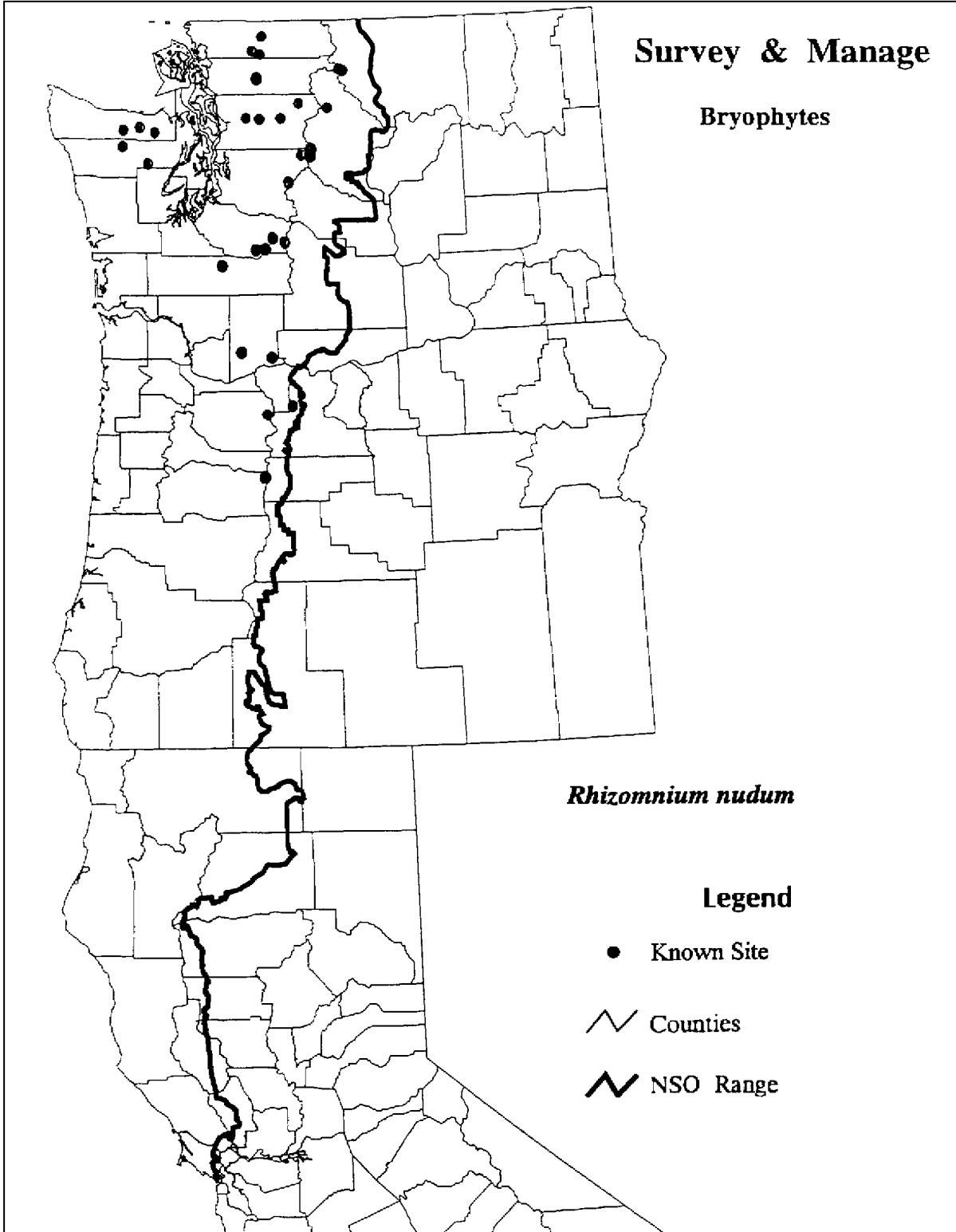


Figure 3. Known sites of *Rhizomnium nudum* (includes all known sites as of Nov. 1, 1998).

## IV. *Schistostega pennata* (Hedw.) Web. & Mohr

### A. Introduction

*Schistostega pennata* was considered a rare species within the range of the Northwest Forest Plan, with occurrences documented only from Washington. It was included in the list of species covered by Mitigation Step 5 of the Scientific Analysis Team Report (Thomas *et al.* 1993). The bryophyte viability panel convened by the Forest Ecosystem Assessment Team included *S. pennata* in the group of rare species rated separately. Panel members indicated that the species was dependent on high humidity and dense shade. The viability rating under the original Option 9 indicated a high level of confidence this species would remain well distributed throughout its range. However, in the Record of Decision (USDA Forest Service and USDI Bureau of Land Management 1994b), the species referenced in the Mitigation Measure Step 5 from the Scientific Analysis Team Report (Thomas *et al.* 1993) were included as Protection Buffer species. Other designations include:

- The Nature Conservancy Oregon State Rank S1 (critically imperiled in Oregon because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.), Global Rank 4 (contains taxa which are of conservation concern but are not currently threatened or endangered), and List 2 (contains species which are threatened, endangered or possibly extirpated from Oregon, but are stable or more common elsewhere (Oregon Natural Heritage Program 1998).
- BLM Oregon, Washington Assessment Species (USDI Bureau of Land Management 1998)
- Washington Natural Heritage Program State Rank S2 (imperiled in Washington because of rarity or because it is vulnerable to extinction or extirpation; typically 6 to 20 occurrences.) (Washington Natural Heritage Program 1997).

### B. Morphology and Reproduction

*Schistostega pennata* forms small fern-like leafy shoots on mineral soil in crevices of root wads of fallen trees. One of the key characteristics of this species is the formation of a “glow-in-the-dark” protonema that reflects a greenish-gold color. Because of this unique protonemal mat, *S. pennata* is capable of surviving in areas with very limited light and therefore occurs in areas where other bryophytes cannot. If the light intensity becomes too high, other bryophytes invade and *S. pennata* disappears (Christy and Wagner 1996). Other species often associated with *S. pennata* include *Fissidens bryoides*, *Epipterygium tozeri*, and several species of *Pohlia*.

*Schistostega pennata* can be readily distinguished from the similar species. *Fissidens bryoides* is unique in that the two sides of the leaf blade are folded together to form a pocket (vaginant laminae). These leaves are also bordered with linear marginal cells and the capsule has reddish peristome teeth. *Epipterygium tozeri* and the several species of *Pohlia* have larger leaves and they are not flattened in appearance.

Technical description: Plants form erect fern-like bluish-gray-green leafy shoots 4-7 mm tall. Leaves of sterile shoots are 0.5-1.2 mm long, in two rows in an opposite arrangement along the stem and are flattened like a fern frond. The shoots often occur in clusters. The leaves lack a costa or midrib. The ephemeral protonemal mat is composed of filamentous strands of tiny clear spherical cells which reflect light to give off a greenish-golden color. The chloroplasts move within the spherical cells to maximize their ability to collect the reflected light. The plants are not contorted when dry. References which provide assistance in identifying this species include Christy and Wagner (1996), Lawton, (1971), and Schofield (1992).

In *S. pennata*, male and female plants arise from the same protonemal mat. Male plants have narrowly lanceolate leaves and usually have two antheridia. A single archegonium develops among a rosette of lanceolate leaves. Small (0.4-0.5 mm) light brown globose capsules occur on top of an erect, 1.5- 4.0 mm tall seta. The peristome is lacking.

### **C. Habitat**

*Schistostega pennata* occurs on the mineral soil in shaded pockets of overturned tree roots, often with shallow pools of standing water at the base of the root wad. It also grows attached to rock or mineral soil around the entrance to caves, old cellars and animal burrows. In British Columbia, it is most often found near watercourses and in swampy, humid, coniferous forests (Schofield 1976). The primary microhabitat requirements for this species are dense shade, high humidity, and some source of reflection for light (*i.e.*, a pool of water).

Habitat information is limited for most of the known sites. In the Oregon Coast Range (Lincoln Co.), *S. pennata* was found on mineral soil widely spread over the undersurface of a very large tree root wad in a 400-year-old stand of western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*) forest, at 475m (1560 ft) elevation. In the North Cascades (Mt. Baker-Snoqualmie National Forest), it was found at 929 m (3050 ft) elevation on mineral soil on the bottom of a large root wad in a 500-year-old stand in the Pacific Silver Fir/Alaska Huckleberry-False lily of the valley (*Abies amabilis* / *Vaccinium alaskaense-Maianthemum dilatatum*) plant association, and in well- shaded pockets of mineral soil on a tree root wad in a 700-year-old stand of Pacific silver fir at about 1000 m (3200 ft) elevation. In southern Oregon (Umpqua National Forest), it was found in a 100-year-old stand of lodgepole pine near the crest of the Cascade Range at 1554 m (5100 ft) elevation. All of the populations occurred on mineral soil on the under surface of tree root wads. In the drier habitats in northern California, *S. pennata* may be restricted to riparian or wetland settings.

### **D. Range of *Schistostega pennata***

#### **1. Known Range**

In the Pacific Northwest *S. pennata* is known from Montana, Oregon, Washington, northward through British Columbia to Alaska. In Washington it is reported from the Olympic and Cascade Mountains in Pierce, Grays Harbor, Snohomish, King, Jefferson and Whatcom counties. In Oregon, it is reported from Lincoln and Douglas counties. *Schistostega pennata* is known from

eleven sites, with three of the sites collected in 1998. Three of the sites occur in Olympic National Park, five sites occur on the Mt. Baker-Snoqualmie National Forest, one site occurs on the Salem District BLM, one site occurs on the Umpqua National Forest, and one site occurs in the vicinity of Mt. Rainier National Park (Figure 4).

*Schistostega pennata* is rare in British Columbia, occurring near the coast, on the islands and is infrequently found in the interior mountains (Schofield 1976). Globally, its range is circumboreal but local in the Northern Hemisphere in both Eurasia and North America.

## **2. Suspected Range**

The suspected range of *S. pennata* extends from northern California north through Washington.

### **E. Timing of Survey**

In general, timing is less restrictive for bryophyte surveys than for vascular plants, given the presence of bryophytes year round, and ability at any time of year to accurately identify *S. pennata*. However, surveys should be conducted when the bryophytes are visible.

### **F. Threats**

The major concern for *S. pennata* is loss of populations due to management activities that impact the habitat or the populations. Threats to this species include logging, removal of fallen tree root wads, and recreational use of caves.

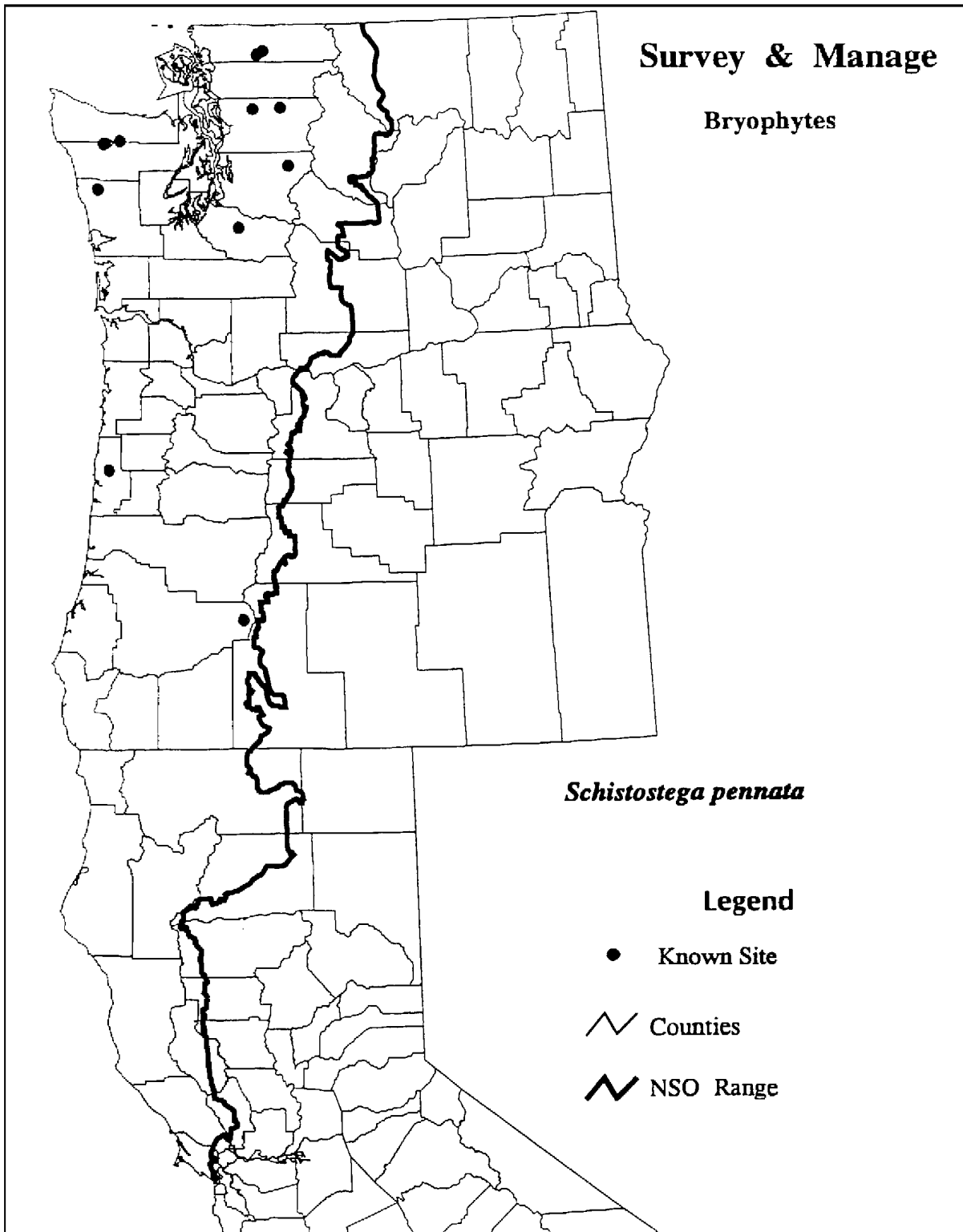


Figure 4. Known sites of *Schistostega pennata* (includes all known sites as of Nov. 1, 1998).



## V. *Tetraphis geniculata* Girg. ex Milde

### A. Introduction

*Tetraphis geniculata* was not rated during the Forest Ecosystem Management Assessment Team (FEMAT) viability panel because of the limited information on this species (USDA Forest Service and USDI Bureau of Land Management 1994a). Because it appears to be rare in the Pacific Northwest, this species was included under Survey and Manage Strategy 1 and 3 in the Record of Decision (USDA Forest Service and USDI Bureau of Land Management 1994b). This standard and guideline provides mitigation to maintain viability at the known sites and to conduct inventories to learn more about the actual extent of its range, abundance, and habitat.

In addition to being identified in the Record of Decision as a Survey and Manage species, *T. geniculata* is included as a Managed Late-successional Area Protection Buffer Species. It was included in the list of species covered by Mitigation Step 5 of the Scientific Analysis Team Report (Thomas *et al.*, 1993). Other designations include:

- The Nature Conservancy Oregon State Rank S1 (Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences.), Global Rank 4 (contains taxa which are of conservation concern but are not currently threatened or endangered), and List 3 (more information is needed before status can be determined, but may be threatened or endangered in Oregon or throughout range (Oregon Natural Heritage Program 1998)
- BLM Oregon, Washington Tracking Species (USDI Bureau of Land Management 1998)
- Washington Natural Heritage Program Rank S2 (Imperiled because of rarity or because it is vulnerable to extinction or extirpation; typically 6 to 20 occurrences) (Washington Natural Heritage Program 1997)

### B. Morphology and Reproduction

*Tetraphis* is the only moss genus which has four large peristome teeth. *Tetraphis geniculata* is distinguished from *T. pellucida*, (a very common species that produces abundant sporophytes) on the basis of the papillose (bumpy), geniculate (bent) seta. Gametophytic characteristics for both species are identical, therefore sporophytes must be present before this species can be identified.

Technical description: Plants are 7-15 mm tall and form brownish-yellow tufts. Leaves are ovate, acute, 1-2 mm long with a costa (midrib) ending before the apex. Median leaf cells are round to hexagonal, thick-walled, smooth, 8-18  $\mu\text{m}$  long. Plants are slightly contorted when dry. Gametophytic characteristics can not be used to separate this species from *T. pellucida*.

*Tetraphis geniculata* is autoicous. The seta is 7-17 mm long, twisted, geniculate near the middle and papillose above the bend. The capsule is narrowly cylindrical, yellow-brown, 1.5-3.0 mm long with four large peristome teeth. Cup-like structures are commonly produced in the tops of the leafy shoots and contain numerous disc-shaped gemmae (asexual reproductive structures) that are

dispersed by splashing water. According to Lawton (1971) these asexual reproductive structures are not commonly found in *T. geniculata*, but Crum and Anderson (1981) indicate that they do occur on this species. The key distinguishing feature is the geniculate, papillose seta. References which provide assistance in identifying this species include Christy and Wagner 1996, Lawton 1971, Crum and Anderson 1981.

### C. Habitat

*Tetraphis geniculata* forms small green to brownish-yellow tufts on well-rotted logs (decay class three, four and five) and stumps. It often occurs on the cut end of rotten logs as “pure” populations or mixed in with *T. pellucida*.

*Tetraphis geniculata* occurs on the cut or broken ends or lower half of large (usually over 15 inches in diameter in Oregon and Washington), decay class three, four and five rotted logs, or stumps, and occasionally on peaty banks in moist coniferous forests from sea level to subalpine elevations.

Habitat information from known sites is limited. On the Olympic National Forest, *T. geniculata* was found on large well-decayed logs in an old-growth stand of Sitka spruce (*Picea sitchensis*), western hemlock and Douglas-fir. On the Gifford Pinchot National Forest, *T. geniculata* was found on large legacy (derived from old-growth forest) logs in cool moist micro-climate areas in four stands ranging in age from 59 years to 461 years. The two younger stands (59 and 66 years old) had fairly high amounts of alder, cottonwood and maple with some residual conifers present. The older Gifford Pinchot sites were located in stands of western hemlock and Douglas-fir. On the Salem District BLM site (Lincoln Co.) it occurred in a 400-year-old stand of western hemlock and Douglas-fir.

In northern California, *T. pellucida* was found on large redwood logs and stumps along the coast. Assuming *T. pellucida* and *T. geniculata* co-occur here, *T. geniculata* may be restricted to sites where there is enough large (over 20 inches in diameter) coarse woody material in microsites with high humidity. Drier sites on the Mad River Ranger District (Six Rivers National Forest) and the Covelo and Upper Lake Ranger Districts (Mendocino National Forest) with a large oak or ponderosa pine element did not appear to be suitable habitat for this species. In these drier sites, the large logs are often still covered with bark and when the bark is gone the logs are very desiccated and most likely too dry to provide suitable habitat for *Tetraphis*.

This species is dependent on legacy logs and stumps derived from old-growth forest that occur in cool, moist stable microsites. In northern California it appears that stands with an oak or ponderosa pine component and very little herbaceous cover would not be provide suitable habitat for *T. geniculata*. Therefore surveys for this species should target areas where the decay class three, four or five logs occur in cool, moist stable microsites.

Other bryophyte species that are often associated with *T. geniculata* include *T. pellucida*, *Hypnum circinale*, *Rhizomnium glabrescens*, *Buxbaumia piperi*, *B. viridis*, *Aulacomnium androgynum*, *Lepidozia reptans* and *Scapania bolanderi*.

## D. Range of *Tetraphis geniculata*

### 1. Known Range

*Tetraphis geniculata* occurs from sea level to subalpine elevations. It appears to be more abundant in Washington but this may result from lack of collecting in other locations. *Tetraphis geniculata* is usually associated with *T. pellucida*, which is known from all states and provinces in the Pacific Northwest.

*Tetraphis geniculata* is known from nine sites in Washington and Oregon. In Washington on federal lands it is known from the Olympic National Forest (Grays Harbor County), Olympic National Park (Jefferson County), Mt. Rainier National Park (Pierce County), and Gifford Pinchot National Forest (Skamania County). There is one site from King County that does not occur on federal land. In Oregon, it was recently found on the Mt. Hood National Forest (Clackamas County), and on Salem District BLM (Lincoln County) (Figure 5).

### 2. Suspected Range

The suspected range for *Tetraphis geniculata* extends from northern California to Washington throughout the range of the Northwest Forest Plan.

There is strong evidence to support that *T. geniculata* and *T. pellucida* occupy the same habitat within the same geographical area. Iwatsuki (1962, 1972) cites the occurrence of *T. geniculata* and *T. pellucida* together on rotten logs in Japan. Froman (1961) notes the occurrence of both species growing together on the same substrate in New Hampshire. Finally Chuang (1973) states, "Since *T. geniculata* Girg. is also present in the same east Asian areas as *T. pellucida*, it is possible that this species is also present in Taiwan; the two species are indistinguishable in the vegetative condition". Because *T. pellucida* has been collected from several locations in northern California (near Eureka, and Trinidad, Humboldt County, near Big River City, Mendocino County, and Sisson, Siskiyou County [Watson 1880, Kock 1950]), it is reasonable to assume that *T. geniculata* could be found in northern California. Furthermore since there is a historical collection of *T. pellucida* from Sission (now called Mt. Shasta City) in Siskiyou County we have to assume that *T. geniculata* could be present in the vicinity of Mt. Shasta City. Recent bryological surveys in the remaining potential suitable habitat around Mt. Shasta City failed to locate any populations of either species of *Tetraphis*. Additional information on this historical site is necessary. Based on current information, it appears that this area may not represent suitable habitat for *Tetraphis*.

## E. Timing of Survey

In general, timing is less restrictive for bryophyte surveys than for vascular plants, given the presence of bryophytes year round, and ability at any time of year to accurately identify *T. geniculata*. However, surveys should be conducted when the bryophytes are visible. Sporophytes need to be present in order to identify this species. Sporophytes for this species are usually persistent throughout the year.

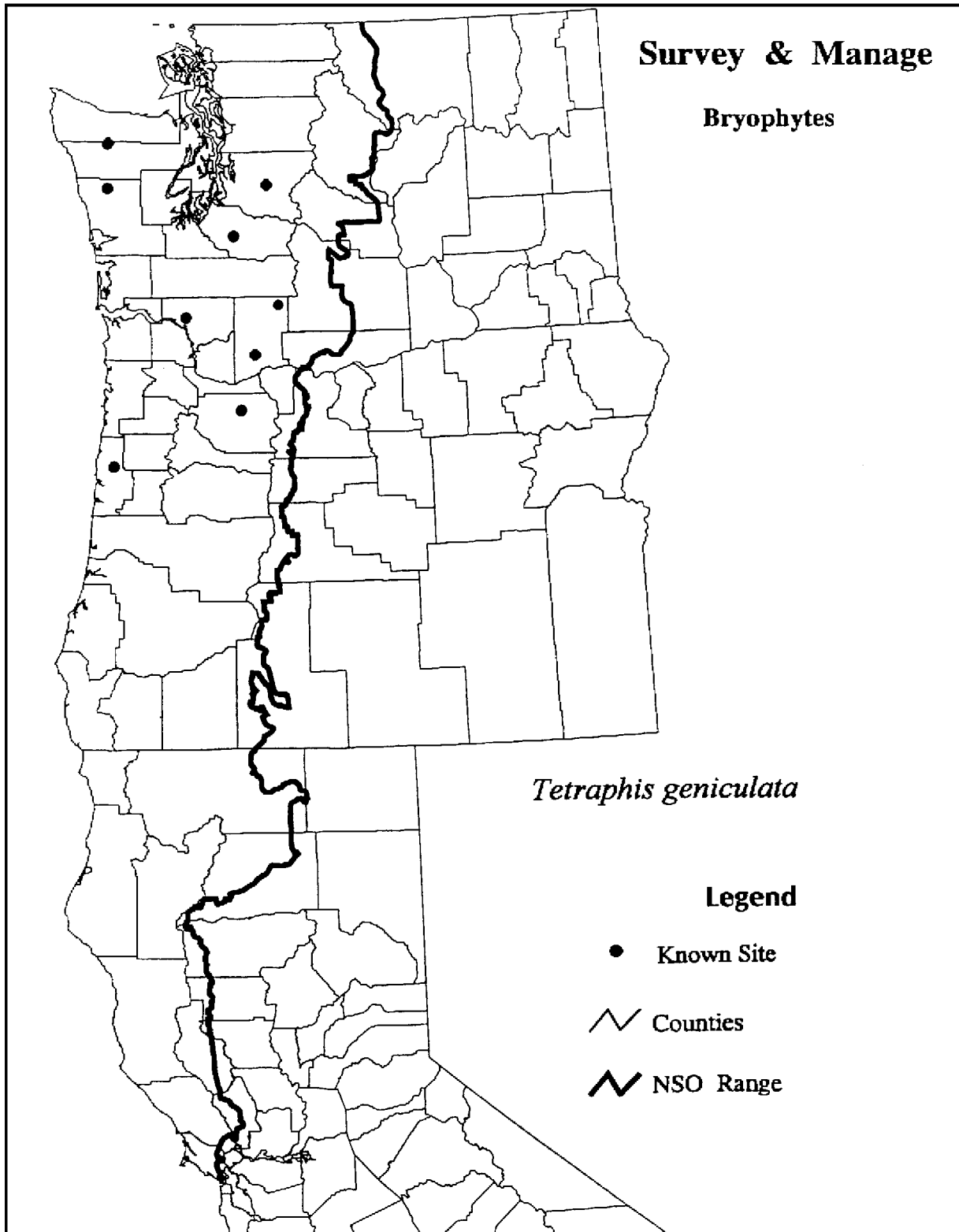


Figure 5. Known sites of *Tetrapihis geniculata* (includes all known sites as of Nov. 1, 1998)

## **F. Threats**

The major concern for *T. geniculata* is loss of populations due to management activities that affect the habitat or the populations. Threats to this species include logging, road construction and campground construction which could alter the cool moist microclimate conditions necessary for this species. The removal and disturbance of large coarse woody debris could eliminate the substrate needed for this species. Although it is not a “target” special forest products species, collection of moss could lead to the incidental removal of this species.

## VI. *Ulotia megalospora* Vent. in Roll.

### A. Introduction

*Ulotia megalospora* was included in the list of species covered by Mitigation Step 5 of the Scientific Analysis Team Report (Thomas, *et al.* 1993). The bryophyte viability panels convened by the Forest Ecosystem Assessment Team (FEMAT) included *U. megalospora* in the group of exterior canopy twig species. The viability ratings under the original Option 9 indicated a high level of confidence that this group would remain well distributed throughout its range. However, in the Record of Decision the species referenced in the Mitigation Measure Step 5 from the Scientific Analysis Team Report were included as “Protection Buffer Species” (USDA and USDI 1994b). There are no other designations for this species.

### B. Morphology and Reproduction

*Ulotia megalospora* is a small, creeping, very flattened, green to yellow-green moss found on the trunks and twigs of conifers, hardwoods and shrubs. Populations found in the canopy of conifers often are not very flattened but may form loose, tufted clumps.

The key diagnostic feature to distinguish *U. megalospora* from other epiphytic mosses such as *Orthotrichum consimile*, *O. pulchellum*, and *Ulotia obtusculia* is the row of 1-9 (rarely up to 12) clear cells that are on the leaf apex. The large spores also help to separate *U. megalospora* from the above similar species.

Technical description: Plants are prostrate, branched, creeping stems (sometimes tufted) up to 1.5 cm long. Leaves are long, lanceolate, from a spoon-shaped base; apex is acute to filiform ending in a single row of 1-9 (12) clear cells. The costa ends before the apex. Median cells are rounded to somewhat elongate 7-9  $\mu\text{m}$  in diameter with small, low papillae. The basal cells are elongate.

*Ulotia megalospora* is autoicous and is often found fruiting. The capsule is 1.5-2.2 mm long, more or less pyriform, ribbed when dry and exerted on a seta 2-3.5 mm long. The stomata within the cell wall of the capsule are superficial. The spores are 33-35  $\mu\text{m}$  (rarely to 60  $\mu\text{m}$ ) and covered with large papillae. References which provide assistance in identifying this species include Christy and Wagner (1996), and Lawton (1971).

### C. Habitat

*Ulotia megalospora* appears to be common throughout the area of the Northwest Forest Plan in Oregon and Washington and it is well established on both the understory shrub species and in the canopy, in all stand ages from sea level to subalpine elevations.

At the present time it appears that in northern California, *Ulotia megalospora* may occur only in Douglas-fir/mixed evergreen stands of various ages. *Ulotia megalospora* has been collected from the following tree and shrub species: red alder (*Alnus rubra*), ocean-spray (*Holodiscus discolor*),

chinquapin (*Castinopsis chrysophylla*), hazelnut (*Corylus cornuta*), Pacific dogwood (*Cornus nuttallii*), big-leaf maple (*Acer macrophyllum*), chokecherry (*Prunus virginiana*), vine maple (*Acer circinatum*), cascara (*Rhamnus purshiana*), bitter cherry (*Prunus emarginata*), Pacific rhododendron (*Rhododendron macrophyllum*), devil's club (*Oplopanax horridum*), and several species of huckleberry (*Vaccinium* spp.), white fir (*Abies concolor*), noble fir (*Abies procera*), subalpine fir (*Abies lasiocarpa*), Douglas-fir, and western hemlock. Substrates in northern California include the following tree and shrub species: tan oak (*Lithocarpus densiflora*), alder (*Alnus* sp.), canyon live oak (*Quercus chrysolepsis*), and Douglas-fir. Surveys for this species should include looking at the shrub and tree species listed above as well as examining recently fallen limbs or tree tops.

#### **D. Range of *Ulotia megalospora***

##### **1. Known Range**

*Ulotia megalospora* is endemic to the Pacific Northwest and occurs in southeastern Alaska, British Columbia, Washington, Oregon, and northern California. *Ulotia megalospora* is well established throughout the range of the Northwest Forest Plan in Oregon and Washington from sea level to the Cascade Crest. Currently, two populations are known just east of the Cascade Crest in westside forest conditions.

In northern California, this species has been found in Humboldt and Del Norte Counties. There are numerous records in the current database with most occurring on federal lands. Well over one hundred known sites have been documented (Figure 6) and new records are being added frequently.

##### **2. Suspected Range**

The suspected range of *Ulotia megalospora* is from sea level to the Cascade Crest in Oregon and Washington. In northern California, the suspected range includes the Outer North Coast Range and lower elevation Klamath Range (Sawyer and Keeler-Wolf 1995), but it could extend beyond this area to the Cascade Crest.

#### **E. Timing of Survey**

In general, timing is less restrictive for bryophyte surveys than for vascular plants, given the presence of bryophytes year round, and ability at any time of year to accurately identify *U. megalospora*. However, surveys should be conducted when the bryophytes are visible. Sporophytes, when present aid in identification of this species, but do not need to be present to identify this species.

## **F. Threats**

It appears that this species is well distributed within the range of the Northwest Forest Plan and is not considered at risk.



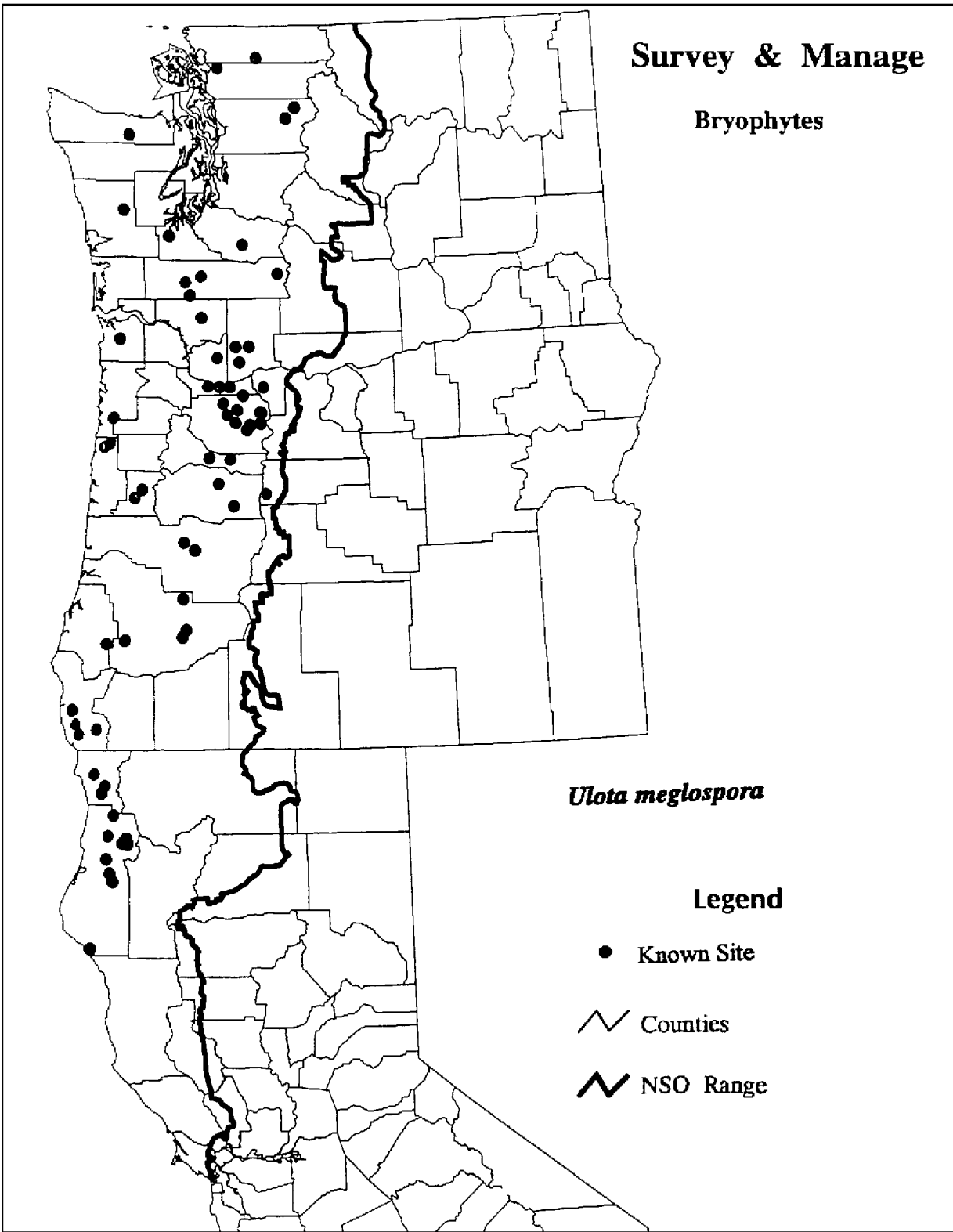


Figure 6. Known sites of *Uloa meglospora* (includes all known sites as of Nov. 1, 1998).

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Appendix A.

Field Form for Documenting Presence/No Detection and Habitat for SURVEY AND MANAGE AND PROTECTION BUFFER BRYOPHYTES

Map ID: \_\_\_\_\_ Date of Survey: \_\_\_\_\_

Surveyor(s) \_\_\_\_\_

Species documented: \_\_\_\_\_

Species surveyed for, but not located: \_\_\_\_\_

Land Ownership: BLM USFS Other \_\_\_\_\_

Forest and District/BLM District and Resource Area (name, not number) \_\_\_\_\_

Land Allocation: LSR MLSA matrix ACEC RNA BSIA RR Wilderness Other \_\_\_\_\_

State \_\_\_\_\_ County \_\_\_\_\_ Quad Name \_\_\_\_\_ 7.5 15 min.

Specific Location: (fill out either latitude/longitude or UTM to 150 ft. level of accuracy)

Lat. \_\_\_\_° \_\_\_\_' \_\_\_\_" Long. \_\_\_\_° \_\_\_\_' \_\_\_\_" Meridian: Willamette Mt. Diablo Humboldt

UTM X \_\_\_\_\_ Y \_\_\_\_\_ UTM Zone: \_\_\_\_\_

Legal Description: T \_\_\_\_\_ R \_\_\_\_\_ S \_\_\_\_\_ 1/4 of \_\_\_\_\_ 1/4

Location: \_\_\_\_\_

Stand Structure/Composition: \_\_\_\_\_

Plant Association \_\_\_\_\_

Successional Stage/Stand Age: \_\_\_\_\_

Vegetation Zone/Series: \_\_\_\_\_

Aspect: \_\_\_\_ degrees Elevation: \_\_\_\_\_ feet meters

Slope: \_\_\_\_% steep, moderate, gentle, flat Light: full sun, partial shade, full shade

Landform: ridgetop, upper slope, mid slope, lower slope, valley bottom, riparian

Topographic Moisture: extremely dry; very dry; dry, well-drained; dry mesic; mesic; moist mesic; moist, well-watered; wet; standing water

Microsite moisture: dry, mesic, moist, wet

Habitat: forest, meadow, wetland, seep, spring, waterfall, intermittent stream, perennial stream, river, wetland, margin of lake or pond, splash zone, high water line, submerged, cut bank, along a trail, along roadside

Other: \_\_\_\_\_ Threats: \_\_\_\_\_

Photographs Taken? Yes No (if yes, of taxon or habitat)

Fill out the following if species was located: New Site? Yes No

Abundance and Distribution: very rare (limited to one thallus or clump), rare (several thalli or clumps) restricted to small area (e.g., one tree); occurring sparsely throughout \_\_\_\_ (size) area; occurring commonly throughout \_\_\_\_ (size) area; occurring abundantly throughout \_\_\_\_ (size) area

Substrate: Mineral soil: gravel, sand, loam, silt, clay Other \_\_\_\_\_

circle Organic: litter (deciduous, conifer), duff, wood, peat, moss Other \_\_\_\_\_

all Rock: granitic, metamorphic, sedimentary, igneous, volcanic, calcareous

that Feature: outcrop, cliff, crevice, underhang, terrace, boulder, talus, scree

apply Tree or Shrub: species \_\_\_\_\_ Location: base, trunk, branch, root

stump, snag, recently fallen log, rotten log (decay class if known \_\_\_\_\_),

bark, wood, tree root-wad, litterfall

Fill out the following if specimen was collected:

Collector \_\_\_\_\_ Collection Number: \_\_\_\_\_ Date: \_\_\_\_\_

Voucher sent to Regional Program for verification and forwarding to Regional Herbaria: yes no

Location of Voucher(s): \_\_\_\_\_

Identification By \_\_\_\_\_ Date of ID \_\_\_\_\_

Verified by \_\_\_\_\_ Date entered into ISMS \_\_\_\_\_

## Directions for the Bryophyte and Lichen Survey Strategy 2 Field Form

**Map ID:** Unique identifier (code), generated by field user, used to cross-reference attached maps

**Species surveyed for, but not located:** scientific name(s), including genus and species of bryophyte and lichen species for which high probability habitat was suspected, but species were not encountered during survey

**Land Ownership:** indicate the name of the Forest and Ranger District or BLM District and Resource Area

**Land Allocations:** If known, specify if this location is in a Late-successional Reserve, Managed Late-successional Area, matrix, Adaptive Management Area, Area of Critical Environmental Concern, Research Natural Area, Botanical Special Interest Area, Riparian Reserve, Wilderness. Circle all that apply. If other, describe.

**Quad Name(s):** full name(s) of the quadrangles used (do not abbreviate), circle either 7.5 or 15 min. scale

**Location:** Provide clear and detailed directions, sufficient to relocate population. Give directions from general to specific, except list the Survey site name first. Be sure to include road numbers, mileages from road junctions, and distance and azimuth (0-360 degrees) from the road. Make it clear which part is driving and which part is walking. Map the location on the appropriate topographic map (7.5 or 15 min.) and label with quad name, township, range, and section.

**Specific Location:** fill in the appropriate Meridian, (Willamette or Diablo Meridian) and either the UTM x and y coordinates and UTM Zone or the latitude/longitude in degrees, minutes, and seconds

**Stand Structure/Composition:** provide a brief description of the stand structure and or composition including dominant species of overstory and understory

**Plant Association:** fill in the correct plant association if known, and name of plant association guide used

**Successional Stage:** fill in the appropriate successional stage (i.e., young, mature, old growth) and include stand age, if known

**Abundance and Distribution:** estimate of quantity and spacing of bryophyte or lichen within the stand

**Substrate:** This information is needed for the identification of most bryophytes because substrate plays an important role in determining where a species will grow. Additional information will also help us to broaden our understanding of where these species occur and will help to confirm that the identification was correct. Specify soil characteristics with regard to duff or organic content and soil texture, parent material (rock type), and landform. If epiphytic, provide the name of the host tree or shrub species.

**Topographic Moisture:** relative amount of soil water due to gravitational redistribution of water (as function of slope shape, position, and steepness)

**Aspect:** record in degrees azimuth (0-360)

**Collector:** name of the person who collected the material

**Surveyor:** name of the person completing the survey

**Coll. Number:** number that the individual who collected the material assigned to the collection, number should correspond to their field notebook.

**Identification by:** name of the person who verified the identification of the material

**Location of Voucher:** Voucher specimens should be forwarded to the Interagency Regional Bryologist/Lichenologist, who will deposit them in the appropriate Regional Herbarium. If duplicates remain on the local USFS District or BLM Resource Area, then also specify that location. If specimen is in a personal collection, provide the name of the individual.

## **APPENDIX B. FIELD FORMS FOR PROTECTION BUFFER BRYOPHYTE SPECIES**

1. Plot Card for Site and Plant Community data
2. Cryptogam field form for recording microsite, substrate, and population information
3. Plot Reference and Location Field Form

These field forms are designed to be 5" x 8" double-sided for use in a field tatem.  
It is recommended they be copied onto rite-in-the-rain paper for field use.

**Plot Reference / Location**

Plot no. \_\_\_\_\_ Crew \_\_\_\_\_ Date \_\_\_\_\_  
 Forest-RD/loc \_\_\_\_\_  
 District-Area/loc \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
**Referencing Plot Location with Plot Reference Point (PR)**  
 Take Road to Plot Reference (PR) pt. \_\_\_\_\_  
 \_\_\_\_\_  
 Location of Plot Reference (PR) pt. is \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 PR tree: Tag no: \_\_\_\_\_ DBH \_\_\_\_\_ Species \_\_\_\_\_  
 other info on PR tree \_\_\_\_\_  
 From PR to Plot Center (PC) \_\_\_\_\_ ft at \_\_\_\_\_ deg.

**Referencing Plot Center with Reference Points (RP)**  
 RP # 1 Tree No. \_\_\_\_\_ species \_\_\_\_\_  
 From tree tag to PC \_\_\_\_\_ ft at \_\_\_\_\_ deg  
 RP # 2 Tree No. \_\_\_\_\_ species \_\_\_\_\_  
 From tree tag to PC \_\_\_\_\_ ft at \_\_\_\_\_ deg  
 RP # 3 Tree No. \_\_\_\_\_ species \_\_\_\_\_  
 From tree tag to PC \_\_\_\_\_ ft at \_\_\_\_\_ deg

**GPS Data / Population Reference**

Plot no. \_\_\_\_\_ Crew \_\_\_\_\_ Date \_\_\_\_\_  
**UTM Zone**  
 \_\_\_\_\_ UTM E \_\_\_\_\_ UTM N  
 Plot Ref. tree E N  
 Plot Center E N  
 Population E N

**Referencing Population to Plot Center**  
 Population #1: species \_\_\_\_\_  
 From Plot Center \_\_\_\_\_ ft at \_\_\_\_\_ deg.  
 Population #2: species \_\_\_\_\_  
 From Plot Center \_\_\_\_\_ ft at \_\_\_\_\_ deg.  
 Population #3: species \_\_\_\_\_  
 From Plot Center \_\_\_\_\_ ft at \_\_\_\_\_ deg.  
 Notes:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Data Dictionary for Survey and Manage /  
Protection Buffer Cryptogam Field Form

**Plot Number:** unique number for plot

**SPECIES:** taxon name

**SUBSTRATE:** substrate class for taxon: bark, wood, rock, soil, litter

**SUBSTRATE DESCRIPTION:** type and quality of substrate: e.g.

SPECIES OF TREE if epiphyte,  
tree LIVE, DEAD (<10 years, fine branches still present) or SNAG;

TYPE OF ROCK if on rock;

TYPE OF SOIL (mineral, organic, saturated);

DECAY CLASS OF LOG:

- I = recent down, fine branches still present,  
log elevated on support points
- II = bark still intact, small twigs absent,  
suspended above ground but with slight sag
- III = trace of bark, shape round, texture hard w/ large pieces,  
log sagging near ground
- IV = bark absent, shape round to oval, all of log on ground,  
texture soft
- V = well decomposed, shape oval, texture soft and powdery

**SIZE OR DBH:** size of substrate (e.g. large boulder, actual dimensions); dbh of tree

**COVER OR ABUNDANCE:** if ground species, measure percent cover  
if epiphyte, use abundance ratings 1-5;

**ABUNDANCE RATING SYSTEM**

1 = RARE, usually 1 or 2 seen, generally < 0.5% cover

2 = UNCOMMON; several seen but not conspicuous; generally 1-10 % cover

3 = COMMON; easily seen but not abundant; generally 10-25% cover

4 = VERY COMMON; easily seen and conspicuous, too many individuals to count;  
generally 25-50% cover

5 = ABUNDANT; abundant and very conspicuous; generally > 50% cover

**AREA:** actual square footage of area covered by taxon

**V** = check if voucher specimen collected

**NOTES:** space for other comments not incorporated under other fields

**BACK SIDE OF S&M CRYPTOGRAM FIELD FORM**

Use back of card to record comments and observations in more detail:

specifics on ecological distribution of taxon in stand, extent of population

population structure, reproductive individuals present

population vigor

population threats



## **Plot Reference / Location and GPS Data / Population Reference Field Form**

This field form needs to be completed with sufficient detail and accuracy so that Protection Buffer bryophyte populations can be relocated efficiently.

Forest-RD/loc or District-Area/loc are the USFS Region, Forest and Ranger district, or the BLM District and Resource Area, plus a description of the location. Record UTM coordinates.

### **Referencing Plot Location with Plot Reference Point (PR)**

This section is for establishing a plot reference point along a road or trail, or conspicuous landmark. This reference point is the key to relocating the plot.

Provide detailed mileage and road information: *e.g.* take Road 65 six miles N from town, then take Road 6520 2.3 miles east from junction with Road 65 to pullout just into the old-growth.

Location of Plot Reference: *e.g.* Douglas-fir tree on north side of road, 15 ft off road up the cutbank.

Plot Reference (PR) tree: provide tag number, dbh, species and any other distinguishing information for the plot reference tree. It may be that some other structure than a tree is used, such as a stump or large boulder. The Plot Reference point should be a permanent feature if possible.

Provide accurate slope-corrected (horizontal) distance and azimuth from the plot reference point to the plot center.

### **Referencing Plot Center with Reference Points (RP)**

This data will allow precise relocation of the plot center. It is recommended that a cedar or plastic stake be put in the ground at plot center.

Reference trees should be tagged with numbered metal tag, and species and dbh recorded. Measure the distance (nearest 0.1 ft) from the tree tag to the plot center where the stake goes into the ground.

Record the azimuth from the tree tag to the plot center.

### **Referencing Population to Plot Center**

Record the species of the population. Measure the distance (nearest 0.1 ft) from the population center to plot center. Record the azimuth from the plot center to the species population.

## APPENDIX C. Field Methods and Data Dictionary

Three field forms are included in Appendix B. Following is a description of fields and data to be collected during field surveys.

### Plot Card for Site and Plant Community data

This card is used to record data on stand and plant community conditions to characterize the habitat and ecological conditions of the site where Protection Buffer bryophyte is observed.

**PLOT NUMBER** will be the first and last initial of the surveyor followed by 2 numbers that are sequential numbers for each survey form, *e.g.* Jane Doe, plot number 2 will be **JD02**. Each plot will have a unique number. This number will appear on all plot cards for the plot, on any voucher specimens collected, map and aerial photo locations, and photographs.

**FOREST/DISTRICT** (4 digit code) or **BLM District/Resource Area**

**ELEVATION:** in feet

**ASPECT:** in degrees 1-360

**SLOPE:** in percent

**See data dictionary** for codes to be used for landform, topographic moisture, macroposition, microposition, microconfiguration (vertical and horizontal), successional stage, regolith and bedrock

**YEAR OF STAND ORIGIN:** field will be completed in office using fire history layer if available

**MAXIMUM TREE AGE:** if a tree is cored on plot, choose oldest looking tree that will produce a good core to document maximum age of trees on plot

**CC OVERSTORY:** canopy cover of overstory, which is the percent cover of the overstory layer on the plot - values 0-99%.

**CC UNDERSTORY:** canopy cover of understory, which is the percent cover of the understory layer on the plot - values from 0-99%.

**AVERAGE STAND DIAMETER:** Estimate the average diameter of dominant trees on the plot.

**SERIES: Key out** the series using the appropriate Plant Association guide for the geographical area of the survey. Record acronym for series (1st two letters of genus and 1st two letters of species, *e.g.* Western Hemlock = TSHE)

**PLANT ASSOCIATION: Key out** the plant association using the appropriate Plant Association guide for the area.

**LICHEN LINE:** Record the lichen line as observed by the average height of lichens on the tree boles. This is an indication of the average annual snow depth for recent years in the stand. Generally the alectorioid lichens give the best indication of snow depth (*Alectoria* or *Bryoria* spp).

**CREW:** record names of crew taking plot data

**TIME:** time of day plot started and finished

**PLOT SIZE:** generally a 1/10 acre plot (37.24 ft radius) is adequate to characterize the stand. Consider that the plot size should be large enough to sample the patchiness and variability in the stand, although the plot should only encompass a homogeneous plant community.

**LOCATION:** provide detailed written description on the location of the plot, using enough detail that someone else could relocate it.

**UTM :** record UTM coordinates (easting and northing), and UTM zone

**MAP:** record quad map used for documenting plot location

**AIR PHOTO:** if aerial photograph used, record the photo number where plot is marked.

**PHOTO:** record photo numbers if photographs taken at plot.

**TOPOGRAPHY AND LANDFORM:** provide a description of the topography and landform of the plot.

**STAND STRUCTURE AND SUCCESSION:** Provide verbal description with **sufficient detail to provide an image of the stand structure and successional stage**. Record qualitative comments on overstory dominants, tree regeneration, canopy structure, snags and down wood, understory dominants, horizontal and vertical structure, successional stage, and any other observations of note or interest.

### BACK SIDE OF PLOT CARD

Record scientific name of species on plot

Record percent cover of species on plot (range from 1 to 99%)

Top section for trees: record total % cover for species ( $\leq 99\%$ )

(optional to record % cover for 5 different size classes) - if these cover values are not recorded, be sure to include in the stand structure description sufficient detail to describe the tree layer, size class distribution and relative abundance for the different tree species

If trees are aged or measured, record dbh, height, age, ring count

Bottom section for understory species; divided into 2 sections for shrubs and herbs; if not enough room for all species on plot, use another card.

Record % cover for species; check in column V if voucher collected

Ph = Phenology Codes (optional):

B = bud; fl = immature flower; FL = mature flower; fr = immature fruit; FR = mature fruit; S = seed

## **APPENDIX D. CRYPTOGRAM PACKET FORM FOR VOUCHER SPECIMENS**

### FOLDING INSTRUCTIONS:

1. flip packet pattern over so folds are made from the unprinted side
2. fold down top 1/3 (section without printing)
3. fold in side panels
4. fold down top panel with label information

**CRYPTOGAMS**  
of the

**Species** \_\_\_\_\_ **Date** \_\_\_\_\_

**Substrate** \_\_\_\_\_ **Plot No.** \_\_\_\_\_

**Location** \_\_\_\_\_

**PA / Habitat** \_\_\_\_\_

**Collector** \_\_\_\_\_ **Collection No.** \_\_\_\_\_