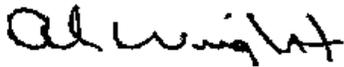


MANAGEMENT RECOMMENDATIONS
FOR
BRYOPHYTES

Version 2.0

December 1998



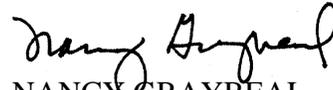
ALFRED W. WRIGHT
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BRADLEY E. POWELL
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Acting Regional Forester, Region 6
USDA Forest Service

Enclosures (2):

- 1 - Management Recommendations for *Ptilidium californicum* (Revised)
- 2 - Management Recommendations for *Radula brunnea* (Revised)

Distribution:

BLM		Forest Service	
District Managers Oregon	Field Managers	Forest Supervisors Region 6	Forest Supervisors Region 5
Coos Bay Eugene Lakeview Medford Roseburg Salem	Arcata Klamath Falls Redding Ukiah	Deschutes Gifford Pinchot Mt. Baker-Snoqualmie Mt. Hood Okanogan Olympic Rogue River Siskiyou Siuslaw Umpqua Wenatchee Willamette Winema	Klamath Lassen Mendocino Modoc Shasta Trinity Six Rivers
<u>BLM Distribution:</u> WO-230 (Room 204LS)-1 CA-330 (P.Roush)-1 CA-930-1 Field OR-014 (Field Manager)-1 OR-931 (C.McCaffrey)-1 OR-932 (P. Teensma)			<u>RO Distribution:</u> R5: Shasta Trinity-Paula Crumpton Orleans RD-John Larson R6: NR-Sarah Madsen RO-SP - 1
<u>REO Distribution:</u> Belisle -1 Knowles -1 Mohoric -1 Sims -1 Watson -1		<u>Research Unit Distribution:</u> PNW - 1 PSW - 1	

1400/ly

**United States
Department of
Agriculture**

**Forest
Service
R-5/6**

**United States
Department of
Interior**

**Bureau of Land
Management
OR/WA/CA**

Reply to: FS: 1920/2600 (FS) Date: March 3, 1999
BLM: 1630/1736-PFP (BLM-OR931)P
EMS TRANSMISSION
BLM: Instruction Memorandum No. OR-99-039
Expires 9/30/00

Subject: Survey and Manage Management Recommendations - Bryophytes

To: USDI Bureau of Land Management District Managers and Area Managers and USDA Forest Service Forest Supervisors Within the Area of the Northwest Forest Plan

Background

The Northwest Forest Plan (NFP) includes measures to protect a variety of species associated with late-successional and old-growth forests (amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropods). The Standards and Guidelines (S&Gs) require identification, mapping, and management of known sites of Component 1 Survey and Manage (S&M) species listed in Table C-3 (S&Gs, pp. C-4 to C-6, C-48 to C-61). In addition, development of species or area management plans is recommended for certain Protection Buffer species (pp. C-20 and C-27).

To implement these provisions of the NFP, the Regional Interagency Executive Committee agreed in January 1995 to have the (S&M) Work Group coordinate preparation of management recommendations (MRs) for known sites. Management recommendations (Enclosure 1) for 5 of the bryophytes listed in Table C-3 or as Protection Buffer species have been completed (MRs for the remaining 19 bryophytes were completed in 1997).

Implementation of S&M Management Recommendations - Bryophytes

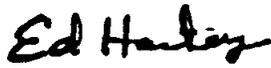
This memorandum transmits 5 bryophytes MRs to field officials for immediate implementation. Please follow the guidance (Enclosure 2) regarding use of these MRs.

Review of S&M Management Recommendations - Bryophytes

The MRs will undergo formal peer review in 1999 by selected scientists, managers, and agency staff knowledgeable about the species. In addition, all field offices are welcome to provide comments.

If you have questions or comments concerning the enclosed MRs or guidance, please address any questions to Cheryl McCaffrey (BLM), Sarah Madsen (FS R-6), or Paula Crumpton (FS R-5). They can be reached at:

- Cheryl - 503-952-6050; E-mail: cmccaffr@or.blm.gov
- Sarah - 503-808-2673; E-mail: smadsen/r6pnw@fs.fed.us
- Paula - 530-246-5222; E-mail: pcrumpton/r5_shastatrinity@fs.fed.us



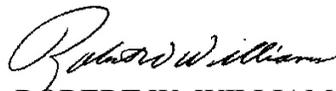
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Enclosures:

- 1 - Management Recommendations - Bryophytes
- 2 - General Guidance for Use of S&M Management Recommendations (2 pp.)

Distribution:

BLM		Forest Service	
District Managers Oregon	Area Managers California	Forest Supervisors Region 6	Forest Supervisors Region 5
Coos Bay Eugene Lakeview Medford Roseburg Salem	Arcata Redding Ukiah	Deschutes Gifford Pinchot Mt. Baker-Snoqualmie Mt. Hood Okanogan Olympic Rogue River Siskiyou Siuslaw Umpqua Wenatchee Willamette Winema	Klamath Lassen Mendocino Modoc Shasta Trinity Six Rivers
<u>BLM Distribution:</u> WO-230 (Room 204LS)-1 CA-330 (P.Roush)-1 CA-930-1 OR-014 (Area Manager)-1 OR-931 (C.McCaffrey)-1			<u>RO Distribution:</u> R5-NR: Paula Crumpton R6-NR: Sarah Madsen R6-SP - 1
<u>REO Distribution:</u> Belisle -1 Knowles -1 FS Rep -1 Sims -1 Watson -1		<u>Research Unit Distribution:</u> PNW - 1 PSW - 1	

MANAGEMENT RECOMMENDATIONS

FOR

BRYOPHYTES

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		Section No.
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<i>Pleuroziopsis ruthenica</i>	<i>Grand Palm Moss</i>	<i>2</i>
<i>Ptilidium californicum</i>	<i>Pacific Fuzzwort</i>	<i>3</i>
<i>Radula brunnea</i>	<i>Brown Flatwort</i>	<i>4</i>
<i>Rhizomnium nudum</i>	<i>Naked Round Moss</i>	<i>5</i>

December 1998

ACKNOWLEDGMENTS

The Bryophyte Management Recommendations were prepared by Judy Harpel, Nancy Fredricks, and Robin Leshner. Technical assistance was provided by John Christy, Lance Holmberg, and Wilf Schofield. Advice on technical editing of the documents was provided by Martha Brookes. The following herbaria provided specimens and assistance: University of British Columbia (UBC), University of Washington (WTU), Western Washington University (WWU), Washington State University (WSU), Oregon State University (OSU), California Academy of Science (CAS), University of California, Berkeley (UC), and San Francisco State University (SFSU). Sheila Martinson and Norm Gartley served as review coordinators and facilitated the bryophyte review panels. Bryophyte review panelists included: John Bachtel, Nancy Fredricks, Randy Gould, Lisa Hoover, Brad Keller and Robin Leshner.

SECTION NO. 1
Plagiochila satoi

Management Recommendations for
Sato's Cedarshingle
Plagiochila satoi Hatt.

version 2.0

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SUMMARY

Species: *Plagiochila satoi* Hatt. (Sato's Cedarshingle)

Taxonomic Group: Bryophyte: Liverwort

ROD Components: 1, 3

Other Management Status: None at present

Range: *Plagiochila satoi* has a North Pacific distribution and is reported from six sites in the range of the northern spotted owl: Olympic National Park, Clallam County, Washington; Clackamas, Douglas, and Lane counties (Mt. Hood and Willamette National Forests), Oregon; and Humboldt County, California. Global range extends from northern California north to Alaska, and Japan.

Specific Habitat: This species is found on tree trunks, decayed wood, and on cliffs. It occurs between 100 and 800 ft. (30 to 242 m) elevation in the Olympic National Park. In Lane County, Oregon it occurred on rock outcrops. In other portions of its range it has been collected on wet rocks along mountain streams, cliffs, decaying logs, and bases of trees in coniferous forests to 7800 ft (2360 m). It is the only *Plagiochila* species in our area that grows on trees.

Threats: Activities that alter existing stand and microsite conditions or directly affect the occupied substrate may threaten this species. Recreational use of cliffs for climbing could disturb cliff dwelling populations.

Management Recommendations:

- Maintain habitat by retaining occupied substrate, associated stand and microsite conditions near the populations.
- Restrict activities that alter stand and microsite conditions, affect occupied substrate, or remove individuals from the populations.

Information Needs: (the following are not required, see section V. in document)

- Resolve the taxonomic status of *P. satoi*.
- Determine if *P. satoi* should remain as a Survey and Manage species

Management Recommendations for *Plagiochila satoi*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Plagiochila satoi Hatt. is a taxonomically difficult species (Christy and Wagner 1996, Godfrey 1977, Schofield 1968) and it is often considered part of the highly variable *Plagiochila asplenioides* species-complex. Hong (1992) recognizes the variety *P. satoi* var. *magnum* as being distinct and occurring as a larger form between *P. asplenioides* and *P. satoi* var. *satoi*. *Plagiochila satoi* var. *magnum* can be distinguished from *P. satoi* var. *satoi* by the large size of the shoots and cells. According to Schuster (1959) "The status of *P. satoi*, as an independent species distinct from *P. asplenioides* must be regarded as uncertain". *Plagiochila satoi* is placed in the order Jungermanniales, family Plagiochilaceae.

Synonymy: none recent

B. Species Description:

1. Morphology (Christy and Wagner 1996, Godfrey 1977, Hong 1992, Inoue 1958)

Plagiochila satoi is a light green to yellowish-green plant 1.0-3.0 cm long and about 2.5 mm wide. Stems are thick, brown to yellowish-brown, sub-erect to erect and moderately forked. Leaves are succubous (overlapping like shingles on a roof), widely ovate to suborbicular with a broadly rounded apex. Leaf margins are reflexed and strongly toothed with numerous fine teeth. Leaf cells are thin-walled, with small but conspicuous trigones (three angled thickenings at the corners of the cells), cells near the base of the leaf form an incipient vitta (strips formed by elongated cells).

Plagiochila satoi shows some variation in shape and often is very difficult to distinguish from *Plagiochila asplenioides* (Godfrey 1977, Schofield 1968). Inoue (1958) separates *P. satoi* from the *P. asplenioides* on size of the plant: *P. satoi* is small (less than 3 cm long and 3 mm wide), while *P. asplenioides* is larger, more than 3 cm long and 3 mm wide. Hong (1992) considers the presence of small vitta-like cells on the leaves of *P. satoi* as the distinctive character separating it from *P. asplenioides*.

2. Reproductive Biology

Plagiochila satoi is dioicous with terminal (or just below the apex) reproductive structures; seta are about 1.5 cm long, and composed of several rows of cells. Capsules are ovoid, about 1.5 cm long and blackish-brown. According to Godfrey (1977) sporophytes are produced occasionally between April and June.

3. Ecological Roles

The ecological roles of this species are not well known at this time.

C. Range and Known Sites

In the area of the Northwest Forest Plan, this species is reported from only six sites, two in the Olympic National Park (Clallam County), Washington; Willamette National Forest, Fall Creek (Lane County); Mt. Hood National Forest, Mt. Hood (Clackamas County); Canyonville (Douglas County) Oregon; and Redwood Valley (Humboldt County), California (Figure 1). *Plagiochila satoi* has a North Pacific distribution. Although this species is common in Japan it is infrequent in Alaska and northwestern British Columbia.

D. Habitat Characteristics and Species Abundance

In the range of the northern spotted owl, *P. satoi* is the only species of *Plagiochila* to commonly occur on the bark of trees. It also is found on rock cliffs where it is often difficult to distinguish from *Plagiochila asplenioides* (Schofield 1968). According to Hong (1992) it is common on the bark of *Chamaecyparis* spp. In Japan, this species is often on rocks with thin layers of humus or soil. Information on abundance is unknown.

II. CURRENT SPECIES SITUATION

A. Why Species Is Listed Under Survey and Manage Standard and Guideline

Plagiochila satoi was not rated by the bryophyte panel convened by the Forest Ecosystem Management Assessment Team due to the lack of information (USDA and USDI 1994a). Because of only six known sites in the region, this species was listed under Survey and Manage Strategies 1 and 3 in the Record of Decision (USDA and USDI 1994b) to manage known sites and to conduct inventories to determine its distribution and identify sites for management.

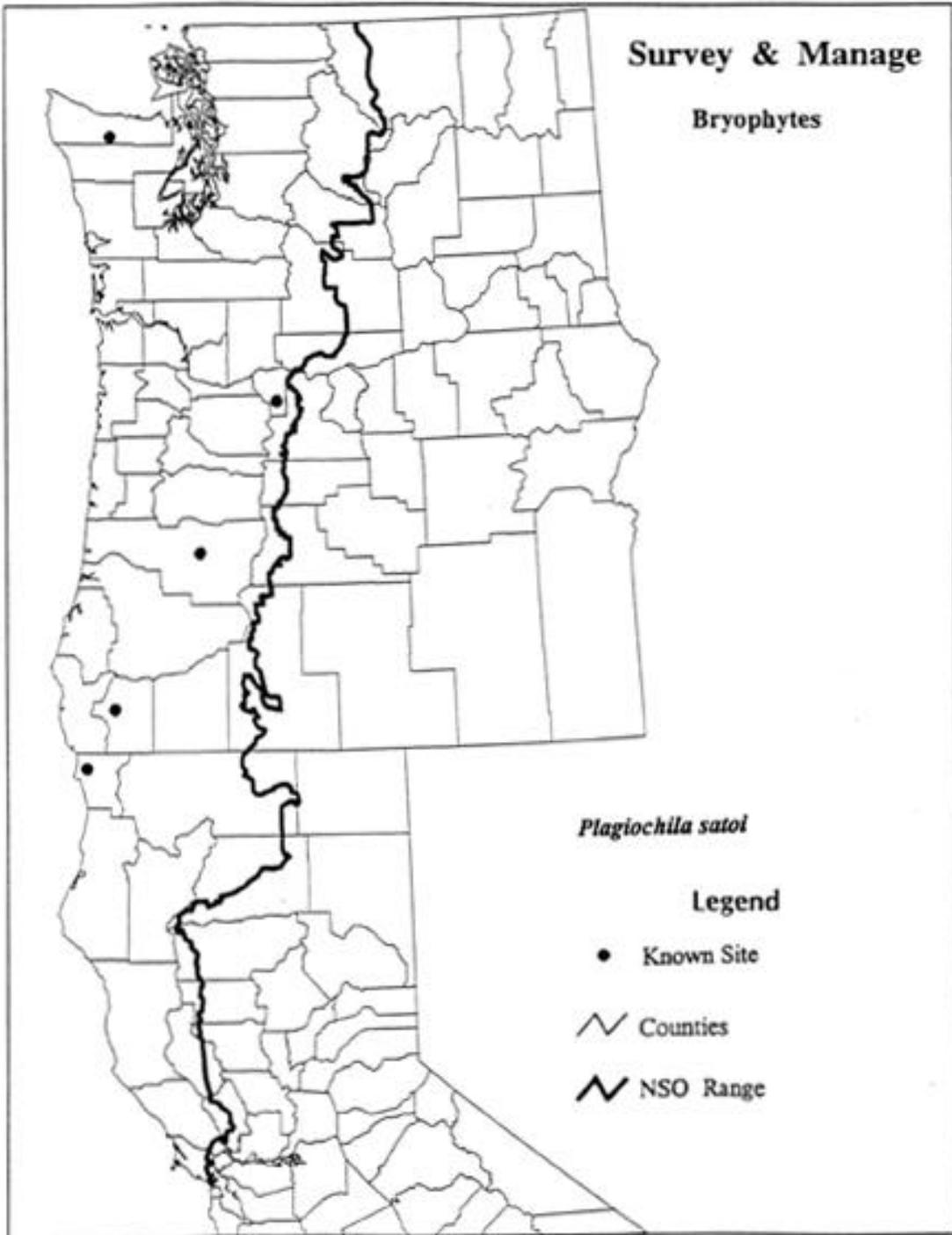
B. Major Habitat and Viability Considerations

The major viability consideration for *P. satoi* is loss of populations resulting from management activities that affect the habitat or the populations. This species appears to be rare in the range of the northern spotted owl. The limited number of known sites makes it vulnerable to stochastic events. Disturbance at the known sites poses the greatest threat to this species.

C. Threats to the Species

Due to the small size of this species and limited survey information available, additional populations may occur. Logging activities, or road, campground or trail building pose the major threats to undocumented populations. Recreational use of cliffs for climbing could disturb cliff-

Figure 1. Known sites of *Plagiochila satoi* (includes all known sites as of 1 Nov. 1998).



dwelling populations. Tree populations would be subject to impact during the harvest of moss as a special forest product.

D. Distribution Relative to Land Allocations

Of the six known sites, two are within Congressionally withdrawn areas (Olympic National Park) and two are on USFS land, (Mt. Hood National Forest, Willamette National Forest).

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *Plagiochila satoi* is to assist in maintaining species viability.

B. Objectives

- Maintain microsite conditions including appropriate microclimate.
- Avoid disturbance of substrates used by this species.

IV. HABITAT MANAGEMENT

A. Lessons from History

No information is available at this time.

B. Identifying Habitat Areas for Management

Any known site on federal land administered by the Forest Service or BLM is identified as a habitat area where these management recommendations should be implemented. A habitat area is defined as suitable habitat occupied by or adjacent to a known population.

C. Managing In Habitat Areas

- Determine the extent of local population and habitat area with a site visit.
- Maintain habitat for this species within the defined area of the local population by retaining shade, moist conditions and protected microsites. Avoid disturbance of rock substrate associated with the plants.
- Due to the limited number of known sites, collection of bryophytes as special forest products in the vicinity of known sites should not be permitted.

D. Other Management Issues and Considerations

Plagiochila satoi is extremely difficult to distinguish from *P. asplenioides*. *Plagiochila asplenioides* is a broadly distributed species that is not at risk. Reconsideration of the appropriate survey strategy for this species and evaluating whether it warrants specific management under the Northwest Forest Plan is recommended.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities for additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

Information on the ecological requirements of this species is very limited. The biggest information need is distributional data. Inventories should be conducted in late-successional reserves, Research Natural Areas and other withdrawn areas to locate additional populations.

B. Research Questions

Determine the taxonomic status of *P. satoi* and its relationship to the *P. asplenioides* species complex.

C. Monitoring Needs and Recommendations

No monitoring needs or recommendations are identified at this time.

REFERENCES

- Christy, J.A. and D.H. Wagner. 1996. Guide for the Identification of Rare, Threatened or Sensitive Bryophytes in the Range of the Northern Spotted Owl, Western Washington, Western Oregon and Northwestern California. USDI Bureau of Land Management, USDA Forest Service, The Nature Conservancy, and Northwest Botanical Institute, Portland, OR.
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- USDA, Forest Service, and USDI, Bureau of Land Management. 1994a. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species within the Range of the Northern Spotted Owl, Appendix A, Forest Ecosystem Management: An Ecological, Economic and Social Assessment. Portland, OR.
- USDA, Forest Service, and USDI, Bureau of Land Management. 1994b. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl and Standards and Guidelines for Management of Habitat for Late-successional and Old-growth Forest Related Species within the Range of the Northern Spotted Owl. Washington D.C.

SECTION NO. 2
Pleuroziopsis ruthenica

Management Recommendations for

Grand Palm Moss

Pleuroziopsis ruthenica (Wienm.) Kindb. ex Britt.

version 2.0

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SUMMARY

Species: *Pleuroziopsis ruthenica* (Wienm.) Kindb. ex Britt. (Grand palm moss)

Taxonomic Group: Bryophyte: moss

ROD Components: 1, 3

Other Management Status: *Pleuroziopsis ruthenica* is included on a preliminary list of rare mosses published by the Washington Natural Heritage Program (1997). Its status was ranked as H1, defined as critically imperiled in the state because of extreme rarity or because it is particularly vulnerable to extinction or extirpation, historically known with the expectation that it may be rediscovered. It is also listed as rare in British Columbia.

Range: In the area covered by the Northwest Forest Plan, *P. ruthenica* is reported from only one historical collection in Washington state; the report is subject to question because of potential mislabeling of this specimen and because the habitat likely no longer exists. The global distribution includes Japan, the Russian Far East, Alaska, and British Columbia.

Specific Habitat: In Alaska and British Columbia, *P. ruthenica* occurs along creek banks and hummocks and in low-elevation shrub thickets. It forms carpets on wet organic soils, rotten wood, and bark.

Threats: Activities that alter existing stand and microsite conditions or directly affect the occupied substrate may threaten this species.

Management Recommendations:

If sites with this species are located, apply the following recommendations:

Maintain habitat by retaining occupied substrate, associated stand and microsite conditions near the populations.

Restrict activities that alter stand and microsite conditions, affect occupied substrate, or remove individuals from the populations.

Information Needs: (the following are not required, see section V. in document)

- Determine if this species occurs in the region covered by the Northwest Forest Plan.
- Determine the distribution and characterize the habitat of this species in the area of the Northwest Forest Plan.
- Determine if *P. ruthenica* should remain as a Survey and Manage species.

Management Recommendations for *Pleuroziopsis ruthenica*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Pleuroziopsis ruthenica was originally described in 1845 by Weinmann as *Hypnum ruthenicum*. Kindberg changed the genus to *Pleuroziopsis* in 1906. The type locality is Sitka, Alaska. The genus, in the family Pleuroziopsidaceae, is monotypic.

Synonymy:

Hypnum ruthenicum Weinm. Bull. Soc. Imp. Nat. Moscou 18(4): 485. 1845

Girgensohnia ruthenica (Weinm.) Kindb. Eur. & N. Amer. Bryin 43. 1897

Climacium ruthenicum (Weinm.) Lindb.

B. Species Description

1. Morphology

Brotherus 1909: 735, Grout 1928, vol. 3, p. 6, part 1: 6, Pl. 1; Lawton 1971: 236, Pl. 130; Noguchi 1994: 1211, Christy and Wagner 1996: 44.

Pleuroziopsis ruthenica forms creeping, densely rhizome-like mats with dendroid (up to 12 cm tall) secondary stems densely covered with branched filamentous paraphyllia (tiny filamentous structures borne on the stems or branches among the leaves). Stem leaves are blunt, green to coppery-colored, 3.4-4 mm by 2.4-3.2 mm, with clusters of brown rhizoids beneath them. Numerous terminal branches form a dense flat-topped cluster at the top of each secondary stem (resembling a shaggy palm tree). Branch leaves are broadly ovate, apiculate, 2 mm by 1 mm, ovate, decurrent, deeply plicate with plane to recurved (except at base) margins, which are entire or serrate above. Median leaf cells are long and narrow with thin or slightly thickened cell walls. The costa is broad, well-defined at the base and extends above the middle of both the stem and branch leaves. Alar cells are very differentiated, clear, inflated, and often long-decurrent.

Other species within range that are superficially similar to *P. ruthenica* are described by Christy and Wagner (1996). They include *Climacium dendroides*, *Leucolepis acanthoneuron*, *Limbella fryei*, and *Thamnobryum neckeroides*. All have an erect, dendroid habit and grow in similar wet habitats. *Climacium* is distinguished by its thick, turgid branches to 2 mm wide, simple or irregular branching, concave, blunt branch leaves without serrate margins, which are longitudinally striate but seldom crisped when dry, and orange branches showing through the yellowish leaves, especially when plants are wet. *Leucolepis* has simple or irregular branching and remote stem leaves, revealing a brownish-black stem with scattered rhizoids. *Limbella* has distinctly thickened leaf margins and remote stem leaves. *Thamnobryum neckeroides* has irregular branching, remote stem leaves, and leaves keeled near the shoot tips.

2. Reproductive Biology

Pleuroziopsis ruthenica is dioecious with male and female plants similar. The seta is 1.3 to 1.7 mm long, smooth, reddish-brown, and flexuose. The capsules are horizontal, oblong-ovate with a double peristome. The exostome teeth are linear-lanceolate, yellowish, and densely papillose above. The endostome teeth are large, keeled, papillose, with a low basal membrane. In British Columbia (Schofield 1976), sporophytes are occasional to rare in coastal regions, but more common in boreal and interior regions. Fruiting material has not been reported from Washington. Sporophytes have frequently been found in Alaska.

3. Ecological Roles

The ecological roles of this species are poorly known.

C. Range and Known Sites

Pleuroziopsis ruthenica grows in Japan, Alaska, British Columbia, and the Russian Far East. A historical collection of *P. ruthenica* was made by N.L. Gardner in about 1898 in Washington. It represents the only report of this species south of the Canadian border. Although it is correctly identified, the location information (“In marsh, Seattle”) is too vague to determine the exact site of the population to verify its status. Because the southern-most known occurrence of *P. ruthenica* is on Vancouver Island in British Columbia, additional work needs to be done to locate the Washington collection before the range of the species can be determined.

D. Habitat Characteristics and Species Abundance

According to Christy and Wagner (1996), *P. ruthenica* forms carpets on wet organic soil, rotten wood in low-elevation shrub thickets, on old-growth cedar, or in Sitka spruce (*Picea sitchensis*) swamps. Schofield (1976) considers this species as very rare on banks and hummocks in forested flood plains of coastal areas near sea-level, mainly in the northern half of British Columbia. Schofield (1990) comments that this species is rare throughout its Pacific range, but Pojar and MacKinnon (1994) indicate that it is a common northern species. In Alaska, *P. ruthenica* forms extensive, deep carpets in forested areas along rivers (Harpel, personal observation).

II. CURRENT SPECIES SITUATION

A. Why Species Is Listed Under Survey and Manage Standard and Guideline

Pleuroziopsis ruthenica was considered at risk under the Northwest Forest Plan because of its rarity and limited distribution in the range of the northern spotted owl (USDA and USDI 1994a). It was considered rare and was not rated by FEMAT bryophyte panel because so little information was available (FEMAT panel notes June 9 and 10, 1993).

B. Major Habitat and Viability Considerations

The major viability consideration for *P. ruthenica* is loss of populations resulting from management activities that harm the populations or their habitat.

C. Threats to the Species

Activities that alter the existing stand and microsite conditions or affect the occupied substrate may threaten this species, where it occurs.

Populations could be affected by activities such as scientific collecting, recreational activities, restoration projects, logging, road building, campground building and collecting of special forest products at sites where the species occurs.

D. Distribution Relative to Land Allocations

No documented sites of *Pleuroziopsis ruthenica* are known on federal lands in the range of the northern spotted owl. The northwest coastal sections of the Olympic Peninsula and lower elevations of the North Cascades, such as the South Fork Stillaguamish drainage are potential habitat. If the Seattle site is verified, then the Puget lowlands would also be potential habitat.

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *P. ruthenica* is to assist in maintaining species viability.

B. Objectives

If sites are documented on federal land, manage them by maintaining existing stand conditions including the forest structure and microclimatic conditions associated with *P. ruthenica*.

IV. HABITAT MANAGEMENT

A. Lessons from History

No information is available at this time.

B. Identifying Habitat Areas for Management

No known sites have been documented on federal land administered by the Forest Service or BLM. Any known site on federal land is identified as a habitat area where these management

recommendations should be implemented. A habitat area is defined as suitable habitat occupied by or adjacent to a known population.

C. Managing in Habitat Areas

If populations are found on federal land, maintain habitat for this species by retaining occupied substrate, associated stand and microsite conditions.

Determine the extent of the local population. A site with identified populations should be managed to include an area large enough to maintain ecological conditions associated with *P. ruthenica*, including forest structure, substrate, and associated microclimatic conditions. The size of the area necessary to maintain populations would be determined by a field visit.

D. Other Management Issues and Considerations

Limited location and habitat data is available for *P. ruthenica*. However, this information suggests that *P. ruthenica* may not meet the criteria for close association with late-successional and old-growth forests (USDA and USDI 1994a [Table IV-6] and 1994b). For a species to be appropriately listed as a Survey and Manage species, it must first meet the criteria established for designation as a species closely associated with late-successional and old-growth forests. This issue should be addressed by a regional coordinating body.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities for additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

Determine if this species occurs in the region covered by the Northwest Forest Plan.

Determine if *P. ruthenica* meets the criteria for species closely associated with late-successional and old-growth forest and should remain as a survey and manage.

Determine distribution and characterize habitat of this species.

B. Research Questions

No research questions are identified at this time.

C. Monitoring Needs and Recommendations

No monitoring is recommended at this time.

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SECTION NO. 3
Ptilidium californicum

**Management Recommendations for
Pacific Fuzzwort**

Ptilidium californicum (Aust.) Underw.

version 2.0

December 1998

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SUMMARY

Species: *Ptilidium californicum* (Aust.) Underw. (Pacific Fuzzwort)

Taxonomic Group: Bryophyte: Liverwort

ROD Components: 1, 2, Protection Buffer (Late-successional Reserve C-9 and C-20, ROD)

Other Management Status: None at present

Range: *Ptilidium californicum* has a North Pacific distribution. In the Pacific Northwest, *P. californicum* is found in Washington, Oregon, northern California, Oregon, Idaho, and Montana.

The area of concern is in northern California which represents the southern extent of its range. At the present time there are three known sites on federal land in northern California. Global distribution includes Japan and the Russian Far East.

Specific Habitat: *Ptilidium californicum* is common in higher elevation Pacific silver fir and mountain hemlock forests of Washington. In northern California, it has only been found at the base of white fir and Douglas-fir in old-growth forests under 1690 m (5000 ft) elevation.

Threats:

- c Activities that alter existing stand and microsite conditions or affect the occupied substrate may threaten this species.
- c The use of spray paint to mark trees could impact the health of the species.

Management Recommendations:

- c Maintain habitat for this species by retaining occupied substrate, associated stand and microclimatic conditions near the populations.
- c Restrict activities that alter stand and microsite conditions or affect occupied substrate.

Information Needs: (the following are not required, see section V. in document)

- c Map known sites to determine distribution, relative to land allocations.
- c Determine the distribution and characterize the habitat of this species.

Management Recommendations for *Ptilidium californicum*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

According to Howe (1899), the original description was developed from material picked out of a specimen of *Hypnum circinale* that was issued as no. 474 (ed. 2) in Sullivan and Lesquereux Musci Boreali-Americani Exsiccata in 1857. It was described by Coe Finch Austin as *Mastigophora californica* in 1879. In 1890 Underwood and Cooke changed the genus name to *Ptilidium*. *Ptilidium californicum* (Aust.) Underw. & Cook is in the order Jungermanniales, family Ptilidiaceae.

B. Species Description

1. Morphology (Howe 1899, Clark and Frye 1928, Christy and Wagner 1996)

Ptilidium californicum forms loose, prostrate, coppery-red to golden-green tufts. Stems are 1-5 cm long, irregularly branched and lack rhizoids (rarely with a few); leaves are deeply divided into 3 or 4 segments, with entire or 1-2 isolated cilia on the margins; leaf cells are thin-walled with very large trigones (three angled thickenings at the corners of the cells), and numerous small oil-bodies. Underleaves are smaller, wider than the stem and divided into 2 to 3 parts, with several cilia on the margins. *Ptilidium californicum* is easily identified in the field.

2. Reproductive Biology

Ptilidium californicum is dioicous. The antheridia are large and terminal, on a long stalk. The sporophyte is ovoid, emergent and opens by four linear slits. According to Godfrey (1977) in British Columbia, sporophytes are produced from May through August (October in the subalpine). Specialized asexual reproductive structures are lacking.

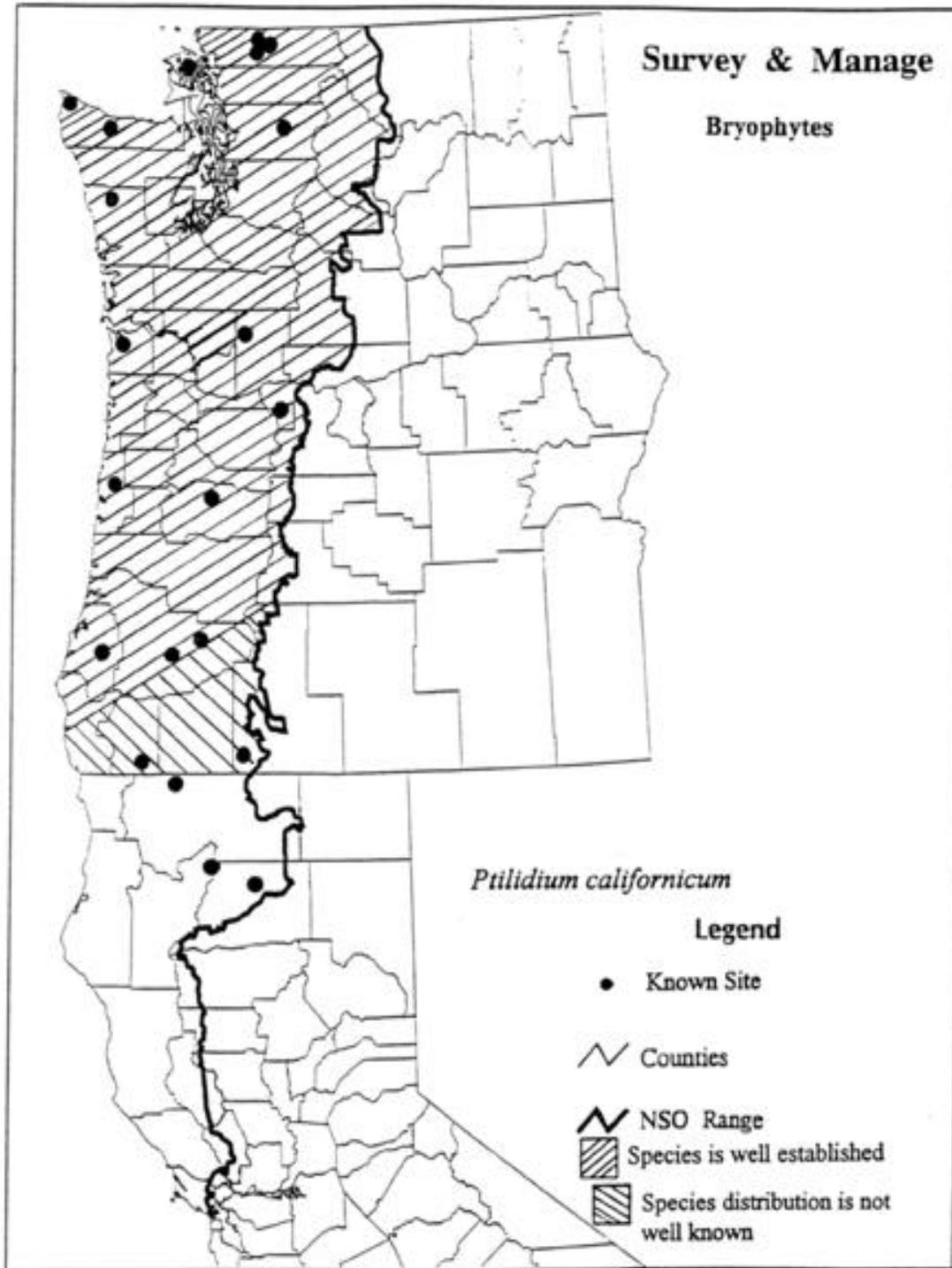
3. Ecological Roles

At the present time the ecological roles of *P. californicum* are not well understood.

C. Range and Known Sites

Ptilidium californicum has a North Pacific distribution extending from Japan and the Russian Far East into southeast Alaska, western British Columbia, Washington, Oregon, Idaho, and Montana. **The area of concern is in northern California** (FEMAT 1993, USDA and USDI 1994a, USDA and USDI 1994b) which represents the southern extent of its range. In northern California it is known from the following three locations: Rogue River National Forest (Siskiyou County), Shasta-Trinity National Forest (Trinity County), and the Lassen National Forest (Shasta County). Norris (pers. comm., 1997) collected *P. californicum* from the Mendocino and Six Rivers National Forests (Figure 1). During a recent field trip to the Mendocino National Forest, potential suitable habitat on the Upper Lake, Covelo, and Corning Ranger Districts (including Anthony Peak and ridge area) were surveyed by Harpel and others, but they did not locate any populations of *P. californicum*. Suspected range includes all portions of northern California within the range of the northern spotted owl.

Figure 1. Known sites of *Ptilidium californicum* (includes all known sites as of 1 Nov. 1998).



D. Habitat Characteristics and Species Abundance

Ptilidium californicum occurs in different habitats and on different substrates in the California portion of its range compared to areas to the north, where it is more common. In Washington and Oregon, *P. californicum* can be found on rotten logs and a wide variety of coniferous tree species. According to Christy and Wagner (1996), in the central Cascades of Oregon, it is most abundant in older forests in the Pacific silver fir (*Abies amabilis*) zone. In California, it has been found on the base of white fir (*Abies concolor*) and Douglas-fir (*Pseudotsuga menziesii*) in old-growth forests under 5000 ft. (1690 m) elevation. Currently, it has not been found on rotten logs in northern California. The habitat of the three known sites in northern California varies as follows:

On the Lassen National Forest, *P. californicum* was found in an open old-growth stand of white fir with incense cedar (*Calocedrus decurrens*), ponderosa pine (*Pinus ponderosa*) and occasional sugar pine (*Pinus lambertiana*). The understory is open with thick patches of vine maple (*Acer circinatum*) in the moister areas. A total of ten white fir trees with clumps of *P. californicum* on the base were found at an elevation of 4880 ft (1623 m). Other mosses found associated with *P. californicum* included *Dicranum tauricum* and *Dicranoweisia cirrata*. The Lassen National Forest site represents the largest population in northern California, with ten trees occurring within a one square mile section.

On the Rogue River National Forest, *P. californicum* was found on the base of a Douglas-fir and a white fir, in an old-growth stand of Douglas-fir and white fir. The understory is composed of vine maple and dwarf Oregon grape (*Berberis nervosa*). This particular stand of old-growth was surrounded by clearcuts. The site is south of the Oregon border and is at an elevation of 4380 feet (1460 m). Associated moss species found on the trees included: on Douglas-fir; *Hypnum circinale* and *Dicranum tauricum*, on the white fir; *Hypnum circinale*, *D. tauricum*, *D. fuscens*, *Isothecium stoloniferum*, and *Antitrichia californica*.

On the Shasta-Trinity National Forest, *P. californicum* was found on the base of a white fir in a mature second-growth mixed conifer stand, with old-growth remnants, dominated by white fir, sugar pine, and ponderosa pine. Understory species included tanbark oak, (*Lithocarpus densiflorus*), bracken fern (*Pteridium aquilinum*), and false hellebore (*Veratrum californicum*). The elevation of this site is 4800 ft (1600 m). Associated moss species found on the white fir included *Dicranoweisia cirrata* and *Orthotrichum lyellii*.

II. CURRENT SPECIES SITUATION

A. Why Species Is Listed Under Survey and Manage Standard and Guideline

Ptilidium californicum was thought to be at risk under the Northwest Forest Plan in California at the southern limit of its range, due to its rarity and limited distribution. *Ptilidium californicum* is listed in the Record of Decision (USDA and USDI 1994b) Table C-3 as a Strategy 1 and 2 species, with direction to manage known sites and conduct surveys prior to ground disturbing activities. In addition, it was also included in Mitigation Measure Step 5 from the Scientific Analysis Team Report (Thomas et al. 1993) and was included as a "Protection Buffer Species" in the Record of Decision.

B. Major Habitat and Viability Considerations

While this species is common throughout most of the range of the northern spotted owl, it is important to maintain the northern California populations because they represent the southern most extent of its range (USDA and USDI 1994a). In particular the type locality (the population from which the species was originally discovered) is of historical and biological significance.

According to Harpel (pers. comm.), *P. californicum* may be a fragment of a relict population, thus the northern California populations should be managed to maintain the genetic diversity of this species.

C. Threats to the Species:

Activities that alter the existing stand and microsite conditions and or directly affect the occupied substrate may threaten this species. Populations could be damaged by activities causing physical removal of the plants. Timber harvest and the removal of large woody debris may reduce suitable habitat for this species. The use of spray paint to mark trees could impact the health of the populations because bryophytes are especially sensitive to particular pollutants and are passive concentrators of radioactive isotopes and heavy metals (Schofield 1985). Because this species grows on the very base of trees, fire would pose a serious threat to this species. In northern California, scientific collection of this species where it is limited in distribution or abundance may threaten these local populations.

D. Distribution Relative to Land Allocations

Ptilidium californicum has been recently found on the Lassen National Forest in an Late-Successional Reserve, Shasta-Trinity National Forest in Matrix, and the Rogue River National Forest in an Adaptive Management Area.

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for the managing *P. californicum* is to assist in maintaining species viability.

B. Objectives

- c Maintain microclimate conditions associated with *P. californicum*.
- c Known sites in California should be maintained until it is determined that management will not result in extirpation of the populations.

IV. HABITAT MANAGEMENT

A. Lessons From History

There is a considerable literature on the declines of bryophytes in Europe. Factors associated with logging that cause declines in bryophytes include the temperature extremes and the drying effect of increased wind, the lowering of surface water, drying of logs, and increased dispersal distance between fragments of primeval forest (Laaka 1992). Lack of suitable substrate is a main reason for rarity of threatened corticolous species in managed forests.

B. Identifying Habitat Areas for Management

This North Pacific species reaches its southern limits in northern California but is widespread throughout the rest of the northern spotted owl range. Any known site on federal land administered by the Forest Service or BLM in California within the range of the northern spotted owl is identified as a habitat area where these management recommendations should be implemented. A habitat area is defined as suitable habitat occupied by or adjacent to a known population.

C. Managing in Habitat Areas

- c Maintain habitat for this species at known sites by retaining old-growth white fir forest in California. Avoid disturbance at known sites, including modifications of the canopy. Specifically, avoid logging, road construction, campground construction, and collection of special forest products in the vicinity of known sites.
- c Do not remove fallen trees and logs, as these serve as substrate in addition to bark of living trees.
- c Do not use spray paint on the base of trees with known populations.
- c Caution should be used in issuing permits for scientific collecting of this species to prevent loss from local populations.

D. Other Management Issues and Considerations

No additional management issues are identified at this time.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities for additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

At the present time only three known sites have been located on federal land within northern California. The type location is given as, "on bark of trees in the mountain forests of California". Howe (1899) states that the specimen doubtless came from Humboldt or Mendocino counties. Additional surveys need to be conducted in suitable habitat in northern California and southern Oregon to determine the distribution of this species.

B. Research Questions

- c What is the ecological amplitude of *P. californicum*, particularly in the southern portion of its range?
- c Is the species restricted to middle elevation white fir forests?

C. Monitoring Needs and Recommendations

Known sites on federal lands should be monitored to assess compliance with management guidelines and evaluate impacts. Until the full extent of the distribution of *P. californicum* is known, this species should be treated as rare in northern California.

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SECTION NO. 4
Radula brunnea

Management Recommendations for
Brown Flatwort
Radula brunnea Steph.

version 2.0

December 1998

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SUMMARY

Species: *Radula brunnea* Steph. (Brown flatwort)

Taxonomic Group: Bryophyte: Liverwort

ROD Components: 1, 3

Other Management Status: *Radula brunnea* is currently placed on list 2 by the Oregon Natural Heritage Program (1998), which contains species that are threatened, endangered, or possibly extirpated from Oregon, but are stable or more common elsewhere. It has a state rank of S1, defined as critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with five or fewer occurrences.

Range: *Radula brunnea* has been found in North America only on the basalt breccia cliffs of Saddle Mountain, Clatsop County, Oregon. Global distribution includes Japan and the Russian Far East.

Specific Habitat: *Radula brunnea* grows on shaded north-facing cliffs below the ridge on Saddle Mountain in high-humidity habitat subject to fog interception. In Japan, it is found on the bark of trees in subalpine areas and occasionally on rock.

Threats: Both hiking trails and rock climbing could affect populations by physically removing or trampling the plants. Scientific collecting could also seriously damage the local populations.

Management Recommendations:

If populations are found on federal lands:

- c Maintain habitat for this species at known sites by retaining occupied substrate and associated microsite conditions near the populations.
- c Restrict activities that alter substrate or microsite, or remove individuals from the local populations.
- c Collect material only for approved scientific purposes to prevent the populations from being extirpated.

Information Needs: (the following are not required, see section V. in document)

- c Determine if *Radula brunnea* meets the criteria for species closely associated with late-successional and old-growth forest and whether it should be a survey and manage species.
- c Determine if this species occurs on federal land in the range of the northern spotted owl.

Management Recommendations for *Radula brunnea*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Radula brunnea Steph. was first described by Franz Stephani in 1910 from Mount Komagadake, Japan (Kitagawa 1973). The species is in the order Jungermanniales, family Radulaceae, section Amentulosae.

Synonymy: none.

B. Species Description

1. Morphology

Radula brunnea forms medium-sized, compact, very pinnately branched dark brown to olive-green mats, which turn blackish to reddish brown when dry. The leafy shoots are 2.0-6.5 cm long and are composed of two types of branches: numerous tiny-leaved (microphyllus) side-branches grow at right angles to the stem under the larger-leaved (macrophyllus) branches. According to Yamada (1979), the leaf lobes are “densely to moderately imbricate, widely spreading, strongly concave, ovate more or less falcate, 1.0-1.1 mm long, 0.7-0.8 mm wide, apex rounded, usually narrowly incurved, dorsal base fully covering the stem.” The leaf cells are slightly mammillose on the outer surface of the dorsal lobes and have bulging trigones (three angled thickenings at the corners of the cells). One large granular, bumpy oil-body is present in each cell. Rhizoids appear to be lacking. The most notable feature is the vast number of tiny branchlets with small leaves under almost every leaf along the stem (Christy and Wagner 1996). This species can be separated from other members of the section Amentulosae by the basal appendages of leaf-lobes and lobules with two or three teeth (Yamada 1979).

2. Reproductive Biology

In Japan, *R. brunnea* is dioicous with the antheridia on short terminal branches in five and six bracts. The archegonia are terminal on the stems and branches, with one or two leaves subtending the archegonia below. Reproductive material of *R. brunnea* was not found on any of the Saddle Mountain collections.

3. Ecological Roles

Little is known about the ecological roles of the species.

C. Range and Known Sites

Radula brunnea is found in Japan and eastern Asia, with one disjunct population on Saddle Mountain in Clatsop County, Oregon (Figure 1). No federal sites are currently known, but the species may occur on other exposed fog-drenched peaks in the Olympic Mountains or the Coast

Range, such as Onion Peak (under private ownership). Potential habitat was inventoried on Mary's Peak and Mount Hebo (Siuslaw National Forest), and Saddleback Mountain Area of Critical Environmental Concern (ACEC) (Salem District BLM), but the species was not found.

D. Habitat Characteristics and Species Abundance

On Saddle Mountain, *R. brunnea* forms dark brown to nearly black patches on very steep, exposed, north-facing basalt breccia cliffs, in both sheltered and open sites just below the ridgetop (Schofield 1979). Associated liverwort species were *Apometzgeria pubescens*, *Herbertus sakuraii*, *Marsupella emarginata*, *Metzgeria conjugata*, *Radula obtusiloba* subsp. *polyclada*, and *Tritomaria quinquedentata*. According to Alaback and Frenkel (1978), many rare vascular plants grow in these rocky, inaccessible habitats. Vascular plants that may be present in these rocky habitats occupied by *R. brunnea* include parsley-fern (*Cryptogramma crispera*), Cardwell's penstemon (*Penstemon cardwellii*), tufted saxifrage (*Saxifraga caespitosa*), and Oregon selaginella (*Selaginella oregana*). For a complete discussion of the vascular plant flora, see Alaback and Frenkel (1978) and Chambers (1973). In Japan, *R. brunnea* grows on rocks, tree trunks, and rarely on humus (Yamada 1979). The species is not abundant where it occurs.

Although a few Pacific silver and noble fir trees (*Abies amabilis* and *A. procera*) are scattered along the top of the ridge at the Saddle Mountain site, *R. brunnea* grows in full sun to partially shaded sites on the north-facing basalt breccia cliffs just below the ridge. It is not associated with late-successional or old-growth forests.

II. CURRENT SPECIES SITUATION

A. Why Species Is Listed Under Survey and Manage Standard and Guideline

This species was not rated by the panels convened by the Forest Ecosystem Management Assessment Team because information about it was lacking. Only one known site (on nonfederal land) exists for this species. Because it is rare, the species was listed under survey and manage strategies 1 and 3 in the Record of Decision (USDA and USDI 1994b) to manage known sites and to conduct inventories to determine its distribution and identify sites for management.

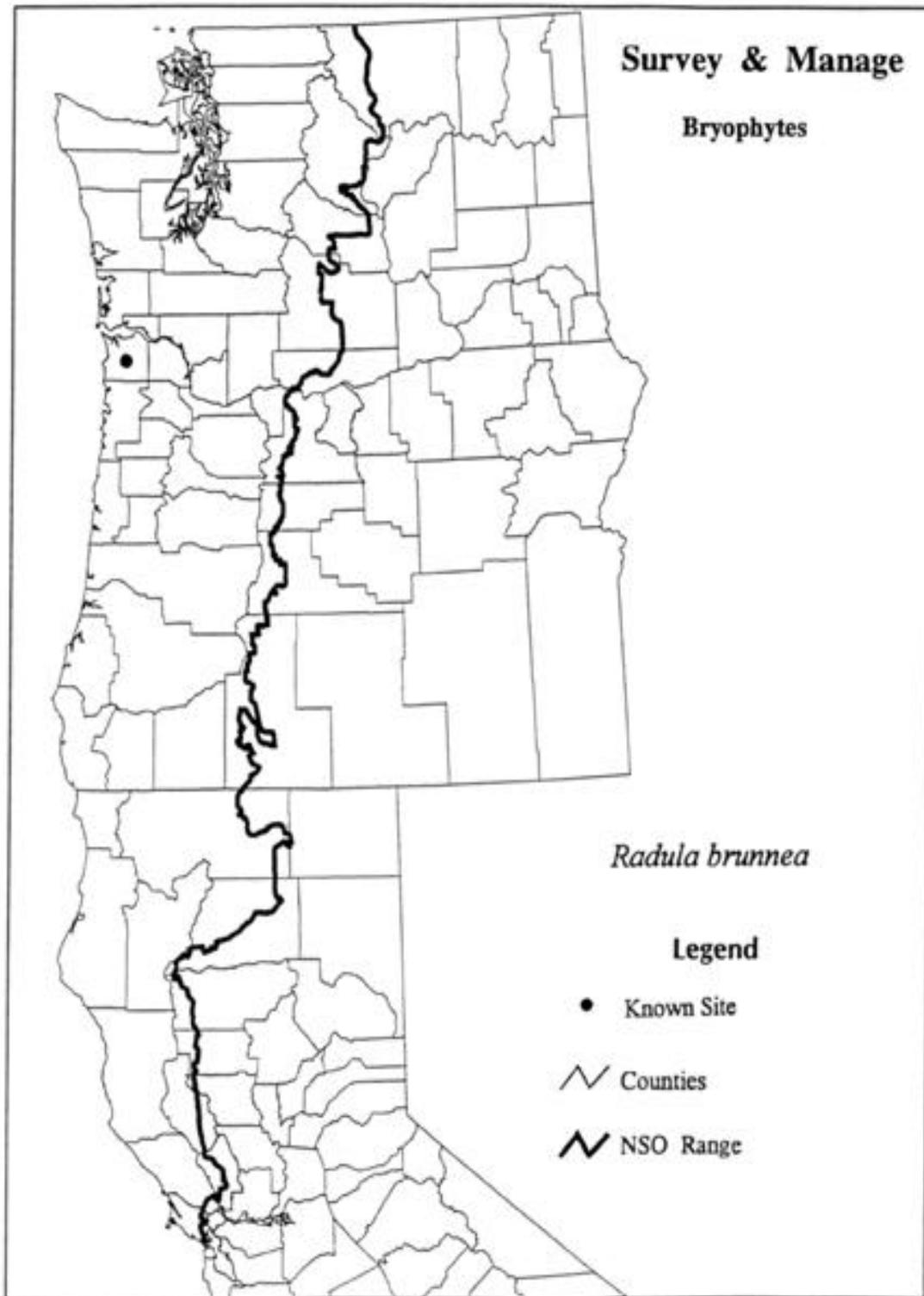
B. Major Habitat and Viability Considerations

The major viability consideration for *R. brunnea* is loss of populations resulting from activities that could degrade the habitat or harm the populations. This species is extremely rare in the area of the Northwest Forest Plan and the single known site makes it vulnerable to stochastic events. Disturbances at the known site pose the greatest threat to this species.

C. Threats to the Species

Activities that alter the microsite or occupied substrate may threaten this species where it now grows; the viability of these populations could be lost or damaged by the physical removal or

Figure 1. Known sites of *Radula brunnea* (includes all known sites as of 1 Nov. 1998).



trampling of the plants. Scientific collecting, trail building, and recreation (such as hiking and rock climbing) may also harm the local populations.

D. Distribution Relative to Land Allocations

The only currently known site for this species in North America is on Saddle Mountain in Clatsop County, Oregon, which is under State Park jurisdiction. No known sites are on federal land.

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *Radula brunnea* is to assist in maintaining species viability.

B. Objectives

If sites are located on federal land administered by the Forest Service and BLM, maintain existing microsite conditions associated with *R. brunnea*, including maintaining existing occupied substrate, and provide a distribution of appropriate substrate and associated microsite conditions in areas of known populations.

IV. HABITAT MANAGEMENT

A. Lessons from History

No information is available at this time.

B. Identifying Habitat Areas for Management

No known sites have been documented on federal land. Any known site on federal land administered by the Forest Service or BLM is identified as a habitat area where these management recommendations should be implemented. A habitat area is defined as suitable habitat occupied by or adjacent to a known population.

C. Managing in Habitat Areas

If *R. brunnea* is found on federal land:

- c Determine the extent of the local population and habitat area with a site visit.
- c In the defined habitat area of the local population, maintain habitat for this species by retaining occupied substrate and associated microsite conditions, specifically avoiding disturbance to the rock substrate associated with the plants.
- c Avoid direct damage to the plants.
- c Because this species is extremely rare, it could be threatened by scientific collecting. Allow only enough collecting at newly discovered sites to provide a single voucher specimen to be deposited at a recognized regional herbarium (e.g., Oregon State University, University of

California Berkeley, University of Washington). Do not permit duplicate collections for exsiccata.

D. Other Management Issues and Considerations

Oregon State Parks is currently the only land manager with the opportunity to maintain this species in North America. Share information about the botanical resource at Saddle Mountain State Park with Oregon State Parks to further activities directed at the conservation of *R. brunnea*.

Limited habitat data is available for *R. brunnea*. However, this information suggests that *R. brunnea* may not meet the criteria for close association with late-successional and old-growth forests (USDA and USDI 1994a [Table IV-6] and 1994b). For a species to be appropriately listed as a Survey and Manage species, it must first meet the criteria established for designation as a species closely associated with late-successional and old-growth forests. This issue should be addressed by a regional coordinating body.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities for additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

- c Determine if *R. brunnea* meets the criteria for species closely associated with late-successional and old-growth forest and should remain as a survey and manage.
- c Determine if this species occurs on federal lands in the range of the northern spotted owl.

Potentially suitable habitat on the Olympic Peninsula and in the Coast Ranges of Oregon should be surveyed to locate additional populations on federal land. Other Coast Range peaks that may also provide suitable habitat include Nicolai Mountain (Clatsop State Forest), and Sugar Loaf (The Nature Conservancy). It might also occur on other exposed fog-drenched peaks in the Olympic Mountains or Coast Range.

B. Research Questions

What are the ecological requirements of this species?

C. Monitoring Needs and Recommendations

If any populations are discovered on federal land, monitor them to determine if they are being damaged by recreational activity or collecting.

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SECTION NO. 5
Rhizomnium nudum

Management Recommendations for

Naked Round Moss

Rhizomnium nudum (Britt. & Williams) T. Kop.

version 2.0

December 1998

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SUMMARY

Species: *Rhizomnium nudum* (Britt. & Williams) T. Kop. (Naked Round Moss)

Taxonomic Group: Bryophyte: Moss

ROD Components: Protection Buffer Species (Managed Late-successional Areas, C-27, ROD)

Other Management Status: None at the present time

Range: This species has a North Pacific distribution and is known from Linn County, Oregon, Idaho, and Montana north through Washington and British Columbia to Alaska. Global distribution includes Kamchatka and Japan.

Specific Habitat: *Rhizomnium nudum* occurs on very moist forest humus or soil, typically near seepage areas in coniferous forests mostly at mid to high elevation. It extends into alpine sites with late-persisting snowbeds.

Threats: Activities that alter existing stand and microsite conditions or directly affect the occupied substrate may threaten this species.

Management Recommendations:

- Maintain habitat for this species by retaining occupied substrate, associated stand and microsite conditions near the populations.
- Restrict activities that alter stand and microsite conditions or affect occupied substrate.

Information Needs: (the following are not required, see section V. in document)

- Revisit known sites to verify population status and characterize the habitat.
- Map known sites to determine distribution, relative to land allocations.
- Evaluate status and determine if sufficient protection within current reserve system is afforded to ensure high likelihood of viability.

Management Recommendations for *Rhizomnium nudum*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Rhizomnium nudum (Britt. & Williams) Kop. was first described by E.G. Britton and R. Williams in 1900 as *Mnium nudum*. Timo Koponen in 1968 moved the species into the genus *Rhizomnium* and selected J.B. Leiberger's 1889 collection from Traill River basin, Idaho as the lectotype (Koponen 1968). The genus is in the order Bryales, family Mniaceae.

Synonyms: (Koponen 1973)

Mnium nudum Britt. & Williams

B. Species Description

1. Morphology

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 mm by 4-9 mm, obovate to nearly circular in outline, obtuse, and lack an apiculus (abrupt slender tip on leaves). The costa (midrib) is broad at the base, and usually ends before the apex. Median leaf cells are large, hexagonal, 50-60 μm by 85-150 μm . 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 (Lawton 1971, Koponen 1973, Christy and Wagner 1996).

2. Reproductive Biology

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.

3. Ecological Roles

Little is known about the ecological role of this species.

C. Range and Known Sites

Rhizomnium nudum is known from 54 sites in Washington and one site in Oregon (Figure 1). 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 a site on nonfederal land in Snohomish County, Washington.

D. Habitat Characteristics and Species Abundance

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 on abundance is not known.

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 plant association in a patch of devil's club (*Oplopanax horridum*) 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 thicket (*Rubus spectabilis*); both sites are in the Pacific silver fir zone. All Mt. Baker-Snoqualmie National Forest populations are in small canopy gaps within the context of old-growth forest.

II. CURRENT SPECIES SITUATION

A. Why Species Is Listed Under Survey and Manage Standard and Guideline

Rhizomnium nudum is not a Survey and Manage species, but rather was carried forward as a Protection Buffer Species from the Scientific Analysis Team (SAT) Report (Thomas *et al.*, 1993) to the Record of Decision (USDA and USDI 1994).

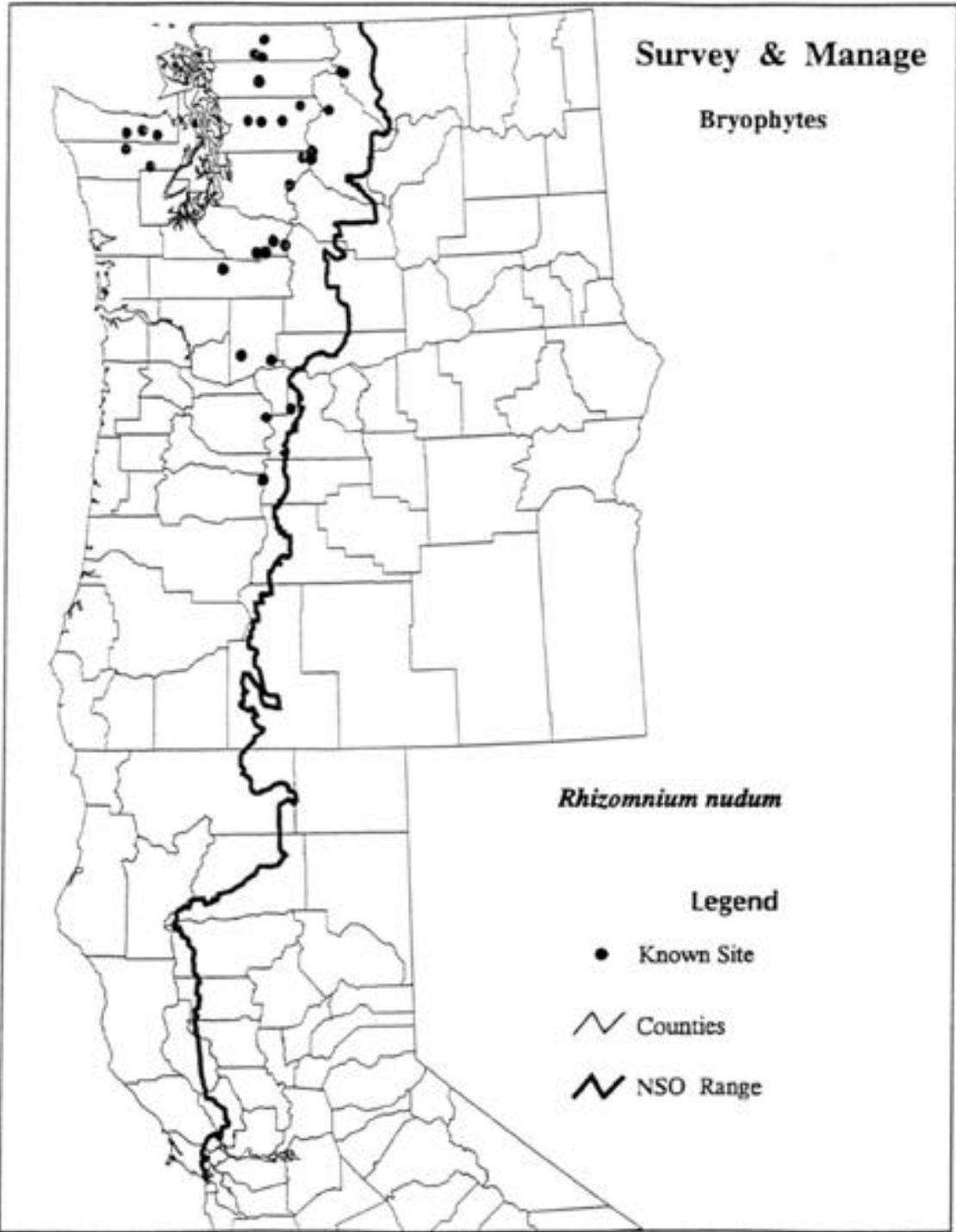
B. Major Habitat and Viability Considerations

The major viability consideration for *R. nudum* is loss of populations resulting from management activities that affect the populations or their habitat.

C. Threats to the Species

Activities that alter the existing stand and microsite conditions or affect the occupied substrate may threaten this species, where it occurs. Populations could be affected by activities such as trail construction, restoration projects, logging, road building, construction activities requiring special use permits, recreation, and collecting of special forest products.

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



D. Distribution Relative to Land Allocations

Most of the known sites occur on federal lands. Fourteen are located in the Olympic National Park, seven in Mt. Rainier National Park, one in North Cascades National Park and twenty-two occur on National Forests throughout the area covered by the Northwest Forest Plan. The remainder of the sites are located on nonfederal land. Land allocations relative to the distribution of this species on federal land needs to be determined.

III. MANAGEMENT GOALS AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *Rhizomnium nudum* is to assist in maintaining species viability.

B. Objectives

Manage known sites on federal land by maintaining existing stand conditions, *i.e.*, forest structure, microclimatic conditions, and hydrologic regime associated with *R. nudum*.

IV. HABITAT MANAGEMENT

A. Lessons from History

There is considerable literature on the declines of bryophytes in Europe. Rapid decreases and fragmentation of primeval forests have caused a serious threat to bryophytes (Laaka 1992). In addition, air pollution (particularly sulfur compounds in combination with low pH) and acid rain are implicated in declines of bryophytes (Hallingback 1992, Rao 1992). The extinction rate and rates of decline are high in areas where trends are documented (Greven 1992, Hallingback 1992). Factors associated with logging that cause declines in bryophytes include the temperature extremes and the drying effect of increased wind, the lowering of surface water, and drying of logs, reduction in amount of coarse woody debris, and increased dispersal distance between fragments of primeval forest (Laaka 1992).

B. Identifying Habitat Areas for Management

Rhizomnium nudum should be managed within fifth-field watersheds to maintain representative populations until an evaluation is completed to determine whether this species warrants continued specific management as a Protection Buffer species under the Northwest Forest Plan. A habitat area for management is defined as suitable habitat occupied by or adjacent to a known population.

C. Managing in Habitat Areas

- Determine the extent of local population and habitat area with a site visit.

- In the habitat area of the local population, maintain habitat for this species by retaining stand, microclimate, and hydrological conditions.
- Avoid disturbance of humus or soil substrate associated with the plants.

D. Other Management Issues and Considerations

Rhizomnium nudum should be evaluated to determine the appropriate management strategy for this species. Consider the additional information gathered since FEMAT and relative risks to its viability. This issue should be addressed by a regional coordinating body.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities for additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

- Revisit known sites to verify population status and characterize the habitat.
- Map known sites to determine distribution, relative to land allocations.
- Evaluate status and determine if sufficient protection within current reserve system is afforded to ensure high likelihood of viability. If so, withdraw Protection Buffer status and evaluate whether it is appropriate to be listed as Survey and Manage species
- Is *R. nudum* closely associated with late-successional and old-growth forests within the range of the northern spotted owl?

B. Research Questions

What are the ecological requirements of this species?

C. Monitoring Needs and Recommendations

No monitoring is recommended at this time.

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**GENERAL GUIDANCE
for use of
SURVEY AND MANAGE
MANAGEMENT RECOMMENDATIONS**

The following guidance was developed to assist field units in implementing management recommendations (MRs) for Component 1 Survey and Manage (S&M) species and Protection Buffer species.

1. Introduction

All MRs will be transmitted by joint Bureau of Land Management (BLM) / Forest Service (FS) memos.

MRs have been developed for use at field offices of the BLM and FS. Other agencies may find them useful as well.

MRs were developed primarily in response to the Standards and Guidelines (S&Gs) for Component 1 Survey and Manage species and Protection Buffer species.

It is the intent of these MRs to maintain a level of flexibility that allows for creativity of interdisciplinary (ID) teams in providing for protection of the species in the context of other Northwest Forest Plan (NFP) goals. Where there are few known sites, it is especially important for these MRs to be followed in order to reduce any possible high risk to species survival in the NFP area.

2. Application of the MRs

The Executive Summary can be scanned for highlights about species. For example, look at range information and determine where a species is likely to be, get an idea of the species' habitat, and review what management options might be useful.

MRs were written primarily for implementation by botanists or biologists, but they also may be useful to others involved in project planning and design.

The enclosed MRs are effective as of the date of the transmittal memorandum, and replace the species management information contained in Appendix J-2 of the Final Supplemental Environmental Impact Statement.

The MRs apply to the species as they occur throughout the range of the northern spotted owl (or limited areas as noted in Table C-3 of the NFP S&Gs). The known site database (KSDB) and other credible locational data available to the field office should be used as appropriate to determine if a particular taxon is known within the project area. Use the MRs in concert with the most recently distributed version of the KSDB to aid in determining the range of each species relative to the project area.

Component 1 provisions for the protection of known sites apply to all activities (including, but not limited to timber sales) that may have adverse or beneficial effects.

For Protection Buffer species, these MRs serve as the management plans recommended by the NFP S&Gs on pp. C-20 and C-27.

Some MRs may suggest proactive management, such as prescribed fire, needed for species viability. Where such opportunities exist, managers are encouraged to implement these proactive recommendations.

3. Follow-up Actions

Field office staff who have expertise regarding these species may be asked to participate in revision of the MRs, in peer reviews, or on teams developing recommendations to change the status of certain species.

Field offices will likely be asked to provide information regarding their implementation of these MRs. Therefore, field office staff are asked to note pertinent aspects of the MRs, such as feasibility of implementation, appropriateness of the level of intensity, magnitude of implementation costs, and the accuracy of biological information.