DRAFT, Version 1.1

Draft Management Recommendations for stream ladderwort *Marsupella emarginata* var. *aquatica* (Lindenb.) Dumort.

Version 1.1
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EXECUTIVE SUMMARY

Species: *Marsupella emarginata* var. *aquatica* (Lindenb.) Dumort.

Taxonomic Group: Bryophyte: Liverwort

ROD Components: 1,2

Other Management Status: The Oregon Natural Heritage Program considers *Marsupella emarginata* var. *aquatica* to be threatened with extirpation within the state of Oregon (List 2, 1995). The Bureau of Land Management includes this taxon on the Bureau Assessment list for Oregon.

Range: *Marsupella emarginata* var. *aquatica* is an aquatic liverwort known from one site at Waldo Lake, Willamette National Forest, in the Oregon Cascades. This is the only known location in western United States. It may occur in other cold perennial streams in the Oregon and Washington Cascades and in Alaska.

Specific Habitat: *Marsupella emarginata* var. *aquatica* grows attached to submerged rocks in the bed in a fast flowing, cold, perennial stream at 1650 m (5410 ft.) elevation near Waldo Lake site. It is shaded by large mountain hemlock, but receives partial sun.

Threats: Water pollution from sewage and motorboats at Waldo Lake could negatively impact the population of *Marsupella emarginata* var. *aquatica*. The main threat to this population is recreational activity. Originally, the ultraoligotrophic lake had the clarity and purity of distilled water. Water quality has deteriorated based on recent studies (Larson and Salinas. 1995). This may have affected aquatic species. Increasing hiker and mountain bike impacts around the lake and along streams may also threaten this species. Construction of a new footbridge at a trail crossing or mountain bike trails may impact the population. Release of zinc from galvinized culverts is known to be toxic to bryophytes. Grazing could have a significant impact on riparian habitats at other potential sites.

Management Recommendations:

- C Maintain microclimate of surrounding habitat of all known sites and avoid disturbance of rocky substrate to which this species attaches. Specifically, maintain habitat for this species at the Waldo Lake site by avoiding construction of trails, bridges, and other structures in the vicinity of the population.
- C Maintain water quality and conditions (e.g., flow, temperature, purity) at known sites.
- C Minimize recreation impacts.

- In riparian reserves, maintain water quality and habitat following standards and guidelines restricting timber harvest, grazing, road construction, recreation, and other activities as prescribed in the Record of Decision (USDA and USDI 1994, page C-31 to C-38).
- Collection of special forest products and scientific collection of the species should not be permitted unless specifically approved to assist species conservation.

Information Needs:

- Evaluate impact of zinc from galvanized culverts and other contaminants on downstream aquatic ecosystems.
- Inventory potential suitable habitat (i.e., cold-water streams and upper elevation perennial streams) to locate additional populations.
- Determine taxonomic status of *Marsupella emarginata* var. *aquatica* and its relationship to the common variety.

I. Natural History

A. Taxonomic/Nomenclatural History

There is debate regarding the appropriate taxonomic rank of *Marsupella emarginata* var. *aquatica*. This taxon was elevated to *Marsupella aquatica* (Lindenb.) Schiffn. However, Schuster reports that transitional forms occur and some authors do not recognize this variety as distinct from the typical variety and consider it an ecotype. Wagner is inclined to recognize this taxon at the species level (Christy and Wagner 1996). Further work, perhaps including genetic studies, may be necessary to resolve these taxonomic questions. This species is placed in the order Jungermanniales, family Gymnomitriaceae (Stotler and Crandall-Stotler 1977).

Marsupella emarginata ssp. *emarginata* var. *aquatica* (Lindenb.) Dum.

B. Species Description

1. Morphology (Frye and Clark 1943:231, Hong 1982, Schuster 1974, Smith 1990:154) *Marsupella emarginata* var. *aquatica* is a robust, dull or deep green to blackish leafy liverwort. It occurs in extensive, dense patches. Shoots are generally 1.6-2.5 mm wide by (3)5-8(10) cm long, erect, and usually simple and rigid. Leaves are transversely inserted and bilobed, usually with two oil-bodies per leaf cell.

Marsupella emarginata var. *aquatica* is macroscopically differentiated from the typical variety by the stiffer, more rigid, shallowly divided leaves which are pectinately oriented. Unlike the variety *M. emarginata* var. *emarginata*, plants of the aquatic variety are not typically brown or red-brown, although reddish patches may occasionally occur. Leaves are usually broader than in *M. emarginata* var. *emarginata*, with rotund or blunt-obtuse lobes. Leaf margins are prominently revolute or reflexed, more strongly so than in *M. emarginata* var. *emarginata*. The most distinctive difference is in habitat: *M. emarginata* var. *emarginata* grows on rocks in very wet

places, but is never submerged throughout the year. No other aquatic bryophytes are similar to this species.

Figure 1. Line drawing of *Marsupella emarginata* var. *aquatica* from Frye and Clark (1943) (to be added).

2. Reproductive Biology

No information was found on the reproductive biology of *Marsupella emarginata* var. *aquatica*. Water is required for sexual reproduction of all bryophytes and is probably the dispersal vector for asexual propagules of this aquatic taxon.

3. Ecology

Marsupella emarginata var. *aquatica* is an aquatic liverwort. It grows submerged in shaded habitats, in cold flowing streams.

C. Range, Known Sites

Marsupella emarginata var. *aquatica* is known from one site at Waldo Lake, Willamette National Forest, in the Oregon Cascades. This is the only known location within the range under consideration. It may occur in other cold perennial streams in the Oregon and Washington Cascades and may actually be widespread (Schofield, pers. comm.).

The global distribution includes the British Isles (Wales and Yorkshire to Shetland Isles, Ireland), Greenland, Newfoundland and Nova Scotia, Scandinavia, central and western Europe, and the northeastern United States (Maine, New Hampshire, New York). It has also been reported in British Columbia and Alaska (Schofield, pers. comm.).

Figure 2. Known sites of *Marsupella emarginata* var. *aquatica* (to be added).

D. Habitat Characteristics and Species Abundance

Marsupella emarginata var. *aquatica* occurs in robust colonies attached to submerged rocks in a cold, perennial stream at 1650 m (5410 ft.) elevation. The Waldo Lake site is shaded by large mountain hemlock, but receives partial sun. It is reportedly abundant at this site, which is readily accessible by boat.

II. Current Species Situation

A. Why Species is Listed under Survey and Manage Standards and Guidelines

The single known location for *Marsupella emarginata* var. *aquatica* in the Pacific Northwest led to its listing under the Survey and Manage standards and guidelines. Viability ratings reflected a high level of concern for this species; under option 9 it was given zero percent likelihood of being well distributed throughout its range, 30 percent likelihood of being locally restricted, 60 percent likelihood of restriction to refugia and 10 percent likelihood of extirpation on federal lands. Due to these concerns, maintaining a viable population at Waldo Lake and surveying before ground disturbing activities in habitat suitable for *Marsupella emarginata* var. *aquatica* was prescribed.

B. Major Habitat and Viability Considerations

Water quality and recreation impacts are the primary considerations for maintaining viable populations of *Marsupella emarginata* var. *aquatica* at the known site.

C. Threats to the Species

Water pollution from sewage and motorboats at Waldo Lake could negatively impact the population of *Marsupella emarginata* var. *aquatica*. The main threat to this population is recreational activity. Originally, the ultraoligotrophic water had the clarity and purity of distilled water; as a result of fish stocking between 1938 and 1990 and improved access to Waldo Lake, water quality has deteriorated based on recent studies. Increased zooplankton abundance, changes in species composition of zooplankton, change in transmission of blue light, and increased phytoplankton production have been documented (Larson and Salinas. 1995). Increasing hiker and mountain biker impacts around the lake and along streams may also threaten this species. Construction of a new footbridge at a trail crossing may impact the population. Release of zinc from galvinized culverts is known to be toxic to bryophytes. Grazing may have a significant impact on riparian habitats at other potential sites. Any rare species known only from a limited number of sites are vulnerable to collection pressures.

D. Distribution Relative to Land Allocations

The Waldo Lake site occurs on Willamette National Forest immediately south of Waldo Lake Wilderness Area, within a Tier 2 Watershed and in Willamette National Forest Plan Dispersed Recreation (semiprimitive non-motorized use, no timber harvest).

III. Management Goals and Objectives

A. Management Goals for the Taxon

The goal for the management of *Marsupella emarginata* var. *aquatica* is to assist in maintaining viability of this taxon.

B. Specific Objectives

C Maintain ultraoligotrophic quality and cold temperature of Waldo Lake and its outlet stream.

- Maintain microclimate of surrounding habitat of all known sites and avoid disturbance of rocky substrate to which this species attaches.
- Minimize recreation impacts.

IV. Habitat Management

A. Lessons from History

A significant decline has been observed in the aquatic lichen *Hydrotheria venosa* in the Appalachian Mountains. Many lichens and liverworts are sensitive to small changes in their environment, and there are concerns that subtle changes in water chemistry from pollution and acid rain may result in similar declines in aquatic liverworts in the Pacific Northwest.

B. Identification of Habitat Areas for Management

Marsupella emarginata var. *aquatica* may occur in cold mountain streams in the Cascade Range of Washington and Oregon. Any known sites located within this area will be considered within the habitat area for management.

C. Management within Habitat Areas

- Maintain habitat of this species at the Waldo Lake site by avoiding construction of trails, bridges, and other structures which may cause change in water quality or directly disturb the population. Monitor impacts to population and take action to minimize recreation impacts. To the extent possible, divert recreationists from the site.
- Maintain water quality with special attention to avoiding dust abatement materials and other non-point sources of contaminants in the vicinity of known sites.
- Maintain cold temperatures and stream flows, microclimate and rocky substrates at known site.
- No collecting for scientific purposes or for special forest products should be allowed at the known sites, unless specifically authorized to assist species conservation.
- If results of monitoring indicate declines in water quality, it may become necessary to restrict motorized boats on Waldo Lake.
- Implementation of Aquatic Conservation Strategy will be important to this species. Maintain riparian reserves and follow standards and guidelines restricting timber harvest, grazing, road construction, recreation, and other activities as prescribed in the Record of Decision (USDA and USDI 1994, page C-31 to C-38).

D. Other Management Issues and Considerations

No other management issues are identified at this time.

V. Research, Inventory and Monitoring Needs

A. Data Gaps and Information Needs

Information on the ecological requirements of this species is very limited. The biggest gap is

distributional data. Inventories in late-successional reserves, Research Natural Areas and other withdrawn areas to locate additional populations, specifically in cold-water streams and upper elevation perennial streams in the Cascade Mountains would contribute the most valuable information at this time. High probability habitat within areas of potential impact where management activities are planned should also receive high priority for surveys.

B. Research Questions

An investigation of the taxonomic status of *Marsupella emarginata* var. *aquatica* and its relationship to the typical variety is needed. Some bryologists do not recognize this variety as sufficiently distinct from the terrestrial *Marsupella emarginata* var. *emarginata* to justify varietal status.

If this taxon is found to occur more widely, it may serve as a biological indicator of water quality. Because there is concern specifically about the impact of zinc from culverts on downstream aquatic bryophytes, laboratory studies to evaluate zinc tolerance limits may help determine thresholds of toxicity. Studies of other more common aquatic bryophytes (e.g., *Fontanalis*) would also be valuable in identifying ecological tolerances to heavy metals, silt, temperature, and organic chemicals from outboard motors).

Other questions include:
What are the dispersal mechanisms of this taxon? How does it reproduce?
What is its tolerance to flood events and to seasonal desiccation?

C. Monitoring Needs and Recommendations

Monitor recreation impacts and water quality (e.g., heavy metals, silt load, temperature) at the Waldo site and track population trends using regionally developed protocol.

VI. 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.

Forest Ecosystem Management Assessment Team 1993. Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. USDA Forest Service, USDI Bureau of Land Management, USDC National Marine Fisheries Service, USDI Fish and Wildlife Service, USDI National Park Service, and Environmental Protection Agency.

Frye, T.C. and L. Clark. 1943. Hepaticae of North America. Part II, University of Washington Press, Seattle, WA. pp. 231-232.

Hong, W.S. 1982. The genus *Marsupella* in western North America. Lindbergia 8:166-176.

Larson, D.W. and J.T. Salinas. 1995. Waldo Lake, Willamette National Forest, Oregon. Limnological Investigations: 1986-1995.

Oregon Natural Heritage Program. 1995. Rare, threatened, and endangered plants and animals of Oregon. Oregon Natural Heritage Program, Portland, OR. 84p.

Schuster, R.M. 1974. The Hepaticae and Anthocerotae of North America, east of the hundredth meridian. Vol. III. Columbia University Press, New York, p. 82-87.

Stotler, R. and B. Crandall-Stotler. 1977. A checklist of the liverworts and hornworts of North America. Bryologist 80:405-428.

Smith, A.J.E. 1990. The Liverworts of Britain and Ireland. Cambridge Univ. Press, Cambridge.

USDA Forest Service and USDI Bureau of Land Management. 1994. 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.