DRAFT, Version 1.1

Draft Management Recommendations for Giant foldedleaf *Diplophyllum plicatum* Lindb.

Version 1.1

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EXECUTIVE SUMMARY

Species: *Diplophyllum plicatum* Lindb. (Giant foldedleaf)

Taxonomic Group: Bryophyte: Liverwort

ROD Components: 1,2

Other Management Status: This species is listed by the Oregon Natural Heritage Program (List 3) indicating that information is needed before status can be determined, but it may be threatened or endangered in Oregon or throughout its range within the conterminous United States (1995). It is considered a Bureau Tracking Species in Oregon by the Bureau of Land Management.

Range: *Diplophyllum plicatum* is rare and local in our region and has been documented from 23 sites, with about half occurring on federal lands. It is reported from Skamania, Grays Harbor, Whatcom, Snohomish, Pierce, Clallam, Jefferson, Mason counties in Washington, and Lincoln and Clatsop counties in Oregon.

Specific Habitat: This species occurs on bark of hardwoods and conifers, on thin soil over rock, and on decaying wood, primarily in cool, moist sites in coastal Sitka spruce forests.

Threats: Logging of old-growth, particularly the remaining Sitka spruce, is the most serious threat to this species. In addition, road construction, campground construction, and collection of special forest products could eliminate local populations.

Management Recommendations:

- Known sites should be managed to maintain habitat microsite conditions, retaining shade and moisture regimes, especially of old-growth Sitka spruce forest at sites near the coast. Avoid disturbance at known sites, including modification of canopy.
- Avoid disturbance at known sites, including modification of canopy.
- Restrict harvest of special forest products in vicinity of known sites.
- Maintain coarse woody debris and avoid disturbance of well rotted wood and humic soil.

Information Needs:

- Revisit known sites to verify status of populations and collect ecological data to characterize suitable habitat.
- Conduct inventory (e.g., in late-successional reserves, Research Natural Areas and other withdrawn areas) to locate additional populations.

I. Natural History

A. Taxonomic/Nomenclatural History

Diplophyllum plicatum Lindb. was described in 1872. A recent synonym is *Macrodiplophyllum plicatum* (Lindb.) Perss. It is currently classified in the division Hepatophyta, order Jungermanniales, family Scapaniceae (Stotler and Crandall-Stotler 1977).

Diplophyllum plicatum Lindb. Acta Soc. Sci. Fenn. 10:235 1872.

B. Species Description

1. Morphology (Frye and Clark 1946:573)

Diplophyllum plicatum is a **large, loosely tufted, dark green** (to brownish or yellowish) leafy liverwort. Stems have an external layer of colored and thickened cells, 1-3 cells thick, and internal cells averaging about the same size. Two rows of bilobed, folded leaves closely clasp the stem at the base and are inserted transversely, with **decurrent ventral lobes** that are 2-4 times as long as wide. A well-developed band of elongated cells (vitta) in each lobe is evident with magnification. The leaf cells have pronounced rounded, bulging thickenings of the cell walls, referred to as **nodose trigones**. Leaves are keeled, sometimes with a wing of one row of cells, lobes are unequal, the lower lobe is distinctly larger than the upper. Lower lobes of leaves are 2-2.5 mm long, 0.8 mm wide, upper lobes are 1.2-1.7 mm long with margins varying from entire to finely serrate. **Deeply plicate perianths**, lobulate to lobed at the mouth may be present in the forks of branches.

Diplophyllum plicatum is the largest member of the genus, and is distinguished by its robustness and leaf-cells with thin walls and distinct bulged thickenings (trigones), with the exception of those near the edge.

This large *Diplophyllum* might be mistaken for a robust *Scapania*. *Diplophyllum* species have narrow lateral lobes, the lower lobes spread almost horizontally from the axis, the upper lobes are much smaller and spread obliquely, while *Scapania* species have lobes of the lateral leaves folded upon each other, with the upper and lower lobes not spreading at widely different angles. The common *Diplophyllum albicans* lacks nodose trigones and also has a vitta in its leaf lobes. However, in *Diplophyllum plicatum* the vitta is evident only under the microscope.

Figure 1. Line drawing of *Diplophyllum plicatum* from Frye and Clark (1946) and Christy and Wagner (1996) (to be added). (AWAITING COPYRIGHT PERMISSION)

2. Reproductive Biology

Diplophyllum plicatum is dioicious and requires water for sexual reproduction. Sporophytes are not common (Schofield, pers. comm.).

3. Ecology

This liverwort appears to require year-round cool, humid, moist conditions and is often associated with fog-drenched Sitka spruce habitats.

C. Range, Known Sites

Diplophyllum plicatum is a North Pacific liverwort which ranges from coastal Oregon north to the Olympic Peninsula, and the Washington Cascades to Alaska, and from sites in Far East Asia, Russia, and elsewhere in Asia. It is a common species in coastal British Columbia and Alaska, extending through the Aleutians (Schofield, pers. comm.).

In our range, *Diplophyllum plicatum* is reported from Skamania (historic locality), Grays Harbor, Whatcom, Snohomish, Pierce, Clallam, Jefferson, Mason counties in Washington, and Lincoln and Clatsop counties in Oregon. It is rare and local in our region. It has been reported from 23 sites, with about half occurring on federal lands. It is listed by the Oregon Natural Heritage Programs (List 3,1995) indicating that information is needed before its status can be determined, but it may be threatened or endangered in Oregon or throughout its range.

Figure 2. Map of *Diplophyllum plicatum* (to be added).

D. Habitat Characteristics and Species Abundance

Diplophyllum plicatum is restricted to sites with high humidity and cool temperatures throughout the year. This species occurs on bark of hardwoods and conifers, thin soil over rock and decaying wood primarily in coastal Sitka spruce forests. In the area of consideration, it is a low elevation species, generally in canyons and in cliffs; northward it extends to alpine areas and commonly grows on tree bases (Schofield, pers. comm.)

II. Current Species Situation

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

Diplophyllum plicatum was considered a rare, narrowly distributed species by the bryophyte viability panel (FEMAT 1993). Viability concerns were based on its uncommon occurrence and its narrow distribution (Bryophyte panel notes, June 1993). The viability ratings reflected a high level of concern for this species. Under option 9, it was considered to have a 10 percent likelihood of being well distributed throughout its range, 30 percent likelihood of being locally restricted, 30 percent likelihood of restriction to refugia, and 30 percent likelihood of extirpation on federal lands. Specific concerns included past logging of old growth Sitka spruce and the limited amount of suitable habitat currently available. It is only known from three localities in Oregon, including one historic locality that may no longer exist.

Due to the low viability ratings and high level of concern, this species was identified as a Survey and Manage strategy 1 and 2 species (USDA Forest Service and USDI Bureau of Land Management 1994), with the goal of avoiding further impact to populations of this rare liverwort.

B. Major Habitat and Viability Considerations

The major concern is the very limited amount of remaining suitable habitat for this species on federal land, particularly old-growth Sitka spruce forests along the northern coastal areas of Oregon.

C. Threats to the Species

Logging of old-growth Sitka spruce forest is the most serious threat to this species. In addition, road construction, campground construction, and collection of special forest products could impact local populations. The infrequency of sporophytes impedes its distributional spread (Schofield, pers. comm.).

D. Distribution Relative to Land Allocations

Analysis in progress.

III. Management Goals and Objectives

A. Management Goals for the Taxon

The goal for the management of *Diplophyllum plicatum* is to assist in maintaining species viability.

B. Specific Objectives

- Maintain microclimate conditions which favor *Diplophyllum plicatum* (e.g., year-round cool temperatures, adequate moisture, high humidity) at known sites.
- Known sites, including newly discovered populations, of this rare species should be protected 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. Rapid decreases and fragmentation of primeval forests have caused a serious threat to bryophytes that grow on decaying wood (Laaka 1992). In addition, air pollution (particularly sulphur compounds in combination with low pH) and acid rain are implicated in declines of bryophytes (Hallingbäck 1992, Rao 1982). The extinction rate and rates of decline are high in areas where trends are documented (Greven 1992, Hallingbäck 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 substrate, increased dispersal distance between fragments of primeval forest (Laaka 1992). Lack of suitable substrate is the main reason for rarity of threatened epixylic (decaying wood inhabiting) species in managed forests.

B. Identification of Habitat Areas for Management

This north Pacific species reaches its southern limits in Oregon and is also rare in Washington. Currently it is known from the northern Oregon Coast Sitka spruce zone and on Saddle Mountain in Clatsop County. It may occur in similar suboceanic habitat, either on organic (bark and rotting logs) or inorganic (rock) substrate on the Olympic Peninsula, Western Washington Lowlands, Western Washington Cascades and northern Oregon Coast Range Provinces.

C. Management within Habitat Areas

- Known sites should be managed to maintain habitat microsite conditions, retaining shade and moisture regimes, especially of old-growth Sitka spruce forest at sites near the coast. Avoid disturbance at known sites, including modification of canopy.
- Maintain adequate coarse woody debris substrates at the sites, and avoid disturbance of well-rotted wood and humic soil.
- Restrict special forest product harvest in the vicinity of known sites if this activity is determined to threaten this species.

D. Other Management Issues and Considerations

No additional management issues are identified at this time.

V. Research, Inventory and Monitoring Needs

A. Data Gaps and Information Needs

Visit known sites to verify the status of populations and to characterize habitat and collect ecological data. Many of the known sites are historical records (five were collected before 1920) and the current distribution of this species is unknown. *Diplophyllum plicatum* is reported from a variety of substrates and the ecological requirements and tolerances need to be clarified.

B. Research Questions

- What is the ecological amplitude of *Diplophyllum plicatum*, particularly in the southern portion of its range?
- Is it restricted to Sitka spruce plant associations within the range of consideration?
- How does *Diplophyllum plicatum* respond to modification of the microclimate?

C. Monitoring Needs and Recommendations

Known sites should be monitored to assess compliance with management guidelines and evaluate impacts. In particular, monitor and manage collection of special forest products to ensure that this activity is not affecting known sites or populations of this species.

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