

Survey Protocol Guidance  
For Conducting  
Equivalent Effort Surveys  
Under the Northwest Forest Plan  
Survey and Manage Standard and Guidelines

Bryophytes:

*Kurzia makinoana*

*Marsupella emarginata* var. *aquatica*

*Orthodontium gracile*

*Tritomaria exsectiformis*

Lichens:

*Bryoria subcana*

*Tholurna dissimilis* (south of the Columbia River)

This document contains an overview of information relating to Equivalent Effort surveys. Included in this document or referenced accordingly, is information about when, where, and how to conduct surveys. Also included are brief descriptions of pertinent information including the technical description, range, and habitat, pulled from Conservation Assessments for each species, and updated where applicable. The full text of the Conservation Assessments may be found at: [www.or.blm.gov/isspp/](http://www.or.blm.gov/isspp/) and [fsweb.r6.fs.fed.us/nr/Botany/botany.shtml](http://fsweb.r6.fs.fed.us/nr/Botany/botany.shtml).

March 10, 2006

USDA Forest Service Regions 5 and 6  
USDI Bureau of Land Management, Oregon and California

# Survey Guidance for Bryophytes

Strategic surveys for four Category B bryophytes have not been completed. In order to reduce the inadvertent loss of undiscovered sites, the 2001 Standard and Guidelines requires equivalent effort surveys for habitat disturbing activities in old-growth forest for projects with decisions in fiscal year 2006 and beyond, until such time that strategic surveys have been completed for the province that encompasses the project area. The four bryophytes are:

- *Kurzia makinoana*
- *Marsupella emarginata* var. *aquatica*
- *Orthodontium gracile*
- *Tritomaria exsectiformis*

Direction in the 2001 ROD (page 9, Standards and Guidelines) specifically identifies that equivalent effort surveys for these species must be conducted for a proposed project when all of the following are met:

1. Project lies within the known or suspected range of the species.
2. The project occurs in old-growth forest.
3. Project lies within or could affect suitable habitat for the species.
4. The project has the potential to cause a significant negative effect on the species habitat or the persistence of the species at the site.
5. The project has a decision in FY06 or later.

The definition provided in the 2001 Standard and Guidelines should be used to determine if condition number 2 is met. The 2001 Standard and Guidelines define old-growth forest as:

An ecosystem distinguished by old trees and related structural attributes. Old-growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species, composition, and ecosystem function. More specific parameters applicable to various species are available in the USFS, Region 6, 1993 Interim Old Growth Definitions (USDA Forest Service Region 6, 1993). The Northwest Forest Plan SEIS and FEMAT describe old-growth forest as a forest stand usually at least 180 to 220 years old with moderate-to-high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground (USDA, USDI 1994a).

To conduct equivalent effort surveys for these 4 bryophyte species, utilize the survey methodology presented in the most recent bryophyte survey protocol (Survey Protocols for Protection Buffer Bryophytes, Section I, Subsection II, IM OR-2000-017, Dec 3, 1999). Subsection II (Survey Methods) within that protocol identifies how and when to conduct surveys. Although the 1997 bryophyte survey protocol contains information about 3 of the 4 bryophyte species covered by this guidance (all but *Orthodontium gracile*), that information is outdated and is superseded by the information presented herein (for instance, “survey triggers” in the 1997 protocol is superseded by the above direction).

Vouchering for these species should follow previous direction transmitted by the agencies for bryophytes. Utilize the other species-specific information presented below to help determine habitat, range, and technical descriptions of the species.

Survey data must be entered into GeoBOB for BLM and NRIS TES Plants for the Forest Service using field forms developed for each respective application. Use of NRIS TES Plants will be contingent on the availability of the application to individual Forests but all Forests should use the field forms developed for NRIS TES Plants.

***References***

USDA Forest Service. 1993. Region 6 interim old growth definitions for the Douglas-fir series, grand fir/white fir series, interior Douglas-fir series, lodgepole pine series, Pacific silver fir series, tanoak (redwood) series., western hemlock series. Portland, Oregon. U.S. Department of Agriculture, forest Service, Pacific Northwest Region.

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 (Northwest Forest Plan). Portland, Oregon.

## ***Kurzia makinoana*** (Steph.) Grolle.

Bryophyte, Liverwort

### **Technical Description:**

(Hattori and Mizutani 1958, Hong 1988, Inoue 1974, Schuster 1980, Christy and Wagner 1996).

*Kurzia makinoana* is a tiny leafy liverwort, dull or deep green to brownish-green in color, dense, aromatic, occurring in interwoven, tufts or patches (occasionally creeping as scattered stems among other bryophytes). Stems are 5-20 mm long, threadlike, creeping to ascending, irregularly to more or less regularly pinnately to bipinnately branched, occasionally terminating in slender, runnerlike branches with reduced leaves (flagella); leafy branches usually lateral; flagella usually behind, toward the substrate (postical). Rhizoids are sparsely developed, at the bases of the lower underleaves, more frequent on flagella. Leaves are barely contiguous to imbricate, transversely inserted, arising from segments (merophytes) 4 cells broad, the basal portion spreading but lobes usually more or less suberect to erect, or even slightly incurved, thus the leaves look typically hand-like, somewhat cupped. Leaves are 3-4 lobed; lobes entire, subulate to narrowly lanceolate, usually somewhat incurved, dorsal lobes of stem leaves reduced and formed of 2 (3) strongly elongated cells, or of 2 (3) cells broad at base and 1-2 cells high, the lobe thus 2-4 (5) celled, or all lobes more or less equal. Branch leaves are similar to stem leaves but smaller and more often 2-3 lobed. Cuticle dull when dry; oil bodies absent, except in medullary (and less often in cortical) stem cells, occasionally few in leaf cells (small, subspherical, glistening, when present). Underleaves of stem are usually 3(4)-lobed, 1-2 lobes often much reduced. Male inflorescences are on short postical (more rarely lateral) branches; bracts in 4-5 pairs, strongly concave, divided 0.5-0.65 their length into two ovate to triangular, acuminate lobes, whose margins are sharply spinose-dentate. Female inflorescence are on a very short postical branch, usually with no leaves except for the closely sheathing bracts, ovate to 2 times as long as wide, 2(3) lobed, with few and short teeth, one margin usually without teeth, lobes 0.25-0.4 of leaf length. Perianth bears only 1-3-celled teeth at mouth.

*Kurzia* species may be confused with *Blepharostoma* (which has more filamentous leaf lobes that are narrow and uniseriate to the base) and *Cephaloziella* (which has bilobed leaves and small or obsolete underleaves).

The name *K. makinoana* is being applied in a broad sense, combining the narrower concepts of both *K. makinoana* and *K. sylvatica*. It may be useful to note in passing that, according to Inoue (1974) and Schuster (1980), vegetative *K. makinoana* can be distinguished from *K. sylvatica* by the reduced dorsal lobes of the leaves (composed of 4-5 cells vs. the typical 8+ cells of the other lobes; *K. sylvatica* leaf lobes are more or less equal, typically 8+ cells each), and the thicker walls of the stem cortical cells. It should be noted as well, that material recently collected on the Olympic Peninsula, Washington (2000) and on the Coos Bay BLM District, Oregon (1999, 2004), generally agrees with the vegetative description provided for *K. makinoana* (Steph.) Grolle by Schuster (1980).

### **Range:**

*Kurzia makinoana* is known from coastal sites in northern California, Oregon, Washington, and British Columbia, as well as Japan. In Oregon, Washington, and California, *K. makinoana* is known from a few coastal or near-coastal localities in Olympic National Park, Clallam County, and Mt. Baker-Snoqualmie National Forest, Snohomish Co., Washington, Coos Bay BLM District, Coos County, Oregon, and in Mendocino, Humboldt, and Del Norte Counties, California.

### **Habitat**

*Kurzia makinoana* occurs on well-shaded, rotten wood and humic soil at low elevations,

especially on stream terraces, floodplains, and other cool, moist forest locations. The two known sites in Washington occur in old-growth forests, near riparian areas, at low elevations 100 m (328 ft.) and 335 m (1,100 ft.), elevation, respectively. Each of these sites is within 40 km (25 miles) of the coast. Helliwell (2006) notes that an Olympic peninsula population he visited is on an upturned, decayed, old rootwad near the edge of a wetland under an open canopy of *Tsuga heterophylla* and *Thuja plicata*, in a bog-like area. The Oregon site occurs on humic material at the edge of a coastal lake where, depending on time of year, it is submerged, emergent, or merely moist. California populations are reported from mires or small bogs. According to the bryophyte viability panel convened by the Forest Ecosystem Management Assessment Team, *K. makinoana* is reported from Ft. Bragg, in coastal Mendocino County, one site in western Del Norte County, and from Redwood National Park (bryophyte panel notes, June 1993). Although most of the collections in British Columbia are from shaded humus banks in forests, the Queen Charlotte Islands collections are from damp humus in bogs (Hong 1988).

### **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.
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## ***Marsupella emarginata* var. *aquatica*** (Lindenb.) Dumort.

Bryophyte: Liverwort

### **Technical Description:**

(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 redbrown, 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.

### **Range:**

Within the states of Washington and Oregon, *Marsupella emarginata* var. *aquatica* is known from only two sites, one on Willamette National Forest, Lane Co., Oregon, and one on the Mt. Baker-Snoqualmie National Forest, Snohomish Co., Washington. These are the only known locations in the western United States. 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.).

### **Habitat**

In Oregon and Washington, *Marsupella emarginata* var. *aquatica* occurs in robust colonies attached to submerged rocks in cold, perennial streams. At the Waldo Lake site, the taxon occurs intermittently in the first two miles of the Lake's outlet stream. Within this reach, it typically is present in the steeper, faster flowing sections, and absent from the lower gradient, slower moving sections (Wagner 1999).

### **References**

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.

Schofield, W.B. 1996. University of British Columbia. Vancouver. Canada. Personal Communication.

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

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

Wagner, 1999. Report on *Marsupella emarginata* var. *aquatica* from Waldo Lake outlet stream. Sponsored by the Willamette National Forest, Contract # 53-04-R4-8-9800.

## ***Orthodontium gracile*** (Wils. ex Sm.) Schwaegr. ex. B.S.G.

Bryophyte, Moss

### **Technical Description:**

(Andrews 1935, Lawton 1971, Smith 1978, Christy and Wagner 1996)

Plants of *Orthodontium gracile* are erect, up to 1.2 cm tall, yellow-green above and brown below. Leaves are erect, 5-7 mm long, linear and very slender, curving in various directions to give mats a felty appearance. The leaf cells are long and narrow, with undifferentiated alar cells. Capsules are smooth, usually erect, 1-2 mm long, symmetric, brownish yellow, becoming whitish with age. The neck of the capsule is about as long as the urn.

Only one other species of *Orthodontium*, *O. pellucens* (Hook.) B.S.G. in C. Müll. occurs within the range of *O. gracile*. According to Christy and Wagner (1996), *Orthodontium* appears similar to a small *Dicranum* or *Dicranella*, which may grow in the same habitat. *Dicranum* is usually larger, has short leaf cells and differentiated, often brown alar cells, and its capsules are large and asymmetric, with short necks. *Dicranella* has short leaf cells and either ribbed or smooth asymmetric capsules.

Norris and Shevock published a key to California mosses that allows for differentiation of the two local species by gametophytic characters. *Orthodontium gracile* has leaves that are narrowed from the base to the apex while *O. pellucens* has leaves that are broadest near the middle. Other differences include placement of antheridia only a few leaf axils below the perichaetium (specialized leaves subtending the archegonium) in *O. gracile* while they appear on a short branch near the base of the perichaetium in *O. pellucens*. *Orthodontium gracile* has exostome (the outer row of peristome teeth of the capsule) teeth evenly tapering from a broad base that is closely striate with a zig-zag median commissural line. *Orthodontium pellucens* has widely separated exostome teeth that are bluntly linear and lightly papillose while lacking the median commissural line.

The Moss Flora of Mexico (Sharp et. al., 1994) is the only other published flora where the two species co-occur. It is also the only flora with line drawings of both species.

### **Range:**

*Orthodontium gracile* is also known from Australia, Great Britain, and northwestern France. It was considered by Dixon (1924) to be a very rare and distinct species, hardly known outside Britain, except in two or three French localities. It is rare in Great Britain, but apparently increasing its range in Europe (Norris, pers. comm.). In the Pacific Northwest it is only known from the coast redwood area of northern California and southwestern Oregon (Koch 1951, 1952; Lawton 1971). Coast redwoods inhabit a discontinuous, narrow and irregular coastal strip approximately 500 km (310 miles) long and 5 to 10 km (3 to 6 miles) wide stretching from Brookings, Oregon south to the San Luis Obispo county line in central California. It occurs on alluvial slopes up to 1000 m (3280 ft.) in elevation within the coastal fog belt.

In California, the range of this species includes the counties of Del Norte, Humboldt, Mendocino, Sonoma, and Marin. The range extends south to San Mateo, Santa Clara, Santa Cruz, and Monterey counties south of the range of the northern spotted owl. Eighteen historical sites are reported for California; two occur on federal land (Muir Woods National Monument and Redwood National Park). There are two sites in Oregon, a historical collection from Loeb State Park in Curry County that has not been recently relocated, and a second site on the Siskiyou National Forest, also in Curry County. The identification of the Siskiyou National Forest site is based upon sterile specimens.

### **Habitat**

*Orthodontium gracile* occurs in shaded habitats on the lower trunks of old-growth or mature second growth coast redwood, sometimes below wounds on the tree, on down logs, or on charred stumps. Norris (1987) reports that it was more abundant in old-growth forest than in 100 year old second-growth. *Orthodontium gracile* is reported to be quite abundant where it is found (Norris, pers. comm.). An elevational range between 90 and 150 m (300 to 1,110 ft.) is reported from sites. Associated species of *O. gracile* include *Aulacomnium androgynum*, *Plagiothecium laetum*, and *Lepidozia reptans*.

### **References**

- Andrews, A.L. 1935. Family Bryaceae. pp. 184-210 *in*: Grout, A.J. Moss flora of North America North of Mexico. Vol. 2. Published by the author. Newfane, Vermont.
- 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.
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- Norris, D.H. 1994. University of California, Berkeley. Personal communication.
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- Smith, A.J.E. 1978. The Moss flora of Britain and Ireland. Cambridge Univ. Press, Cambridge. 706 pp.

## ***Tritomaria exsectiformis*** (Breidl.) Schiffn.

Bryophyte, Liverwort

### **Technical Description:**

*Tritomaria exsectiformis* is a small 1.0-2.0 mm wide, green to brownish-green, liverwort. Shoots are ascending to erect, unbranched or little branched, in pure patches or intermixed with other liverwort species. Leaves are generally longer than wide, more or less transversely inserted, typically asymmetrically 2-3 lobed, lobes acute, the dorsal lobe small, tooth-like, often appearing remote from the ventral 1 or 2 lobes. Leaf cells are thin-walled with bulging trigones and 7-15 oil bodies per cell. Underleaves are absent. When plants are in pure patches, abundance of red gemmae can give a reddish cast to the patches, causing them to contrast with the green of adjacent liverwort species.

This species is very similar to *T. exsecta*, which can be distinguished by the smooth ovoid gemma. Gemmae of *Tritomaria quinquedentata* are angular, polygonal to pyriform. *Lophozia longidens* also has dark reddish-brown gemmae, but *Tritomaria exsectiformis* differs in its asymmetric, three-lobed leaves (Vitt et al. 1988).

### **Range:**

*Tritomaria exsectiformis* is an arctic-alpine, circumboreal species that is missing in Eastern Asia. Within Western North America it is known from Alaska, British Columbia, Colorado, Idaho, Montana, Oregon, Washington and Wyoming. In Oregon it occurs on the Deschutes National Forest, (Deschutes and Jefferson Counties) and on the Umpqua National Forest, (Douglas County). Recently a new site was located on the Olympic National Forest, (Clallam Co.) near Sequim, Washington. In eastern Washington there are sites on the Okanogan-Wenatchee National Forest (Okanogan County) and on the Colville National Forest (Stevens County).

### **Habitat**

Within the Pacific Northwest this species is currently known from mid-elevational (3200-5200 feet) riparian zones. Typically, its habitat is open to shaded coniferous forest in association with low volume, perennial water flow at or near springs and seeps, along very gentle topographic gradients. Lodgepole pine (*Pinus contorta*) is present at nearly all sites of *T. exsectiformis* within the Oregon and Washington Cascades. Other tree species occurring at these sites include white fir, ponderosa pine, Engelmann spruce (*Picea engelmannii*), Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tusga heterophylla*), mountain hemlock (*Tusga mertensiana*), and subalpine fir (*Abies lasiocarpa*). Currently, all but one of the *T. exsectiformis* sites in the Oregon and Washington Cascades occur within spring-fed hydrologic systems.

Substratum is most commonly decay class four, occasionally decay class three or five, down wood that generally is in direct contact with water. Plants have been documented to occur on a “small twig” hanging over water, and may also occur on rotten limbs as small as three inches in diameter. Generally, however, the woody substratum is rotten logs that are 10+ inches in diameter. Plants may also occur on wet, peaty soil beside spring-fed creeks. Key habitat elements appear to be hydrologic stability (low, steady flow, no scouring) and substrates that will serve as wicks for a water supply that is continuously available during the snow-free period of the year. It may also be significant that the surface water associated with *T. exsectiformis* locations, being generally spring-fed, is usually very cold. A fairly broad range of sunlight (amount direct light vs. diffuse light or shade) appears to be tolerated as long as these hydrologic and substrate conditions are met. It is notable that the microsite conditions observed at the Cascade *T. exsectiformis* sites within Oregon and Washington appear to differ markedly from those described for this species in British Columbia. In southwestern

British Columbia, Godfrey (1977) found *T. exsectiformis* "growing on humus over rotting logs, boulders, and in outcrop crevices. Substrate dry to mesic, partially shaded."

***References***

Godfrey, J.D. 1977. The hepaticae and anthocerotae of southwestern British Columbia. Ph.D. Thesis. University of British Columbia. Vancouver, Canada. 433 p.

Vitt, D.H., J.E. Marsh, and R.B. Bovey. 1988. Mosses, lichens, and ferns of Northwest North America. Lone pine Publ., Edmonton, Alta., 296 pp.

# Survey Guidance for Lichens

Strategic surveys for two Category B lichens, *Bryoria subcana* and *Tholurna dissimilis* (south of the Columbia River), have not been completed. In order to reduce the inadvertent loss of undiscovered sites, the 2001 Standard and Guidelines requires equivalent effort surveys for habitat disturbing activities in old-growth forest with decisions signed in fiscal year 2006 and beyond until such time that strategic surveys have been completed for the province that encompasses the project area.

Direction in the 2001 ROD (page 9, Standards and Guidelines) specifically identifies that equivalent effort surveys for these species must be conducted for a proposed project when all of the following are met:

1. Project lies within the known or suspected range of the species.
2. The project occurs in old-growth forest.
3. Project lies within or could affect suitable habitat for the species.
4. The project has the potential to cause a significant negative effect on the species habitat or the persistence of the species at the site.
5. Project has a decision in FY06 or later.

The definition provided in the 2001 Standard and Guidelines should be used to determine if condition number 2 is met. The 2001 Standard and Guidelines define old-growth forest as:

An ecosystem distinguished by old trees and related structural attributes. Old-growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species, composition, and ecosystem function. More specific parameters applicable to various species are available in the USFS, Region 6, 1993 Interim Old Growth Definitions (USDA Forest Service Region 6, 1993). The Northwest Forest Plan SEIS and FEMAT describe old-growth forest as a forest stand usually at least 180 to 220 years old with moderate-to-high canopy closure; a multi-layered, multi-species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground (USDA, USDI 1994a).

The Survey Methods previously developed for lichen surveys (Survey Protocols for Survey & Manage Category A & C Lichens, Section 1, IM OR-2003-078, June 9, 2003), should be followed for conducting Equivalent Efforts surveys. Vouchering for these species should follow previous direction transmitted by the agencies covering lichens. Utilize the other species-specific information presented below to help determine habitat, range, and technical descriptions of the species.

Survey data must be entered into GeoBOB for BLM and NRIS TES Plants for the Forest Service using field forms developed for each respective application. Use of NRIS TES Plants will be contingent on the availability of the application to individual Forests but all Forests should use the field forms developed for NRIS TES Plants.

## References

USDA Forest Service. 1993. Region 6 interim old growth definitions for the Douglas-fir series, grand fir/white fir series, interior Douglas-fir series, lodgepole pine series, Pacific silver fir

series, tanoak (redwood) series., western hemlock series. Portland, Oregon. U.S. Department of Agriculture, forest Service, Pacific Northwest Region.

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 (Northwest Forest Plan). Portland, Oregon.

## ***Bryoria subcana*** (Nyl. ex Stizenb.) Brodo & D. Hawksw.

Lichen

### **Technical Description:**

*Bryoria subcana* is a short, pendant to almost tufted, fruticose lichen, up to 5 cm long. Its distinctive color (pale brown to greenish-white or whitish), nearly perpendicular branching angles, and typically abundant soralia, coupled with strong red color reaction of the cortex, medulla, and soralia to the spot chemical, p-phenylenediamine, differentiate it from very pale forms of *B. trichodes* ssp. *trichodes* that also grow near the coast (McCune and Geiser 1997).

The branching pattern is isotomic dichotomous, and the branches are round in cross-section, even in diameter, straight, often brittle, 0.15-0.3 mm in diameter. The basal parts are pale brownish- gray. The thallus surface is usually matte but occasionally shiny; apical parts are very pale brownish-gray to greenish-white or whitish, sometimes becoming variegated. True lateral spinules are absent. Pseudocypbellae are often present, sparse, inconspicuous, fusiform, and white. Soralia are usually abundant, tuberculate, as wide as or slightly broader than the branches on which they occur, occasionally becoming spinulose, to 0.8 mm in diameter. Apothecia and pycnidia have not been observed in North American material. Spot test reactions are K-, C-, KC, PD+ bright red (rapid). *B. subcana* contains large amounts of fumarprotocetraric acid (Brodo and Hawksworth 1977).

### **Range:**

*Bryoria subcana* is known only from coastal western North America between south-central Alaska and central California (Brodo and Hawksworth 1977) and from Great Britain. In the Pacific Northwest, *B. subcana* is known from seven sites within 130 km (80 mi) of the coast. There are two sites (USDA 1998) on the Hebo Ranger District, Siuslaw National Forest. One is south of the Little Nestucca River about 5 km (3 mi) west of Dolph, and the other is north of Cedar Lake. However, the Little Nestucca River site has not been verified. Other Oregon sites are the summit of Saddle Mountain State Park (Clatsop County) (Pike 3818 in OSC Herbarium), the Eel Creek area of the Oregon Dunes NRA (Geiser *et al.* 2004), the summit of Grass Mountain (McCune *et al.* 1997), in Grass Mountain Area of Critical Environmental Concern (ACEC) on Salem District BLM (Benton County), and a new site on BLM land near Coos Bay. No verified sites are known for Washington. There have been a number of reports of this species from the Cascade Range in Oregon and Washington, but to date it has only been confirmed to occur on the Sweet Home Ranger District of the Willamette National Forest (Geiser *et al.* 2004). In California, *B. subcana* is known from the Bolinas Trail, Inverness ridge area (Brodo and Hawksworth 1977) (Marin County); ownership of this site is unknown.

Selected specimen record (Geiser *et al.* 2004) includes Oregon. Coos Co. Oregon Dunes National Recreation Area, Eel Creek, *Ingersoll 957* (OSC). Tillamook Co. Siuslaw National Forest, Cedar Lake, *Mikulin 1290*(OSC). Clatsop Co. Saddle Mountain State Park, *Mikulin 1180* (OSC). Previously, a location was identified as occurring in Douglas Co., Umpqua National Forest. Upon further analysis, this identification has been determined to be in error (Glavich *et al.*, 2005a)

### **Habitat**

*Bryoria subcana* is found on the bark and wood of conifers in Sitka spruce (*Picea sitchensis*), western hemlock (*Tsuga heterophylla*), wet Douglas-fir (*Pseudotsuga menziesii*), wet noble fir (*Abies procera*), and mixed hardwood-coniferous forests along coastal bays and streams, dune forests (tentative), coastal mountain ridges, and high precipitation summits. High humidity, either as coastal fog or high precipitation, appears to be an important habitat requirement. Glavich *et al.*

(2005b) noted that the species was found at sites with greater than 200 cm of annual precipitation, with greater than 170 days with measurable precipitation. In addition, these sites were located between 650-1,000 meters in elevation, on steep slopes. At the sites where stand age was noted, the host plant is old or the stand age is late-seral to old-growth. Requirements for light are not well understood. The lichen tolerates shade at two sites but canopy cover is low at other sites. Sites in western North America are found within 15-130 km of the ocean.

At Inverness ridge in coastal Marin County, CA, *Bryoria subcana* was found on the lower trunk of a Douglas-fir. At the Little Nestucca site, it was found mid-slope on a steep ridge, among red alders (*Alnus rubra*) and large, old western hemlocks. Exposure to light at this site was also low. At the Cedar Lake site, the lichen was found on Douglas-fir in an open, even-aged Sitka spruce/swordfern (*Polytrichum munitum*) forest of about 85 years. At the summits of Grass Mountain and Saddle Mountain it was found in wet noble fir forests, but the exposure is not known. (The tentative site at Eel creek was an open canopy, mature western hemlock/rhododendron (*Rhododendron macrophyllum*) dune forest with mats of the lichen *Stereocaulon* on the forest floor.)

Little information is available about species abundance. The species was noted as rare at two sites. No large populations have been identified.

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## ***Tholurna dissimilis*** (Norman) Norman.

Lichen

This species has Survey and Manage status only south of the Columbia River. Equivalent effort surveys and site management only apply to those FS and BLM lands that are south of the Columbia River.

### ***Technical Description:***

*Tholurna dissimilis* is a very distinctive, dwarf, fruticose lichen composed of short, erect, hollow gray stalks. The tiny stalks are 1-3 (5) mm tall and 1 mm broad, arising from a squamulose to nearly crustose primary thallus. The brownish-gray stalks form a coarse stubble, and terminate with black apothecia, which dissolve into a powdery mass of spores. *Tholurna dissimilis* is obscure because of its diminutive size.

Squamulose thallus of once-pinnate sterile lobes bearing erect, nearly cylindrical sulcate fertile podetia 1-3 mm high. Thallus dark brown to black and with upper and lower cortex and a spongy medulla. Green algal photobiont is *Protococcus*. Cup-shaped black apothecia are solitary on the apices of the gray podetia, which are expanded to a disciform receptacle. Asci slender and narrowed at the base to a thin stalk, 8-spored, the spores uniseriate. Spores composed of two globose cells and constricted in the middle; each cell with spiral diagonal-stripped apispore. Conceptacle of the pycnoconidia at the edge of the thallus, small, wart-like and brownish, and with a soft wall. Sporophores septate and with nearly globose cells; pycnoconidia straight, constricted in the middle, possessing secondary branches (Otto 1964).

### ***Range:***

*Tholurna dissimilis*, once thought to be endemic to Scandinavia (Otto 1964), is known from the Northwest Territories, Yukon, and British Columbia south into Washington and Oregon (Otto 1983). It reaches its southern limit in the central Oregon Cascades, and is known from 18 sites in Washington and 3 sites in Oregon. All known sites are on federal land with the exception of a Port Angeles location. In Washington it is found in Clallam, Whatcom, Snohomish, King, Chelan, Pierce, Lewis, and Skamania counties. Sites on federal lands in Washington include Hurricane Ridge (Olympic National Park); the Mt. Baker-Snoqualmie National Forest on Skyline Divide, Table Mountain, Tomyhoi Peak area, White Mountain in the Glacier Peak Wilderness, Mt. Defiance in Alpine Lakes Wilderness, and Crystal Mountain Ski Area; Lake Wenatchee Ranger District on the Wenatchee National Forest, and above Harts Pass near the Cascade Crest on the Okanogan National Forest. It has been reported on the Gifford Pinchot National Forest from Castle Butte on the Cowlitz Valley Ranger District, and the canopy crane site on the Wind River District. There was a known site at the Carson Fish Hatchery in southern Washington, although that population no longer exists (J. Davis, pers. comm.). The only known site on nonfederal land is at low elevation near Port Angeles, Washington.

In Oregon, there are three known sites. It has been reported from the Mt. Hood Wilderness. The two sites on the Willamette National Forest at Iron Mountain and Carpenter Mountain represent the known southern limit of this species. The rarity of *Tholurna dissimilis* in Oregon, its sparseness, and stunted condition suggest that conditions at the southernmost site are near the limit for its growth (Pike 1972).

### **Habitat**

In the Pacific Northwest, the typical habitat reported for *Tholurna dissimilis* is on krummholz or flag-form subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) on windswept ridges in the upper montane and subalpine zones up to timberline. The elevation of sites in this region ranges from near sea level to 2042 m (6700 ft). Atypical habitat characteristics include the historic location on ornamental birch (*Betula* sp.) near the Carson Fish Hatchery, on alder (*Alnus* sp.) near Port Angeles, and on rock on a mountain summit in Lewis County, Washington. In Oregon, populations were reported at treeline on subalpine fir and in an alpine area on wild currant (*Ribes triste*).

*Tholurna dissimilis* appears to be rare in Oregon, becoming more common to the north in British Columbia. Abundance data for this species are not currently available.

There has been only one report of *Tholurna dissimilis* from low-elevation tree canopies in the range of the northern spotted owl, but few if any surveys have been conducted in this habitat. In the Kitimat Valley of west-central British Columbia, it was found in the emergent crowns (40 m height, 131 ft) of dominant spruce (presumably *Picea sitchensis*) in low elevation forests (150 m, 492 ft) (Otto 1983). *T. dissimilis* was recently observed at the very top of an emergent spike-top old-growth Douglas-fir (*Pseudotsuga menziesii*) at the canopy crane site at Wind River on the Gifford Pinchot National Forest (J. Davis, pers. comm.). This recent discovery is evidence that *T. dissimilis* occurs in tree canopies other than krummholz, and at lower elevations.

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