Management Recommendations for

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

version 2.0

CONTENTS

SUMMARY

Species: *Bryoria subcana* (Nyl. ex Stizenb.) Brodo & D. Hawksw.
Taxonomic Group: Lichens (Rare Oceanic-Influenced)
ROD Components: 1, 3

Other Management Status: Oregon Natural Heritage Program: List 3 (more information is needed before status can be determined, but may be threatened or endangered in Oregon or throughout their range); Natural Heritage Networks Rank: Global Rank G4 (not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences); State Rank S1 (critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation in Oregon, typically with 5 or fewer occurrences) (Oregon Natural Heritage Program 1998); and BLM Tracking Status (USDI Bureau of Land Management 1998).

Range: *Bryoria subcana* is known from five sites in the range of the Northwest Forest Plan. The Oregon sites are near the Little Nestucca River and near Cedar Lake, Hebo Ranger District, Siuslaw National Forest; Grass Mountain Area of Critical Environmental Concern on Salem District BLM; and Saddle Mountain State Park. The California site is Inverness Ridge in Marin County. A sixth site, near Eel Creek in the Oregon Dunes National Recreation Area needs to be verified.

Specific Habitat: *Bryoria subcana* grows on bark and wood of conifers in forests of coastal bays, streams, dune forests, and high precipitation ridges and summits within 50 km (30 mi) of the ocean.

Threats: The major threat to *B. subcana* is loss of populations from activities that directly affect the habitat or the population.

Management Recommendations:
- Manage known sites to maintain local populations and their habitat area.
- Develop practices to route human use away from known sites.
- Manage fire in the habitat areas, with emphasis on prevention.
- Restrict removal of trees, shrubs, or other vegetation from the known sites and habitat areas, except when removal will not harm habitat integrity.
- Consider opportunities for managing known sites during Forest Plan and Resource Management Plan revisions, such as administratively withdrawn designations, or by prescribing special standards and guidelines.

Information Needs:
- Visit known sites to determine the extent of local populations and improve habitat descriptions.
- Determine if *B. subcana* is closely associated with late-successional and old-growth forests.
- Determine whether additional populations exist in areas identified as potential suitable habitat.

version 2.0

Management Recommendations for *Bryoria subcana*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Bryoria subcana (Nyl. *ex* Stizenb.) Brodo & D. Hawksw. was first described in 1892 by Stizenberger, who recognized it as a variety of *Alectoria prolixa* (*A. prolixa* var. *subcana* Nyl. *ex* Stiz.), a species complex originally described by Nylander. Gyelnik elevated the variety to species status in 1931 (*A. subcana* (Nyl. ex Stiz.) Gyeln.). In 1977, Brodo and Hawksworth subdivided the genus *Alectoria*, into *Alectoria*, *Bryoria, Pseudephebe*, *Sulcaria,* and *Oropogon,* and the current epithet was established. The type specimen of *B. subcana* was collected in Scotland in 1875 by J.M. Crombie (Herbarium Nylander 35835). *Bryoria subcana* has also been known by at least 12 other names, none of which are currently used; Hawksworth (1972) details the long taxonomic history of this species.

Synonyms:
Alectoria haynaldii Gyeln., Nyt Mag. Naturv. 70: 49 (1932)
?Alectoria implexa var. *subimplexa* Ndv., Klick Urcovn R Lisejnikd CSR 1: 122 (1956), nom inval. (Art. 36)
Alectoria jubata var. *subcana* (Nyl. *ex* Stiz.) D.T. & Sarnth, Flecht. Tirol. 11 (1902)
Alectoria prolixa var. *subcana* Nyl. *ex* Stiz, Annals Naturhist. Hofmus. Wien 7: 129 (1892)
Alectoria subcana Nyl. *ex* Cromb., J. Bot., Lond. 14:360 (1876), nom. inval. (Art. 32)
Alectoria subcana (Nyl. *ex Stiz.)* Gyeln., Magy. Bot. Lapok 30: 54 (1931)
?Alectoria subcana var. *obscurata* Mot., Fl. Polska, Porosty (2): 88 (1962), nom. inval. (Art. 37)
Alectoria subcana var. *subosteola* (Gyeln.) Mot., Fl. Polska, Porosty (2): 88 (1962)
Bryopogon haynaldii (Gyeln.) Zahlbr., *Cat.* Lich. Univ. 10: 557 (1940)
Bryopogon jubatus var. *subcanus* (Nyl. ex Stiz.) Oksn., Viznachik Lishainikiv URSR: 276 (1937)
Bryopogon lanestris f. *haynaldii* (Gyeln.) Gyeln., Feddes Repert. 38: 227 (1935)
Bryopogon subcana (Nyl. *ex* Stiz.) Gyeln., Feddes Repert. 38: 226 (1935)
Bryopogon subosteolus Gyeln., Acta Geobot. Hungar. 2: 164 (1937)

B. Species Description

1. Morphology and Chemistry

Bryoria subcana is a short, pendant to almost tufted, fruticose lichen, up to 5 cm long (Figure 1). 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).

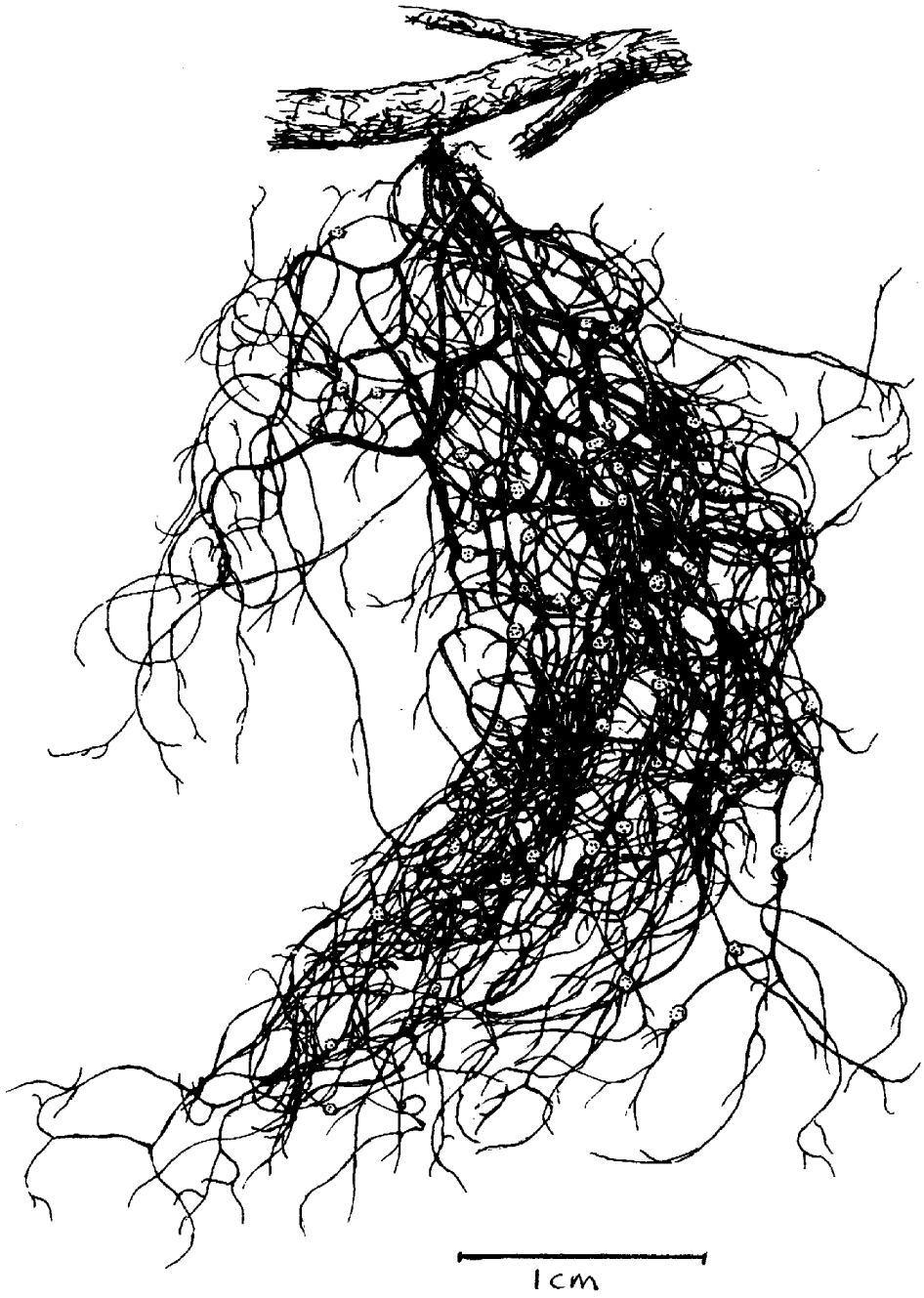

Figure 1. Line drawing of *Bryoria subcana* by Alexander Mikulin.

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. Pseudocyphellae 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). *Bryoria subcana* contains large amounts of fumarprotocetraric acid (Brodo and Hawksworth 1977).

2. Reproductive Biology

Sexual reproductive structures are unknown for North American material. *Bryoria subcana* reproduces asexually via soredia and thallus fragmentation.

Soredia are microscopic, usually spherical clusters of fungal mycelium and green algal cells that can be dispersed long distances by wind or animals. Birds can be important vectors, dispersing lichen propagules as a kind of litter along the migratory coastal highway (McCune *et al.* 1997). In contrast, thallus fragments are heavier and are more important for dispersal over short distances, usually within a few tree lengths.

3. Ecological Roles

Little is known about the ecological roles of *Bryoria subcana*. Other *Bryoria* species provide nesting material and forage for small mammals (Maser *et al.* 1985 and 1986, Rosentreter and Eslick 1993), and critical winter forage for ungulates (Stevenson and Rochelle 1984). Lichen foraging is optimal in late-seral and old-growth forests, places where there has been sufficient time to develop a large biomass (Stevenson and Rochelle 1984, Neitlich 1996).

C. Range and Known Sites

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 (Purvis *et al.* 1992). In the range of the Northwest Forest Plan, *B. subcana* is known from five sites, all within 50 km (30 mi) of the coast. There are two sites (USDA 1998) on 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. The other Oregon sites are the summit of Saddle Mountain State Park (Clatsop County) (Pike 3818 in OSC Herbarium), and the summit of Grass Mountain (McCune *et al.* 1997), in Grass Mountain Area of Critical Environmental Concern (ACEC) on Salem District BLM (Benton County). In California, *B. subcana* is known from the Bolema Trail, Inverness Ridge area (Brodo and Hawksworth 1977) (Marin County); ownership of this site is unknown. A sixth site, near Eel Creek (USDA 1998) in the Oregon Dunes National Recreation Area (Coos County) has been tentatively identified. The voucher specimen from this site is pale brown, with protocetraric acid and many soralia, but it is very small.

D. Habitat Characteristics and Species Abundance

Bryoria subcana is found on 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. 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. In western North America, *B. subcana* has always been found within 50 km (30 mi) of the ocean.

At Inverness ridge, *B. 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.

II. CURRENT SPECIES SITUATION

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

Bryoria subcana 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, 1994b). At the time of the lichen viability panel, it was known from only one site (USDA and USDI 1994a, 1994b). Ratings by the viability panel reflected a high level of concern for this species. The rare oceanic-influenced lichens as a group received the lowest viability ratings among all of the lichens considered (USDA and USDI 1994a).

Because of the low viability ratings and high level of concern, this species was identified as a Survey and Manage strategy 1 and 3 species with the dual objectives of managing known sites and conducting extensive surveys to find additional populations and identify other high-priority sites for species management (USDA and USDI 1994c).

B. Major Habitat and Viability Considerations

Frequent fog along the coast, and high precipitation summits of the Coast Range create a suitable environment for oceanic-influenced lichens such as *B. subcana*. The major concerns for this

lichen are the small number of populations on federal land and loss of populations from management activities that directly harm the populations or impact habitat areas. Much of the coastal forest land in the Pacific Northwest is under nonfederal ownership, generally managed on short harvest rotations. Given that lichens are slow to establish in rapidly growing stands and do not become abundant until later in successional development (USDA and USDI 1994a), most of these stands are harvested before lichens have a chance to establish significant populations. One explanation for the limited distribution of *Bryoria subcana* is that it may not have time to establish significant populations in areas where there is frequent disturbance of host plant communities.

C. Threats to the Species

Threats to *B. subcana* are those actions that disrupt stand conditions necessary for its survival; such actions include treatments that reduce populations by removing colonized Sitka spruce, Douglas-fir, and noble fir, or other colonized bark or wood substrates; alter the light, moisture or temperature regime in habitat areas; or reduce air quality.

Recreational activities and developments may inadvertently alter the habitat of this species. Trampling by recreational vehicles and frequent foot traffic are serious threats, especially in shore pine woodlands and edge communities, as these degrade the habitat by disturbing fragile root systems of trees and shrubs, and the fragile protective mats of ground cryptogams, which stabilize the soil (Christy *et al.* 1998). Destabilization of the foredunes by recreationists or removal of European beachgrass (*Ammophila arenaria*) can destabilize tree island habitats of *B. subcana* by increasing the amount of sand drift into them and burying trees on the perimeter (Christy *et al.* 1998). Buildings, roads, campgrounds, and trails along the immediate coast have replaced many natural habitats to improve access, facilitate scenic views, or develop recreational uses.

Although the air-pollution sensitivity of this species is unknown, other coastal members of this genus are sensitive to sulfur- and nitrogen-based acidifying pollutants (Wetmore 1983, Insarova *et al.* 1992, McCune and Geiser 1997). The primary habitat of this lichen is the coastal fog belt, and fog significantly concentrates pollutants--especially acidic forms of SO_x and NO_x to which lichens are most sensitive. Although air quality is generally good at known sites, rising pollution emissions from increased traffic (mainly NO_x) and new or expanded point sources (SO_x and NO_x) along the coast, might threaten this species in the future.

Climate change affecting coastal fog patterns could be expected to affect the vigor of this species, possibly resulting in an even more restricted distribution or contributing to local extirpation.

D. Distribution Relative to Land Allocations

The Little Nestucca River site is in the North Coast Adaptive Management Area, Hebo Ranger District, Siuslaw National Forest. The Cedar Lake site is in Unit 93, block III of the Hebo long term restoration project. Grass Mountain is managed by the BLM as an Area of Critical

Environmental Concern. Saddle Mountain State Park is owned and administered by the State of Oregon. The population in Marin County, California must be visited to determine ownership.

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *B. subcana* is to assist in maintaining species viability.

B. Objectives

Manage populations at all known sites on federal lands by maintaining habitat and potential habitat immediately surrounding known populations.

IV. HABITAT MANAGEMENT

A. Lessons from History

Habitat destruction or alteration has made a significant contribution to the decline of lichens world-wide (Seaward 1977). Rare lichens, such as *Bryoria subcana*, that occur in habitats optimal for human activities, are especially vulnerable. In coastal Oregon, activities of the past 140 years: increased fire, agriculture and grazing, logging, changes in hydrology and recreation have affected plant succession in a major way (Christy *et al.* 1998). For example, at Sand Lake dunes of Oregon, a hotspot for lichen diversity, off-road vehicles have destroyed nearly all the fragile shore pine woodland habitat in just thirty years (Wiedemann 1984, 1990 as cited by Christy *et al.* 1998).

Lichens have been known to be sensitive to air pollution more than a century. Populations of many species in eastern United States and Europe (Hawksworth and Rose 1976) have declined precipitously from exposure to sulfur dioxide and other air pollutants. In the United States, lichens are one of the components used to indicate stress to forests from air pollution (McCune *et al.* 1996), and dozens of studies in the United States have used lichens as air-quality indicators (see bibliography in USDA 1998). In the Pacific Northwest, sensitive species are already declining in some areas (Denison and Carpenter 1973, Taylor and Bell 1983).

B. Identifying Habitat Areas for Management

All known sites of *B. subcana* on federal land administered by the Forest Service and BLM in the range of the Northwest Forest Plan are identified as areas where these management recommendations should be implemented. 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 the local population and habitat area with a site visit.
- Maintain suitable habitat around the current host trees and shrubs, so that the lichen may have adequate new substrate as current substrates decline.
- Retain groups of standing trees to maintain suitable microclimate and to aid dispersal. Avoid harvesting or thinning trees, and removing shrubs or other vegetation in the population and habitat area, unless these actions would do no harm to, or would improve, the habitat for *B. subcana*.
- Prevent fire in the population but utilize or prevent fire in habitat areas, depending on the role of fire in the plant community. Consider recommendations by Christy *et al.* (1998) for fire management in coastal plant communities.
- Restrict commercial collection of moss, fungi or other special forest products if these activities would adversely affect the integrity of habitat areas.

D. Other Management Issues and Considerations

- Consider opportunities for managing known sites during Forest Plan and Resource Management Plan revisions, such as Botanical Special Interest Areas, Areas of Critical Environmental Concern, or other administratively withdrawn designations, or by prescribing special standards and guidelines.
- Continue to work with state and federal regulatory agencies to protect air quality on federally-managed lands from on- or off-site emissions, especially of nitrogen- and sulfur-containing pollutants.
- Provide information about conserving rare lichens at visitor centers or other locations along the coast to build public support of conservation efforts and to discourage collection of specimens.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities to acquire 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 the distribution of *B. subcana* in the range of the Northwest Forest Plan, focusing on potential suitable habitat--foggy Sitka spruce, western hemlock, true fir (*Abies*) and wet Douglas-fir forests of bays, rivers, steep slopes and ridges along the immediate coast, and high precipitation mountain summits within 50 km (30 mi) of the coast.

- Assign high priority to Strategy 3 surveys in areas where management treatments or projects are scheduled or proposed within 50 km (30 mi) of the ocean.
- Revisit the site near Eel Creek in the Oregon Dunes to verify the presence of *Bryoria subcana*.
- Determine if *Bryoria subcana* meets the criteria for being closely associated with late-successional and old-growth forests.

B. Research Questions

- What are the dispersal rates and mechanisms of *B. subcana*?
- Which habitat characteristics are necessary for establishing *B. subcana* propagules and survival of established thalli?
- Can stands be managed to mimic those characteristics?
- What are the minimum and optimum patch sizes of colonized habitat necessary to provide for *B. subcana*?
- How can conditions be optimized to encourage colonization of lichens from refugia into managed stands?
- What is the air pollution sensitivity of *B. subcana*?

C. Monitoring Needs and Recommendations

- Monitor known sites for changes in microclimatic conditions, successional changes, and for inadvertent habitat damage from human activities or wildfire.
- Monitor dispersal and population trends of existing populations.
- Establish air-quality monitoring sites near any key populations should air quality become an issue.

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