

Conservation Assessment
for
Dermatocarpon meiophyllizum Vainio



May 25, 2007

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**U.S.D.A. Forest Service Region 6 and
U.S.D.I. Bureau of Land Management, Oregon and Washington**

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Disclaimer

This conservation assessment was established to compile available information on the aquatic lichen, *Dermatocarpon meiophyllizum*. This assessment does not represent a management decision by either the U.S. Forest Service or Bureau of Land Management. The best and most recent scientific information was used to prepare this document, but it is likely that new information will emerge. To aid further understanding of this taxon, please contact the Interagency Special Status/Sensitive Species Conservation Planning Coordinator in Portland Oregon if you can provide new information: <http://www.fs.fed.us/r6/sfpnw/issssp/contactus/>.

Executive Summary

Dermatocarpon meiophyllizum has only recently been discovered in North America (Glavich & Geiser 2004), due to misidentifications of this species as *Dermatocarpon luridum*. *Dermatocarpon* voucher specimens from all sites previously thought to harbor *D. luridum* in Washington, Oregon, and California have been analyzed and determined to not be *D. luridum*; most of the historic *Dermatocarpon* vouchers from these sites were *D. meiophyllizum* (Glavich 2007b). Given this recent determination, the name *D. luridum* is still in the process of being replaced by *D. meiophyllizum* in the Special Status/Sensitive Species and Survey & Manage Programs. *Dermatocarpon meiophyllizum*, however, is now included on the NatureServe list (NatureServe 2007), and it has replaced *D. luridum* on the Oregon Natural Heritage program's rare, threatened, and endangered list—retaining *D. luridum*'s Heritage rankings: S1S2 (ORNHIC 2007). Washington and California Heritage programs have not yet ranked *D. meiophyllizum*, but like Oregon, the rankings will likely follow that of *D. luridum*. The global ranking of *D. meiophyllizum* in the Natural Heritage Program is G4G5, but a national rank has not yet been assigned. The Oregon List rank for *D. meiophyllizum* is List 3. Recent information should assist in assigning the status of *D. meiophyllizum* (Glavich 2007a).

Dermatocarpon meiophyllizum was discovered in the Northwest Forest Plan (NWFP) area (western Washington, Oregon, and northern California) during a Forest Service and BLM funded aquatic lichen study. Many historical *D. luridum* sites were revisited during this study in 2002 and 2003, and all *Dermatocarpon* specimens collected from these sites were identified as *D. meiophyllizum* (Glavich & Geiser 2004). Thus, it was realized that *D. meiophyllizum* was confused for *D. luridum*, and that the management status in Washington, Oregon, and California actually belonged to *D. meiophyllizum*.

D. luridum was added as Sensitive to the Forest Service Region 6 Sensitive Species Program in 2004. Since *Dermatocarpon meiophyllizum* has been misidentified as *D. luridum* in the past, *D. meiophyllizum* and *D. luridum* sites in Region 6 will be managed under the Forest Service Sensitive Species Program as *D. luridum*, until status and list updates are completed.

Within the NWFP area, *D. meiophyllizum* is known from the Klamath Mountains, Six Rivers National Forest north through the Oregon Cascades to the Olympic and North Cascade ranges of Washington. Most known sites are on federal land (Glavich & Geiser 2004), while two recently identified sites are not: Trask River, Tillamook Co. and Eagle Creek, Clackamas Co. (Glavich 2007b). Outside the NWFP area in Region 6, *D. meiophyllizum* was recently discovered on the Ochoco National Forest (Glavich 2006b). In Oregon and Washington it is also suspected, or may potentially occur, in the coast and eastside mountain ranges, especially the Wallowa mountains (Glavich 2007c). It also occurs in California's Sierra Nevada range, Colorado, and Minnesota (Glavich & Geiser 2004). Globally, it is known from Finland, Iceland, Norway, Sweden, and the British Isles (Heiðmarsson 2001).

Dermatocarpon meiophyllizum is mostly found on the rocks of stream channels within the splash zone, but can be found submerged and up to 2 meters above the water surface (Glavich 2007a; Heiðmarsson 2001; Gilbert & Giavarini 1997). High elevation tends to favor *D. meiophyllizum*, but it has been found from elevations of 61 to 2300 meters (Glavich 2007a).

Threats to this species may include a decline in water quality from upstream mining, agricultural runoff, and fertilizer runoff from tree plantations. In addition logging, road building and deconstruction/decommissioning, and other sediment generating activities near or upstream could impact this lichen. Because *D. meiophyllizum* occurs in habitats with some level of exposure (Glavich 2007a), habitat alteration that would shade population sites, such as trail bridge building and stream restoration (including down log placement and tree planting), may also constitute threats.

At known sites, the following management considerations could be applied:

- Conduct an evaluation of potential threats at known sites, and develop site specific management plans
- Avoid activities near or upstream from the site that would reduce water quality; if these actions are unavoidable, consider mitigation measures to reduce or eliminate sediment pulses, chemical inputs, or other actions detrimental to water quality
- Maintain current environmental conditions at population sites including canopy closure, water quality, and sedimentation
- Avoid activities that might shade the population site

Specific information needs to assist in effectively managing to meet conservation goals for this species include information about:

- Population growth rates
- Population site water temperature tolerance
- Population site microclimate parameters
- Nitrogen, phosphorus, and heavy metal tolerance
- Population dispersal distance

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Introduction

Prior to the 2002-2003 Forest Service and BLM funded aquatic lichen study, all published studies including *Dermatocarpon meiohyllizum* were conducted in Europe (Gilbert 1996; Gilbert & Giavarini 1997; Gilbert & Giavarini 2000). Not only have very few aquatic lichen studies been carried out in North America, *D. meiohyllizum* was only recently recognized as occurring in the U.S. where it has been confused with other *Dermatocarpon* species, often *D. luridum* (Glavich & Geiser 2004). This confusion is not surprising as the genus *Dermatocarpon* is a morphologically plastic group and some species' definitions were based on vague morphological features. More recent taxonomic investigations of *Dermatocarpon* (Heiðmarsson 2001, 2003) clarified morphological distinctions and have facilitated correct identification of species. Glavich & Geiser (2004) found *D. meiohyllizum* rather than *D. luridum* at all historical *D. luridum* sites revisited during the large-scale NWFP area wide aquatic lichen study.

Goal

The goal of this conservation assessment is to summarize the existing information on the biology and ecology of *Dermatocarpon meiohyllizum*. This assessment will also address potential threats to the species, research needs, and management considerations to assist land managers in achieving their objectives in species management. Information is drawn from recent works of Glavich & Geiser (2004), Glavich (2006b, 2007a, 2007b), and some analyses from the aquatic lichen study data performed for this assessment.

There is concern for *D. meiohyllizum* because of its infrequency within Oregon, Washington, and northern California. Its rarity may be due to dispersal limitation. Reproduction and dispersal occurs primarily via fungal spores and the cause of its dispersal limitation is not known at this time. This question and others are addressed to facilitate adequate management of the species.

Forest Service management for this species follows Region 6 Sensitive Species (SS) policies. Sensitive Species policy requires the agency to maintain viable populations of all native and desired non-native wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands. Management "must not result in a loss of species viability or create significant trends toward federal listing" (FSM 2670.32) for any identified SS.

Scope

The geographic scope of this assessment covers federal lands within the range of this species in Oregon, Washington, and northern California. *Dermatocarpon meiohyllizum* was only recently discovered in the Pacific Northwest. The location and site information covered in this Conservation Assessment are the new sites discovered by the aquatic lichen study and the historic *D. luridum* sites which have recently been correctly identified as *D. meiohyllizum*.

Management Status

Dermatocarpon meiophyllizum has only recently been discovered in North America (Glavich & Geiser 2004). *Dermatocarpon* voucher specimens from all sites previously thought to harbor *D. luridum* in Washington, Oregon, and California have been analyzed and determined to not be *D. luridum*; most of the historic *Dermatocarpon* vouchers from these sites were *D. meiophyllizum* (Glavich 2007b). Given this recent determination, the name *D. luridum* is still in the process of being replaced by *D. meiophyllizum* in the Special Status/Sensitive Species and Survey & Manage Programs. *Dermatocarpon meiophyllizum*, however, has just been evaluated by NatureServe (NatureServe 2007), and it has replaced *D. luridum* on the Oregon Natural Heritage program's rare, threatened, and endangered list—retaining *D. luridum*'s heritage rankings: S1S2, where S1 is defined as “critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences” and S2 is defined as “imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences” (ORNHIC 2007). Washington and California heritage programs have not yet ranked *D. meiophyllizum*, but like Oregon, the rankings will likely follow that of *D. luridum*. Updates can be found at the Oregon Natural Heritage Program website at <http://oregonstate.edu/ornhic>. The global ranking of *D. meiophyllizum* in the Natural Heritage Program is G4G5, but a national rank has not yet been assigned. The ORNHIC List rank for *D. meiophyllizum* is List 3, denoting a taxon for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range. Recent information should assist in assigning the status of *D. meiophyllizum* (Glavich 2007a).

Dermatocarpon meiophyllizum was discovered in the Northwest Forest Plan (NWFP) area (western Washington, Oregon, and northern California) during a Forest Service and BLM funded aquatic lichen study. Many historical *D. luridum* sites were revisited during this study in 2002 and 2003, and all *Dermatocarpon* specimens collected from these sites were identified as *D. meiophyllizum* (Glavich & Geiser 2004). Thus, it was realized that *D. meiophyllizum* was confused for *D. luridum*, and that the management listing in Washington, Oregon, and California actually belonged to *D. meiophyllizum*.

Dermatocarpon luridum was first identified for management concern in 1994, as part of the Survey and Manage mitigation measure of the Northwest Forest Plan. Initially the species was assigned to survey strategies 1 (manage known sites) and 3 (conduct extensive surveys and manage sites) (USDA & USDI 1994). In 2001, this lichen was assigned to the new Category B (rare, Pre-disturbance Surveys Not Practical); pre-disturbance surveys were determined to be not practical because this lichen was difficult to locate in streams and to identify (USDA & USDI 2001). In June 2002 under the Annual Species Review process the species was placed in Category E, due to a lack of information regarding whether the species was associated with late-successional or old-growth forests. *D. luridum* was added as Sensitive to the Forest Service Region 6 Sensitive Species Program in 2004. Since *Dermatocarpon meiophyllizum* has been misidentified as *D. luridum* in the past, *D.*

meiophyllizum and *D. luridum* sites on Region 6 Forest Service lands will be managed under the Forest Service Sensitive Species Program as *D. luridum*; any Forest Service or BLM management status for *D. luridum* is transferred to *D. meiophyllizum* until status and list updates are completed. The Agencies' Sensitive Species lists will be updated after the rarity ranks for both *D. meiophyllizum* and *D. luridum* have been updated to reflect current information.

Classification and Description

Systematics and Synonymy

Kingdom: Fungi
Division: Ascomycota
Class: Ascomycetes
Order: Verrucariales
Family: Verrucariaceae
Genus: *Dermatocarpon* Eschw.
Species: *Dermatocarpon meiophyllizum* Vain.

The genus *Dermatocarpon* is widespread in the northern hemisphere, New Zealand, and occurs in high elevation regions of Africa, Central America, the Caribbean, the Himalayas, and Antarctica (Heiðmarsson 2001). There are 19 species of *Dermatocarpon* in North America (Esslinger 2007) and potentially 10 species in the Pacific Northwest (Glavich 2006a).

There has been confusion among some *Dermatocarpon* species in the Pacific Northwest and, in particular, between *D. meiophyllizum* and *D. luridum*. However, *D. luridum* is not synonymous with *D. meiophyllizum* and the confusion was just a case of mistaken identity. This is attributed to the fact that *D. meiophyllizum* was only recently discovered in North America, and thus, it was not included in any North American lichen keys.

Species Description

Dermatocarpon meiophyllizum was described by Vainio in 1921 with more recent taxonomic work by Heiðmarsson (2001). *Dermatocarpon meiophyllizum* is a small, dark brown, single lobed lichen that is attached to the rocks of stream channels by a single holdfast. Some *D. meiophyllizum* thalli have been observed to turn green when wet, so submerged populations are often green where those occurring on the exposed, dry stream bed are brown. It reproduces by spores from sunken chambers appearing as tiny black dots on the upper surface.

This more technical definition of *D. meiophyllizum* is as described by Heiðmarsson (2001): Thallus 6 – 15 [31] mm in diameter, single lobed, and umbilicate. The upper cortex is usually brown to dark brown in color, and the lower cortex is typically very dark brown [to blackish]. Dry thallus thickness is from 0.39 to 0.64 mm while when wet measures from 0.28 to 0.55 mm. The epinecral layer of the

upper cortex consists of compressed hyphae (epruinose appearance), and the lower cortex is smooth to finely granulose. Reproduction is by fungal ascospores in numerous perithecia and conidia in pycnidia. Ascospores are simple and 14-18 μm long and 6-8 μm wide. Spot tests, including I (Melzer's reagent), are negative.

There are several other *Dermatocarpon* species that are likely to occur or co-occur in similar habitats with *D. meiophyllizum*, and all morphological differences stated below are from Heiðmarsson (2001), except for *D. reticulatum* (McCune & Geiser 1997). *Dermatocarpon luridum*, *D. miniatum* complex (*D. miniatum* var *miniatum* and *D. miniatum* var. *complicatum*), *D. reticulatum*, and *D. rivulorum* are species that could be found in areas with *D. meiophyllizum*. Although there is no verified record of *D. luridum* in the Pacific Northwest, it does occur in the U.S. and might also be found in the NWFP area (Glavich, personal observation). *Dermatocarpon luridum* is distinctively multilobed, and the deep red medullary reaction to Melzer's reagent would clearly distinguish it from other species in the Pacific Northwest. The *Dermatocarpon miniatum* complex and *D. reticulatum* all mostly have a grey colored upper surface, usually have a pruinose appearance (whitish layer on the upper surface), and have ascospores generally $< 15 \mu\text{m}$.

Dermatocarpon reticulatum also has a finely papillose lower surface giving a granular appearance. *Dermatocarpon rivulorum*, like *D. meiophyllizum*, has a brownish, epruinose thallus with long spores ($\geq 15 \mu\text{m}$); however, *D. rivulorum* is generally much larger ($> 15 \text{ mm}$ wide lobes) and has a distinctly reticulate lower surface.

Biology and Ecology

Reproduction and Dispersal

Dermatocarpon meiophyllizum is a saxicolous chlorolichen and primarily reproduces by fungal spores, sexually produced in perithecia and asexually produced in pycnidia (Heiðmarsson 2001). As with other lichens that only reproduce by fungal spores, these spores must find a compatible photobiont while germinating to form a lichen thallus. There appears to be little known about *D. meiophyllizum*'s photobiont, but many *Dermatocarpon* species utilize green algae of the genus *Myrmecia* (Nash 1996). This lichen has no asexual reproductive structures that are composed of both the fungal and algal partners, and the small, single lobe is unlikely to fragment. Dispersal of spores within the stream channel is most likely to occur by way of water flow. Dispersal of spores between stream channels is most likely to occur by animal vectors. There is very little information regarding the biology of this species as there has only been work on regional distributions, habitats, and the taxonomy of this lichen.

Range, Distribution, and Abundance

Dermatocarpon meiophyllizum is well known in Scandinavia, central Europe, the British Isles (Heiðmarsson 2001), and more recently discovered in North America. Verification in US states so far are Minnesota, Colorado, Washington, Oregon, and

California (Glavich & Geiser 2004). Within Oregon, Washington, and northern California the range mostly covers the Cascade Mountains of Oregon and Washington and California's Klamath mountains (Fig. 1).

At this time, the range of *D. meiophyllizum* in North America is limited to sites discovered in the aquatic lichen study and through recent re-evaluation of historic *Dermatocarpon* specimens, most of them *D. luridum*, from various herbaria (Glavich & Geiser 2004, Glavich 2007a, Glavich 2007b). New-found historic sites in the Pacific Northwest are as follows. In Washington, sites are known from the Minotaur Lake area, near Susan Jane Lake, Rock Mountain, and upper Snowy Creek of Wenatchee National Forest, Trout Creek near the Pacific Crest trail, Okanogan National Forest, and several sites are known from the East Fork Lewis River area and the North Fork Crispus River of Gifford-Pinchot National Forest. In Oregon, it is known from the Trask River, Tillamook Co., Eagle Creek, Clackamas Co., the mainstem Umpqua River, Myrtle Island RNA, Roseburg BLM, and Conde Creek, Medford BLM. In California, it is known from Shackleford Creek, Marble Mountain Wilderness.

New sites identified by the aquatic lichen study were mostly within the 'historic' range. In Washington, new sites have been found in the Olympic Mountains, Olympic National Forest and in the Cascade Mountains in Wenatchee National Forest and southeastern Gifford-Pinchot National Forest. In Oregon, new sites have been found in the Cascade Mountains in Willamette, Umpqua, and Rogue River National Forests. In California, new sites have been found in Six Rivers, Shasta-Trinity, and Klamath National Forests (Glavich & Geiser 2004). In all, verified *D. meiophyllizum* localities visited by aquatic lichen study crews totaled 31 across the NWFP area, and the sites are divided up almost evenly among Washington, Oregon, and northern California (Table 1). Outside the NWFP area but in Region 6, *D. meiophyllizum* was recently discovered in the Ochoco National Forest (Glavich 2006b).

There appears to be no clear abundance pattern across its current range. Site level population abundance ratings, from less than 10 to greater than 1000 individuals, were variable from site to site across the NWFP area (Glavich 2007a). However, from the aquatic lichen survey of the Aquatic Riparian Effectiveness Monitoring Program (AREMP) random NWFP sixth field watershed sample, only two watersheds that occurred in southern Oregon and northern California had high frequencies of occurrence (Glavich 2007a). Stream habitats can vary within a watershed based on many factors, such as elevation. Localized abundant populations within a watershed reflect several scenarios. For example, a watershed with a high frequency of sites may contain a large area of favorable habitat conducive to effective dispersal. A large watershed population frequency might also reflect a longer habitation period for this lichen within the watershed and, conversely, a small population frequency might suggest relatively new recruitment.

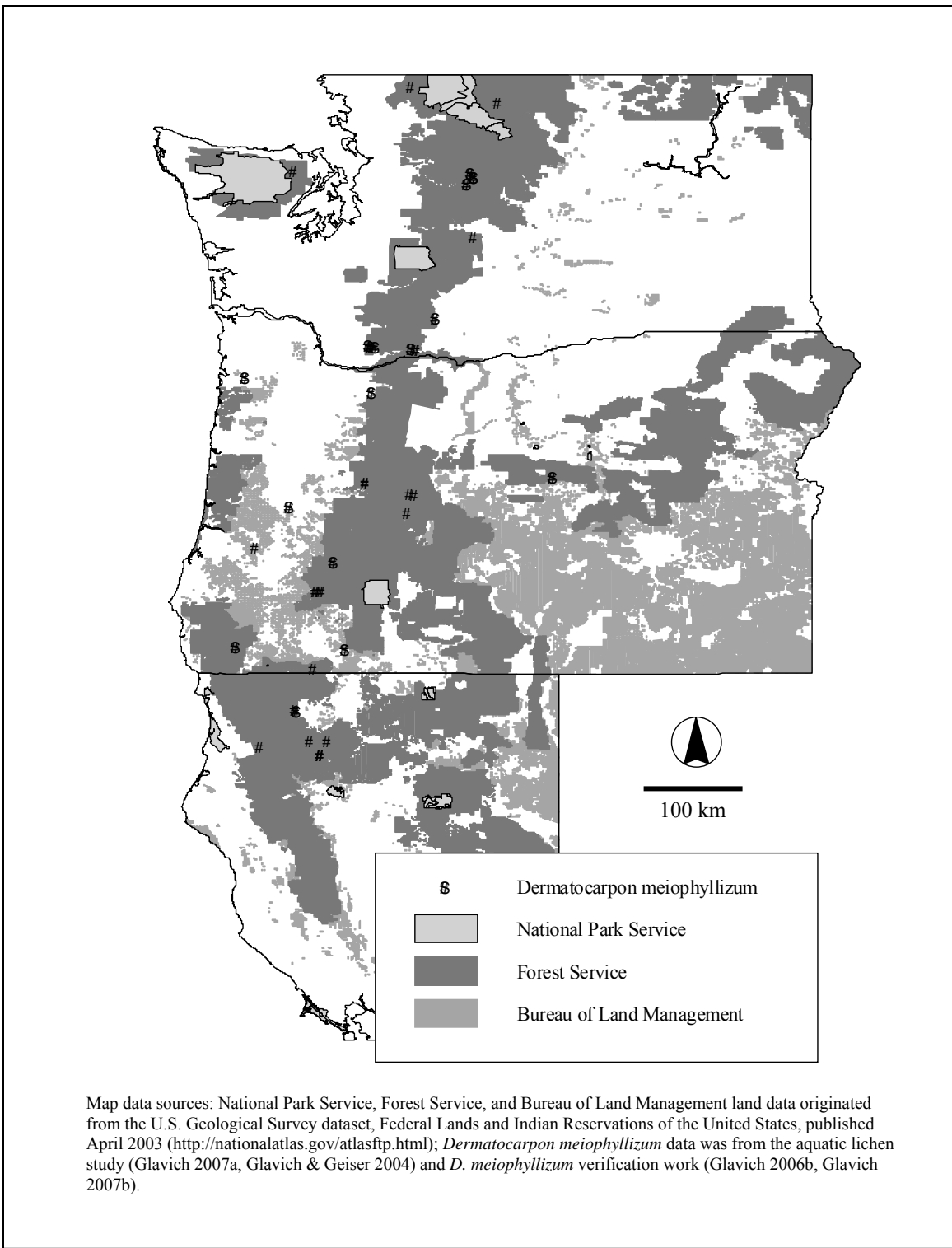


Figure 1. Distribution of *Dermatocarpon meiophyllizum* in Oregon, Washington, and northern California.

Habitat

Dermatocarpon meiophyllizum is typically found on rocks of stream channels and lake margins within the splash zone (Gilbert & Giavarini 1997, 2000). This species also can be found in seeps and on both basic and acidic rocks (observed on peridotite, andesite, and granitic rocks; Glavich, pers. observation) (Heiðmarsson 2001). Exposure is likely an important habitat factor for this lichen as it has only been found in exposed or partially exposed sites in the NWFP (Glavich 2007a). In the Pacific Northwest, *D. meiophyllizum* has been found mostly within 50 cm above the water surface but also in the submerged condition and up to 2 m above the water surface (Glavich 2007a). Being associated with aquatic or semi-aquatic habitats, water quality is an important habitat factor for this lichen. In Europe, aquatic lichen communities, which included *D. meiophyllizum*, deteriorated when total oxidized nitrogen exceeded 0.5 mg/l (Gilbert & Giavarini, 1997).

Table 1. *Dermatocarpon meiophyllizum* sites on federal land from the aquatic lichen study. Sites are from both randomly and non-randomly selected stream reaches and are divided among states and between land use allocations.

State	Protected Land Allocation (LSRs, Wilderness, etc.)	Matrix Lands (but likely within Riparian Reserves)
California	9	1
Oregon	5	6
Washington	3	7

In the Pacific Northwest aquatic lichen study, no stream sites visited had poor water quality. At those stream sites that did have relatively lower water quality (0.33 mg/l total nitrogen and an average water temperature of 19.6 °C) and where *D. meiophyllizum* was present, the lichen thalli were growing well above the water level (Glavich 2007a). Conceivably, submergence would occur with raised stream levels and improved water quality during the winter season. At this time, however, there has been no investigation into the tolerance levels of water quality parameters for *D. meiophyllizum*.

High elevations tend to favor *D. meiophyllizum*, but this lichen has been found from 61 to 2300 meters (Glavich 2007a). During the aquatic lichen study it was observed often in subalpine to alpine areas (e.g. Green Lake basin, Three Sisters Wilderness, OR, Bear Lake basin in the Trinity Alps Wilderness, CA, and in the North Cascades, WA). Lower elevation sites are, for example, Lookout Creek in the Blue River watershed and on the mainstem Umpqua River in Oregon (Glavich & Geiser 2004).

Conservation

Threats

The impact of disturbance activities on *D. meiophyllizum* has not yet been investigated and is therefore not well understood. However, drawing from threats previously identified for *D. luridum* and because this lichen inhabits stream channels, a decline in water quality from upstream mining, agricultural runoff, and fertilizer runoff from tree plantations would likely impact populations of *D. meiophyllizum*. The absence of *D. meiophyllizum* from stream sites with moderate to major siltation (Glavich 2007a) suggests that logging, road building and deconstruction/decommissioning, and other sediment generating activities near or upstream could impact this lichen. Because *D. meiophyllizum* occurs in habitats with some level of exposure (Glavich 2007a), habitat alteration that would shade population sites, such as trail bridge building and stream restoration (including down log placement and tree planting), could impact its population.

Conservation Status

Although several factors should contribute to the definition of a species' rarity, a frequency of less than 4% for the NWFP area does suggest that *D. meiophyllizum* is rare (Glavich 2007a). This species was not wide spread in most sixth-field watersheds where it occurred and is usually limited to a few stream sites or less (Glavich 2007a). *Dermatocarpon meiophyllizum* should gain some level of conservation attention on rarity alone. Although this species occurs mainly in riparian reserve and aquatic management land allocations, disturbance and impacts to the species may occur even when surrounding lands are considered protective (Late-successional Reserves, Wilderness, etc.). Activities such as riparian/stream restoration projects, trail building and maintenance, and cattle grazing occur in Late-Successional Reserves and Wilderness areas, and these activities can have direct impacts to populations of this species, or downstream affects (if populations are downstream from the activity)—a consideration for prioritizing conservation efforts when solely looking at land use allocations.

Management Considerations

More detailed information is needed on microsite and habitat disturbance responses of *D. meiophyllizum*. In the interim, land management should consider the following:

- Conduct an evaluation of potential threats at known sites, and develop site specific management plans
- Avoid activities near or upstream from the site that would reduce water quality; if these actions are unavoidable, consider mitigation measures to reduce or eliminate sediment pulses, chemical inputs, or other actions detrimental to water quality

- Maintain current environmental conditions at population sites including canopy closure, water quality, and sedimentation
- Avoid activities that might shade the population site

Research, Inventory, and Monitoring Opportunities

Many sites for *Dermatocarpon meiophyllizum* have now been established, and there are some observational data regarding its habitat (Glavich & Geiser 2004; Glavich 2007a). These sites, covering a wide elevation range, now provide an opportunity for long term monitoring and microsite data collection. Not only is field monitoring needed, laboratory research investigating thresholds of water quality parameters would further support adequate management of *D. meiophyllizum* habitat.

Information needs to further assist in providing effective management for this species are as follows:

- Population growth rates
- Population site water temperature tolerance
- Population site microclimate parameters (water quality, shading, humidity, temperature, etc.)
- Nitrogen, phosphorus, and heavy metal tolerance
- Population dispersal distance

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