

DRAFT, Version 1.1

Draft Management Recommendations for  
Slender thread moss  
*Orthodontium gracile* (Wils. ex Sm.) Schwaegr. ex. B.S.G.

Version 1.1  
November 1, 1996

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EXECUTIVE SUMMARY

**Species:** *Orthodontium gracile* (Wils. ex Sm.) Schwaegr. ex. B.S.G. (Slender thread moss)

**Taxonomic Group:** Bryophyte: Moss

**ROD Components:** 1,3

**Other Management Status:** none

**Range:** *Orthodontium gracile* is known in the Pacific Northwest from the Coast Ranges of northern California (Del Norte, Humboldt, Mendocino, Sonoma, and Marin counties) and southwestern Oregon (Curry county). There are 19 historical records; two occur on federal land within Muir Woods National Monument and Redwood National Park. The only known site in Oregon (Loeb State Park) has been logged and the species may be extirpated from the state.

**Specific Habitat:** *Orthodontium gracile* occurs in shady habitats in old-growth or mature second growth coast redwood (*Sequoia sempervirens*) forest. It may be found on lower bark of coast redwood trunks, sometimes below wounds on the tree, or on downed redwood logs. It typically occurs on redwood bark that has been burned or charred.

**Threats:** Logging of redwoods is the primary threat to this species. It is currently known from only two populations on federal land.

**Management Recommendations:**

- C Maintain viable populations at known sites by maintaining habitat of old-growth coast redwoods.
- C Maintain substrate of large coast redwood boles and down logs.

**Information Needs:**

- C Conduct surveys in old-growth and mature second-growth redwood stands to determine abundance and distribution and determine ecological requirements.

**I. Natural History**

**A. Taxonomic/Nomenclatural History**

*Orthodontium gracile* was originally described in 1839 as *Bryum gracile* Wils., then placed in the genus *Orthodontium* by Schwaeger in 1844. There are no recent synonyms. The genus is placed in the order Eubryales, family Bryaceae.

**B. Species Description**

### **1. Morphology** (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 *Orthodontium gracile*. According to Wagner and Christy (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.

The combination of characters that distinguish *Orthodontium gracile* include the linear leaves without differentiated alar cells, the erect, smooth yellow-brown capsules, and the habitat of rotting or charred wood or bark of coast redwood (*Sequoia sempervirens*).

Figure 1. Line drawing of *Orthodontium gracile* (from Andrews [1935] in Grout) (to be added).

### **2. Reproductive Biology**

Although no specific information has been located on the reproductive biology of *Orthodontium gracile*, some generalizations may apply to this moss. Asexual reproduction is common in most bryophytes (Wyatt and Anderson 1984) and dispersal distance may be limited even in those species which reproduce by means of spores (Stoneburner et al. 1992). While it was previously speculated that the small spores of bryophytes were widely dispersed, few spores may actually survive the atmospheric environment (Pócz and van Zanten 1991). Limited dispersal ability of bryophytes has important conservation implications. Populations may not recolonize readily and outcrossing opportunities may be limited. Even in continuously distributed bryophyte taxa, it appears that gene flow may be highly restricted (Wyatt 1992).

### **3. Ecology**

In general, bryophyte growth is very sensitive to environmental conditions, due to lack of storage organs or specialized tissues to mediate nutrient and water uptake and loss (Norris, pers. comm.). Most species of bryophytes have highly specialized habitat requirements and are often very substrate, microclimate, and microhabitat specific.

The apparently close association with the locally endemic coast redwood is a paradox, in light of the more widespread global range of this species. In Australia, this species is epiphytic on *Eucalyptus*. In Europe and England, it occurs on rock faces and peaty soil at the foot of trees, more rarely on rotten tree stumps (Dixon 1924). Hypotheses explaining disjunctions in ranges of

bryophytes, including continental drift, long-distance dispersal, and fragmentation of a once more continuous distribution are discussed by Schofield and Crum (1972).

Numerous collections from the redwood area reference the presence of charred or burned bark. The high incidence of occurrence on charred bases of old-growth redwood suggests that fire may play a role in the establishment of *Orthodontium gracile*. In Australia, this species has been reported from the burned stumps of *Eucalyptus* (Norris, pers. comm.). Fire has played an important role in the maintenance of coastal redwood forests and may also be a factor in the life cycle of *Orthodontium gracile*.

The greater abundance of *Orthodontium gracile* in old-growth habitats suggests that interactions of moisture, humidity, temperature, and vegetation provide optimum microclimate conditions. These relationships are not yet understood.

### **C. Range, Known Sites**

*Orthodontium gracile* is known in the Pacific Northwest only from the redwood area of northern California and southwestern Oregon (Koch 1951, 1952; Lawton 1971). One collection from Oregon (Loeb State Park in Curry County) has been reported (Koch 1952). This northernmost occurrence of *Orthodontium* is also the northern extent of the range of coast redwood. This site has been subsequently logged.

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 known sites are reported for California; two occur on federal land (Muir Woods National Monument and Redwood National Park).

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.

*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.).

### **D. Habitat Characteristics and Species Abundance**

*Orthodontium gracile* occurs in shaded habitats on 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 known sites. Associated species of *Orthodontium gracile* include *Aulacomnium androgynum*, *Plagiothecium laetum* and *Lepidozia reptans*.

## II. Current Species Situation

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

Insufficient information was available to rate *Orthodontium gracile* at the time of the bryophyte viability panel during the Forest Ecosystem Management Analysis Team assessment. Because of its very limited range, apparent close-association with old-growth redwood forest, the few known sites on federal land, and the documented impact of timber harvest, this species was included under Survey and Manage Strategies 1 and 3 in the Record of Decision (USDA and USDI 1994). The basis for its inclusion was to maintain viability at the few known sites on federal land and conduct inventories to learn more about the actual extent of its range, abundance, and associations.

### B. Major Habitat and Viability Considerations

The major viability considerations for *Orthodontium gracile* are the loss of populations due to management activities, particularly the harvest of coast redwood. Timber harvest and road building may directly impact the habitat or populations of this species by altering the microclimate and removing the substrate. Of the original 1,971,000 acres of old-growth redwood, there are approximately 102,690 acres of old-growth (5 percent) remaining within state parks (Becking 1982). Because most of the coast redwood habitat occurs on state and private land generally managed on short rotations, the role of federal lands is key to maintaining the viability of this species in North America. The narrow elevational and geographical range of *Orthodontium gracile* could also make this species potentially vulnerable to climate change, which could result in a decline in vigor of this species. Fire may be required to maintain or increase habitat for this species.

### C. Threats to the Species

Removal of redwood trees providing current and future habitat for *Orthodontium gracile* is the primary threat to this species. The two known sites on federal land occur in the Redwood National Park and Muir Woods National Monument. Because no timber harvest is permitted in these areas, these populations are unlikely to be at risk from harvest activities. This species is restricted to a very narrow elevational band along the coast and may be subject to changes in

microclimate. If *Orthodontium gracile* requires specific conditions created by burning the fire-resistant bark of the coast redwood, fire suppression could result in the decline of this species.

#### **D. Distribution Relative to Land Allocations**

One site is reported from Redwood National Park, one from Muir Woods National Monument, seven from State Parks in California and Oregon, and ten are from private land or unknown ownership. The single known report from Oregon was Loeb State Park, which has been subsequently logged<sup>1</sup>. There is a limited amount of federal land within the known range.

### **III. Management Goals and Objectives**

#### **A. Management Goals for the Taxon**

The goal for the management of *Orthodontium gracile* is to assist in maintaining species viability.

#### **B. Specific Objectives**

- C Maintain substrate, moist, shaded habitat within old-growth redwood forest, and appropriate fire regime for *Orthodontium gracile*.

### **IV. Habitat Management**

#### **A. Lessons from History**

The northernmost population of this species in the Pacific Northwest was originally discovered in 1950, northeast of Brookings, Oregon. This site has been subsequently logged and the population apparently extirpated. In other cases, where original, undisturbed collecting sites has been revisited (in several cases over ten years later), populations have been relocated.

Strong declines in three species of *Orthotrichum* have been noted in southern Sweden, with the role of air pollution implicated (Hallingbäck 1992). Air pollutants (both in precipitation and as dry particles) have negative effects on reproduction and growth of bryophytes (Rao 1982). The degree to which this issue is a concern for this coastal species is unknown, although it is unlikely that air quality is an immediate threat within the range of consideration.

#### **B. Identification of Habitat Areas for Management**

Only two sites are known on federal land, within Muir Wood National Monument and Redwood National Park.

#### **C. Management within Habitat Areas**

- C Maintain habitat at all known populations on federal lands. Avoid removal or disturbance of

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<sup>1</sup> The name of this park has been changed from Redwood State Park to Loeb State Park, since the time of the original collection.

substrate (coast redwood boles and down logs) and maintain microsite conditions including high humidity and moisture.

- C Collection of bryophytes for scientific purposes and as special forest products is a concern for rare species known from a limited number of sites. *Orthodontium gracile* is reported to be abundant at some sites, so limited scientific collection may be permitted at these locations. If populations are small, collection should be discouraged or restricted.
- C Maintain appropriate fire regime with prescribed burns if research results indicate it is beneficial.

#### **D. Other Management Issues and Considerations**

No other issues or considerations are identified at this time.

### **V. Research, Inventory and Monitoring Needs**

#### **A. Data Gaps and Information Needs**

Evaluate known sites to determine which are currently included in existing reserves and state parks. Survey known sites to verify population status. Once the habitat at known sites is characterized, conduct surveys of suitable habitat within the range of coast redwood to determine the distribution of this species on federal lands.

#### **B. Research Questions**

- C What is the role of fire in the establishment of *Orthodontium gracile*?
- C Does *Orthodontium gracile* occur on substrates other than coast redwood?
- C What specific habitat characteristics are provided by the coast redwood.
- C Are the *Orthodontium gracile* populations within the range of coastal redwood the same taxon that occurs in Australia and Europe? In Europe, its substrate includes sandstone, and in Australia it occurs on *Eucalyptus*, suggesting quite different ecological tolerances in other parts of the world. These collections were not available for study in the herbaria visited.
- C What are the population growth rates at the known sites? Are populations stable?

#### **C. Monitoring Needs and Recommendations**

It is recommended that populations within federally managed areas be monitored to gather basic information and to ensure that the populations at the known sites remain viable and monitor possible site impacts. Macro-photo points should be established which allow changes in the size of the moss mats to be compared over time.

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