

DRAFT, Version 1.1

Draft Management Recommendations for
Common scissorleaf (*Herbertus aduncus* (Dicks.) S.F. Gray)
and
Pacific scissorleaf *Herbertus sakurarii* (Warnst.) Hattori
Version 1.1
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EXECUTIVE SUMMARY

Species: *Herbertus aduncus* (Dicks.) S.F. Gray (Common scissorleaf) and *Herbertus sakuraii* (Warnst.) Hattori (Pacific scissorleaf). These species are treated together due to similarities in taxonomy, morphology, and ecology.

Taxonomic Group: Bryophyte: Liverwort

ROD Components: 1,3

Other Management Status: *Herbertus aduncus* is listed by the Oregon Natural Heritage Program (List 3) indicating that information is needed before status can be determined, but it may be threatened or endangered in Oregon or throughout its range within the conterminous United States (1995). The Oregon Natural Heritage Program considers *Herbertus sakuraii* to be threatened with extirpation within the state of Oregon (List 2). In Oregon, the Bureau of Land Management treats *H. aduncus* as a Tracking species and *H. sakuraii* as an Assessment species.

Range: Within our range, *Herbertus aduncus* is known from a total of five localities in Skagit and Clallam County in Washington and from Saddle Mountain, Clatsop County in Oregon. Three occur on federal land: two on Olympic National Park and one on Mt. Baker Snoqualmie National Forest. *Herbertus sakuraii* has been reported only from Saddle Mountain State Park, Clatsop Co, Oregon.

Specific Habitat: *Herbertus aduncus* occurs in relatively exposed, dry, montane, windswept sites, in generally moist, protected microsites on rock outcrops, in crevices, and on ledges, wedged among stones or roots. *Herbertus sakuraii* occurs on both inorganic and organic substrates, typically found on wet, shady cliffs.

Threats: Both *Herbertus sakuraii* and *H. aduncus* are very rare within our range and reported primarily from arctic-boreal sites. Primary threats to existing known sites include air pollution, and overcollecting. Additional threats include logging, road and trail construction, helicopter landings, campground construction, and collection of bryophytes as special forest products.

Management Recommendations:

C Maintain habitat for these species at known sites by retaining shade, moist conditions, and protected microsites. Avoid disturbance of rock substrate associated with the plants.

- C Due to the extremely limited number of known sites, collection of bryophytes as special forest products in the vicinity of known sites should not be permitted. Collection for scientific purposes requires specific approval. Allow only sufficient collection at new sites to provide voucher specimens to be deposited at a recognized regional herbarium.

Information Needs:

- C Conduct inventory in high probability coast range habitat to locate additional populations and collect ecological data including associated species, population size, and habitat characteristics.

I. Natural History

A. Taxonomic/Nomenclatural History

Herbertus has a rather convoluted taxonomic literature and the synonymy of *H. aduncus* and *H. sakurarii* is extensive. The genus *Herbertus* is placed in the order Jungermanniales, family Herbertaceae (Stotler and Crandall-Stottler 1977). *Herbertus aduncus* subsp. *aduncus*

Synonymy:

- Herbertus aduncus* (Dicks.) S.F. Gray, Nat. Arr. Brit. Pl. 1:705, 1821.
Jungermannia adunca Dicks., Plant. Crypt. Fasc. 3:12, pl. 8, fig. 8, 1793.
Jungermannia sertularioides Michx., Fl. Bor. Amer. 2:278, 1803.
Jungermannia juniperina var. *b.* Hook., Brit. Jungerm., Pl. 4, 1816 (in part).
Herbertus aduncus Gray, Nat. Arr. Brit. Pl. 1:705, 1821; Underwood, Bot. Gaz. 14:195, 1889 (not of Evans, 1917b; Macvicar, 1926; Schuster, 1957d, etc.)
Schisma aduncum Dumort., Comm. Bot., p. 116, 1822.
Schisma juniperinum Sulliv., Musc. Alleg. No. 258, 1846 (nec Dumort).
Sendtnera juniperina Sulliv., in A. Gray. Manual of Botany, p. 689, 1848 (nec Nees).
Sendtnera adunca var. *b. Hutchinsiae* G., in Rabenh. Hep. Eur., p.210 (cum text), 1862.
Herberta adunca var. *b. Hutchinsiae* Schiffn., Lotos 60:54, 1912.
Schisma aduncum K. Mull., Rabenh. Krypt.-Fl. 6(2):324, 1914, in part (fig. 96).
Herberta hutchinsiae Evans, Bull. Torrey Bot. Club 44:214, pl. 8, 1917; K. Muller, Rabenh. Krypt.-Fl. 3rd ed., 6(1):560, fig. 159, 1954.
Herberta tenuis Evans, Bull. Torrey Bot. Club 44:219, figs. 21-29, 1917; K. Muller, Rabenh. Krypt.-Fl. 3rd ed., 6(1):562, figs. 158c-d, 1954.
Schisma pusillum Steph., Spec. Hep. 6:361, 1922.
Herberta pusilla Hatt., Bull. Tokyo Sci. Mus. 11:8, 1944; Bot. Mag. Tokyo 58: 42, fig. 18, 1944.
Herberta sakurarii fo. *pusilla* Hatt., Jour. Hattori Bot. Lab. no. 2:6, fig. 3a-f, 1947.
Herberta remotiusculifolia Horikawa, Jour. Sci. Hiroshima Univ. Ser. B, Div. 2, 2(2):209, fig. 36, 1934 (fide Hattori, 1947); Hattori, Nat. Sci. Mus. (Tokyo) 14:165, fig. 6, 1943.
Herberta sakurarii fo. *remotiusculifolia* Hattori, Jour. Hattori Bot. Lab. no. 2:6, 1947.
Herberta sakurarii Hatt., Jour. Hattori Bot. Lab. no. 2:6, fig. 1j-k, 2-3, 1947; Hattori, *ibid.*, 15:81,

1955; Schuster, Rev. Bryol. et Lichen, 26:129, figs. 1-4, 1957
Schisma sakurarii, Warnst., Hedwigia 57:69, 1915

B. Species Description

1. Morphology (Frye and Clark 1943: 177, Godfrey 1977:64, Pojar and MacKinnon 1994:438, Schuster 1966:712, Smith 1990:16, Hong et al. 1993:42)

Within the area of consideration, *Herbertus aduncus* is a **rusty brown leafy liverwort** which often forms extensive, loose, sometimes straggly mats, which may be pendulous from cliff-faces or bark. Stems are radially symmetric, almost thread-like or at least very slender, typically unbranched and rigid, the leafy ones erect or ascending to pendulous, 2-10 cm long (occasionally 15-20 cm). Stems are 150-250F m wide by 130-200F m high (9-12 cells high by 10-14 cells wide). Leaves are about 1 mm long, lance shaped, **divided into two sharp lobes** to halfway or more. Leaves are imbricate (overlapping), variable with different nutritional conditions, on slender stems only about 360-440F m wide (at and below level of sinus) x 900-1,040F m long, with the lobes scarcely curved, on robust stems 480-650F m wide x 1250-1950F m long with the lobes strongly falcate (curved like a sickle), postically secund (turned toward the substrate). Vittae (well-developed band of elongated cells) of leaves distinct, extending to, or beyond the middle of the lobes, but not to the apices; cells of vittae elongated, near leaf base ca. (15)17-20(22) x 35-75F m. Underleaves are similar to leaves but slightly smaller, squarrose, the lobes subparallel to slightly divaricate. Male inflorescences are intercalary (somewhere below the apex). The bracts mostly in 4-6 pairs, less deeply lobed than the leaves, with non-falcate lobes. The margins below the lobes are subentire to irregularly denticulate. Female inflorescence is terminal. Bracts (modified leaf associated with inflorescences) and bracteoles (modified underleaf of female inflorescences) are similar to each other, forming a compact "budlike" structure, especially before fertilization. Margins of bracts are closely denticulate to just above the level of the sinuses, with curved teeth. Perianth ovate, not strongly narrowed to the mouth, divided to the middle into six lanceolate, long-acuminate lobes. Capsule is \pm ovoid.

The wiry stems, and upright leaves may superficially resemble a moss, but the two-lobed leaves help distinguish these species as members of the liverwort genus *Herbertus*. Hong et al. (1993) uses the following key characters to distinguish *Herbertus aduncus* subsp. *aduncus* from *Herbertus sakurarii* subsp. *sakurarii*: *Herbertus aduncus* leaves more or less weakly imbricate, up to 3/4 to 4/5 bifid, bands of elongated cells (vitta) strongly developed, lobes narrow (less than 15 cells wide, with vitta consisting of 7-8 cells), linear-lanceolate, 4-6 times as long as wide, usually not glossy. *Herbertus sakurarii* subsp. *sakurarii* leaves are bifid to less than half with acuminate segments, strongly falcate, vitta well developed and extending entire

portion of leaf lobes, margins of lobes weakly recurved; leaf disc suborbicular to broadly ovate, usually glossy.

Herbertus sakurii differs in color and subtle leaf characters. *Herbertus sakurii* is slightly larger on average than *H. aduncus*, with leaf bases that are broader and more rounded at the corners and underleaves that are more differentiated from the lateral leaves. It is typically golden-brown in color. Over the range of the species, there is considerable variation in color and habit (Schofield, pers. comm.). Pojar and MacKinnon (1994) describe *Herbertus aduncus* as red to brown in color and Hong (1993) reports it as yellowish brown. Hong (1993) described *Herbertus sakurii* as strongly blackish brown to reddish brown, Schofield (pers. comm.) reports it as dark brown to rusty brown, while Christy and Wagner (1996) indicate it is typically golden-brown.

2. Reproductive Biology

Herbertus aduncus is dioecious with both male and female reproductive structures produced on separate plants. Pojar and Mackinnon (1994) note that *Herbertus aduncus* rarely produces sporophytes, however Schofield (1968) indicates that in suitable habitats (e.g. on *Alnus rubra*, *Chamaecyparis nootkatensis*, and *Pinus contorta*) it is often fertile, with both male and female tufts occurring on the same tree. However, on humid cliffs, over boulders, in bogs and fens reproductive structures have not been found. Like all bryophytes, water is required for sexual reproduction. Sporophytes have not been reported on *Herbertus sakurii* in North America (Schofield, pers. comm.).

3. Ecology

Herbertus aduncus and *H. sakurii* grow nearby on Saddle Mountain and are both similar ecologically. *Herbertus aduncus* may form large mats on rocks and tree limbs. Schofield (1968) describes immense, red-brown hemispheres and masses of this species that entirely encircle the conifer or deciduous tree. Both species tolerate both inorganic and organic substrates and are typically found on wet, shady cliffs and bark of trees.

Most liverworts of forested environments are intolerant of desiccation and are highly specialized in their habitat requirements. In dense stands where little light penetrates to the forest floor, there is a sharp decline in bryophyte species diversity and abundance. Riparian areas are very important to liverworts in general, particularly the tertiary streams. Burning is detrimental to most bryophytes.

C. Range, Known Sites

Herbertus aduncus is reported from a total of five localities in Skagit, Snohomish, and Clallam County in Washington and Clatsop County in Oregon. Three of these sites are on federal land: two on Olympic National Park and one on Mt. Baker Snoqualmie National Forest. To the north, it is widespread and locally abundant in coastal southern Alaska and British Columbia, becoming rare south of the Canadian border. Globally, it is also known from Europe, Japan and Formosa.

Within our range, *Herbertus sakurii* subsp. *sakurii* has been reported only from Saddle Mtn, Clatsop Co., Oregon. It occurs in Alaska, British Columbia, Japan, Formosa, and Nepal.

D. Habitat Characteristics and Species Abundance

Herbertus aduncus occurs in generally moist, protected microsites on basaltic rock outcrops, in crevices, and on ledges, wedged among stones or roots. On Saddle Mountain, it is shaded by trees near the cliff base. Elevations range from 100 to 215 m (328 to 700 ft.) in Washington and from 750 to 945 m (2470 to 3090 ft.) at Saddle Mountain in Oregon.

The known site of *Herbertus sakurii* is on relatively open cliff ledges within a mixed Douglas-fir, Sitka spruce, silver fir, and western hemlock forest. This occurs within the Sitka spruce zone of the Coast Range. It inhabits damp crevices of shaded humid north-facing slope near the ridge top, from 750 to 945 m (2470 to 3090 ft.) in elevation. Both species occur on cliffs and the degree of association with late-successional and old-growth forest is not clear.

II. Current Species Situation

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

Herbertus aduncus and *H. sakurii* were not rated by the panels convened by the Forest Ecosystem Management Assessment Team because insufficient information was available. Both were reported from old-growth sites and were considered rare in our range.

B. Major Habitat and Viability Considerations

Both species are extremely rare within our range and the limited number of known sites make them vulnerable to stochastic events. Disturbance of known sites poses the greatest threat to these species. The limited amount of habitat within the suspected range of the species may be a major habitat consideration. Low elevation old-growth habitat on the Olympic Peninsula is limited. The Sitka spruce zone occupies a fairly narrow band and in general has been extensively harvested.

C. Threats to the Species

Most known sites are not in areas scheduled for timber harvest or other management activities. Collecting may pose a threat to currently known sites. Other threats could include quarrying, timber harvest, road building, and recreational activities. In general, bryophytes are sensitive to air pollution.

D. Distribution Relative to Land Allocations

Only one known site (on non-federal land) exists for *Herbertus sakurarii*; three sites are known on Federal land for *H. aduncus*. Two known sites of *Herbertus aduncus* occur within Olympic National Park, one is on Mt. Baker Snoqualmie National Forest, and the fourth is in Saddle Mountain State Park. *Herbertus sakurarii* is known only from Saddle Mountain State Park.

III. Management Goals and Objectives

A. Management Goals for the Taxon

The goal for the management of *Herbertus aduncus* and *Herbertus sakurarii* is to assist in maintaining species viability.

B. Specific Objectives

- C Maintain microsite characteristics including damp crevices of cool, shaded, humid slopes and avoid disturbance of substrate associated with the plants.

IV. Habitat Management

A. Lessons from History

There is a considerable literature on the declines of bryophytes in Europe. Rapid decreases and fragmentation of primeval forests have caused a serious threat to bryophytes (Laaka 1992). In addition, air pollution (particularly sulphur compounds in combination with low pH) and acid rain are implicated in declines of bryophytes (Hallingbäck 1992, Rao 1982). The extinction rate and rates of decline are high in areas where trends are documented (Greven 1992, Hallingbäck 1992). Factors associated with logging that cause declines in bryophytes include the temperature extremes and the drying effect of increased wind, the lowering of surface water, and drying of logs, reduction in amount of coarse woody debris substrate, increased dispersal distance between fragments of primeval forest (Laaka 1992). Lack of suitable substrate is the main reason for rarity of threatened epixylic (decaying wood inhabiting) species in managed forests.

B. Identification of Habitat Areas for Management

All known sites on federal land are identified for management. In addition, any known site that is located or discovered will be considered a habitat area, with the management guidelines described below applied to the site.

C. Management within Habitat Areas

- C Maintain habitat for these species at known sites by retaining shade, moist conditions, and protected microsites. Avoid disturbance of rock substrate associated with the plants.
- C Due to the extremely limited number of known sites, collection of bryophytes as special forest products in the vicinity of known sites should not be permitted. Collection for scientific purposes requires specific approval. Allow only sufficient collection at new sites to provide voucher specimens to be deposited at a recognized regional herbarium. Duplicate collections

will not be permitted.

D. Other Management Issues and Considerations

No other issues are identified at this time.

V. Research, Inventory and Monitoring Needs

A. Data Gaps and Information Needs

High probability habitat for additional sites occurs on the Olympic Peninsula, and in the coast ranges of Oregon. Other coast range peaks which may also provide suitable habitat include Onion Peak (Clatsop State Forest), Sugar Loaf (The Nature Conservancy), Mt. Hebo (Siuslaw National Forest, Salem District BLM), and Nicolai Mountain (Clatsop State Forest). The degree of association with late-successional and old-growth forest is unknown and the specific habitat requirement for these species have not been identified.

Additional ecological data should be collected and known sites to further characterize the habitat for these species and similar areas surveyed to locate additional populations on Federal lands. The Koma Kulshan site should be revised to confirm that this site is still occupied. The Olympic National Park Beach trail locality is vague; Hong may be able to provide more specific locality information.

B. Research Questions

- C How different genetically are *Herbertus aduncus* and *H. sakurarii*?
- C What are the ecological requirements of these species?

C. Monitoring Needs and Recommendations

Monitor the impacts of recreational activity on populations near hiking trails.

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