

Pumice grape-fern (*Botrychium pumicola*)



THREATENED



Single plant with mature sporophore extending above compound blade of trophophore (left); cluster of 3 plants, each exhibiting a more or less erect immature sporophore (toward middle of cluster) and a spreading-ascending trophophore (center); and alpine habitat of pumice grape-fern (right). Photos by ODA staff (left and center) and Melissa Carr (right). If downloading images from this website, please credit the photographer.

Family

Ophioglossaceae

Plant description

Pumice grape-fern is a perennial with a stout, fleshy underground stalk about 10 cm long, usually bearing a single leaf divided into sterile and fertile parts. The sterile portion of the leaf (trophophore) is dull, glaucous, grayish green, sessile or nearly so, the blade up to 4 cm long by 6 cm wide, usually ternately divided, the middle segment largest, each segment further divided pinnately into overlapping ascending, roundish, asymmetrically cuneate segments with wavy to crenate margins, the lower pinnae often lobed. The trophophore appears to originate near ground level, although it is located high on the subterranean common stalk. The fertile portion of the leaf (sporophore) is 1-3-pinnate, 1-1.5 times the length of the trophophore, with a short stalk and very compact sporangial cluster.

Distinguishing characteristics

Botrychium simplex most closely resembles pumice grape-fern, and the two species are known to co-occur in at least one site (at Newberry Crater), although *B. simplex* does not typically occupy the alpine or montane frost pocket habitats characteristic of pumice grape-fern. The more restricted pumice grape-fern is distinguished by its grayish green color (versus the yellow green of *B. simplex*), pinnae overlapping (versus approximate or remote in *B. simplex*) and sporophores 1-1.5 times longer than trophophores (versus sporophores 2-8 times longer than trophophores in *B. simplex*).

When to survey

Surveys for pumice grape-fern should be completed when the plants are fully emerged and before they begin to senesce, typically from the beginning of June to late July in montane forest habitats. At alpine sites, plants emerge when the snow pack recedes, with peak emergence generally observed by mid July to mid August.

Habitat

As its common name suggests, pumice grape-fern inhabits loose volcanic soils, which range from fine to coarse in texture. It occurs in two main habitat types, alpine and montane, at elevations ranging from 1290-2760 m (4240-9065 ft). In high elevation alpine sites the species grows on rocky rims and ridges with relatively flat (on ridge tops) to gently sloping topography. Plants occur within openings of alpine and subalpine plant communities, usually bordered by stands of *Pinus albicaulis*. Commonly associated plant species in this habitat type include *Juniperus communis*, *Raillardella argentea*, *Lupinus lepidus*, *Antennaria media*, *Elymus elymoides*, *Trisetum spicatum*, *Carex breweri*, *Eriogonum ovalifolium*, *E. pyrolifolium*, *E. umbellatum*, *Phacelia hastata*, *Penstemon davidsonii*, *Calyptidium umbellatum*, and *Hulsea nana*.

Montane sites typically occur on deep pumice soils within frost pockets or other comparable areas that retain soil moisture into late spring, although specific edaphic conditions and associated vegetation vary considerably at these sites. Montane pumice grape-fern populations often occupy *Pinus contorta/Achnatherum nelsonii* plant communities where tree cover is scattered, usually less than 30%, and there are large expanses of bare soil. Scattered herbaceous associates include *Carex rossii*, *Eriogonum umbellatum*, *Lupinus lepidus*, *Viola vallicola*, and *Calyptidium umbellatum*. Other plant community types in which Pumice grape-fern occurs are the *Pinus contorta/Purshia tridentata/Achnatherum nelsonii* type, and occasionally the *Pinus contorta/Artemisia tridentata* and *Artemisia tridentata/Achnatherum nelsonii* types. In sites in which logging has occurred, soils usually contain more organic matter with a groundcover including downed material, and the plant community is usually the *Pinus contorta/Purshia tridentata/Festuca idahoensis* type. Herbaceous cover within this community type may be more extensive and may include *Fragaria virginiana*, *Horkelia fusca*, and *Achillea millefolium*.

Range

Pumice grape-fern is restricted to central and south-central Oregon, with alpine sites at Crater Lake, Newberry Crater, Broken Top, and Mt. Bachelor. The species occurs within the East Cascade Range and West Cascade Range and Crest ecoregions. There is a historic collection of the species from Shastina, a secondary cone of Mt. Shasta, in Siskiyou county, California.

Oregon counties

Deschutes, Klamath, Lake

Federal status

None

Threats

Successional encroachment of understory vegetation and canopy closure resulting from fire suppression has changed many of the montane sites occupied by pumice grape-fern. Fuel accumulations, litter buildup, competition, and shade may threaten the long term survival of the species. Machine salvage timber harvesting and associated practices of slash piling, landing construction, and skid trail formation that disturb the ground and cause soil compaction or displacement may harm or destroy occurrences of pumice grape-fern. Plants may be directly damaged by recreational activities such as hiking, mountain biking, and off road vehicle use; these activities can also lead to soil compaction and churning which may be detrimental to the species. Pumice grape-fern is further threatened by habitat loss or degradation due to construction of buildings,

roads, and trails, and may be negatively affected by long term drought conditions.

Conservation Planning

An interagency Conservation Strategy for pumice grape-fern was developed by the U.S. Forest Service and U.S. Bureau of Land Management in 2001.

An interagency [Conservation Assessment](#) (Word document, 4.95 MB) for 13 *Botrychium* species, including *B. pumicola*, was completed by the U.S. Forest Service and U.S. Bureau of Land Management in 2007.

Did you know?

Pumice grape-fern can reproduce both sexually and asexually. It reproduces sexually by spores that produce an underground gametophyte requiring prolonged darkness and the formation of mycorrhizae to develop. A sporophyte arises when the flagellated sperm produced by a gametophyte fertilizes the archegonium (egg) of either the same gametophyte (self-fertilization) or a different gametophyte (cross-fertilization) underground. The species reproduces asexually by means of small (0.4 mm wide) subterranean sporophytic gemmae that form on the underground stem of pumice grape-fern plants. The gemmae may germinate and develop into mature plants with emergent fertile leaves. Gemmae often remain attached to the parent plant and likely play an important role in maintaining a genet over time.

References

Ahlenslager, K., and L. Potash. 2007. Conservation assessment for 13 species of moonworts (*Botrychium* Swartz subgenus *Botrychium*). USDA Forest Service Region 6 and USDI Bureau of Land Management, Oregon and Washington. Available at <http://www.fs.fed.us/r6/sfpnw/issssp/documents/planning-docs/ca-va-botrychium-13-species-2007-04-18.doc> (Word document, 4.95 MB). Accessed March 5, 2011.

Amsberry, K. and R. Meinke. 2002. Responses of *Botrychium pumicola* to habitat manipulation in forested sites in south-central Oregon – Final fourth year research summary. Unpublished report prepared for the Deschutes, Fremont, and Winema National Forests, and Prineville BLM. Oregon Department of Agriculture, Salem, Oregon.

Camacho, F. J., and A. Liston. 2001. Population structure and genetic diversity of *Botrychium pumicola* (Ophioglossaceae) based on inter-simple sequence repeats (ISSR). *American Journal of Botany* 88:1065-1070.

Farrar, D. R., and C. L. Johnson-Groh. 1990. Subterranean sporophytic gemmae in moonwort ferns, *Botrychium* subgenus *Botrychium*. *American Journal of Botany* 77:1168-1175.

Hopkins, C., R. Wooley, K. Grenier, C. Levack, C. Close, S. Malaby, K. Cushman, and R. Halvorson. 2001. Conservation strategy for the pumice grape fern *Botrychium pumicola* on the Deschutes, Fremont, and Winema National Forests, and BLM Prineville District. U.S. Forest Service, Fremont-Winema National Forest, Lakeview, Oregon.

Meinke, R.J. 1982. Threatened and endangered vascular plants of Oregon: An illustrated guide. Unpublished report for the U.S. Fish and Wildlife Service, Region 1, Portland, Oregon. Oregon Department of Agriculture, Salem, Oregon.

OFP (Oregon Flora Project). 2010. Oregon Plant Atlas.
<http://www.oregonflora.org/atlas.php>. Accessed, March 23, 2011.

ORBIC (Oregon Biodiversity Information Center). 2010a. Rare, threatened and endangered species of Oregon. Institute for Natural Resources, Portland State University, Portland, Oregon. 105 pp. Available at
<http://orbic.pdx.edu/documents/2010-rte-book.pdf> (pdf document, 971 kB). Accessed December 13, 2010.

ORBIC (Oregon Biodiversity Information Center). 2010b. ORBIC element occurrence database. Portland, Oregon.

Peck, M. E. 1961. A manual of the higher plants of Oregon. Binford and Mort, Portland, Oregon.

Wagner, W. H. Jr. and F. S. Wagner. 1993. *Botrychium*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 16+ vols. New York and Oxford. Vol. 2, pp. 86-101. Available at
http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=104332. Accessed March 23, 2011.