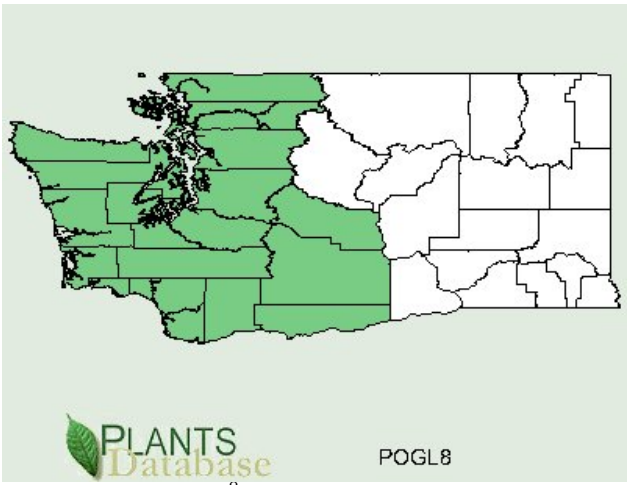
Plant Propagation Protocol for *Polypodium glycyrrhiza*
ESRM 412 – Native Plant Production
Spring 2011

North America Distribution Map

Washington State Distribution Map



Source: USDA PLANTS Database[8]

TAXONOMY	
Family Names	
Family Scientific Name:	Polypodiaceae
Family Common Name:	Polypody Family
Scientific Names	
Genus:	*Polypodium*
Species:	*glycyrrhiza*
Species Authority:	D.C. Eaton
Variety:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s)	*Polypodium vulgare* L. ssp. *occidentale* (Hook.) Hultén *Polypodium vulgare* L. var. *commune* Milde *Polypodium vulgare* L. var. *occidentale* Hook
Common Name(s):	licorice fern
Species Code:	POGL8
GENERAL INFORMATION	
Geographical range	Western Coastal Region of North America to the Cascade Mountains from Alaska to Central California[1] (See maps above for North America and Washington State)
Ecological distribution:	Epiphytic on deciduous tree trunks and branches,

	commonly bigleaf maple, also on wet mossy ground, rocks and logs[2] mostly in the shade.[3]
Climate and elevation range	Moist temperate climate[3], at low elevation[1] up to 1350 m.[4]
Local habitat and abundance; may include commonly associated species	Commonly found on deciduous trees, particularly *Acer macrophyllum*.[2] Or on any damp nutrient rich soil or moss. Prefers calcium rich soils or bark.[4]
Plant strategy type / successional stage:	As an epiphyte, *P. glycyrrhiza* is not stress-tolerant, nor does it do well in drought, but colonizes primarily on established moss or fallen logs which retain necessary water.[56] It may spread, but is not invasive.[7]
Plant characteristics:	It is a small to medium perennial forb,[8] from creeping reddish-brown scaly licorice flavored rhizomes.[9] Evergreen, once-pinnate smooth leaves with pointed tips and serrate to finely scalloped margins. Blades up to 50cm.[2]
PROPAGATION DETAILS	
Ecotype:	N/A
Propagation Goal:	Plants
Propagation Method:	Spore
Product Type:	Container
Stock Type:	N/A
Time to Grow:	2 years[10]
Target Specifications:	N/A
Propagule Collection (how, when, etc):	Collect Spores in late fall and spring.[10] Pick frond from mature plant and place in paper envelope or on clean piece of paper, sporangia side down. Wait a couple of days to ensure all of the spores are shed.[11]
Propagule Processing/Propagule Characteristics:	Spores lose viability with age, and should be kept in an airtight container at 4°C. One study indicated that fresh, the spores are 89.6% viable, but decreased to 53.7% after four years.[10]
Pre-Planting Propagule Treatments:	Spores are viable upon harvest. If you wish to clean them for scientific purposes, lightly tilt the paper they were collected on and tap it gently. The non-spore material will fall away.[11]
Growing Area Preparation / Annual Practices for Perennial Crops:	Use milled sphagnum moss, mixing 1:1 sand and organic material.[10] Any container with 5cm of room for soil media and 2.5cm of growing space is adequate. The tops should be able to be covered with a clear plastic or glass lid, or plastic wrap. Because additional watering after sowing is typically unnecessary, many growers use pots without drain holes.[11]
Establishment Phase:	Keep between 20° and 28°C, in low to medium intensity light (150-500 foot-candles). Watering in

	unnecessary.[11]
Length of Establishment Phase:	~14 days[11]
Active Growth Phase:	Add water with a fine mister if the environment dries out. Half strength fertilizer can be applied 2-3 weeks after the green germination mat appears. When sporelings have developed 3 leaves, transplant clumps of plantlets to 6.5cm pots with fine-textured potting mix, water with a fine spray[11] and keep humid and covered.[10] Transplant again when the prothalli are about 4mm in diameter.[11]
Length of Active Growth Phase:	N/A
Hardening Phase:	Remove the covering gradually exposing to more light and less moisture over the hardening phase.[11]
Length of Hardening Phase:	3-6 weeks (not specific to *P. glycyrrhiza*)[11]
Harvesting, Storage and Shipping:	Keep in partial shade and sheltered.[10]
Length of Storage:	Until 2 years from sowing.[10]
Guidelines for Outplanting / Performance on Typical Sites:	N/A
Other Comments (including collection restrictions or guidelines, if available):	Many sources indicate *P. glycyrrhiza* volunteers regularly in baskets lined with moss collected from western Canada or western US.
Ecotype:	N/A
Propagation Goal:	Plants
Propagation Method:	Vegetative (Rhizome)
Product Type:	Container
Stock Type:	N/A
Time to Grow:	N/A
Target Specifications:	N/A
Propagule Collection:	Harvest *P. glycyrrhiza* rhizomes in the Spring.[10] The following directions have not been tested specifically with *P. glycyrrhiza*, but are common to most ferns. Look for a section of rhizome with many growing tips (places where new fronds will grow) while ensuring there are enough growing tips on the parent plant. Preferably divide the rhizome at a natural joint or weak spot with a clean sharp knife. The larger the rhizome is, the more likely it will successfully propagate. Dig up the surrounding soil with a trowel and transport together.[11]
Propagule Processing/Propagule Characteristics:	Transplant soon after harvesting to ensure the rhizome does not dry out.[11]
Pre-Planting Propagule Treatments:	Remove old or broken fronds and roots as close to the rhizome as possible. And remove parts of larger fronds to avoid water loss. Dust cut ends with a fungicide.[11]

Growing Area Preparation / Annual Practices for Perennial Crops:	Well drained media is key, such as 1:1 perlite and peat moss. They do particularly well in moist uncut sphagnum moss. Container shape is unimportant as long as good drainage is ensured. Avoid using soil, manure, or compost.[11]
Establishment Phase:	Replant rhizome division about half their thickness into the medium. Secure rhizomes to the rooting medium. Firm the medium and water well. Keep it shaded, humid and warm until roots are established.[11]
Length of Establishment Phase:	N/A
Active Growth Phase:	No further information is available specific to rhizomal propagation.
Length of Active Growth Phase:	N/A
Hardening Phase:	N/A
Length of Hardening Phase:	N/A
Harvesting, Storage and Shipping:	See seeding guidelines above.
Length of Storage (of seedlings, between nursery and outplanting):	N/A
Guidelines for Outplanting / Performance on Typical:	See seeding guidelines above.
Other Comments:	N/A
INFORMATION SOURCES	
References:	See end of document
Other Sources Consulted (but that contained no pertinent information) (full citations):	http://www.wta.org/hiking-info/nature-on-trail/nature-on-trail-plants Robin Rose et al, *Propagation of Pacific Northwest Native Plants*, (Corvalis: Oregon State University Press, 1998).
Protocol Author:	Hollis Crapo
Date Protocol Created or Updated:	04/18/11

Licorice fern

Polypodium glycyrrhiza

Left photo courtesy of California Lutheran University's Wildflowers of Southern California page:http://ww1.clunet.edu/wf/nca/flowers/fwr-494.htm
Right photo courtesy of Pacific Rim Native Plants Nursery's fern page: http://www.hillkeep.ca/ferns.htm

Range

Distribution photo courtesy of Flora of North America: http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500977

Found in moist temperate forests of the Pacific coast, this epiphyte ranges as far south as Marin county and as far north as coastal Alaska. Inland, it resides in the western cascades, the valleys of British Columbia, and the Columbia Gorge [5]

Clearwater National Forest in Idaho is P. glycyrrhiza's only known location further inland[4]

Climate, Elevation

Low elevation, below 1,800 ft [13, 4]. P. glycyrrhiza's distribution indicates it prefers a moist temperate region with warm, wet winters, cool, wet summers, and dense fog. "All inland locations are associated with the riparian areas of large streams that have coastal environments" [4].

Local occurrence (where, how common)

Look for this fern on rocks, logs and the braches of bigleaf maple and alder trees in shady lowland forests throughout its range [1, 2]

Habitat preferences

The epiphytic P. glycyrrhiza will be spotted growing on bigleaf maple trees in low elevation forests. Can also be found on wet, mossy ground, logs and sometimes forms large sheets over moist rocks [7]. Prefers partial shade to full shade [10]. However it is also documented that it can grow in no shade at all for short periods, and that despite its requirement for moist soil, it can tolerate brief drought [11, 12]. "It needs to be in the ground or planted on a rotted log in areas with extended periods of frost or the rhizomes will freeze" (http://www.fancyfronds.com).

Plant strategy type/successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)

The habitat preferences of P. glycyrrhiza indicate that it is not a stress tolerator. As it is highly associated with bigleaf maple, it would most likely occur in older primary succesional forests in which this tree species is well established. As an epiphyte, it may unlikely compete with the host plant by crowding out its leaves. Can also be found in mid-seral Douglas fir and grand fir cover types[4]

Associated species

Associates with mossy Bigleaf maple (pojar), Douglas-fir, grand fir [4], salix spp. [3], and other moist forest species.

May be collected as: (seed, layered, divisions, etc.)

Collect and propagate using divisions and spores.

Collection restrictions or guidelines

Collect spores in the late fall and spring [9]. Sow spores thinly in pots covered with glass or plastic (an aquarium with a glass cover will work [14]) to create a moist, humid environment, allowing the gametophytes to fertilize, then carefully place small clumps of the plantlets into individual pots and keep humid. Plant in a sheltered position when plants are 2 years old (12). Make sure your plants do not get moldy when under plastic or glass [6].

Use division in the spring [12]. This fern goes dormant in the summer and can be difficult to find in this time [13], so mark your plants to avoid destroying them if you will be modifying the site then.

Seed germination (needs dormancy breaking?)

For the spore to germinate, it must be kept moist at all times [14]. Spores do not need dormancy breaking, and can be sown as soon as they are ripe. Smith and Robinson kept their cultures at 23 degrees Celsius under continuous fluorescent light at 250 lux [15].

Seed life (can be stored, short shelf-life, long shelf-life)

With increasing spore age, the percentage of viable spores decreases, with an increasing delay in germination. Immediately after collection, spores germinated at about 89.6%, while after 4 years of storage, germination declined to 53.7%. [15].

Recommended seed storage conditions

Smith and Robinson stored their spores at 4 degrees Celsius in an air-tight screw-capped vial in their study on age vs. spore viability in P. glycyrrhiza. The spores had a water content of 6.5% [15]

Propagation recommendations (plant seeds, vegetative parts, cuttings, etc.)

Division would be the simplest form of propagation. However, if that is not possible, propagate using spores.

Soil or medium requirements (inoculum necessary?)

Sow in high densities on the surface of a humus rich, sterilized soil – this plant does not tolerate heavy clay soils or soils that lack sufficient nutrients [12]. Any fairly porous medium such as peat moss, equal parts sand and shredded organic material is suitable [14].

Installation form (form, potential for successful outcomes, cost)

As mentioned before, wait until the plants are about 2 years old before planting out, and make sure they are placed in a shady area which will receive sufficient moisture [12].

Recommended planting density

None indicated, however, these plants are acclimated to growing in mats and in shade, so consider this when installing.

Care requirements after installed (water weekly, water once etc.)

Water often enough, depending on climate, but do not saturate. Keep the plant moist at all times, especially during establishment period. While P. glycyrrhiza tolerates drought, it will not survive for long. This plant normally dries in the summer during its dormancy.

Normal rate of growth or spread; lifespan

P. glycyrrhiza grows to 0.3 m by 0.3 m [11]. Height 10-40 cm and spread 40-50 cm. [10]. Growth rate and overall lifespan undetermined.

Sources cited

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9) "Polypodium glycyrrhiza." Flora of North America. Efloras.org. 06 May. 2005 http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500977.

10) "Polypodium glycyrrhiza - Licorice fern." Native Ferns. NATS Naturals Nursery. 06 May. 2005http://www.natsnaturals.com/Pages/Native2.htm.

11) "Polypodium glycyrrhiza." Plant for a Future Database. 06 May. 2005 http://www.ibiblio.org/pfaf/cgi-bin/arr_html?Polypodium+glycyrrhiza&CAN=COMIND.

12) "Polypodium glycyrrhiza." The Plant Archives. Gardenbed.com. 06 May. 2005 http://gardenbed.com/51/5064_pro.asp.

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14) "Propagation of Ferns From Spore." Tree Ferns Down Under. 06 May. 2005 http://www.geocities.com/rlhill47/spores.html.

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Data compiled by (student name and date)

Ivona Kaczynski, May 9, 2005.

[1] Thomas M.C. Taylor, *Pacific Northwest Ferns and Their Allies*, (Toronto: University of Toronto Press, 1970).
[2] Jim Pojar and Andy McKimmon, *Plants of the Pacific Northwest Coast*, (Vancouver, BC: Lone Pine Publishing: 2004).
[3] Theodore C. Frye, *Ferns of the Northwest*, (Portland: Binford and Mort, 1956).
[4] "E-Flora BC: Electronic Atlas of the Plants of British Columbia, *Polypodium glycyrrhiza* D.C. Eaton," Department of Geography University of British Columbia, Accessed April 18, 2011, http://linnet.geog.ubc.ca/Atlas/Atlas.aspx?sciname=Polypodium%20glycyrrhiza
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