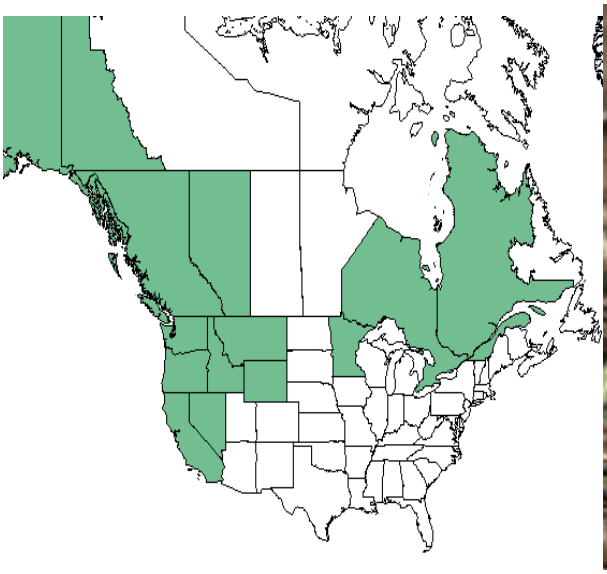
Plant Propagation Protocol for *Botrychium ascendens* W.H. Wagner
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/BOAS2.pdf



SOURCE: USDA Plants Database and Berkeley

TAXONOMY	
Plant Family	
Scientific Name	Ophioglossaceae
Common Name	Adder's-Tongue
Species Scientific Name	
Scientific Name	*Botrychium ascendens* W.H. Wagner
Varieties	None
Sub-species	None
Cultivar	None
Common Synonym(s)	None
Common Name(s)	Trianglelobe Moonwort
Species Code (as per USDA Plants database)	BOAS2
GENERAL INFORMATION	
Geographical range	Coastal Plain, Basin and Range, Rocky Mountains, Great Plains, Interior Lowlands, and Great Plains[1, 2]
Ecological distribution	*Botrychium ascendens* primarily grows in open habitats including: open beaches, mountain meadows, grassy roadsides, avalanche meadows.[3]
Climate and elevation range	*Botrychium ascendens* can be found at elevations ranging from 2,100 to greater than 10,000 feet. It is found in California's Mediterranean climate, the marine west coast climate, highland climate, semiarid steppe climate, and humid continental climate.[3.4]
Local habitat and abundance	In Washington and Oregon *Botrychium ascendens* is

	found in "avalanche meadows, pastured forest meadows and grassy roadsides at elevations" ranging from 2,100 to 6,300 feet.[3]
Plant strategy type / successional stage	Moonwort is an extremely rare species but can grow in a wide range of light conditions and successional stages.[5]
Plant characteristics	*Botrychium ascendens lives for a long period of time, it has a persistent rhizome.*[6] The plant is a fern with dense sporophore branches, sharply toothed pinnae, and a stalk that measures about 30% of the tropophore length.[6, 10] Moonwort may remain dormant and show no above ground growth for 1 to 3 years.[6]
PROPAGATION DETAILS	
Ecotype	Unknown, the species is very rare but a gametophyte would certainly come from one of the previously mentioned climates.
Propagation Goal	Plants and spores.
Propagation Method	Both, moonwort spores are very difficult to cultivate.[7]
Product Type	Bareroot, moonwort spores are very difficult to cultivate, however the plants will overtime create a dense spore bank in the surrounding soil which can remain viable for a long period of time.[7]
Time to Grow	Moonwort sporophytes remain below ground for several years, there is a high mortality rate at this stage and there is a higher density of sporophytes below ground than above ground.[7]
Propagule Collection Instructions	The plant is perennial and produces one frond per year in the late-spring or early-summer making this an ideal time for collection.[8]
Propagule Processing/Propagule Characteristics	There is an average spore density of 6,000 spores per square meter for most species of moonwort and this number can be much higher. There is a very high spore mortality rate. The spores can remain dormant for a long period of time but are extremely difficult to cultivate.[7]
Pre-Planting Propagule Treatments	Spores are released passively and are extremely difficult to cultivate unless released in this manned.[7]
Growing Area Preparation / Annual Practices for Perennial Crops	Moist soil, partial light or full shade.[7]
Establishment Phase Details	Moonwort produces asexual by release gemmae passively. This passive spore release is critical and cannot be replicated by removing particles form the plant.[7]
Length of Establishment Phase	Once spores have been released into the soil they can remain dormant for several years before growing into a below ground fern.

Active Growth Phase	Moonwort can sprout up to one frond per year.[7,9]
Length of Active Growth Phase	Moonwort can continue to produce perennial several years, producing one frond per year.[7]
Hardening Phase	Unknown.
Length of Hardening Phase	Unknown.
Harvesting, Storage and Shipping	Plant is very fragile, spores must be passively release by the fern in order to survive.[7]
Length of Storage	Unknown.
Guidelines for Outplanting / Performance on Typical Sites	Transplanting Moonwort is not very successful, however a plant can produce a high density of spores in the area surrounding it.[7] Moving spore dense soil may be the best option.
Other Comments	Very little information was found regarding Moonwort propagation generally and especially regarding this species. The plant is very uncommon ans highly fragile.
INFORMATION SOURCES	
References	1. "Plants Profile for Botrychium Ascendens (trianglelobe Moonwort)." Plants Profile for Botrychium Ascendens (trianglelobe Moonwort). Web. 21 May 2015. <http://plants.usda.gov/core/profile?symbol=BOAS2>. 2. "North America Geographic Regions." Virginia Department of Education. Web. 21 May 2015. <http://www.doe.virginia.gov/instruction/history/elementary/northamerica_regions.pdf>. 3. "Botrychium Ascendens." Herbarium. Iowa State. Web. 21 May 2015. <http://www.herbarium.iastate.edu/botrychium/B-ascendens.pdf>. 4. "Climate Zones of the United States." Wikimedia. Web. 21 May 2015. <http://upload.wikimedia.org/wikipedia/commons/5/57/Climatemapusa2.PNG>. 5. "Botrychium Spp." Botrychium Spp. US Forest Service. Web. 21 May 2015. <http://www.fs.fed.us/database/feis/plants/fern/botspp/all.html>. 6. "Botrychium Ascendens W.H. Wagner." Rare

	Plant Field Guide. Alaska National Heritage Program. Web. 21 May 2015. <http://aknhp.uaa.alaska.edu/big-files/botany/Alaska_Rare_Plant_Field_Guide/Botrychium_ascendens.pdf>. 7. "Conservation Assessment for 13 Species of Moonwort." Bureau of Land Management. Bureau of Land Management. Web. 21 May 2015. <http://www.blm.gov/or/plans/surveyandmanage/files/ca-va-botrychium-13-species-2007-04-18.pdf>. 8. "Regional Forester's Sensitive Plants of the Ottawa National Forest." US Forest Service. Web. 21 May 2015. <http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3791430.pdf>. 9. "Botrychium Ascendens." Flora of North America. Efloras. Web. 21 May 2015. <http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500271>. 10. "Upward-lobed Moonwort - Botrychium Ascendens." Montana Field Guide. Montana. Web. 21 May 2015.
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