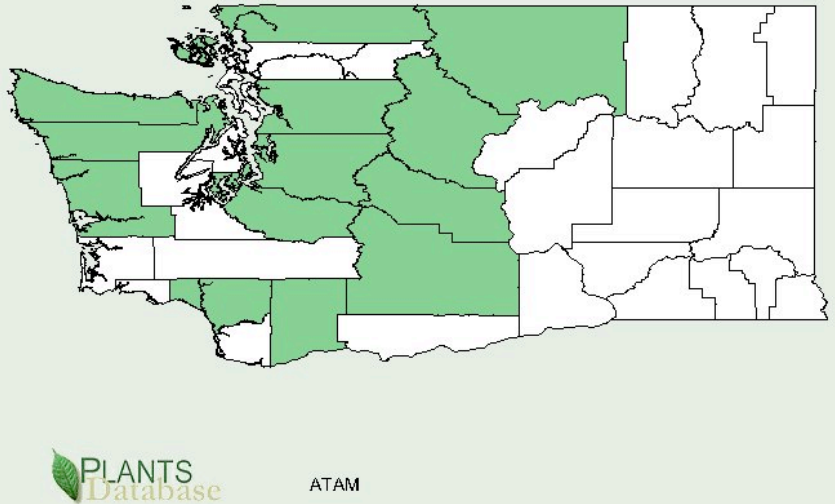


Plant Propagation Protocol for *Athyrium americanum*
 ESRM 412 – Native Plant Production

TAXONOMY	
Family Names	
Family Scientific Name:	<i>Dryopteridaceae</i> (USDA)
Family Common Name:	Wood fern family (USDA)
Scientific Names	
Genus:	<i>Athyrium</i> Roth
Species:	<i>Athyrium americanum</i> (Butters) Maxon
Species Authority:	(Butters) Maxon
Common Synonym(s) (include full scientific names (e.g., <i>Elymus glaucus</i> Buckley), including variety or subspecies information)	<ul style="list-style-type: none"> • <i>Athyrium alpestre</i> (Hoppe) Milde • <i>Athyrium alpestre</i> (Hoppe) Milde ssp. <i>americanum</i> (Butters) Lellinger • <i>Athyrium alpestre</i> (Hoppe) Milde var. <i>americanum</i> Butters • <i>Athyrium alpestre</i> (Hoppe) Milde var. <i>gaspense</i> Fernald • <i>Athyrium distentifolium</i> Tausch ex Opiz ssp. <i>americanum</i> (Butters) Hultén • <i>Athyrium distentifolium</i> Tausch ex Opiz var. <i>americanum</i> (Butters) B. Boivin
Common Name(s):	Alpine ladyfern (USDA)
Species Code (as per USDA Plants database):	ATAM
GENERAL INFORMATION	
Geographical range (distribution maps for North America and Washington state)	

	 <p>PLANTS Database ATAM</p> <p>green=present white=absent</p>
<p>Ecological distribution (ecosystems it occurs in, etc):</p>	<p><i>A. americanum</i> is a circumboreal species, occurring at, often near timberline, in rocky slopes and stream borders (Wick).</p>
<p>Climate and elevation range</p>	<p>Mid to high montane elevations (Wick).</p>
<p>Local habitat and abundance; may include commonly associated species</p>	<p>Moist acidic soil among rocks, meadows and talus slopes from mid to high elevations often near timberline (Ellingboe).</p>
<p>Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)</p>	<p>-</p>
<p>Plant characteristics (life form (shrub, grass, forb), longevity, key characteristics, etc)</p>	<ul style="list-style-type: none"> • Forb/herb • Perennial (USDA).
<p>PROPAGATION DETAILS</p>	
<p>Ecotype (this is meant primarily for experimentally derived protocols, and is a description of where the seed that was tested came from):</p>	<p>-</p>
<p>Propagation Goal (Options: Plants, Cuttings, Seeds, Bulbs, Somatic Embryos,</p>	<p>Plants (Wick).</p>

and/or Other Propagules):	
Propagation Method (Options: Seed or Vegetative):	Seed (Wick).
Product Type (options: Container (plug), Bareroot (field grown), Plug + (container-field grown hybrids, and/or Propagules (seeds, cuttings, poles, etc.))	Container (Plug).
Stock Type:	800 ml container (Wick).
Time to Grow (from seeding until plants are ready to be outplanted):	1 year (Wick).
Target Specifications (size or characteristics of target plants to be produced):	<ul style="list-style-type: none"> • Stock Type: Container sporophyte • Height: 30 cm, 7 mature fronds • Root System: Fully developed rhizomatous root mass in containers (Wick).
Propagule Collection (how, when, etc):	Spore Processing: Collect fronds when spores are tan in color. Spore bearing fronds are collected in late August. Fronds are placed in bags and taken to drying room immediately after collection (Wick).
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Fronds are placed in a room with no air movement, spore surface down on butcher paper. Spores will appear as a fine dust on the paper after several days of drying (Wick).
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	<p>Collect spores from the surface of paper and surface sow in sterilized flats filled with sterile, finely milled sphagnum peat moss. Water spores with distilled water and seal flats with clear plastic wrap to seal in moisture and prevent fungal contamination. Place flats under 60 watt soft incandescent lights set at 12 hour per day illumination. Germination of spores will occur after 15 days. The thread like germ filaments can be seen with the aid of a microscope and will appear as fine green threads on the surface of the medium. A constant temperature of 20 C to 25 C should be maintained throughout the growth of the prothalli.</p> <p>Container Type and Volume: Sporophytes are transplanted into 4.5" pots and 1-gallon containers. Growing Medium: Promix #1</p>

	Medium (Wick).
Growing Area Preparation / Annual Practices for Perennial Crops (growing media, type and size of containers, etc):	Sealed flats are grown under grow lights, for 2 to 3 months. Continued growth under greenhouse conditions at 20 to 25C for 2 to 3 months, followed by growth in the outdoor shadehouse for 6 months (Wick).
Establishment Phase (from seeding to germination):	Spores germinate 10 to 15 days after sowing. The heart shaped prothalli continue to grow for 6 to 8 weeks. Examination of the prothalli under a microscope will reveal the presence of the reproductive structures; the antheridia (male) and archegonia (female), located along the margins and notch of the prothalli. At this stage, it is critical to maintain a thin film of distilled water over the surface of the prothalli for fertilization to occur. It is critical to maintain sterile conditions during germination and establishment. Trays must be inspected for fungal contamination on a regular basis. If fungal contamination occurs, remove infected portions of the medium and treat trays with a highly diluted (1/4 recommended rate) fungicide drench. Treat with dilute fungicide only if prothalli are well developed. Reseal flats immediately and water only with distilled water. Once sporophytes appear, clear plastic is removed from the trays and aseptic conditions are no longer necessary (Wick).
Length of Establishment Phase:	2-3 months (Wick).
Active Growth Phase (from germination until plants are no longer actively growing):	Appearance of sporophytes occurred 3 months after spore germination. Individual plants are transplanted from flats to pots when they are 2 inches tall. After establishment in the greenhouse, they are moved to the outdoor shadehouse in late spring. Plants are fertilized with 13-13-13 Osmocote fertilizer and Micromax micronutrients mixed into medium (Wick).
Length of Active Growth Phase:	7 months (Wick).
Hardening Phase (from end of active growth phase to end of growing season; primarily related to the development of cold-hardiness and preparation for winter):	Plants are fertilized with 10-20-20 liquid NPK at 200 ppm during August and September. Plants were given one final irrigation prior to winterization (Wick).
Length of Hardening Phase:	2 months (Wick).
Harvesting, Storage and Shipping (of seedlings):	Total Time to Harvest: 1 year production time from spores. Harvest Date: September Storage Conditions: Overwinter in outdoor shadehouse under

	insulating foam and snow (Wick).
Length of Storage (of seedlings, between nursery and outplanting):	5 months (Wick).
Guidelines for Outplanting / Performance on Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):	Outplanting Site: Avalanche, Glacier National Park, MT. Outplanting Date: Spring or Fall (Wick) (no data on percent survival)
Other Comments (including collection restrictions or guidelines, if available):	Plants have been held successfully for two years in 800 ml (4.5") and 3L (1 gallon) containers in the nursery. Root mass is extensive and rhizomatous. Nursery grown plants produced spore-bearing fronds 2 years after germination (Wick). Vegetative Propagation Method: Rhizome Divisions Type of Cutting: Rhizome sectioning/ wounding Cutting Treatments: Rhizomes are split down the center axis with knife, cut into 20 cm lengths (Wick).
INFORMATION SOURCES	
References (full citations):	Ellingboe, James. "Athyrium alpestre." <i>Washington Native Plant Society</i> . N.p., 2010. Web. 14 May 2012. "Plants Profile for Athyrium alpestre." <i>USDA Plants Database</i> . USDA, n.d. Web. 14 May 2012. Wick, Dale; Evans, Jeff.; Luna, Tara. 2008. Propagation protocol for production of container <i>Athyrium americanum</i> (Butters) Maxon plants (800 ml container); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 28 April 2012). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.
Other Sources Consulted (but that contained no pertinent information) (full citations):	Flora of North America Editorial Committee, Nancy R. Morin, Convening Editor <i>Flora of North America North of Mexico: Volume 2, Pteridophytes and Gymnosperms</i> . Oxford University Press, New York, 1993. Luna, Tara. "Native Fern Propagation in Glacier National Park's Native Plant Nursery." <i>Native Plant Network</i> . N.p., 1993. Web. 14 May 2012. Olsen, Sue. "Fern Propagation: Growing ferns from spore." <i>Hardy Ferns</i> . N.p., 2010. Web. 14 May 2012.

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