Plant Propagation Protocol for Athyrium Filix-Femina
ESRM 412 – Native Plant Production
Spring 2008

(Washington Native Plant Society 2007)

TAXONOMY (USDA Plants)	
Family Names	
Family Scientific Name:	Dryopteridacea
Family Common Name:	Wood Fern Family
Scientific Names	
Genus:	*Athyrium*
Species:	*filix-femina*
Species Authority:	(L.) Roth
Variety:	
Common Synonym(s) (may repeat this section multiple times as needed)	
Genus:	*Athyrium*
Species:	filix-femina
Species Authority:	(L.) Roth
Variety:	
Sub-species:	*Angustum*
Cultivar:	
Authority for Variety/Sub-species:	(willd) R.T. Clausen
Common Name(s):	Subarctic Ladyfern

Sub-species:	*Asplenioides*
Cultivar:	
Authority for Variety/Sub-species:	(Michx) Hultén
Common Name(s):	asplenium ladyfern
Sub-species:	*Cyclosorum*
Cultivar:	
Authority for Variety/Sub-species:	(Rupr.) C. Chr
Common Name(s):	subarctic ladyfern
Species Code (as per USDA Plants database):	ATFI

GENERAL INFORMATION	
General Distribution:	Europe, Asia, and North America in temperate and tropical regions (botany.com). It is a circumboreal species, common in moist forests, meadows, and swamps (Wick et al. 2008).
Climate and elevation range:	Lowland to mid-mountain elevation (Wick et al. 2008).
Local habitat and abundance; may include commonly associated species:	Moist, partly shaded areas, usually in slightly acidic soil (Connecticut Botanical Society). Meadows, open thickets, moist woods, and occasionally swamps. Commonly grows in understory of *Picea glauca* (white spruce) and *Picea mariana* (black spruce) (Rook.org).
Plant strategy type / successional stage:	Some early succession as it colonizes cracks in rocks and crevices between rocks. More commonly grows as a dominant species on perennially wet soil with other herbs. Very strong plant if roots are will protected and have constant water supply. Often grows at wet sites that burn infrequently because only the top is killed by fire and the plant resprouts from the surviving rhizomes (Rook.org).
PROPAGATION DETAILS (Wick et at. 2008)	
Ecotype:	Cedar/Devil's Club habitat, understory species, Glacier National Park, Flathead CO, MT.
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Container (plug)
Stock Type:	3 L container
Time to Grow:	1 year
Target Specifications:	Stock Type: Container sporophyte Height: 45 cm, 7 mature fronds Root System: Fully developed rhizomatous root mass in containers.
Propagule Collection:	An indusium is present; collect fronds when indusium begins to lift and spore color is tan. Fronds ares collected in late August.
Propagule Processing/Propagule Characteristics:	Fronds are placed in a room without air movement, spore surface down on butcher paper. Spores will appear as fine as dust on the paper after several days of drying. Collect spores from the surface of paper and surface sow in sterilized flats filled with sterile, finely milled sphagnum peat moss that has been moistened with distilled

	water.
Pre-Planting Propagule Treatments:	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 20c to 25c should be maintained throughout the growth of the prothalli.
Growing Area Preparation / Annual Practices for Perennial Crops:	Greenhouse and outdoor nursery growing facility. Sowing/Planting Technique: Surface sow spores evenly by hand using sterile gloves or other sterilized sowing implement. Spores require light for germination. Sowing flats immediately after sowing.
Establishment Phase:	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 te 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 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 of 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 asceptic conditions are no longer necessary.
Length of Establishment Phase:	2 to 3 months
Active Growth Phase:	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 bi-weekly with 20-20-20 liquid NPK. Plants are root tight 8 months after germination.
Length of Active Growth Phase:	8 months
Hardening Phase:	Plants are fertilized with 10-20-20 liquid NPK at 200 ppm in early fall; pots are leached with water. Plants are watered before winterization.
Length of Hardening Phase:	4 weeks
Harvesting, Storage and Shipping (of seedlings):	Total Time to Harvest: 1 year Harvest Date: September Storage Conditions: Overwinter in outdoor shadehouse under

	insulating foam and snow.
Length of Storage:	5 months
Guidelines for Outplanting / Performance on Typical Sites:	Outplanting Site: Avalanche, Glacier National Park, MT. Outplanting Date: Fall
Other Comments:	Plants have been held successfully for two years in 800 m l(4.5") and 3L (1 gallon) containers in the nursery. Root mass is extensive and rhizomatous, and quickly fills containers. Nursery grown plant produce spore bearing fronds 2 years after germination.
PROPAGATION DETAILS (Davis et al. 2001)	
Ecotype:	National Capital Parks-East, Washington, D.C., Oxon Run Parkway
Propagation Goal:	Plants
Propagation Method:	Vegetative
Product Type:	Container (plug)
Stock Type:	1 gallon container plants
Time to Grow:	18 months
Target Specifications:	Height: 10-12 inches with a well-formed crown, multiple stems and fiddleheads. Root System: root ball is fibrous and firm, but does not always fill out container completely.
Propagule Collection:	National Capital Parks-East, Washington, D.C., Oxon Run Parkway by J. Kujawski, and M. Norman 7/28/97; spores and/or fertile fronds are collected into paper bags or envelopes.
Propagule Processing/Propagule Characteristics:	Spore Processing: No processing of spores is required; if fertile fronds are collected, fronds should be allowed to sit in paper bgs to allow ripe spores to drop off. Fronds can be shaken into bags or envelopes to dislodge spores.
Pre-Planting Propagule Treatments:	Sowing/Planting Technique: Spores are sprinkled by hand over Jiffy 7 peat pellets; pellets are placed into sealed clear plastic containers (such as hinged salad containers) and maintained in the lab at 72-77 F with a 16 hour light, 8 hour dark light cycle. This part of the process is also feasible in the greenhouse.
Growing Area Preparation / Annual Practices for Perennial Crops:	Propagation Environment: Lab, greenhouse, outdoor shadehouse.
Establishment Phase:	Sowing Date: Summer Establishment Phase: Once prothalli develop on the peat pellets, plugs are kept moist to allow for sporophyte production. Prothalli may require thinning if they become too crowded on pellets.
Length of Establishment Phase:	1 month
Active Growth Phase:	Once sexual reproduction on the prothalli occurs, small sporophytes begin to develop. These tiny ferns are transferred to flats with humidity domes containing loose peat pellet mix and maintained for approximately 2 months during which they develop

	many stems and roots. Moisture is maintained by handwatering and misting. Larger ferns are transplanted to trays containing Promix BX and for plants with several sets of true leaves, 1/4 strength 20-20-20 fertilizer is applied. These flats are moved from the lab to the greenhouse to begin hardening off plants. Again, this process could be done entirely in the greenhouse with attention to temperature and moisture.
Length of Active Growth Phase:	1 to 1-1/2 years
Hardening Phase:	Young ferns in Promix trays are exposed to open air in the greenhouse by removal of humidity domes after they have reached approximately 1-2 inches in height. Misting will help prevent dehydration of plants as they acclimate. These ferns can be transplanted into quart size containers after they reach a height of 2-3 inches. Ferns in larger containers should be moved outside to a shade house from the greenhouse in summer.
Length of Hardening Phase:	
Harvesting, Storage and Shipping:	Spore storage: Store cool and dry until spores are ready to use. Harvest Date: Ferns are ready approximately 1 to 1-1/2 years after spore germination. Storage Conditions: Container plants smaller than 1 gallon are stored in a cold house @ 40 F for the winter; containers are periodically watered to prevent dehydration. Gallon size containers are stored outside on weed barrier fabric, and covered with 2 layers of a microfoam insulating blanket. The blanket is secured over plants by threading a rope over the blanket between rebar anchors on either side of a group of containers.
Length of Storage:	December to mid-March
Guidelines for Outplanting / Performance on Typical Sites:	
Other Comments:	Vegetation Propagation Method: Spores
INFORMATION SOURCES	
References (full citations):	Works Cited "Athyrium - Lady Fern, Painted Fern." Botany.Com. 13 Apr. 2008 <http://www.botany.com/athyrium.html>. "Athyrium Filix-Femina." Rook.Org. 13 Apr. 2008 <http://www.rook.org/earl/bwca/nature/ferns/athyriumfil.html>.

	Davis, Kathy M.; Kujawski, Jennifer L. 2001. Propagation protocol for vegetative production of container Athyrium filix-femina plants; USDA NRCS - Beltsville National Plant Materials Center, Beltsville, Maryland. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 13 April 2008). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. "Lady Fern (Athyrium Filix-Femina)." Connecticut Botanical Society. 25 Nov.-Dec. 2005. 12 Apr. 2008 <http://www.ct-botanical-society.org/ferns/athyriumfili.html>. "PLANTS Profile for Athyrium Filix-Femina (Common Ladyfern)." USDA Plants. 13 Apr. 2008 <http://plants.usda.gov/java/profile?symbol=ATFI>. "Washington Native Plant Society: Photograph of Athyrium Filix-Femina." Washington Native Plant Society. 25 Nov. 2007. 16 Apr. 2008 <http://www.wnps.org/plants/athyrium_filix-femina.html>. Wick, Dale; Evans, Jeff; Hosokawa, Joy; Luna, Tara. 2008. Propagation protocol for production of container Athyrium filix-femina L. (Roth) plants (3 L container); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org

	(accessed 13 April 2008). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.
Other Sources Consulted (but that contained no pertinent information) (full citations):	"Lady Fern." 15 Apr. 2008 <http://greenwoodnursery.com/page.cfm/333>. "MrGrow.Com." 15 Apr. 2008 <http://www.mrgrow.com/>.
Protocol Author (First and last name):	Kimberly Jones
Date Protocol Created or Updated (MM/DD/YY):	04/26/08

Note: This template was modified by J.D. Bakker from that available at: http://www.nativeplantnetwork.org/network/SampleBlankForm.asp

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Plant Data Sheet

Species Athyrium Filix-Femina
Lady fern

Range

Circumpolar; Alaska to Labrador and Greenland, south in North America to Saskatchewan, Nebraska, Missouri, Illinois, Ohio, West Virginia, and North Carolina.

Climate, elevation

Occurs along the coast and wet interior regions at all elevations.

Local occurrence (where, how common)

Common in moist to wet forest, swamps, thickets, openings, slidetracks, stream-banks, gullies, meadows and clearings.

Habitat preferences

Wet or damp areas such as swamps, stream banks, wet forests and in clearings such a meadows

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

Lady Fern is relatively tolerant of sun and dry soil as compared to many other ferns.

Associated species

A. Goeringianum pictum; A. alpestre; A. crenatum; A. macrocarpum; A. niponicum; A. spinulosum; A. umbrosum.

Other common names include: wood fern's wife

May be collected as: By division in the spring or spores may be sown in the summer. The spores must be fully ripe.

Collection restrictions or guidelines

Place fronds with the spores in a paper bag and dry for a week at 21ºC. Collect spores that fall into the bag. Athyrium can be transplanted in the spring or fall; however, division is best attempted in the spring, shortly after new growth has emerged.

Seed germination (needs dormancy breaking?)

No seeds.

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

Recommended seed storage conditions

Spores may be stored in a dry, cool place.

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

Division in spring or by collecting spores in late July and August

Soil or medium requirements (inoculum necessary?)

Moist/Well-Drained acidic soil (www.horticulture.com)

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

Division.

Recommended planting density

Spacing 18"-24"

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

Fertilization unnecessary, keep soil moist and protect from strong wind. (www.mrgrow.com)

Normal rate of growth or spread; lifespan

Moderate to fast growth rate (greenwoodnursery.com)

Sources cited

http://www.rook.org/earl/bwca/nature/grass/carexros.html

www.horticulture.com

www.mrgrow.com

www.botany.com

greenwoodnursery.com

Pojar, Jim and Andrew MacKinnon. 1994. Plants of the Pacific Northwest Coast Washington, Oregon British Columbia & Alaska. BC Ministry of Forests and Lone Pine Publishing, Vancouver, British Columbia, Canada 527 p.

Data compiled by (student name and date)

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