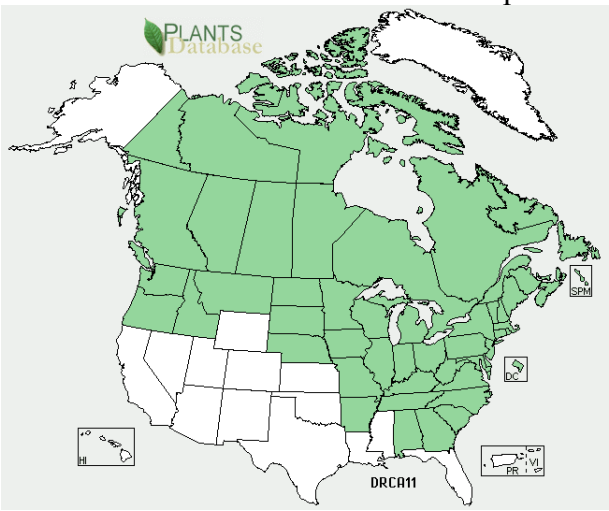
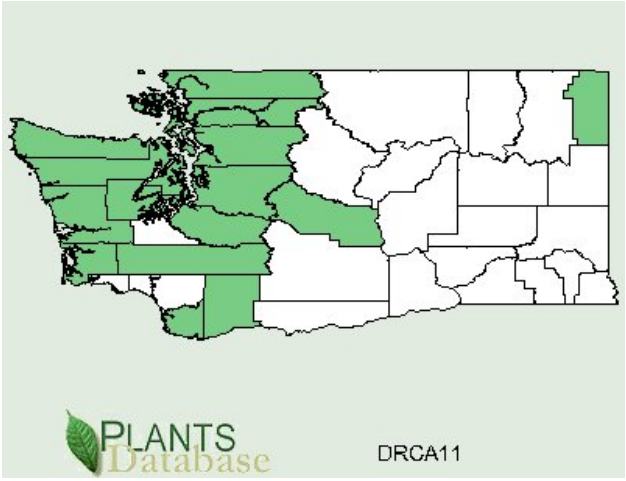
Plant Propagation Protocol for *Dryopteris carthusiana*
ESRM 412 – Native Plant Production
Spring 2011

North America Distribution Map



Washington State Distribution Map



Source: USDA PLANTS Database

TAXONOMY	
Family Names	
Family Scientific Name:	Dryopteridaceae
Family Common Name:	Wood Fern Family
Scientific Names	
Genus:	*Dryopteris*
Species:	*carthusiana*
Species Authority:	H.P. Fuchs
Variety:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s)	*Dryopteris austriaca* (Jacq.) Woynar ex Schinz & Thell. var. *spinulosa* (O.F. Müll.) Fisch. *Dryopteris spinulosa* (O.F. Müll.) Watt
Common Name(s):	spinulose woodfern
Species Code:	DRCA11
GENERAL INFORMATION	
Geographical range	N. America (See maps above for North America and Washington State),[1] Europe and Asia.[4]
Ecological distribution:	Moist woods and along stream banks, in full shade to almost full sun.[2]
Climate and elevation range	Found 18-1500m in elevation[3] in moist areas.[2]
Local habitat and abundance	Prefers rotting wood, occasionally found on the base of trees, but no more than 2 ft from the ground.[4]

Plant strategy type / successional stage:	*D. carthusiana* prefers shade in moist areas which implies it is a secondary colonizer coming in with the underbrush like many other ferns. Also it is not drought tolerant.[5]
Plant characteristics:	It is a forb, ~1m tall with bi to tri-pinnate leaves.[2] The blades have scales, but no hairs.[5] It is perennial, dying in the winter.[6] It has round sori halfway between the midvein and the margin, with kidney shaped indusia lacking glands.[7]
PROPAGATION DETAILS	
Seed Propagation	
Ecotype:	Cedar/Devil's Club habitat, understory species[8]
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Container (plug)[8]
Stock Type:	800 mL Container[8]
Time to Grow:	1 year[8]
Target Specifications:	Container sporophyte, 25cm, 7 mature fronds, fully developed rhizomatous root mass in container.[8]
Propagule Collection:	An indusium is present; collect fronds when indusium begins to lift and spore color is black. Fronds are collected by hand in July and August.[8]
Propagule Processing/Propagule Characteristics:	Fronds are placed spore surface down on butcher paper to collect spores in a room without air movement. Spores will appear as a fine dust on the paper after several days of drying.[8]
Pre-Planting Propagule Treatments:	N/A
Growing Area Preparation / Annual Practices for Perennial Crops:	Sterilized flats of sphagnum moss with drainage holes.[8]
Establishment Phase:	Spores are surface sown on sterilized milled sphagnum peat moss in sterilized flats with drainage holes. Water spores with distilled water only. Seal flats promptly after sowing with clear plastic wrap to seal in moisture and prevent fungal contamination. The thread like germ filaments can be seen with the aid of a microscope and will appear as a fine green threads on the surface of the medium. A constant temperature of 20 to 25C should be maintained throughout the growth of the prothalli. Place flats under 60 watt soft incandescent lights set at 12 hour per day illumination.[8]
Length of Establishment Phase:	10-20 Days
Active Growth Phase:	Sealed flats are grown under grow lights and sterile conditions, for 2 to 3 months. Individual plants are transplanted from flats to 100mL pots with Promix #1 medium when they are 4 cm tall. After establishment in the greenhouse, they are moved to the outdoor shade

	house in late spring for 6 months. Plants are fertilized with time released Osmocote (13-13-13) and Micromax micronutrients mixed into medium.[8]
Length of Active Growth Phase:	~8 months.[8]
Hardening Phase:	Plants are fertilized with 10-20-20 liquid NPK at 200 ppm in early fall. Plants are watered before winterization.[8]
Length of Hardening Phase:	4 weeks
Harvesting, Storage and Shipping:	Harvest in September and overwinter in outdoor shade house under insulating foam.[8]
Length of Storage:	5 months
Guidelines for Outplanting / Performance on Typical Sites:	Outplant in the Spring or Fall.[8]
Other Comments:	Plants have been held successfully for two years in 800 ml (4.5 inch) containers in the nursery. Root mass on mature plants consists of a series of short, stout rhizomes. This species develops more slowly than other fern species. Nursery grown plants produced spore bearing fronds 2 years after germination.[8]
Rhizomal propagation	
Ecotype:	N/A
Propagation Goal:	Plants
Propagation Method:	Rhizomal (Vegetative)
Product Type:	Container
Stock Type:	N/A
Time to Grow:	N/A
Target Specifications:	N/A
Propagule Collection:	Collect *D. carthusiana* rhizomes in late winter or early spring.[2] The following directions have not been tested specifically with *D. carthusiana*, 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.[5]
Propagule Processing/Propagule Characteristics:	Transplant soon after harvesting to ensure the rhizome does not dry out.[5]
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.[5]
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.[5]
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.[5]
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:	N/A
Guidelines for Outplanting / Performance on Typical Sites:	See seeding guidelines above.
Other Comments:	N/A
INFORMATION SOURCES	
References:	See Below
Other Sources Consulted:	[i]"*Dryopteris carthusiana* (Vill.) H. P. Fuchs," Germplasm Resources Information Network, Accessed May 14, 2011, http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?401939 [ii]"Spinulose Wood Fern, Toothed Wood Fern (*Dryopteris carthusiana*)," Fancy Fronds Nursery, Accessed May 14, 2011, www.fancyfronds.com/store/detail.cfm?ItemID=127
Protocol Author:	Hollis Crapo
Date Protocol Created or Updated:	05/16/11

[1] USDA PLANTS Database

[2] Kathleen A. Robson, Alice Richter and Marianne Filbert, *Encyclopedia of Northwest Native Plants for Gardens and Landscapes*, (Portland: Timber Press, 2008).

[3] "E-Flora BC: Electronic Atlas of the Plants of British Columbia, *Dryopteris carthusiana* (Vill.) H.P. Fuchs," Department of Geography University of British Columbia, Accessed May 14, 2011, http://linnet.geog.ubc.ca/Atlas/Atlas.aspx?sciname=Dryopteris%20carthusiana

[4] Theodore C. Frye, *Ferns of the Northwest*, (Portland: Binford and Mort, 1956).

[5] Barbara Joe Hoshizaki and Robbin C. Moran, *Fern Growers Manual: Revised and expanded edition*, (Hong Kong: Timber Press, 2001).

[6] "Dryopteris Carthusiana," Flora of North America, Accessed May 14, 2011, http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500591

[7] *Dryopteris carthusiana* Spinulose Wood Fern," Earl J.S. Rook, Accessed May 14, 2011, http://www.rook.org/earl/bwca/nature/ferns/dryopteriscar.html

[8] "Untitled Page," Native Plant Network, Accessed May 16, 2011, http://www.nativeplantnetwork.org/network/ViewProtocols.aspx?ProtocolID=89