Jessica Taylor
ESRM 412 – Native Plant Production
Protocol for *Galium Boreale L.,* Northern bedstraw
May 9, 2007


Images by Ben Legler
http://biology.burke.washington.edu/herbarium/imagecollection/wtu8000-8499/lg/wtu008231_lg.jpg (left)
http://biology.burke.washington.edu/herbarium/imagecollection/wtu8000-8499/lg/wtu008232_lg.jpg (right)

TAXONOMY	
Family Names	
Family Scientific Name:	Rubiaceae
Family Common Name:	Madder
Scientific Names	
Genus:	Galium
Species:	Boreale L.
Species Authority:	Linnaeus (L.)
Variety:	*Hyssopifolium, intermedium, linearifolium, scabrum, typicum*
Sub-species:	ssp. *septentrionale*
Cultivar:	none
Authority for Variety/Sub-species:	*Galium boreale L.* ssp. *septentrionale* (Roemer & J.A. Schultes) Hara *Galium boreale L. var. hyssopifolium* (Hoffmann) DC. *Galium boreale L. var. intermedium* DC. *Galium boreale L. var. linearifolium* Rydb. *Galium boreale L. var. scabrum* DC. *Galium boreale L. var. typicum* G. Beck

Common Synonym(s)	
Genus:	*Galium*
Species:	*Boreale L.*
Species Authority:	Linnaeus (L.)
Varieties:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Name(s):	Northern bedstraw
Species Code (as per USDA Plants database):	GABO2
GENERAL INFORMATION	
General Distribution:	The USDA reports that Galium boreale L. occurs in the following states: Alaska, Arizona, California, Colorado, Connecticut, Delaware, Iowa, Idaho, Illinois, Indiana, Kentucky, Massachusetts, Maryland, Maine, Michigan, Minnesota, Missouri, Montana, North Dakota, Nebraska, New Hampshire, New Jersey, New Mexico, Nevada, New York, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Utah, Virginia, Vermont, Washington, Wisconsin, West Virginia, Wyoming. It is endangered in Maryland and Massachusetts. In Washington state, it is found mesic habitats, from sea level to timber line (WTU-Burke Museum). In eastern Washington it is usually found on more mesic sites in grasslands of the Palouse Prairie and in open coniferous woods (Skinner).
Climate and elevation range	It's mimimum temperature for growth is -33°F (USDA). It's adapted to various climates, but grows best in conditions listed by the USDA's characteristic information page. It adapted to a wide range of elevations from sea level (0 feet) to timberline (area in which trees will not grow).
Local habitat and abundance; may include commonly associated species	The WTU-Burke Meseum herbarium specimens collected from Oregon, Idaho and Washington (between 1999 to 2004) were associated with: Sedges, rushes, Bromus, Phleum, Alopecurus, Poa, Potentilla; Pinus and Populus tremuloides; Pinus contorta, Artemesia arbuscula, Salix exigua, Juncus sp.; and at lower elevations ninebark, ribes and snowberry.
Plant strategy type / successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)	These species appears to be a stress-tolerant species with its wide geographical distribution, climate and elevation range. No comments have actually been made from the listed sources determining what this species real strategy type and successional stage is.
PROPAGATION DETAILS	
Ecotype:	Paradise Creek drainage near Pullman, WA.
Propagation Goal:	Plants
Propagation Method:	Seed
Product Type:	Container (plug)
Stock Type:	10 cu.
Time to Grow:	4 Months.

Target Specifications:	Tight root plug in container.
Propagule Collection:	Seed is collected in September when the inflorescence is dry and the seeds are brown in color. Seed can be stripped from the stalks by hand or entire stalks can be cut. Plants hold their seed well, shattering is not generally a problem. Harvested seed is stored in paper bags at room temperature until cleaned.
Propagule Processing/Propagule Characteristics:	Small amounts are rubbed to free the seed and then cleaned with an air column separator. Larger amounts are threshed with a hammermill and then cleaned with air screen equipment. Clean seed is stored in controlled conditions at 40 degrees Fahrenheit and 40% relative humidity. The USDA's listed seed density was 725,760 seeds/lb.
Pre-Planting Propagule Treatments (cleaning, dormancy treatments, etc):	Germination was equally low for seeds from a Wisconsin source either without pretreatment or after 2 months cold moist stratification (Green & Curtis 1950). Maguire and Overland (1959) found 4 weeks of cold moist stratification resulted in 84% germination, while untreated seed germinated at 64%. For this ecotype, germination without pretreatment is high. Trials conducted at the PMC comparing untreated seed with cold, moist stratified seed showed no benefit from stratification.
Growing Area Preparation / Annual Practices for Perennial Crops:	In January seed is sown in the greenhouse in 10 cu. in. Ray Leach Super cell conetainers filled with Sunshine #4 and covered lightly. Head space of ¼ to ½ inch is maintained in conetainers to allow deep watering. A thin layer of coarse grit is applied to the top of the planting soil to prevent seeds from floating during watering. Conetainers are watered deeply.
Establishment Phase:	Medium is kept moist until germination occurs. Germination usually begins in 10-12 days and is complete in 3 weeks.
Length of Establishment Phase:	3 weeks
Active Growth Phase:	Plants are watered deeply every other day and fertilized once per week with a complete, water soluble fertilizer containing micro-nutrients.
Length of Active Growth Phase:	2-3 months
Hardening Phase:	Plants are moved to the cold frame in late March or early April, depending on weather conditions. They are watered every other day if the weather is cool, and every day during hot, dry spells.
Length of Hardening Phase:	2-4 weeks
Harvesting, Storage and Shipping:	N/A
Length of Storage:	N/A
Guidelines for Outplanting / Performance on Typical Sites:	Transplanting is done in early May by using an electric drill and portable generator to drill 1.5 inch diameter holes at the planting site. Survival in seed increase plantings without competing vegetation exceeds 95%. Transplanting into sites with existing vegetation reduces survival and vigor depending on weather conditions following planting. Flowering and seed production may occur the same year as transplanting.
Other Comments:	Unless otherwise stated all information is taken from Skinner’s protocol.

	Skinner comments that no insect problems have been noted. It may also be possible to propagate this species from pieces of the rhizome or from divisions.
INFORMATION SOURCES	
References:	Skinner, David M. 2007. Propagation protocol for production of container *Galium boreale L* plants (10 cu.); Pullman Plant Materials Center, Pullman, Washington. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 4 May 2007). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. Chirco, Ellen, and Terry Turnoer. 1986. Species without AOSA Testing Procedures. The Newsletter of the Association of Official Seed Analysts 60(2):2-66. Available online at http://www.aosaseed.com/Species%20wo%20AOSA%20list%20plus%20adds.pdf Updated November 11/10/03. Craighead, John J., Frank C. Craighead, and Ray J. Davis. 1963. A Field Guide to Rocky Mountain Wildflowers. Houghton Mifflin Co. Boston, MA. 277 pp. Greene, H.C. and J.T. Curtis. 1950. Germination Studies of Wisconsin Prairie Plants. American Midland Naturalist 43:186-194. Hassell, Wendell, W. Rocky Beavers, Steve Ouellette, and Thomas Mitchell. 1996. Seeding Rate Statistics for Native and Introduced Species. USDI National Park Service and USDA Natural Resources Conservation Service. 25 pp. Hitchcock, C. Leo, and Arthur Cronquist. 1973. Flora of the Pacific Northwest. University of Washington Press. Seattle, WA. 730 pp. Kruckeberg, Arthur R. 1996. Gardening with Native Plants of the Pacific Northwest. 2nd ed. University of Washington Press. Seattle, WA. 282 pp. Larrison, Earl J., Grace W. Patrick, William H. Baker, and James A. Yaich. 1974. Washington Wildflowers. The Seattle Audubon Society. Seattle, WA. 376 pp. Lyons, C.P. 1956. Trees, Shrubs and Flowers to Know in Washington. J.M. Dent & Sons (Canada) Limited. Vancouver, BC. 211 pp. Lyons, C.P. 1997. Wildflowers of Washington. Lone Pine Publishing, Renton, WA. 192 pp. Maguire, James D. and Alvin Overland. 1959. Laboratory Germination of Seeds of Weedy and Native Plants. Washington State Agricultural Experiment Station Circular 349, Pullman, WA. 15 p.

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	WTU Herbarium Specimens. URL : http://biology.burke.washington.edu/herbarium/imagecollection.php
Other Sources Consulted:	None.
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