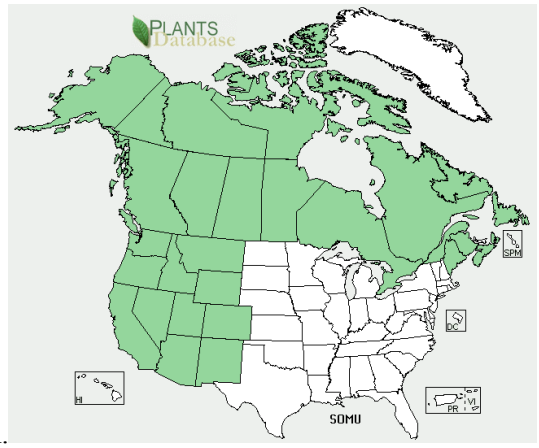
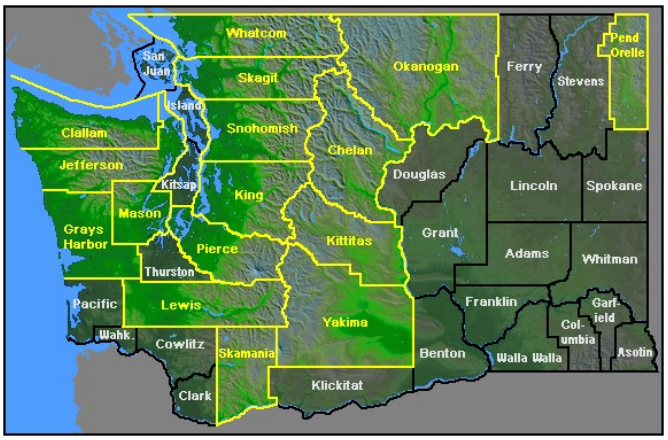
Plant Propagation Protocol for *[Insert Species]*

ESRM 412 – Native Plant Production

A. 

B. 

A. North America Distribution (USDA PLANTS database) B. Washington State Distribution (University of Washington Burke)

TAXONOMY	
Family Names	
Family Scientific Name:	Asteraceae
Family Common Name:	Aster
Scientific Names	
Genus:	*Solidago*
Species:	*Solidago multiradiata*
Species Authority:	Aiton
Variety:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s) :	*Solidago multiradiata* Aiton var. *arctica* (DC.) Fernald *Solidago multiradiata* Aiton var. *multiradiata* *Solidago multiradiata* Aiton var. *scopulorum* A. Gray *Solidago multiradiata* Aiton ssp. *scopulorum* (A. Gray) W.A. Weber
Common Name(s):	Rocky Mountain goldenrod Arctic goldenrod Manyray goldenrod Mountain goldenrod Alpine goldenrod
Species Code (as per USDA Plants database):	SOMU

GENERAL INFORMATION	
Geographical range	Alaska south in the mountains to California and New Mexico.
Ecological distribution:	Subalpine, rocky slopes and dry meadows (Pojar & MacKinnon, ; Cullina, 2000)
Climate and elevation range	High mountain elevations to above timberline (7,000 to 12,000 ft) (Burbridge, 1989; Cullina, 2000)
Local habitat and abundance; may include commonly associated species	Grows well in well drained soils. (Nau, 1996)
Plant strategy type / successional stage	Understory plant in an early successional setting (Treberg & Turkington, 2003)
Plant characteristics	**Life form**: Forb, subshrub **Duration**: Perennial **Longevity**: Up to 3 years in gardens **Blooming period**: July – August **Leaves**: Basal leaves and lower stem-leaves spatula-shaped with long haired stalks and smooth blades. (2-10 cm long and 9mm-1.5cm wide) **Flowers**: Short compact clusters at ends of plant stems. Approximately 13 5mm long ray-petals surround larger number of disk-flowers. 3-5mm long involucre with thin, narrow, pointed bracts **Stems**: Slightly hairy **Height**: 5-50cm (Burbridge, 1989; Nau, 1996)
PROPAGATION DETAILS	
Ecotype:	From a closed-to-open spruce forest near Kluane Lake in a glacial valley, Shakwak Trench, in southwestern Yukon, Canada. Valley located in the rain shadow of St. Elias Mountains. Precipitation consists of ca. 230mm mean annual precipitation (mostly rain in summer and 100cm of snow in winter). (Treberg & Turkington, 2003)
Propagation Goal:	Seedlings for ecological studies.
Propagation Method	Seed
Product Type	Container (plug)
Stock Type:	
Time to Grow (from seeding until plants are ready to be outplanted):	Relatively fast Germinated in June in the Yukon. (Treberg & Turkington, 2003)
Target Specifications (size or characteristics of target plants to be produced):	Seedling height approx. 5 cm Seedling plants for ecological research in Kluane region (Burbridge, 1989; Treberg & Turkington, 2003)
Propagule Collection (how, when, etc):	Waited for natural seed maturation/dispersal (Treberg & Turkington, 2003)

Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	Mean percent germination: 65.1±5.0 germination (Treberg & Turkington, 2003)
Pre-Planting Propagule Treatments :	Seeds dried and stored in plastic or paper bags in freezer (3˚C) from November to May (Treberg & Turkington, 2003)
Growing Area Preparation / Annual Practices for Perennial Crops:	- Petri dish containing moist sand - Peat plugs (Treberg & Turkington, 2003)
Establishment Phase (from seeding to germination):	- Seeds germinated on moist sand in closed petri dishes in early June. Seedlings removed immediately after radical removal and sprayed with 2.5 oxine benzoate to help prevent damping off. Then, seedlings were transplanted into either peat plugs or seedling trays. - Seeds also germinated in peat plugs. (Treberg & Turkington, 2003)
Length of Establishment Phase:	
Active Growth Phase (from germination until plants are no longer actively growing):	Transplanting done from 4 cm soil core plugs. Larger cores helped increase transplanting success. Plants also had to be well watered before and after transplanting process.
Length of Active Growth Phase:	June to August (Burbridge, 1989)
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):	
Length of Hardening Phase:	
Harvesting, Storage and Shipping:	Store in at 3˚C in paper bags

Length of Storage (of seedlings, between nursery and outplanting):	
Guidelines for Outplanting / Performance on Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):	
Other Comments (including collection restrictions or guidelines, if available):	
PROPAGATION DETAILS	
Ecotype	From a closed-to-open spruce forest near Kluane Lake in a glacial valley, Shakwak Trench, in southwestern Yukon, Canada. Valley located in the rain shadow of St. Elias Mountains. Precipitation consists of ca. 230mm mean annual precipitation (mostly rain in summer and 100cm of snow in winter). (Treberg & Turkington, 2003)
Propagation Goal:	Seedlings
Propagation Method:	Vegetative
Product Type	Container (plug)
Stock Type:	
Time to Grow:	Relatively fast (Treberg & Turkington, 2003)
Target Specifications:	5 cm tall seedlings (Burbridge, 1989)
Propagule Collection (how, when, etc):	5cm long fresh growing tips collected in June. (Treberg & Turkington, 2003)
Propagule Processing/Propagule Characteristics (including seed density (# per pound), seed longevity, etc):	
Pre-Planting Propagule Treatments (cleaning, dormancy	

treatments, etc):	
Growing Area Preparation / Annual Practices for Perennial Crops (growing media, type and size of containers, etc):	- Moist sand in tray with plastic cover - Peat plugs (4cm) (Treberg & Turkington, 2003)
Establishment Phase (from seeding to germination):	Removed 2.5 cm of the leaves near the cut and cut into the stem 4-5 times with a clean blade. Cutting was then dipped in rooting compound Wilson Roots® Liquid Root Stimulator, Sure-Gro Inc. containing auxin and fungicide in the forms of 0.4% IBA and 0.01% etridiazole respectively. Cuttings then placed on moist sand when rooting and shoots appear, transplant into 4cm peat plugs.
Length of Establishment Phase:	30 days (Treberg & Turkington, 2003) with 22.6± 0.5 mean survival
Active Growth Phase (from germination until plants are no longer actively growing):	Transplanting done from 4 cm soil core plugs. Larger cores helped increase transplanting success. Plants also had to be well watered before and after transplanting process. (Treburg & Turkington, 2003)
Length of Active Growth Phase:	June to August (Burbridge, 1989)
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):	
Length of Hardening Phase:	
Harvesting, Storage and Shipping (of seedlings):	
Length of Storage (of seedlings, between nursery and outplanting):	
Guidelines for Outplanting / Performance on	

Typical Sites (eg, percent survival, height or diameter growth, elapsed time before flowering):	
Other Comments (including collection restrictions or guidelines, if available):	
INFORMATION SOURCES	
References (full citations): Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Location: Publisher.	Burbridge, J. (1989). Wildflowers of the Southern Interior of British Columbia. Manitoba, Canada: Frisen Printers. Cullina, W. (2000). *The New England wild flower society guide to growing and propagating wildflowers of the United States and Canada*. New York, NY: Houghton Mifflin Harcourt. Knoke, D. (2011). Solidago multiradiata. Retrieved from Burke Museum of Nature History and Culture. <http://biology.burke.washington.edu/herbarium/imagecollection.php?ID=658 > Nau, J. (1996). *Ball perennial manual: Propagation and production*. Batavia, IL: Ball Publishing. Treberg M.A. & Turkington R. (2003).How to grow, propagate and kill some of the native plants in the Kluane region, southwestern Yukon. *Davidsonia*, 19(2), 42-53.
Other Sources Consulted (but that contained no pertinent information) (full citations):	Gavin D.G. and Brubaker L.B. (1999). A 6000-year soil pollen record of subalpine meadow vegetation in the Olympic Mountains, Washington, USA. *Journal of Ecology*, 87(1), 106-122. Lam, J., Christensen, L.P., Farcht, T., & Thomasen, T. (1992). Actetylenes from the roots of Solidago species. *Phytochemistry*, 31(12), 4159-4161. Lindgren DT, Schaaf D. (2005). Survival and growth of wildflowers with buffalo grass or blue grama grass. *Hortscience*, 40(6), 1787-1789. Metzger K.L., Romme W.H., Turner M.G. (2006). Foliar nitrogen patterns

	following stand-replacing fire in lodgepole pine (Pinus contorta var. latifolia) forests of the Rocky Mountains, USA. *Forest Ecology and Management*, 227(1-2), 22-30. Treberg M.A. & Turkington R. (2010). Facilitation in an unproductive boreal forest understorey community. *Journal of Vegetation Science*, 21(4), 761-771. United States Department of Agriculture. (2011). The Native Plants Propagation Protocol Database. Retrieved from http://www.nativeplantnetwork.org/network/
Protocol Author (First and last name):	Megumi Miyake
Date Protocol Created or Updated (MM/DD/YY):	April 20th, 2011

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