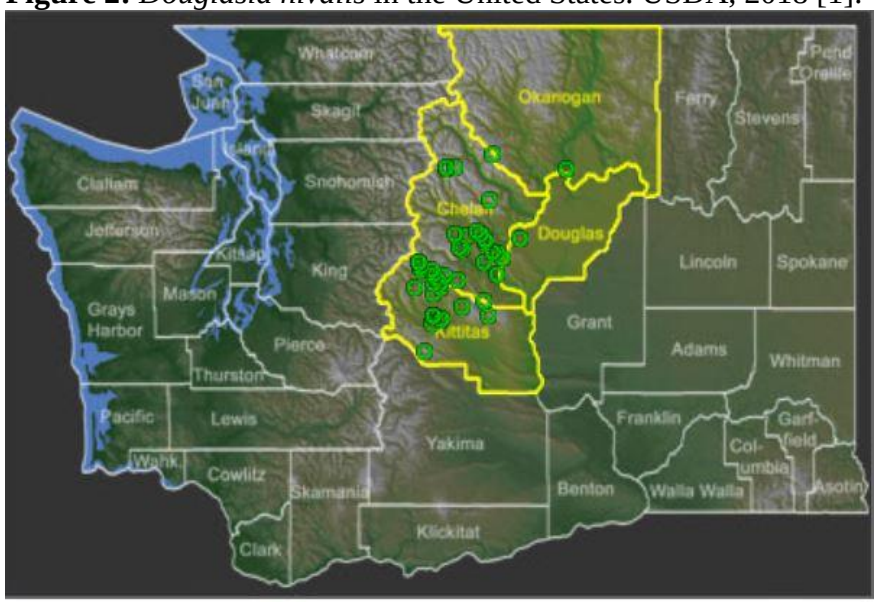
Plant Propagation Protocol for *Douglasia nivalis* (snow dwarf-primrose)
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/DONI.pdf

Figure 1: *Douglasia nivalis var. dentata* growing on serpentine substrate near Ingalls Peak, Wenatchee Mountains, Kittitas County, Washington. Photo by Stephen Munro.

TAXONOMY	
Plant Family	
Scientific Name	Primulaceae
Common Name	Primrose family
Species Scientific Name	
Scientific Name	DONI *Douglasia nivalis* Lindl.
Varieties	DONID *Douglasia nivalis* Lindl. *var. dentata* (S.Watson) A. Gray
Sub-species	N/A
Cultivar	N/A
Common Synonym(s)	*Androsace dieckeana* *Douglasia dentata* S. Wats *Douglasia nivalis* Lindl. *var. nivalis* *Primula dentata* Kuntze

Common Name(s)	Snow dwarf-primrose, snow douglasia
Species Code (as per USDA Plants database)	DONI
GENERAL INFORMATION	
Geographical range	 **Figure 2:** *Douglasia nivalis* in the United States. USDA, 2018 [1].  **Figure 3:** Reported locations in Washington State. Note that **Figure 2** differs and does not include Okanogan County and includes Ferry County. Burke Museum [2]. The species also ranges into the Rocky Mountains of British Columbia and Alberta, Canada [3].
Ecological distribution	This species inhabits alpine ridges and talus ranging into sagebrush slopes at lower elevations [3]. The species is also often found on serpentine soils [1]. Discovery of the plant may be an indicator of

	serpentine substrate [4]. Apparently, it is variety *dentata* that is found on serpentine. This variety could be exhibiting adaptive speciation as on other soils the type species is encountered, always [5].
Climate and elevation range	In the United States the plant grows adjacent to Wenatchee, Washington. This city's climate in a a semi-arid climate with cold winters, and hot dry summers or Köppen *BSk* designation [6]. The species is found in the nearby mountains at middle to high elevations [7]. Exact elevation ranges have yet to be documented in detail.
Local habitat and abundance	The species is found in montane and sagebrush habitats [3]. No thorough study of plant associates in these areas has yet been published. In the Wenatchee Mountains, variety *dentata* is associated with serpentine endemic species such as *Chaenactis thompsonii* and *Polystichum lemmonii* [5].
Plant strategy type / successional stage	N/A
Plant characteristics	Mat or cushion forming perennial herb [1]. The leaves are grayish with stellate hairs. Involucre bracts longer than wide on pedicels that are 3-40mm. Flowers are 2 to 10 in involucre umbels. The corolla ranging from red to various shades of purple [3]. The corolla tube is similar to calyx. The 5 flower lobes ovate and wedge-shaped, rounded, 4-5 mm. There are 5 stamens that are arranged opposite the corolla lobes are found attached half way up the corolla. The fruit is a capsule that opens via 5 valves [1].
PROPAGATION DETAILS	
Ecotype	N/A
Propagation Goal	Plants
Propagation Method	Seed
Product Type	7 cm containers
Stock Type	N/A
Time to Grow	N/A
Target Specifications	N/A
Propagule Collection Instructions	Seeds collection for protocols specific to *Douglasia montana* indicate that seeds are available for collection in July or August when the capsules turn brown [8].
Propagule Processing/Propagule Characteristics	*Douglasia* seeds are brown. [8].
Pre-Planting Propagule Treatments	This species requires stratification for seed dormancy to be broken. Extensive study of seed stratification strategies for this species and the genus itself is lacking. It has been observed that seed left outside in containers to naturally break dormancy will have spotty germination after the first year. Germination is not reported to be anywhere near 100%, with rates relatively low. Sometimes two years of this type of stratification strategy is required [9]. Protocol

	for *D.montana* states that 1.5 years was needed for an indeterminate germination rate. One reports states that germination occurred after repeated cycles of 5 months of cold stratification followed by 5 months of warm stratification [8]. Other reports suggest that exposing the seeds to light while cold stratifying the seeds for 8 weeks should break dormancy within a month [10]. Interestingly, the species has been observed to germinate during the winter months during a cold out door treatment period from December to February [11].
Growing Area Preparation / Annual Practices for Perennial Crops	It is advised that a medium consisting of sand and/or a large proportion of rock grit for sharp drainage is essential [9]. The following mix was reportedly used on *D. montana*: Growing medium used is 6:1:1 milled spaghnum peat, perlite, and vermiculite with Osmocote controlled release fertilizer (13N:13P2O5:13K2O; 8 to 9 month release rate at 21C) and Micromax fertilizer (12%S, 0.1%B, 0.5%Cu, 12%Fe, 2.5%Mn, 0.05%Mo, 1%Zn) at the rate of 1 gram of Osmocote and 0.20 gram of Micromax per 172 ml conetainer [8].
Establishment Phase Details	Medium should be kept slightly moist during the establishment phase [8].
Length of Establishment Phase	*D.montana* establishment phase recorded at 6 weeks [8].
Active Growth Phase	*D.montana* growth apparently rapid after germination with several true leaves evident in a small rosette after 6 weeks [8].
Length of Active Growth Phase	*D.montana* reported at 12 weeks [8].
Hardening Phase	Watering reduced in the fall and ceased completely once the plant enter dormancy [8], [9].
Length of Hardening Phase	For *D.montana* the hardening phase recorded at 4 weeks [8].
Harvesting, Storage and Shipping (of seedlings)	2 years total reported for *D. montana* [8].
Length of Storage (of seedlings, between nursery and outplanting)	5 months storage reported for *D.montana* [8].
Guidelines for Outplanting / Performance on Typical Sites	N/A
Other Comments	Wild collected seed should be collected judiciously. Please refer to the Washington State Department of Natural Resources for further information.
PROPAGATION DETAILS	
Ecotype	N/A
Propagation Goal	Plants

Propagation Method	Vegetative
Product Type	7cm containers
Stock Type	N/A
Time to Grow	*D. montana required* over a year from cuttings being struck until outplanting [8].
Target Specifications	N/A
Propagule Collection Instructions	Cuttings should be taken after the plant has flowered [8], [9]. Slicing off a rosette with a slice of stem is reportedly sufficient in *D. nivalis*. Cutting lengths for *D. montana* were 1 to 2 cm [8].
Propagule Processing/Propagule Characteristics	N/A
Pre-Planting Propagule Treatments	Vegetative propagation of *D. montana* is aided by addition of 2500ppm Hormex rooting powder [8].
Growing Area Preparation / Annual Practices for Perennial Crops	Sand is reported to work best as a medium for cuttings with both *D. montana* and *nivalis* [8], [9].
Establishment Phase Details	8 weeks from cuttings taken and struck to rooting reported in *D.montana* [8]. 4 weeks has been reported for *D. gormanii* [9].
Length of Establishment Phase	N/A
Active Growth Phase	N/A
Length of Active Growth Phase	N/A
Hardening Phase	N/A
Length of Hardening Phase	N/A
Harvesting, Storage and Shipping	*D. montana* is reportedly over a year from the cuttings being taken, struck, and rooted to outplanting [8].
Length of Storage	N/A
Guidelines for Outplanting / Performance on Typical Sites	N/A
Other Comments	Cuttings taken of wild specimens should be judicious and sparing. Check for any required permit authorization(s).
INFORMATION SOURCES	
References	[1]USDA NRCS National Plant Data Team. (2018). *Douglasia nivalis* Lindl: Snow-dwarf primrose. [Accessed May 5 2018]. https://plants.usda.gov/core/profile?symbol=DONI [2]*Collections Databases*. Collections Databases | Burke Museum. N.p., n.d. Web. [Accessed May 5 2018]. http://biology.burke.washington.edu/

	[3]Hitchcock C.L., Cronquist A. 1973. *Flora of the Pacific Northwest.* Seattle (WA): University of Washington Press. [4]Kruckeberg, A.R. 2002. *Geology and Plant Life: The effects of landforms and rock types on plants.* Seattle (WA): University of Washington Press. [5]Kruckeberg, A.R., Leuthy, C. 1991. *The Wenatchee Mountains*. Bulletin of the American Rock Garden Society. 49: 163-168. [6]*Climatography of the United States* NO.81" (PDF). National Oceanic and Atmospheric Administration. May 2011. [Accessed April, 2018]. https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data [7]Kruckeberg, A.R. 1982. *Gardening with Native Plants of the Pacific Northwest.* Seattle (WA): University of Washington Press. [8]*Douglasia montana protocol information.* Native Plant Network Propagation Protocol Database. Native Plant Network. 2008. [Accessed May 5 2018]. [9]Nicholls, G. 2002. *Alpine Plants of North America: An encyclopedia of mountain flowers from the Rockies to Alaska.* Portland (OR): Timber Press. [10]*ALPLAINS Seed Catalog*. [accessed 2018 May 5]. http://www.alplains.com [11]Deno, Norman C. 1993. *Seed Germination Theory and Practice.* 139 Lenor Drive, State College, PA USA 16801.
Other Sources Consulted	Doonan, S. 1991. *Growing Wenatchee Wildflowers.* Bulletin of the American Rock Garden Society. 49: 193-206.
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