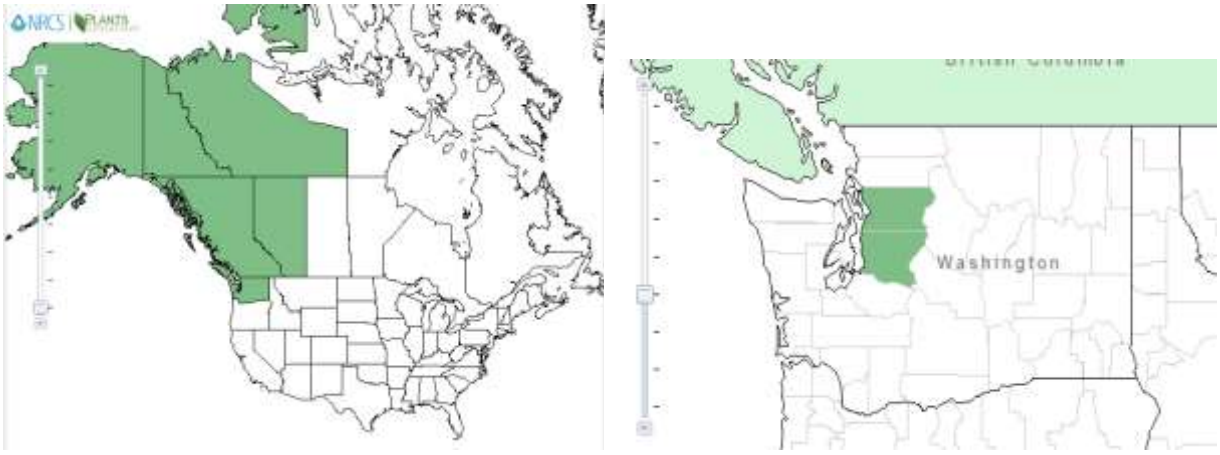
Plant Propagation Protocol for *Campanula lasiocarpa*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/*CALA7.pdf*



Source: USDA PLANTS Database[7]

TAXONOMY	
Plant Family	
Scientific Name	Campanulaceae
Common Name	Bellflower Family
Species Scientific Name	
Scientific Name	*Campanula lasiocarpa* Cham.
Varieties	
Sub-species	*Campanula lasiocarpa* Cham. subsp. *latisepala* (Hultén) Hultén
Cultivar	
Common Synonym(s)	*Campanula latisepala* Hulten *Campanula latisepala* Hulten var. *dubia* Hulten
Common Name(s)	Mountain Harebell[7], Alaska Harebell[6] Alpine Bellflower [2]
Species Code (as per USDA Plants database)	CALA7
GENERAL INFORMATION	
Geographical range	See maps above for distribution in North America and Washington State.[7] Range extends from Kamchatka & Northern Japan to Western North America.[2]
Ecological distribution	Globally, Mountain Harebell grows in alpine heaths and sandy tundra. In Washington this species is adapted to grow in unglaciated and wet subalpine zones among rock crevices.[6]
Climate and elevation range	Mountain Harebell can be found in sites with adverse climate conditions such as unpredictable precipitation,

	severe temperature fluctuation and strong winds, common in unglaciated and subalpine zones of mountains between 610 – 2085 m (2000-6480 ft.) elevation[6]
Local habitat and abundance	There are very few extant populations in Snohomish County. Due to being listed as "Imperiled" in Washington State, locations of population sites are withheld from the public.[3] Associated species include Yellow Mountain Heather (*Phyllodoce glandulifola),* Golden Fleabane (*Erigeron aureus),* Bellflower (*Campanula rotundifolia),* Forked Wornwood (*Artemis ia furcata var. furcata)* and Partridgefoot (*Luetkea pectinata).*[6]
Plant strategy type / successional stage	Primary successional species[8,10]
Plant characteristics	 Photo Credit: Mark W. Skinner;,hosted by the USDA-NRCS PLANTS Database Perennial forb [2,5,8,9,10] Many small oblong, toothed leaves at base of stem. A single leafy stem can grow 2- 4 inches high.[2,5] Single flower, bell-shaped, light – dark blue coloration, 18-30 mm long.[5] Flowers July to August.[1,4,6] These flowers are pollinated by bumble bees and other large insects.[2] Distinguishing feature from other Campanula species is the presence of a hairy hypanthium, or floral cup. [1,4,5,6] Seeds are contained within a capsule covered with soft downy hairs at end of stem after flowering period. [2,5] The seeds are dispersed by the capsules (stalks) which swing back and forth in strong winds, effective for broadcasting seeds over large areas.[9,10]

	Mountain Harebell forms dense bunches of shoots and has long thin branching rhizomes[1,2,4,6]. Rhizomes allow for rapid colonization on bare substrates and sites with adverse climate conditions such as unpredictable precipitation, severe temperature fluctuation and strong winds.

PROPAGATION DETAILS

[9]Tsuyuzaki, S. & Miyoshi, C. "Effects of Smoke, Heat, Darkness and Cold Stratification on Seed Germination of 40 Species in a Cool Temperature Zone in Northern Japan" (2009) *Plant Biology* 11: 369-378

Ecotype	Terrestrial
Propagation Goal	Seed germinates
Propagation Method	Seed
Product Type	The purpose of experiment was to determine effects of smoke, heat, darkness and cold stratification on seed germination. Article did not mention the fate of seeds after successful germination.
Stock Type	
Time to Grow	
Target Specifications	
Propagule Collection Instructions	*Campanula lasiocarpa* Cham. is an early successional species distributed in cool temperature zones of northern Japan. Seeds were collected from the south slope of Mount Koma, 1131 m elevation, in Japan. Seeds collection occurred in late autumn and early winter of 2005, when seeds were deemed mature. Seeds were collected from more than 5 different individuals.
Propagule Processing/Propagule Characteristics	Average seed mass was measured 0.022 mg. Mean seed mass was measured for 30 seeds.
Pre-Planting Propagule Treatments	After collection, seeds were stored in paper bags at room temperature for no more than 5 weeks.
Growing Area Preparation / Annual Practices for Perennial Crops	Seeds were tested for four different treatments: smoke exposure, heat exposure, darkness and cold stratification. Germination was compared to a control group of untreated seeds. Seeds tested for heat and smoke exposure were placed on moistened filter paper in petri dishes and placed in appropriate testing chambers. 50 – 100 seeds undergoing light or dark stratification were sown in petri dishes and placed in an incubator in continuous light or darkness. Cold stratification seeds were placed on three layers of moist filter paper in petri dishes wrapped in parafilm and

	placed in an incubator.
Establishment Phase Details	Heat treatment was conducted in an oven at 75 degrees C for 25 minutes. Seeds were exposed to smoke in a chamber filled with smoke for 1 hour. Seeds were left in cold stratification incubator for a period of 1 month. For light and dark treatments the number of germinated seeds was counted at 1-3 day (light treatment) and 6-10 day (dark treatment) intervals until seed germination peaked. Seeds were recorded as "germinated" when the radicle was visible.
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	N/A
Length of Storage	N/A
Guidelines for Outplanting / Performance on Typical Sites	N/A
Other Comments	Results of experiment demonstrated that *Campanula lasiocarpa* seeds were completely inhibited by exposure to smoke and darkness. The greatest germination rate resulted from the heat treatment, followed by light and cold treatments. Mountain Harebell germination is restricted by physiological dormancy, which is why endogenous factors such as light, heat and cold stratification promoted germination of seeds.
INFORMATION SOURCES	
References	See Below
Other Sources Consulted	See Below
Protocol Author	Jacqueline Watts
Date Protocol Created or Updated	May 16, 2015

References:

[1]Camp, P. & Gamon, J. *Field Guide to the Rare Plants of Washington* Washington Natural Heritage Program & Washington State Department of Natural Resources, 2011. Print.

[2]"*Campanula lasiocarpa: Alpine Bellflower*" Central Yukon Species & Inventory Project. Web. Accessed 16, May 2015. http://www.flora.dempstercountry.org/0.Site.Folder/Species.Program/Species2.php?species_id=Campan.lasi

[3]*"Herbarium Specimens from the Pacific Northwest"* Consortium of Pacific Northwest Herbaria & Burke Museum of Natural History and Culture (2013). Web. Accessed 16, May 2015. http://www.pnwherbaria.org/data/search.php

[4]Hitchcock, C. & Cronquist, A. *Flora of the Pacific Northwest* University of Washington Press, 1973. Print.

[5]Hulten, E. *Flora of Alaska and Neighboring Territories: A Manual of the Vascular Plants* Stanford University Press, 1968. Print.

[6]*"List of Vascular Plants Tracked by Washington Natural Heritage Program"* Washington Department of Natural Resources. Web. Accessed 15, May 2015. http://www1.dnr.wa.gov/nhp/refdesk/lists/plantrnk.html

[7]*"Plant Profile"* USDA Natural Resources Conservation Service, Web. Accessed 15, May 2015 http://plants.usda.gov/core/profile?symbol=CALA7

[8]Titus, J. & Tsuyuzaki, S. (2003) "Distribution of Plants on Mount Koma, Hokkaido, Japan" *Ecological Research* 18: 91-98

[9]Tsuyuzaki, S. & Miyoshi, C. (2009) "Effects of Smoke, Heat, Darkness and Cold Stratification on Seed Germination of 40 Species in a Cool Temperature Zone in Northern Japan" *Plant Biology* 11: 369-378

[10]Voronkova, N., Kholina, A. & Verkholat, V. (2008) "Plant Biomorphology & Seed Germination in Pioneer Speices of Kamchatka Volcanoes" *Biology Bulletin* 35(6): 599-605