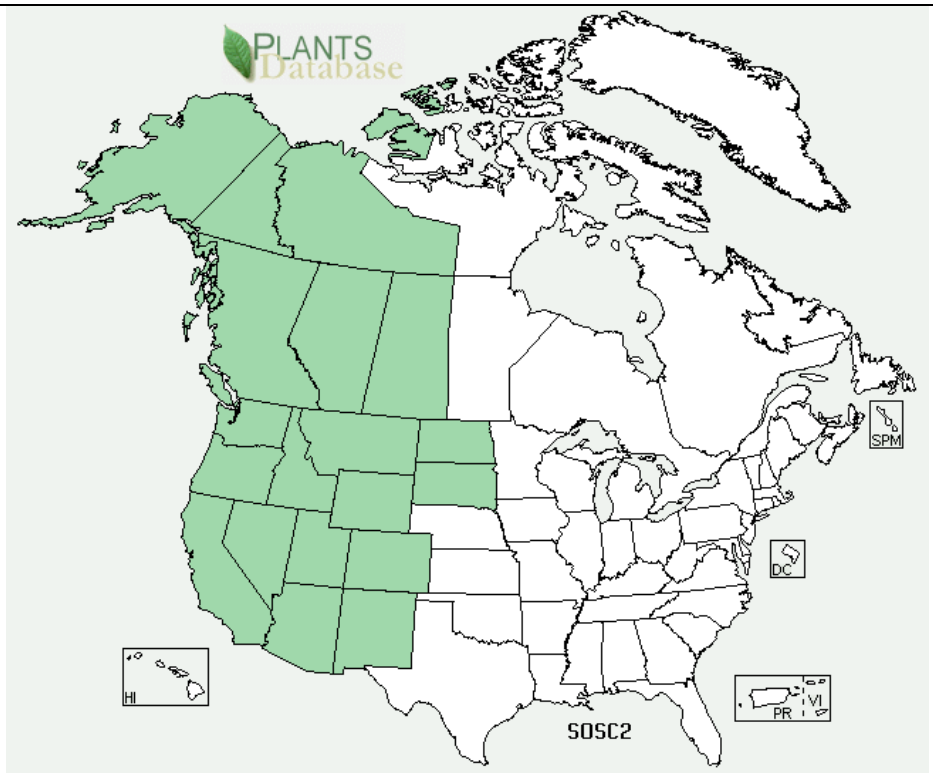
Plant Propagation Protocol for *[Insert Species]*
ESRM 412 – Native Plant Production

TAXONOMY	
Family Names	
Family Scientific Name:	Rosaceae
Family Common Name:	Rose family
Scientific Names	
Genus:	*Sorbus* L.
Species:	*Sorbus scopulina*
Species Authority:	Greene
Variety:	*Sorbus scopulina* Greene var. *cascadensis*– Cascade mountain ash *Sorbus scopulina* Greene var. *scopulina* – Greene's mountain ash
Sub-species:	N/A
Cultivar:	N/A
Authority for Variety/Sub-species:	G.N. Jones
Common Synonym(s)	*S. cascadensis* G.N. Jones *Pyrus scopulina* (Greene) Longyear *S. andersonii* G.N. Jones
Common Name(s):	Cascade Mountain-ash; Greene's Mountain-ash; Western Mountain-ash
Species Code	SOSC2
GENERAL INFORMATION	
Geographical range	 (8)
Ecological distribution	*S. scopulina* likes to inhabit well drained soils along streams, avalanche chutes and rocky hillsides. Usually found in open, coniferous forest, parkland, streambanks, and clearings

	such as meadow edges and rockslides. (7)
Climate and elevation range	The climate type for this species is montane boreal & cool temperate. (3) This species occasionally occurs in north-coast bogs at low elevations (7), but otherwise in upper montane and subalpine elevations. (5)
Local habitat and abundance; may include commonly associated species	This is a shade-tolerant / intolerant to very shade-intolerant plant. It occurs in continental boreal and wet cool temperate climates on moderately dry to fresh, nitrogen-medium soils; its occurrence increases with increasing continentality. Common but scattered in open-canopy, coniferous forests on watershedding sites; persists in clearings. Characteristic of Mor humus forms. (4)
Plant strategy type / successional stage	Facultative upland plant, early to mid successional colonizer. (1)
Plant characteristics	A small tree or multitrunked shrub forming dense clumps, with pinnate leaves and unbels of white flowers in spring, followed by red berries in autumn. (10)
PROPAGATION DETAILS	
Ecotype	N/A
Propagation Goal	Plants
Propagation Method	Seed and vegetative
Product Type	Container (plug) (5) Bareroot (field grown) (6) Propagules (seeds, cuttings, poles, etc.) (14)
Stock Type:	Range: 172 ml containers to 800 ml containers
Time to Grow	10 Months to 2 years
Target Specifications	Stock Type: Container seedling Height: 9 cm Caliper: 8 mm Root System: firm plug in container. (5) Stock Type: Container cutting Height: 30 cm Caliper: 1.0 cm Root System: firm plug in container. (6) Other targets: Large healthy, 2-year crown foliage; Roots filling soil profile; Root system must balance top growth. (12)
Propagule Collection	Example 1: Seeds are hand collected when fruit turns red-orange in early October. Seeds are brown at maturity. Fruit is collected in plastic bags and kept under refrigeration prior to cleaning. (5) Example 2: Vegetative Propagation Method: Pre-Rooting Late summer semi-hardwood stem cutting collected in early August. Cuttings were taken from non-flowering stem tip shoots. (6)
Propagule Processing / Propagule Characteristics:	Seeds are extracted from fruit by maceration using a Dyb-vig seed cleaner and are washed and screened to remove pulp from the seeds. Seed longevity is up to 5 years at 3 to 5C with low relative humidity in sealed containers. Seed dormancy is classified as physiological dormancy. Seeds/Kg: 100,000/kg % Purity: 100% % Germination: 90 to 100% (5)
Pre-Planting Propagule	Seeds are treated with 1,000 ppm gibberellic acid for 24 hours, followed by a 3:1

Treatments:	water/hydrogen peroxide soak for 10 minutes, and a 24 hour running water rinse. A 90 to 120 day cold, moist stratification is needed to break dormancy. Seeds are placed in fine mesh bags and buried in moistened peat moss in ventilated containers under refrigeration at 1 to 3C. (5)
Growing Area Preparation / Annual Practices for Perennial Crops	Greenhouse and outdoor nursery growing facility. Sowing Method: Direct Seeding or planting germinant. Seeds are covered with medium. Growing medium used is 6:1:1 milled sphagnum 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. Greenhouse temperatures are maintained at 21 to 25C during the day and 16 to 18C at night. Seedlings are hand watered and remain in greenhouse until mid May. Seedlings are then moved to outdoor nursery for the remainder of the growing season. Seedlings are irrigated with Rainbird automatic irrigation system in early morning until containers are thoroughly leached. (5) Spacing = 24+ inches. Will form dense thickets. (11)
Establishment Phase	Seeds are sown in late September using an Oyjard seed drill at a depth of 0.12 inches. Seeds are lightly covered and irrigated when soils appear to be drying out on warm days. (12) Germination occurs at 22C and is usually complete in 20 days. Cotyledon to true leaf stage is 2 weeks. Seedlings are thinned at this stage. (5)
Length of Establishment Phase:	4 weeks to 6 weeks. (1 month after emergence in the spring.)
Active Growth Phase	Seedling growth is rapid following germination. Plants are fertilized with 20-10-20 liquid NPK at 100 ppm and increase in height to 9 centimeters in 10 weeks. Root development occurs at a rapid rate and seedlings must be uppotted to 1 gallon containers the 1st season if they are not outplanted by fall. (5)
Length of Active Growth Phase	May to August (4 months)
Hardening Phase	Hardening begins during the third week of August or when dormancy is induced. No fertilizer is applied after August 28th. Irrigation frequency and duration is shortened and applied only when needed. (11)
Length of Hardening Phase:	4 weeks August – September
Harvesting, Storage and Shipping	Total Time to Harvest: 10 months Harvest Date: September Storage Conditions: Overwinter in outdoor nursery under insulating foam and snow. Storage: Cold Storage, 33-38 Degrees Fahrenheit; humidity of 92 to 98% (2)
Length of Storage	Seed reportedly stores well for several years in sealed containers at 6 to 8% moisture content. (1) Seed longevity is up to 5 years at 3 to 5C with low relative humidity in sealed containers. (5)
Guidelines for Outplanting / Performance on Typical Sites	Roots should be scored at outplanting time in late September. Plants survived well in the lodge restoration planting at the park. First year seedlings in 3L (1 gallon) containers were 15 cm tall with 2.0 cm caliper. Plants reach reproductive maturity in 3 to 5 years. (5)
Other Comments:	*S. scopulina* is an important browse for bears, deer, moose and elk. The berries are eaten by many species of birds and small mammals. Bears feed on berries in late Fall. (5)

	Sorbus sitchensis is very similar to Sorbus scopulina. The berries of both species of mountain-ash were generally not eaten by the northwest coast people; However, the Haida sometimes ate the berries raw. The Nuxalk rubbed the berries on the scalp to combat lice and dandruff. (7)
INFORMATION SOURCES	
References	(1) Barner, Jim 2009. Propagation protocol for production of *Sorbus scopulina* (G.N. Jones) C.L. Hitchc. *cascadensis* seeds; USDA FS - R6 Bend Seed Extractory, Bend, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 19 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. (2) Barner, Jim 2009. Propagation protocol for production of *Sorbus scopulina* Greene seeds; USDA FS - R6 Bend Seed Extractory, Bend, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 19 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. (3) "BC Species Code Definitions." *UBC Department of Geography*. Web. 19 Apr. 2011. <http://www.geog.ubc.ca/biodiversity/eflora/species_list_metadata.html>. (4) Klinka, Karel. *Indicator Plants of Coastal British Columbia*. Vancouver: University of British Columbia, 1989. Print. (5) Luna, Tara; Wick, Dale. 2008. Propagation protocol for production of container *Sorbus scopulina* Greene *scopulina* Greene plants (172 ml containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 19 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. (6) Luna, Tara; Hosokawa, Joy. 2008. Propagation protocol for vegetative production of container *Sorbus scopulina* Greene *scopulina* Greene plants (800 ml containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 19 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery (7) MacKinnon, A., Jim Pojar, and Paul B. Alaback. *Plants of Coastal British Columbia including Washington, Oregon & Alaska*. Edmonton: Lone Pine Pub., 2004. Print. (8) "Plants Profile." *United States Department of Agriculture*. Natural Resources Conservation Service. Web. 19 Apr. 2011. <http://plants.usda.gov/java/profile?symbol=SOSC2&mapType=large&photoID=sosc2_002_ahp.tif>. (9) Seeds of the Woody Plants in North America, Young and Young, Dioscorides Press, 1992. (10) "Sorbus Scopulina." *Pennine Software : Root Page (index)*. Web. 19 Apr. 2011. <http://www.pennine.demon.co.uk/Arboretum/Sosc.htm>.

	(11) "Sorbus Scopulina Fact Sheet." *VT Forest Biology and Dendrology*. Web. 19 Apr. 2011. <http://dendro.cnre.vt.edu/dendrology/Syllabus2/factsheet.cfm?ID=693>. (12) Trindle, Joan DC; Flessner, Theresa R. 2003. Propagation protocol for production of container *Sorbus scopulina* Greene plants (one-gallon containers); USDA NRCS - Corvallis Plant Materials Center, Corvallis, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 19 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. (13) "WTU Herbarium Image Collection - Burke Museum." *ELWHA RIVER VALLEY BIODIVERSITY*. Web. 19 Apr. 2011. <http://biology.burke.washington.edu/herbarium/imagecollection.php?Genus=Sorbus>. (14) Zeidler, Scott; Justin, John. 2003. Propagation protocol for production of field-grown *Sorbus scopulina* Greene plants (2+0); Utah Division of Forestry, Fire and State Land - Lone Peak Nursery, Draper, Utah. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 19 April 2011). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.
Other Sources Consulted	Utah State Horticulture index found at: http://www.hort.usu.edu/html/shrubs/WesternMtAsh.htm McKenzie Watershed Counsel: Atlas of the Natural Environment. Found at: http://www.mckenziewatershedcouncil.org/mckenzieatlas/veg_types.htm
Protocol Author	Wan Wu
Date Protocol Created or Updated	Updated 04/19/11

Original Protocol at http://depts.washington.edu/propplnt/Plants/sorbus%20scopulina.htm

Species (common name, Latin name)
Western mountain-ash
Sorbus scopulina

Various forms of *Sorbus scopulina* (5)

Range
Southern Alaska to northern California, mainly in the east Cascades, east to the Dakotas, and south to Utah and New Mexico (4)

Climate, elevation
Down to sea level in the north, between 1200-2750m in south. (6)
Found at 6,500' to 9,000' from the east slope of the Rocky Mountains west across the mountainous regions of the Great Basin. (7)

Range of *Sorbus scopulina* (6)

Local occurrence (where, how common)
Mostly along the E. Cascades (4)

Habitat preferences
S. scopulina inhabits well drained soils along streams, avalanche chutes and rocky hillsides. (3)

Plant strategy type/successional stage (stress-tolerator, competitor, weedy/colonizer, seral, late successional)
Facultative upland plant, early to mid successional colonizer.

Associated species
Grass: *Calamagrostis rubescens, Carex pennsylvanica, C. rossii, Festuca viridula, Juncus drummondii, Elymus glaucus, Poa pratensis, Stipa lemmonii, S. occidentalis*. (8)
Trees: *Abies amabilis, Pinus contorta, Tsuga mertensiana,Abies concolor, Abies lasiocarpa, magnifica var. shastensis, A. procera, Picea englemannii, Populus.* (8)
Shrubs: *Pachistima myrsinites, Rhododendron macrophyllum, Rubus lasiococcus, Sorbus scopulina, S. sitchensis, Spiraea sp., Vaccinium membranaceum, V. scoparium, Arctostaphylos nevadensis, Castanopsis chrysophylla, Menziesia ferruginea, Pachistima myrsinites, Rosa gymnocarpa, Rubus parviflorus, R. ursinus, Vaccinium alaskaense, V. ovatum, V. parvifolium.* (8)
Forbs: *Achillea millefolium, Anemone oregana, Pedicularis racemosa, Aster alpigenus, Chimaphila umbellata, Cornus canadensis, Luetkea pectinata, Ligusticum grayi, Linnaea borealis, Lomatium martindalei, Luina stricta, Lupinus bicolor, Pyrola secunda, Senecio triangularis, Smilacina stellata, Tiarella trifoliata, Veratrum viride, Viola orbiculata, V. sempervirens, Xerophyllum tenax.* (8)
May be collected as: (seed, layered, divisions, etc.)
Seeds or Cuttings

Collection restrictions or guidelines
Seed: Ripe berries in large clusters, easily identified and collected in September and transported in plastic bags in cooler. (1)

Cutting:
Late summer semi-hardwood stem cutting collect in early August. Take from nonflower stem tip shoots. (3)

Seed germination (needs dormancy breaking?)
Physiological dormancy, berries should be depulped as soon as possible because pulp contains germination inhibitors. Depulp in blender with rubber tubing covering blender blades; wash and float off pulp / juice several times to remove all traces of fruit pulp prior to straining and air-drying on paper towels. (1)(2) Requires 60-100 day cold-moist stratification. (1)

Seed life (can be stored, short shelf-life, long shelf-life)
Seed reportedly stores well for several years in sealed containers at 6 to 8% moisture content. (1)
Seed longevity is up to 5 years at 3 to 5C with low relative humidity in sealed containers. (2)

Recommended seed storage conditions
Seed should be stored at 3to 5C with low relative humidity in sealed containers. (2)
Cuttings should be kept moist and under refrigeration. (3)

Propagation recommendations (plant seeds, vegetative parts, cuttings, etc.)
Seed or cutting

Soil or medium requirements (inoculum necessary?)
Mesic to moist, no inoculum necessary. (5)(7)

Installation form (form, potential for successful outcomes, cost)
Seed or cutting very successful, and both very cheap.

Recommended planting density
Space 24+ inches. Will form dense thickets. (5)

Care requirements after installed (water weekly, water once etc.)
Water weekly depending on weather, use well drained soil. (3) Not very drought tolerant. (7)

Normal rate of growth or spread; lifespan
An erect deciduous shrub growing to 15 feet tall often forming dense thickets. (5)

Sources cited

1. Trindle, Joan DC; Flessner, Theresa R. 2003. Propagation protocol for production of container *Sorbus scopulina* Greene plants (one-gallon containers); Corvallis Plant Materials Center, Corvallis, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 8 May 2005). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery

2. Luna, Tara; Wick, Dale. 2004. Propagation protocol for production of container *Sorbus scopulina* Greene var. *scopulina* Greene plants (172 ml containers); Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 8 May 2005). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

3. Luna, Tara; Hosokawa, Joy. 2001. Propagation protocol for vegetative production of container *Sorbus scopulina* Greene var. *scopulina* Greene plants (800 ml containers); Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 8 May 2005). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

4. Zeidler, Scott; Justin, John. 2003. Propagation protocol for production of field-grown *Sorbus scopulina* Greene plants (2+0); Lone Peak Nursery,Utah Division of Forestry, Fire and State Land, Draper, Utah. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 8 May 2005). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

5. http://www.cnr.vt.edu/dendro/dendrology/Syllabus2/factsheet.cfm?ID=693

6. http://www.pennine.demon.co.uk/Arboretum/Sosc.htm

7. Utah State Horticulture index found at: http://www.hort.usu.edu/html/shrubs/WesternMtAsh.htm

8. McKenzie Watershed Counsel: Atlas of the Natural Environment. Found at: http://www.mckenziewatershedcouncil.org/mckenzieatlas/veg_types.htm

Data compiled by (student name and date)

Nick Ostrovsky 05/08/05