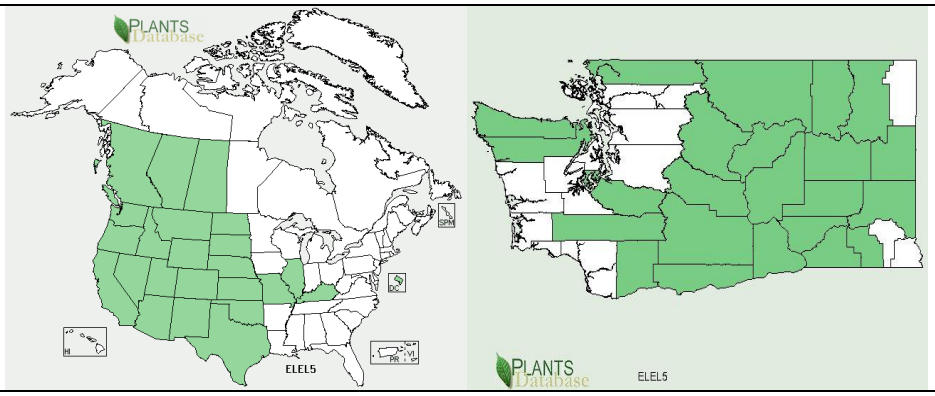
Plant Propagation Protocol for *Elymus elymoides*
ESRM 412 – Native Plant Production
http://courses.washington.edu/esrm412/protocols/ELEL5.pdf

TAXONOMY	
Family Names	
Family Scientific Name:	Poaceae
Family Common Name:	True grasses
Scientific Names	
Genus:	*Elymus*
Species:	*Elymoides*
Species Authority:	Swezey
Variety:	
Sub-species:	
Cultivar:	
Authority for Variety/Sub-species:	
Common Synonym(s) (include full scientific names (e.g., *Elymus glaucus* Buckley), including variety or subspecies information)	*Sitanion hystrix* (Nutt.) J.G. Smith *Elymus hystrix* L. var. *bigeloviana* (Fern.) Bowden *Elymus hystrix* L. var. *histrix* *Elymus elymoides* (Raf.) Swezey var. *brevifolius* (J.G. Sm.) Barkworth *Elymus elymoides* (Raf.) Swezey var. *californicus* (J.G. Sm.) Barkworth *Elymus elymoides* (Raf.) Swezey spp. *elymoides* *Elymus elymoides* (Raf.) Swezey var. *brevifolius* (J.G. Sm.) Barkworth *Elymus elymoides* (Raf.) Swezey spp. *hordeoides* (Suksdorf) Barkworth *Elymus elymoides* (Raf.) Swezey var. *brevifolius* (J.G. Sm.) Barkworth (7)
Common Name(s):	Bottlebrush squirreltail; Squirreltail bottlebrush; Squirreltail; Squirrel tail (1) (2) (7)
Species Code (as per USDA Plants database):	ELEL5
GENERAL INFORMATION	

Geographical range	
Ecological distribution	Found throughout western North America from Canada to Mexico. Grows in a wide range of habitats, from shadescale communities to alpine tundra to low lands of the Great Basin. (7)
Climate and elevation range	Typically found from 600 to 3,500 meters. It has been documented in California from 100 m to 4,300 m in elevation. Widespread in the interior regions of western North America at mid to high elevation sites that receive 6 to 14 inches mean annual precipitation. (3) (5) (7)
Local habitat and abundance	A component of many different community types, including short-grass prairies where it may be associated with *Pascopyrum smithii* and *Aristida purpurea*; sagebrush scrub, where it may be associated with *Koeleria macrantha*; and sagebrush rangelands with *Artemisia tridentata*. Other associations include *Festuca idahoensis* and *Phlox hoodia*. (10)
Plant strategy type / successional stage	
Plant characteristics	Perennial tufted bunchgrass. Plants are short, 10 to 45 cm, with culms erect to spreading. Leaves: Flat to involute, 1 to 6 mm wide. Flowers: The inflorescence is a spike from 2 to 17 cm long, not counting awns. Internodes are 2 to 10 mm long with the rachis disarticulating regularly. Spikelets generally 2 per node. At maturity, the spike can be over 12 cm wide due to the widely spreading awns. Awns are scabrous and may grow from 2 to as much as 10 cm long, becoming purple with maturity. Spikelets 12 to 20 mm. Lemma awn 30 to 90 mm, spreading. Anthers about 2 mm. (3) (5) (7)
PROPAGATION DETAILS	
Ecotype	
Propagation Goal	Plugs
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	
Time to Grow	
Target Specifications	Root plug in container
Propagule Collection	If possible, seed from local sources should be used, as it has been shown to result in greater establishment than commercially-obtained seed. (4) (6)

	Wildland collection occurs late July to early September, just before spike begins to disarticulate; Mechanical harvest is not successful due to the expanded nature of the inflorescence and the spontaneous separation at the base of each joint of the rachis. Hand-harvesting is preferable but difficult. Seedheads may be collected in paper yard bags (8) (1)
Propagule Processing/Propagule	Seed is spread out on tarp in a dry, sheltered environment away from any air movement and turned daily for approximately 3 to 5 days, until no moisture or warmth is detected. Seed is threshed with a hammermill through a 8/64 inch round hole screen; this process is repeated until awns are very short or completely reduced or removed. A Clipper M2B or Eclipse cleaner with a 10/64 inch round hole screen is used to proves the threshed material. The large amount of chaff and seed trash may require slower feeding and several passes to achieve a clean product. (8) Alternate method: Seed lot is processed using a Westrup Model HA 400 brush machine with three row brushes, a #18 mantel with pins to prevent clogging and keep the lot moving through the machine. Seed was air screened to remove chaff and inert material using a Clipper Eclipse, Model 324 with a top screen 1/18 x ¼, second screen 1/18 x ¼ and bottom screen 1/25 round or blank, on medium speed with medium air. (1) Seed density variously reported as 155,000 seeds per pound (8), 150,200 seeds/pound (1) and 190,000 seeds per pound (7)
Pre-Planting Propagule Treatments	Seeds placed in 0 to 1 degrees C for a 10-day cold stratification treatment followed by exposure to 22 to 25 degrees C. (8)
Growing Area Preparation / Annual Practices for Perennial Crops	Seedbed is firm and free of weeds with good field moisture to 4 inches depth. (8) Container type: Unknown For seed production, plant in rows with 36-inch spacing at a rate of 2.4 PLS per acre for 30 PLS per foot of row. Seeding depth to 1.3 cm maximum. (7)
Establishment Phase	Soil should be kept moist throughout the germination phase. Broadleaf weeds can be controlled with low rates of bromoxynil at the three to five leaf stage (7)
Length of Establishment Phase:	About 14 to 28 days (7)
Active Growth Phase	No fertilizer should be applied during the first year to discourage annual weed competition. (7) Broadleaf weed control with herbicides must occur prior to boot stage; Soil moisture is critical during boot stage, milk stage of seed development, and post-harvest to pre-freezeup. (8) No irrigation should be applied during flowering to encourage seed set. (7)
Length of Active Growth Phase:	2 to 3 growing seasons (8)

Hardening Phase	Unknown
Length of Hardening Phase:	Unknown
Harvesting, Storage and Shipping	Unknown
Length of Storage	Unknown
Guidelines for Outplanting / Performance on Typical Sites	Thrives in sandy loam to silt loam
Other Comments	
INFORMATION SOURCES	
References	1. Barner, Jim. (2009). Propagation protocol for production of *Elymus elymoides* (Raf.) Swezey seeds; USDA FS – R6 Bend Seed Extractory, Bend, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 11 May 2014). 2. Baskin, Carol C.; Baskin, Jerry M. 2002. Propagation protocol for the production of container *Elymus elymoides* (Raf.) Swezey *elymoides* plants; University of Kentucky, Lexigton, Kentucky. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 11 May 2014). 3. Darris, D. C. (2005). Seed production and establishment of western Oregon native grasses. RK Dumroese, LE Riley and TD Landis (tech. cords.), National Proceedings: Forest and Conservation Nursery Associations 2004. Proc. RMRS-P-35. Fort Collins, CO: US Department of Agriculture, Forest Service, Rocky Mountain Research Station, 119-128. 4. Humphrey, L. D., & Schupp, E. W. (March 01, 2002). Seedling Survival from Locally and Commercially Obtained Seeds on Two Semiarid Sites. *Restoration Ecology, 10*, 1, 88-95. 5. Jepson Herbarium, UC Berkeley. (2013). Consortium of California Herbaria. URL: http://ucjeps.berkeley.edu/cgi-bin/get_consort.pl?county=&source=All&taxon_name=elymus%20elymoides (accessed 12 May 2014) 6. Rowe, C. L. J., & Leger, E. A. (Dec 01, 2012). Seed Source Affects Establishment of Elymus multisetus in Postfire Revegetation in the Great Basin. *Western North American Naturalist, 72*, 4, 543-553. 7. Tinney, Derek J, Ogle, D., St. John, L., Holzworth, L., Jones, T. A., Winslow, S.R. (Feb 24, 2006). Bottlebrush squirreltail and Big squirreltail Plant Materials Fact Sheet. USDA Natural Resources Conservation Service. 8. Winslow, Susan R. 2002. Propagation protocol for production of Elymus elymoides seeds; Natural Resources Conservation Service – Bridger Plant Materials Center, Bridger, Montana. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 23 April 2014).

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Other Sources Consulted	• Finch-Savage, W. E., & Leubner-Metzger, G. (August 01, 2006). Seed dormancy and the control of germination. *New Phytologist, 171,* 3, 501-523. • Hardegree, S. P., Pierson, F. B., Clark, P. E., Flerchinger, G. N., & Jones, T. A. (March 01, 2008). Dynamic variability in thermal-germination response of squirreltail (Elymus elymoides and Elymus multisetus). *Environmental and Experimental Botany, 62,* 2, 120-128. • Hardegree, S. P., Steven, S. V. V., Frederick, B. P., & Debra, E. P. (January 01, 1999). Predicting Variable-Temperature Response of Non-Dormant Seeds from Constant-Temperature Germination Data. *Journal of Range Management, 52,* 1, 83-91. • Jones, T. A. (May 01, 1998). Viewpoint: The Present Status and Future Prospects of Squirreltail Research. *Journal of Range Management, 51,* 3, 326-331. • Meyer, S. E., Debaene-Gill, S. B., & Allen, P. S. (January 01, 2000). Using hydrothermal time concepts to model seed germination response to temperature, dormancy loss, and priming effects in Elymus elymoides. *Seed Science Research, 10,* 213-224. • Young, K., & Mangold, J. (January 01, 2008). Medusahead (Taeniatherum Caput-medusae) Outperforms Squirreltail (Elymus Elymoides) Through Interference and Growth Rate. *Invasive Plant Science and Management, 1,* 1, 73-81.
Protocol Author	Ben Antonius
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