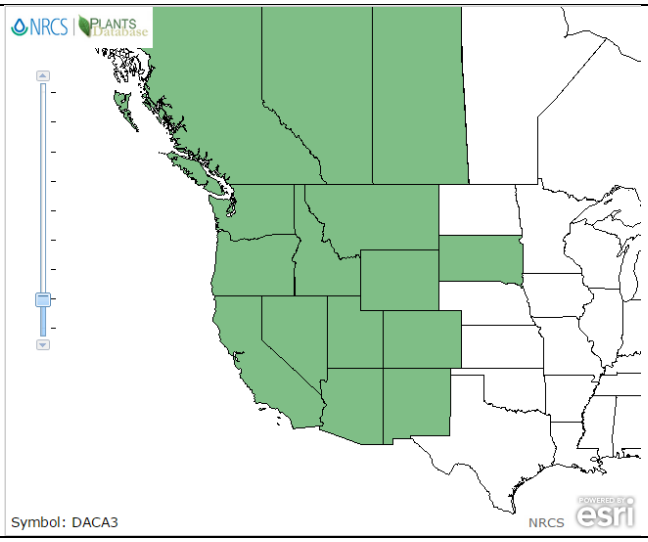
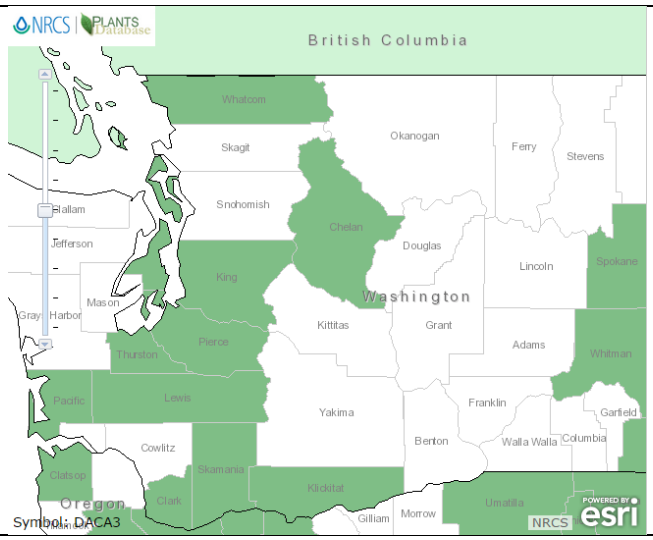
Plant Propagation Protocol for *Danthonia californica*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/*DACA3.pdf*

TAXONOMY	
Plant Family	
Scientific Name	*Poaceae*
Common Name	Grass Family
Species Scientific Name	
Scientific Name	*Danthonia californica*
Varieties	*Danthonia americana* Scribn. *Danthonia californica* Bol. var. *americana* (Scribn.) Hitchc. *Danthonia californica* Bol. var. *californica* *Danthonia californica* Bol. var. *palousensis* H. St. John *Danthonia californica* Bol. var. *piperi* H. St. John
Sub-species	None
Cultivar	Baskett Slough Germplasm California oatgrass
Common Synonym(s)	*Danthonia americana*
Common Name(s)	California oatgrass, California danthonia
Species Code (as per USDA Plants database)	DACA3
GENERAL INFORMATION	
Geographical range	

	
Ecological distribution	*Danthonia californica* occurs in prairies, mid-elevation meadows, forests and transitional wetland habitats.
Climate and elevation range	Grows from sea level up to 7,000 feet. *Danthonia californica* grows in a moist environment ranging from 17 to 79 inches annually. They also grow in areas that have a cold winter.
Local habitat and abundance	*Danthonia californica* can be found with many other native vegetation on the south Puget Sound prairie and in the northern Puget lowlands. Common species found with *Danthonia californica* are *Deschampsia cespitosa* and *Elymus glaucus.*
Plant strategy type / successional stage	*Danthonia californica* is an early successional plant that can live in a myriad of conditions. These conditions can range in precipitation, soil pH, grazing, and soil drainage. It produces cleistogenes, which are self-pollinated seeds that are produced from flowers that do not open, as an adaption to live in stressful conditions. *Danthonia californica* is a fire adapted plant.
Plant characteristics	This is a grass that is adapted to fire. Thus it will live up to a point when it burns which should happen every three to four years.
PROPAGATION DETAILS	
Ecotype	Marin County, California. Polk County, Oregon. Douglas County, Oregon.
Propagation Goal	Plants
Propagation Method	Seed Can also be propagated by crown division
Product Type	Container (plug)
Stock Type	
Time to Grow	It should take around 21 days for seeds to germinate.

	After germinating wait another 21 days before transplanting them into containers. In the containers it will take 9-12 weeks to become well established. Then plants should be acclimated for several weeks in a lath house or shade house before outplanting.
Target Specifications	Firmly established in potting media
Propagule Collection Instructions	Collect seeds from the plant from May to July. This can be done manually if working with low quantities. If working with large quantities swothing with machinery is needed. To remove the seeds, try out the seeds and stalk and use a combine machine or a seed stripper to extract the seeds.
Propagule Processing/Propagule Characteristics	90,000 to 165,000 seeds per pound This species has innate dormancy patterns (requiring specific environmental cues to germinate) and plant adaptations (e.g. hygroscopic awns that lodge beneath the soil) that likely cause seeds to persistent in the seedbank. Seeds will maintain viability after two years in a cold and dry storage.
Pre-Planting Propagule Treatments	Seed lot is first processed using a Westrup Model HA 400 brush machine, with 3 row brushes, a #16 mantel with pins, at a speed of 3. Seeds are then air-screened, using a Clipper Eclipse, Model 324, with a top screen: 1/13 x 1/2 slot, 2nd screen: 1/15 x 1/2 slot and a bottom screen: #5 triangle, and medium to high air, (screen size and air vary by lot). Seed lot is finished, using an Oliver Model 30, Gravity Separator, Speed: 45, Air: 60, hopper speed: 1.5 (speed, air, and hopper speed vary by lot). This final process removes remaining nonviable seed and inert material. These seeds may contain both physical and physiological dormancy. To break the physical dormancy very dilute acid concentrations or machine hulling can be used. Using acid and machine hulling will have varying effects depending on the damage done to the vulnerable seeds. In most cases there will be less germination. To break physiological dormancy stratify the seeds outdoors over the winter or moist stratify them for one to three months at 1-4ºF.
Growing Area Preparation / Annual Practices for Perennial Crops	Use large containers or flats to sow seeds. The rooting and growing media can be a standard potting media amended with micronutrients and fertilizer. Another rooting media can be a media of 1:1 ratio of peat and vermiculite.

	Seeds should be covered with .25 inches or less of potting media or vermiculite and kept moist.
Establishment Phase Details	Maintain the moisture of the rooting media with irrigation. Keep temperatures in the range of 15-25ºC.
Length of Establishment Phase	Up to 21 days
Active Growth Phase	Transplant germinated seeds 21 days after germination to individual 4 inch containers containing standard potting mix. Irrigate to keep the potting mix moist. Apply a light amount of nitrogen fertilizer every week. Discontinue fertilizer use during the summer. "Empty" containers or flats should be held over until next spring or keep water because there will often be viable seeds that can germinate.
Length of Active Growth Phase	Start of Fall to the end of Spring
Hardening Phase	None
Length of Hardening Phase	
Harvesting, Storage and Shipping	Harvesting and shipping can begin after 9-12 weeks after transplanting.
Length of Storage	Can survive about 2 months without water
Guidelines for Outplanting / Performance on Typical Sites	Can survive on rain water. Flowers in the spring to early summer. Can grow to be 30 to 100 cm tall. Use a lot of plants because the first years growth is slow. Plant in 5 inch grids.
Other Comments	Poor germination rate when seeding on restoration site.
INFORMATION SOURCES	
References	Amme, David, and Sean Micallef. "The Ecology and Development of California Oatgrass: the Champagne of Grasses." Web. 26 Apr. 2015. Barner, Jim 2009. Propagation protocol for production of *Danthonia californica* Bol. seeds; USDA FS - R6 Bend Seed Extractory, Bend, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 27 April 2015). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. "Danthonia californica." California Flora Nursery. Web. 26 Apr. 2015. "Danthonia californica." Puget Prairie Plants. The Evergreen State College. Web. 26 Apr. 2015. Darris, Dale, and Peter Gonzalves. "California Oatgrass Plant Fact Sheet." USDA NRCS. Web. 26 Apr. 2015.

	Darris, Dale, and Peter Gonzalves. "California Oatgrass Plant Guide." USDA NRCS. Web. 26 Apr. 2015. Darris, Dale. "The Effect of Scarification and Stratification Treatments on the Germination of Danthonia californica Seed from Three Populations." USDA NRCS. Web. 26 Apr. 2015. Young, Betty 2001. Propagation protocol for production of container *Danthonia californica* Boland plants; , San Francisco, California. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 27 April 2015). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.
Other Sources Consulted	Edminster, Craig. "The Role of Native and Domestic Grasses in Erosion Control." DLF International Seeds. Web. 26 Apr. 2015. "Propagation Techniques." Native Plant Network. Web. 26 Apr. 2015. "Rare species are finding a home in restored South Puget Sound prairie." Highlights in Conservation. USDA Washington. Web. 26 Apr. 2015. "Species: Grasses, Rushes, and Sedges." California's Coastal Prairies. Sonoma State University. Web. 26 Apr. 2015.
Protocol Author	Amos Chan
Date Protocol Created or Updated	04/27/2015

California oatgrass (*Danthonia californica)*

Range

Western coastal regions of North America and South America1[1]

Elevation and Climate

California oatgrass can be found at elevations between 500ft-7000ft2[2] growing in diverse climates, ranging from the cool, humid conditions near the coast to the hot, dry environments in inland valleys and foothill woodlands. Records from 48 climatic observation stations within or

1[1] Dobrenz, A. K.;Beetle, A. 1966. Cleistogenes in *Danthonia*. Journal of Range Management 19:292-296 Referred to in Maslovat, 2002.

2[2] Selected Perennial Grasses Suitable for Foothill Rangeland, University of California Cooperative Extension Agriculture and Natural Resources http://ucce.ucdavis.edu/files/filelibrary/616/3986.pdf

bordering its range indicate that California oatgrass has endured temperature extremes of -34° to 47° C (-30° to 116° F).3[3]

In coastal areas climate is also affected by heavy wind in combination with abundant salt-spray. Fog is common in the summer. Climate is generally mild and moist to wet, with mean annual precipitation ranging from about 70 to 120 inches.4[4]

Local occurrences

California oatgrass occurs amongst native vegetation of the south Puget Sound prairie, and northern Puget lowland found on glacial outwash soils and represented by Idaho fescue-white-topped aster plant community type.5[5] California oatgrass was likely a dominant bunchgrass of the original Canadian Garry oak ecosystem found on southeastern Vancouver Island and the Gulf Islands.6[6]

Habitat preferences

This species is found growing in areas of grassland balds and prairie (shallow to excessively drained deep soils)[5] Serpentine bedrock is present in some areas. An important dominant grass in California coastal prairies7[7] especially in drier areas8[8] Also found in Coastal sagebrush,9[9]California oakwoods, Fescue-oatgrass 10[10] and Garry Oak6 plant communities.

3[3] William I. Stein, Oregon White Oak
http://www.na.fs.fed.us/spfo/pubs/silvics_manual/volume_2/quercus/garryana.htm

4[4] http://www.sfsu.edu/~geog/bholzman/ptreyes/tripcpr.htm

5[5] Chappell, C. and Crawford, R. 1997. *Native Vegetation of the South Puget Sound Prairie Landscape*. As referenced in Dunn, P. Ewing K. eds. 1997. Ecology and Conservation of the South Puget Sound Prairie landscape, Nature Conservancy of Washington, Seattle.

6[6] Maslovat, C. 2001. Historical Jigsaw Puzzles: Piecing Together the Understory of Garry Oak (Quercus garryana) Ecosystems and the Implications for Restoration. http://danr.ucop.edu/ihrmp/proceed/maslovat.pdf

7[7] Hatch, D. A.;Bartolome, J. W.; Fehmi, J.S.; Hillyard, D. S. 1999. Effects of Burning and Grazing on a Coastal California Grassland. Restoration Ecology 7: 376-381

Plant strategy

Colonizers of early successional habitats, California oatgrass is considered a species that can tolerate regularly disturbed ecosystems. It produces cleistogenes (self-pollinated seeds that are produced from flowers that do not open) and has hygroscopic awns that are known to be associated with disturbance-prone habitats[6]. California oatgrass is considered a "stress-tolerator," often found in sites with low moisture11[11]. Cleistogenes are often produced during stressful conditions, such as overgrazing or repeated mowing, and found in areas susceptible to fire [11, 1]. California oatgrass also has a high fire tolerance and does not decrease in cover after burning [7,12[12]]

Associated species

Puget Sound prairies species associated with California oatgrass include houndstongue hawkweed (*Hieracium cynoglossoides*), cutleaf microseris (*Microseris laciniata*), spike goldenrod (*Solidago spathulata*), white-top aster (*Aster curtus*), and prairie lupine (*Lupinus lepidus*). Long-stolon sedge (*Carex pensylvania*), field woodruch (*Luzula campestris*), Idaho fescue (*Festuca idahoensis*), and common camas (*Camassia quamash*)[5]

8[8] Hektner, M.M., and T.C. Foin 1977. Vegetation analysis of a northern Californinia prairie: Sea Ranch, Sonoma County, California. Madrono 24:83-103 Referred to in Maslovat, 2002.

9[9] Shiflet, T.N., 1994. Rangeland cover types of the United States. Denver, CO: Society for Range Management. 152p.
http://www.fs.fed.us/database/feis/plants/graminoid/naspul/distribution_and_occurence

10[10] Kuchler, A. W. 1964. United States [Potential natural vegetation of the conterminous United States. Special Publication No. 36. New York: American Geographical Society. 1:3,168,000; colored.
http://www.fs.fed.us/database/feis/plants/graminoid/naspul/distribution_and_occurence

Referred to in Maslovat, 2002.

11[11] Campbell, C.S.;Quinn, J. A.; Cheplick, G. P.;Bell, T.J. 1983. Cleistogamy in grasses. Annual Review of Ecological Systematics 14:411-441 Referred to in Maslovat, 2002.

12[12] FEIS (Fire Effects Information System) 1999. Botanical and ecological characteristics. http://www.fs.fed.us.database/feis/plants

Collection

Collect seeds from the seed head or cleistogamous spikelets (or "bud-like, unopened flowers") from the base of the leaf sheaths.13[13] California oatgrass produces up to eight cleistogamous seeds per node (25-36 per plant), often more seeds than are produced from cross fertilization (21-33). [1,14[14]] It can also be propagated by divisions. [13]

Collection guidelines

Collect seeds late summer, early fall, in July and August.15[15] Ripen seeds on cardboard sheets in a warm dry area for 24-48 hours[15]

This species is a relatively poor seed producer which has made commercial seed production prohibitive16[16]

Seed germination

Exhibits both embryo and seedcoat dormancy[16] Does not regularly germinate in the fall and requires specific treatments to overcome dormancy. 17[17] 18[18]

13[13] Keator 1990. Complete Garden Guide to the Native Shrubs of California, Chronicle Books, San Francisco, CA.

14[14] Hitchcock,C.L.1969. Vascular plants of the Pacific Northwest.University of Washington Press;Seattle,WA

15[15] Keeley, M.A. 2000.A Study in Urban Revegetation:Germination and Establishment of South Puget Sound Prairie Plants on a Capped Landfill. MS Thesis University of Washington

16[16] Edminster, C.W. The Role of Native and Domestic Grasses in Erosion Control http://www.intlseed.com/documents/info_erosion_control.htm

17[17] Knapp, E.;Rice,K. 1994. Isozyme tests of Elymus glaucus and Danthonia californica. Work in progress USDA Forest Service, The Nature Conservancy, and Bureau of Land Management. Referred to in Maslovat, 2002

18[18] Laude, H.M. 1949. Delayed germination of California oatgrass. Agronomy Journal 41:404-408. Referred to in Maslovat, 2002.

In a germination test conducted by Dobrenz (1966) potassium nitrate treatment was the only condition under which both types of seeds (fertilized and cleistogamous seeds) germinated. Therefore it is possible that certain elements in the soils can affect germination requirements[1]

In germination studies by Keeley (2002) seeds were scarified by hand removal of the lemma and palea and stratified for 3 weeks at 3-4C[15]

Seed life

This species has innate dormancy patterns (requiring specific environmental cues to germinate) and plant adaptations (e.g. hygroscopic awns that lodge beneath the soil) that likely cause seeds to persistent in the seedbank[6]

Seed storage

Store seeds in large zip-lock plastic bag in a coldroom at 3-4C[15]

Propagation

Hoophouse propagation is recommended.[15] Sow scarified seeds (removal of lemma and palea) in plastic flats, lined with newspaper. Keep flats at temperatures between 24-15C[15]

Medium requirements

Moist peat mix [15]

Installation form

Propagated grass plugs

Planting density

Plant densely, using 1 foot centers in groups of 3 or more plants.

Care requirements

Weed planting area before installation, follow-up with additional weeding and watering as needed.

Rate of growth

California oatgrass grows slowly and has weak seedling vigor, but is unique in that it stays green all year long.[16] It grows in dense tufts reaching 15 to 35 inches tall and may control the spatial distribution of other grassland species.[7]

Data compiled by: Amy Lambert, April 14, 2003