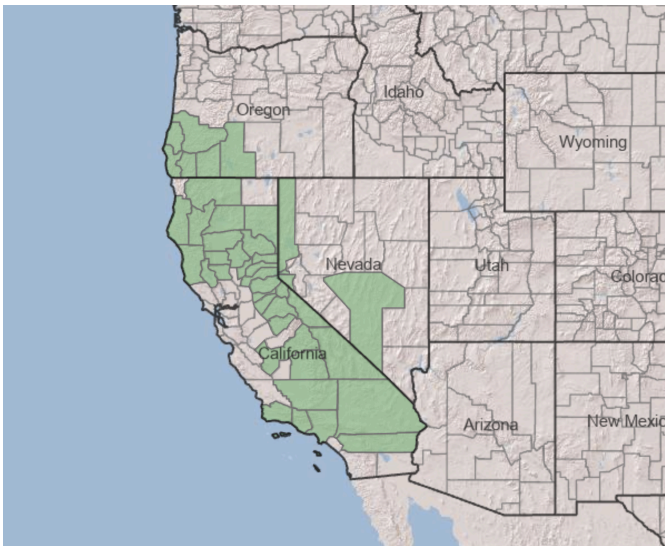
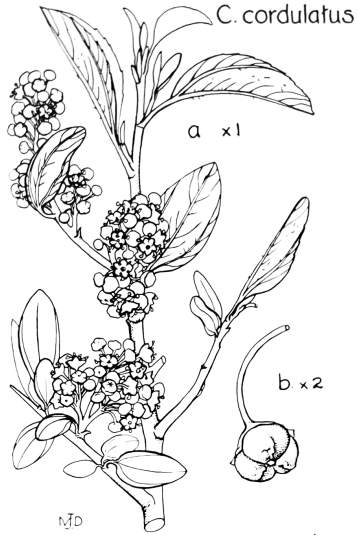
Plant Propagation Protocol for *Ceanothus cordulatus*

ESRM 412 – Native Plant Production

URL: https://courses.washington.edu/esrm412/protocols/2024/CECO.pdf





Pacific Northwest distribution map[6], Ceanothus branch with leaves[1]

TAXONOMY	
Plant Family	
Scientific Name	Rhamnaceae
Common Name	Buckthorn Family
Species Scientific Name	
Scientific Name	*Ceanothus cordulatus* Kellogg
Varieties	
Sub-species	
Cultivar	'Maleza' Cultivar: Lockeford, Plant Materials Center, Lockeford, California, 1989[6]
Common Synonym(s)	
Common Name(s)	Mountain Whitethorn, Whitethorn Ceanothus, Snowbush
Species Code (as per USDA Plants database)	CECO (CEACOR (FEIS))
GENERAL INFORMATION	
Geographical range	Native to California, parts of Oregon, Nevada
Ecological distribution	One of the most common species found in California, often being found in sclerophyllous shrub communities, higher elevations on rocky ridges, slopes, dry flats as well as hardwood forests on the coast and interior alike. it has also been documented to occur in the understory of giant sequoia communities as it can tolerate low light levels[1,7,8]

Climate and elevation range	prefers very low moisture, full sun ranging to partial shade, can tolerate temperatures down to -20F, and is commonly found in elevations of 300 to 13935ft but has also been found anywhere from 4000 to 10000 ft.[8]
Local habitat and abundance	commonly found with other mountain species such as Firs, Manzanita, Dogwood, Western Juniper (*Juniperus occidentalis*), Tanoak (*Notholithocarpus densiflorus*), Ninebark (*Physocarpus capitatus*), Pines, Quaking Aspen (*Populus tremuloides*), Canyon Live Oak (*Quercus chrysolepis*), and Giant Redwood (*Sequoiadendron giganteum*)[8]
Plant strategy type / successional stage	early-successional colonizing species especially following fire/disturbance, heavily competitive and well suited for adverse environments due to their symbiotic ability to fix nitrogen within their root nodules[1,8]
Plant characteristics	semi-erect spreading shrub 1-5ft tall, 12-15ft-wide spread, alternate evergreen leaves, elliptic to broadly ovate somewhat leathery, light green to gray-green with stiff distal branches that become strongly spine-like. the fluffy white inflorescences appear in the upper axils of 1- or 2-year-old branches, 1-inch long with a strong, pungent fragrance[1]
PROPAGATION DETAILS: FROM SEED	
Ecotype	Umpqua National Forest, Oregon
Propagation Goal	Plants, Cuttings, Seeds, other propagules
Propagation Method	Seed
Product Type	Container (plug), Propagules (seeds, cuttings, etc.)
Stock Type	444ml container
Time to Grow	18 weeks[3]
Target Specifications	container seedling with an established root system creating firm plug in container[3]
Propagule Collection Instructions	collect seeds from a healthy, vigorous plant as diseased or weak plants do not produce as viable seeds. plant flowers between May and August (dependent on climate/location) and seed maturity is reached in late summer (August/September) Cloth mesh bags can be tied tightly around clusters of green seed pods in the summer and left until seeds have fully matured, often lasting up to several months. As the seed pods split open, seeds will be ejected into the mesh bag. Seed pod clusters should never be cut

	as the seeds will not ripen correctly disconnected from the plant and premature seeds have extremely low viability.[2,3] Can also be collected into paper bags by hand but are much less time-efficient and need to ensure the seeds being collected are mature.[4]
Propagule Processing/Propagule Characteristics	approx. 166000-168000 seeds/lb[4]
Pre-Planting Propagule Treatments	seeds are cleaned first with sieves (mesh 6 and 12) to remove stems and other undesirable material and then transferred to an office clipper to air screen out nonviable and inert material further. With a top screen of 5 ½ round and a bottom screen of 1/20 round, high speed and medium-high air. yielded results (as assessed through Oregon State University Seed Laboratory Analysis): Purity: 99%, X-Ray 100 Seeds: 48% Filled, TZ: 80% seeds can be stored in cold Storage, 33-38 Degrees Fahrenheit due to the high dependency on fire, before germination seeds must undergo heat treatment to break dormancy as well as cold moist stratification to mimic natural environmental conditions for maximum success.[2,3,4] boiling seeds for five minutes and then stratifying them for three or four months at about 2.5° C. (36° F.)[5] After boiling, water should be allowed to cool and seeds to soak for 24 hours, rinsed, and placed back in water for an additional 4 hours, and then sown into trays filled with stabilized medium plugs (Q-plugs) trays are sealed into plastic bags and placed into refrigeration at 1 to 3 °C for 90 days making sure to be kept moist and checked weekly. if mold appears trays should be treated with a 1% solution of hydrogen peroxide.[3]
Growing Area Preparation / Annual Practices for Perennial Crops	growing media ideally composed of a 5:4:3 ratio mix of loam, peat/leaf mold, and sand.[2] Within a greenhouse growing facility, Q-plugs are lightly coated with nursery grit, and seedlings are transplanted to target containers (444ml) approx. 3 weeks after removal from cold stratification. Apex controlled fertilizer mix (16N:5P2O5:10K2O with

	minors; 6 to 7-month release rate at 21C) at the rate of 2-gram Apex per 444 ml container is applied.[3]
Establishment Phase Details	germination, fairly uniform generally takes 2 weeks to complete, after which, (while plants are still in Q-plugs) plants are fertilized with soluble 12-2-14-6Ca-3Mg at 75 to 100 ppm for 2 weeks.[3]
Length of Establishment Phase	2-3 weeks
Active Growth Phase	once several sets of true leaves have developed, the seedlings can be uppotted into 2 to 3-inch/ 444ml pots with a potting medium consisting of a 5:3:1 mixture of loam, peat/leaf-mold, and sand, ensuring not to plant the seedling too deeply- with the root crown just below the surface. Make sure to not overwater, watering seedlings very thoroughly only once signs of slight wilting occur as well as consistent monitoring of root development in the container and up-planting to a ½ or gallon pot once a root system has formed outside the ball but not become rootbound (in which case plants should just be discarded rather than try to keep growing) [2]
Length of Active Growth Phase	15 weeks
Hardening Phase	No dry-down is done to induce dormancy. Seedlings are moved to an outdoor growing area in early September.[3]
Length of Hardening Phase	2-3 weeks
Harvesting, Storage and Shipping	seedlings are often outplanted in the fall and not often stored for long other than in an outdoor growing area. Plants are well irrigated before shipping and shipped within their containers, being ready mid to late october [3]
Length of Storage	5-6 months
Guidelines for Outplanting / Performance on Typical Sites	The outplanting hole should be dug well in advance, larger than twice the size of the container the plant is in. Placing loamy soil in the hole first and filling it with water helps avoid air pockets and settle the soil. To avoid outplanting failure due to stem rot, make sure the root crown stays near the surface and does not get covered- generally, it is recommended to plant high rather than too low into the hole.[6] Making sure the soil is fully saturated following outplanting is important to help the root system

	establish. Following root establishment, ceanothus thrive with little to no water as they grow.[2] suitable planting density: minimum of 700, maximum of 4800 (per acre)
Other Comments	N/A
PROPAGATION DETAILS: VEGETATIVE	
Ecotype	N/A
Propagation Goal	Plants, Cuttings, and other propagules, (could use for seeds)
Propagation Method	Vegetative (layering, cuttings, stump sprout regrowth)
Product Type	container, live stake cutting
Stock Type	
Time to Grow	2 years
Target Specifications	viable plant with healthy, growing roots and new shoots/leaves, firm plug in 800 ml container
Propagule Collection Instructions	collect cuttings in late spring/early summer of the terminal end of well-ripened wood, of 3 to 5 inches in length[9] or 20-30 cm in length*[10] with a “heel” from branchlets having short internodes. For higher quantities of propagules, it is recommended that cuttings be taken of soft tips cut from nursery stock.*[2,9,10]
Propagule Processing/Propagule Characteristics	Layering is a common natural vegetative regeneration mode for *C. cordulatus* as in higher elevations, under heavier snows pushes branches down to the ground where they often begin to layer thereafter. Stump-sprouting is also quite common if the majority of the plant above ground is damaged, for instance in fire[7] cuttings are generally kept consistently moist and cool (refrigerated) between collecting the cutting and planting into medium* [10]
Pre-Planting Propagule Treatments	optionally, to increase rooting success, the basal end of the cutting can be dipped in a talc-based rooting hormone (or IBA dip) prior to placing it in medium* [9,10]
Growing Area Preparation / Annual Practices for Perennial Crops	moist and consistent atmosphere, a very well-drained, porous rooting medium (coarse sand or 50/50-perlite/sand mix) and watered frequently and thoroughly with air of high humidity and never stagnant, can be easily achieved by storing cuttings in mist bench with lower intervals of misting* [2,10]

Establishment Phase Details	time to transplant, cuttings that are adequately rooted can be removed from mist bench and uppotted as needed
Length of Establishment Phase	8 weeks
Active Growth Phase	rooting period, 2 to 3 weeks
Length of Active Growth Phase	20 weeks [11]
Hardening Phase	fertilized as needed and given one final irrigation before overwintering* [10]
Length of Hardening Phase	4 weeks
Harvesting, Storage and Shipping	time since cutting: 2years, over-winter storage under foam and snow
Length of Storage	5 months
Guidelines for Outplanting / Performance on Typical Sites	Should be outplanted in late spring or early summer to be able to take full advantage of growing season to get established in the outplanting site [2,10]
Other Comments	
INFORMATION SOURCES	
References	1. Van Rensselaer, M., & McMinn, H. (1942). *Ceanothus; part I, Ceanothus for gardens, parks, and roadsides*. Santa Barbara botanic garden. 2. Fross, D., & Wilken, D. (2006) *Ceanothus*. Timber Press, Portland, Oregon. 3. Riley, Lee E. (2018) *Propagation protocol for production of Container (plug) Ceanothus cordulatus*. USDA FS - Dorena Genetic Resource Center Cottage Grove, Oregon. 4. Barner, J. (2009) *Propagation protocol for production of Propagules (seeds, cuttings, poles, etc.) Ceanothus cordulatus Kellogg seeds.* USDA FS - R6 Bend Seed Extractory Bend, Oregon. In: Native Plant Network. 5. Quick, C. R., & Quick, A. S. (1961) *Germination of Ceanothus Seeds. Madroño.* Vol. 16, No. 1 pp. 23-30 6. Dyer, D. (2005). *USDA plants database*. USDA Plants Database. https://plants.usda.gov/ 7. Reeves, Sonja L. (2006). *Ceanothus cordulatus. In: Fire Effects Information System*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer)

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Other Sources Consulted	*Plant database*. (2022, October 17) Lady Bird Johnson Wildflower Center - The University of Texas at Austin. https://www.wildflower.org/plants/result.php?id_plant=CECO
Protocol Author	Ailia Schmid
Date Protocol Created or Updated	04/27/2024

This propagation protocol template was modified by J.D. Bakker from that available at: http://www.nativeplantnetwork.org/network/SampleBlankForm.asp

* where indicated with an asterisk, information was not found for this specific species, and is generalized from a very closely related species, (*C. velutinus)*