

Native Plant Materials: seed increase primer

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Fourth Corner
Nurseries



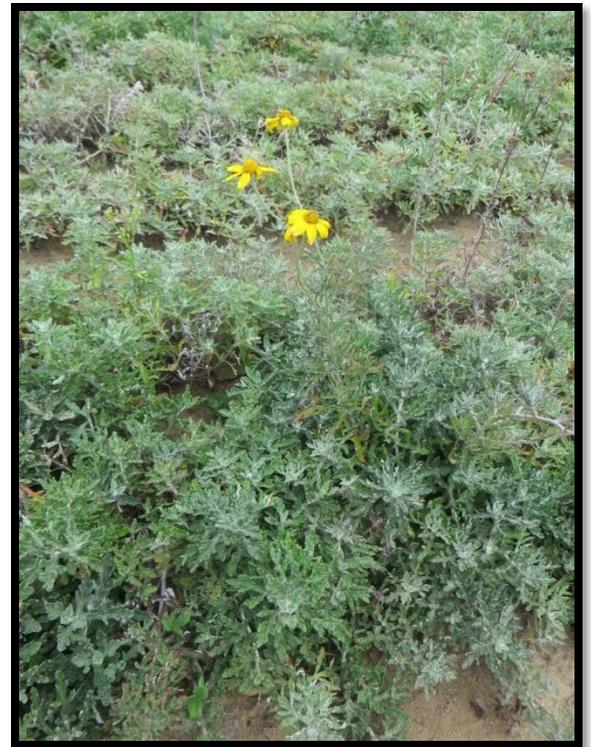
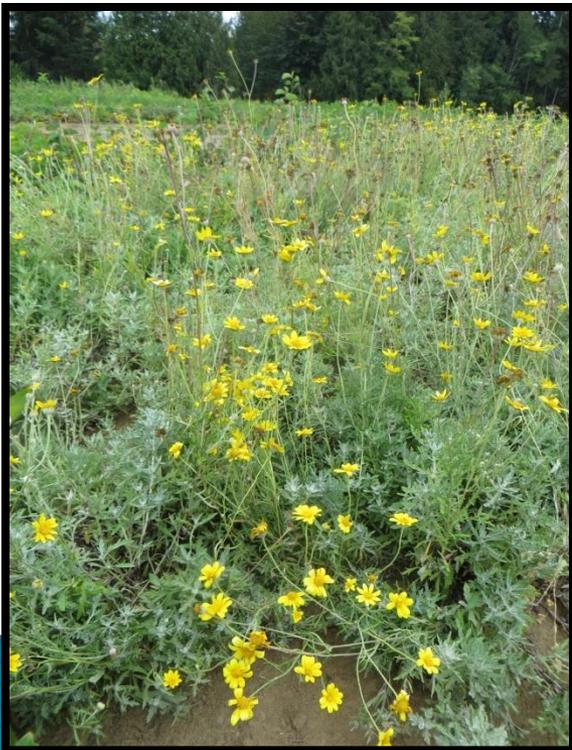
Fourth Corner Nurseries
Bellingham, WA

Premise:

- ▶ Planning a restoration or revegetation project(s) and want to use, or are considering seed as a plant material
 - ▶ Answer some basic questions pertinent to any type of plant material and some specific to seed.
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Seed Source – Quick Review

- ▶ Genetic variation between populations across a species' range
- ▶ Important for performance and ecological fit



Eriophyllum lanatum

Source considerations

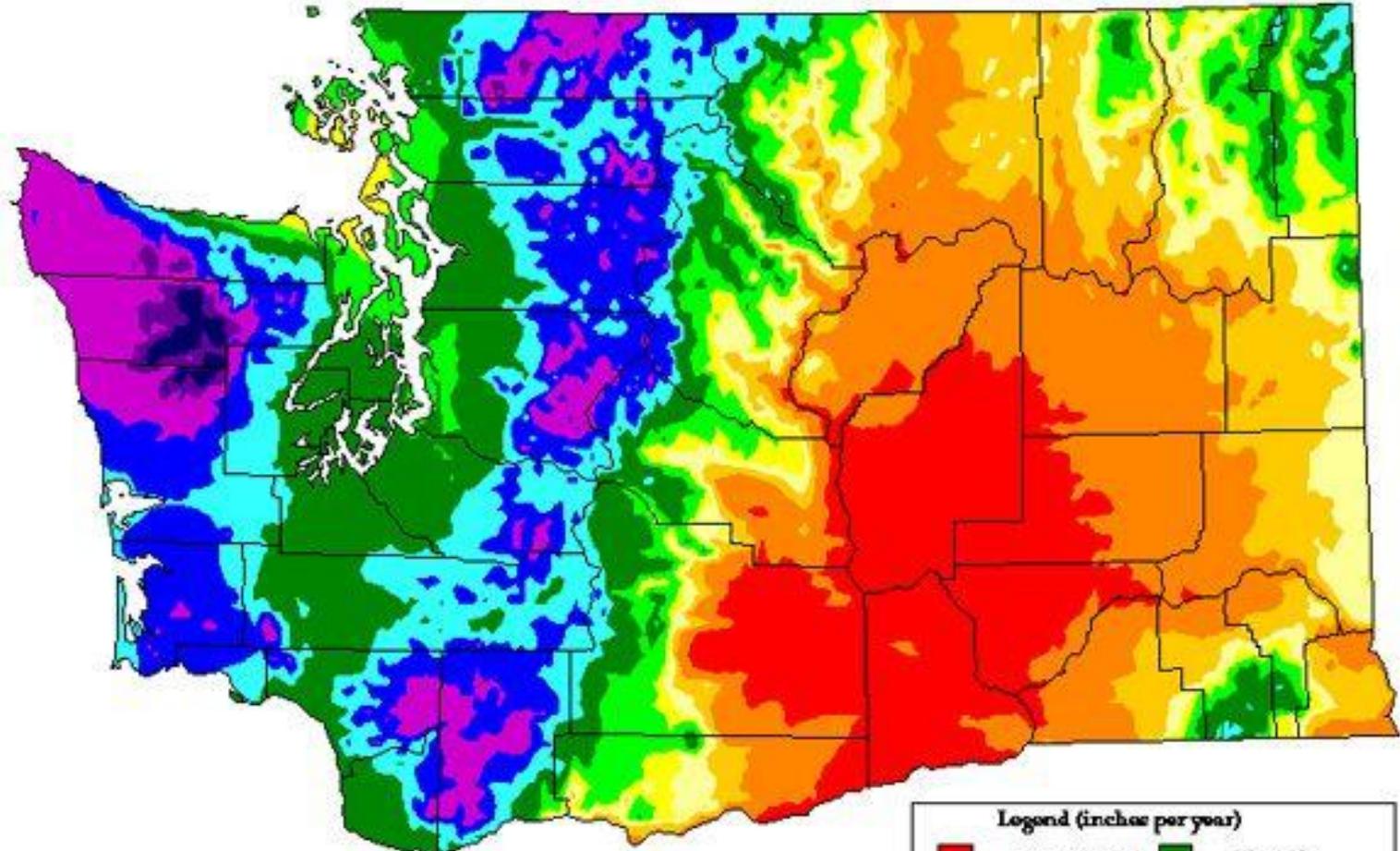
▶ Source Distance

- Home-site advantage, aka 'locally adapted'
- Environmental similarities and genetic similarities between populations are better predictors of performance than geographic distance

▶ Genetic Diversity

- Single source, multiple sources, or selections?
- –Thomas N Kaye. 2001 Common Ground and Controversy in Native Plant Restoration

Environmental Gradients



Average Annual Precipitation

Washington

Period: 1961-1990 Units: inches

Legend (inches per year)

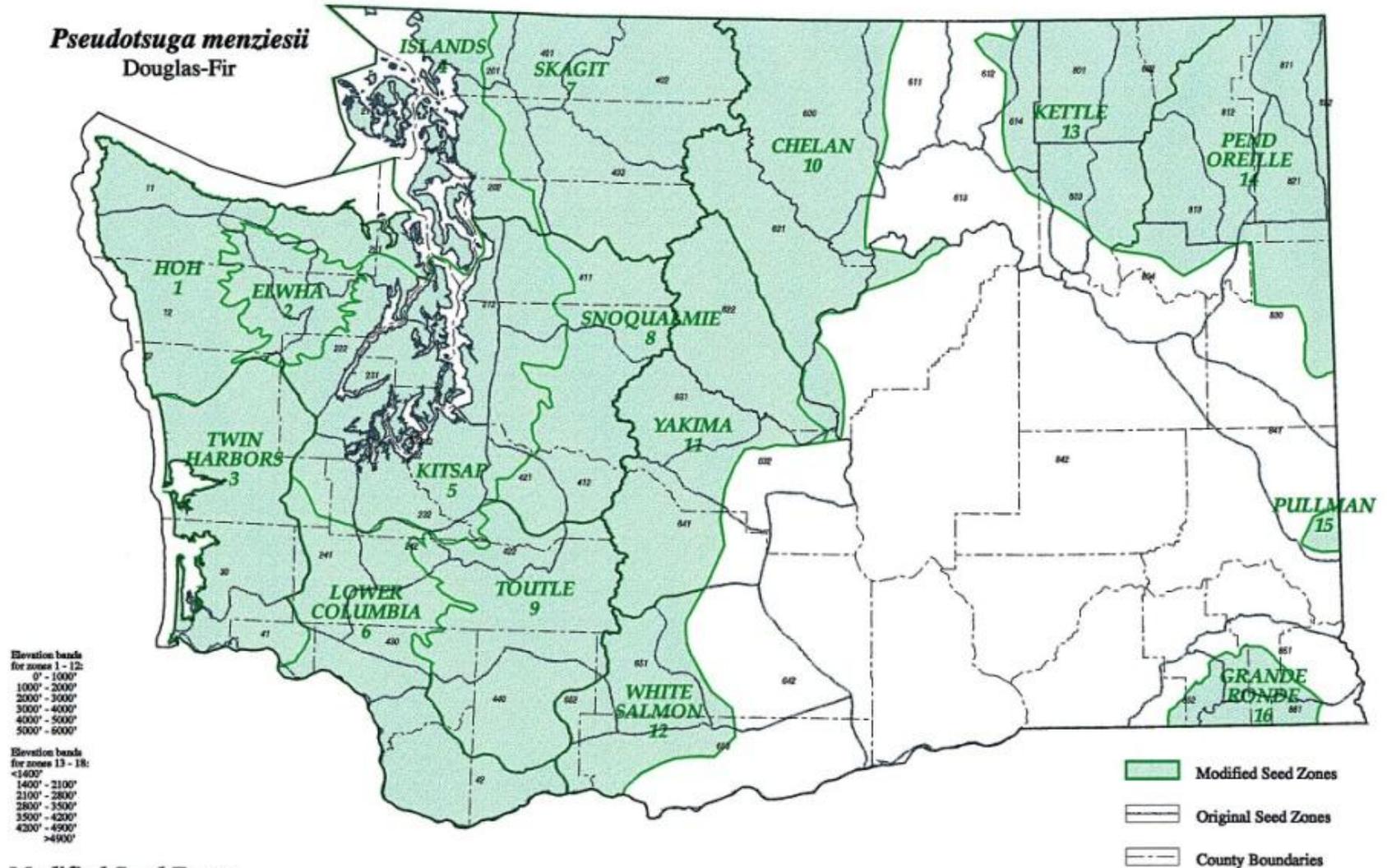
Red	Less than 10	Dark Green	40 to 60
Orange	10 to 15	Cyan	60 to 80
Yellow-Orange	15 to 20	Blue	80 to 100
Yellow	20 to 25	Purple	100 to 140
Light Yellow	25 to 30	Dark Purple	140 to 180
Light Green	30 to 40	Dark Blue	More than 180

Seed Transfer Zones

- ▶ “A seed zone is an area with fixed boundaries on a map, within which plant materials can be transferred with little risk of adapting poorly to their new location.”
 - –Winthrow–Robinson and Johnson, 2006
- ▶ AND
- ▶ “Will produce no adverse genecological effects”
 - –Rob Fiegenger, Native Seed Network

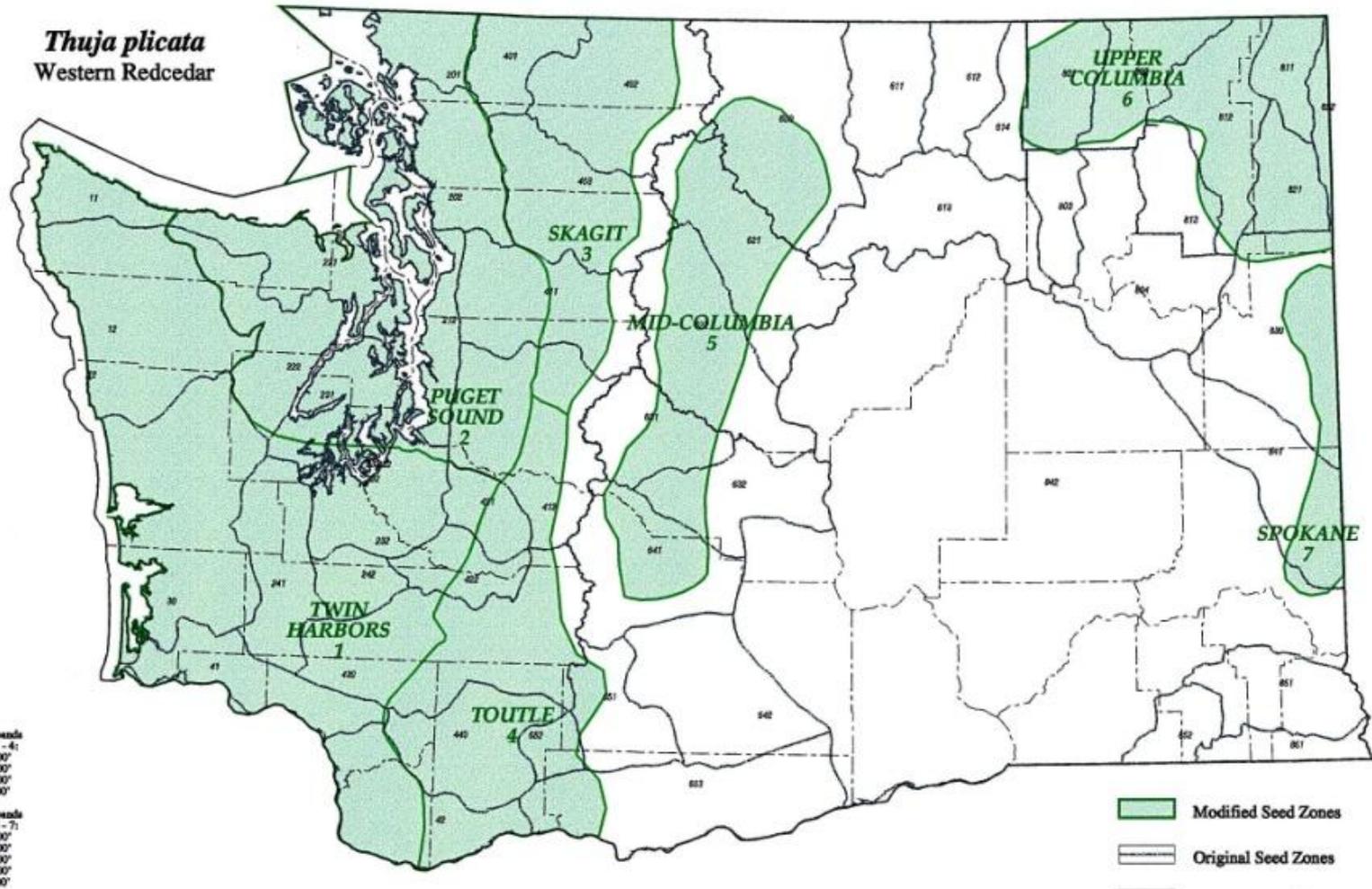
WA DNR Tree Seed Zones

Pseudotsuga menziesii
Douglas-Fir



Pseudotsuga menziesii

Thuja plicata
Western Redcedar



Modified Seed Zones

▶ ***Thuja plicata***

Provisional Seed Zones



Level III Ecoregions of the Pacific Northwest

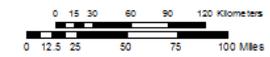


EPAL Level III Ecoregions

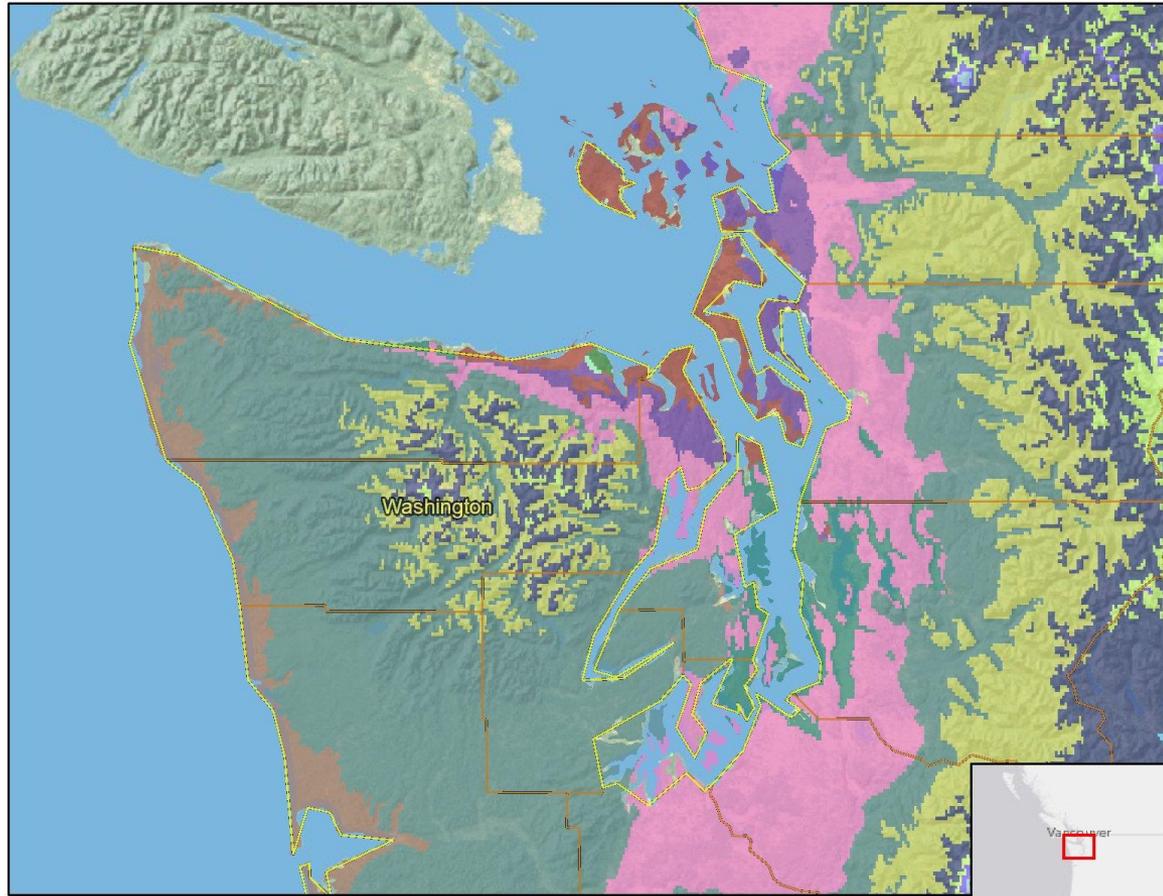
- 1-Coast Range
- 2-Puget Lowland
- 3-Willamette Valley
- 4-Cascades
- 77-North Cascades
- 78-Klamath Mountains/California High North Coast Range
- 9-Eastern Cascades Slopes and Foothills
- 10-Columbia Plateau
- 11-Blue Mountains
- 12-Snake River Plain
- 13-Central Basin and Range
- 15-Northern Rockies
- 16-Idaho Batholith

CEC Level III Ecoregions

- 10.1.1-Thompson-Okanogan Plateau
- 7.1.5-Coastal Western Hemlock-Sitka Spruce Forests

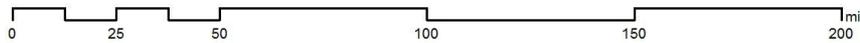


WWETAC Wildland Threat Mapper



Legend

-  State Boundaries
-  County Boundaries



USDA Forest Service Western Wildlands Environmental Threat Assessment Center

Date: 5/15/2017

Time: 1:01:47 PM

Service Layer Credits: Copyright:© 2013 National



Genetics/Seed Source Resources

- ▶ Kaye, T.N. 2001. Common ground and controversy in native plant restoration: the SOMS debate, source distance, plant selections, and a restoration-oriented definition of native.



EM 8885-E • November 2006

Selecting
NATIVE PLANT MATERIALS
for restoration projects

*Ensuring local adaptation
and maintaining genetic diversity*

Lynn Ketchum
B. Withrow-Robinson and R. Johnson

Seed Quality and Qualities

- ▶ Size and seed count

Common Name	Scientific Name	Seed Size
Yarrow	<i>Achillea millefolium</i>	2835k/lb
Common camas	<i>Camassia quamash</i>	130K/lb
Alumroot	<i>Heuchera cylindrica</i>	7560k/lb
Silky lupine	<i>Lupinus sericeus</i>	24.5k/lb
Beaked filbert	<i>Corylus cornuta v. californica</i>	300/lb

- Dave Skinner USDA NRCS Plant Materials Center

Seed Quality

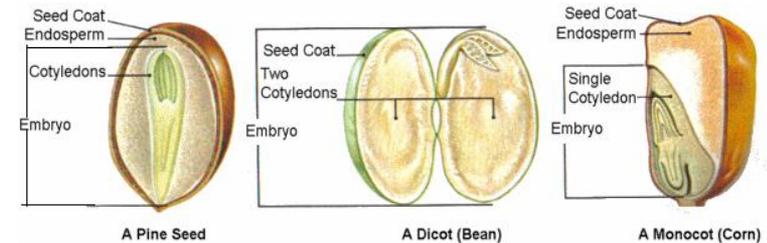
▶ Viability

- Tetrazolium Chloride (TZ) test
- Germ test
- Cut test
- Float test
- Density separation (e.g. air column separator)

▶ Vigor...and Aging

- Vigor tests are designed to mimic poor seeding conditions to find out how the seed lot will perform under stress. It's the exact opposite of a germination test, where seed is grown under optimum conditions.

- -<http://www.2020seedlabs.ca/what-vigour-test>



Purity

- ▶ Test of percentage of pure seed, inert matter (such as sticks, chaff), other crop seeds and weed seed in a seed lot
- ▶ Seed is often sold as Pure Live Seed (PLS) which is the percentage of seed (i.e. good viable seed) that has the potential to germinate within a measured one pound weight of any seed lot.

Pure Live Seed (PLS)

- ▶ The basic formula to calculate PLS is:
- ▶
$$\frac{(\%) \text{ Purity} \times (\%) \text{ Total Germination}}{100} = \% \text{ PLS}$$

For example: Seed lot A – Purity% (0.90) x Germ % (0.70) = 0.63 (this is the PLS correction factor). To determine how much bulk seed is needed to equal 1 PLS lb, one is divided by 0.63 = 1.59. Thus, **1.59** bulk pounds of Seed lot A seed is equivalent to one PLS pound.

Ripeness / Moisture Content and Storage

- ▶ **Seed Moisture Content:** This test determines the percentage by weight of moisture content in seeds. Seed moisture content affects the capacity of seeds to stay alive and maintain germinability and vigor over time.
 - -OSU Seed Lab

Seed Dormancy

- ▶ “... a mechanism that prevents germination of a seed at an inappropriate time”
 - (Vivrette, SCST Seed Technologist Training Manual, Chap. 9, 2002)
- ▶ “...the absence of germination of an intact, viable seed under germination favoring conditions within a specific time lapse”.
 - (Hilhorst, 1995)
- http://seedbiology.osu.edu/HCS631_files/8A%20Seed%20Dormancy,%20after%20MM.pdf

Overcoming Dormancy

- ▶ Scarification
- ▶ Afterripening
- ▶ Stratification (chilling)
- ▶ Use of chemical compounds
- ▶ Light
- ▶ Leaching
- ▶ Alternating temperatures
- ▶ Priming



Sow in the **FALL** if Species Has

- 1.** Seeds that are dormant and must overwinter in the soil before they will germinate (examples - Camas, California outgrass)
- OR**
- 2.** Seeds that are not dormant but only germinate in cool temperatures and grow actively in the early winter and fall. These plants are also typically early bloomers (examples - pink seablush, clarkia).
- OR**
- 3.** Plants that have significantly higher summer survival or an increase in flowering if fall sown (examples - blue wildrye, California brome).



Sow in the **SPRING** if Species Has

- 1.** Seeds that are not dormant but require the warmth of late spring to trigger germination (example - sedges).
- OR**
- 2.** Seedlings that are very small and grow slowly in cool weather but vigorously in warm temperatures. (examples- goldenrod, Asters).
- OR**
- 3.** Seedlings that have low winter establishment or survival due to wet, cold conditions or no growth advantages to fall seeding (silverleaf lipine, yarrow).

Chart 1: Seeding Schedule

-Native Seed Production Manual for the Pacific Northwest - Corvallis PMC

https://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/orpmcpu12767.pdf

How to obtain seed for restoration plantings?

- ▶ Buy seed on commercial market – (farm produced or wild collected)
- ▶ Wild collect your own
- ▶ Contract seed increase



Carex packystachya

Native Seed Network

NATIVE SEED NETWORK

- Home Page
- Buy Seed
- Vendor Search
- Restoration Resources
- About NSN
- Terms of Use
- Contact NSN
- Login / New User



Plant Detail

small camas - *Camassia quamash*

Symbol	CAQU2
Common Name	small camas
Scientific Name with Author	<i>Camassia quamash</i> (Pursh) Greene
Family	Liliaceae
Growth Habit	Forb/herb
Duration	Perennial
U. S. Nativity	Native to U.S.
Seed/lb.	130,000



View NRCS Plant Profile for *Camassia quamash*
[Google Image Search for *Camassia quamash*](#)

www.nativeseednetwork.org

Google Image Search for *Camassia quamash*

This seed is for sale in the marketplace:

Click on a column header to sort by column

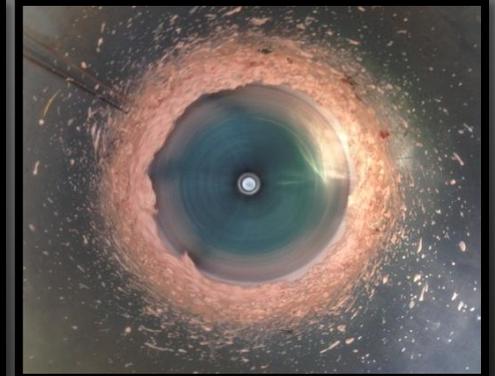
For Sale	Source State - County	Source Ecoregion	Release Name	Certification	Quantity Available	Price	Company
	CA				ask	ask	Sierra Seed Supply
	MT - Lake				100 lbs	\$4/pkt	Native Ideas Seed Company, LLC.
	OR				ask	ask	Bailey Seed Co., Inc.
	OR				ask	ask	Sunmark Seeds International, Inc.
	OR - Lane	Willamette Valley			ask	ask	Pacific Northwest Natives
	OR - Lane	Willamette Valley			ask	\$150/lb	Jonny Native Seed
	OR - Linn				ask	ask	River Refuge Seed Co
	OR - Marion	Willamette Valley			ask	\$127/lb	Heritage Seedlings Inc
	OR - Polk	Willamette Valley			ask	ask	Harland Farms
	WA				ask	ask	Inside Passage Seeds
	WA	Puget Lowlands			ask	\$120/lb	aspen valley nursery
	WA	Columbia Plateau			ask	\$65/lb	Sun Mountain Natives

Note: If this species has releases, the list of releases will not include synonyms

Collect Seed

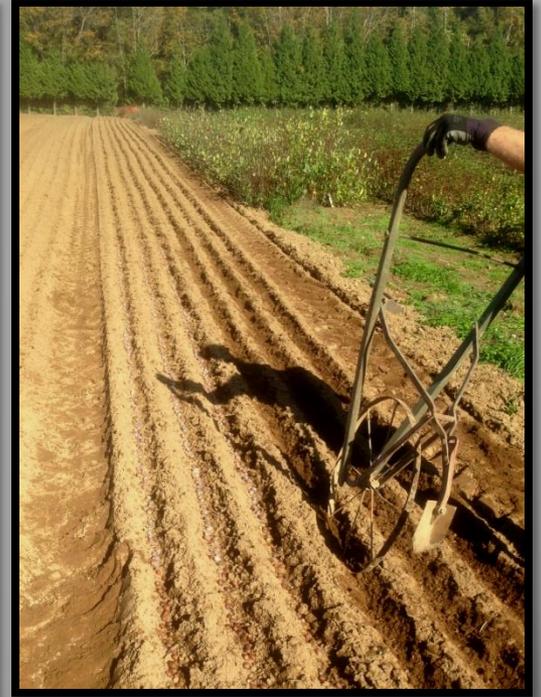


Seed Processing



Seed Storage

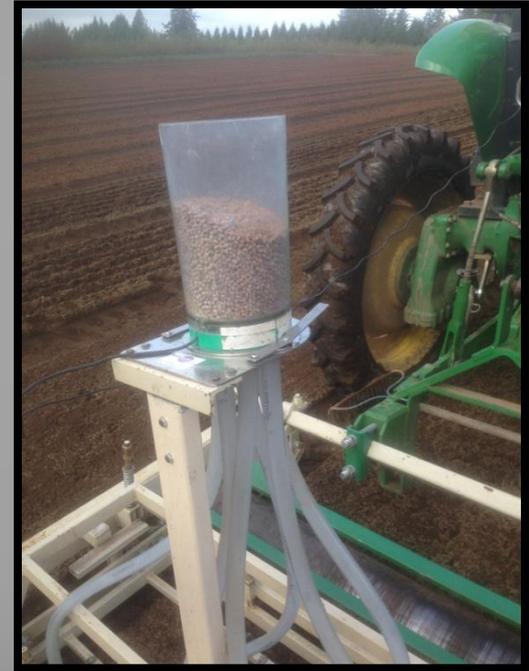


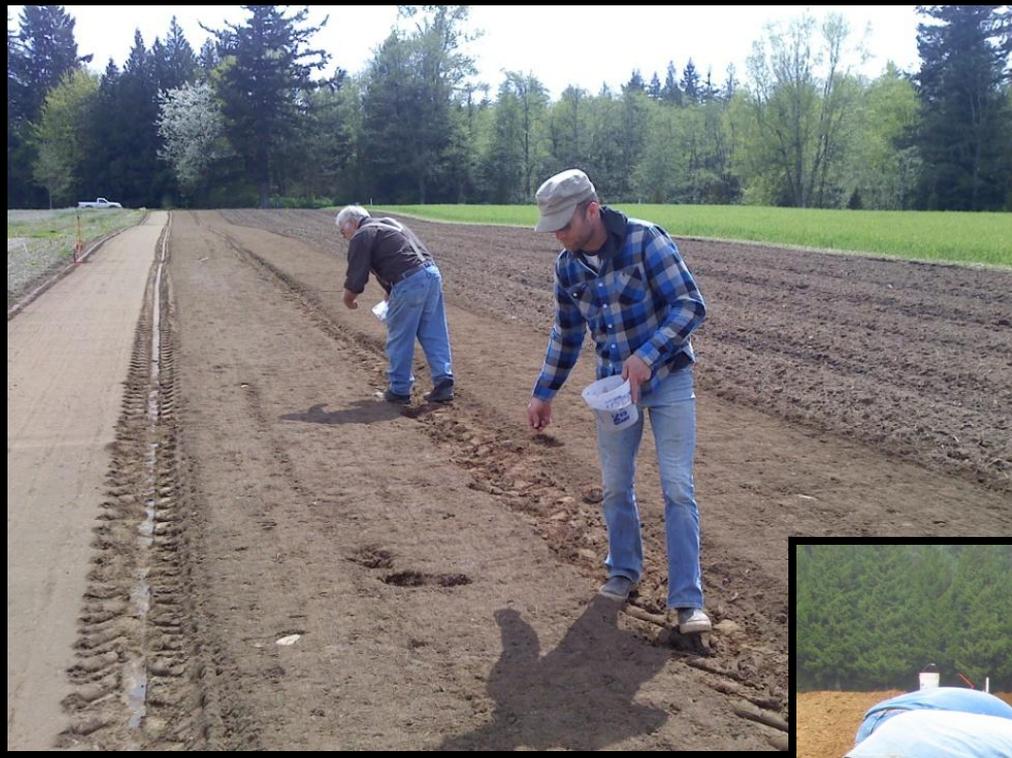


Field Prep



Planting





Seedlings



Oemleria cerasiformis

Production beds





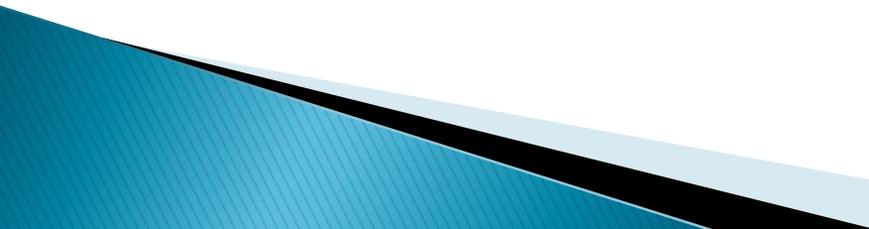


Wet land emergents



Lilium pardalinum

What are Good Candidates for Increase – End User Perspective

- ▶ Species that are onerous to wild collect in volume
 - ▶ Species that grow and perform well from seed
 - ▶ Species that naturally occur at high densities in the landscape such that revegetating with live plants would be cost prohibitive
 - ▶ Species with no source from preferred seed transfer zone, or that are known or presumed to be ‘site specialists’
- 

What are Good Candidates for Increase – Producer Perspective

- ▶ Species that bear fruit in relatively short order
 - ▶ Species that are fecund
 - ▶ Species that are not overly challenging to clean
 - ▶ Species with minimal staggered ripening
 - ▶ Species that hold their seed and/or successfully after-ripen
 - ▶ Species amenable to mechanical assisted harvest
- 

Seed Characteristics of Some Native Species

common name	scientific name	yield	ease of harvest	1st harvest	ease of cleaning	planting duration	insect problem	stratify	shatter	seed size	harvest
Yarrow	<i>Achillea millefolium</i>	high	easy	same yr	easy	short	no	no	low	2835k/lb	early Sept
Agoseris	<i>Agoseris grandiflora</i>	medium	medium	same yr	medium	short	no	no	high	274k/lb	early July
Tapertip onion	<i>Allium acuminatum</i>	low	medium	3+	easy	long	no	yes	medium	254k/lb	July
Foothills arnica	<i>Arnica sororia</i>	low	medium	2+	medium	long?	no	yes	low	406k/lb	late July
Western aster	<i>Aster occidentalis</i>	medium	medium	1	medium	medium	no	no	high	1292k/lb	late Sept
Balsamroot	<i>Balsamorhiza sagittata</i>	low-med	medium	3+	medium	long	yes	yes	medium	61.6k/lb	early July
Red besseya	<i>Besseya rubra</i>	low	medium	?	easy	?	no	yes	medium	small	late June
Brodiaea	<i>Brodiaea douglasii</i>	low	medium	4+	easy	long	no	yes	medium	medium	late June
Common camas	<i>Camassia quamash</i>	medium	easy	4+	easy	long	no	yes	medium	130k	early July
Paintbrush	<i>Castilleja</i> spp.	medium	medium	2	medium	long	no	yes	medium	small	late June
Elkhorn clarkia	<i>Clarkia pulchella</i>	low	medium	annual	easy	annual	no	no	high	2090k/lb	Aug
Blue-eyed Mary	<i>Collinsia parviflora</i>	very low	difficult	annual	easy	annual	no	no	high	350k/lb	late May
Collomia	<i>Collomia grandiflora</i>	high	difficult	annual	easy	annual	no	no	high	147k/lb	Aug
Upland larkspur	<i>Delphinium nuttallianum</i>	low	med-diff	2+	easy	long?	no	yes	high	617k/lb	June
Blanketflower	<i>Gaillardia aristata</i>	high	medium	1	difficult	short-med	no	no	medium	186k/lb	Aug-Sept
Northern bedstraw	<i>Galium boreale</i>	medium	easy	1	easy	long	no	no?	low	726k/lb	Sept
Prairie Gentian	<i>Gentiana affinis</i>	low	medium	2	easy	long	no	yes	medium	very small	Sept
Sticky Geranium	<i>Geranium viscosissimum</i>	high	difficult	1	easy	medium	no	scarify	high	54.8k/lb	late June
Prairie smoke	<i>Geum triflorum</i>	medium	medium	1	difficult	long	no	no	medium	450k/lb	late June
False sunflower	<i>Helianthella uniflora</i>	medium	easy	2-3	easy	long?	yes	no?	low	41.1k/lb	late July
Alumroot	<i>Heuchera cylindrica</i>	medium	medium	1	easy	long	no	yes	medium	7560k/lb	late July
Western iris	<i>Iris missouriensis</i>	low-med	medium	2+	easy	long	yes	yes	low	23.3k/lb	Aug
Prairie flax	<i>Linum lewisii</i>	medium	easy	1	easy	medium	no	no	low	295k	late July
Prairie star	<i>Lithophragma</i> spp.	very low	difficult	2+	medium	long?	yes	yes	medium	very small	early June
Puccoon	<i>Lithospermum ruderales</i>	low	medium	2	easy	long?	no	yes	medium	230k	Aug
Fernleaf biscuitroot	<i>Lomatium dissectum</i>	medium	easy	2+	easy	long	yes	yes	medium	45k/lb	late June
Nine-leaf biscuitroot	<i>Lomatium triternatum</i>	medium	easy	2	easy	long	no?	yes	medium	100k	late June
Velvet lupine	<i>Lupinus leucophyllus</i>	medium	difficult	same yr	easy	short	yes	scarify	high	large	mid July
Silky lupine	<i>Lupinus sericeus</i>	medium	difficult	same yr	easy	short	yes	scarify	high	24.5k	mid July
Yellow penstemon	<i>Penstemon confertus</i>	medium	medium	1	easy	medium?	no	yes	medium	4629k/lb	early Aug
Tall cinquefoil	<i>Potentilla arguta</i>	medium	medium	1	easy	medium?	no	yes	medium	4404k/lb	mid July
Slender cinquefoil	<i>Potentilla gracilis</i>	med-low	medium	2	easy	medium	no	yes	medium	1712k/lb	late July
Checkermallow	<i>Sidalcea oregana</i>	medium	medium	1-2	medium	medium	no	yes?	med-high	158k/lb	early Aug
Douglas' silene	<i>Silene douglasii</i>	low	medium	2	medium	long?	yes	yes	medium	small	mid July
Grass widows	<i>Sisyrinchium inflatum</i>	low	medium	2+	easy	long?	no	yes	medium	medium	July
Missouri goldenrod	<i>Solidago missouriensis</i>	medium	medium	1	medium	long	yes	no	medium	1998k/lb	early Sept
Mule's ears	<i>Wyethia amplexicaulis</i>	low	easy	3+	medium	long	yes	yes	medium	28.2k/lb	mid Aug

Other considerations

- ▶ Variable yield or loss of production over time
 - ▶ Disease and predation
 - ▶ Improvement with experience
 - ▶ Orchards – especially for trees and shrubs
 - ▶ TIME – Potentially long-term investment
 - ▶ Gene-flow isolation
 - ▶ Cost
- 

A vibrant field of purple flowers, likely pansies or violas, with lush green foliage. The flowers are in various stages of bloom, and the background is a soft-focus field of similar plants. The text is overlaid in white, sans-serif font.

Thank You

Questions?

▶ Dylan@fourthcornernurseries.com