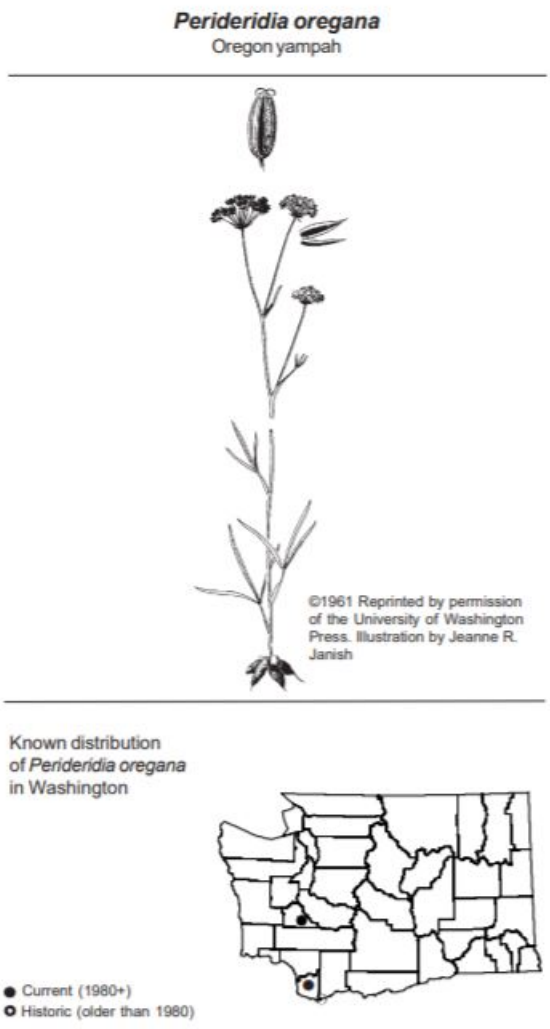
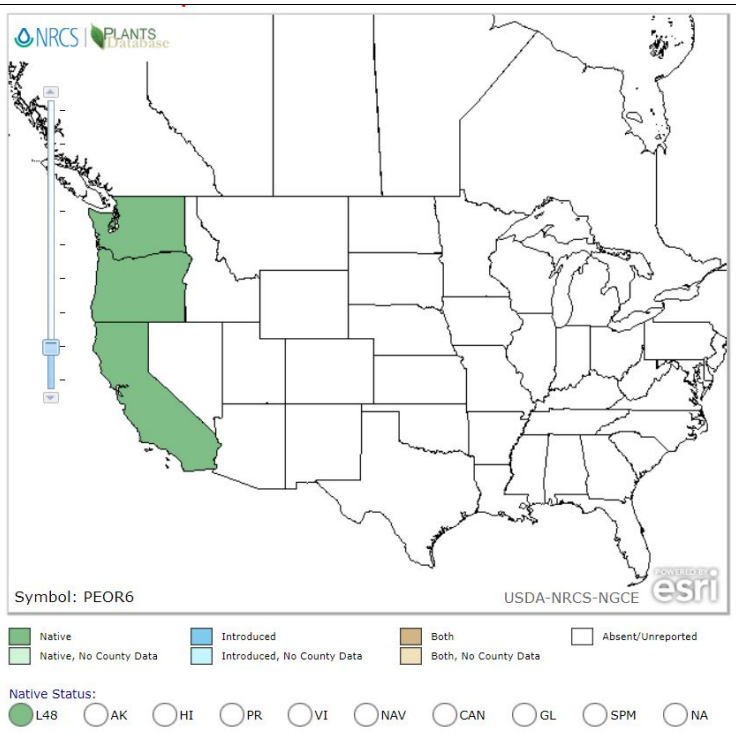
Plant Propagation Protocol for /Perideridia oregano (S. Wats.) Mathias (3)**/**
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/*[* PEOR6*.pdf]*

TAXONOMY	
Plant Family	
Scientific Name	Apiaceae (1)
Common Name	Carrot family (1)
Species Scientific Name	
Scientific Name	*Perideridia oregano* (S. Wats.) Mathias (3)
Varieties	N/A
Sub-species	N/A
Cultivar	N/A
Common Synonym(s)	*P. leptocarpa* might be a tetraploid of *Perideridia oregano* and might become synonymous in the future. (2)
Common Name(s)	Oregon yampah (1), Eppaw (2) *Ipos (2), Indian potato (2), Indian carrot (2), Wild carrot (2), False caraway (2), Wild caraway (2), Squaw root (2) *these 7 are common names for Yampah in general, not specifically Oregon yampah, but Oregon yampah is part of 6 species for which there is historical evidence of indigenous peoples eating and using the root Utah Northern Paiute Area: yampah (Couture et al 1986); yapa (Couture et al. 1986); payapa (Couture et al. 1986); suiyapa (Couture et al. 1986); yapa (Fowler 1989); kazu (Fowler 1989); yapah (Fowler 1989); ya'pa' (Kelly 1932) (6) Utah Pit River Area: pEtsku (Garth 1953); paha (Kniffen 1928) (6) Utah Klamath Area: E'-pâ (Coville 1897) (6)
Species Code (as per USDA Plants database)	PEOR6 (1)
GENERAL INFORMATION	

Geographical range	 (4) Found from SW Washington (Thurston, Clark, and Skamania counties) to central California. (4) According to reports from early settlers, *Perideridia oregano* once grew abundantly in Oregon's Willamette Valley, but is now rare besides in the mountains. (2)

	 (11)
Ecological distribution	Occurs in balds, moist-dry meadows, prairies, and oak woodlands. (4)  Photo of an oak woodland in California. (10)
Climate and elevation range	In Washington, this species has been found at an elevation of 380 feet (100 m). (4) More broadly, it can be found at elevations between 60-2100 m. (6)
Local habitat and abundance	Associated species found in Thurston County include Oregon white oak (Quercus garryana), common snowberry (Symphoricarpos albus), western buttercup (Ranunculus occidentalis), Virginia strawberry (Fragaria virginiana), common yarrow (Achillea millefolium), and long-stolon sedge (Carex inops). In Clark County,

	associated species include Roemer's fescue (Festuca roemeri), white brodiaea (Triteleia hyacinthina), common camas (Camassia quamash), California danthonia (Danthonia californica), silver hairgrass (Aira caryophyllea), and rosy plectritis (Plectritis congesta). (4) This species has recently been added to the Washington state rare plant list and has only been documented through five occurrences. It is associated with endangered ecosystems in western Washington like balds and prairies. Development and agriculture that threatens these ecosystems also threatens *Perideridia oregano.* (4)
Plant strategy type / successional stage	Unknown
Plant characteristics	Adapted from Hickman (1993) and Chuang (1969): Perideridia oregana is a slender perennial 4 to 36 in. (1-9 dm) tall, and shining green to waxy. The plant arises from a cluster of 2-6 spindle-shaped to spherical, chestnut-brown, tuberous roots. The basal leaf petiole is ¾ to 4 in. (2-10 cm) long and sheathing to the middle or throughout. The basal leaves are triangular to ovate, 1 to 12 in. (3-30 cm) long, and 1 ½ to 5 ½ in. (4-14 cm) broad, and are pinnately dissected with each leaflet further dissected into 3 narrow segments. The ultimate segments are 3/16 to 2 3/8 in. (0.5-6 cm) long and up to ¼ in. (0.5-6 mm) broad. The stem leaves are dissected like a simple feather or with 2-parted leaflets. The inflorescence is convex or sometimes flattened with slender peduncles 1 to 8 in. (3-20 cm) long. There are 1 to 29 unequal rays of flower clusters that are 1 to 1 ½ in (2.5-4 cm) long. The flower clusters have 10 to 29 flowers with toothed leafy bracts beneath. The white petals are rounded, about 1/16 in. (1-1.5 mm) long and broad, and have a single vein. The fruit is oblong, 1/8 to ¼ in. (3-6 mm) long, about 1/16 in. (1.5-2 mm) broad, and has threadlike ribs. (4) This diploid species forms 2-6 fascicled storage roots that are typically an inch or less long, which can either be eaten or replanted. (2) (6) Blooms from July-August. (6) *Perideridia* spp. storage starch granules are trimodal in size, ranging from 3-33 microns with an average size of 11 microns. Heteromorphic shape distribution; diads, triads and fours common. Many grains have central fissures, with 'Y' and 'X' markings most common. Irregular reniform grains have mesial longitudinal clefts. Cross is bright with symmetrical to wavy arms of a thin to medium thickness. (6)

(5)

(6)

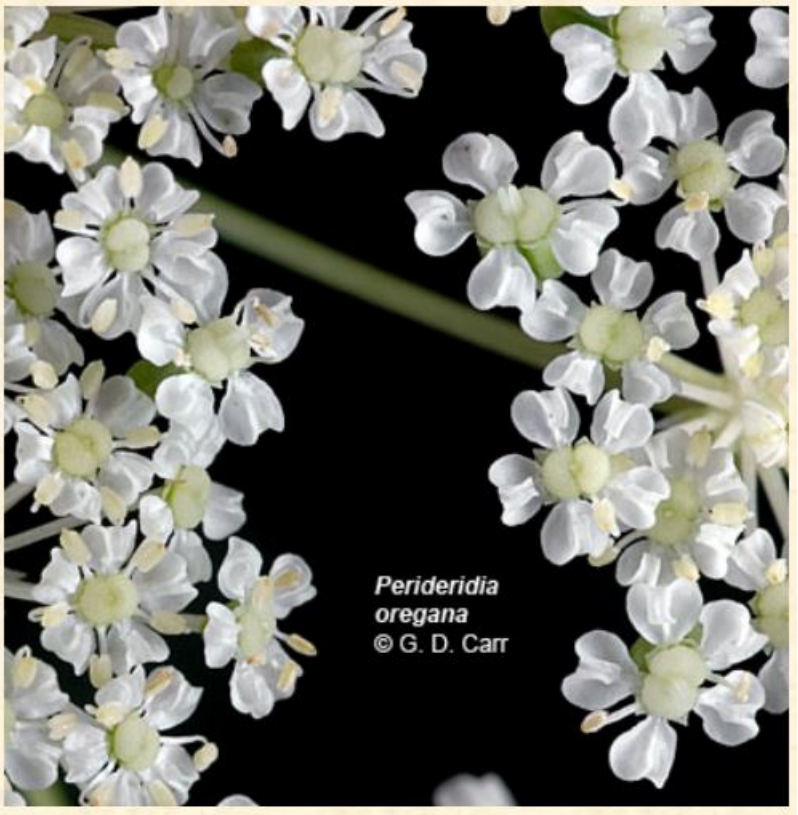
Jackson-Frazier Wetlands, Corvallis, Benton Co., OR, 8/15/2006

(7)

Jackson-Frazier Wetlands, Corvallis, Benton Co., OR, 8/15/2006

(7)

Jackson-Frazier Wetlands, Corvallis, Benton Co., OR, 8/15/2006



(7)

(8)

	 (8)  (9)

PROPAGATION DETAILS	
Ecotype	For the USDA NRCS protocol for Corvallis Plant Materials Center, seeds were collected from Lane Co, OR (1)
Propagation Goal	Plants (1)
Propagation Method	Seed (1)
Product Type	Container (plug) (1)
Stock Type	Unknown
Time to Grow	Unknown
Target Specifications	Unknown

Propagule Collection Instructions	Use a paper bag to cover maturing umbels while seeds mature and dry, in order to maximize the amount of large seeds available for harvest. (2) Hand collect into paper bag. Clean using Laboratory Test Sieves and air-screening using an office Clipper with no screens on medium speed with medium air. (3)
Propagule Processing/Propagule Characteristics	Seeds are not known to last in storage very long; in the second year after they've been collected, germination tends to be extremely sparse. (2) The larger the seed, the more viable it is; seeds should be left to mature on the plant as long as possible. (2)
Pre-Planting Propagule Treatments	For the USDA NRCS protocol for Corvallis Plant Materials Center, trials using no cold-moist stratification and 45 days of cold-moist stratification yielded little to no germination. The ideal pre-planting treatment was found to be 90 days of cold-moist stratification. (1) *Perideridia oregano* has morpho-physiological dormancy. You can either sow the seeds directly outdoors as long as winter temperatures are around 40 degrees F or below, or use 3 months (approximately 90 days) of cold-moist stratification. The seedlings do not grow well indoors. (2) For cold-moist stratification, mix seeds with about 1-2" of moist soil in a plastic bag and refrigerate. The best time to start the stratification process is in April, so that after 3 months, the temperatures are around 60-70 degrees F. This will vary depending on climate, so plan accordingly, aiming for mildly warm temperatures after 3 months. (2) Using potassium nitrate, ethephon, or 0.03mM (about 1 g/L) of gibberellic acid can aid in germination, with the gibberellic acid being the best of the three. (2)
Growing Area Preparation / Annual Practices for Perennial Crops	Sow seeds directly into cone-tainers filled with a soil-less peat-based media called Sunshine#1, amended with Micromax for micro-nutrients and Osmocote 14-14-14 as a slow-release fertilizer. (1) 10" cone-tainers are best. (2)
Establishment Phase Details	Cover flats of cone-tainers with poly-ethylene bags and place in a cooler (35-40 degrees F) for 90 days. (1)
Length of Establishment Phase	1-2 weeks after being removed from cooler, 80% of the seeds should have germinated. The total length of the establishment phase will be 97-114 days. (1)

Active Growth Phase	Seedlings don't require much space. Use a drip system to keep the soil consistently moist, but never over saturated. Grow in full sun and avoid fertilizing or having an abundance of organic matter in the soil. (2)
Length of Active Growth Phase	In 3 months, *Perideridia oregano* goes from seedling to a first year storage root. It has a short growing season and is done growing for the year by the middle of summer. But, regular watering might extend the active growing phase. (2)
Hardening Phase	When seedling develops a first year storage root, refrigerate for 2 months. Then, place outdoors or in a greenhouse for them to continue growing. Withhold water after 3-4 months to induce dormancy. (2)
Length of Hardening Phase	Unknown
Harvesting, Storage and Shipping	Transplant when plants are dormant in fall or early winter, but avoid transplanting during the active growth phase because of high mortality rates. (2) Store at 33-38 degrees F. (3) In 3 years, you can produce a harvestable root when growing from seed. If propagating from a root offset, it will be quicker. (2)
Length of Storage	Unknown
Guidelines for Outplanting / Performance on Typical Sites	If plants are outplanted during winter, they will most likely have a high survival rate and will flower the following year. But, it is not uncommon for plants to take two years after outplanting to flower. (2)
Other Comments	Growing *Perideridia oregano* from seed is more difficult than replanting the roots. If replanting a root, do not keep out of ground for long. (2)
INFORMATION SOURCES	

References	(1) Bartow, Amy L. 2002. Propagation protocol for production of container Perideridia oregana plants; Corvallis Plant Materials Center, Corvallis, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 20 May 2020). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. (2) Whitson , William. "Growing Yampah." *Cultivariable*, 12 Sept. 2018, www.cultivariable.com/instructions/root-crops/how-to-grow-yampah/#care. (accessed 20 May 2020) (3) Barner, Jim. 2007. Propagation protocol for production of Propagules (seeds, cuttings, poles, etc.) *Perideridia oregana* (S. Wats.) Mathias seeds USDA FS - R6 Bend Seed Extractory Bend, Oregon. In: Native Plant Network. URL: http://NativePlantNetwork.org (accessed 20 May 2020). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources. (4) *Perideridia Oregana S. Wats*. https://www.dnr.wa.gov/publications/amp_nh_perore.pdf. (accessed 20 May 2020) (5) Morse, Kleir. "Perideridia Oregana." *Calflora*, https://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=6253. (accessed 20 May 2020). (6) Morse, Kleir. "Oregon Yampah." *Natural History Museum of Utah*, nhmu.utah.edu/native-plants/plant/Oregon yampah. (accessed 20 May 2020). (7) Carr, G D. *Oregon Flora Image Project*, University of Hawaii, http://www.botany.hawaii.edu/faculty/carr/ofp/per_ore.htm. (accessed 20 May 2020) (8) "BLM OR014." *Seeds of Success*, Bureau of Land Management's Klamath Falls Resource Area, Oregon , https://seedsofsuccess.smugmug.com/Bureau-of-Land-Management/OR014/i-fpRk78q. (accessed 20 May 2020) (9) "Oregon Yampah." *Heritage Seeds*, http://www.heritageseedlings.com/page_824_52/perideridia-oregana. (accessed 20 May 2020) (10) "Oak Woodlands." *Off-Highway Motor Vehicle Recreation*, California State Parks, https://ohv.parks.ca.gov/?page_id=25604. (11) United States Department of Agriculture, Natural Resource Conservation Status, *Perideridia oregana* (S. Watson) Mathias https://plants.usda.gov/core/profile?symbol=PEOR6

Other Sources Consulted	Michael Russell "Dormancy and Germination Pre-Treatments in Willamette Valley Native Plants," Northwest Science, 85(2), 389-402, (1 July 2011) (accessed 20 May 2020
Protocol Author	Cheyenne Jobe
Date Protocol Created or Updated	05/20/20

Cheyenne Jobe

ESRM 412

June 3, 2020

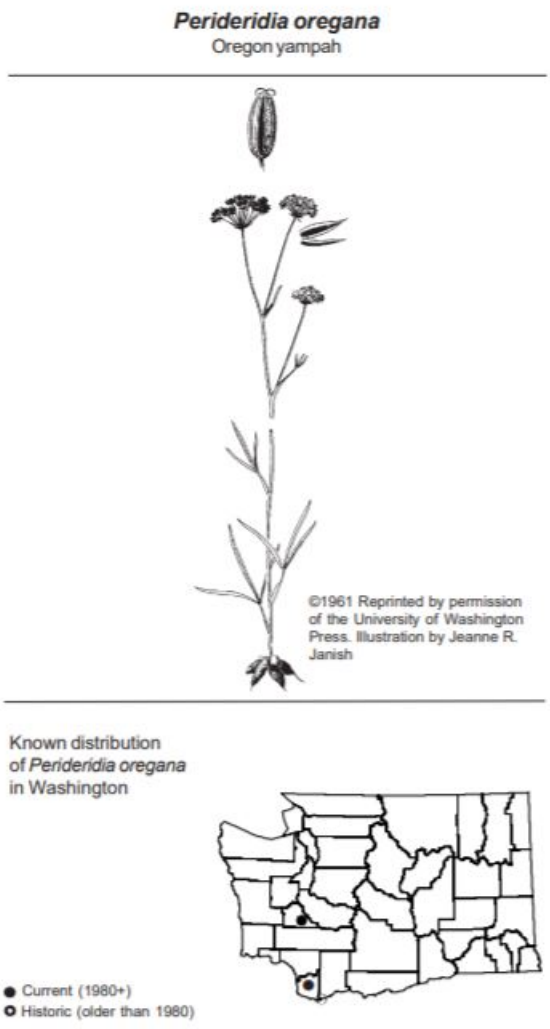
Protocol 2 Revision Statement

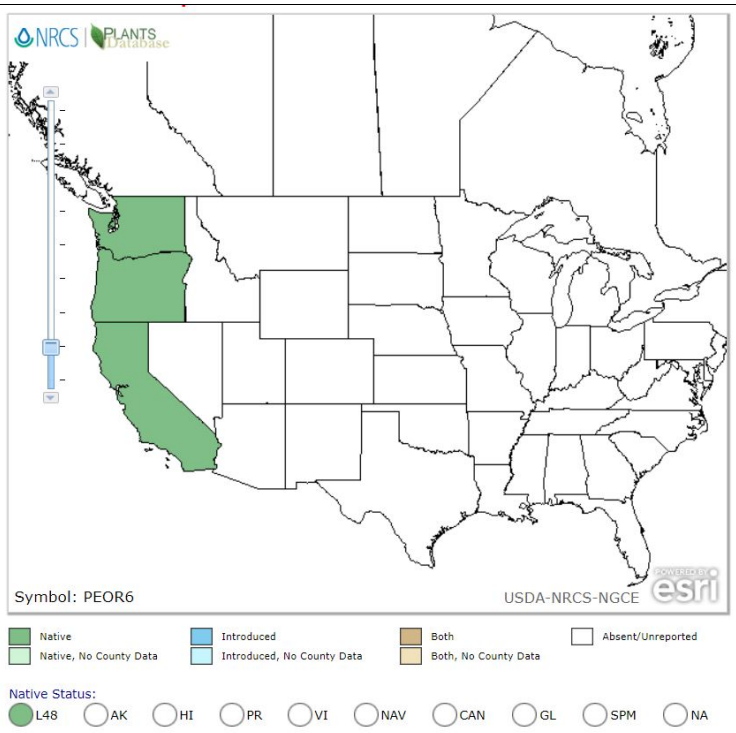
In editing my 2nd protocol, I have…

- Removed the brackets from the heading
- Italicized the scientific name
- Removed the word “trimordial” from the “Plant Characteristics” section, as that was from my source and I’m unsure what it means
- Added some notes in the “Other Comments” section about propagating vegitatively (there is not enough info to include a whole other propagation section, but I added as much detail as I could find)

Plant Propagation Protocol for *Perideridia oregano* (S. Wats.) Mathias (3)
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/PEOR6.*pdf*
Updated by author: June 3, 2020

TAXONOMY	
Plant Family	
Scientific Name	Apiaceae (1)
Common Name	Carrot family (1)
Species Scientific Name	
Scientific Name	*Perideridia oregano* (S. Wats.) Mathias (3)
Varieties	N/A
Sub-species	N/A
Cultivar	N/A
Common Synonym(s)	*P. leptocarpa* might be a tetraploid of *Perideridia oregano* and might become synonymous in the future. (2)
Common Name(s)	Oregon yampah (1), Eppaw (2) *Ipos (2), Indian potato (2), Indian carrot (2), Wild carrot (2), False caraway (2), Wild caraway (2), Squaw root (2) *these 7 are common names for Yampah in general, not specifically Oregon yampah, but Oregon yampah is part of 6 species for which there is historical evidence of indigenous peoples eating and using the root Utah Northern Paiute Area: yampah (Couture et al 1986); yapa (Couture et al. 1986); payapa (Couture et al. 1986); suiyapa (Couture et al. 1986); yapa (Fowler 1989); kazu (Fowler 1989); yapah (Fowler 1989); ya'pa' (Kelly 1932) (6) Utah Pit River Area: pEtsku (Garth 1953); paha (Kniffen 1928) (6) Utah Klamath Area: E'-pâ (Coville 1897) (6)
Species Code (as per USDA Plants database)	PEOR6 (1)
GENERAL INFORMATION	

Geographical range	 (4) Found from SW Washington (Thurston, Clark, and Skamania counties) to central California. (4) According to reports from early settlers, *Perideridia oregano* once grew abundantly in Oregon's Willamette Valley, but is now rare besides in the mountains. (2)

	 (11)
Ecological distribution	Occurs in balds, moist-dry meadows, prairies, and oak woodlands. (4)  Photo of an oak woodland in California. (10)
Climate and elevation range	In Washington, this species has been found at an elevation of 380 feet (100 m). (4) More broadly, it can be found at elevations between 60-2100 m. (6)
Local habitat and abundance	Associated species found in Thurston County include Oregon white oak (Quercus garryana), common snowberry (Symphoricarpos albus), western buttercup (Ranunculus occidentalis), Virginia strawberry (Fragaria virginiana), common yarrow (Achillea millefolium), and long-stolon sedge (Carex inops). In Clark County,

	associated species include Roemer's fescue (Festuca roemeri), white brodiaea (Triteleia hyacinthina), common camas (Camassia quamash), California danthonia (Danthonia californica), silver hairgrass (Aira caryophyllea), and rosy plectritis (Plectritis congesta). (4) This species has recently been added to the Washington state rare plant list and has only been documented through five occurrences. It is associated with endangered ecosystems in western Washington like balds and prairies. Development and agriculture that threatens these ecosystems also threatens *Perideridia oregano.* (4)
Plant strategy type / successional stage	Unknown
Plant characteristics	Adapted from Hickman (1993) and Chuang (1969): Perideridia oregana is a slender perennial 4 to 36 in. (1-9 dm) tall, and shining green to waxy. The plant arises from a cluster of 2-6 spindle-shaped to spherical, chestnut-brown, tuberous roots. The basal leaf petiole is ¾ to 4 in. (2-10 cm) long and sheathing to the middle or throughout. The basal leaves are triangular to ovate, 1 to 12 in. (3-30 cm) long, and 1 ½ to 5 ½ in. (4-14 cm) broad, and are pinnately dissected with each leaflet further dissected into 3 narrow segments. The ultimate segments are 3/16 to 2 3/8 in. (0.5-6 cm) long and up to ¼ in. (0.5-6 mm) broad. The stem leaves are dissected like a simple feather or with 2-parted leaflets. The inflorescence is convex or sometimes flattened with slender peduncles 1 to 8 in. (3-20 cm) long. There are 1 to 29 unequal rays of flower clusters that are 1 to 1 ½ in (2.5-4 cm) long. The flower clusters have 10 to 29 flowers with toothed leafy bracts beneath. The white petals are rounded, about 1/16 in. (1-1.5 mm) long and broad, and have a single vein. The fruit is oblong, 1/8 to ¼ in. (3-6 mm) long, about 1/16 in. (1.5-2 mm) broad, and has threadlike ribs. (4) This diploid species forms 2-6 fascicled storage roots that are typically an inch or less long, which can either be eaten or replanted. (2) (6) Blooms from July-August. (6) *Perideridia* spp. storage starch granules range from 3-33 microns with an average size of 11 microns. Heteromorphic shape distribution; diads, triads and fours common. Many grains have central fissures, with 'Y' and 'X' markings most common. Irregular reniform grains have mesial longitudinal clefts. Cross is bright with symmetrical to wavy arms of a thin to medium thickness. (6)

(5)

(6)

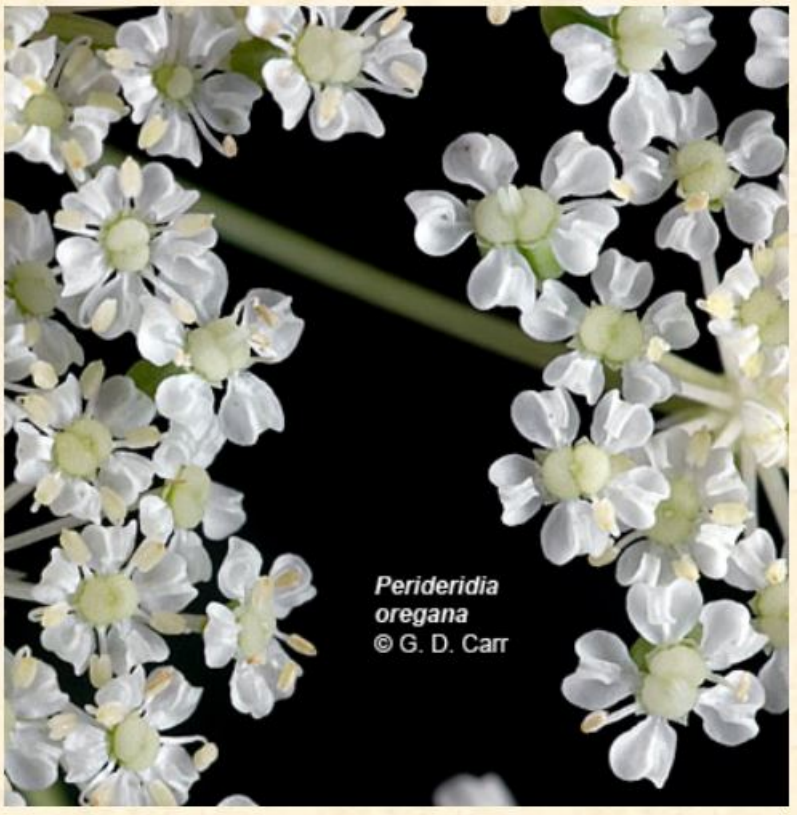
Jackson-Frazier Wetlands, Corvallis, Benton Co., OR, 8/15/2006

(7)

Jackson-Frazier Wetlands, Corvallis, Benton Co., OR, 8/15/2006

(7)

Jackson-Frazier Wetlands, Corvallis, Benton Co., OR, 8/15/2006



(7)

(8)

	 (8)  (9)

PROPAGATION DETAILS	
Ecotype	For the USDA NRCS protocol for Corvallis Plant Materials Center, seeds were collected from Lane Co, OR (1)
Propagation Goal	Plants (1)
Propagation Method	Seed (1)
Product Type	Container (plug) (1)
Stock Type	Unknown
Time to Grow	Unknown
Target Specifications	Unknown

Propagule Collection Instructions	Use a paper bag to cover maturing umbels while seeds mature and dry, in order to maximize the amount of large seeds available for harvest. (2) Hand collect into paper bag. Clean using Laboratory Test Sieves and air-screening using an office Clipper with no screens on medium speed with medium air. (3)
Propagule Processing/Propagule Characteristics	Seeds are not known to last in storage very long; in the second year after they've been collected, germination tends to be extremely sparse. (2) The larger the seed, the more viable it is; seeds should be left to mature on the plant as long as possible. (2)
Pre-Planting Propagule Treatments	For the USDA NRCS protocol for Corvallis Plant Materials Center, trials using no cold-moist stratification and 45 days of cold-moist stratification yielded little to no germination. The ideal pre-planting treatment was found to be 90 days of cold-moist stratification. (1) *Perideridia oregano* has morpho-physiological dormancy. You can either sow the seeds directly outdoors as long as winter temperatures are around 40 degrees F or below, or use 3 months (approximately 90 days) of cold-moist stratification. The seedlings do not grow well indoors. (2) For cold-moist stratification, mix seeds with about 1-2" of moist soil in a plastic bag and refrigerate. The best time to start the stratification process is in April, so that after 3 months, the temperatures are around 60-70 degrees F. This will vary depending on climate, so plan accordingly, aiming for mildly warm temperatures after 3 months. (2) Using potassium nitrate, ethephon, or 0.03mM (about 1 g/L) of gibberellic acid can aid in germination, with the gibberellic acid being the best of the three. (2)
Growing Area Preparation / Annual Practices for Perennial Crops	Sow seeds directly into cone-tainers filled with a soil-less peat-based media called Sunshine#1, amended with Micromax for micro-nutrients and Osmocote 14-14-14 as a slow-release fertilizer. (1) 10" cone-tainers are best. (2)
Establishment Phase Details	Cover flats of cone-tainers with poly-ethylene bags and place in a cooler (35-40 degrees F) for 90 days. (1)
Length of Establishment Phase	1-2 weeks after being removed from cooler, 80% of the seeds should have germinated. The total length of the establishment phase will be 97-114 days. (1)

Active Growth Phase	Seedlings don't require much space. Use a drip system to keep the soil consistently moist, but never over saturated. Grow in full sun and avoid fertilizing or having an abundance of organic matter in the soil. (2)
Length of Active Growth Phase	In 3 months, *Perideridia oregano* goes from seedling to a first year storage root. It has a short growing season and is done growing for the year by the middle of summer. But, regular watering might extend the active growing phase. (2)
Hardening Phase	When seedling develops a first year storage root, refrigerate for 2 months. Then, place outdoors or in a greenhouse for them to continue growing. Withhold water after 3-4 months to induce dormancy. (2)
Length of Hardening Phase	Unknown
Harvesting, Storage and Shipping	Transplant when plants are dormant in fall or early winter, but avoid transplanting during the active growth phase because of high mortality rates. (2) Store at 33-38 degrees F. (3) In 3 years, you can produce a harvestable root when growing from seed. (2)
Length of Storage	Unknown
Guidelines for Outplanting / Performance on Typical Sites	If plants are outplanted during winter, they will most likely have a high survival rate and will flower the following year. But, it is not uncommon for plants to take two years after outplanting to flower. (2)
Other Comments	Growing *Perideridia oregano* from seed is more difficult than vegetatively. If you're planning on breeding or propagating, choosing the plants that grow rootlets (not all of them will) will ensure a sustainable endeavor, as you can cut the rootlets off the main root and replant. There is not much information available about the processes, but do not keep your rootlets out of the ground for long, and replant immediately. (2)
INFORMATION SOURCES	

References	(1) Bartow, Amy L. 2002. Propagation protocol for production of container Perideridia oregana plants; Corvallis Plant Materials Center, Corvallis, Oregon. In: Native Plant Network. URL: http://www.nativeplantnetwork.org (accessed 20 May 2020). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery. (2) Whitson , William. "Growing Yampah." *Cultivariable*, 12 Sept. 2018, www.cultivariable.com/instructions/root-crops/how-to-grow-yampah/#care. (accessed 20 May 2020) (3) Barner, Jim. 2007. Propagation protocol for production of Propagules (seeds, cuttings, poles, etc.) *Perideridia oregana* (S. Wats.) Mathias seeds USDA FS - R6 Bend Seed Extractory Bend, Oregon. In: Native Plant Network. URL: http://NativePlantNetwork.org (accessed 20 May 2020). US Department of Agriculture, Forest Service, National Center for Reforestation, Nurseries, and Genetic Resources. (4) *Perideridia Oregana S. Wats*. https://www.dnr.wa.gov/publications/amp_nh_perore.pdf. (accessed 20 May 2020) (5) Morse, Kleir. "Perideridia Oregana." *Calflora*, https://www.calflora.org/cgi-bin/species_query.cgi?where-calrecnum=6253. (accessed 20 May 2020). (6) Morse, Kleir. "Oregon Yampah." *Natural History Museum of Utah*, nhmu.utah.edu/native-plants/plant/Oregon yampah. (accessed 20 May 2020). (7) Carr, G D. *Oregon Flora Image Project*, University of Hawaii, http://www.botany.hawaii.edu/faculty/carr/ofp/per_ore.htm. (accessed 20 May 2020) (8) "BLM OR014." *Seeds of Success*, Bureau of Land Management's Klamath Falls Resource Area, Oregon , https://seedsofsuccess.smugmug.com/Bureau-of-Land-Management/OR014/i-fpRk78q. (accessed 20 May 2020) (9) "Oregon Yampah." *Heritage Seeds*, http://www.heritageseedlings.com/page_824_52/perideridia-oregana. (accessed 20 May 2020) (10) "Oak Woodlands." *Off-Highway Motor Vehicle Recreation*, California State Parks, https://ohv.parks.ca.gov/?page_id=25604. (11) United States Department of Agriculture, Natural Resource Conservation Status, *Perideridia oregana* (S. Watson) Mathias https://plants.usda.gov/core/profile?symbol=PEOR6

Other Sources Consulted	Michael Russell "Dormancy and Germination Pre-Treatments in Willamette Valley Native Plants," Northwest Science, 85(2), 389-402, (1 July 2011) (accessed 20 May 2020
Protocol Author	Cheyenne Jobe
Date Protocol Created or Updated	05/20/20