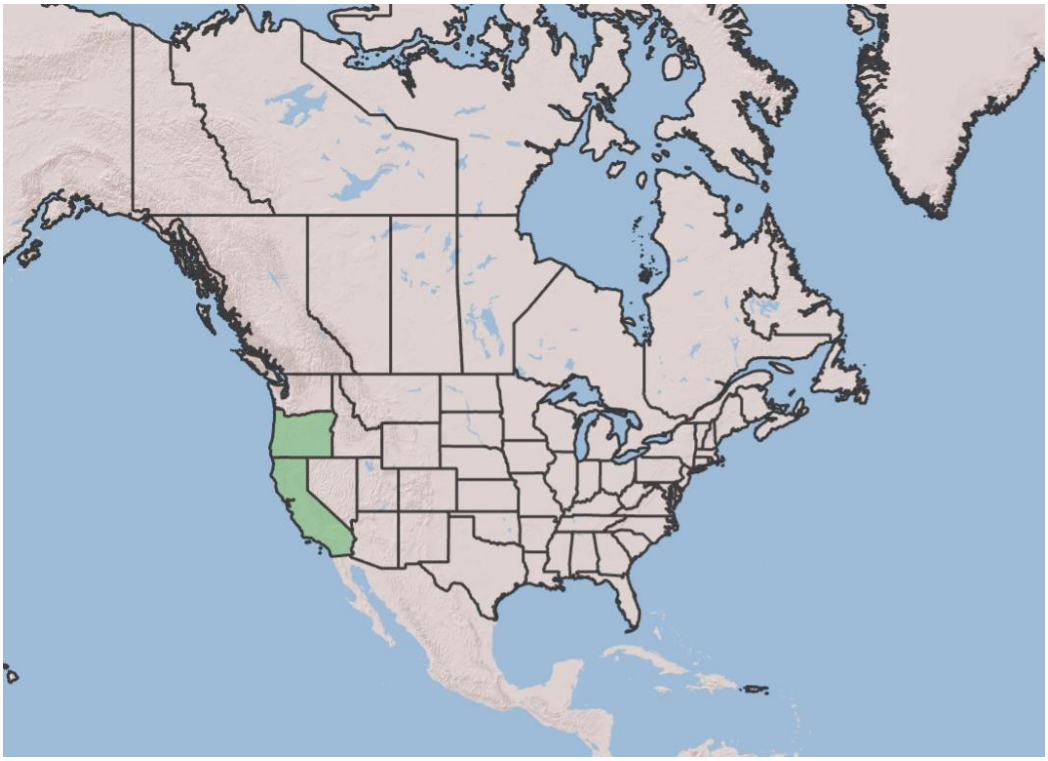
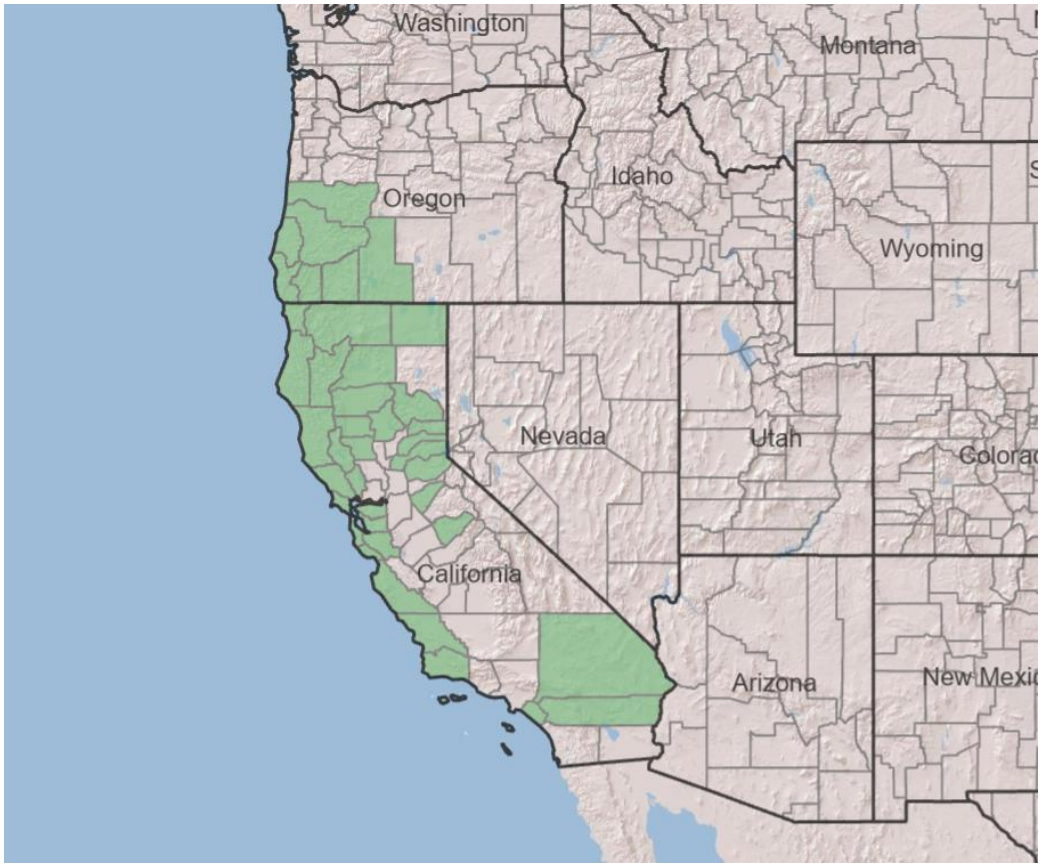
Plant Propagation Protocol for *Pinus attenuata*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/2023/PIAT.pdf

Pinus attenuata cones (photo credit: C. J. Earle)



North American distribution (USDA)



Pacific Northwest distribution (USDA)

TAXONOMY	
Plant Family	
Scientific Name	Pinaceae
Common Name	Pine family
Species Scientific Name	
Scientific Name	*Pinus attenuata* Lemmon
Varieties	None
Sub-species	None
Cultivar	N/A
Common Synonym(s)	*Pinus tuberculata* Gordon 1849, *P. tuberculata* var. *acuta* Mayr[2]
Common Name(s)	Knobcob pine
Species Code (as per USDA Plants database)	PIAT
GENERAL INFORMATION	
Geographical range	Oregon and California, with some populations extending into Baja California. Klamath, Cascade, and Coast ranges, and Sierra Nevada.[3] Distribution is patchier in southern parts of range. See above maps.
Ecological distribution	Occurs in chaparral environments with fire disturbance, dry slopes[2], in Douglas-fir, Ponderosa pine, mixed evergreen woodlands, oak woodlands at lower elevations. Occurs in single-aged stands that establish after fire.[3]
Climate and elevation range	Sea level to 1700 m.[3]
Local habitat and abundance	Found on well-drained, moist, gravelly to sandy soil and other low-nutrient substrates with high concentrations of heavy metals, usually of volcanic origin, especially serpentine soils.[3] Associates with other conifer species including *Sequoia sempervirens* in Redwood National Park.[2] Also Pacific madrone (*Arbutus menziesii*) and oak species including *quercus chrysolepis* and *quercus wislizeni*.[5] Hybridizes with Monterey pine (*Pinus radiata*) where ranges overlap to produce *P.* × *attenuradiata*.[1]
Plant strategy type / successional stage	Post-fire colonizer
Plant characteristics	Tree up to 24 m tall or shrub on very poor sites. Relatively short lifespan of 75-100 years.[7] Straight trunk and conical crown. Brown to dark gray bark, smooth when young then later shallowly fissured with scaly plates. Three 9-15 cm long and 1.3-1.8 mm wide evergreen needles per fascicle, persisting 4-5 years.[2,3] Serotinous seed-bearing cones are opened by fire and usually do not open independently unlike other closed-cone species[3], sometimes remaining on the tree for decades and becoming enclosed by the branch or trunk.[4] Cones woody and asymmetric with knob-like projections on scales[3], usually growing in whorls of 4-5 around the branch. Shade intolerant.[3]

PROPAGATION DETAILS	
Propagation for Seeds (Kirk & Coggeshall)	
Ecotype	N/A
Propagation Goal	Seed
Propagation Method	Seed
Product Type	Seed
Stock Type	D40 210A Sp
Time to Grow	5-8 years
Target Specifications	Able to produce seed (typically 5-8 years)[9]
Propagule Collection Instructions	Collect mature cones and extract seeds. Seeds mature 16-18 months after pollination, but additional maturation on the tree can facilitate seed extraction.[9]
Propagule Processing/Propagule Characteristics	2-3 seeds per cell.[8]
Pre-Planting Propagule Treatments	Cones can be induced to open by placing them in a 120 °C kiln for 48 hours [9] or keeping them in a warm environment for a few weeks.[6] Seeds should be rehydrated by soaking in aerated water for 48 hours before being placed in plastic bags with damp sphagnum moss and stratified at 35 °C.[8] Seeds collected from the southern part of the species' range may require stratification for less than 3 weeks, while seeds of northern origin require a longer stratification period. Stratifying all seeds for 60 days is recommended.[9] Spraying the contents of bags with fungicide may be necessary to prevent fungal growth during stratification.[8]
Growing Area Preparation / Annual Practices for Perennial Crops	For germination use a media of composted pine bark, medium grade vermiculite, sphagnum peat moss, horticulture perlite, fertilizer, and wetting agent. Amend with slow-release fertilizer such as Osmocote and micronutrients. Deepot cells (D40) will provide adequate room for seedling growth for the first few years, after which trees will likely need to be moved to larger containers or planted in the field. Mulch with crushed granite and mist with fungicide after sowing seeds.[8]
Establishment Phase Details	None
Length of Establishment Phase	About 14 days.[8]
Active Growth Phase	No information available.
Length of Active Growth Phase	No information available.
Hardening Phase	No information available.
Length of Hardening Phase	No information available.
Harvesting, Storage and Shipping	No information available.
Length of Storage	No information available.

Guidelines for Outplanting / Performance on Typical Sites	N/A
Other Comments	None
PROPAGATION DETAILS	
Propagation of Bareroot Plants	
Ecotype	N/A
Propagation Goal	Bareroot
Propagation Method	Seed
Product Type	Bareroot
Stock Type	BBR 1+0
Time to Grow	1 year[9]
Target Specifications	Mature root system
Propagule Collection Instructions	Collect mature cones and extract seeds. Seeds mature 16-18 months after pollination, but additional maturation on the tree can facilitate seed extraction.[9]
Propagule Processing/Propagule Characteristics	Sow seeds 3/8" deep at a density of 25 per square ft in spring[9]
Pre-Planting Propagule Treatments	Cones can be induced to open by placing them in a 120 C kiln for 48 hours [9] or keeping them in a warm environment for a few weeks.[6] Seeds should be rehydrated by soaking in aerated water for 48 hours before being placed in plastic bags with damp sphagnum moss and stratified for at 35 C.[8] 60 days is the recommended stratification period for seeds of this species.[9]
Growing Area Preparation / Annual Practices for Perennial Crops	Treat soil in growing area for diseases, pests, and weed seeds.[9]
Establishment Phase Details	None
Length of Establishment Phase	About 14 days.[8]
Active Growth Phase	No information available.
Length of Active Growth Phase	No information available.
Hardening Phase	No information available.
Length of Hardening Phase	No information available.
Harvesting, Storage and Shipping	No information available.
Length of Storage	No information available.
Guidelines for Outplanting /	Trees grown from seeds collected in northern parts of range may be more frost-tolerant than those from southern areas.[9]

Performance on Typical Sites	
Other Comments	None
INFORMATION SOURCES	
References	See below
Other Sources Consulted	*Knobcone Pine, Pinus attenuata*. (n.d.). https://calscape.org/Pinus-attenuata-() Trees Foundation. (2020). Knobcone Pine. *Trees Foundation*. https://treesfoundation.org/2020/11/knobcone-pine/ *Factsheet - Pinus attenuata*. (n.d.). https://nzfri.scionresearch.com/Content/Projects/nzfri/keys/cultivated-pines/key/cultivated_pines/Media/Html/Pinus_attenuata.htm *Pinus attenuata in Flora of North America @ efloras.org*. (n.d.). http://www.efloras.org/florataxon.aspx?flora_id=1&taxon_id=233500923 *Pinus attenuata / knobcone pine	Conifer Species	American Conifer Society*. (n.d.). American Conifer Society. https://conifersociety.org/conifers/pinus-attenuata/
Protocol Author	Milena Matthews
Date Protocol Created or Updated	05/24/23

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[1]Howard, Janet L. 1992. *Pinus attenuata*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). https://www.fs.usda.gov/database/feis/plants/tree/pinatt/all.html [Accessed May 23, 2023].

[2] Earle, C. J. (Ed.). (2023, February 26). *Pinus attenuata*. The Gymnosperm Database. https://www.conifers.org/pi/Pinus_attenuata.php [Accessed May 23, 2023]

[3]*Pinus attenuata* | Landscape Plants | Oregon State University. (2023). https://landscapeplants.oregonstate.edu/plants/pinus-attenuata [Accessed May 23, 2023]

[4]*Pinus attenuata - Trees and Shrubs Online*. (n.d.). https://www.treesandshrubsonline.org/articles/pinus/pinus-attenuata/ [Accessed May 23, 2023]

[5]*CNPS Alliance: Pinus attenuata*. (n.d.). https://vegetation.cnps.org/alliance/46 [Accessed May 24, 2023]

[6]*Pinus attenuata*. (2022, September 23). Lady Bird Johnson Wildflower Center. https://www.wildflower.org/plants/result.php?id_plant=piat [Accessed May 24, 2023]

[7]Griffith, L. L. G. (2020, November 5). *Knobcob Pine*. ANR Blogs. https://ucanr.edu/blogs/blogcore/postdetail.cfm?postnum=44122 [Accessed May 24, 2023]

[8]Coggeshall, M. V., & Kirk, S. D. (2001). Small Batch Seed Propagation of Various Pinus Species. In *Combined Proceedings International Plant Propagators' Society* (Vol. 52). http://admin.ipps.org/uploads/52_87.pdf

[9]Forest Service & United States Department of Agriculture. (1974). *Seeds of Woody Plants in the United States* [Book]. https://archive.org/details/seedsofwoodyplan00fore/page/n10/mode/1up

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Trees Foundation. (2020). Knobcone Pine. *Trees Foundation*. https://treesfoundation.org/2020/11/knobcone-pine/

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