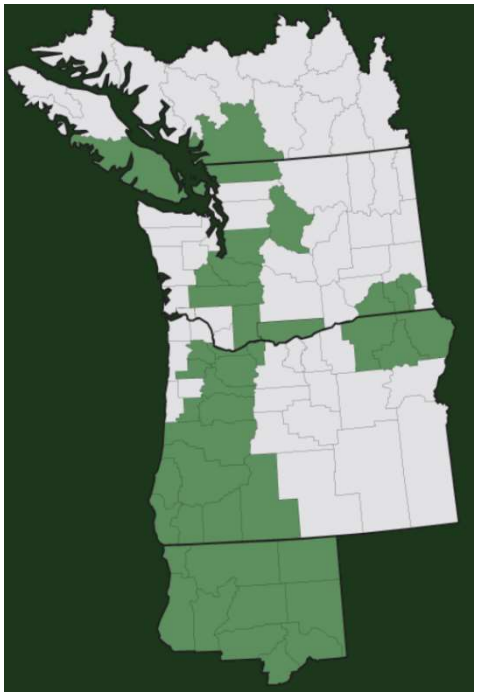
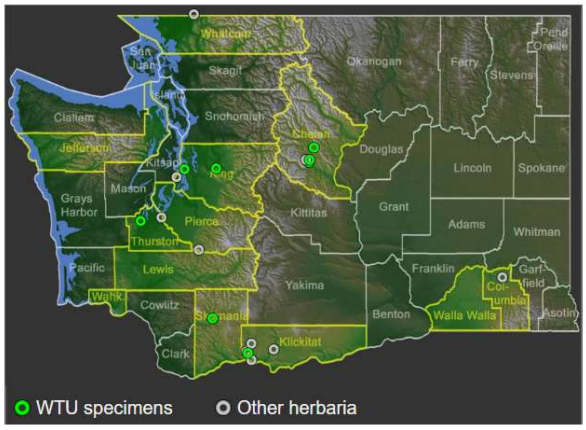
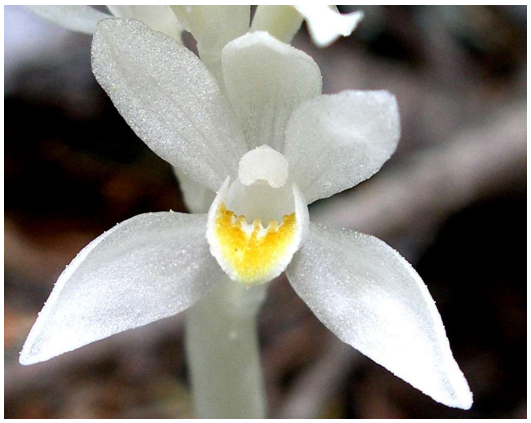
Plant Propagation Protocol for *Cephalanthera austiniae*
ESRM 412 – Native Plant Production
Protocol URL: https://courses.washington.edu/esrm412/protocols/CEAU.pdf

TAXONOMY	
Plant Family	
Scientific Name	Orchidaceae[1]
Common Name	Orchid[1]
Species Scientific Name	
Scientific Name	*Cephalanthera austiniae*[1]
Varieties	n/a
Sub-species	n/a
Cultivar	n/a
Common Synonym(s)	*Eburophyton austiniae*[1], *Chloraea austiniae*[3], *Epipactis austiniae*[3]
Common Name(s)	Phantom orchid, snow orchid[3]
Species Code (as per USDA Plants database)	CEAU[1]
GENERAL INFORMATION	
Geographical range	Can be found from California to British Colombia [8]  *Source 8*  *Source 2* *WTU Specimens sourced through WTU Burke Herbarium
Ecological distribution	Dense, moist, usually coniferous woods.[3] Grows in the shade (since it's non-photosynthetic) in moist, humus enriched soils.[3] Only occurs where there is an abundance of mycorrhizae fungi, which occur in conjunction with specific species of trees (see below).[5]

Climate and elevation range	Moist maritime climate. 0-2200 m in elevation.
Local habitat and abundance	Abundance: Status in the USA- Rare Status in Canada- Endangered *Suitable habitat, (which must include the associated fungus and associated host tree) is isolated, occurring in islands separated by large distances, or by large expanses of altered habitat destroyed by urban development.[5] Key Attributes of Phantom Orchid Habitat: Can grow in mature forests (60-140 years), old forest (>140 years), and older second growth forests (50-60 years).[4] Stand will be dominated by Douglas-fir, Bigleaf Maple, Western Hemlock, Western Redcedar, and/or Paper Birch.[4] There will be sparse ground cover with well-developed leaf litter layer.[4] The soils will have a pH >5, and a high availability of calcium and potassium.[4] Commonly found near *Monotropa uniflora* (Indian-Pipe), which is another non-photosynthetic native flower.[7]
Plant strategy type / successional stage	Since *Cephalanthera* is typically found in deep coniferous or deciduous forests, one can infer that this orchid is a late successional plant owing to the fact that well established mycorrhizae fungi are found in old growth forest
Plant characteristics	Cephalanthera austiniae is an extremely rare, epiparasitic orchid found in moist, coniferous forests.[4] This perennial orchid is aptly named "phantom orchid" or "snow orchid" for its pure white coloration. They are white, leafless plants that grow to a height of 20-50 cm. and turn brown or yellow with aging.[2] *Cephalanthera austiniae* is mycoheterotrophic.[2] This means the orchid lacks chlorophyll for photosynthesis and the plant relies solely on mycorrhizae fungi for food.[5] The flowering stems have 5-20 vanilla scented white flowers, each with a yellow gland on the lower lip.[6] These flowers have zygomorphic symmetry.[9] The root structure consists of small roots and an extensive underground rhizome structure.[9] Rarely after flowering, dry, seed-bearing capsules can form.[6] Note: flowers indicate the presence of the orchid, they do not reflect the full extent of the below-ground plants.[4]

Source 10



Source 10

PROPAGATION DETAILS	
Ecotype	n/a
Propagation Goal	Seeds and possibly (but highly unlikely) plants from tissue culture.
Propagation Method	Eventually seed or tissue culture. Not currently able to be propagated manually or artificially. Hand-pollinated plants have been reported to produce capsules and seeds, but viability of the seeds produced is unknown.[5]
Product Type	n/a
Stock Type	n/a
Time to Grow	Unknown. Plant has extensive underground rhizome structure and can remain dormant for up to 17 years.[6] No studies have been, or currently could be, done to see how long it takes for seed to develop to sprout. Because of unique growing conditions, most likely cannot be transported once established.
Target Specifications	n/a
Propagule Collection Instructions	Capsule production and seed dispersal rarely occur. When it does occur, seed dispersal happens between the beginning of August to mid-November.[6] Hypothetically, you'd allow seeds to ripen and dry on flowers, making sure to collect the pod before it splits open and scatters the seeds. However, even this is a

	risky procedure because these orchids are difficult to find, and it's encouraged to leave them alone due to their rarity/endangered status.[4]
Propagule Processing/Propagule Characteristics	When it seeds, Cephalanthera species produce large numbers of very tiny seeds that are dispersed by wind, generally with short dispersal distances (i.e. less than 6 m).[5] Very few of the flowering stems produce capsules or mature seed.[5] Believed to be able to self-pollinate (due to isolation and the fact that other orchids in the same family utilize self-pollination) and can also be pollinated by sweat bees (after the bee comes in contact with a sticky substance produced by the stigma) Cross pollination is achieved when this pollen is transferred to the stigma of the next flower it visits.[5] (Pollination by bees has been observed in California)
Pre-Planting Propagule Treatments	n/a
Growing Area Preparation / Annual Practices for Perennial Crops	Theoretically, you'd have to manipulate growing conditions to mimic the root structure and soil acidity ideal for mycorrhizae fungi to create the three-way symbiotic relationship necessary for growing *Cephalanthera austiniae.* The containers would need to be very large, as *Cephalanthera austiniae* creates an extensive underground rhizome structure.[6]
Establishment Phase Details	Unknown
Length of Establishment Phase	Unknown
Active Growth Phase	Unknown
Length of Active Growth Phase	When *Cephalanthera* flowers, the visible part of the plant is present from May to mid-November.[6] It is unknown if the rhizome structure continues to grow underground during the dormancy period.
Hardening Phase	Unknown
Length of Hardening Phase	Unknown
Harvesting, Storage and Shipping	*Cephalanthera austiniae* is impossible to harvest, store, or ship with current technology.[6] The phantom orchid relies on its delicate balance between healthy mycorrhizal fungi and healthy trees of specific species.[5] This is further challenged by the rarity of the species. Because of these issues, these orchids are difficult to study, and impossible to transport without killing.[6]
Length of Storage	Seeds have no endosperm and are short-lived. If possible, sow directly while they're fresh and viable.
Guidelines for Outplanting / Performance on Typical Sites	n/a
Other Comments	*Cephalanthera austiniae* is very rare, due to destruction of habitat, isolation of populations, and unique growing conditions.[4] Endangered and protected in Canada.[4] Collecting seeds is difficult because the plant can remain dormant for up to 17 years, and when it does flower, it rarely seeds.[6] This is further confounded by the difficulty of finding wild *Cephalanthera austiniae* to collect seed from, and that it's frowned upon, if not illegal, to interact with the plant.[5] Due to the extensive rhizome

	structure, individual stems (when seen) may be part of the same plant, so the number of individuals is unknown.[5]
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