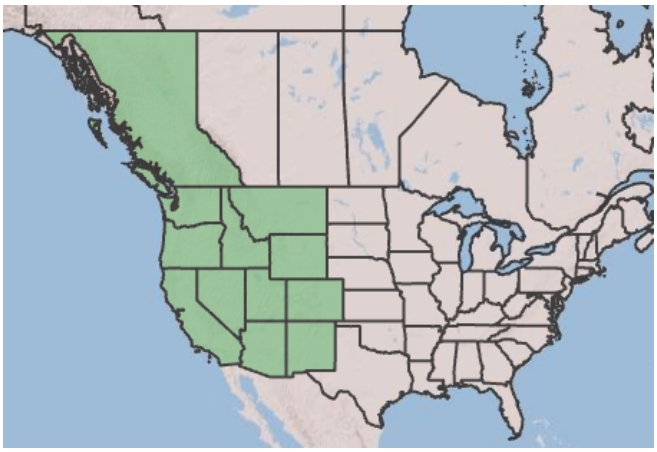
Plant Propagation Protocol for *Salix geyeriana*
ESRM 412 – Native Plant Production
URL: https://courses.washington.edu/esrm412/protocols/*2022/SAGE2.pdf*
Spring 2022

North America Distribution



Washington State Distribution

Source: USDA Plants Database, accessed May 2, 2022[10]

TAXONOMY	
Plant Family	
Scientific Name	*Salicaceae*
Common Name	Willow Family
Species Scientific Name	
Scientific Name	*Salix geyeriana* Andersson
Varieties	NA
Sub-species	NA
Cultivar	NA
Common Synonym(s)	*Salix geyeriana* Andersson var. *argentea* (Bebb) C.K. Schneid. *Salix geyeriana* Andersson ssp. *argentea* (Bebb) A.E. Murray *Salix geyeriana* Andersson var. *meleina* J.K. Henry *Salix meleina* (J.K. Henry) G.N. Jones *Salix macrocarpa* Nutt. *Salix macrocarpa* Nutt. var. *argentea* Bebb
Common Name(s)	Geyer willow, Silver willow, Geyer's willow
Species Code (as per USDA Plants database)	SAGE2
GENERAL INFORMATION	
Geographical range	Distributed throughout western North America, from southern British Columbia to Arizona.[9] See maps above

	for the range of distribution in North America and Washington State.
Ecological distribution	Geyer willow often forms the overstory in open mountain meadows and streams.[9] This species is also found along floodplains and wetlands at low to high mountain elevations.[5]
Climate and elevation range	Grows in wetter areas in montane and subalpine zones.[9] This species prefers a high water table and will rarely grow in areas with a water table lower than 1 meter.[5] This species prefers alluvial soils with a finer texture and a greater predominance of silt and clay.[9] Grows at elevations of 3,100 to 5,900 feet in Oregon.[5] This species does not tolerate shade and requires full sun to grow and reproduce.[9]
Local habitat and abundance	Geyer willow often forms the overstory in open stream and meadow environments.[9] When forming the canopy in more open environments, common associates in the understory are Bebb willow (*Salix bebbiana*), yellow willow (*S. lutea*), Booth willow (*S. boothii*), Baltic Rush (*Juncus balticus*) and Water Sedge (*Carex aquatilis*).[5,9] In somewhat drier sites, Geyer willow helps make up the understory in stands predominating in Engelmann Spruce (*Picea engelmannii*) or Lodgepole Pine (*Pinus contorta*).[5]
Plant strategy type / successional stage	Geyer willow is capable of colonizing fresh alluvium, and will rapidly regrow on sites disturbed by flooding from broken portions of stem embedded in the newly-deposited sediment.[9] After becoming established, this species grows to form the canopy in willow-dominated areas, requiring ample sunlight to reproduce and grow.[9]
Plant characteristics	Large shrub to small tree, growing up to 6 meters (20 feet) tall.[1] Numerous straight stems sprout out of a basal cluster.[1] Branching is alternate, twigs become glaucous as they age.[1] Leaves are long and narrow, with entire or very finely toothed margins; the undersides of leaves turn glaucous as they mature.[1] There is no published information currently available regarding the longevity of Geyer willow, though other *Salix* species usually start to degrade at around 20 to 30 years of age.[7] This species is diecious, with male and female flowers on separate plants.[9] Flowering occurs during May and June in Oregon, with seed dispersal starting in July.[5] Seeds are covered with cottony down, which aids in

	dispersal by wind and water.[9] Geyer willow seeds lose viability within about a week at normal temperatures.[9] If moistened, germination typically occurs within 24 hours.[9]
PROPAGATION DETAILS	
Propagation of Container Willows via Seed as Outlined by Dreesen[2]	
Ecotype	NA
Propagation Goal	Plants
Propagation Method	Seed
Product Type	Container (plug)
Stock Type	1GPT treepots[2]
Time to Grow	1 year+[2, 9]
Target Specifications	Sexually mature (flowering) young trees suitable for planting in an outdoor seed orchard.[2]
Propagule Collection Instructions	For willows in general, seed should be harvested from partially-opened female catkins at the beginning of the seed dispersal season.[2] For Geyer willow, the beginning of the seed dispersal season occurs around July 1st in Oregon[9], meaning that female catkins should be collected at the very end of June if one is working in the Pacific Northwest. Exactly when the female catkins of *Salix geyeriana* open is partially dependent upon local environmental conditions and can vary by region[9], highlighting the importance of closely observing the catkins of any type of willow when seeding season is approaching.[2] Female catkins can be simply plucked or clipped off and placed into a paper bag or other breathable container to avoid molding and decomposition.[2]
Propagule Processing/Propagule Characteristics	If not refrigerated or otherwise stored in special conditions, Geyer willow seeds remain viable for about 1 week.[9] Some *Salix* species have seeds that can be refrigerated and stored long term[6], though the ability for *S. geyeriana* seeds to be stored this way is uncertain. Geyer willows produce an abundance of small, wind-blown seeds[9], though the exact seed density is not specified in the current literature.
Pre-Planting Propagule Treatments	Collected female catkins should first be set out to dry in the paper sacks that they were collected in.[2] As the female catkins dry, they open further and release most of their seeds.[2] This process can be assisted by occasionally stirring or shaking the bag, especially if there are a large number of catkins in the bag.[2] After the female catkins are fully dried, most of the seeds can be poured out into a separate container. To separate the

	remaining seeds from the catkins, one can utilize a set of sediment sieves and a stream of compressed air. Using a set of three sieves, sized top to bottom #60 (250 µm), #35 (500 µm) and #120 (125 µm), one can first place the catkins with the seeds between the #60 and #35 sieves and then blow a stream of compressed air through the top of the stack.[2] The #60 sieve prevents the cotton from blowing all over the place, and the remaining seeds are able to pass through the #35 sieve while the catkins are not. At the end of this process of drying and sieving one should have numerous clean Geyer willow seeds. Geyer willow seeds, like many other willow seeds, do not require stratification and should be planted immediately.[2, 9]
Growing Area Preparation / Annual Practices for Perennial Crops	A germination mix of sphagnum peat moss and perlite with a coarser texture should be used, along with small "mini-plug" containers, though larger containers can be used if extra greenhouse space is available.[2] The seeds should not be buried deep in the medium, as willow seeds contain abundant chlorophyll and require light to germinate. [2, 9]
Establishment Phase Details	After sowing, care should be taken to ensure that the surface of the medium does not dry out. This can be achieved by irrigating the pots with mini-sprinklers attached to the greenhouse benches once a day as described in the literature.[2] Germination usually occurs within 24 hours so long as the seeds remain moist.[2,9]
Length of Establishment Phase	1-7 days (time span between first possible germination and maximum seed viability)[2, 9]
Active Growth Phase	The seedlings are left in their germination containers until their roots are robust enough for transplanting; this typically takes about 3-6 weeks.[2] After the seedlings have a somewhat developed root system, they are transferred to sc-10 cone containers (cone-tainers), and are fertilized with 3-4 month CRF in the case of summer-seeding species like *Salix geyeriana*. Thinning, if necessary, should ideally be done while transferring the seedlings from the mini-pots to the cone-tainers; if this is not possible, thinning can be done later after some growth has occurred in the cone-tainers. [2] Irrigation should continue throughout the active growth phase on a daily basis, with the growing medium remaining moist to promote ideal growth.[2]
Length of Active Growth Phase	Implied to be about 3-4 months, or from mid-summer to early winter, though Dreesen does not specify a set length of active growth.[2]

Hardening Phase	The literature does not lay out any sort of explicit hardening process for willows propagated from seed. After about 3-4 months of growing in the cone-tainers, the willows are transplanted to 1GPT treepots and given another 5 months of CRF to continue their vertical growth and sexual development.[2] One can interpret this as being a form of hardening, though this is not presented as such by Dreesen, nor are measures such as cutting back fertilizer use or irrigation described.[2] The only guidance beyond transplanting and continuing fertilization and irrigation is to outplant after the seedlings reach sexual maturity.[2]
Length of Hardening Phase	Unspecified by Dreesen.[2]
Harvesting, Storage and Shipping	Unspecified by Dreesen.[2]
Length of Storage	Seedlings are immediately outplanted in seed orchards after reaching sexual maturity.[2]
Guidelines for Outplanting / Performance on Typical Sites	Typically it takes about 2 years before *Salix geyeriana* starts flowering if propagated from seed.[9]
Other Comments	This protocol for propagating from seed is largely based off of a general protocol for the genus *Salix*, as protocols for propagating *S. geyeriana* from seed are currently unavailable. Nursery practitioners are advised to take the above information as a broad guide for propagating *S. geyeriana* from seed as opposed to a rigid set of rules, and to experiment to see what works best for their region and individual set of circumstances.
Propagation of Container Willows via Cuttings as Outlined by Dumroese[3, 4]	
Ecotype	Northern Idaho[4]
Propagation Goal	Plants[3, 4]
Propagation Method	Vegetative[3, 4]
Product Type	Container (plug)[4]
Stock Type	336 ml (20.5 cu. in) containers[4]
Time to Grow	18 weeks[4]
Target Specifications	A height of 41 cm, as well as a firm root plug[4]
Propagule Collection Instructions	Willow whips (long, thin stems of willow) should be cut from donor plants in January and early February, while the buds are still dormant.[3] Stems of roughly one year of age, 6 to 10 mm (0.25 to 0.38 in) in diameter are ideal for creating cuttings, though material up 13 mm (0.5 in) can be used, assuming that healthy buds are present.[3, 4] Stems should be cut down near the base of the plant.[3]
Propagule Processing/Propagule Characteristics	Whips should be cut down to 3 inch lengths with two buds each.[3, 4] One bud must be within an inch of the

	distal end of the cutting, while the other bud can be located anywhere along the length of the cutting.[3, 4] Any other buds located below the second have a tendency to either rot away or abort after starting growth.[3, 4]
Pre-Planting Propagule Treatments	Cuttings can be stored for multiple months by sealing them in a plastic bag and refrigerating them.[3] Before striking, cuttings should ideally be soaked for three days under running water.[3, 4]
Growing Area Preparation / Annual Practices for Perennial Crops	A medium of 1 part sphagnum peat moss and 1 part vermiculite should be used, along with 336 ml (20.5 in^3) containers.[3, 4] Containers should be placed in an outdoor hoophouse, with the plants being subject to ambient temperatures.[4]
Establishment Phase Details	Striking is generally done in late May or early June.[4] After striking the cuttings in the medium so that the distal bud is just above the surface of the medium, the medium should be saturated and permitted to drain using an overhead irrigation system.[3, 4] After leaves appear, fertilize using Peters Conifer Starter (7-40-17) to supply 42 ppm N through the irrigation system (fertigation) twice a week.[3, 4] 1.5 ppm B and 24 ppm MgSO4 should also be fertigated twice a week.[3, 4]
Length of Establishment Phase	2 weeks[4]
Active Growth Phase	Fertilize twice a week using Peters Excel Cal-Mag (15-5-15) to supply 114 ppm N.4 Pruning should be undertaken when the willows grow to 20 to 25 cm (or 8 or 10 in) in height, with the target height after pruning being 15 to 20 cm (6 to 8 in).[4] After this initial pruning, the willows should be permitted to grow another 15 cm (6 cm) and then pruned to remove half of the new growth since the last pruning.[4] There should be 3 or 4 prunings throughout the active growth phase, with the last pruning in early september resulting in plants of about 41 cm (or 16 in) in height.[4]
Length of Active Growth Phase	4 weeks[4]
Hardening Phase	For the first 6 weeks of hardening the cuttings should receive 1 dose of Conifer Finisher (4-25-35) to supply 24 ppm N every other week. Then, for the last 6 weeks, Conifer Finisher should be alternated with liquid calcium ammonium nitrate at 77 ppm N every biweekly fertilization. By mid-October, ambient temperature should drop to the point where the willows drop their leaves, after which fertilization should be stopped.[4]
Length of Hardening Phase	12 weeks[4]

Harvesting, Storage and Shipping	After the willows drop their leaves, they can be extracted by hand and sealed bare root inside plastic bags, 5 plants to a bag.[4] These plastic bags can then be deposited in stack-and-nest tote boxes, which can be conveniently stacked inside a cooler.[4] The exact way in which the now-rooted cuttings are stored is less important than keeping them refrigerated and keeping them moist, which is the purpose of the plastic bag.
Length of Storage	4-5 months
Guidelines for Outplanting / Performance on Typical Sites	Dumroese does not include information on outplanting methods or performance.[3, 4]
Other Comments	The protocol above is for *Salix* in general and not *S. geyeriana* specifically. However, Dumroese does describe an early experiment that used *S. geyeriana* where 1 year old micro-cuttings taken from S. geyeriana rooted at a 99%+ rate.[3]
INFORMATION SOURCES	
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Note: This propagation protocol template was modified by J.D. Bakker from that available at: http://www.nativeplantnetwork.org/network/SampleBlankForm.asp