

Plant Propagation Protocol for *SAFR5*
ESRM 412 – Native Plant Production

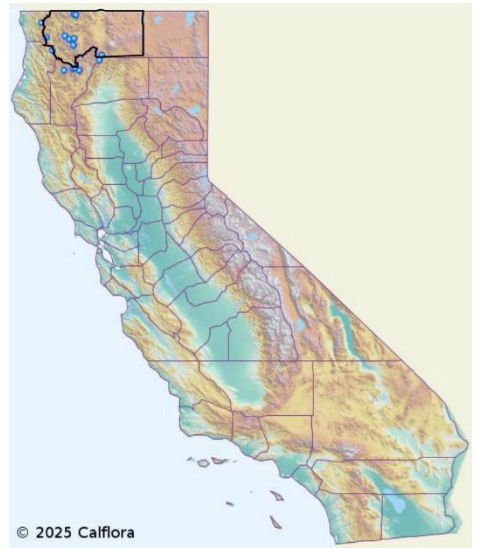
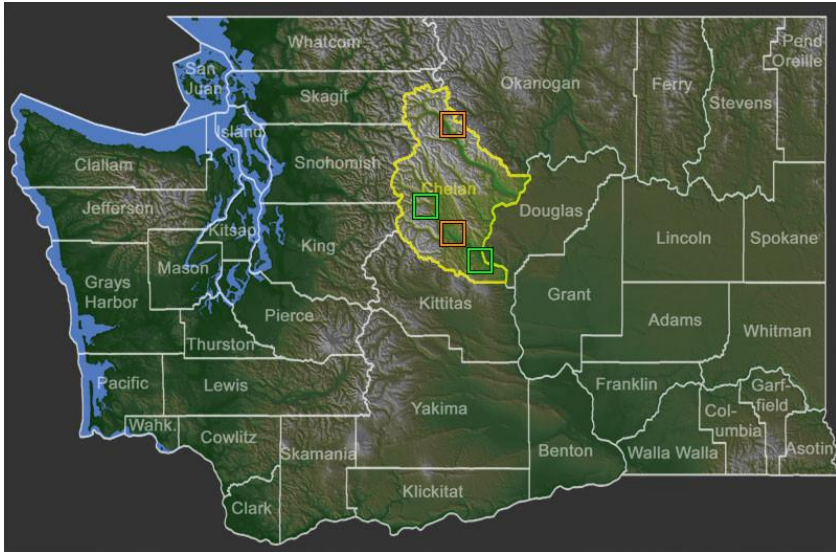

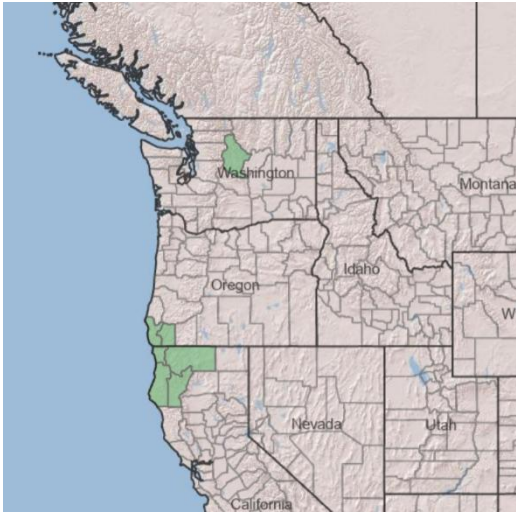

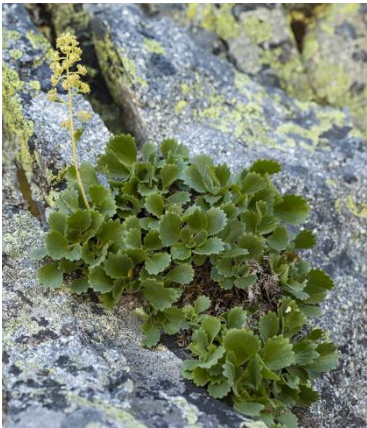


Image Source: WTU Herbarium 2010 (left) and Calflora n.d. (right)

TAXONOMY	
Plant Family	
Scientific Name	<i>SAFR5 - Saxifragopsis fragarioides</i> (Greene) Small Publication: Bull. Torrey Bot. Club. 23: 20. 1896. Source: WTU Herbarium 2010
Common Name	Strawberry Saxifrage, Strawberry-leaf Saxifrage Source: WTU Herbarium 2010
Species Scientific Name	
Scientific Name	Accepted Name: <i>Saxifragopsis fragarioides</i> Greene Publication: Bull. Torrey Bot. Club. 23: 20. 1896.
	Image Source: WTU Herbarium 2010 (Taken by Clayton J. Antieau in 1991) 

	<p>Synonyms & Misapplications: <u><i>Saxifraga fragarioides</i> Greene</u> in Bull. Torrey Bot. Club 7: 121 (1881) No subspecies noted</p> <p>Source: WTU Herbarium 2010 and KEW 2023</p> <p>Image Source: USDA Plants Database 2014</p> <table border="1" data-bbox="998 235 1469 655"> <thead> <tr> <th colspan="2">strawberry saxifrage Classification</th> </tr> </thead> <tbody> <tr> <td>Kingdom</td> <td>Plantae - Plants</td> </tr> <tr> <td>Subkingdom</td> <td>Tracheobionta - Vascular plants</td> </tr> <tr> <td>Superdivision</td> <td>Spermatophyta - Seed plants</td> </tr> <tr> <td>Division</td> <td>Magnoliophyta - Flowering plants</td> </tr> <tr> <td>Class</td> <td>Magnoliopsida - Dicotyledons</td> </tr> <tr> <td>Subclass</td> <td>Rosidae</td> </tr> <tr> <td>Order</td> <td>Rosales</td> </tr> <tr> <td>Family</td> <td><u><i>Saxifragaceae</i> Juss.</u> - Saxifrage family P</td> </tr> <tr> <td>Genus</td> <td><u><i>Saxifragopsis</i> Small</u> - saxifragopsis P</td> </tr> <tr> <td>Species</td> <td><u><i>Saxifragopsis fragarioides</i> (Greene) Small</u> - strawberry saxifrage P</td> </tr> </tbody> </table>	strawberry saxifrage Classification		Kingdom	Plantae - Plants	Subkingdom	Tracheobionta - Vascular plants	Superdivision	Spermatophyta - Seed plants	Division	Magnoliophyta - Flowering plants	Class	Magnoliopsida - Dicotyledons	Subclass	Rosidae	Order	Rosales	Family	<u><i>Saxifragaceae</i> Juss.</u> - Saxifrage family P	Genus	<u><i>Saxifragopsis</i> Small</u> - saxifragopsis P	Species	<u><i>Saxifragopsis fragarioides</i> (Greene) Small</u> - strawberry saxifrage P
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Varieties	None are listed on the USDA database																						
Sub-species	None are listed on the USDA database																						
Cultivar	None are listed on the USDA database																						
Common Synonym(s)	SAFR2 - <i>Saxifraga fragarioides</i> (Greene) small Source: USDA Plants Database 2014 and WTU Herbarium 2010																						
Common Name(s)	Strawberry saxifrage Source: Calscape 2025																						
Species Code (as per USDA Plants database)	SAFR5 (Accepted) and/or SAFR2 (Synonym) Source: USDA Plant Database 2014																						
GENERAL INFORMATION																							
Geographical range	 <p>Native to Washington’s central cascades, along with Northwest Oregon and Northwest California (Siskiyou Mountains). The <i>Saxifraga fragarioides</i> is found in Chelan County in Washington, Curry and Josephine County in Oregon, and Del Norte, Humboldt, Trinity, and Siskiyou County in California.</p> <p>Image and Text Source: USDA Plants Database 2014</p>																						

<p>Ecological distribution</p>	<p>Occurs on cracks and crevices of cliff zones – whether it be mountain regions or beach cliffs. Lives in elevation ranges of 1440-4300 ft and is usually found amongst ponderosa pine (<i>Pinus ponderosa</i>) and Douglas-fir (<i>Holodiscus discolor</i>) forests. Furthermore, these areas are usually exposed to harsh sunlight and wind. The strawberry saxifrage can be considerably resilient and adapted to areas with minimal root and soil space. These areas are also classified as talus slopes at middle elevations, along rock outcrops.</p>  <p>Text Source: Washington DNR n.d. and WTU Herbarium 2010 Image Source: WTU Herbarium 2010 (Photographed by Game)</p>
<p>Climate and elevation range</p>	<p>The Strawberry Saxifrage is found in climates along the Southern Oregon and Northern Californian coast, thus being exposed to colder temperatures during the wintertime (Average: 43 degrees Fahrenheit), moderate temperatures during the summer (Average: 63 degrees Fahrenheit), and subjected to marine mist and fog. Furthermore, those that are found in the mountain regions of Washington state may be subjected to extreme cold temperatures in the winter (Average: 27 degrees Fahrenheit) and hot temperatures in the summer (Average: 71 degrees Fahrenheit). Since these strawberries are directly exposed to the elements, they are relatively resilient to temperature and climate changes in that specific region.</p>  <p>Source: Climate Oregon Coast n.d. and Chelan Climate n.d. Image Source: WTU Herbarium 2010 (Photographed by Game)</p> <p>Specific elevations include 5545 to 7185 feet in California and Oregon, and 1640 feet in Washington.</p> <p>Source: Calflora n.d. and UC Berkley Education</p>

Local habitat and abundance

Commonly associated species include, "oceanspray (*Holodiscus discolor*), mock-orange (*Philadelphus lewisii*), snowbrush ceanothus (*Ceanothus velutinus*), snowberry (*Symphoricarpos albus*), field chickweed (*Cerastium srvense*), Tweedy's Lewisia (*Lewisia tweedyi*), beardtongue (*Pnetemon spp.*), and balsamroot (*Balsamorhiza sagittate*)."

Source: Washington DNR n.d.


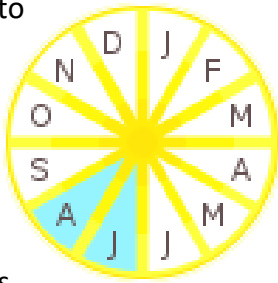
TOLERANCES		Shade tolerant	Low water tolerant
Elevation	5545 to 7185 ft	1690 to 2190 m	
Annual Precipitation:	43 to 127 inches	109 to 323 cm	
Wet Season	7 to 10 months		
Temperature Range	43 to 56 ° F	6 to 13 ° C	
December Low	26 ° F	-3 ° C	
July High	82 ° F	28 ° C	
Accumulated Temperature	38 to 74 ° F	3 to 23 ° C	
Growing Season	3 months		
Hardiness Zones	7b to 8a (5 to 15 ° F)		
SOIL:			
pH	5.3 to 6.4		
Max Salinity	0.1 mmhos / cm (non-saline)		
Min Depth	4 inches	9 cm	
Textures:	Bedrock		
Max CaCO ₃	0 % (none)		
Min AWS	2 cm		

Data in the highlighted cells above is based on relatively few plant locations (orange: < 20). The values shown for the various factors are likely to be overly narrow.


Image Source: Calflora n.d

In regard to abundance, they are considered threatened in Washington (WANHP) and they are considered to be affected by "rock climbing, road maintenance, and herbicide applications" and are documented as being "rare in OR and uncommon in CA." Additionally, in the areas they tend to inhabit, they aren't extremely common and are only located in undisturbed sites.

Source: WTU Herbarium 2010 and Washington DNR n.d.

<p>Plant strategy type / successional stage</p>	<p>For plant strategy, these plants are stress-tolerant, specifically regarding the varying range of temperatures they are exposed to both on the coast and in the lower mountain ranges, and growing conditions of minimal and low-nutrient soils. Since they grow in rocky outcrops and in talus, they are resilient to changes – whether it be erosion, abrupt temperature shifts, varying moisture levels, etc.</p> <p>Image Source: Calflora n.d.</p> 
<p>Plant characteristics</p>	<p>The Strawberry Saxifrage is a dicot and considered to be a rhizomatic flora. They are considered a forb/herb and produce leaf petioles that measure 1.5-4 cm long. Their flowers are hypanthium campanulate that are 1mm and are “moderately stipitate glandular; sepals spreading to reflexed, triangular ovate [...] petals.” They tend to flower in June to August and are also classified as shade and low water tolerant.</p> <p>Since they are perennials, they will begin to die in the fall and winter and may only live up to two years.</p> <p>Source: UC Berkley Education n.d. Image Source: Calflora n.d.</p> <p>Furthermore, it produces more than 40 flowers when it blooms and the hypanthium is partly fused to the ovary. The DNR has also classified them as glandular perennials with “thick, woody, trailing stems; caudex thick, woody, branched, scaly.” Their fruits are considered capsules.</p> <p>Source: Washington State DNR n.d.</p> 
<p>PROPAGATION DETAILS: FROM SEED</p>	
<p>Ecotype</p>	<p>Since the Strawberry Saxifrage is relatively rare and not commercially grown, the seeds will be sourced from native specimens – whether it be in Washington, Oregon, and/or California. It is important to note that when they are collected, they will be derived from multiple sites and will only consist of <10 percent of the total seeds found in that location. If extras are picked, it is best to disperse them within that region to aid in</p>

	<p>new plant growth – especially since they are threatened and noninvasive. This is also called the 10 Percent Rule in plant conservation – which is especially followed with rare or threatened seed harvesting.</p> <p>Influential Text: Kimmerer 2013</p>
Propagation Goal	We will be propagating from seeds derived from native Strawberry Saxifrage.
Propagation Method	Seed propagation method.
Product Type	<p>Even though these seedlings can be grown using bareroot techniques because of their specific soil requirements (i.e. Rock outcrops, talus slopes, bedrock), we will still utilize pots to meet their specific needs and to allow for easy transplanting on sites. Thus, instead of propagating them in rocky soil within a hoophouse, we will use a greenhouse to grow them in small deepots.</p> <p>Furthermore, these greenhouses do not have to be state-of-the-art, especially since the seeds can withstand conditions of the Pacific Northwest. If these were grown in other states (i.e. Texas, Michigan), these seeds may have to be grown in a specialized greenhouse with temperature controls, lighting settings, and different moisture levels.</p> <p>Source: WTU Herbarium 2010 and Calflora n.d.</p>
Stock Type	<p>In the USDA Forest Service, they have been known to recommend using stocktypes (i.e. bareroot, container, and “plug plus”) when trying to grow plants that are accustomed to high elevation and tend to be slow growing. This can also help make bigger specimens and are usually relatively successful – especially since seedlings that are grown in containers can be easily transported to specific sites.</p> <p>Thus, for this case study, we will utilize containers when trying to grow these seedlings.</p> <p>Text Source: Dumroese and Owston 2003</p>
Time to Grow	Since these strawberries are relatively small, they will take roughly 2-3 months to grow before transplanting and will last another 3 months until fall and winter. Thus, the best time to start growing them would be near March, giving them time to grow and then flower in June through August.


<p>Target Specifications</p>	<p>Roots should be roughly 4 inches deep, along with being approximately 12-18 inches in height and 19-24 inches across (spread). These size estimates were made by cross referencing another plant called <i>Saxifraga stolonifera</i>, which is notably similar in physicality.</p> <p>Furthermore, it would be ideal to produce Strawberry Saxifrage that has flowers, self-pollinate them, and harvest the seeds to thus make more. Therefore, being able to produce flowers would be a major goal that can be easily achieved based on the survival success of these plants when growing them in monitored greenhouses.</p> <p>Source: The National Gardening Association 2013 Image Source: WTU Herbarium 2010</p> 
<p>Propagule Collection Instructions</p>	<p>Less than a 1/2 year prior, there will be seed collections within multiple sites across specific locations in Washington, Oregon, and California. The seeds from these perennials will be collected in late summer (i.e. August and September) before the plants begin to die back in mid to late fall.</p> <p>Seed collection will be done by identifying the plant out in nature, holding a container of sorts (i.e. Ziploc bag, Tupperware) directly underneath where the seeds are stored, gently shaking the seeds to release them from the plant, and close the container's lid. Seeds tend to look like brown, ovoid capsules measuring from 4-5mm. Furthermore, there are usually 50-75 seeds per plant.</p> <p>Source: Torrey Bot 1896</p>
<p>Propagule Processing/Propagule Characteristics</p>	<p>Now, when collecting <10 percent of the native seeds, this may equate to roughly 1,000 seeds – since one plant can produce 50-75 seeds. The seed density has not been provided on any sources online, as well as for any other Saxifrage relative.</p> <p>Their seed longevity, however, has been noted as being non dormant, thus it is best to plant them as soon as can be. The longevity is unknown, but when compared to their relative <i>Saxifraga Oregona Howell</i>, a rough</p>

	<p>estimate may be less than ½ year – thus it is vital to start the seed sowing process as soon as they are collected.</p> <p>Furthermore, the seeds tend to germinate at 54 degrees Fahrenheit, thus when storing them, it is important to keep them in a cool refrigerator that consistently stays below this temperature level.</p> <p>Source: University of California 1993 and Ross 2012</p>
<p>Pre-Planting Propagule Treatments</p>	<p>When processing these seeds, stratification will be the only method used to aid in germination and storage. Thus, they will be put in a storage cooler and may not need to be cleaned – for many of them are relatively small, light, and not affected by debris. However, if there are concerns regarding cleaning them, techniques such as using a brush machine or an air screen machine may be used to help separate the seed from plant material, chaff, and soil. Additionally, in the chance that the seeds are wet, they may need to be dried out first and then stored soon after.</p> <p>Source: Ross 2012</p> <p>No scarification will be needed; thus, the seeds can remain in the cooler for less than ½ a year until they are sowed. Furthermore, since they are nondormant, it is ideal to start sowing them relatively soon after collection.</p>
<p>Growing Area Preparation / Annual Practices for Perennial Crops</p>	<p>Since this propagation protocol will utilize containers for growth, there is no need for outside preparation (i.e. garden weeding, old soil tilled with new soil added).</p> <p>The growing media fit for these seeds would be basic peat moss or sunshine mix #4 and some vermiculite sprinkled on top towards the end of sowing. It also may be helpful to fluff up the soil manually by using a tarp or a sifter to increase aeration in the soil and allow for the seed to root and easily move within the media. Later, when the seed has germinated and needs repotting, it may be advantageous to repot it in a media consisting of higher amounts of perlite, bark, and rocks to help it acclimate before it is transplanted into rocky terrain after the hardening phase later.</p> <p>Source: Sunshine Mix Information 2025 Image Source: Walmart 2025</p> <p>Container sizes may range from 2” to 3” for beginner sizes. They can also be sowed in interconnected pots, as shown to the right. Ensure that the containers have drainage holes. Furthermore, a ½ gallon watering can</p>




	<p>may be used if a hose is unavailable. Fertilizer may also help in the later stages of growth, as well as having pruners, a clear top to go over the pots to maintain moisture during germination, plant tags, and pencils to make labels (These can be made from old food containers).</p>
Establishment Phase Details	<p>Prepare the 2” pots with fluffed peat moss or sunshine mix #4. Gently water the soil to let them soak up the moisture and settle into most of the container’s volume. Since the seeds are relatively small, two to three seeds may be planted into an individual container and then separated with repotted. Furthermore, when they are sowed into the pots in early fall (September/October) when the temperature begins to reach 54 degrees Fahrenheit. If using a greenhouse to grow them, this can be done earlier – which is highly recommended based upon the minimum longevity of these seeds. Thus, these seeds can theoretically be sowed right after collection.</p> <p>Many tend to sow the seeds into the soil directly and as long as the temperature is above 54 degrees Fahrenheit with adequate water (mist every day or directly water every other day) and sunlight, they will likely germinate. If it is difficult to reach exact temperatures, heating mats may be used – as well as warm misters to expedite the germination process.</p>
Length of Establishment Phase	<p>There are no resources online describing the establishment phase, but when related to other relatives – such as the <i>Oregon Saxifrage</i>, it may take around 1 to 2 weeks for growth to be noticeable. These seeds are noted as being slow growers, thus they may take some time.</p> <p>Source: Ross 2012</p>
Active Growth Phase	<p>As the plants begin to outgrow their pots, they can be moved to bigger, individual pots until they are comfortably situated in a 1-gallon pot. Other related species, like <i>Saxifraga oppositifolia</i> tend to be transplanted to an outdoor location after the plant has filled a 1-gallon pot, thus it is ideal to allow for the plant to reach this size potential. Usually, they are continued to be watered and may even be fertilized towards the later stages of growth to help them reach this end goal.</p> <p>Source: University of Washington 2006</p>
Length of Active Growth Phase	<p>There are no resources online specifically describing how long it takes between germination until the plant no longer grows, but from interpretation and by referencing closely related plants, it may be safe to say that it can take up to 4 to 5 months. This is especially so because they tend to be slow growers. Furthermore, since they are being sown in the</p>

	<p>fall, they will grow throughout the winter within a greenhouse (if provided) and thus be ready to flower in early to mid-Spring.</p> <p>They may be able to last throughout the spring and summer without expanding out of their pots or from being transplanted and tend to die off in late summer.</p> <p>Source: Ross 2012</p>
Hardening Phase	<p>It is noted that many can be extremely sensitive to spring freezes, thus it is vital that the specimens are fully grown into their 1-gallon pots before they are transplanted outside. Additionally, they can also be exposed to some wind (i.e. fans) and slightly colder overnight temperatures (i.e. approximately 35 to 45 degrees) before they are planted outside.</p> <p>Furthermore, if they are planned to be transplanted in their natural habitat, it may be advantageous to replot them in more rocky soil to allow their roots to adjust to similar terrain when brought outside.</p> <p>Source: University of Washington 2006</p>
Length of Hardening Phase	<p>After they are fully grown, which may take a few months – as previously mentioned – they may stop growing and only produce flowers in early to mid-spring. Furthermore, they may survive for a few more months throughout spring and summer and then begin to die back from early to mid-fall. Therefore, they will ultimately live for another 6 months after being transplanted outside (i.e. March – September).</p>
Harvesting, Storage and Shipping	<p>Harvesting seeds is usually done before the plants die and at peak bloom. They typically bloom around late spring to early summer but may also last until the end of summer if temperatures are ideal. From this, it is important to collect the seeds sometime during this window and plant the seeds as soon as they are collected due to storage difficulties.</p> <p>Furthermore, if they are shipped, they should be kept in environments that are colder than 54 degrees Fahrenheit and stored in dry containers. Furthermore, they should be shipped soon after they are harvested – especially since the seeds are nondormant.</p> <p>Source: University of California 1993 and Ross 2012</p>
Length of Storage	<p>Seedlings should be grown until they fully acclimate to a 1-gallon pot. This can take a few months and if timed correctly, can be grown in a Greenhouse from the end of fall (November) to the beginning of spring (March-April). From this point, they may be prepared to be out planted after they've reach maturity.</p>

	<p>Source: University of Washington 2006</p>
<p>Guidelines for Outplanting / Performance on Typical Sites</p>	<p>If the seeds are conditioned and slowly subjected to slightly colder temperatures in the Greenhouse, as well as wind and rocky terrain, then they should be prepared enough to survive in their outdoor habitat. Some may be sensitive to colder temperatures during spring freezing, but for the most part, the survival percentage may be relatively high (i.e. >75%).</p> <p>The end product should look thick, woody, and branched. The petioles such be 1.5 – 4 cm with blades sharing the same measurement with a tapered base. Stems are usually about 12 – 18 cm long and may have flower clumps measuring 1 cm in length. There roots are relatively small and can be measured to be approximately 4 – 8 cm long.</p>  <p>Furthermore, they typically take 2 months to settle into their environment before flowering. This could be from late March to early June before flowering. They will then proceed to bloom up until August.</p> <p>Source: University of Washington 2006 and Washington State DNR n.d. Image Source: Wells 1996</p>
<p>Other Comments</p>	<p>No collection restrictions are known; however, it is important to mention how relatively rare these plants are – especially since they are in only a few regions within the Pacific Northwest. From this, it is important to restrain yourself from picking more than 10% of the seeds within the known populations in order to not affect their natural growth outdoors.</p>
<p>PROPAGATION DETAILS: VEGETATIVE</p>	
<p>Ecotype</p>	<p>Since the Strawberry Saxifrage is relatively rare and not commercially grown, the vegetative material (i.e. cuttings) will be sourced from native specimens – whether it be in Washington, Oregon, and/or California. It is important to note that when they are collected, they will be derived from multiple sites and will only consist of <10 percent of the total plants found in that location. If extras are picked, it is best to disperse them</p>

	<p>within that region to aid in new plant growth – especially since they are threatened and noninvasive. This is also called the 10 Percent Rule in plant conservation – which is especially followed with rare or threatened plants. Even though this rule particularly targets seed collections, it is also important to ensure accumulating cuttings follows the same procedure to minimize damage to natural populations.</p> <p>Influential Text: Kimmerer 2013</p> <p>Furthermore, once they are cultivated, these cuttings can be taken using the plants in the Greenhouse as well.</p>
Propagation Goal	Cuttings will be the primary propagation goal.
Propagation Method	This will be a vegetative strategy.
Product Type	The product type will be propagules.
Stock Type	<p>In the USDA Forest Service, they have been known to recommend using stocktypes (i.e. bareroot, container, and “plug plus”) when trying to grow plants that are accustomed to high elevation and tend to be slow growing. This can also help make bigger specimens and are usually relatively successful – especially since seedlings that are grown in containers can be easily transported to specific sites.</p> <p>Thus, for this case study, we will utilize containers when trying to grow these cuttings.</p> <p>Text Source: Dumroese and Owston 2003</p>
Time to Grow	Since these cuttings can be taken at any time, this window is up to the grower. Because these plants do well when growing during the spring to summer months, it may be advantageous to make these cuttings during early spring (if it’s natural specimens) or late winter (if it’s indoor specimens) to influence their growth during the spring and summer months. Since the cuttings already have leaves and some roots, they will be quicker to establish in new pots, especially if they are layered into new soil from their mother plant.
Target Specifications	Roots should be roughly 4 inches deep, along with being approximately 12-18 inches in height and 19-24 inches across (spread). These size estimates were made by cross referencing another plant called <i>Saxifraga stolonifera</i> , which is notably similar in physicality.

	<p>Furthermore, it would be ideal to produce Strawberry Saxifrage that has flowers, self-pollinate them, and harvest the seeds to thus make more. Therefore, being able to produce flowers would be a major goal that can be easily achieved based on the survival success of these plants when growing them in monitored greenhouses.</p> <p>Source: The National Gardening Association 2013</p>
<p>Propagule Collection Instructions</p>	<p>Making cuttings can happen at any time and could even be prepared by taking the mother plant and layering the desired region for cutting in soil. This is called layering and will allow the cutting to produce roots and receive nutrients from the mother plant before their separation. This, as said before, can be done at any time.</p> <p>If the grower was aiming to have these cuttings ready by spring, this layering can be prepared during the winter when the mother plant is beginning to grow in the greenhouse. If the mother plant is from a natural habitat, however, then it may be a good idea to make the cutting directly (when the plant is alive during the Fall), put it into some water until roots are formed, apply auxin hormone to the roots, and then place them into specific pots.</p>
<p>Propagule Processing/Propagule Characteristics</p>	<p>The propagules will need to have 2-3 nodes in order to increase the chances of survival. They will also need 2-3 leaves to help them photosynthesize during their acclimation period. Therefore, the cuttings will need to be immediately put into water after they are removed from the mother plant and then placed into potting mix after they begin to grow roots (after approximately 2 weeks).</p> <p>If they are layered, then they can be allowed to grow until roots are visible and then removed from the mother plant and placed into potting mix. Thus, in short, since the cuttings can only survive for roughly an hour or two post removal, they will need to be processed as soon as possible to ensure their roots and body do not dry out.</p>
<p>Pre-Planting Propagule Treatments</p>	<p>Since the cuttings aren't seeds, they can't necessarily be stored before planting. From this, they won't need to be cleaned (unless they have contaminants on them/pests) and can be directly put into water or soil depending on root presence.</p> <p>One treatment that may aid in growth is applying auxin powder to exposed ligaments towards the root apex. This will allow the plant to receive essential hormones that can help the region begin to grow roots faster than usual.</p>

<p>Growing Area Preparation / Annual Practices for Perennial Crops</p>	<p>Since these cuttings will begin to grow roots, it is important to use soil that has adequate aeration. Sunshine mix #4 with bark, rocks, and perlite may be a good medium to help the roots acclimate from either their original soil or from being in direct water for 2 weeks. Additionally, if the propagules were originally in water when developing their root, it is important to know that watering may have to increase when they are transplanted into a soil medium and then begin to taper off until it is a regular amount. This will help allow the plant to transition from a 100% water environment to a 100% moist soil environment.</p> <p>In regard to containers, small cutting may fit in 4 " pots, but this size may vary depending on the root length and size of the cutting.</p>
<p>Establishment Phase Details</p>	<p>As previously mentioned, the potential cutting will either develop roots within soil media itself while being connected to the mother plant, or they can be directly cut first and placed into water until roots are visible.</p>  <p>An example of layering runners is shown to the right where parts of the plant are placed into the soil to help allow them to begin growing their roots. Some even will lead the runners off of the original mother pot and grow the potential cuttings directly into new pots.</p> <p>Image Source: Strawberry Plants 2022</p>
<p>Length of Establishment Phase</p>	<p>The time it takes for them to root will be approximately 1-2 weeks depending on the size of the cutting. After this period, they can be placed into new, aerated soil to aid in the next phases of growth.</p>
<p>Active Growth Phase</p>	<p>As the plants begin to outgrow their pots, they can be moved to bigger, individual pots until they are comfortably situated in a 1-gallon pot. Other related species, like <i>Saxifraga oppositifolia</i> tend to be transplanted to an outdoor location after the plant has filled a 1-gallon pot, thus it is ideal to allow for the plant to reach this size potential. Usually, they are continued to be watered and may even be fertilized towards the later stages of growth to help them reach this end goal.</p> <p>Source: University of Washington 2006</p>
<p>Length of Active Growth Phase</p>	<p>There are no resources online specifically describing how long it takes between germination until the plant no longer grows, but from interpretation and by referencing closely related plants, it may be safe to</p>

	<p>say that it can take up to 4 to 5 months. This is especially so because they tend to be slow growers. Furthermore, since they are being planted in the fall, they will grow throughout the winter within a greenhouse (if provided) and thus be ready to flower early to mid-Spring.</p> <p>They may be able to last throughout the spring and summer without expanding out of their pots or from being transplanted and tend to die off in late summer.</p> <p>Source: Ross 2012</p>
<p>Hardening Phase</p>	<p>It is noted that many can be extremely sensitive to spring freezes, thus it is vital that the specimens are fully grown into their 1-gallon pots before they are transplanted outside. Additionally, they can also be exposed to some wind (i.e. fans) and slightly colder overnight temperatures (i.e. approximately 35 to 45 degrees) before they are planted outside.</p> <p>Furthermore, if they are planned to be transplanted in their natural habitat, it may be advantageous to repot them in more rocky soil to allow their roots to adjust to similar terrain when brought outside.</p> <p>Source: University of Washington 2006</p>
<p>Length of Hardening Phase</p>	<p>After they are fully grown, which may take a few months – as previously mentioned – they may stop growing and only produce flowers in early to mid-spring. Furthermore, they may survive for a few more months throughout spring and summer and then begin to die back from early to mid-fall. Therefore, they will ultimately live for another 6 months after being transplanted outside (i.e. March – September).</p>
<p>Harvesting, Storage and Shipping</p>	<p>Harvesting will be the same as previously mentioned – for the cuttings will either be layered or propagated via water exposure. They cannot be stored like seeds and must be exposed to sunlight, receive water daily or every other day, and must be relatively warm (> 54 degrees Fahrenheit). From this, they may only be able to be shipped if it is to nearby locations (i.e. taking less than a day to arrive) and shipped via trucks. Anything that can accommodate their growing requirements will be needed to help them survive during transportation from the greenhouse to any other desired location.</p>
<p>Length of Storage</p>	<p>Since they are not seeds, they cannot be stored in the traditional sense (i.e. cooling refrigerators, dry manila envelopes). They must be kept in greenhouse conditions to aid in their survival.</p>

<p>Guidelines for Outplanting / Performance on Typical Sites</p>	<p>If the propagules are conditioned and slowly subjected to slightly colder temperatures in the Greenhouse, as well as wind and rocky terrain, then they should be prepared enough to survive in their outdoor habitat. Some may be sensitive to colder temperatures during spring freezing, but for the most part, the survival percentage may be relatively high (i.e. >75%).</p> <p>The end product should look thick, woody, and branched. The petioles such be 1.5 – 4 cm with blades sharing the same measurement with a tapered base. Stems are usually about 12 – 18 cm long and may have flower clumps measuring 1 cm in length. There roots are relatively small and can be measured to be approximately 4 – 8 cm long.</p> <p>Furthermore, they typically take 2 months to settle into their environment before flowering. This could be from late March to early June before flowering. They will then proceed to bloom up until August.</p> <p>Source: University of Washington 2006 and Washington State DNR n.d.</p>
<p>Other Comments</p>	<p>No collection restrictions are known; however, it is important to mention how relatively rare these plants are – especially since they are in only a few regions within the Pacific Northwest. From this, it is important to restrain yourself from picking more than 10% of propagules/cuttings within the known populations in order to not affect their natural growth outdoors.</p> <p>Furthermore, once the grower has established some within greenhouse settings, it would be extremely worthwhile to begin making cuttings from these plants and continue this generational use solely within the greenhouse (unless genetic variation is needed).</p>
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