

A GUIDE TO VEGETATIVE PROPAGATION OF  
NATIVE WOODY PLANTS IN UTAH

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# NURTURING NATIVE PLANTS

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## A GUIDE TO VEGETATIVE PROPAGATION OF NATIVE WOODY PLANTS IN UTAH



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2014

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# NATIVE WOODY PLANTS IN THE CULTIVATED LANDSCAPE



In the natural landscape, genetic diversity is not only a valuable asset, but an essential one. As a result, plants of the same species are able to thrive in different locations and survive pressure from insects, disease, and a variable climate. If changes in drought cycles or annual temperatures tip the balance in favor of pine bark beetles over pine trees, then hopefully there will be a few pines that are more drought tolerant or more resistant to the beetles. These hardy specimens then become the parents of the next generation of trees and nature adapts to the constant changes in our world. When a forest fire destroys the plants in a wildland area, resource managers take great care to re-plant with plant materials that are not only adapted to that environment, but are genetically diverse enough that some will hopefully survive and thrive.

Propagation by vegetative means circumvents the genetic diversity so desirable in wildlands. When a plant is propagated by a cutting or graft, the daughter plant is genetically identical to the mother plant. If all the plants in a population are genetically identical, they might be equally superior, but they are also equally susceptible to climatic or biological problems. This narrow genetic base is dangerous because of the risk of a new pest wiping out an entire population of susceptible plants. This is especially a problem if the landscape is a monoculture. In other words, if an entire urban forest consisted of a single clone of one species, then if a problem did occur, there would be a risk

of a catastrophic failure where every tree is lost. In contrast, if the forest consists of multiple species and clones within species, then it would be much more resilient. If a problem did occur, only a few of the trees would be lost.



Bigtooth maple (*Acer grandidentatum*) in a residential landscape

of a catastrophic failure where every tree is lost. In contrast, if the forest consists of multiple species and clones within species, then it would be much more resilient. If a problem did occur, only a few of the trees would be lost.

In contrast to a natural system, genetic uniformity is often preferred in agriculture. Production, marketing, and profitability are enhanced if all of a grower's lilies bloom for Easter and poinsettias flower for Christmas. Traditional farmers want crops to ripen at the same time so they can be harvested with one pass of a combine. Similar preferences hold true for landscape horticulture. Consumers want landscape plants that look and perform as expected. If a homeowner spends \$100 on a tree, they expect it to look like it did in the catalog. If it was purchased for its red fall color and it turns yellow instead, inevitably the consumer is disappointed. More critically, if a plant is advertised as being hardy to  $-10^{\circ}\text{F}$ , it should be hardy and not die the first time the temperature drops to  $0^{\circ}\text{F}$ . In general for managed landscapes, we are looking for uniformity, not a variant from a genetically diverse pool of plants.



It is somewhat of a philosophical question whether a native landscape should use seed propagated plants or selected clones. Genetically diverse landscapes may be functional, attractive, and wonderfully resilient to any number of problems, but they may be less uniform and have fewer ornamental characteristics. In contrast, native landscapes using selected clones may be more susceptible to problems, but the use of superior plants with greater growth or enhanced appearance may outweigh that risk. It is worth noting that in cultivation, the landscape is often small enough, and the value high enough that it justifies the use of supplemental resources such as water to overcome problems. Supplying such resources would be economically unfeasible for a national forest, but it is feasible for plants with high value found in relatively small quantities such as a backyard.



Bigtooth maple (*Acer grandidentatum*) in its native landscape

In many urban areas, there are increasing restrictions on the use of supplemental resources for plants because of either scarcity or harmful side effects. Therefore, water, fertilizer, pesticides, and even labor must be used with greater precision and wisdom. As a result, more attention is being paid to the use of native plants (either clonal or genetically diverse) that may be already adapted to local environmental conditions. Many native woody plants, such as blue spruce, red-stem dogwood, shrubby cinquefoil, quaking aspen, chokecherry, juniper, and limber pine are already being used in Utah landscapes.

Landscaping with native plants is a great idea, but their function in the landscape can be improved by choosing superior plants and then cloning them. Indeed, all of the previously mentioned plants have at least one superior selection that is grown as a cultivated variety or cultivar. This designation means that the plant material is genetically uniform and that all plants sold under a given name are the same. In order to maintain this genetic uniformity, it is helpful if the plants being used are also relatively easy to propagate and grow. Of course, they should also reach some standard of performance in the landscape. They may have no other value except being beautiful and easy to maintain, but that is sufficient for adoption in cultivated landscapes when aesthetic values are the primary goal.

Currently there are also many native woody plants that are not being used for landscape purposes. The list is large and includes beautiful plants like bigtooth and Rocky Mountain maples, snowbrush, and point-leaf manzanita. The reasons for not using them are complex and may include adaptation to urban environments, marketing, consumer preference, and other factors. Less apparent to the consumer, but possibly even more important is the potential for a given plant to be clonally propagated in sufficient numbers that it can be produced and sold.

Unlike grasses or herbaceous perennial plants, it is uncommon to have seed propagated woody plants that grow uniformly true to type. In most cases, trees and shrubs are so genetically diverse that the chances of two seedlings being exactly the same is almost impossible. The best way to maintain the genetic characteristics of a superior selection is to vegetatively propagate it. One of the challenges of using native plants is finding superior plants and then being able to propagate them. Some are easy – quaking aspen naturally propagates itself through suckering. Others, such as oaks or pines, can be very difficult and may require elaborate techniques to start a new plant that is genetically identical to the mother plant.

The goal of this publication was to collect propagation protocols from research literature and compile successful methods used for each native species listed. Where information was unavailable for a species, we have listed the only propagation alternatives. The propagation protocols are laid out much like a recipe would be, listing the various ingredients and materials required for each 'dish'. This 'cookbook' is a work-in-progress. If you find you have additions to suggest, please email: [larry.rupp@usu.edu](mailto:larry.rupp@usu.edu).

# PROPAGATION METHODS



Plant propagation is the essence of horticulture. It is the process whereby we manipulate a plant and its environment to induce it to form a daughter plant. In many ways it is as ancient as the first person who figured out that a grape vine lying on the ground would root and start a new plant. It carries a fascination that never quits due to the thrill of seeing new roots form on a cutting or a seed germinate. In short, it's a lot of fun, and working with native plants provides an opportunity to explore depths of horticulture never before uncovered.

There are many methods for vegetatively propagating woody plants. From the simplest to the most complicated they include division, layering, cuttings, grafting, and micropropagation. In general, commercial propagators select those methods that are most efficient and profitable. In contrast, hobbyists may select those methods that are easiest or most reliable.

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## DIVISION

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Many plants naturally reproduce themselves by vegetative means. Examples include the previously mentioned quaking aspen, which sends up suckers from the root system, creeping mahonia, which forms new shoots from rhizomes, or sego lily which can produce new bulblets from the parent bulb. In each case the plant naturally forms a propagule which, under the correct conditions, can develop into an individual daughter plant. Such plants often remain attached to each other and may form clumps, ground covers, or groves. Propagators can manipulate such plants by physically dividing them into segments containing both shoots and roots. Such segments can then grow into fully independent daughter plants. Division with these plants is usually done by waiting until the plant is dormant, and then carefully cutting or breaking the propagules away from the parent plant. Once separated, the offspring can be established in a container or bed where they can grow and develop independent of the parent plant.



Harvesting mound layered shoots of chokecherry (*Prunus virginiana*)



Division not only includes those plants that form daughter plants on their own, but plants that can be induced to form vegetative offspring through propagation techniques. Chief among these techniques is layering. Plants such as vines can be induced to form new plants by burying a portion of the stem and leaving the tip of the shoot exposed. The vine will quickly form roots and can be separated from the parent plant once it is dormant. More elaborate forms of layering include mound, air, and serpentine layers. But, they all consist of inducing a segment of the parent plant to form roots while still attached to the parent.

Division is one of the most reliable methods of propagation. But it is often slow and requires space to maintain both the mother plant and the developing daughter plants. For this reason, propagators often turn to cuttings as a more efficient, though sometimes less reliable, method.



Mound layering of bigtooth maple (*Acer grandidentatum*)

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## CUTTINGS

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Softwood cutting



Rooted softwood cuttings



Rooted hardwood cutting

Propagation by cuttings is the process of cutting off a portion of the mother plant and inducing it to develop into a completely independent plant. It is probably the most common method of vegetative propagation of woody plants. In its most common application, cuttings consist of shoot tips that are placed in an environment that allows new, adventitious roots to develop on the stem. It may also include leaves or root segments that are induced to form both adventitious shoots and adventitious roots.

Woody plants exhibit a large spectrum of ability to form adventitious roots on cuttings. Some, such as willows, root very easily. Others, such as oaks, are virtually impossible to root. Each woody plant fits somewhere on the spectrum of easy to difficult rooting. Fortunately, difficulty in rooting can often be overcome by manipulating either the parent plant, the cutting, or the environment. The more difficult it is to root a cutting, the more treatments or manipulations that may be required to induce rooting. These treatments can include intermittent mist, rooting hormones, soilless rooting substrates, or bottom heat. In addition, cuttings can be collected during different physiological stages as hardwood, softwood, or semi-hardwood cuttings. Lastly, parent or stock plants can be manipulated by etiolation, girdling, or rejuvenation. One of the challenges to propagating native woody plants is determining the correct combination of treatments required to get cuttings to root, or to root more efficiently. Many of these codes still need to be broken!

# PROPAGATION METHODS



## GRAFTING

If a plant cannot be effectively propagated by cuttings, grafting presents an alternative that does not require new roots to form. While grafting and budding are common practices in commercial nurseries in the northwest and California, they are much less common in Utah. Since grafting requires development of both the scion and the rootstock, and is a more technical process than many other methods, it is generally used only when there are no other options. In order for a nursery to successfully graft native plants, the following principles should be kept in mind.

- The easiest and most successful method of grafting is budding. Budding is a type of grafting where the scion is reduced to a single bud. In general, the preferred budding techniques are T-budding and chip budding. Excellent descriptions and tutorials can be found online.
- Grafting can be done with methods such as side grafting and involves using a piece of shoot for the scion. It is usually done only in situations involving container grown plants or plants held in cold storage. It is the most common means of propagating clones of conifers.



Side grafting uses a piece of shoot for the scion



Chip budding

- Scions (budwood) collected from native plants growing in the wild in Utah are not the same quality as budwood from a stock plant cultivated strictly for that purpose. One of the reasons for successful budding in top production nurseries is that everything is optimized – not just the budding technique. All materials and components are produced with the goal of creating the best opportunity for successful grafting. Budwood should be fully turgid, healthy, at the correct physiological stage (fully developed but quiescent or dormant), and of the right vigor.
- Budding and grafting both require the application of careful techniques. Both stock and scion must be cut so that parts fit together closely. Once combined, the graft must be carefully wrapped to provide stability and protection from desiccation.
- Rootstocks can be either container or field grown, but they need to be quality plant material with straight, smooth stems and vigorous, but not excessive vegetative growth.
- Plants vary in their ease of budding. For example, apples are relatively easy, while other plants (such as maples) are more difficult. Many native plants have never been grafted and their potential for success is unknown. Further, their potential for problems such as delayed incompatibility (failure of the graft over time) is also unknown.
- Both scion and rootstock material must be genetically similar so that they are compatible. In general, this would mean that a selected scion is grafted onto a seedling of the same species.
- Lastly, new grafts or buds must be carefully protected so they are not damaged before the union has matured to the point that it is physically strong.



Grafting onto container-grown plants

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## MICROPROPAGATION

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Micropropagation is the process of collecting very small propagules, such as apical meristems, and establishing them on a sterile culture medium. The propagules are increased by inducing them to form a number of shoots which are further divided until induced to form roots. With the development of easy-to-handle culture media and other materials, micropropagation is easier than it has ever been, but its application is beyond the scope of this guide. The remainder of this guide provides the current state of vegetative propagation for some of Utah's most beautiful native woody plants.



# ROCKY MOUNTAIN MAPLE

*Acer glabrum*

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## PLANT DESCRIPTION

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Rocky Mountain maple (*Acer glabrum*) is a small tree/large shrub that is found throughout the western United States and Canada. It is often found in sheltered canyons, along streams and on moist slopes. Commonly multi-stemmed, it has attractive red bark when young that grays and becomes rough in texture with age. Rocky Mountain maples have yellow fall color and the winged samaras typical of maples.

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## PROPAGATION

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Rocky Mountain maple is commonly propagated by seed, even though it is very difficult to do so. There are no published techniques for its vegetative propagation. At Utah State University, preliminary studies have shown that cuttings can be successfully rooted using etiolated cuttings (see bigtooth maple). For more information on seed propagation, see Young and Young's 'Seeds of Woody Plants in North America'.



# BIGTOOTH MAPLE

*Acer grandidentatum*

## PLANT DESCRIPTION

Bigtooth or canyon maple (*Acer grandidentatum*) is a small deciduous tree native to much of the western United States. It is closely related to the eastern sugar maple as confirmed in part by its sweet sap, brilliant fall colors, and deeply lobed leaves reminiscent of the Canadian flag.

Bigtooth maple is highly desirable in the landscape for its hardiness, drought tolerance and fall color that varies from yellow to orange to red to maroon. Its size ranges from a few feet in height to 60 feet (19 m) or more and it occurs in columnar, pyramidal, round, or multi-stemmed forms.

## PROPAGATION

There are a number of methods for propagating bigtooth maple. Seed propagation is very effective and commonly used to grow plants for reclamation and for propagating rootstocks for budding of selected clones. Production of selected clones with highly desirable traits is currently possible through the use of cuttings, layering, and budding. Recent work at Utah State University has shown that restricting light (etiolation) to the base of developing shoots significantly improves rooting of softwood cuttings.

### PROPAGULE

- softwood cuttings

### MATERIALS

- nursery-grown mother trees
- black velour drawstring bags with open ends
- rooting hormone (2,000-5,000 ppm IBA and 1,000-2,500 ppm NAA) in 25% ethanol
- 3:1 perlite: peat rooting substrate

### ENVIRONMENT

- cool greenhouse 60/65°F (16/18°C) (day/night temperatures)
- bottom heat 75-80°F (24-27°C)
- intermittent mist
- shade (60%) in summer

[Source: Richards 2012]

## [1: ETIOLATED SOFTWOOD CUTTINGS]

### METHOD

1. Prune shoots to a point immediately below the third node from the shoot base in January or early February.
2. Place the black velour drawstring bag with open ends over the terminal buds of the pruned shoots at bud swell.
3. When approximately two sets of fully expanded leaves have emerged from the bag, cut the shoots off to use as softwood cuttings.
4. Trim cuttings to base of stem and bottom two nodes.
5. Wound by scraping off ½ inch (13 mm) long strip of bark on one side.
6. Dip in rooting hormone.
7. Stick in pre-moistened substrate.
8. Place under 60% shade keeping temperatures cool (65°F, 18°C).
9. Use bottom heat.
10. Keep under intermittent mist (misting approximately 7 seconds every 12 minutes).

[continued]





## BIGTOOTH MAPLE *[continued]*

*Acer grandidentatum*

### [2: LAYERING]

#### PROPAGULE

- layered shoots

#### MATERIALS

- mother trees in field stool bed
- cable ties (hog rings or wire will also work)
- conifer shavings
- 4,000 ppm IBA/2,000 ppm NAA in a 25% alcohol solution

#### ENVIRONMENT

- irrigation system

*[Source: Rupp, unpublished]*

#### METHOD

1. Prune mother trees to within 1-2 inches (2.5-5 cm) of crown in late winter.
2. Mound shavings around base of new shoots as they develop, being careful not to cover tips.
3. In early July, girdle shoots with cable ties about 1 cm from the base of the stem.
4. Apply rooting hormone to about 1 inch (2.5 cm) of stem above the girdle with a small paintbrush or cotton swab.
5. Re-cover the base of the shoots with conifer shavings and replenish as needed.
6. Keep base of stem dark and moist.
7. Harvest rooted layers after plants have gone dormant in the fall by removing shavings and cutting at the girdle.

### [3: BUDDING]

#### PROPAGULE

- rootstock plants in field
- budwood

#### MATERIALS

- Parafilm® grafting tape

#### NOTES

Budding is the most common method of producing maples in the nursery industry. The optimum window for budding maples in northern Utah is from mid-July to mid-August. Determination of successful budding can be estimated in 3-4 weeks, though final success rate can only be determined by bud break the following spring.

*[Source: Richards, 2012]*

#### METHOD

1. Prepare budwood by cutting budsticks of current season's growth off of the mother tree, removing the leaf blades, and keeping the wood cool and moist until used.
2. Make a cut in the rootstock at the location where the bud is to be placed, similar to the chip bud below.
3. Prepare chip bud by making a 45 degree cut into the scion about 1/2 inch (13 mm) below the bud and to a depth of between 25-33% of the way through the stem.
4. Make a second cut starting about 1/2 inch (13 mm) above the upper tip of the bud and proceeding in a straight line to the base of the first cut.
5. Place buds on rootstocks of the same or slightly larger diameter, keeping a remnant of the petiole to help protect the bud.
6. Cover the entire bud with grafting tape.

**Richards, M.R., and L.A. Rupp, 2011.** Propagation of Bigtooth Maple. Utah State University Extension.

**Richards, M.R., and L.A. Rupp, Larry A., 2012.** Etiolation Improves Rooting of Bigtooth Maple (*Acer grandidentatum*) Cuttings. Utah State University Extension.

**Rupp, L. unpublished.** Utah State University.



# BOXELDER

*Acer negundo*

## PLANT DESCRIPTION

Boxelder (*Acer negundo*) is a very common native tree. In western North America it is usually found along creek banks in the bottom of canyons. It is a quick growing tree with a broad rounded crown that can reach up to about 60 feet (18 m).

Its utility in the landscape is limited due to its aggressive growth habit and weak wood. Female trees also attract the boxelder bug, which can be a nuisance. However, cultivars of selected male trees reduce the problems of bugs, seed litter, and weedy seedlings caused by female plants.

Boxelder was once popular as an urban tree in the Great Plains and the West because of its drought and cold tolerance and quick establishment.

## PROPAGATION

Growing boxelder from cuttings or by grafting allows selection of desirable cultivars.

### [CUTTINGS]

#### PROPAGULE

- softwood or semi-hardwood cuttings

#### MATERIALS

- standard rooting substrate
- 8,000 ppm IBA talc rooting hormone

#### ENVIRONMENT

- mist system

[Source: Dirr, 2006]

#### METHOD

1. Collect cuttings at the softwood or semi-hardwood stage from suitable male cultivars.
2. Wound cuttings by removing a strip of bark about ½ inch (13 mm) long from the bottom of the stem.
3. Dip the wounded portion of the cuttings in a talc-based rooting hormone of at least 8,000 ppm IBA.
4. Hold cuttings under intermittent mist for 5-7 weeks.

**Dirr, M.A. and C.W. Heuser, Jr., 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Macdonald, B., 1986.** Practical Woody Plant Propagation for Nursery Growers. Timber Press, Inc.

**USDA, NRCS., 2013.** The PLANTS Database. (<http://plants.usda.gov>, 6 May 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.



# THINLEAF ALDER

*Alnus incana*

## PLANT DESCRIPTION

*Alnus incana* is commonly known as thinleaf, white, or gray alder. While the subspecies *virescens* is native to Utah, the species is native throughout North America and Europe. Thinleaf alder is commonly found in moist areas in the mountains and foothills of Utah.

As a landscape plant, its primary features are rapid growth, attractive green leaves, and the small, persistent “cones” which remain on the tree following seed release. It is characterized by multiple gray to brown stems typically reaching heights of 15 feet (4.5 m) or less, though they may be significantly taller. It is more commonly grown as a landscape plant in Europe than in the U.S.

## PROPAGATION

Cuttings of alders in general can be rooted by collecting in June or July and treating with 8,000 ppm IBA for a rooting rate of 20-40%. With the below method of hardwood cuttings collected in late October, 78% of cuttings were rooted after 3 months.

Alders can also be propagated by grafting onto seedling rootstocks using a side-veneer graft, or by micropropagation.

## [HARDWOOD CUTTINGS]

### PROPAGULE

- hardwood cuttings (second year growth)

### MATERIALS

- well-drained rooting substrate (1:1 sand: perlite)
- 8,000 ppm IBA; 20,000 ppm IBA; or a combination of 1,000 ppm IBA + 2,000 ppm NAA + 40,000 ppm Thiram

### ENVIRONMENT

- greenhouse with 75-80°F (24-25°C)/ 65-70°F (18-21°C) (day/night temperatures)

[Source: Scianna, 2003]

### METHOD

1. Collect cuttings in late October and place in water until stuck. (Stick within 48 hours).
2. Trim to 6-10 inches (15-25 cm) and wound cuttings by removing a strip of bark about ½ inch (13 mm) long from the bottom of the stem.
3. Dip cutting in rooting hormone and stick in rooting substrate.
4. Water at least twice daily for 4 weeks, then daily thereafter.
5. At 8 weeks, apply fertilizer at 350 ppm 9-45-15 two to three times per week.

### NOTES

This method was conducted in Yellowstone National Park with an 82% rooting rate.

**Dirr, M.A., and C.W. Heuser, Jr., 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Scianna, Joe. 2003.** Propagation protocol for vegetative production of container *Alnus incana* (L.) Moench plants; In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 7 May 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.

**Photo credits:** Al Schneider @ USDA-NRCS PLANTS Database (top left), Louis-M. Landry (top right), Sandra Smith (bottom)



# SERVICEBERRY

*Amelanchier* spp.

**SASKATOON SERVICEBERRY** *Amelanchier alnifolia*

**DWARF SERVICEBERRY** *Amelanchier pumila*

**UTAH SERVICEBERRY** *Amelanchier utahensis*

## PLANT DESCRIPTION

Serviceberries (*Amelanchier* spp.) are commonly shrubs to small trees, with most plants in the west tending toward the shrubby side. Saskatoon serviceberry (*A. alnifolia*), is found in the Pacific Northwest and throughout the Rocky Mountains and across most of Canada. Dwarf serviceberry (*A. pumila*) and Utah serviceberry (*A. utahensis*) are native to the western United States and are adapted to drier sites than the Saskatoon serviceberry.

Serviceberries are characterized by a display of white flowers in the spring and by leaves that have a toothed margin near the tip and a smooth margin at the base. The fruits were a food source for Native Americans and the entire plant is also valuable as a food source for wildlife. Plants are tenacious once established.

## PROPAGATION

There are many species of serviceberry and while they can be propagated as a rooted cutting, there is a large amount of variability in its success. In general, there has been little information published about propagating native serviceberry from cuttings or other vegetative means. Experiments at Aberdeen, Idaho, found the best rooting to occur with shoots that were either suckers from the root system or that had been etiolated early in their growth. Such cuttings rooted much more quickly than did cuttings from the aerial portion of the plant.

### [1: SOFTWOOD CUTTINGS]

#### PROPAGULE

- softwood cuttings

#### MATERIALS

- well-drained rooting substrate
- 3,000 ppm IBA talc rooting hormone

#### ENVIRONMENT

- mist system

#### METHOD

1. Take softwood cuttings when new growth is several inches long, but well before the terminal bud has set. In most parts of the U.S., late May into June would be ideal.
2. Treat with rooting hormone.
3. Stick in rooting substrate.
4. Place on mist bench until rooted.

[Source: Dirr 2006]

[continued]





## SERVICEBERRY [continued]

*Amelanchier* spp.

### [2: ROOT CUTTINGS IN COLD FRAME]

#### PROPAGULE

- root cuttings collected from stock plants

#### MATERIALS

- 1:1 peat: sand (can also add 1 part loam)
- coarse sand or perlite to cover
- fungicide: 5 g to 100-150 cuttings such as Thiram® or Benlate®

#### ENVIRONMENT

- cold frame with lights
- thermal blanket or burlap matting

[Source: Macdonald, 1986]

#### METHOD

1. Prepare cold frame by aerating/amending soil with addition of peat, sand, or perlite. A base dressing of 6-8-6 ratio compound fertilizer at 34 g/m<sup>2</sup> is beneficial.
2. Take pencil-thick root cuttings from as close to the crown as possible from nursery stock. Optimal time is December to February.
3. Place in polyethylene bag and shake with fungicide.
4. Stick cuttings vertically in rows with 2 inch (5 cm) spacing, upper cut surface to be at soil level.
5. Cover with coarse sand or perlite to a depth of ½ inch (13 mm).
6. Use thermal blankets or burlap matting to cover cold frames during extreme cold spells, if necessary.
7. Takes 8 weeks in cold frame to root, but the rooted cuttings should remain in the cold frame until the following fall or winter.

### [3: SEMI-HARDWOOD CUTTINGS]

#### PROPAGULE

- semi-hardwood cuttings collected in summer

#### MATERIALS

- 1:1 sand: perlite
- 4,000 ppm Hormex rooting powder

#### ENVIRONMENT

- outdoor mistbed
- bottom heat at 70°F (21°C)
- shade cloth

[Source: Hosokawa, 2008]

#### METHOD

1. Collect semi-hardwood stem cuttings in late June and cut to 5-7 inches (12-17 cm) in length.
2. Treat with rooting hormone.
3. Stick in rooting substrate.
4. Place in outdoor mistbed and apply mist for 6 seconds every 6 minutes.
5. Cover mistbed with shade cloth during rooting period.
6. Maintain bottom heat.
7. Cuttings should root in 8 weeks.

**Dirr, M.A., and C.W. Heuser, Jr., 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Hosokawa, J., and T. Luna, 2008.** Propagation protocol for vegetative production of container *Amelanchier alnifolia* Nutt. plants (800 ml containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.native-plantnetwork.org> (accessed 11 September 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Macdonald, B., 1986.** Practical Woody Plant Propagation for Nursery Growers. Timber Press, Inc.



# MANZANITA

*Arctostaphylos* spp.

**COLORADO MANZANITA** *Arctostaphylos x coloradensis*

**GREENLEAF MANZANITA** *Arctostaphylos patula*

**POINT-LEAF MANZANITA** *Arctostaphylos pungens*

## PLANT DESCRIPTION

Manzanitas are appreciated for their reddish, exfoliating bark and pink-to-white urn-shaped flowers. Greenleaf manzanita (*A. patula*) is an erect, evergreen shrub that is generally 5-6 feet (1.5-1.8 m) tall, though it can reach heights of 12 feet (3.7 m). *Patula* means 'wide-spreading' and it is generally wider than it is tall. It is found in dry, well-drained soils and requires similar conditions in the landscape. Greenleaf manzanita is especially common in ponderosa pine communities throughout Utah. It is also found as far north as western Oregon and Montana to Baja Mexico in the south, and from California to Colorado.

Point-leaf manzanita (*A. pungens*) is found in open pine forests, chaparral, and pinyon-juniper woodlands. It is found in the southwest corner of Utah and throughout the Sonoran Desert. Point-leaf manzanita is similar in appearance to greenleaf manzanita, but with more pointed leaves. Both have the urn-shaped pink flowers typical of the genus.

Colorado manzanita (*A. x coloradoensis*) is a naturally occurring hybrid between *A. uva-ursi*, *A. nevadensis*, and *A. patula*. A large population grows at 7,000 to 9,000 feet (2,100-2,700 m) in elevation in the Uncompahgre Plateau in Western Colorado. Colorado manzanita ranges in size from 6 inch (15 cm) groundcovers to 3 foot (0.9 m) mounded shrubs.

## PROPAGATION

Protocols for vegetative propagation of greenleaf and point-leaf manzanita are not as common in the literature as they are for the related kinnikinick (*A. uva ursi*).

Recipe 1 for vegetative propagation from dormant cuttings was used for greenleaf manzanita.

Recipe 2 for vegetative propagation from dormant cuttings was used for Colorado manzanita. Colorado manzanita is not common in the nursery trade because of difficulties in propagation. However, particular attention to harvest timing, cutting preparation and rooting substrates can successfully produce rooted cuttings.

In addition to the following propagation recipes, the protocols used for kinnikinick would also be worth trying for these three species. (See *Arctostaphylos uva-ursi*.)

[continued]





## MANZANITA *[continued]*

*Arctostaphylos* spp.

### [1: DORMANT CUTTINGS]

#### PROPAGULE

- dormant 1-year-old cuttings

#### MATERIALS

- horticultural vermiculite rooting substrate
- Hormex® #8 (8,000 IBA)
- 5% bleach solution

#### ENVIRONMENT

- minimally heated greenhouse
- bottom heat 68-70°F (20-21°C)

[Source: Trindle, 2003]

#### METHOD

1. Collect dormant cuttings as late into fall/early winter as possible from mature, dormant 1-year-old wood.
2. Store in moist peat at 37-41°F (3-5°C) until January.
3. Dip in bleach solution for 10 seconds.
4. Make fresh basal cuts before applying rooting hormone.
5. Stick into rooting substrate.
6. Place on bottom heat in minimally heated greenhouse (i.e., no supplemental heat provided during the day; heating only to about 50°F (10°C at night)
7. Mist lightly to keep vermiculite moist.
8. Leave cuttings undisturbed until rooted, which can take up to 4 months.

### [2: DORMANT CUTTINGS]

#### PROPAGULE

- terminal dormant cuttings

#### MATERIALS

- perlite rooting substrate
- rooting hormone 10,000-20,000 ppm of active ingredients
- 10% bleach solution

#### ENVIRONMENT

- bottom heat 70-75°F (21-24°C)
- mist bench

#### NOTES

Sanitation is key to successful propagation of *A. x coloradensis*. With this method, rooting began at 3-4 weeks with a 50-90% success rate.

[Source: Skogerboe, 2003]

#### METHOD

1. Collect cuttings during frost season.
2. Place in plastic bag, mist with water and keep cool until processed. Cuttings can be refrigerated for up to 2 weeks before sticking.
3. Sanitize propagation tools and work area with bleach solution and let sit for 30 min.
4. Prepare single-stem cuttings 1-3 inches (2.5 cm-8 cm) and remove lower leaves and any flower buds.
5. Dip in bleach solution for 15-30 seconds then rinse in clean tap water.
6. Wound bottom ½ inch (13 mm) of cutting.
7. Dip in rooting hormone.
8. Stick cuttings close together in rooting substrate.
9. Place on bottom heat.
10. Mist during the day so cuttings are constantly moist, allow to dry off at night.

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** *Water Wise: Native Plants for Intermountain Landscapes*. USU Press, Logan, UT.

**Skogerboe S. 2003.** Asexual propagation of *Arctostaphylos x coloradensis*. The International Plant Propagators' Society Combined Proceedings 55:370-371.

**Trindle, J.D.C., and T.R. Flessner., 2003.** Propagation protocol for vegetative production of container *Arctostaphylos patula* Greene plants (6); USDA NRCS - Corvallis Plant Materials Center, Corvallis, Oregon. In: *Native Plant Network*. URL: <http://www.nativeplantnetwork.org> (accessed 17 October 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** *Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines*. Utah State University Press.



# KINNIKINICK

*Arctostaphylos uva-ursi*

## PLANT DESCRIPTION

Kinnikinnick (*A. uva-ursi*) belongs to the Ericaceae family of plants, which are typically known for being evergreen and adapted to acidic soils. In spite of those requirements, kinnikinnick is an understory plant in Utah's coniferous forests. It is widely used in the eastern United States as a landscape groundcover and there are several selected cultivars. This plant is typically 2-3 inches (5-8 cm) tall, has attractive evergreen leaves, pink urn-shaped flowers and bright red berries.

## PROPAGATION

This is one woody plant that is easier to grow from cuttings than from seed. In fact, plants in the wild generally propagate themselves by stolons, and plants that develop as natural seedlings are rare.

### [1: SPRING CUTTINGS]

#### PROPAGULE

- hardwood or softwood cuttings

#### MATERIALS

- well-drained rooting substrate (1:1 perlite:sand)
- 2,000-3,000 ppm liquid IBA

#### ENVIRONMENT

- mist system
- bottom heat

#### NOTES

In Glacier National Park, cuttings were collected as hardwood cuttings in April, or as softwood cuttings in mid-May to mid-June (before terminal bud had set). Hardwood cuttings had 66-95% rooting while softwood cuttings had 76-100% rooting.

[Source: Johnson 2008]

#### METHOD

1. Collect hardwood or softwood cuttings before terminal bud has set. Cuttings should be from 4-6 inches (10-15 cm) long with 2 inches (5 cm) of last season's wood attached. Horizontal growth may have pre-formed root initials and would be a good choice of cutting material.
2. Keep cuttings moist and cool during collection.
3. Remove basal 1/3 of the leaves.
4. Treat with rooting hormone
5. Place on bottom heat at 70°F (21°C).
6. Mist 6 seconds every 6 minutes.
7. Cuttings should root within 4 weeks.

[continued]

Photo credit: Robert Potts © California Academy of Sciences (top), Terry Glase (bottom)





**KINNIKINICK** [continued]*Arctostaphylos uva-ursi***[2: SUMMER CUTTINGS]****PROPAGULE**

- 6-10 inch (15-25 cm) long cuttings with pre-formed root initials

**MATERIALS**

- well drained rooting substrate treated with fungicide
- 1,000-3,000 ppm IBA in talc

**ENVIRONMENT**

- bottom heat at 75°F (24°C)

*[Source: Scianna, 2006]***METHOD**

1. Collect cuttings.
2. Keep cuttings moist and cool.
3. At sticking, trim cuttings to 5-8 inches (12-20 cm).
4. Re-cut base and treat with rooting hormone.
5. Place on bottom heat.

**NOTES**

This method was used in Yellowstone National Park, where cuttings are collected in mid-summer due to access challenges earlier in the year.

**[3: FALL CUTTINGS]****PROPAGULE**

- 2-6 inch (5-15 cm) long cuttings from current season's growth

**MATERIALS**

- sand rooting substrate
- 1,000 ppm IBA as liquid and 500 ppm NAA

**ENVIRONMENT**

- bottom heat at 75°F (24°C)
- misting bench

*[Source: Holden, 1975]***METHOD**

1. Collect cuttings.
2. Keep cuttings moist and cool.
3. At sticking, trim cuttings to 5-8 inches (12-20 cm).
4. Re-cut base and treat with rooting hormone.
5. Place on bottom heat.

**NOTES**

Holden found that the timing of collecting cuttings was critical in Oregon and they should be stuck from September 15 to October 15. Cuttings root at 85% or better.

**Dirr, M.A. 1975.** Manual of Woody Landscape Plants, 6th Ed. Stipes Publishing L.L.C. Champaign, Illinois.

**Holden, V.L. 1975.** Propagation of *Arctostaphylos uva-ursi* by cuttings. Proceedings of the International Plant Propagator's Society, 25:74-76.

**Johnson, K., J. Evans, T. Luna, J. Hosokawa, and D. Wick. 2008.** Propagation protocol for vegetative production of container *Arctostaphylos uva-ursi* (L.) Spreng. Plants. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 7 May 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Kunth, in A. von Humboldt et al.** Flora of North America. Vol. 8 Page 411, 416, 417. online <http://www.efloras.org> (accessed 11 September 2013).

**Remphrey, W.R., T.A. Steeves, and B.R. Neal. 1983.** The morphology and growth of *Arctostaphylos uva-ursi* (bearberry): an architectural analysis. Canadian J. Bot. 61: 2430-2450.

**Scianna, Joe 2006.** Propagation protocol for vegetative production of container *Arctostaphylos uva-ursi* (L.) Spreng. Plants. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 7 May 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.



# SILVER SAGEBRUSH

*Artemisia cana*

## PLANT DESCRIPTION

Silver sagebrush (*Artemisia cana*) occurs throughout western North America and, as the name implies, has a light silvery leaf color. It can reach 3-5 feet in height and has long, narrow leaves. The flowers of silver sage are inconspicuous. It is different than many other species of sagebrush in that it propagates itself by layering of horizontal stems that touch the ground and by rhizomes. In either case, it can spread readily throughout the landscape and may be considered invasive in some cases.

## PROPAGATION

As a plant with the ability to layer itself and form rhizomes, silver sagebrush is readily adapted to vegetative propagation. Harvey (1981) successfully propagated plants through hardwood cuttings.

### PROPAGULE

- hardwood cuttings

### MATERIALS

- rooting substrate 50:25:15:10 sand:vermiculite:peat:perlite
- Rootone F®

### ENVIRONMENT

- intermittent mist system

## [HARDWOOD CUTTINGS]

### METHOD

1. Collect 6 inch (15 cm) cuttings.
2. Strip leaves off bottom 1½ inches (4 cm) of stem.
3. Dip in rooting hormone.
4. Stick in rooting substrate.
5. Place under an intermittent mist system.

### NOTES

This system had a reported result of 87% rooting.

[Source: Harvey, 1981]

**Harvey, S.J. 1981.** Life history and reproductive strategies in *Artemisia*. M.S. thesis, Montana State University, Bozeman, MT. 132 p.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen.Tech.Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 16 August 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Wambolt, C.L., T.P. Walton, and R.S. White. 1990.** Sprouting and Seedling Establishment in Plains Silver Sagebrush (*Artemisia cana* Pursh. Ssp. *Cana*). Great Basin Naturalist 50:201-207.



# BASIN SAGEBRUSH

*Artemisia tridentata*

## PLANT DESCRIPTION

Big basin sagebrush (*Artemisia tridentata*) is common throughout the western United States and Canada. It has three subspecies as well as numerous ecotypes and biotypes. It ranges in size from 2 to 15 feet (0.6-4.5 m) in height, but never takes a tree form. All variants have the common long narrow leaves with three blunt tips at the end, as well as a silvery gray-green color. It is a fairly long-lived shrub with the potential to live for 100 years in uncultivated locations. Its spreading and lanky habit makes it best used as a background plant or massed in naturalistic designs.

## PROPAGATION

Big basin sagebrush can be propagated by hardwood cuttings, but is most commonly propagated by seed. For more information on propagating sagebrush by seed, see Young and Young's 'Seeds of Woody Plants in North America'.

### PROPAGULE

- 3- 5 inch (8-13 cm) cuttings of terminal and lateral twigs

### MATERIALS

- 8,000-20,000 IBA talc
- peat pellet substrate

### ENVIRONMENT

- mist bench

### NOTES

After 40-50 days, upwards of 75% of cuttings had rooted with this method.

[Source: Alvarez-Cordero, 1979]

## [HARDWOOD CUTTINGS]

### METHOD

1. Take hardwood cuttings of terminal and lateral twigs (with terminal buds) from the previous season's growth during February-April.
2. Remove the leaves from the bottom 1½ inches (4 cm) of the stem.
3. Dip in water then dip into rooting hormone.
4. Stick in peat pellet substrate.
5. Place in clear plastic tent with day temperatures of 70-76°F (21-24°C) and peat temperatures averaging 66°F (19°C).
6. Mist daily until rooted.

**Alvarez-Cordero, E., and C.M. McKell. 1979.** Stem cutting propagation of big sagebrush (*Artemisia tridentata* Nutt.). J Range Management. 32:141-143.

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press, Logan, UT.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 16 August 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Young, J. A., & Young, C. G. 1992.** Seeds of woody plants in North America. Dioscorides Press.

**Photo credit:** J.S. Peterson @ USDA-NRCS PLANTS Database (bottom)



# FOURWING SALTBUUSH

*Atriplex canescens*

## PLANT DESCRIPTION

Fourwing saltbush (*Atriplex canescens*) is native from the 100th meridian west in the continental United States. It is commonly found with other shrubs in natural mixed plantings and while its landscaping potential is limited, it is an excellent choice for saline sites. It is also drought and cold tolerant. There are many variations with ranges in height from 1 to over 10 feet (0.3-3 m) tall and leaves from 1-2 inches (2.5-5 cm) long. It is long-lived and has a taproot extending to 20 feet (6 m) in length.

## PROPAGATION

Fourwing saltbush is primarily propagated by seed. However it can be propagated vegetatively by cuttings. The potential for rooting is a genetic trait and can vary between selections and varieties. Some varieties produce rhizomes that are able to root by layering.

### PROPAGULE

- softwood cuttings

### MATERIALS

- rooting substrate 1:1 sand: peat
- 3,000 ppm IBA talc

### ENVIRONMENT

- bottom heat
- intermittent mist

## [1: SOFTWOOD CUTTINGS]

### METHOD

1. Collect 3 inch (8 cm) terminal softwood cuttings.
2. Wrap in moist paper towels, place in plastic bags and refrigerate for 24 hours.
3. Moisten base of the cuttings and dip in rooting hormone.
4. Stick in rooting substrate.
5. Place on 68°F (20°C) bottom heat.
6. Keep moist with intermittent mist.

[Source: Wiesner, 1977 (modified)]

### PROPAGULE

- semi-hardwood cuttings

### MATERIALS

- coarse horticultural grade perlite
- 3,000 ppm IBA talc
- fungicide

### ENVIRONMENT

- bottom heat
- intermittent mist
- supplemental lighting

[Source: Crowder, 2006]

## [2: SEMI-HARDWOOD CUTTINGS]

### METHOD

1. Collect 4-6 inch (10-15 cm) long semi-hardwood cuttings in late July or August.
2. Strip lower leaves and keep cool and moist until stuck.
3. Drench cuttings with fungicide.
4. Dip fresh cut ends ½ inch (12 mm) deep in rooting hormone.
5. Stick cuttings 4 inches (10 cm) deep in substrate.
6. Bottom heat at 75-77°F (24-25 °C) with greenhouse air temperature at 65-70°F (18-21°C).
7. Use supplemental lighting 24 hours/day.
8. Use intermittent mist at 15 seconds every 20 minutes.

**Crowder, W. 2006.** Propagation protocol for vegetative production of container *Atriplex canescens* (Pursh) Nutt. Plants. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 20 May 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**USDA, NRCS. 2013. The PLANTS Database.** (<http://plants.usda.gov>, 6 May 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Wiesner, L.E., and W.J. Johnson. 1977.** Fourwing Saltbush (*Atriplex canescens*) Propagation Techniques. *Journal of Range Management*. 30:154-156.

**Photo credits:** Adrea Wheaton





# WESTERN RIVER BIRCH

*Betula occidentalis*

## PLANT DESCRIPTION

Western river birch, or water birch (*Betula occidentalis*), is a lovely, small tree characterized by multiple stems of deep copper color. It is commonly found along streams throughout the west and in most drainages of the Rocky Mountains. One of its major advantages is resistance to bronze birch borer and to birch leaf miner (though we have found a native population from Sevier County, Utah, that is susceptible to leaf miner). It is a fast growing tree with a bright yellow fall color.

## PROPAGATION

There is no well-documented information published about vegetative propagation of western river birch. Birches in general can be propagated by cuttings if taken when the stem base is hardening, but no visible terminal bud has formed (Dirr). In some cases rooting can also work in the fall. With non-native species such as *B. papyrifera* or *B. pendula*, 6 to 8-inch (15-20 cm) cuttings are treated with 8,000 ppm IBA as a talc and rooted in sand. If rooting is successful it will occur within 2 weeks.

River birch propagates easily from seed. However, it crosses readily with other birch species and trees produced from seed may not be true natives and may differ in appearance and pest susceptibility. For more information on propagating birches by seed, see Young and Young's 'Seeds of Woody Plants in North America'.

**Dirr, M.A. and C.W. Heuser, Jr., 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Doran, W.L. 1957.** Propagation of woody plants by cuttings. Expt. Sta. Bull. 491. Univ. of Massachusetts.

**Young, J. A., & Young, C. G. 1992.** Seeds of woody plants in North America. Dioscorides Press.



# SNOWBRUSH

*Ceanothus velutinus*

## PLANT DESCRIPTION

Snowbrush or buckbrush (*Ceanothus velutinus*) is a broad-leaf evergreen that occurs at elevations of 7,000 to 9,000 feet (2,100-2,700 m). It is typically found on south-facing slopes and is predominantly shade intolerant. It is characterized by multiple stems and a height of 3-6 feet (0.9-1.8 m). While the branches are often procumbent, it does not self-layer, but sprouts from the crown if disturbed or burned. Its greatest value in the landscape is as a broadleaf evergreen and the very shiny leaves that appear almost as though they have been varnished. The entire plant has a characteristic balsam scent.

## PROPAGATION

Snowbrush is a difficult plant to grow from seed. However, once collected and treated, generally 70-80% of seed germinates. Vegetative propagation is not done extensively. Plants should be inoculated with *Streptomyces ceanothii* before outplanting to enable nitrogen fixation. Roots are susceptible to rot and cuttings should be uprooted into well-drained rooting substrate overwinter.

### [1: SEMI-HARDWOOD CUTTINGS]

#### PROPAGULE

- semi-hardwood cuttings

#### MATERIALS

- 2,000 ppm liquid IBA
- 1:1 perlite:sand rooting substrate

#### ENVIRONMENT

- mist bed with bottom heat 70° F (21°C)

[Source: Evans, 2001]

#### METHOD

1. Take summer semi-hardwood cuttings from late April to early June.
2. Keep moist and cool until stuck.
3. Trim cuttings to 8-12 inches (20-30 cm).
4. Dip in rooting hormone.
5. Stick cuttings in rooting substrate.
6. Place bottom heat under shade cloth.
7. Use intermittent mist 6 seconds every 6 minutes.

#### NOTES

Cuttings taken in late April had 99% success rate after 8 weeks, while cuttings taken in late June only had a 31% success rate after 8 weeks.

[continued]



# SNOWBRUSH *[continued]*

*Ceanothus velutinus*

## [2: TERMINAL CUTTINGS]

### PROPAGULE

- terminal cuttings from semi-hardwood

### MATERIALS

- 8,000 ppm IBA
- well-drained rooting substrate

### ENVIRONMENT

- mist bed with bottom heat 70°F (21°C)
- intermittent mist

### METHOD

1. Collect terminal cuttings from semi-hardwood.
2. Treat with rooting hormone.
3. Stick cuttings in rooting substrate.
4. Place on bottom heat.
5. Use intermittent mist.

### NOTES

There is no information available about the rooting rate of this method.

*[Source: Borland, 1988]*

**Borland, J. 1988.** *Ceanothus velutinus*. American Nurseryman. 168(9):154.

**Evans, J., T. Luna, J. Hosokawa, and D. Wick, 2001.** Propagation protocol for vegetative production of container *Ceanothus velutinus* Dougl. Plants. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 13 May 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.



# NETLEAF HACKBERRY

*Celtis laevigata* var. *reticulata*

## PLANT DESCRIPTION

Netleaf hackberry (*Celtis laevigata* var. *reticulata*) is native throughout the southwest and is a close relative of the common hackberry (*Celtis occidentalis*). It is a large shrub to small tree reaching only about 20 feet (6 m) in height, though there are instances of it being larger. It has the unkempt appearance common to hackberries, but its appearance improves with age as it takes on a more weathered, picturesque form. It is also characterized by bark that has prominent corky ridges. It is a slow growing tree, but is also drought and wind tolerant.

## PROPAGATION

The literature is replete with references to propagation of netleaf hackberry by cuttings, but with no documented protocols. It is commonly propagated by seed. For information on propagating netleaf hackberry by seed, see Young and Young's 'Seeds of Woody Plants in North America'.

**Anonymous. 2009.** *Celtis laevigata* var. *reticulata* (Torr.) L. Benson. In: Native Plant Database. [www.wildflower.org/plants/](http://www.wildflower.org/plants/) (accessed 15 May 2013). Lady Bird Johnson Wildflower Center. University of Texas at Austin.

**Dorn, R.D., and J.L. Dorn. 2007.** Growing Native Plants of the Rocky Mountain Area.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 16 August 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Young, J. A., & Young, C. G. 1992.** Seeds of Woody Plants in North America. Dioscorides Press.

**Photo credits:** Sheri Hagwood @ USDA-NRCS PLANTS Database (top left), ©AI Schneider @ USDA-NRCS PLANTS Database (bottom)





# WESTERN REDBUD

*Cercis occidentalis*

## PLANT DESCRIPTION

Western redbud or California redbud (*Cercis occidentalis*) is a multi-stemmed small tree or large shrub that grows 7-20 feet (2.1-6 m) tall. It is native to the southern parts of California, Nevada, and Utah and throughout Arizona. Western redbud is found on steep slopes in canyons and near streams, and thrives in hot, dry environments.

Western redbud is an attractive landscape tree that is grown for its stunning magenta blooms on bare branches in the spring. However, it can take several years of establishment in the landscape before blooming. The young, wine-red branches of western redbud are valuable to Native Americans for weaving baskets.

## PROPAGATION

There is no documented information published on vegetative propagation of western redbud by cuttings. However, its close relative, *Cercis canadensis*, has been propagated by grafting. This is usually done by T-budding in mid-summer or side grafting in the winter. Understock must be cut back to the bud after 3 weeks or the graft will fail. For more information on propagating western redbud by seed, see Young and Young's 'Seeds of Woody Plants in North America.'

**Baer-Keeley, Melanie. 2004.** Propagation protocol for production of container *Cercis orbiculata* Greene plants (Deep pots); USDI NPS - Sequoia Kings Canyon National Park. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 10 June 2013). Moscow (ID): University of Idaho.

**USDA, NRCS. 2013.** The PLANTS Database. (<http://plants.usda.gov>, 6 May 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.

**Young, J.A., and C.G. Young. 1992.** Seeds of Woody Plants in North America. Dioscorides Press, Portland, Oregon.

**Photo credits:** Adrea Wheaton (top left), Gary Monroe (top right), Barry Rice (bottom)



# CURL-LEAF MOUNTAIN MAHOGANY

*Cercocarpus ledifolius*

## PLANT DESCRIPTION

In Utah there are three generally recognized species of mountain mahogany; curl-leaf mountain mahogany (*Cercocarpus ledifolius*), little-leaf mountain mahogany (*C. intricatus* or *C. ledifolius* var. *intricatus*), and alder-leaf mountain mahogany (*C. montanus*). The curl-leaf and little-leaf versions are evergreen and do not sprout from the roots. In contrast, alder-leaf is deciduous and does sprout from the roots. All three of these species are known to hybridize with each other. As a result, mahogany plant and leaf morphology can be variable. In addition, the ability to root from cuttings also appears to be variable; both within a species and as a result of hybridization.

Curl-leaf mountain mahogany (*Cercocarpus ledifolius*) is a large shrub or small tree that is well-adapted to low-water landscapes. It is found throughout Utah at 4,500 to 9,800 feet (1,400-3,000 m) in elevation in Arizona, California, Colorado, Idaho, Montana, and Washington. The leaves are small and leathery and curl in at the edges. Perhaps the most distinctive feature is the feathery achenes that cover the shrub late summer into fall.

## PROPAGATION

The propagation literature covers only the little-leaf mahogany (*C. ledifolius* var. *intricatus*), but the same propagation techniques could be applied to the curl-leaf mahogany. Curl-leaf mountain mahogany can be propagated by mound layering. However, relatively slow regrowth of sheared plants and few shoots growing from the base of the plant suggest that mound layering through stool beds is not a viable, long-term propagation system.

### [1: HARDWOOD CUTTINGS]

#### PROPAGULE

- hardwood cuttings

#### MATERIALS

- 3,000-6,000 ppm Hormex® rooting powder
- sand rooting substrate

#### ENVIRONMENT

- greenhouse
- misting bed with shading

[Source: Dougher, unpublished]

#### METHOD

1. Take dormant cuttings in winter. (This experiment was done in February in Montana.)
2. Trim to 4-6 inches (10-25 cm) in length and remove lower leaves.
3. Dip in rooting hormone.
4. Stick in rooting substrate.
5. Roots should form in 8-10 weeks.

#### NOTES

This experiment at Montana State University had an 80% success rate. Other rooting substrates were used, but sand was the most successful.

[continued]



## CURL-LEAF MOUNTAIN MAHOGANY

*Cercocarpus ledifolius* [continued]

## PROPAGULE

- layered shoots

## MATERIALS

- stock plants in stool bed
- conifer shavings
- 4-inch (10 cm) cable ties
- 2,000-4,000 ppm IBA as Dip 'N Grow® (diluted with 25% ethanol)

## ENVIRONMENT

- sprinkler irrigation system (use as needed to keep wood shavings moist)

[Source: Rupp, unpublished]

## [2. MOUND LAYERING]

## METHOD

1. In late winter, prune stock plant to within 1-3 inches (25-75 mm) of base.
2. Beginning in May, mound wood shavings around the base of the stems being careful not to cover the entire shoot.
3. In early July, remove shavings and girdle each shoot to be rooted by placing a cable tie tightly around the base of the shoot.
4. Treat the shoot with rooting hormone by applying with a cotton-tipped swab just above the girdle.
5. Reapply the wood shavings to cover the treated portion of the stem.
6. Keep moist until plants have gone dormant in November.
7. Remove wood shavings prior to them freezing solid for the winter and remove rooted shoots by breaking at the girdle.
8. Transplant rooted shoots to container and keep in a cool environment until placing in final location the next spring.

**Dougher, T. unpublished.** Montana State University.

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** *Water Wise: Native Plants for Inter-mountain Landscapes.* USU Press. Logan, UT.

**Rupp, L. unpublished.** Utah State University.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** *Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines.* Utah State University Press.



# LITTLE-LEAF MOUNTAIN MAHOGANY

*Cercocarpus ledifolius* var. *intricatus*

## PLANT DESCRIPTION

Little-leaf mountain mahogany (*Cercocarpus ledifolius* var. *intricatus*) is native to Utah, Arizona, and Nevada. It occurs on dry, rocky sites with limited water and extreme summer temperatures. While it is always a small, evergreen shrub with fleshy leaves that curl under at the margins, it can come in different forms ranging from rounded to columnar to prostrate. The flowers are not particularly showy, but the fruit has a cork-screw shaped plumose style that is quite unique and attractive. It has a very dense and intricate branching pattern, with the stems being a significant part of its appearance and adding a rather coarse textured feel. It is a very drought tolerant plant with minimal disease or insect problems. It is also actinorhizal and able to fix nitrogen.

## PROPAGATION

Little-leaf mountain mahogany can be propagated vegetatively by cuttings. There does seem to be genetic variability in the ability to root.

### [CUTTINGS]

#### PROPAGULE

- terminal cuttings

#### MATERIALS

- 4:1 perlite: peat rooting substrate
- 2,000-4,000 ppm IBA as Dip 'N Grow® (diluted with 25% ethanol)

#### ENVIRONMENT

- intermittent mist as needed (7 seconds every 12 minutes in northern Utah greenhouse)
- greenhouse with 60% shade and set at 65/60°F (16/18°C)(day/night temperatures) during summer, same temperatures during winter with 18 hour days
- bottom heat at approximately 75°F (24°C)

#### METHOD

1. Collect terminal cuttings of current season's growth.
2. Trim to 4-6 inches (10-25 cm) in length and remove leaves from the lower 1 ½ inches (38 mm) of stem.
3. Dip cuttings for 5 seconds in rooting hormone.
4. Stick in pre-moistened substrate and place under mist on bottom heat.
5. Cuttings should root within 8 weeks.

#### NOTES

Cuttings have been rooted in May, July, September, and January; but the best success seems to be in mid-summer.

[Source: Rupp, unpublished]

Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003. Water Wise: Native Plants for Inter-mountain Landscapes. USU Press. Logan, UT.

Rupp, L. unpublished. Utah State University.

Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011. Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.





# ALDER-LEAF MOUNTAIN MAHOGANY

*Cercocarpus montanus*

## PLANT DESCRIPTION

Alder-leaf or true mountain mahogany (*Cercocarpus montanus*) is a shrub to small tree growing to 13 feet (4 m) in height. It is found throughout the western continental United States. Its roots form a symbiotic relationship with bacteria that allows them to fix nitrogen (actinorhizal). It is characterized as having an extensive root system including rhizomes. It can also hybridize with other species of *Cercocarpus*. Alder-leaf mountain mahogany can be used effectively in low-water landscapes and adds a nice form and attractive seedheads.

## PROPAGATION

In the nursery industry, alder-leaf mountain mahogany is propagated entirely by seed, though in nature it does regenerate from the crown or rhizomes in situations where it has been burned or damaged.

Even though there are anecdotal references to cutting propagation, there is no published record of it happening. In fact, Rosner, et al. (2000) in a study of alder-leaf mountain mahogany in New Mexico, found less than 1% rooting when cuttings of current season's wood were taken from January to April.

The presence of rhizomes would indicate that adventitious rooting is possible. It may just require that rooting be done as a softwood cutting.

**Rosner, L., J.T. Harrington, and D. Dreesen. 2000.** Preliminary Evaluation on Adventitious Rooting Hardwood Stem Cuttings of *Symphoricarpos oreophilus*, *Ribes cereum*, and *Cercocarpus montanus* from throughout New Mexico 5. New Mexico Plant Materials Center Annual Technical Report (200): 15.

**Mee, W., J. Barnes, R. Kjølgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press, Logan, UT.

**USDA, NRCS. 2013.** The PLANTS Database. (<http://plants.usda.gov>, 6 May 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.



# FERNBUSH

*Chamaebatiaria millefolium*

## PLANT DESCRIPTION

Fernbush (*Chamaebatiaria millefolium*) is a large shrub that can reach over 6 feet (1.8 m) in height. Its most distinguishing features are the thick, leathery leaves that are so finely dissected they look almost fern-like. It is covered with panicles of white flowers in midsummer. In the winter, most of the older leaves drop to reveal smooth, russet bark. Fernbush is useful in the landscape as a screen or mass planting. It is also very attractive to pollinators when blooming. It requires very little water once established.

## PROPAGATION

There is no record of any vegetative propagation of fernbush; it is propagated solely by seed. For more information on propagating fernbush by seed, see Young and Young's 'Seeds of Woody Plants in North America.'

**Denver Water. 1996.** Xeriscape Plant Guide / introduction by Rob Proctor. Fulcrum Publishing, Golden, Colorado.  
**Young, J. A., & Young, C. G. 1992.** Seeds of woody plants in North America. Dioscorides Press.



# DESERT WILLOW

*Chilopsis linearis*

## PLANT DESCRIPTION

Desert willow (*Chilopsis linearis*) is a multi-stemmed tree that can grow up to 20 feet (6 m) or more in favorable conditions. It can be found in washes and stream courses in southern Utah and also in Arizona, California, Nevada, and New Mexico. Desert willow is appreciated as a landscape plant for its showy pink to white orchid-like flowers that attract hummingbirds. Its linear, light green leaves create a wispy, open appearance. Flowers turn into bean-like seedpods that can be messy in landscape situations.

## PROPAGATION

Desert willow germinates readily from fresh seeds. It can also be easily rooted from semi-hardwood cuttings taken in late summer.

### PROPAGULE

- semi-hardwood cuttings

### MATERIALS

- 3,000-8,000 ppm IBA in talc
- well-drained rooting substrate

### ENVIRONMENT

- intermittent mist

## [SEMI-HARDWOOD CUTTINGS]

### METHOD

1. Take semi-hardwood cuttings from current season's growth in late summer.
2. Treat with rooting hormone.
3. Stick in rooting substrate.
4. Place under intermittent mist.
5. Reduce frequency of misting once cuttings begin to callus and root.
6. Cuttings usually root in 2 to 3 weeks.

[Source: Mortensen, 1947]

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press. Logan, UT.

**Mortensen, E. Ornamentals for Southwest Texas. 1947.** Texas Agricultural Experiment Station Bulletin MP-139. College Station, Texas. (<http://repository.tamu.edu/handle/1969.1/86346> accessed Oct. 10, 2013)

**Nokes, J. 1951.** How to Grow Native Plants of Texas and the Southwest. Texas Monthly Press. Austin, Texas.

**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 10 October 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.

**Photo credits:** Thomas L. Muller (top), Gary A. Monroe, hosted by the USDA-NRCS PLANTS Database (bottom).



# ROCKY MOUNTAIN CLEMATIS

*Clematis columbiana*

## PLANT DESCRIPTION

Rocky Mountain clematis (*Clematis columbiana*) is a semi-woody aerial vine that can grow up to 12 feet (3.7 m) in length, though it is often creeping. The nodding blue to reddish-purple flowers are followed by plumed seedhead typical to the genus. Rocky Mountain clematis is found east of the Cascades throughout the Intermountain West in open forests and montane slopes. In the landscape, it is well-suited as a rock garden plant.

## PROPAGATION

Descriptions of vegetative propagation of Rocky Mountain clematis are not as common in the literature as other clematis species. Rooting by softwood cuttings has been documented, but the hardwood cutting method used for *C. ligusticifolia* could be worth trying.

## [SOFTWOOD CUTTINGS]

### PROPAGULE

- softwood cuttings collected in early summer

### MATERIALS

- 8,000 ppm IBA talc
- rooting substrate of 1:1 sand:perlite
- wild or cultivated stock plants

### ENVIRONMENT

- bottom heat 70°F (21°C)
- intermittent mist
- shade cloth

### METHOD

1. Take softwood cuttings from healthy plants in early summer.
2. Treat cuttings with rooting hormone.
3. Stick in rooting substrate.
4. Use bottom heat.
5. Apply mist for 6 seconds at 6 minute intervals.
6. Cover mistbed with shade cloth during rooting.

### NOTES

Rooting success with this method was 38% after 7 weeks.

[Source: Luna and Hosokawa, 2008]

**Luna, T., and J. Hosokawa. 2008.** Propagation protocol for vegetative production of container *Clematis columbiana* (Nutt.) In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 11 June 2013). Moscow (ID): University of Idaho.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Stannard, M., and W. Crowder.** Western Clematis. USDA, NRCS, Plant Materials Center, Pullman, Accessed 11 June 2013.

**USDA, NRCS. 2013.** The PLANTS Database. (<http://plants.usda.gov>, 6 May 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.

**Photo credit:** Bransford, W.D. and Dolphia, Lady Bird Johnson Wildflower Center (top), W. Padgett (bottom)





# VIRGIN'S BOWER

*Clematis ligusticifolia*

## PLANT DESCRIPTION

Western virgin's bower (*Clematis ligusticifolia*) is a woody vine that can grow up to 30 feet (9 m) in length. It has white to cream colored flowers and typically is found growing on trees or other supportive material. It can be found in riparian communities from British Columbia to North Dakota and south to California, Arizona, and New Mexico.

## PROPAGATION

Vegetative propagation of *Clematis ligusticifolia* is described by many sources. Basically there are two methods: softwood and hardwood cuttings. Softwood cuttings are taken in June to July when the stems are firm. They require at least one leaf bud. Softwood cuttings taken early in the season are less successful.

### [1: SOFTWOOD CUTTINGS]

#### PROPAGULE

- softwood cuttings

#### MATERIALS

- 3,000 ppm IBA talc
- fungicide
- coarse perlite rooting substrate
- wild or cultivated stock plants

#### ENVIRONMENT

- bottom heat 75-77°F (24-25°C)
- intermittent mist

#### METHOD

1. Take softwood cuttings in June to July when stems are firm. They require at least one leaf bud.
2. Drench in fungicide for 30 seconds.
3. Treat cuttings with rooting hormone.
4. Stick in rooting substrate.
5. Place on mist bench with bottom heat and mist for 15 seconds every 15 minutes.

[Source: Crowder, 2006]

### [2: HARDWOOD CUTTINGS]

#### PROPAGULE

- hardwood cuttings

#### MATERIALS

- 3,000 ppm IBA talc
- rooting substrate of perlite, sand/perlite or similar material

#### ENVIRONMENT

- bottom heat 70°F (21°C)
- intermittent mist

#### METHOD

1. Collect hardwood cuttings when plants are dormant.
2. Treat cuttings with 3,000 ppm IBA talc.
3. Stick in rooting substrate.
4. Place in cool, dark environment or under mist bench with bottom heat until rooted.
5. Use shade cloth covering.

#### NOTES

Rooting success with hardwood cuttings can be up to 76%.

[Source: Stannard & Crowder, 2013]

**Crowder, W. 2006.** Propagation protocol for vegetative production of container *Clematis ligusticifolia* Nutt. Plants. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 11 June 2013). Moscow (ID): University of Idaho.

**Stannard, M., and W. Crowder.** Western Clematis. USDA, NRCS, Plant Materials Center, Pullman, Accessed 11 June 2013. [http://www.nrcs.usda.gov/Internet/FSE\\_PLANTMATERIALS/publications/wapmcp4909.pdf](http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/wapmcp4909.pdf)

**USDA, NRCS. 2013.** The PLANTS Database. (<http://plants.usda.gov>, 6 May 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.



# RED-STEM DOGWOOD

*Cornus sericea*

## PLANT DESCRIPTION

Redstem dogwood (*Cornus sericea*) is a native shrub found along streambeds throughout North America. It is very cold hardy and is distinguished by its lush foliage in the summer and bright red stems in the winter. Several selections have been identified and are currently used in the landscape industry as cultivated varieties. While it is commonly found in riparian areas, it is actually quite drought tolerant, especially if given adequate space and protection from competing plants.

## PROPAGATION

Redstem dogwood roots relatively easily and will anchor and root itself wherever a stem touches the ground. Thus, it is fairly versatile in the ways it can be vegetatively propagated. Cuttings can be collected in late winter (as dormant hardwood cuttings) or in mid-summer as softwood cuttings.

### [1: SOFTWOOD CUTTINGS]

#### PROPAGULE

- softwood cuttings

#### MATERIALS

- 1:1 sand:perlite rooting substrate
- wild or cultivated stock plants
- fungicide
- 2,000 ppm IBA liquid quick dip

#### ENVIRONMENT

- outdoor mist bed with shade cloth
- bottom heat at 70°F (21°C)

#### METHOD

1. Collect softwood cuttings.
2. Keep moist until sticking.
3. Trim cuttings to 8-12 inches (20-30 cm) long and 1/4 to 1/3 inch (13-17 mm) in diameter.
4. Prepare cuttings by removing the bottom 1/3 of leaves and rinsing for 2 minutes in a fungicide bath.
5. Quick-dip cuttings in rooting hormone.
6. Stick in rooting substrate.
7. Place in mistbed with bottom heat.
8. Cuttings should root within 8 weeks.

[Source: Wick et al. 2008]

### [2: HARDWOOD CUTTINGS]

#### PROPAGULE

- dormant stem cuttings

#### MATERIALS

- wild or cultivated stock plants
- 2:1:1 peat:perlite:vermiculite

#### ENVIRONMENT

- greenhouse, shadehouse
- intermittent mist

#### METHOD

1. Collect stem cuttings from dormant stock plants.
2. Hold at 36-39°F (2 – 4°C) until sticking, but stick before bud burst.
3. Trim cuttings to 6 inches (15 cm) in length and remove terminal buds.
4. Stick cuttings in substrate to a depth of 4 inches (10 cm).
5. Water in cuttings and keep moist with an intermittent schedule until rooted.

[Source: Harrington, 2008]

**Harrington, J.T., and M.W. Loveall. 2008.** Propagation protocol for vegetative production of container *Cornus sericea* L. plants (164 ml container); New Mexico State University-Mora Research Center, Mora, New Mexico. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 19 September 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Wick, D., J. Evans, S. Corey, and J. Hosokawa. 2008.** Propagation protocol for vegetative production of container *Cornus sericea* L. *sericea* L. plants (3 L (1 gal) containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 24 January 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 16 August 2013). National Plant Data Team, Greensboro, NC, USA.

**Photo credit:** Shasta-Trinity National Forest USDA Forest Service (top), Wikipedia (bottom)



# RIVER HAWTHORN

*Crataegus douglasii* var. *rivularis*

## PLANT DESCRIPTION

There are 214 species of hawthorns with five native to Utah. River hawthorn (*Crataegus douglasii* var. *rivularis*) is a deep-rooted small tree or shrub characterized by smooth bark, thorns, and narrow oval leaves. The leaves are bright red in the fall and the ¼ -inch (6 mm) fruit is black when ripe. It is typically located in well-drained soils in riparian regions.

River hawthorn has great value as wildlife habitat and for soil conservation. It is a good candidate for use in landscape plantings in locations where the thorns are not a liability.

## PROPAGATION

There are several hawthorns that are common in the nursery/landscape trade. Without exception they are vegetatively propagated by grafting or budding, not by cuttings. Techniques used are root grafting or T-budding. Budding is done in August and uses seedling rootstocks. No information is available on grafting of hawthorns native to Utah.

According to Hartmann and others (2011), hawthorns tend to reproduce true from seed. Of course, all rootstocks are currently started from seed. For more information on propagating hawthorns by seed, see Young and Young's 'Seeds of Woody Plants in North America.'

**Dirr, M.A. and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Hartmann, H.T., F.T. Davies, R.L. Geneve, and D.E. Kester. 2011.** Hartmann and Kester's Plant Propagation: Principles and Practice. Prentice Hall.



# SHRUBBY CINQUEFOIL

*Dasiphora fruticosa*

## PLANT DESCRIPTION

Shrubby cinquefoil (*Dasiphora fruticosa*, formerly *Potentilla fruticosa*) is a member of the rose family. It is common throughout the mountains of Utah and is a widely used landscape ornamental with multiple varieties available in the nursery trade. It is characteristically a small (2-3 foot, 0.6-0.9 m) shrub with gray-green leaves that are pinnately lobed, and it has exfoliating bark on the older stems. Its most outstanding feature is its bright yellow blossoms that occur in June-August.

## PROPAGATION

Shrubby cinquefoil can be propagated by division, seed, or cuttings. The most common commercial technique used is cuttings. Shrubby cinquefoil is also vegetatively propagated by tissue culture (see HortScience 17:190 (1982) and by layering (Tirmenstein, 1987.)

## [CUTTINGS]

### PROPAGULE

- 4-6 inch (10-15 cm) cuttings from current season's growth

### MATERIALS

- 1,000 ppm IBA talc
- 1:1 peat:perlite rooting substrate

### ENVIRONMENT

- bottom heat 75°F (24°C)
- intermittent mist

[Source: Dirr, 2006]

### METHOD

1. Collect cuttings anytime during the summer or early fall from current season's growth.
2. Remove lower leaves.
3. Make a fresh 45° angle cut and dip in rooting hormone.
4. Stick in 1:1 peat:perlite rooting substrate.
5. Place on bottom heat.
6. Hold under light intermittent mist, but cease as soon as rooting begins since cuttings are prone to mildew.
7. Cuttings root in about 6 weeks.

**Dirr, M.A. and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Freeland, K.S. 1977.** Propagation of *Potentilla*. Proceedings of the International Plant Propagator's Society, 27:441-442.

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**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 6 November 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Photo credit:** Patrick Alexander @ USDA-NRCS PLANTS Database (top), Wikipedia (bottom)





# MORMON TEA

*Ephedra viridis*

## PLANT DESCRIPTION

Green ephedra (*Ephedra viridis*) is a dioecious shrub with evergreen stems that can grow to 3-4 feet (0.9-1.2 m) in height. It has very small leaves and in the landscape its primary effect is long, stiff stems. It is somewhat similar to Scotch broom in appearance, but the flowers are not showy. Nevada ephedra (*E. nevadensis*) is a related species that has a much more blue color than the bright green of *E. viridis*. Other ephedra species occurring in Utah include *E. fasciculata* and *E. torreyana*.

## PROPAGATION

Ephedra is reluctant to be propagated vegetatively. The only known example of successful rooting was done by Wieland, Frolich, and Wallace in the late 1960s. They had successful rooting by collecting cuttings from seedling plants (assumed to be nursery grown), sticking them in a Yolo loam soil, and holding in a ventilated greenhouse with bottom heat. They found no benefit of 3,000 and 8,000 ppm IBA treatments. When attempts were made to propagate field collected cuttings, none survived transplanting. For information on propagating ephedra by seed, see Young and Young's 'Seeds of Woody Plants in North America.'

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.

**Wieland, P.A.T., E.F. Frolich, A. Wallace. 1971.** Vegetative propagation of woody shrub species from the northern Mojave and southern Great Basin deserts. Madrono. 21 (3): 149-152.

**Young, J. A., & Young, C. G. 1992.** Seeds of woody plants in North America. Dioscorides Press.



# RABBITBRUSH

*Ericameria nauseosa*

## PLANT DESCRIPTION

There are a multitude of species and subspecies of rabbitbrush throughout the state of Utah, with rubber rabbitbrush (*Ericameria nauseosa*, formerly *Chrysothamnus nauseosa*) being the most common. It is difficult for all but the most experienced taxonomist to differentiate between all the different classifications. Rabbitbrush is a shrub ranging in size from 1-6 feet (0.3-1.8 m) in height with colors that cover the spectrum of white to gray to green. Rabbitbrush typically has yellow flowers that form in the fall, and it is a prolific producer of seed. It easily propagates itself through seeding, to the point it is often considered a weedy plant in the landscape. It is a very drought tolerant plant and is attractive to wildlife. One of its biggest faults is the tendency to become rank and leggy in a cultivated environment.

## PROPAGATION

The consensus on rabbitbrush propagation is quite variable, but it clearly can be propagated by cuttings. Various research projects have demonstrated success ranging from 0-67%, depending on the plant and the conditions.

### [CUTTINGS]

#### PROPAGULE

- cuttings from current season's shoot growth

#### MATERIALS

- 3:1 perlite:peat substrate
- 3,000 ppm IBA in talc or
- 2,000 ppm IBA/1,000 ppm NAA in 50% alcohol
- wild or cultivated stock plants

#### ENVIRONMENT

- intermittent mist system
- bottom heat at 70-75°F (21-24°C)

#### NOTES

At Utah State University we rooted cuttings from a white rabbitbrush (*Ericameria nauseosa* ssp. *nauseosa* var. *speciosa*) and an unidentified dwarf rabbitbrush at a success rate of 50-67%. Cuttings were taken in early to mid-summer from current season's growth. Cuttings taken after October were less successful.

[Source: Rupp, unpublished]

#### METHOD

1. Take cuttings during early to mid-summer from current season's growth.
2. Strip leaves from the lower stem and wound the stem.
3. Dip in rooting hormone.
4. Stick in rooting substrate.
5. Place on bottom heat.
6. Hold under intermittent mist for 7 seconds every 12 minutes taking care to avoid stem and root rot.

McArthur, E.D., A.C. Blauer, A.P. Plummer, R.Stevens. 1979. Characteristics and hybridization of important Intermountain shrubs. III. Sunflower family. Res. Pap. INT-220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermtn Forest and Range Experiment Station. 82 pp.

Rupp, L. unpublished. Utah State University.



# APACHE PLUME

*Fallugia paradoxa*

## PLANT DESCRIPTION

Apache plume (*Fallugia paradoxa*) is a member of the rose family and somewhat similar to bitterbrush and cliffrose. It is unique in that the feathery plumes on the seeds are showier than the flowers themselves. When flowers or seeds are not present, it is a semi-evergreen plant that is very informal and twiggy in appearance. It is common throughout the southwestern United States and varies in size. It has an extensive root system.

## PROPAGATION

Apache plume is commonly propagated by seed, and not by vegetative means. In fact, there are no detailed protocols available on propagation with any kind of cutting or layering. There are, however, numerous references to its ability to send up suckers from its extensive root system. Suckering increases with available moisture and if there has been an injury to the plant. Suckering also increases if the plant is in a coarse soil and is not inhibited by other plants.

The literature also suggests that Apache plume can be propagated by root cuttings. It would appear that taking advantage of the root's ability to sprout by using root cuttings would be the best means of vegetatively propagating unique clones of this interesting plant.

For information on propagating Apache plume by seed, refer to Young and Young's 'Seeds of Woody Plants in North America'.

**Ladyman, J.A.R.**, *Fallugia paradoxa* (D. Don) Endl. Ex Torr. <http://www.fs.fed.us/global/itf/pdf/shrubs/Fallugia%20paradoxa.pdf>

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Young, J. A., & Young, C. G. 1992.** Seeds of woody plants in North America. Dioscorides Press.



# DESERT OLIVE

*Forestiera pubescens*

## PLANT DESCRIPTION

Desert olive (*Forestiera pubescens*) is a member of the olive family and produces a black drupe (think olive) that is about 1/4 inch (6 mm) long. It is a fairly fast growing shrub reaching heights of 12-15 feet (3.7-4.6 m) and a spread of 6-10 feet (1.8-3 m). The plant is round in form and has multiple stems and gray-green leaves that are about 1 inch long and oval. It can be used as an informal hedge or pruned into a formal sheared one. In Utah it is native to the Colorado Plateau region. It is used in the landscape in northern Utah, but is at the limit of its cold hardiness in these areas and may have winter injury as a result.

## PROPAGATION

There is not very much information in the literature on propagating desert olive vegetatively, but Dirr and Hueser have successfully experimented with semi-hardwood cuttings.

### [SEMI-HARDWOOD CUTTINGS]

#### PROPAGULE

- 5-8 inch (13-20 cm) long semi-hardwood cuttings

#### MATERIALS

- 3:1 perlite:peat rooting substrate
- sand rooting substrate or peat:perlite
- Ethrel®

#### ENVIRONMENT

- no information, but standard conditions should work

#### METHOD

1. Take cuttings in midsummer.
2. Strip leaves from the lower stem and wound the stem.
3. Treat with Ethrel®.
4. Stick in rooting substrate.

#### NOTES

Dirr and Heuser report that cuttings taken in late July in Colorado have 80% rooting in sand. The cuttings used were 5-8 inches (13-20 cm) long. Interestingly, treating with 960 ppm Ethrel® increased rooting from 35% to 100% in a peat:perlite rooting substrate.

[Source: Dirr, 2006]

**Dirr, M.A. and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 20 August 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Photo credits:** Adrea Wheaton(top), Roger Kjelgren (bottom)





# SINGLE-LEAF ASH

*Fraxinus anomala*

## PLANT DESCRIPTION

Single-leaf ash (*Fraxinus anomala*) is a small tree or shrub and one of the few ashes native to the intermountain region. At maturity, it ranges in size from 8-25 feet (2.4-7.6 m) and is characterized by having a single leaf (as opposed to the compound leaves found with most ash trees), four-angled branches, and one-seeded samaras. It is very common in eastern and southern Utah at elevations of 3,000-8,500 feet with well drained, shallow, alkaline soils.

## PROPAGATION

The only published method of single-leaf ash propagation is by seed. However, preliminary research at Utah State University indicates that vegetative propagation by cuttings is a feasible alternative. It is interesting to note that rooted cuttings appear to break bud and begin new growth immediately after rooting. This is a beneficial characteristic for nursery production. Cuttings seem to be quite tolerant of the rooting process and not prone to wilting.

### PROPAGULE

- softwood cuttings

### MATERIALS

- 2,000 ppm IBA and 1,000 ppm NAA as Dip 'N Grow® in 25% ethanol
- 4:1 perlite:peat rooting substrate

### ENVIRONMENT

- intermittent mist
- bottom heat 72°F (22°C)

## [SOFTWOOD CUTTINGS]

### METHOD

1. Take softwood cuttings in early June.
2. Wound by scraping along the basal ½ inch (13 mm) of the stem.
3. Dip in rooting hormone for 5 seconds.
4. Stick in rooting substrate.
5. Hold under intermittent mist with bottom heat for 5-6 weeks.

[Source: Rupp unpublished]

Rupp, L. unpublished. Utah State University.

USDA, NRCS. 2013. The PLANTS Database (<http://plants.usda.gov>, 20 August 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.



# MOUNTAIN SPRAY

*Holodiscus dumosus*

## PLANT DESCRIPTION

Mountain spray (*Holodiscus dumosus*) is found in the Great Basin from eastern Oregon to northern Mexico. It is the Intermountain version of its close relative, oceanspray (*H. discolor*). Mountain spray is a multi-stemmed shrub growing from 1-10 feet (0.3-3 m) tall. It grows in a number of different habitats, but is most common in dry, rocky areas. Mountain spray is covered with panicles of white-pink flowers in the summer and has deep red fall color. Seed capsules persist throughout the summer.

## PROPAGATION

We have been unable to find any published record of mountain spray being propagated vegetatively. However, there are multiple records of vegetative propagation of oceanspray (*H. discolor*), which is a close relative. To the extent such information applies to both species, it may be a useful starting point for propagating mountain spray. The Garry Oak Ecosystems Recovery Team found that hardwood and semi-hardwood cuttings, suckers, and plant division can all work well for oceanspray.

### PROPAGULE

- softwood cuttings from stock plants

### MATERIALS

- 1:1 perlite:sand rooting substrate
- 2,000 ppm IBA rooting hormone as talc
- fungicide

### ENVIRONMENT

- mist bench
- bottom heat 70°F (21°C)

[Source: Wick and Luna, 2008]

## [SOFTWOOD CUTTINGS]

### METHOD

1. Collect summer softwood stem cuttings and cut into 6 inch (15 cm) lengths.
2. Remove leaves from bottom 1/3 of the cuttings.
3. Dip in fungicide bath.
4. Treat with 2,000 ppm IBA talc.
5. Place on bottom heat.
6. Use intermittent mist 6 seconds every 6 minutes.

### NOTES

The above method was conducted by Wick and Luna with cuttings taken in early July and resulted in a success rate of 31%.

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press. Logan, UT.

**Garry Oak Ecosystems Recovery Team.** Native Plant Propagation Guidelines. [http://www.goert.ca/propagation\\_guidelines/shrubs/holodiscus\\_discolor](http://www.goert.ca/propagation_guidelines/shrubs/holodiscus_discolor) Accessed 19 July 2013

**Shaw, N., E. Hurd, and P. Stickney. 2008.** *Holodiscus* (K. Koch) Maxim. Ocean-Spray. In: The Woody Plant seed Manual, USDA-FS Ag Handbook 727. (accessed 19 July 2013). [http://www.fs.fed.us/rmi/pubs\\_other/wo\\_AgricHandbook727/wo\\_AgricHandbook727\\_591\\_594.pdf](http://www.fs.fed.us/rmi/pubs_other/wo_AgricHandbook727/wo_AgricHandbook727_591_594.pdf)

**Wick, D., and T. Luna. 2008.** Propagation protocol for vegetative production of container *Holodiscus discolor* (Pursh) Maxim. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 19 July 2013). Moscow (ID): University of Idaho. <http://www.nativeplantnetwork.org/Network/ViewProtocols.aspx?ProtocolID=188>

**Photo credits:** Robert Sivinski, Cal Photos (top), Adrea Wheaton (bottom)



# UTAH JUNIPER

*Juniperus osteosperma*

## PLANT DESCRIPTION

Utah juniper (*Juniperus osteosperma*) is a small evergreen tree found throughout much of the Colorado Plateau and the Great Basin. As one of the most common plants in Utah, it is often considered a borderline weed depending on where it is located and what it is being used for. Regardless of its status as a desirable or undesirable plant, it is clearly one of the toughest and most water efficient native plants available.

## PROPAGATION

Utah juniper is difficult to propagate under any circumstances, even from seed.

### PROPAGULE

- juvenile terminal cuttings

### MATERIALS

- talc based rooting hormone (8,000 ppm IBA)
- 2:1 perlite:peat rooting substrate

### ENVIRONMENT

- opaque, white polyethylene tent with mist in greenhouse
- bottom heat at 75°F (24°C) with cool air temperatures at 65°F (18°C)
- supplemental lighting

[Source: Cope, 2012]

## [CUTTINGS]

### METHOD

1. Collect 4-6 inch (10-15 cm) long terminal cuttings from juvenile portions of stock plants in late November.
2. Strip leaves and stems from the bottom 1-2 inches (25-50 mm) of the cutting.
3. Wound cuttings by removing a strip of bark about 1/2 inch (13 mm) long from the bottom of the stem.
4. Dip the wounded portion of the cuttings in a talc-based rooting hormone of at least 8,000 ppm IBA.
5. Stick cuttings in a pre-moistened rooting substrate.
6. Place cuttings on bottom heat in a white plastic tent with a mist system inside.
7. Set mist to come on three times daily.
8. Irrigate rooting substrate weekly.
9. After 8 weeks, reapply hormone to unrooted cuttings.
10. Harvest at 16 weeks.



# ROCKY MOUNTAIN JUNIPER

*Juniperus scopulorum*

## PLANT DESCRIPTION

Rocky Mountain juniper (*Juniperus scopulorum*) is a common evergreen throughout the west. Its form is typically pyramidal to conical, though there are unique forms (such as those found in Huntington Canyon, Utah) that are strongly columnar. Generally it grows 10-20 feet (3-6 m) tall, though it can reach heights of 50 feet (15 m). Rocky Mountain juniper is usually larger and occurs at higher elevations than Utah juniper, though their range can overlap.

## PROPAGATION

Rocky Mountain juniper's upright form is difficult to root from cuttings. Junipers occur in a wide variety of forms. Interestingly the prostrate forms are easier to root from cuttings than are the upright forms.

### [1: TERMINAL CUTTINGS]

#### PROPAGULE

- terminal cuttings from leaders or branches

#### MATERIALS

- Benomyl fungicide
- 30,000ppm IBA in talc carrier
- 3:1:1 perlite:peat:vermiculite rooting substrate

#### ENVIRONMENT

- greenhouse conditions
- 60% shade covering

#### METHOD

1. Take 12 inch (30 cm) long terminal cuttings from leaders or branches cut at a 45° angle mid-November.
2. Soak cuttings for 30 seconds in 1g/L benomyl fungicide.
3. Dip in rooting hormone.
4. Stick ½ inch (13 mm) deep in rooting substrate.
5. Place in greenhouse with relative humidity >85% and 60% shade.
6. Hand water periodically.

[Source: Edson, 1996]

### [2: TERMINAL CUTTINGS]

#### PROPAGULE

- terminal cuttings from 2-year-old field grown plants with hard juvenile growth and dark stems for the basal 3-4 inches (8-10 cm) (*J. scopulorum* 'Wichita Blue' was used in this experiment)

#### MATERIALS

- Benlate fungicide ½ tsp per 7 oz of water
- 10,000 ppm IBA talc
- 3:1 perlite:peat rooting substrate

#### ENVIRONMENT

- Polyethylene greenhouse conditions
- bottom heat 68-70°F (20-21°C)

#### METHOD

1. Take 8-12 inch (20-30 cm) long cuttings.
2. Rinse in diluted Benlate fungicide.
3. Trim to 8-10 inches (20-25 cm) retaining 3-4 inches (8-10 cm) of hard, dark wood.
4. Re-cut stems and wound with a 1 ¼ inch (3 cm) double slit wound stopping 1/16 inch (1.6 mm) from the base.
5. Dip prepared cuttings in diluted fungicide.
6. Dry slightly, then dip in 10,000 ppm IBA as Stim-Root® 10,000 for 5 seconds.
7. Use bottom heat.
8. Place in high-humidity poly house.
9. Do not use mist or fans.
10. Hand water 1-3 times per day as needed.
11. Apply Benlate at 1 tsp/gal weekly.

[Source: Alward, 1990]

**Alward T.M., 1990.** Propagation of *Juniperus scopulorum* 'Wichita Blue' by cuttings. Proceedings of the International Plant Propagator's Society 40:613-614.

**Edson J.L., D.L. Wenny, R.K. Dumroese, A. Leege-Brusven. 1996.** Mass propagation of Rocky Mountain juniper from shoot tip cuttings. Tree Planters' Notes 47(3):94-99.

**Monsen S.B., R. Stevens, and N.L. Shaw. 2004.** Restoring western ranges and wildlands. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-136. p 635-640.

**Photo Credit: USDA-NRCS PLANTS Database / Herman, D.E., et al. 1996.** North Dakota tree handbook. USDA NRCS ND State Soil Conservation Committee; NDSU Extension and Western Area Power Administration, Bismarck. (top photo)





# FREMONT BARBERRY

*Mahonia fremontii*

## PLANT DESCRIPTION

Fremont barberry (*Mahonia fremontii*) is a shrub native to the southwestern United States. It grows up to 10 feet tall and has small, compound evergreen leaves. Each gray-green leaf has up to nine leaflets that are tipped with a sharp spine. It has bright yellow flowers in the spring followed by red to purple berries. Fremont barberry is very drought tolerant and can be used as a specimen plant or a barrier in the landscape.

## PROPAGATION

Fremont barberry purportedly can be propagated from seed, soft- and hardwood cuttings, and by layering. However, there are no details of vegetative propagation recorded in the literature. The following recipe was an experiment at Utah State University.

### [SOFTWOOD CUTTINGS]

#### PROPAGULE

- stem cuttings from stock plants

#### MATERIALS

- 4:1 Perlite:Peat rooting substrate
- 2,000/1,000 ppm IBA/NAA as Dip 'N Grow in 25% ethanol

#### ENVIRONMENT

- mist bench
- bottom heat 72°F (22°C)

#### METHOD

1. Collect summer softwood stem cuttings.
2. Remove bottom leaves and cut off tip so only two leaves remain.
3. Wound base of cutting.
4. Treat with rooting hormone.
5. Place on bottom heat.
6. Use intermittent mist.

#### NOTES

Stem cuttings were collected mid-June in Logan, Utah. After 6 weeks, 38% of the cuttings had rooted.

[Source: Rupp, unpublished]

**Dorn, R.D., and J.L. Dorn. 2007.** Growing Native Plants of the Rocky Mountain Area.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen.Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Rupp, L.** unpublished. Utah State University.

**USDA, NRCS. 2013.** The PLANTS Database (<http://plants.usda.gov>, 15 August 2013). National Plant Data Team, Greensboro, NC 27401-4901 USA.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.



# CREEPING BARBERRY

*Mahonia repens*

## PLANT DESCRIPTION

Creeping barberry (*Mahonia repens*) is a small, broadleaf evergreen shrub native to much of western North America. It spreads itself naturally by rhizomes and is both heat and drought tolerant. It can be grown in either sun or shade, and its fruit is utilized by wildlife. The leaves are compound with 3-7 oval to elliptical leaflets with spine-tipped teeth on the leaf margin. Flowering occurs in late spring to early summer and produces showy yellow blossoms followed by glaucous, blue berries.

## PROPAGATION

Creeping barberry can be propagated by hardwood or softwood cuttings and by division.

### [1: CUTTINGS]

#### PROPAGULE

- terminal cuttings of mixed age

#### MATERIALS

- 2,000 ppm IBA/1000 ppm NAA as Dip N'Grow in 25% alcohol
- Turface® calcined clay rooting substrate

#### ENVIRONMENT

- bottom heat at 72°F (22°C)
- intermittent mist
- greenhouse or nearing frame

[Source: Buhler & Rupp, unpublished]

#### METHOD

1. Collect terminal cuttings from field-grown plants in late fall.
2. Trim lower leaves of cuttings.
3. Wound cuttings with 1 cm basal scrape.
4. Dip in rooting hormone.
5. Stick in moistened Turface® substrate.
6. Place on bottom heat in either a greenhouse or a nearing frame.
7. Irrigate every other day in the nearing frame or apply intermittent mist with a Phytotronics® controller in greenhouse.

#### NOTES

After 6 weeks, over half of the cuttings were rooted in both the greenhouse and the nearing frame treatments.

[continued]



# CREEPING BARBERRY *[continued]*

*Mahonia repens*

## [2: CUTTINGS]

### PROPAGULE

- hardwood or softwood cuttings

### MATERIALS

- Thiophanate methyl fungicide rinse
- 1,000 ppm IBA as liquid
- 1:1 perlite:sand rooting substrate

### ENVIRONMENT

- bottom heat at 70°F (21°C)
- outdoor mistbed covered with shade cloth

*[Source: Wick, 2001]*

### METHOD

1. Collect terminal cuttings with a heel (piece of previous season's wood) at base. Collect from early spring to early summer from healthy mother plants grown in full sun.
2. Trim cuttings to 4-6 inches (10-15 cm) keeping the heel section.
3. Remove leaves from bottom 1/3 of cutting.
4. Rinse in fungicide for 2 minutes and then treat with rooting hormone.
5. Place in rooting substrate on bottom heat and mist as needed to keep moist.
6. Rooting takes 5-8 weeks.

## [3: DIVISION]

### PROPAGULE

- whole plants in either containers or soil

### MATERIALS

- shovel
- rooting substrate

### ENVIRONMENT

- shaded area

*[Source: Anonymous]*

### METHOD

1. In the early spring or late fall, dig mother plants and divide rhizomes so that each propagule has both a growing tip, stem, and roots. As an alternative, container-grown plants can be removed from the container and divided in the same fashion.
2. Plant rhizome sections in a clean, soil-less rooting substrate.
3. Place divided plants in a shaded area.
4. Water and fertilize as needed.

**Anonymous. 2009.** *Mahonia repens*. In: Native Plant Database. [www.wildflower.org/plants/](http://www.wildflower.org/plants/) (accessed 5 November 2012). Lady Bird Johnson Wildflower Center. University of Texas at Austin.

**Buhler, M., and Rupp, L. 2013.** unpublished. Utah State University.

Based on work by **Wick, D., R. Keating, R. Potter, and T. Luna. 2001.** Propagation protocol for vegetative production of container *Mahonia repens* (Lindl.) G. Don; USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 5 November 2012). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.



# MOUNTAIN LOVER

*Paxistima myrsinites*

## PLANT DESCRIPTION

Mountain lover (*Paxistima myrsinites*) is a small evergreen shrub with glossy leaves that occur in opposite pairs along the stem. While it is found across western North America in a variety of habitats, in Utah it is commonly found at higher elevations and in shaded conditions as an understory plant. It is easy to propagate and has potential for greater use in the landscape.

## PROPAGATION

Mountain lover is very easy to propagate by cuttings. Although it roots successfully even without rooting hormones, a better root system is produced if hormones are used.

### [1: SPRING CUTTINGS]

#### PROPAGULE

- 6-8 inch (15-20 cm) cuttings

#### MATERIALS

- Domain® fungicide
- 2,000-3,000 ppm IBA rooting hormone
- 1:1 perlite:sand rooting substrate

#### ENVIRONMENT

- intermittent mist
- bottom heat at 70°F (21°C)
- shade cloth

#### METHOD

1. Collect cutting in late May and keep moist and cool until sticking.
2. Remove leaves from lower 1/3 of cutting.
3. Treat with 2 minute fungicide bath.
4. Dip cuttings in rooting hormone.
5. Hold under intermittent mist with bottom heat and a shade covering.

[Source: Wick et al., 2008]

### [2: SUMMER CUTTINGS]

#### PROPAGULE

- cuttings collected in mid-summer at 6,900 feet elevation

#### MATERIALS

- 4:1 perlite:peat rooting substrate
- 2,000-4,000 IBA as Dip-N-Grow (optional)

#### ENVIRONMENT

- intermittent mist
- bottom heat at 75°F (24°C)
- shaded greenhouse 65/60°F (18/16°C) day/night temperature

#### METHOD

1. Collect 3-5 inch (8-12 cm) cuttings in late July.
2. Dip cuttings in rooting hormone, if using.
3. Place in shaded greenhouse.
4. Place on bottom heat.
5. Mist for 7 seconds every 12 minutes.

#### NOTES

100% of the cuttings were well rooted after 7 weeks.

[Source: Rupp, unpublished]

Rupp, L. unpublished. Utah State University.

Wick, D., K. Johnson, T. Luna, J. Evans, J. Hosokawa. 2008. Propagation protocol for vegetative production of container *Paxistima myrsinites* (Pursh) Raf. plants (800 ml containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 1 November 2012).





# INDIAN APPLE

*Peraphyllum ramosissimum*

## PLANT DESCRIPTION

Indian apple (*Peraphyllum ramosissimum*) is a rounded shrub with narrow leaves. It forms a fruit reminiscent of a small crabapple that is about ½ inch (13 mm) in diameter. It typically occurs in the Great Basin at elevations of 3,000-9,000 feet in a number of different plant communities. In the landscape it is moderately drought tolerant and can be used as a structural or background plant.

## PROPAGATION

There are no methods or records of this plant having been propagated vegetatively. For information on propagating Indian apple by seed, see Young and Young's 'Seeds of Woody Plants in North America'.

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press. Logan, UT.

**Young, J. A., & Young, C. G. 1992.** Seeds of woody plants in North America. Dioscorides Press.



# LITTLE-LEAF MOCKORANGE

*Philadelphus microphyllus*

## PLANT DESCRIPTION

Little-leaf mockorange (*Philadelphus microphyllus*) is a small shrub with fine-textured foliage and fragrant white flowers that bloom in late spring. It occurs throughout the southwest from California to Texas. There is a lot of variability within the species and several varieties have been described. It is a highly drought tolerant plant and is often found in extremely rocky soils and very dry conditions. It can be used as a screen, hedge, or specimen plant in the landscape.

## PROPAGATION

Little if anything has been published on the vegetative propagation of *Philadelphus microphyllus*. However, Dale Wick at Glacier National Park has published a method for propagating *P. lewisii*, a close relative that occurs in the northwest.

The traditional mockorange found in the nursery trade is readily propagated by softwood or hardwood cuttings, or by layering. However, propagation of plants used in the nursery industry can be very different from native plants.

### PROPAGULE

- summer softwood cuttings (*P. lewisii*)

### MATERIALS

- Domain® fungicide
- 2,000 ppm IBA (liquid)
- 1:1 peat:perlite rooting substrate

### ENVIRONMENT

- bottom heat at 70°F (21°C)
- intermittent mist system
- shade cloth

[Source: Wick, 2001]

## [SOFTWOOD CUTTINGS]

### METHOD

1. Collect softwood cuttings in summer from field-grown plants and keep refrigerated until used.
2. Remove terminal buds and recut the base before sticking.
3. Dip in fungicide for 2 minutes.
4. Dip bases in rooting hormone.
5. Stick in rooting substrate.
6. Place on bottom heat.
7. Mist every 6 minutes for 6 seconds.
8. Cover mist beds with shade cloth.

### NOTES

Wick reports approximately 70% of *P. lewisii* cuttings rooted with this method.

**Dirr, M.A., and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Shaw, N.L.** *Philadelphus microphyllus* Gray Little leaf mock orange. In URL: <http://www.fs.fed.us/global/iitf/pdf/shrubs/Philadelphus%20microphyllus.pdf> (accessed 5 August 2013). USDA-FS Rocky Mountain Research Station, Boise, ID.

**Wick, D. 2001.** Propagation protocol for vegetative production of container *Philadelphus lewisii* Pursh plants. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 5 August 2013). Moscow (ID): University of Idaho

**Photo credit:** Margaret Williams @ USDA-NRCS PLANTS Database (top)



# MALLOW NINEBARK

*Physocarpus malvaceus*

## PLANT DESCRIPTION

Mallow ninebark (*Physocarpus malvaceus*) occurs through the intermountain area and the Pacific Northwest as an understory plant. It is commonly found on north facing slopes and while ubiquitous enough in western mountains to be overlooked, it can make a handsome specimen in the landscape. Mallow ninebark is shrub that can range from 3 to 8 feet (0.9-2.4 m) in height. It has clusters of white flowers that form in late spring to early summer. The fruit is a follicle and is rather inconspicuous. It has a spreading root system and spreads by rhizomes. Fall color ranges from yellow to orange to deep red.

## PROPAGATION

Mallow ninebark can easily be vegetatively reproduced with misted softwood cuttings or by planting hardwood cuttings directly in the field. More published information is available on the propagation of common ninebark (*P. opulifolius*) of which there are several commercial cultivars.

## [CUTTINGS]

### PROPAGULE

- softwood cuttings collected in late spring to early summer

### MATERIALS

- IBA rooting hormone as 3,000 ppm talc or 1,000 ppm IBA liquid
- well-drained rooting substrate

### ENVIRONMENT

- mist bench
- cool greenhouse 60/65°F (16/18°C day/night temperatures) and same temperatures during winter with 18 hour days

### METHOD

1. Take softwood cuttings in June or July.
2. Dip in rooting hormone.
3. Place cuttings in rooting substrate under mist.

### NOTES

Mallow ninebark can also be propagated by collecting rooted suckers arising from the rhizomes.

[Source: Rupp unpublished]

**Dirr, M.A., and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc

**Francis, J.K.** *Physocarpus malvaceus* (Greene) Kuntze mallow ninebark. <http://www.fs.fed.us/global/ititf/pdf/shrubs/Physocarpus%20malvaceus.pdf>

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.



# QUAKING ASPEN

*Populus tremuloides*

## PLANT DESCRIPTION

Quaking aspen (*Populus tremuloides*) is the most widely distributed tree species in North America and extends from Alaska to Newfoundland in the north to northern Mexico and Virginia in the south. It is found at high elevations between 5,000-10,000 feet (1,500-3,000 m) and is not well-adapted to lower valleys.

Aspen is appreciated in the landscape for its beautiful white bark, trembling leaves and spectacular yellow to orange fall color. Aspens grow in colonies that spread through suckering. This suckering habit and its susceptibility to disease and insects make it an undesirable tree for formal landscape situations, so it is best used in naturalized settings.

## PROPAGATION

Aspen is easily propagated by seed and root cuttings, though root cuttings appear to have better vigor than seed propagated material. Unlike other members of the Poplar genus, aspen does not do well from traditional stem cuttings.

A new propagation technique called stacked propagation maximizes root cutting capabilities. A containerized mother plant is placed on a stack of Styroblock containers™. The roots of the mother plant grow down through the cells of the propagation blocks. The roots are then severed between the blocks and shoots develop from the roots in the cells.

### [1:ROOT CUTTINGS]

#### PROPAGULE

- lateral roots from rooted stock plants

#### MATERIALS

- paraffin wax
- 1:1 perlite:sand rooting substrate
- Domain® fungicide
- 2,000 ppm IBA rooting hormone

#### ENVIRONMENT

- shade cloth
- mist bench
- bottom heat 70°F (21°C)

#### NOTES

This propagation technique was used in Glacier National Park in Montana. Johnson reports approximately 95% of excised shoots produced roots. She also notes that suckering ability among clones may vary considerably, as would the rooting ability of the cuttings.

[Source: Johnson, 2008]

#### METHOD

1. Collect lateral roots 1/3-1 inch (1-2.5 cm) in diameter from healthy clones in early June. Sections collected nearest the trunk of the donor tree produce more shoots.
2. Cut roots into 4-8 inch (10 to 20 cm) sections.
3. Seal ends of each cutting with paraffin.
4. Place cuttings in fungicide for 2 minutes.
5. Place in mistbed with bottom heat.
6. Once new shoots have emerged and are 2 inches (5 cm) tall, excise shoots with a razor blade from the root cuttings.
7. Treat the excised shoots with rooting hormone.
8. Stick excised shoot cuttings in rooting substrate.
9. Place on mistbed with bottom heat for 8 weeks until an adequate root system forms.
10. Use shade cloth during rooting.

[continued]





# QUAKING ASPEN *[continued]*

*Populus tremuloides*

## [2: ROOT CUTTINGS IN COLD FRAME]

### PROPAGULE

- root cuttings collected from stock plants

### MATERIALS

- 1:1 peat:sand (can also add 1 part loam)
- coarse sand or perlite to cover
- fungicide such as Thiram® or Benlate®; 5 g to 100-150 cutting

### ENVIRONMENT

- cold frame with lights
- thermal blanket or burlap matting

*[Source: Macdonald, 1986]*

### METHOD

1. Prepare cold frame by aerating/amending soil with addition of peat, sand or perlite. A base dressing of 6-8-6 ratio compound fertilizer at 34 g/m<sup>2</sup> is beneficial.
2. Take pencil thick root cuttings from as close to the crown as possible from nursery stock. Optimal time is December to February.
3. Place in polyethylene bag and shake with fungicide.
4. Stick cuttings vertically in rows with 2 inch (5 cm) spacing.
5. Cover with coarse sand or perlite to a depth of ½ inch (13 mm).
6. Use thermal blankets or burlap matting to cover cold frames during extreme cold spells, if necessary.
7. Takes 8 weeks in cold frame to root, but the rooted cuttings should remain in the cold frame until the following fall or winter.

*[continued]*



QUAKING ASPEN *[continued]**Populus tremuloides*

## [3: STACKED BLOCK ROOT CUTTINGS]

## PROPAGULE

- well-established nursery stock plant growing in a 3L (1 gallon) container (to produce root cuttings)

## MATERIALS

- Styroblock™ cover block with a hole cut out for the mother plant in a 3L (1 gallon) container.
- Styroblock™ propagation block with cells
- well-drained rooting substrate

## ENVIRONMENT

- climate controlled greenhouse

*[Source: Dreesen et al., 2006]*

## METHOD

1. Fill Styroblock™ propagation block cells with rooting substrate.
2. Place containerized stockplant in Styroblock™ cover block that has a hole cut out for it.
3. Place cover block over the multi-celled propagation block.
4. Propagation blocks can be added to the bottom as the roots grow throughout the growing season.
5. When roots have reached the bottom of the propagation cells, sever the roots between the cover block and the propagation block(s).
6. Irrigate individual propagation blocks until shoots emerge from the root cuttings in the cells.

**Dreesen, D. 2001.** Propagation protocol for vegetative production of container *Populus tremuloides* (Michx.) plants; USDA NRCS - Los Lunas Plant Materials Center, Los Lunas, New Mexico. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 27 August 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Dreesen D.R., T.D. Landis, and J.R. Pinto. 2006** Stacked Propagation: A New Way to Grow Native Plants from Root Cuttings. *Native Plants Journal*, Volume 7, Number 3, Fall, pp. 286. University of Wisconsin Press DOI: 10.1353/npj.2007.0002

**Johnson, K., T. Luna, D. Wick, and J. Evans. 2008.** Propagation protocol for vegetative production of container *Populus tremuloides* Michx. plants (3 L containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 12 December 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**LaFleur, L. 2003.** Propagation protocol for vegetative production of container *Populus tremuloides* L. plants (containerized plugs); Coast to Coast Reforestation, Edmonton, Alberta. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 27 August 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Macdonald, B. 1986.** *Practical Woody Plant Propagation for Nursery Growers*. Timber Press, Inc.

**Photo Credits:** David Dreesen



# DESERT ALMOND

*Prunus fasciculata*

## PLANT DESCRIPTION

Desert almond (*Prunus fasciculata*) is a low growing shrub reaching heights of about 5 feet. It is intricately branched with clusters of narrow, light green leaves with very short petioles. Each branch is tipped by a sharp spine. The small white flowers turn into almond-like fruits that provide food for wildlife.

## PROPAGATION

Research indicates that, to date, desert almond can only be propagated by seed. In 1978, Everett and others reported an attempt to propagate desert almond by cuttings. They tried three separate accessions for a total of 97 cuttings at the hardwood and semi-hardwood stages and had no success. The related desert peach (*Prunus andersonii*) was more successful in rooting, but it is also a rhizomatus plant and desert almond is not. Desert peach is native to Nevada and California, but not found growing native in Utah. For information on propagating desert almond from seed, refer to Monson, Stevens and Shaw's 'Restoring Western Ranges and Wildlands'.

**Everett, R.L., R.O. Meeuwig, and J.H. Robertson. 1978.** Propagation of Nevada Shrubs by Stem Cuttings. Journal of Range Management, 31:426-429.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen.Tech.Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.



# CHOCKECHERRY

*Prunus virginiana*

## PLANT DESCRIPTION

Chokecherry (*Prunus virginiana*) is common throughout North America. It is also available as several named varieties in the nursery trade. In the wild it commonly grows in riparian regions, though smaller plants are often found in dry areas. It reproduces itself by suckering from a rhizomatous root system. It has a beautiful, fragrant white blossom in the spring followed by a cluster of attractive small dark fruits in late summer that can be used for jellies. Chokecherry leaves commonly are a dark green until early fall when they take on a variety of fall colors.

## PROPAGATION

Chokecherry is most commonly propagated by cuttings, but some selections can be very difficult to root. For hard-to-root plants, another method of vegetative propagation is through mound layering. At Utah State University, Rupp and Black (unpublished) accomplished this by establishing selected clones in a nursery bed. After establishment, plants were pruned in late winter to just above the surface of the soil. As new shoots developed and elongated in the spring, they were mounded with conifer shavings. By early July the new shoots had formed roots, even without the use of rooting hormones or girdles.

## [CUTTINGS]

### PROPAGULE

- semi-hardwood cuttings 6-8 inches long

### MATERIALS

- 2,000 ppm NAA
- 40,400 ppm Thiram®(fungicide)
- Perlite rooting substrate

### ENVIRONMENT

- bottom heat at 70°F (21°C)
- intermittent mist
- 70-75/ 60-65°F (21-24/15-18°C) day/night greenhouse with 14-16 hour photoperiods

### NOTES

This method is used to root cuttings from wild plants that cannot be accessed until late in the summer.

### METHOD

1. Collect 6- to 8-inch (15-20 cm) long cuttings with a basal diameter of at least 1/4 inch (6 mm) in early August from semi-hardwood sprouts.
2. Keep on ice or at 34-37°F (1-3°C) until stuck.
3. Trim cuttings to 5-6 inches (13-15 cm).
4. Remove all fruit, buds, leaves, and branches from the basal 2-3 inches (5-8 cm) of each cutting.
5. Recut the base of each stem at an angle.
6. Wound the basal end of the stem.
7. Mist the wound and shake off excess water.
8. Insert the base into rooting compound.
9. Use bottom heat until the cuttings initiate roots at 12-16 weeks.
10. Cuttings should be well-rooted after 24 weeks.

[Source: Scianna, 2003]

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Scianna, J. 2003.** Propagation protocol for vegetative production of container *Prunus virginiana* L. plants. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 26 July 2013). Moscow (ID): University of Idaho.





# BITTERBRUSH

*Purshia tridentata*

## PLANT DESCRIPTION

Bitterbrush (*Purshia tridentata*) is a deciduous shrub found on open slopes from British Columbia to Mexico and from California to Colorado. Bitterbrush is attractive to animals as a browse plant for big game and livestock, and as a source of food and cover for birds. It is a slow growing shrub generally 2-6 feet (0.3-1.8 m) tall, but can also be prostrate.

Bitterbrush is desirable in the landscape for its profuse yellow flowers in spring and its thick grey-green leaves. It has a high ability to withstand drought.

## PROPAGATION

Bitterbrush can be propagated by seed and stem cuttings. Layering can also be used on plants with a decumbent growth form. Layering can take up to 2 years for roots to form along the branch.

## [CUTTINGS]

### PROPAGULE

- 4 inch (10 cm) long stem cuttings with heel

### MATERIALS

- 3,000 ppm IBA
- 1:1:1 sand:pumice:vermiculite substrate

### ENVIRONMENT

- temperatures of 68-77°F (20-25°C)

### METHOD

1. Take cuttings from current season's growth.
2. Moisten cuttings in water then dip in rooting hormone.
3. Stick in rooting substrate.
4. Keep at 68-77°F (20-25°C).
5. Water daily until roots form (45-60 days).

[Source: Rose et al., 1998]

**Bradley, A. F., N.V. Noste, and W.C. Fischer. 1992.** Fire ecology of forests and woodlands of Utah. Gen. Tech. Rep. INT-287. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 128 p. [18212].

**Mee, W., J. Barnes, R. Kjølgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press. Logan, UT.

**Rose, R., C.E.C. Chachulski, and D.L. Haase. 1998.** Propagation of Pacific Northwest Native Plants. OSU Press. Corvallis, OR.



Hybrid of *Q. gambelii* and *Q. turbinella*



# OAK

*Quercus* spp.

**GAMBEL OAK** *Quercus gambelii*

**SCRUB LIVE OAK** *Quercus turbinella*

**WAVYLEAF OAK** *Quercus pauciloba*

## PLANT DESCRIPTION

Utah is home to three different kinds of oaks; gambel oak (*Quercus gambelii*), scrub live oak (*Q. turbinella*), and wavyleaf oak (*Q. pauciloba*), which is a naturally occurring hybrid between the two.

Gambel oak occurs in mountain brush communities throughout Utah and is very common along the foothills from Brigham City south. It can also be found in Arizona, Colorado, Nevada, New Mexico, Texas, Wyoming, and Mexico. Gambel oak is a white oak and hybridizes readily with other white oaks. It is a small, deciduous tree, though it can be highly variable in form. It typically occurs in dense stands formed by suckers arising from rhizomes.

Scrub live oak occurs in southern Utah and throughout the southwestern states. It is evergreen with small gray-green leaves that are ½ to 1½ inches (13-38 mm) in length. It is a small tree and is usually less than 10 feet (3 m) in height.

Wavyleaf oak occurs in the southeastern corner of Utah. All of these oaks occur in thick clumps or stands formed by the emergence of suckers from roots, rhizomes, or lignotubers (a fleshy root organ made up of primarily meristematic tissue).

These oaks have great potential for use in water conserving landscapes. They make a great small tree, especially if one is looking for a more naturalized effect with clumping. Their single biggest disadvantage is their tendency to sucker profusely.

## PROPAGATION

Historically all oaks have been difficult to propagate vegetatively. Some work has been done on grafting, but there are challenges with delayed incompatibility between grafts with some oaks. Currently there is work being done on rooting cuttings or layers, but nothing that has been adopted commercially at this point.

It is interesting that even though these plants propagate themselves readily by suckers from rhizomes, rhizomes have not been used as propagules for propagation.

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press. Logan, UT.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.





# ALDER BUCKTHORN

*Rhamnus alnifolia*

## PLANT DESCRIPTION

Alder buckthorn (*Rhamnus alnifolia*) is a deciduous shrub that grows up to 5 feet. It is found in aspen-mixed conifer forests along the Wasatch Front in Utah. It can also be found in California, Idaho, and Wyoming, and in southern Canada from British Columbia to Newfoundland. The fruit of alder buckthorn are red drupes that turn to black in the fall. 'Alnifolia' means alder-like leaves.

## PROPAGATION

Alder buckthorn is generally propagated by seed and there is little information in the literature for vegetative propagation. However, Evans has had moderate success (50% rooted) with summer softwood cuttings.

### [SUMMER SOFTWOOD CUTTINGS]

#### PROPAGULE

- summer softwood stem cuttings

#### MATERIALS

- 8,000 ppm Hormex® rooting powder
- 1:1 sand:perlite rooting substrate

#### ENVIRONMENT

- mistbed covered with shade cloth
- bottom heat

#### METHOD

1. Take 6 3/4 inch (17 cm) softwood stem cuttings in late June.
2. Treat with rooting hormone.
3. Stick in rooting substrate.
4. Place on bottom heat and mist for 6 seconds every 6 minutes.

[Source: Evans, 2001]

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.

**Evans, J. 2001.** Propagation protocol for vegetative production of container *Rhamnus alnifolia* L'Her plants (800 ml containers); USDI NPS - Glacier National Park, West Glacier, Montana. In: Native Plant Network. URL: <http://www.nativeplantnetwork.org> (accessed 2 October 2013). Moscow (ID): University of Idaho, College of Natural Resources, Forest Research Nursery.

**Photo credit:** Jessica O'Brien © 2011 Sierra Pacific Industries



## SMOOTH SUMAC

*Rhus glabra*

## PLANT DESCRIPTION

Smooth sumac (*Rhus glabra*) is a small shrub that is commonly found in dense thickets that result from its extensive root suckering. It is small in stature and usually gets no taller than 3-6 feet (0.9-1.8 m). It is a very drought tolerant plant and can often be easily spotted in Utah as a patch of welcome green on the side of a dry, south-facing slope with very little other green foliage. Smooth sumac is found throughout North America. It is often identified in the literature as *Rhus glabra* var. *cismontana*, but it is the same plant. It is commonly used as a landscape plant because of its small stature, brilliant red-orange fall color, and attractive fruit. It is also a welcome asset to any water conserving landscape.

## PROPAGATION

Smooth sumac is unique from many other plants in that the best means of propagation is root cuttings. According to Dirr, two methods can be used; spring propagation or fall propagation.

## [1: SPRING ROOT CUTTINGS]

## PROPAGULE

- root cuttings

## MATERIALS

- sand

## ENVIRONMENT

- cold storage facility

## METHOD

1. Collect large roots (½-1 inch (13-25 mm) diameter) in the spring as soon as the soil can be worked.
2. Cut into 3 inch (8 cm) lengths.
3. Place in slightly moist sand.
4. Store for 3 weeks to callus.
5. Place cuttings in the field in a well-drained soil.

[Source: Dirr and Heuser, 2006]

## [2: FALL ROOT CUTTINGS]

## PROPAGULE

- root cuttings

## MATERIALS

- sphagnum peat moss
- 3,000 ppm IBA talc

## ENVIRONMENT

- cold storage facility

## METHOD

1. Collect roots in the fall.
2. Cut into 4-inch (10 cm) lengths.
3. Treat with rooting hormone.
4. Pack cuttings tip up in moist sphagnum moss.
5. Hold at 50-60°F (10-16°C) until roots are callused.
6. Drop temperatures to 35°F (2°C) and chill root cuttings until planting out the following spring.

[Source: Dirr and Heuser, 2006]

**Dirr, M.A., and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Flemer III, W. 1961.** Propagating woody plants by root cuttings. Proc. Internat'l Plant Prop. Soc. 11:49.





# SKUNKBUSH SUMAC

*Rhus aromatica* var. *trilobata*

## PLANT DESCRIPTION

Skunkbush sumac (*Rhus aromatica* var. *trilobata*) is a western variety of fragrant sumac (*Rhus aromatica*). In general, skunkbush sumac occurs west of the 100th meridian.

Skunkbush sumac is a very tough plant occurring throughout Utah. It occurs on mesic sites such as riparian areas, while another variety (*Rhus aromatica* var. *simplicifolia* or single leaf sumac) occurs in drier areas. Both plants are very drought tolerant in the landscape. Crushed leaves of fragrant sumac are said to smell like lemons, whereas the sap of skunkbush has a very pungent and unpleasant odor. The name is justified from a smell standpoint, but from a visual standpoint the other common name of three-leaved or oakleaf sumac is more fitting. It is also called squawbush, which refers to the Native American practice of using the stems for weaving baskets.

## PROPAGATION

Virtually all vegetative propagation has been done with the eastern *Rhus aromatica*, which begs the question, how much of that information applies to the western variety? Skunkbush can self-propagate by sprouting from the roots and rhizomes, but it does not sucker as aggressively as other sumacs.

## [CUTTINGS]

### PROPAGULE

- softwood cuttings of *Rhus aromatica*

### MATERIALS

- 1,000 ppm IBA as talc powder
- soilless rooting substrate

### ENVIRONMENT

- mist system

### METHOD

1. Take terminal cuttings in June through August.
2. Dip in rooting hormone.
3. Stick in soilless rooting substrate.
4. Put under mist until rooted.
5. Reduce mist as soon as roots begin to develop.

[Source: Dirr and Heuser, 2006]

**Dirr, M.A., and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004.** Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.

**Wennerberg, S.B. 2005.** Propagation and field assessment of West Virginia native species for roadside revegetation. Masters Thesis, West Virginia University.



# CURRANTS

*Ribes* spp.

**GOLDEN CURRANT** *Ribes aureum*

**WAX CURRANT** *Ribes cereum*

**NORTHERN BLACK CURRANT** *Ribes hudsonianum*

## PLANT DESCRIPTION

There are more than 100 species within the genus *Ribes*, and many of them are native to North America. Some, such as golden currant (*R. aureum*), have a wide ecological range and can be found through much of North America. Others, such as *R. laxiflorum* (trailing black currant), are limited to more narrow geographic areas and in Utah occur only in the Deep Creek range. Golden currant is used commonly as a landscape shrub and reaches 6-10 feet (0.9-3 m) in height. It has bright yellow flowers and small, many-seeded berries that range from yellow to red to black in color. Currants are easy to transplant and tend to form rhizomes and suckers.

## PROPAGATION

Currants propagate so easily from hardwood cuttings that there is very little detailed information on how to do it. Most of the information available is for production of varieties of currant used for horticultural production. While there are some differences between cultivars (and undoubtedly species), these methods should apply to all cultivars and species of currants.

### [DORMANT HARDWOOD CUTTINGS]

#### PROPAGULE

- dormant, hardwood cuttings 8 inches (20 cm) in length

#### MATERIALS

- 1,000 ppm IBA can be used, but is not necessary

#### ENVIRONMENT

- appropriately prepared field conditions to allow direct sticking

#### METHOD

1. Collect dormant, hardwood cuttings in late fall through winter. Cuttings should be a minimum of 8 inches (20 cm) in length.
2. Stick cuttings in the field while dormant and then allow to grow until harvested in the fall.
3. In the fall after plants have gone dormant they can be dug and transplanted.

#### NOTES

Cuttings less than 4 inches (10 cm) in length have both reduced rooting and new growth. Rooting percentages can exceed 90% in the field. Cuttings can also be stuck directly through black plastic mulch to reduce weed competition and improve soil moisture status.

[Source: Wainright and Hawkes, 1988]

**Dirr, M.A., and C.W. Heuser, Jr. 2006.** The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

**Hartmann, H.T., F.T. Davies, R.L. Geneve, and D.E. Kester. 2011.** Hartmann and Kester's Plant Propagation: Principles and Practice. Prentice Hall.

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# ROSES

*Rosa* spp.

**WOOD'S ROSE** *Rosa woodsii*

**NOOTKA ROSE** *Rosa nutkana*

## PLANT DESCRIPTION

Wood's rose (*Rosa woodsii*) is found throughout Utah and all of western North America. It is a deciduous shrub that can range from a low prostrate plant to more than 10 feet tall. It is prone to suckering from rhizomes and can form dense thickets made almost impenetrable by the prickles on the stems. It has small clusters of pink-colored flowers that give rise to orange-red rose hips in the fall that persist into the winter. The genus *Rosa* has a number of species that freely hybridize and a number of varieties within species, making it difficult to distinguish Wood's rose from Nootka rose (*R. nutkana*) which also occurs throughout Utah. Wood's rose is also highly variable in its size, shape, drought hardiness, and other characteristics suggesting that vegetative propagation of superior selections might be a valuable practice.

## PROPAGATION

Wood's rose can be relatively easy to propagate vegetatively by a number of techniques including hardwood and softwood cuttings, layering, and digging suckers for transplanting. Plants within the genus *Rosa* are commonly propagated by these methods using standard commercial propagation techniques.

### [1: SOFTWOOD CUTTINGS]

#### PROPAGULE

- softwood cuttings of current season's growth

#### MATERIALS

- 1:1 Peat:perlite rooting substrate
- 1,000-3,000 ppm IBA powder (optional)

#### ENVIRONMENT

- intermittent mist system

#### METHOD

1. Collect softwood cuttings of current season's growth.
2. Wound the base of the cutting.
3. Treat with rooting hormone, if using.
4. Stick into a well-drained rooting substrate.
5. Place under intermittent mist.

[Source: Dirr and Heuser, 2006]

[continued]



## ROSES [continued]

*Rosa* spp.WOOD'S ROSE *Rosa woodsii*NOOTKA ROSE *Rosa nutkana*

## [2: DORMANT HARDWOOD CUTTINGS]

## PROPAGULE

- dormant hardwood cuttings of current season's growth

## MATERIALS

- peat moss
- 1,000-3,000 ppm IBA powder (optional)

## ENVIRONMENT

- cold storage

[Source: based on Everett et al., 1978 and Monson et al., 2004]

## METHOD

1. Collect dormant wood from the current season's growth in late fall or early winter.
2. Trim 1/8 to 1/4 inch (3-6 mm) diameter cuttings to 6-8 inches (15-20 cm) in length.
3. Treat with rooting hormone, if using.
4. Bundle and store cuttings in a moist substrate such as peat moss at temperatures just above freezing.
5. After soils have warmed up in the spring, plant directly into the field.

Dirr, M.A., and C.W. Heuser, Jr. 2006. The Reference Manual of Woody Plant Propagation. Timber Press, Inc.

Everett, R.L., R.O. Meeuwig, and J.H. Robertson. 1978. Propagation of Nevada Shrubs by Stem Cuttings. Journal of Range Management, 31:426-429.

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Monsen, S.B., R. Stevens, and N.L. Shaw. comps. 2004. Restoring western ranges and wildlands. Gen.Tech.Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.





# DORR'S SAGE

*Salvia dorrii*

## PLANT DESCRIPTION

Dorr's sage (*Salvia dorrii*) is a compact, small shrub with grey-blue foliage that contrasts nicely with the purplish-blue flowers protruding from dark purple calyxes. Dorr's sage is found in shrub and sagebrush communities throughout the southwest and into Idaho. As a member of the mint family, Dorr's sage has aromatic foliage. It is a very drought tolerant plant and is susceptible to overwatering in the landscape. It is also referred to as purple sage or desert sage.

## PROPAGATION

Most of the propagation literature for Dorr's sage suggests propagation by seed. Everett (1978) had some success with vegetative propagation, which could be a starting point. In 1978 he stuck 625 cuttings from seven accessions. Success ranged from 13-45%, with an average of 22% of the cuttings rooting. A variety of propagation techniques were employed, but the estimated best treatment was softwood cuttings during the leaf growth stage.

## [SOFTWOOD CUTTINGS]

### PROPAGULE

- softwood cuttings

### MATERIALS

- 8,000 IBA in talc
- perlite
- fungicide

### ENVIRONMENT

- mist bench

### METHOD

1. Take softwood stem cuttings during period of leaf growth.
2. Keep moist until sticking.
3. Wound basal ends of cuttings and dip in talc.
4. Stick cuttings in coarse perlite.
5. Apply a fungicide to the mist bench at the time of planting.
6. Place on mist bench and keep plants moist.
7. Optimal rooting time is 12 weeks.

[Source: Everett et al., 1978]

Everett, R.L., R.O. Meeuwig, and J.H. Robertson. 1978. Propagation of Nevada shrubs by stem cuttings. *J. Range Manage.* 31:426-429.

Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003. *Water Wise: Native Plants for Intermountain Landscapes.* USU Press. Logan, UT.

Native Plant Database. [www.wildflower.org/plants/](http://www.wildflower.org/plants/) Lady Bird Johnson Wildflower Center. University of Texas at Austin.

Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011. *Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines.* Utah State University Press.

Photo credits: Mary Winter (top), Sally and Andy Wasowski [wildflower.org](http://wildflower.org) (bottom)



# ELDERBERRY

*Sambucus caerulea*

## PLANT DESCRIPTION

Blue elderberry (*Sambucus caerulea*) is a large, fast growing, multi-stemmed shrub that can reach 12 feet (3.7 m) in height. It is semi-riparian and found in montane forests throughout Utah. It is also found in Arizona, California, Nevada, New Mexico, Wyoming, and British Columbia. Blue elderberry has thick stems that are filled with a spongy pith.

The plant is most striking in the spring with its cluster of creamy white flowers, and in the fall with its metallic blue berries. The berries are edible when cooked and are often used for jams, jellies, and wine. Blue elderberry would work well in an irrigated naturalistic landscape.

## PROPAGATION

While there is little information about vegetative propagation of blue elderberry (*S. caerulea*) in the literature, vegetative propagation of other elderberries (*S. canadensis* and *S. racemosa*) is common in the literature. The propagation protocols below are for *S. canadensis*, but would be a good starting point for blue elderberry.

### [1: SOFTWOOD CUTTINGS]

#### PROPAGULE

- softwood cuttings

#### MATERIALS

- well-drained rooting substrate

#### ENVIRONMENT

- no information, but standard conditions should work

#### METHOD

1. Take softwood stem cuttings from 1-year-old juvenile seedlings.
2. Trim to 10-18 inches (25-45 cm) and include three sets of opposite buds.
3. Stick cuttings in rooting substrate or plant directly in ground.

[Source: Nokes, 1951]

### [2: SEMI-HARDWOOD CUTTINGS]

#### PROPAGULE

- semi-hardwood cuttings

#### MATERIALS

- IBA rooting hormone
- rooting substrate

#### ENVIRONMENT

- no information, but standard conditions should work

#### METHOD

1. Take semi-hardwood cuttings in late summer from mature plants.
2. Apply rooting hormone.
3. Stick cuttings in rooting substrate.

[Source: Nokes, 1951]

**Mee, W., J. Barnes, R. Kjelgren, R. Sutton, T. Cerny, and C. Johnson. 2003.** Water Wise: Native Plants for Intermountain Landscapes. USU Press. Logan, UT.

**Nokes, J. 1951.** How to Grow Native Plants of Texas and the Southwest. Texas Monthly Press. Austin, Texas.

**Rose, R., C.E.C. Chachulski, D.L. Haase. 1998.** Propagation of Pacific Northwest Native Plants. OSU Press. Corvallis, OR.

**Van Buren, R., J.G. Cooper, L.M. Shultz, and K.T. Harper. 2011.** Woody Plants of Utah: A Field Guide with Identification Keys to Native and Naturalized Trees, Shrubs, Cacti, and Vines. Utah State University Press.



# SILVER BUFFALOBERRY

*Shepherdia argentea*

## PLANT DESCRIPTION

Silver buffaloberry (*Shepherdia argentea*) is native to western Canada and the United States. It is a rapid grower and can obtain heights of 6-10 feet (1.8-3 m). The leaves and young branches are covered in scales giving the plant a silver-gray appearance. Branches also have sharp thorns at their tips. Silver buffaloberry works well in both wet and dry locations. It is also capable of fixing nitrogen which is an added plus for sustainability. In the landscape it can be excessively invasive due to suckering from the roots.

## PROPAGATION

The yellow-fruited variety of silver buffaloberry is easily propagated by cuttings.

### [SEMI-HARDWOOD CUTTINGS]

#### PROPAGULE

- semi-hardwood cuttings

#### MATERIALS

- 8,000 ppm IBA talc or Rootone®
- 1:1 sand:perlite
- 3% bleach
- Thiram® fungicide

#### ENVIRONMENT

- intermittent mist system

#### METHOD

1. Collect semi-hardwood cuttings in late July.
2. Dip cuttings in rooting hormone.
3. Stick cuttings in rooting substrate.
4. Hold cuttings under intermittent mist.

#### NOTES

The method used by Mirza (2009) was to surface sterilize cuttings with 3% bleach, after which they were dipped in Rootone® and stuck in sterile sand under intermittent mist.

[Source: Monson, et al., 2004]

**Mirza, B.S., A. Welsh, G. Rasul, J.P. Rieder, M.W. Paschke, and D. Hahn. 2009.** Variation in *Frankia* populations of the *Elaeagnus* host infection group in nodules of six host plant species after inoculation with soil. *Microb. Ecol.* 58:384-393.

**St. Pierre, R.G. 2008.** *Shepherdia argentea*. In: J. Janick and R.E. Paull (eds.). *The Encyclopedia of Fruits and Nuts*. CABI Publishing, Oxon, UK. <http://www.prairie-elements.ca/buffaloberry.html> accessed 22 Aug 2013.

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# ROUNDLEAF BUFFALOBERRY

*Shepherdia rotundifolia*

## PLANT DESCRIPTION

Roundleaf buffaloberry (*Shepherdia rotundifolia*) is native to southern Utah and the Colorado Plateau. It is striking in its appearance due to its silvery-white color and a form so rounded it appears to have been manually sheared. The leaves of roundleaf buffaloberry are thick and covered with trichomes (hairs). This shrub grows to a height of 3-6 feet (0.9-1.8 m).

## PROPAGATION

Unfortunately, roundleaf buffaloberry is very slow growing in the nursery and while relatively easy to propagate, the new plants have a high mortality in the nursery and most eventually die before reaching a marketable size. It is also difficult to establish in the landscape. This plant has great potential for landscape use and further research into its production and maintenance is justified.

## [SOFTWOOD CUTTINGS]

### PROPAGULE

- terminal softwood cuttings

### MATERIALS

- Calcined clay (Turface®)
- 1,000 ppm IBA talc rooting hormone

### ENVIRONMENT

- intermittent mist system
- shade cloth

### METHOD

1. Collect softwood cuttings.
2. Wound cuttings on two sides.
3. Moisten and dip in rooting hormone.
4. Stick in Turface® (calcined clay)
5. Place under intermittent mist and shade cloth for 12 weeks.

### NOTES

With this method, cuttings collected from wild plants in Southern Utah in April were rooted with 70% success.

[Source: Sriladda et. al, 2009]

**Sriladda, C., H. Kratsch, B. Curtis, and R. Kjelgren. 2009.** Vegetative propagation of *Shepherdia rotundifolia* (roundleaf buffaloberry) from softwood cuttings. Annual Conf. Am. Soc. Hort. Sci., St. Louis, MO. HortScience 44: 1105.

**Monsen, S.B., R. Stevens, and N.L. Shaw. 2004.** Shrubs of other families. In: Monsen, S.B., R. Stevens, and N.L. Shaw. comps. Restoring western ranges and wildlands. Gen. Tech. Rep. RMRS-GTR-136-vol-2. Ft. Collins, CO. USDA Forest Service.





# SNOWBERRY

*Symphoricarpos* spp.

**DESERT SNOWBERRY** *Symphoricarpos longiflorus*

**WESTERN SNOWBERRY** *Symphoricarpos occidentalis*

**UTAH SNOWBERRY** *Symphoricarpos oreophilus*

## PLANT DESCRIPTION

Snowberries are best known for their white berries in the fall. Utah snowberry (*Symphoricarpos oreophilus*) is one of the most common plants in the foothills and mountains of Utah. It is an understory plant that can reach up to 5 feet (1.5 m). Western snowberry (*S. occidentalis*) can be found in riparian areas with cottonwoods and willows. It spreads by rhizomes and can form extensive colonies. Desert snowberry (*S. longiflorus*) is found in more open desert spaces and is a more drought-tolerant species. True to its Latin name, the flowers of desert snowberry are longer than others in the genus.

## PROPAGATION

Snowberries can be vegetatively propagated by semi-hardwood cuttings, softwood cuttings, and there are reports of rhizome cuttings, though there is no documentation. Everett used semi-hardwood cuttings with 8,000 ppm IBA and found 56% rooting of *S. longiflorus* after 4 weeks and 28% rooting for *S. oreophilus* after 20 weeks. Scianna used bottom heat for *S. oreophilus* and treated with 2,000 ppm NAA + 40,400 ppm Thiram® (fungicide) resulting in a 79% success rate.

### [SEMI-HARDWOOD CUTTINGS]

#### PROPAGULE

- semi-hardwood cuttings

#### MATERIALS

- 8,000 ppm IBA talc preparation (Everett) or 2,000 ppm NAA (Scianna)
- perlite
- fungicide

#### ENVIRONMENT

- mist bench
- bottom heat (Scianna)

#### METHOD

1. Take semi-hardwood stem cuttings.
2. Keep moist until sticking.
3. Wound basal ends of cuttings and dip in talc.
4. Stick cuttings in coarse perlite.
5. Apply a fungicide to the mist bench at the time of planting.
6. Place on mist bench and keep plants moist.

[Source: Everett, 1978 and Scianna, 2003]

[continued]



**SNOWBERRY** *[continued]**Symphoricarpos* spp.**[SOFTWOOD CUTTINGS]****PROPAGULE**

- softwood cuttings

**MATERIALS**

- 0/0, 2000/1000, or 4000/2000 ppm IBA/NAA as Dip 'N Grow® in 25% ethanol
- Oasis® Rootcubes® rooting substrate

**ENVIRONMENT**

- intermittent mist
- bottom heat 75°F (24°C)
- 60% shade

**METHOD**

1. Collect shoots of current season's growth in early summer.
2. Wrap in moist newsprint, store in plastic bags, and keep in cooler until ready to prepare cuttings.
3. Cut shoots into segments of approximately 5 nodes. (Average length was 7/8 inch (22 mm).
4. Strip leaves from the bottom two nodes.
5. Dip in rooting hormone for 3 seconds.
6. Stick in rooting substrate.
7. Place on bottom heat.
8. Cover with shade cloth.
9. Mist for 7 seconds every 12 minutes.

**NOTES**

Cuttings were randomly assigned to the three rooting hormone treatments. After 5 weeks, roughly 70% of all cuttings rooted, regardless of treatment.

*[Source: Rupp, unpublished]*

**Everett, R.L., R.O. Meeuwig, and J.H. Robertson. 1978.** Propagation of Nevada shrubs by stem cuttings. *J. Range Manage.* 31:426-429.

**Dorn, R.D., and J.L. Dorn. 2007.** Growing Native Plants of the Rocky Mountain Area.

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**Rupp, L.** unpublished. Utah State University.

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# MATERIALS LIST

## Rooting Substrates

Soilless rooting substrates are ideal for propagating plants for several reasons. The most common rooting substrate materials are peat, vermiculite, perlite, and sand. These can be mixed together at different ratios custom to the type of plant that will be planted in it. By creating and following a 'recipe' with soilless substrate materials, the grower can have a consistent growing medium. Also soilless potting mixtures are less likely to contain weed seed. The following materials often comprise soilless rooting substrates, whether mixed with other substrates or used on their own:

- **Peat:** A highly water-retentive, spongy organic soil amendment, peat is the partially decomposed remains of aquatic, marsh, bog, or swamp vegetation. Peat pellets are disks of peat in biodegradable casing that expand when watered. They are used to start individual plants and minimize transplant shock.
- **Sand:** The heaviest of all rooting material, sand consists of small rock particles 0.05 to 2.0mm in diameter.
- **Vermiculite:** A micaceous mineral that expands when heated. It is able to absorb large quantities of water.
- **Perlite:** Gray-white siliceous material mined from lava flows. Perlite is used in soil mixtures to improve drainage and to prevent packing.
- **Pumice:** A substrate component of volcanic origin used to increase drainage and aeration.
- **Calcined Clay:** Clay mineral aggregates (like those used in cat litter) with particles less than .002 mm in diameter. Calcined clay retains water and controls nutrient leaching. It is commercially available as **Turface®**.
- **Foam substrates:** Foam blocks such as **Oasis® Rootcubes®** provide a water retentive substrate for cuttings.

## Rooting Hormones

Rooting hormones are synthetic compounds similar to those occurring naturally in plants. They are generally formulated using talc, liquid, or gel form and are used to stimulate root growth. Some rooting compounds also contain a fungicide

to deter rot in the cuttings. To use the rooting hormone, tip a small amount into a lid or a tray, dip the ends of the stem in the hormone and then stick the cuttings into the rooting substrate. Any leftover rooting hormone should be discarded as it may be contaminated. In this publication, the following rooting hormones are mentioned:

- **IAA: Indole-3-acetic acid**
- **IBA: Indolebutyric acid**
- **NAA: Naphthaleneacetic acid**
- **Ethrel (Ethephon)**

**Hormodin** and **Dip-'N-Grow** are brand-name plant hormones. **Ethanol** has been used to dilute rooting hormones.

## Fungicides

After cuttings are collected and before they are stuck, many of the recipes in this publication call for a fungicide dip. The following products were used as mentioned in some of the propagation protocols:

- **benzimidazole:** marketed as Benlate® and Benomyl®
- **Sodium hypochlorite solution**
- **Thiophanate methyl:** marketed as Cleary 3336®, Allban Flo®, Domain® and other products
- **Thiram®**

## Environment

There are a variety of environments for propagating plants. Where available, we have provided as much information as was available about the propagation environment, but this may change depending on location. The following environments were utilized in the collected propagation protocols:

- **Cold Frame**
- **Greenhouse**
- **Shadehouse**
- **Mist bed**
- **Mist bench**
- **Intermittent Mist**
- **Bottom Heat**

Precautionary Statement: Utah State University Extension and its employees are not responsible for the use, misuse, or damage caused by application or misapplication of products or information mentioned in this document. All pesticides are labeled with active ingredients, directions for use, and hazards, and not all are registered for edible crops. "Restricted use" pesticides may only be applied by a licensed applicator. The pesticide applicator is legally responsible for proper use. USU makes no endorsement of the products listed herein.

# GLOSSARY

## A

**Actinorhizal:** Actinorhizal plants are able to fix nitrogen with root nodules due to a symbiotic relationship with the nitrogen fixing actinobacteria, *Frankia*.

**Adventitious root:** A root other than the original seedling root, generally arising where it would not normally be expected, such as from a leaf or shoot.

**Adventitious shoot:** A shoot other than the original seedling shoot or its buds, generally arising where it would not normally be expected, such as from a leaf or root.

**Air layering:** A type of layering where a rooting environment is created around an aerial shoot of a woody plant to allow adventitious root formation.

**Apical meristem:** a dividing zone of each shoot or root tip that forms new cells.

**Asexual propagation:** Plant propagation where somatic (non-sexual) tissues are used to start new plants.

**Auxin:** A plant growth regulator that induces root initiation in cuttings. Auxins occur naturally in the plant and are also manufactured commercially as chemical concentrates for vegetative propagation. Indole-3-acetic acid (IAA), indolebutyric acid (IBA), and naphthaleneacetic acid (NAA) are all auxins.

## B

**Basal:** Relating to or situated at the base.

**Bath:** A mixture of fungicide or other material designed for soaking entire cuttings or other propagules.

**Base dressing:** A fertilizer application applied to a rooting substrate as a minimal base amount to support growth of newly rooted plants.

**Bottom heat:** A heating source placed below a rooting or germination substrate to increase substrate temperatures and subsequent rooting or germination.

**Budding:** A type of grafting where the scion is reduced to a single bud.

**Budsticks/Budwood:** A segment of shoot from the scion stock plant with the leaf blades removed. Budwood is used as the source of buds for budding.

**Burlap matting:** A covering of burlap suspended above outdoor propagation beds and kept moist to create a cool, shady, moist environment.

## C

**Calcined clay:** A substrate material made from heating clay (calcined) at high temperatures. Used to improve drainage and aeration, but also absorbs water and nutrients.

**Callus:** New, unorganized, cells proliferating from cut tissues in response to wounding or cutting of stems or roots.

**Chip bud:** A type of budding in which a segment of both bark and wood is removed from the stock plant and replaced with an identically shaped segment from the scion that also contains a bud.

**Clone:** One of a group of genetically identical plants produced by vegetatively propagating a single plant over one or more vegetative generations. Accomplished in woody plants by rooting stem cuttings, budding, grafting, air layering, or micropropagation.

**Cold frame:** A small, unheated structure with a transparent covering for use in starting cold-hardy plants.

**Compatibility:** Scion and rootstock material that can be successfully grafted is said to be compatible. If the scion and stock cannot be grafted (due to genetic or other differences) the two materials are said to be incompatible.

**Crown:** That part of a woody plant that occurs at the junction of the roots and the shoots. Generally at ground level.

**Cultivar:** A taxonomic term developed as a contraction of "cultivated variety" and used to identify unique plants within a species. Plants labeled as a given cultivar would be unique from other plants within the species and identical to other, similarly labeled plants.





**Cutting:** A propagule consisting of a portion of a leaf, stem, or root that is cut from a mother plant and used to start a new daughter plant.

## D

**Daughter plant:** Generally refers to new plants propagated vegetatively from a single original (mother) plant.

**Dilute soak:** The process of soaking cuttings in a diluted rooting hormone solution for an extended period of hours.

**Dip:** The process of dipping a cutting into a liquid or talc rooting hormone mixture.

**Division:** A type of vegetative propagation where whole daughter plants (containing both shoots and roots) are physically divided or separated from a mother plant to create an independent new plant.

**Dormancy:** A condition where perennial plants are not growing, such as during the winter. Woody plants require a moist, chilling period to overcome dormancy and will not grow until such a condition has been met.

**Drupe:** A botanical term for a fruit with an outer fleshy portion surrounding a hard shell with a seed inside (i.e., peach).

## E

**Ecotype:** A population of plants within a species that are adapted to a narrow segment of the species' environment.

**Etiolation:** Growth of plant shoots in the absence of light. Etiolated growth is more responsive to rooting treatments.

## F

**Fungicide:** A chemical compound formulated to protect plants from fungal attacks.

## G

**Genetic diversity:** The condition where each plant has some genetic differences from other plants of the same species or grouping.

**Genetic uniformity:** The condition where a group of plants is genetically identical.

**Genus:** The taxonomic category containing distinct species. A group of more than one related species.

**Girdling:** The process of limiting the flow of photosynthates from the leaves to the roots either by removing a ring of bark or restricting the stem by a wire or other means.

**Grafting:** The process of placing two genetically distinct plants together such that they combine and grow as one single plant with two distinct parts.

**Grafting tape:** Any of several types of tape that are used to hold grafts or buds in place and prevent their desiccation while healing.

## H

**Hardwood cuttings:** Cuttings of previous season's wood of deciduous or evergreen plants taken when the plant is dormant and the leaves have abscised. Deciduous hardwood cuttings require minimal care due to the lack of leaves and therefore water loss. Evergreen hardwood cuttings retain the potential to lose water through the leaves.

**Heel:** A small piece of 2-year-old or previous season's wood left at the base of a cutting of 1-year-old or current season's wood.

**Herbaceous perennial:** In temperate climates such as Utah, a plant that dies back to the ground and goes dormant during the winter only to return again the following spring.

## I

**Indole-3-acetic acid:** A type of naturally occurring auxin used as a rooting hormone. Commonly abbreviated as IAA.

**Indole Butyric Acid:** A type of synthetic auxin used as a rooting hormone. Commonly abbreviated as IBA.

**Intermittent mist:** A method of keeping cuttings or other propagules alive until rooted by periodically spraying with water.

**Internode:** The region of a stem in between the nodes.



# GLOSSARY

## J

**Juvenility:** The phase of plant growth where the plant is unable to flower, even if the environmental conditions are appropriate to flowering. Juvenile plants are more responsive to rooting treatments than mature plants.

## L

**Lateral roots:** Roots growing laterally from the primary seedling root system of a plant.

**Layering:** A type of vegetative propagation where daughter plants are developed while still attached to the mother plant, such as tip layering of blackberries.

## M

**Micropropagation:** The process of propagation using very small propagules in a sterile environment with enriched agar substrates.

**Mist bed:** A ground-level propagation area with an overhead mist system that is generally outdoors.

**Mistbench:** A raised bench with rooting medium and overhead mist for propagating plants. Generally housed in a greenhouse or shadehouse.

**Mother plant:** Generally refers to a plant used as the source of propagules to vegetatively propagate daughter plants. Synonymous with stock plant.

**Mound layering:** A type of layering where soil or other rooting substrate is mounded around shoots at the base of a plant to permit adventitious root formation. After roots have developed and the shoots have gone dormant, the rooted layers can then be separated from the parent plant.

## N

**Naphthaleneacetic acid:** A type of synthetic auxin used as a rooting hormone. Commonly abbreviated as NAA.

**Node:** Segments of a shoot where buds have developed and are attached.

## P

**Peat:** A highly water-retentive, spongy organic substrate used as potting medium. Only peat from sphagnum peat bogs should be used in propagation.

**Peat pellet:** A pellet of condensed peat moss that expands when moistened. Used in some instances as a rooting substrate.

**Perlite:** A substrate component made from mined siliceous material. It is white, lightweight, and non-absorbing so as to promote drainage. It is also sterile (as a result of the manufacturing process).

**Physiological stage:** A stage of plant growth or development (such as juvenility, maturity, or dormancy) that results in the expression of different genes and subsequently different responses to propagation.

**Plastic tent:** A covering of clear or white plastic used to retain high humidity around cuttings or other propagules.

**Propagate:** The process of increasing the numbers of a plant.

**Propagule:** A piece of a mother plant that can be used to propagate a daughter plant.

**Pumice:** A substrate component of volcanic origin used to increase drainage and aeration.

## Q

**Quiescent:** A type of dormancy requiring only favorable conditions to be overcome.

**Quick-dip:** The process of dipping cuttings into a liquid hormone solution for a brief (<10 seconds) period of time.

## R

**Rejuvenation:** The process of inducing a plant to change from a mature phase to a juvenile phase.

**Rhizomatous:** Having an underground stem with buds that develop new shoots and roots.

**Root initials:** Incipient roots at the stage where they have not developed enough to

be visible. Some plants have pre-formed root initials that are basically undeveloped roots on the stems that will rapidly develop when placed in appropriate conditions.

**Rooting hormone:** Synthetic auxins that encourage the initiation of new adventitious roots on stems and stems on roots.

**Rooting Substrate:** A substrate used specifically for rooting cuttings. Generally composed largely of materials such as perlite or sand that promote drainage.

## S

**Samara:** A dry, one-seeded, indehiscent fruit with a wing attached.

**Sand:** The heaviest of all rooting substrates, sand consists of small rock particles, 0.05 to 2.0 mm in diameter.

**Scion:** The upper or shoot portion of a grafted plant.

**Seedling:** A plant propagated from seed during its initial, small stage of growth.

**Seedling rootstock:** A rootstock that was propagated from seed for use as a recipient for a grafted scion.

**Semi-hardwood cuttings:** Cuttings of current season's wood that has begun to stiffen, but has not become fully hardened.

**Serpentine layering:** A type of layering where vines or other flexible shoots are alternatively passed in and out of the soil with the goal of adventitious roots forming where the shoot is underground and new shoots forming from the above ground portion.

**Sexual propagation:** Plant propagation by a seed that developed as a result of pollination.

**Shading:** The process of using various materials such as lath or shade cloth to reduce the amount of sunlight striking plants in a propagation facility. Usually expressed as a percentage of light blocked.

**Shade cloth:** A knit or woven fabric in either black or white color that is used to reduce the amount of light in propagation.

**Shade house:** A structure for propagation or production of plants under shade. Usually unheated and open to air movement.

**Side-veneer graft:** A graft made by making a long vertical cut in the side of a rootstock. The scion is cut with a long cut surface matching the length of the rootstock cut and with a small back-cut to remove the bark at the tip. The scion is placed in the cut on the rootstock and tied into place.

**Softwood cuttings:** Cuttings of current season's wood that is still soft and flexible, but hard enough to snap when fully bent.

**Soilless mixture:** A substrate used for rooting or growing plants and made entirely of non-soil materials such as peat moss, perlite, sand, vermiculite or other materials. It is used instead of soil for drainage and cleanliness.

**Stock plant:** Generally refers to a plant used as the source of propagules to vegetatively propagate daughter plants. Synonymous with mother plant.

**Stem cutting:** A cutting consisting of stem segments without the terminal bud.

**Stolon:** A runner or modified stem, often below ground, rooting at the tip or creeping and rooting at the nodes. A horizontal stem that produces a new plant at its tip. A spreading rootstock.

**Stool bed:** A nursery bed consisting of a number of mother plants grown in a row for the purpose of mound layering.

**Sucker:** An underground stem or shoot, eventually rising to a leafy stem.

**Supplemental lighting:** Artificial lighting of plants in a greenhouse or other structure to provide long days and/or enhance photosynthesis.

## T

**T-bud:** A type of budding in which the bud consists primarily of the bud and the surrounding bark shield and is placed between the bark and wood of the rootstock through the use of a T-shaped cut.

# GLOSSARY

**Talc rooting hormone:** A rooting hormone compound formulated by mixing the rooting hormone with talc powder and using the talc as a carrier.

**Taproot:** The main descending root of a plant.

**Terminal bud:** The bud located at the end of a twig that marks the end of that year's growth.

**Terminal cutting:** A cutting consisting of just the terminal or tip of a branch or shoot.

**Thermal blanket:** A covering material used to cover outdoor propagation beds to reduce energy costs. Examples include aluminized polyester or bubble polyethylene.

**Trench layering:** A type of layering where aerial portion of a woody plant is grown horizontally in a trench and covered with soil such that new shoots will grow up through the soil and be induced to develop adventitious roots.

**Turgid:** Refers to cells in plants that are fully inflated with water, causing the stems to be rigid and plants to stand up.

## V

**Variety:** Plants having minor characteristics or variations that separate them from one or more similarly characterized varieties within a species.

**Vegetative propagation:** Plant propagation where somatic (non-sexual) tissues are used to start new plants.

**Vermiculite:** A substrate component made of refined micaceous base material. It is light weight, readily absorbs water, and is sterile (as a result of the manufacturing process).

## W

**Whip graft:** One of many types of grafting where the terminal end of a scion shoot is grafted to the top of a rootstock shoot.

**Woody perennial:** A plant that develops woody stems that survive for multiple years as exemplified by trees and shrubs.

**Wounding:** Cutting propagation can often be enhanced by wounding the stem in addition to cutting it off the stock plant. This is done by making cuts through the bark parallel to the stem at its base, or by scraping or cutting off a portion of the bark at the stem base.

# GLOSSARY OF TRADE TERMS

**Benlate®:** A systemic benzimidazole fungicide. *Currently unavailable.*

**Benomyl®:** A systemic benzimidazole fungicide. *Currently unavailable.*

**Dip 'N Grow®:** A liquid rooting hormone containing IBA and NAA.

**Domain® fungicide:** A fungicide containing thiophanatemethyl.

**Ethrel®:** The trade name for ethephon, a chemical which gives rise to ethylene gas.

**Hormex®:** A talc-based rooting hormone available in a variety of concentrations of IBA.

**Oasis® Rootcubes®:** A foam rooting substrate used for sticking cuttings.

**Parafilm®:** A mildly self-adhesive grafting tape made of paper and paraffin and used primarily for budding.

**Phytotronics®:** Intermittent mist controllers.

**Rootone®:** A talc-based rooting hormone.

**Rootone F®:** A talc-based rooting hormone which also includes a fungicide.

**Stim-Root®:** A talc-based rooting powder containing 0.1-0.8% IBA.

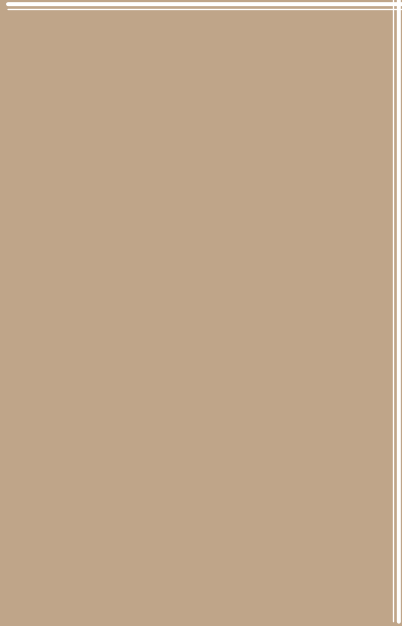
**Styroblock™:** A container growing system based on styrofoam blocks with cells for individual plants (complete with drain holes) within the block.

**Thiophanatemethyl:** A fungicide marketed as Cleary 3336®, Allban Flo®, Domain and other products.

**Thiram®:** A fungicide containing tetramethylthiuram disulfide.

**Turfacer®:** A calcined clay used as a rooting substrate

\*Some products may no longer be commercially available.



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