

Appendix B—Propagation and Establishment of Requirements for Selected Plant Species

The information displayed for each plant species was gleaned from just a few sources. Additional information is available for these plant species, but this chart should provide a starting point. In the *Propagation Method* column, numbers in **bold** text indicate the method of propagation that the literature suggested would be the most successful. In the *References* column, authors in **bold** text indicate works with more complete descriptions.

Key to Propagation Methods

1. Seed
 - a. Cold moist stratification: the number of days required for stratification follows (for example, 1a: 60)
 - b. Scarification
 - c. Water leaching
 - d. Treatment with sulfuric acid
 - e. No treatment needed
 - f. Warm/cold stratification (days required for warm/cold stratification; for example, 1f: 45/140)
 - g. Other
2. Semihardwood stem cuttings
3. Hardwood stem cuttings (firm stems after leaves have dropped)
4. Softwood or herbaceous cuttings
5. Root cuttings
6. Leaf cuttings
7. Leaf bud cuttings
8. Divisions
9. Simple layering
10. Mound layering
11. Trench layering
12. Tip layering
13. Seed-increase program

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| <i>Abies</i> spp. | 1a: 14–28 | Young and Young 1986 | Germinates in or on melting snowbanks in the wild. |
| <i>Abies grandis</i> Grand fir | 1a: 15–30 | Rose and others 1998 | The seed is fragile and requires afterripening in the cone. Do not extract it immediately. Stratify and sow the seed 0.2 inch (5 millimeters) deep during the spring. |
| <i>Abies lasiocarpa</i> Subalpine fir | 1, 2 | Weisberg 1993 | |
| <i>Abronia latifolia</i> Yellow sand verbena | 1 | Schmidt 1980 | Direct sow the seed during the fall on sandy soil in full sun. Expect spotty germination. Seedlings do not tolerate disturbance. |
| <i>Abronia umbellata</i> Pink sand verbena | 1 | Schmidt 1980 | Direct sow the seeds during the fall. Protect the seedlings from moles and rabbits until they have become established. |
| <i>Abronia villosa</i> Desert sand verbena | 1 | Schmidt 1980 | Annual species. Direct sow the seed on sandy soil during the fall or early spring. |
| <i>Acer circinatum</i> Vine maple | 1a: 120–240 or 1f: 30–60 warm/ 30–90 cold | Potash and Aubry 1997 Landis and Simonich 1983 Link 1993 Rose and others 1998 | Collect the seed when it is green, from August to October. Stratify the seed immediately or plant the seed on the site. Start the seed during the spring. It takes 3 to 4 months to grow. Bareroot and containerized stock also have been planted successfully. |
| <i>Acer glabrum</i> Rocky Mountain maple | 1f: 180 warm/180 cold | Link 1993 Rose and others 1998 | Apply seed directly on the site. Expect 25-percent germination. |
| <i>Acer macrophyllum</i> Bigleaf maple | 1a: 40–80, 8 | Weisberg 1993 Rose and others 1998 | Seed decays rapidly. Collect seed late in the fall before the rains. Stratify the seed before sowing it at 34 to 41 degrees Fahrenheit (1 to 5 degrees Celsius). Sow during February or early March or plant directly during the fall. |

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| <i>Achillea millefolium</i> Western yarrow | 1, 8 (spring) | Potash and Aubry 1997 Rose and others 1998 Young and Young 1986 | Seed ripens between August 1 and October 31. Cut off the seed heads. Plant seed directly during the fall or late April, or plant 1.6-inch (40-millimeter) rhizome fragments. Lift divisions during the early spring and divide them into small groups of rosettes. Cut back the leaves and plant them. |
| <i>Achlys triphylla</i> Vanilla leaf | 8 | Weisberg 1993 | |
| <i>Actaea rubra</i> Baneberry | 1, 1a | Schmidt 1980 | Remove the seed from pulpy fruit. Add peat or wood humus to the soil before sowing the seed. If germination is poor, cold stratification may help. |
| <i>Adenocaulon bicolor</i> Trail plant | 8 | Weisberg 1993 | |
| <i>Adenostoma fasciculatum</i> Chamise | 1d | Young and Young 1992 | The hard seedcoat requires acid treatment. An alternative is to sow seed in soil in flats and burn pine needles on the surface. |
| <i>Adenostoma sparsifolium</i> Red shank | 1d | Young and Young 1986 | Treat seed in sulfuric acid for 15 minutes. |
| <i>Adiantum</i> spp. Maidenhair fern | 8, spores | Schmidt 1980 | Schmidt (1980) includes the complete protocol for propagating ferns from spores. |
| <i>Aesculus californica</i> California buckeye | 1e | Harris and Leiser 1979 | Direct seed during the fall. |
| <i>Agave utahensis</i> Century plant | 1e | Link 1993 | Grow seedlings in deep-ridged containers with well-drained medium. Fertilize seedlings with each watering. |
| <i>Agoseris glauca</i> | 1 | Weisberg 1993 | |
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| <i>Agropyron macrourum</i> | 1e, 13 | Densmore and others 1990 Young and Young 1986 | |
| <i>Agropyron spicatum</i> Bluebunch wheatgrass | 1e | Rose and others 1998 | Collect seed during the fall. Remove awns with a hammer mill. Sow a minimum of 100 to 160 seeds per square acre during the fall. |
| <i>Agrostis scabra</i> Rough bentgrass | 1e | Link 1993 | Seed ripens from July 15 to August 15. Collect seed for a seed-increase program. Broadcast the seed and rake it into the soil. |
| <i>Ailanthus altissima</i> Tree of heaven | 1a: 60 | Young and Young 1986 | |
| <i>Allium</i> spp. | 1a | Young and Young 1986 | |
| <i>Alnus</i> spp. | 1a: 180 | Young and Young 1986 Hartmann and others 1990 | Thoroughly clean the seed. Sow the seed when it is fresh or chill the seed before planting. |
| <i>Alnus crispa</i> | 1 | Densmore and others 1990 | This alder fixes nitrogen. Inoculate its seedlings with a solution made from root nodules. |
| <i>Alnus incana</i> Thinleaf alder | 1a: 180, 1e, 4 | Rose and others 1998 | Collect fruit during the fall when the bracts start to separate. Fresh seed will not stratify. Dried seed stratifies at 41 degrees Fahrenheit (5 degrees Celsius). Sow during the spring. |
| <i>Alnus rubra</i> Red alder | 1e, 4 | Potash and Aubry 1997 Rose and others 1998 | This alder fixes nitrogen. The seed ripens from September 1 to October 15. Seed from the upper one-third of the tree is more likely to be viable. The seed is ripe when the strobile (a fruiting structure characterized by rows of overlapping scales) twists easily and its scales part. Start seed during the spring or sow onsite during the fall. Seed needs light to germinate. Plants are more likely to become established when they are planted in mineral soil, watered, and supplied with fertilizer that is low in nitrogen and high in phosphorus. |

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| <i>Alnus sinuata</i> Sitka alder | 1a: 30–90, 4 | Potash and Aubry 1997 Rose and others 1998 | This alder fixes nitrogen. See <i>Alnus rubra</i> for instructions on handling seed. Inoculate the planting medium with root nodules. |
| <i>Amelanchier alnifolia</i> Saskatoon serviceberry | 1e or 1a: 112–168, 5, 8 | Rose and others 1998 | Collect seed during the late summer. Macerate fruit with water. The seed has a tendency to develop fungal mold. Plant the seed during the winter or stratify the seed at 34 to 43 degrees Fahrenheit (1 to 6 degrees Celsius) and plant it in sandy soil during the spring. Take root cuttings from December to February. Cut segments of fleshy roots 2 inches (50 millimeters) long. The cut should be horizontal at the end closest to the root crown and slanted at the end farthest from the crown. For reproduction by division, divide plants during the early spring. |
| <i>Amelanchier utahensis</i> Utah serviceberry | 1a: 60 4 | Link 1993 | Seed ripens between April 1 and August 31. Clean seed by macerating fruit and washing the pulp over screens. Dry the pulp, then rub the seed through the screens. |
| <i>Amorpha californica</i> California false indigo | 1e | Young and Young 1992 | Soaking seed in hot water for 10 minutes may improve germination. |
| <i>Amorpha canescens</i> | 1e | Young and Young 1992 | |
| <i>Amorpha fruticosa</i> | 1e | Young and Young 1992 | |
| <i>Amorpha nana</i> | 1e | Young and Young 1992 | |
| <i>Anaphalis margaritacea</i> Pearly-everlasting | 1e, 8 (spring or fall) | Potash and Aubry 1997 Rose and others 1998 | Seed ripens between July 1 and October 31 when the flower's center is dark brown. Collect the entire seed head. The pappus (hairs or bristles attached to an achene) can remain on the seed. Sow seed under a thin layer of soil during the spring. For reproduction by division, replant the divided plants during the spring or fall. |
| <i>Andromeda polifolia</i> Bog rosemary | 1a, 2 | Young and Young 1992 | The seed needs prechilling. Winter cuttings can be rooted easily. |

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| <i>Andropogon gerardii</i> Bluestem | 1a: 14 | Young and Young 1986 | The seed needs light and potassium nitrate (KNO ₃) to germinate. |
| <i>Andropogon hallii</i> | 1a: 14 | Young and Young 1986 | The seed needs light and potassium nitrate (KNO ₃) to germinate. |
| <i>Andropogon virginicus</i> Broomsedge bluestem | 1e | Link 1993 | The seed is very difficult to collect and clean because the very small seed is encased in hairy appendages and the leaf sheath. |
| <i>Anemone multifida</i> Cutleaf anemone | 1e | Link 1993 | Direct seed. |
| <i>Anemone occidentalis</i> Western pasqueflower | 1a: 30–90 | Link 1993 | The seed ripens between August 1 and 31. Dry the seed in an oven to break off the long, plumose tails. During greenhouse trials, seedlings emerged, but did not survive. |
| <i>Antennaria alpina</i> Alpine pussytoes | 1 | Weisberg 1993 | |
| <i>Antennaria corymbosa</i> Pussytoes | 8 | Link 1993 | When plants that had been divided were planted above the crown, they died back. |
| <i>Antennaria microphylla</i> Littleleaf pussytoes | 1e | Link 1993 | The seed ripens between June 15 and July 15. Seed production is low. Use cone-tainers or direct seed. |
| <i>Antennaria neglecta</i> Field pussytoes | 1e | Link 1993 | The seed ripens between June 15 and July 10. Seed production is low. Use cone-tainers or direct seed. |
| <i>Aquilegia formosa</i> Red columbine | 1e | Link 1993 Rose and others 1998 Young and Young 1986 | The seed ripens between June 1 and August 15. Start seed during the spring or fall in cone-tainers or use direct seeding. Seed needs to be chilled for 3 days before planting or it will not germinate. |
| <i>Arabis</i> spp. Rock cress | 1 | Young and Young 1986 | Seed requires light and potassium nitrate (KNO ₃) to germinate. |

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| <i>Aralia</i> spp. Ginseng | 1a, 1b | Young and Young 1992 | May need a period of afterripening and scarification, followed by prechilling. |
| <i>Arbutus menziesii</i> Pacific madrone | 1a: 30–90, 4, 9 | Rose and others 1998 Young and Young 1992 | Collect berries from October to December. Macerate the berries and separate the seed by drying or flotation. Stratify at 36 to 41 degrees Fahrenheit (2 to 5 degrees Celsius) or stratify naturally outdoors over winter. |
| <i>Arctostaphylos</i> spp. Manzanita | 1d, 1f: 60–120/60–90 Cuttings | Landis and Simonich 1983 Young and Young 1992 | Scarify the seed in sulfuric acid for 3 to 6 hours. Use warm/cold stratification. |
| <i>Arctostaphylos columbiana</i> Bristly manzanita | 2 | Weisberg 1993 | |
| <i>Arctostaphylos nevadensis</i> Pinemat manzanita | 1a, 1b, 1d, 3, 4 | Link 1993 Rose and others 1998 | Use cuttings from 1- or 2-year-old wood. Seed is difficult to germinate. |
| <i>Arctostaphylos patula</i> Greenleaf manzanita | 1a: 90, 1b, 4 | Rose and others 1998 | Seed ripens from July to September. Macerate the fruit and separate the seed using floatation. Scarify the seed in hot water and stratify the seed at 39 degrees Fahrenheit (4 degrees Celsius) in moist sand. Seed can be sown in coarse soil during the early summer. Keep the seedbed mulched over the winter. Take cuttings from stems with five to six nodes of the current year's growth. |
| <i>Arctostaphylos uva-ursi</i> Kinnikinnick | 1d or 1d then f: 60 warm/60 cold 2, 5 | Potash and Aubry 1997 Rose and others 1998 | The fruit is ripe when it is red or pink, usually from June 1 to October 15. Collect stem cuttings 2 to 6 inches (50 to 150 millimeters) long during the fall. Collect 3- to 5-inch (75- to 150-millimeter) root cuttings during the fall. Separate the seed by flotation or by grinding when the seed is dry. Establish seedlings on well-drained sandy or gravelly soils. |
| <i>Arctostaphylos viscida</i> Whiteleaf manzanita | 1a, 1b, 9 | Rose and others 1998 | Plant seed during the late summer. Seed needs heat and mechanical or chemical scarification. Stratify the seed over the winter. |

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| <i>Aristida longiseta</i> | 1e | Young and Young 1986 | |
| <i>Aristida purpurea</i> Triple-awned grass | 1e | Young and Young 1986 | |
| <i>Arnica</i> spp. | 8 | Weisberg 1993 | |
| <i>Arnica frigida</i> | 1 | Densmore and others 1990 | |
| <i>Arnica latifolia</i> Mountain arnica | 1 | Weisberg 1993 | |
| <i>Arnica sororia</i> Twin arnica | 1e | Link 1993 | Seed ripens between July 15 and 31. Seed production is low. Plant in cone-tainers. |
| <i>Artemisia arbuscula</i> Low sagebrush | 1a: 60 | Link 1993 Young and Young 1992 | Seed ripens between October 1 and December 31. Sow in rows and transplant to pots or direct sow the seed under ¼ inch (6 millimeters) of soil and cover with light mulch. |
| <i>Artemisia frigida</i> Fringed sagebrush | 1a: 10, 1d | Link 1993 | Seed ripens during the fall. Direct sow the seed on top of the soil if the soil is moist. Fringed sagebrush is easy to propagate. |
| <i>Artemisia ludoviciana</i> Sagewort | 1a: 14, 1d | Link 1993 | Seed ripens between July 15 and October 15. Grow in containers or direct seed. Sagewort is easy to grow. |
| <i>Artemisia tilesii</i> | 1 | Densmore and others 1990 | |
| <i>Artemisia tridentata</i> Big sagebrush | 1a: 0–10, 3 | Landis and Simonich 1983 Rose and others 1998 | Seed ripens between November 5 and January 15. Start seedlings during the spring, summer, or fall. Seed takes 2 to 3 months to grow. |
| <i>Aruncus sylvestris</i> Goatsbeard | 1, 8 (spring) | Potash and Aubry 1997 | Seed ripens between July 1 and November 30. Shake the seed loose or strip the heads. Sow seed during the fall when the soil is moist. |

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| <i>Asarum caudatum</i> Wild ginger | 1, 5, 8 | Weisberg 1993 Rose and others 1998 | Mature seed is difficult to collect, but the plant readily seeds itself. For divisions, divide the plant during the early spring or fall when it is dormant. Plant the rhizomes 0.4 inch (10 millimeters) deep with the tip reaching the soil level. Keep the soil moist by mulching. Take cuttings during the summer; start them in sand for planting during the fall. |
| <i>Asarum hartwegii</i> Marble-leaf ginger | 1, 5, 8 | Schmidt 1980 | Same as <i>Asarum caudatum</i> . |
| <i>Asclepias cordifolia</i> Purple milkweed | 1 | Schmidt 1980 | Requires sun and porous soil. |
| <i>Asclepias speciosa</i> Butterfly weed | 1, 5 | Schmidt 1980 | Spreads rapidly underground. Butterfly weed is a host plant for the monarch butterfly. |
| <i>Aster alpigenus</i> Alpine aster | 1 | Weisberg 1993 Young and Young 1986 | |
| <i>Aster foliaceus</i> Leafybract aster | 1e | Link 1993 Weisberg 1993 | The seed ripens between June 1 and September 15. Rub the seed to remove fuzz. Dry the seed quickly. Use mothballs to control insects. |
| <i>Aster glaudoces</i> Blueleaf aster | 1e | Link 1993 | Seed ripens between August 1 and September 30. Rub the seed to remove fuzz. |
| <i>Aster integrifolius</i> Thickstem aster | 1a: 7 | Link 1993 | Seed ripens between August 15 and September 15. Rub the seed to remove fuzz. Dry the seed quickly. Use mothballs to control insects. Grow in cone-tainers. Direct seed by broadcast seeding and raking. |
| <i>Aster ledophyllus</i> Cascade aster | 1 | Weisberg 1993 | |

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| <i>Aster leevis</i> Smooth aster | 1e | Link 1993 | Seed ripens between August 15 and September 30. Direct seed by broadcast seeding and raking. |
| <i>Aster modestus</i> Modest aster | 1e | Link 1993 | Dry the seed quickly. Use mothballs to control insects. Grow in cone-tainers. |
| <i>Aster sibericus</i> | 1 | Densmore and others 1990 | |
| <i>Astragalus</i> spp. | 1b | Young and Young 1986 | |
| <i>Astragalus antiselli</i> | 1e | Young and Young 1986 | |
| <i>Astragalus eucosmus</i> | 1b or 1d | Densmore and others 1990 | Inoculate seedlings with a solution of root nodules. |
| <i>Atriplex</i> spp. Saltbush | 1a | Young and Young 1992 | Direct seed. |
| <i>Atriplex canescens</i> Fourwing saltbush | 1a: 30–50 | Landis and Simonich 1983 | Seed ripens between October 20 and March 1. Store seed in the open. Start plants during the spring, summer, or fall. Seeds take 3 to 4 months to grow. |
| <i>Atriplex confertifolia</i> | 2 | Landis and Simonich 1983 | |
| <i>Atriplex cuneata</i> | 2 | Landis and Simonich 1983 | |
| <i>Atriplex lentiformis</i> Quail bush | 1e | Harris and Leiser 1979 | Direct seed during the late winter or spring. |
| <i>Baccharis pilularis</i> Coyote bush | 1e | Harris and Leiser 1979 Young and Young 1992 | Direct seed during the fall. |
| <i>Baileya</i> spp. Desert marigold | 1 | Young and Young 1986 | Seed requires light for germination. |

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| <i>Balsamorhiza sagittata</i> Arrowleaf balsamroot | 1a: 56–84, 8 | Rose and others 1998 | Seed ripens by mid-June. Harvest seed by hand. Clean seed by drying, fanning, and macerating. Stratify seed at 25 degrees Fahrenheit (–4 degrees Celsius). Broadcast seed when sowing and cover the seeds. Fall or winter sowing is recommended. Plants can be salvaged by transplanting root crowns. |
| <i>Beloperone californica</i> Chaparosa | 1e | Young and Young 1992 | |
| <i>Berberis</i> spp. (See also <i>Mahonia</i> spp.) | 1a: 14–48, 1e, 2, 8, 9, 10 (summer) | Hartmann and others 1990 Young and Young 1992 | Separate the seed from the fruit by flotation. Remove all pulp from the seed. Stratify seed at 40 degrees Fahrenheit (4 degrees Celsius) or direct sow the seed during the fall. Root cuttings under mist. Application of 2,000 to 8,000 parts per million IBA (indole-3-butyric acid) aids rooting for some species. |
| <i>Berberis fremontii</i> (See <i>Mahonia fremontii</i>) | | | |
| <i>Berberis nervosa</i> Oregon grape (See also <i>Mahonia nervosa</i>) | 1a: 45–150 3, 4, 5, 7 (summer or fall) | Browse 1979 Potash and Aubry 1997 | Seed ripens between August 1 and September 30. Process the seed immediately by flotation or by rubbing the fruit on a screen. Store the seed above freezing without drying. Start seed during the spring. With cuttings, take no more than 5 percent of the donor plant. |
| <i>Betula glandulosa</i> | 1e | Young and Young 1992 | Needs light to germinate best. |
| <i>Betula occidentalis</i> Water birch | 1e | Rose and others 1998 | Collect strobiles (a fruiting structure characterized by rows of overlapping scales) while they are still green and spreading and dry them during the late summer. Sow the seed during the fall. Seedlings require shade for 2 to 3 months during their first summer. |
| <i>Betula papyrifera</i> Paper birch | 1e, 4 | Rose and others 1998 | Collect seed from September to November. Pick strobiles while they are still green. Unstratified seed germinates better than stratified seed. Sow seed during the late summer and fall. For cuttings, the timing is critical— |

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| | | | shoots should be active with the base of the cutting just becoming firm. Nodal cuttings from 6 to 8 inches (150 to 200 millimeters) long are best. Plant cuttings during warm, dry conditions with good air and moisture. |
| <i>Bouteloua breviseta</i> Chino grama | 1e | Link 1993 | Seed ripens during November. Seed is difficult to collect because of the short period that it is available, its tendency to shatter, and its low viability. |
| <i>Bouteloua curtipendula</i> | 1e | Young and Young 1986 | |
| <i>Bouteloua hirsuta</i> Hairy grama | 1e | Link 1993 | Seed ripens during November. Seed is easy to collect, but has low viability. |
| <i>Brickellia californica</i> Brickle brush | 1e | Young and Young 1992 | |
| <i>Bromus carinatus</i> Mountain brome | 1e | Link 1993 Young and Young 1986 | Seed ripens between June 1 and August 31. Avoid plants with smut. Direct seed. Can be used in a seed-increase program. |
| <i>Bromus vulgaris</i> Columbia brome | 1e | Link 1993 | Seed ripens between July 1 and August 31. Avoid plants with smut. Direct seed. Can be used in a seed-increase program |
| <i>Buchloe dactyloides</i> Buffalo grass | 1a: 42 | Young and Young 1986 | Seed requires light and potassium nitrate (KNO ₃) during germination. |
| <i>Calamagrostis breweri</i> Shorthair reedgrass | 1, 8 | Link 1993 | Start divisions in January. Use vitamin B1. Don't cover the root crown with soil. |
| <i>Calamagrostis canadensis</i> Bluejoint reedgrass | 1e | Link 1993 Young and Young 1986 | Seed ripens during the spring. Plant seed ¾ to 1 inch (20 to 25 millimeters) deep. Plant in moist to saturated soil with no standing water. |
| <i>Calamagrostis rubescens</i> Pinegrass | 1e | Rose and others 1998 | Diurnal fluctuating temperatures are needed: 16 hours at 68 degrees Fahrenheit (20 degrees Celsius) and 8 hours at 86 degrees Fahrenheit |

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| | | | (30 degrees Celsius). Needs adequate moisture and light. |
| <i>Callicarpa</i> spp. Beauty bush | 1e, 4 | Young and Young 1992 Link 1993 | Take cuttings from June to September. Treat with 1,000 parts per million IBA (indole-3-butyric acid) talc. Expect 50-percent germination when planting seed in trays. Seedlings should be transplanted to containers. |
| <i>Callicarpa americana</i> American beautyberry | 1e | Young and Young 1992 Link 1993 | Same as <i>Callicarpa</i> spp. |
| <i>Caltha asarifolia</i> Marshmarigold | 8 | Weisberg 1993 | |
| <i>Caltha biflora</i> White marshmarigold | 1 | Weisberg 1993 | |
| <i>Calycanthus occidentalis</i> Western spice bush | 1e | Harris and Leiser 1979 | Direct seed during the fall. |
| <i>Carex exserta</i> Shorthair sedge | 1e, 8 | Link 1993 | Start divisions during January. Use vitamin B1. Don't cover the root crown with soil. |
| <i>Carex illota</i> Small-headed sedge | 1 | Weisberg 1993 | |
| <i>Carex mertensii</i> Mertens sedge | 1e | Link 1993 | Seed ripens between August 1 and September 1. |
| <i>Carex microptera</i> Smallwing sedge | 1a: 60 | Link 1993 | Soak seed for 60 days in water at 33 to 45 degrees Fahrenheit (0.5 to 7 degrees Celsius) in the dark. Plant seed in moist soil that is not submerged in water. |
| <i>Carex nigricans</i> Black alpine sedge | 1, 8 | Potash and Aubry 1997 | Seed ripens between August 15 and September 30. Ripe seed comes off easily in the fingers. Store seed in the cold for several months to |

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| | | | stratify. After direct seeding during early summer, use plastic sheeting on the soil to force germination. |
| <i>Carex obnupta</i> Slough sedge | 1e | Link 1993 | Sow seed during the fall. Slough sedge needs very wet soil. |
| <i>Carex paschystachya</i> Thick-headed sedge | 1 | Link 1993 | Seed ripens between July 30 and August 30. Seed can be planted during the fall without removing the hull. |
| <i>Carex phaecephala</i> Dunhead sedge | 1 | Weisberg 1993 | |
| <i>Carex rossii</i> Ross sedge | 1, 8 | Link 1993 | Start divisions during January. Use vitamin B1. |
| <i>Carex rostrata</i> Beaked sedge | 1 | Rose and others 1998 | Harvest achenes during August or September. Sow seed into moist soil during the fall. |
| <i>Carex spectabilis</i> Showy sedge | 1 | Weisberg 1993 | |
| <i>Carex utriculata</i> Sedge | 1a: 60 | Link 1993 | Same as <i>Carex microptera</i> . |
| <i>Carpenteria californica</i> Bush anemone | 1e, 4 | Young and Young 1992 | Collect seed between July and October. Bush anemone suckers freely and can be propagated easily by cuttings. |
| <i>Carya aquatica</i> Water hickory | 1a: 30–150 | Link 1993 | Direct seed during the fall. Soak seeds before planting in the spring. |
| <i>Cassia armata</i> Armed senna | 1d | Young and Young 1986 | |
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| <i>Cassiope mertensiana</i> White mountain heather | 1, 2, 9, 10 | Potash and Aubry 1997 | Seed ripens between September 1 and the first snowfall. See appendix C for more detailed information. |
| <i>Castanopsis chrysophylla</i> Golden chinkapin | 1e | Young and Young 1992 Link 1993 | Seed has 53-percent germination. Expect problems with seedling survival. Poor results with cuttings. |
| <i>Castilleja</i> spp. Indian paintbrush | 1 | Link 1993 Young and Young 1986 | |
| <i>Castilleja miniata</i> Common red paintbrush | 1a: 28–84 | Rose and others 1998 | Stratify the seed at temperatures between 34 and 41 degrees Fahrenheit (1 and 5 degrees Celsius). Seed germinates at 70 degrees Fahrenheit (21 degrees Celsius), but grows slowly. Seedlings need a constant supply of nitrogen. Seeds germinate best near the roots of other plants they can parasitize. |
| <i>Cathastecum erectum</i> False grama | 1, 8 | Link 1993 | Irrigate, fertilize, and cultivate seedlings. Good stands of false grama are difficult to establish. |
| <i>Ceanothus arboreus</i> Feltleaf ceanothus | 1c | Harris and Leiser 1979 | Direct seed during the fall. Soak seed in hot water. Ceanothus can fix nitrogen. |
| <i>Ceanothus cordulatus</i> | 1e | Young and Young 1992 | |
| <i>Ceanothus crassifolius</i> | 1a: 90, 1e | Young and Young 1992 | |
| <i>Ceanothus cuneatus</i> Buck brush | 1c | Harris and Leiser 1979 Rose and others 1998 | Same as <i>Ceanothus arboreus</i> . |
| <i>Ceanothus diversifolius</i> | 1: 90, 1e | Young and Young 1992 | |
| <i>Ceanothus fendleri</i> | 1e | Young and Young 1992 | |

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| Scientific name Common name | Propagation method | References | Remarks |
|---|-------------------------------|--|--|
| <i>Ceanothus foliosus</i> Wavyleaf ceanothus | 1c | Harris and Leiser 1979 | Same as <i>Ceanothus arboreus</i> . |
| <i>Ceanothus fresnensis</i> Fresno mat | 1a: 90, cuttings | Link 1993 | Cuttings should be at least 6 inches (150 millimeters) long. |
| <i>Ceanothus greggii</i> | 1a: 60 | Young and Young 1992 | |
| <i>Ceanothus impressus</i> Santa Barbara ceanothus | 1c | Harris and Leiser 1979 | Same as <i>Ceanothus arboreus</i> . |
| <i>Ceanothus integerrimus</i> Deerbush ceanothus | 1a: 90, 1e | Young and Young 1992 | Plant seed directly during the fall or stratify the seed before planting. Deerbush ceanothus germinates rapidly after wildfires. This plant can fix nitrogen. |
| <i>Ceanothus leucodermis</i> Whitethorn | 1c | Harris and Leiser 1979 | Same as <i>Ceanothus arboreus</i> . |
| <i>Ceanothus megacarpus</i> Bigpod ceanothus | 1c | Harris and Leiser 1979 | Same as <i>Ceanothus arboreus</i> . |
| <i>Ceanothus oliganthus</i> | 1a: 90, 1e | Young and Young 1992 | |
| <i>Ceanothus prostratus</i> Squaw carpet | | Rose and others 1998 Young and Young 1992 | Soak seed in water at 180 degrees Fahrenheit (82 degrees Celsius). Cool the seed, mix it with sand, and place the mixture in a refrigerator. Once the seed swells, sow it in containers. Plants will be ready for outplanting in 2 years. |
| <i>Ceanothus rigidus</i> | 1a: 90, 1e | Young and Young 1992 | |
| <i>Ceanothus sanguineus</i> Redstem ceanothus | 1a: 90, 1d | Rose and others 1998 Young and Young 1992 | Viable seed will turn dark as it matures. Soak the seed in hot water and stratify it or soak the seed in acid or gibberellin for 30 minutes. Sow seed directly during the fall after heat treatment or pretreat the seed and sow it in spring. |

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| Scientific name Common name | Propagation method | References | Remarks |
|--|-------------------------------|--|--|
| <i>Ceanothus sorediatus</i> Jim brush | 1c | Harris and Leiser 1979 Young and Young 1992 | |
| <i>Ceanothus thyrsiflorus</i> Blueblossom | 1c | Harris and Leiser 1979 Young and Young 1992 | |
| <i>Ceanothus velutinus</i> Snowbrush ceanothus | 1a: 60–85, 4 | Hingston 1982 Rose and others 1998 Young and Young 1992 | Nitrogen fixer. Seed ripens from July to September. Soak seed in hot water and stratify seed before sowing it in flats during December or January. Seedlings are susceptible to damping off (dying suddenly because of fungal attacks). Take cuttings during the summer. Treat them with 0.8-percent IBA (indole-3-butyric acid) and plant them in a damp, sandy mixture of medium- to coarse-textured soils with low nutrient content. Apply bottom heat. Pot seedlings after they have rooted. |
| <i>Celtis occidentalis</i> | 1a: 56–84, 1e, 4, 5 | Young and Young 1992 | |
| <i>Celtis reticulata</i> | 1a: 84, 1e, 4 | Young and Young 1992 | |
| <i>Cephalanthus occidentalis</i> Common buttonbrush | 1e, 4 | Young and Young 1992 | |
| <i>Ceratoides lanata</i> Winterfat | 1e | Young and Young 1992 | Seed requires 2 to 3 months afterripening. Plant during cool weather. |
| <i>Cercidium floridum</i> Palo Verde | 1e | Young and Young 1986 | |
| <i>Cercis occidentalis</i> Western redbud | 1a: 84, 1c, 1d, 1g | Young and Young 1992 Harris and Leiser 1979 | Scarify the seed with acid or soak the seed in boiling water for 1 minute or expose the seed to dry heat, 230 degrees Fahrenheit (110 degrees Celsius), for 9 minutes. Stratify the seed. Direct seed during the fall. Western redbud can fix nitrogen. |

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| Scientific name Common name | Propagation method | References | Remarks |
|---|-------------------------------|--|--|
| <i>Cercocarpus betuloides</i> Mountain mahogany | 1e | Harris and Leiser 1979 | Direct seed during the fall. |
| <i>Cercocarpus ledifolius</i> Curleaf mountain mahogany | 1a | Rose and others 1998 Young and Young 1992 Link 1993 | Seed ripens during August and September. Stratify seed before sowing or sow the seed into flats and stratify the flats. Provide drainage to prevent root rot. |
| <i>Cercocarpus montanus</i> Mountain mahogany | 1a: 30–90 | Rose and others 1998 Young and Young 1992 Landis and Simonich 1983 | Fruit ripens during late summer to early fall. Stratify the seed. Sow stratified seed during the spring or sow unstratified seed during the fall. Outplant seedlings after 1 to 2 years. Mountain mahogany can fix nitrogen. |
| <i>Chaenactis douglasii</i> Douglas dustymaiden | 1 | Link 1993 Young and Young 1986 | Seed ripens during August. |
| <i>Chamaebatia foliolosa</i> Bearmat | 1a: 28–84 | Young and Young 1992 | |
| <i>Chamaebatiaria millefolium</i> Fernbrush | 1a: 90, 8 | Link 1993 | Seed should be sown directly into growing containers and thinned to one plant per cell to increase survival. |
| <i>Chamaecyparis</i> Port Orford cedar | 1f: 30/30 | Young and Young 1986 | |
| <i>Chamaecyparis nootkatensis</i> Alaska cedar | 1a: 21 | Young and Young 1992 | |
| <i>Chilopsis linearis</i> Desert willow | 1a: 3 | Young and Young 1992 | Sow seed ½ inch (13 millimeters) deep during the spring. Desert willow can be propagated by cuttings. |
| <i>Chimaphila umbellata</i> Prince's pine | 2, 8 | Rose and others 1998 | Prince's pine flowers from June to August. Take summer stem cuttings and root them in a mixture of sand and peat. Plant them in late spring about 6 to 8 inches (150 to 200 |

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| Scientific name Common name | Propagation method | References | Remarks |
|---|--------------------------|-----------------------------------|--|
| | | | millimeters) apart. Prince's pine produces long, fast-growing rhizomes. Underground stems can be divided. |
| <i>Chrysolepis chrysophylla</i> Golden chinkapin | 1e, 9, grafting, budding | Rose and others 1998 | Pick burs after they are ripe in late summer, but before they open. Plant the seed directly. |
| <i>Chrysolepis sempevirens</i> Sierra chinkapin | 1e | Link 1993 Young and Young 1992 | Sierra chinkapin has 53-percent germination. Expect problems with seedling survival. |
| <i>Chrysopsis villosa</i> Golden aster | 1e | Young and Young 1986 | Golden aster has 30-percent germination. Expect problems with seedling survival and poor results with cuttings. |
| <i>Chrysothamnus nauseosus</i> Rubber rabbitbrush | 1a: 0–120 | Landis and Simonich 1983 | Start seed during the spring or summer. Seedlings take 3 to 4 months to grow. |
| <i>Chrysothamnus viscidiflorus</i> Green rabbitbrush | 1a: 0–28 | Young and Young 1992 | |
| <i>Cirsium edule</i> Edible thistle | 1 | Weisberg 1993 | |
| <i>Clarkia</i> spp. | 1 | Schmidt 1980 | Direct sow the seed or propagate <i>Clarkia</i> in flats. <i>Clarkia</i> is an annual. |
| <i>Clarkia unguiculata</i> | 1e | Young and Young 1986 | |
| <i>Clematis</i> spp. | 1a: 56–168 | Young and Young 1992 | Propagation requirements vary by species. |
| <i>Cleome</i> spp. Rocky Mountain bee plant | 1 | Young and Young 1986 | Rocky Mountain bee plant is difficult to germinate. It needs light, potassium nitrate (KNO ₃) enrichment, and warm temperatures. |
| <i>Coleogyne ramosissima</i> Blackbrush | 1a | Young and Young 1992 | |

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| Scientific name Common name | Propagation method | References | Remarks |
|--|--------------------------|--|--|
| <i>Collinsia grandiflora</i> Blue lips | 1 | Schmidt 1980 | Direct sow the seed during the fall or spring or propagate in flats. <i>Collinsia</i> is an annual. |
| <i>Collinsia heterophylla</i> Purple Chinese houses | 1 | Schmidt 1980 | Direct sow the seed during the fall or spring or propagate in flats. <i>Collinsia</i> is an annual. |
| <i>Colubrina californica</i> Colubrina | 1e | Young and Young 1986 | |
| <i>Coreopsis</i> spp. | 1 | Young and Young 1986 | <i>Coreopsis</i> requires light and potassium nitrate (KNO ₃) enrichment. |
| <i>Coreopsis calliopsidea</i> Leafstem coreopsis | 1 | Schmidt 1980 | Direct sow the seed during November or December. <i>Coreopsis</i> prefers sunny areas and sandy loam. <i>Coreopsis</i> is an annual. |
| <i>Coreopsis douglasii</i> Douglas's coreopsis | 1 | Schmidt 1980 | Direct sow the seed. <i>Coreopsis</i> is an annual. |
| <i>Coreopsis stillmanii</i> Stillman's coreopsis | 1 | Schmidt 1980 | Direct sow the seed. <i>Coreopsis</i> is an annual. |
| <i>Coreopsis tinctoria</i> Plains coreopsis | 1 | Link 1993 | Seed ripens around July 1. |
| <i>Cornus</i> spp. Dogwood | 1, 9 (spring and summer) | Hartmann and others 1990 Weisberg 1993 Young and Young 1986 | Separate the seed from the fruit by flotation. Dogwood stones can be sown without extracting the seed from the fruit. Sow seed immediately after collecting it. Some species can be started from cuttings. |
| <i>Cornus canadensis</i> Bunchberry dogwood | 1b, 1f: 45/140, 9 | Link 1993 | Collect soil and duff from a native stand to provide mycorrhizal inoculum. Seed germinates best if it is sown during the fall right after it has been cleaned. |
| <i>Cornus nuttallii</i> Pacific dogwood | 1a: 90–120, 1b, 1e, 4 | Rose and others 1998 | Sow fresh seed in fruit directly during the fall or macerate the fruit and separate the seed using flotation. Scarify stored seed for 4 hours, stratify seed at 37 degrees Fahrenheit (3 degrees |

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| Scientific name Common name | Propagation method | References | Remarks |
|--|--------------------|--|--|
| | | | Celsius), and sow during the fall. Take cuttings during June or July. When transplanting, place transplants in a ring of native shrubs to protect them from the sun. |
| <i>Cornus stolonifera</i> Redosier dogwood | 1a: 60–90, 2, 3, 9 | Shaw 1983 Potash and Aubry 1997 Rose and others 1998 | Seed ripens between July 1 and October 31. Sow fresh seed or fruit during the fall. Branch tips 2 to 3 inches (50 to 76 millimeters) long can be collected during the late summer and planted during late spring. Collect 2- to 4-foot- (0.6- to 1.2-meter-) long whips of 1-year-old wood during midwinter. Outplant the whips during late winter or early spring. Whips can be planted directly in moist soil. |
| <i>Corylus cornuta</i> California hazelnut | 1a: 56–168 | Young and Young 1992 | Plant during the fall or chill the seed before planting. |
| <i>Cowania mexicana</i> Cliffrose | 1e, 1f: 28/30 | Landis and Simonich 1983 Young and Young 1992 | Seeds are not likely to germinate without treatment. Chilling seed for 2 weeks at 5 degrees Celsius produced mean optimal germination of 55 percent. |
| <i>Crataegus columbiana</i> Columbia hawthorn | 1a: 120–180 | Young and Young 1986 | The seed must be treated in moist medium at low temperature before it will germinate. |
| <i>Crataegus douglasii</i> Douglas hawthorn | 1a: 84–112, 1b, 9 | Rose and others 1998 | Seed ripens from late July through August. Use flotation to separate the seed and stratify the seed at 41 degrees Fahrenheit (5 degrees Celsius). Scarify the seed in acid for up to 3 hours. Sow the seed during early fall. |
| <i>Crepis acuminata</i> Hawk's beard | 1e | Young and Young 1986 | |
| <i>Crossosoma californicum</i> | 1e | Young and Young 1992 | |
| <i>Cupressus</i> spp. Cypress | 1a: 21 | Young and Young 1992 | Many species. The seed of most species needs to be prechilled. |
| <i>Dalea</i> spp. Indigo bush | 1b, 1e | Young and Young 1992 | The seed needs to be scarified. |

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| Scientific name Common name | Propagation method | References | Remarks |
|---|-------------------------------|--|--|
| <i>Danthonia californica</i> California oat grass | 1a: 84, 8 | Link 1993 Rose and others 1998 | Pretreat divisions with vitamin B1. Collect plants when they are dormant. Bring them into the greenhouse. In January, divide the plants, making sure each division has a single root system. Keep the plants moist at 64 to 70 degrees Fahrenheit (18 to 21 degrees Celsius). After 2 weeks, move the plants to a lathhouse. If you are propagating from seed, soak the seed for 1 to 3 days. Stratify the seed at 34 to 41 degrees Fahrenheit (1 to 5 degrees Celsius). |
| <i>Danthonia compressa</i> Mountain grass | 1 | Link 1993 | <i>Danthonia</i> does not grow well in direct sunlight. |
| <i>Danthonia intermedia</i> Timber oatgrass | 1a: 30–60 | Weisberg 1993 Link 1993 | Plant the seed directly during the fall. |
| <i>Dasiphora fruticosa</i> Shrubby cinquefoil | 1a: 60, 4, 9 | Densmore and others 1990 Landis and Simonich 1983 Rose and others 1998 Link 1993 | Direct sow the seed or stratify it at 34 degrees Fahrenheit (1 degree Celsius). Take softwood cuttings in July. Dip cuttings in 1,000 parts per million indole-3-butyric acid (IBA) and root them in a mixture of peat, perlite, and sand. |
| <i>Delphinium</i> spp. Larkspur | 1a: 112 | Young and Young 1986 | |
| <i>Dendromecon rigida</i> Stiff bushpoppy | 1 | Young and Young 1992 | Sow the seed in moist medium at temperatures alternating diurnally from 41 to 72 degrees Fahrenheit (5 to 22 degrees Celsius). |
| <i>Deschampsia atropurpurea</i> Mountain hairgrass | 1, 1a: 112 | Potash and Aubry 1997 Rose and others 1998 | Seed ripens from August 1 to October 31. Start plants during late May or early June. The seed takes 30 days to germinate. |
| <i>Deschampsia caespitosa</i> Tufted hairgrass | 1 | Rose and others 1998 | Keep seed for 6 weeks at 68 degrees Fahrenheit (20 degrees Celsius) for 16 hours and 50 degrees Fahrenheit (10 degrees Celsius) for 8 hours, then reduce the temperatures to 59 degrees |

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| Scientific name Common name | Propagation method | References | Remarks |
|---|--------------------|--|---|
| | | | Fahrenheit (15 degrees Celsius) for 16 hours and 41 degrees Fahrenheit (5 degrees Celsius) for 8 hours. Sow seed during the fall or spring. |
| <i>Dicentra formosa</i> Bleeding heart | 1a: 48, 8 | Link 1993 Rose and others 1998 Young and Young 1986 | Seed ripens from August through early September. Sow seed fresh during late summer or fall. Divide rhizomes after the plant has flowered. |
| <i>Distichlis spicata</i> Desert saltgrass | 1 | Young and Young 1986 | Desert saltgrass has low seed production. The seed germinates best with temperatures of 50 degrees Fahrenheit (10 degrees Celsius) at night and temperatures of 105 degrees Fahrenheit (41 degrees Celsius) during the day. |
| <i>Dodecatheon clevelandii</i> Shootingstar | 1e | Young and Young 1986 | |
| <i>Downingia concolor</i> Fringed downingia | 1 | Schmidt 1980 | Sow seed thickly directly into the soil. Provide ample water. Fringed downingia is an annual. |
| <i>Downingia cuspidata</i> Toothed downingia | 1 | Schmidt 1980 | Same as <i>Downingia concolor</i> . |
| <i>Draba aureola</i> Alpine draba | 1 | Weisberg 1993 | |
| <i>Dryas drummondii</i> Yellow dryad | 1 | Link 1993 | Seed ripens from August 1 to 15. |
| <i>Dyssodia cooperi</i> | 1 | Young and Young 1992 | Seed has about 20-percent germination. |
| <i>Eastwoodia elegans</i> | 1 | Young and Young 1992 | Seed has about 35-percent germination. |
| <i>Eleocharis coloradoensis</i> Spikerush | 1a | Young and Young 1986 | Seed should be stored in cold water. |

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|--|-------------------------------|---|---|
| <i>Elymus canadensis</i> Wild rye | 1a: 14 | Young and Young 1986 | |
| <i>Elymus cinereus</i> | 1e | Young and Young 1986 | |
| <i>Elymus elymoides</i> Bottlebrush squirrel tail | 1e | Link 1993 | Seed directly during the spring or fall. Expect 40- to 60-percent germination. |
| <i>Elymus glaucus</i> Blue wild rye | 1e, 13 | Potash and Aubry 1997 Young and Young 1986 | Seed ripens from August 1 through October 31. Heads shatter, so collect seed during the soft- to hard-dough phase or as the heads turn gold. A nursery can produce 10 to 50 pounds of seed per acre (11 to 56 kilograms per hectare) during the first year and 250 to 600 pounds of seed per acre (280 to 673 kilograms per hectare) during the second year. Plant seed at 10 to 50 pure live seeds per foot (30 to 150 pure live seeds per meter) or 10 pounds of seeds per acre (11 kilograms per hectare) if the seeds are drilled. Plant 20 pounds of seeds per acre (22 kilograms per hectare) if they are broadcast. Sow the seed during the fall and cover it lightly with soil and mulch. |
| <i>Elymus innovatus</i> | 1 | Densmore and others 1990 | |
| <i>Elymus salinus</i> Saline wild rye | 1a: 30 | Link 1993 | Seed ripens from July 15 through July 30. Expect 30- to 70-percent germination. |
| <i>Elymus triticoides</i> | 1e | Young and Young 1986 | |
| <i>Encelia</i> spp. | 1e | Young and Young 1992 | |
| <i>Ephedra californica</i> | 1e | Young and Young 1992 | |
| <i>Ephedra nevadensis</i> Gray ephedra | 1e | Young and Young 1992 | |

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|---|--------------------|---|--|
| <i>Ephedra viridis</i> Mormon tea | 1e | Landis and Simonich 1983 Shaw 1983 Young and Young 1992 | Seed ripens from July 15 to September 1. Store seed in the open. Start seed during the spring, summer, or fall. Plants take 4 to 6 months to grow. |
| <i>Epilobium</i> spp. Willowherb | 1 | Weisberg 1993 | |
| <i>Epilobium angustifolium</i> Fireweed | 1, 5 | Potash and Aubry 1997 | Seed ripens from July 15 to September 30 when 50 percent or more of the flowering surface has fluffed out. Collect the seed during dry weather. Cut the entire flower head and store it upside down in paper bags to mature. Seed may not need to be cleaned. Sow the seed during the fall or spring with a seed spreader. Mix the seed with three parts medium vermiculite and one part fine peat. Root cuttings should be 12 to 24 inches (31 to 610 millimeters) long. Plant root cuttings directly, about 2 inches (50 millimeters) deep and 4 inches (100 millimeters) apart. |
| <i>Eremocarpus setigerus</i> Doveweed | 1e | Young and Young 1986 | |
| <i>Ericameria bloomeri</i> Bloomer rabbitbrush | 1 | Link 1993 | Expect germination to be 20 percent or less. |
| <i>Erigeron peregrinus</i> Subalpine daisy | 1 | Weisberg 1993 Young and Young 1986 | |
| <i>Eriogonum fasciculatum</i> California buckwheat | 1 | Young and Young 1992 | Seed ripens during August. Germination is epigeal (the cotyledons are photosynthetic above the ground). Considerable dormancy. Low viability. |
| <i>Eriogonum heermannii</i> Zigzag bush | 1 | Young and Young 1992 | |

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|--|--------------------|--------------------------------------|---|
| <i>Eriogonum inflatum</i> Desert trumpet | 1 | Young and Young 1992 | |
| <i>Eriogonum marifolium</i> Wild buckwheat | 1a: 48–56 | Link 1993 | Establish plants from seed in a greenhouse. Expect 14- to 19-percent germination. |
| <i>Eriogonum nudum</i> Bare stem buckwheat | 1e | Rose and others 1998 | Seed ripens during July and August. Plant during the fall in coarse soil. Cover the seed with sphagnum moss. Transplant seedlings into 3-inch (76-millimeter) pots during the spring. |
| <i>Eriogonum umbellatum</i> Sulfur buckwheat | 1e | Rose and others 1998 | Same as <i>Eriogonum nudum</i> . |
| <i>Eriophyllum confertiflorum</i> Golden yarrow | 1e | Young and Young 1986 | |
| <i>Eriophyllum nevinii</i> Catalina silver lace | 1e | Young and Young 1986 | |
| <i>Erythronium montanum</i> Avalanche lily | 1 | Weisberg 1993 | |
| <i>Eschscholzia</i> spp. California poppy | 1e | Schmidt 1980 Young and Young 1986 | <i>Eschscholzia</i> will self-seed abundantly. |
| <i>Euonymus occidentalis</i> Western burning bush | 1a: 84 | Young and Young 1986 | |
| <i>Euphorbia</i> spp. | 1a: 56 | Young and Young 1986 | |
| <i>Fallugia paradoxa</i> Apache plume | 1e | Young and Young 1992 | Sow seed during the spring or during summer rains. |