Forest Health Technology Enterprise Team

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Utilizing *Native Species* in the Western United States

ROADSIDE REVEGETATION

2012 Revision

Rachel Winston & Mark Schwarzländer

Original Version by:
Sara Robson & Jim Kingery
with Cathy Ford & Bill Vance

USDA

University of Idaho Extension

CRISSP

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ROADSIDE REVEGETATION: UTILIZING NATIVE SPECIES IN THE WESTERN UNITED STATES

2012, 2nd Edition

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CONTENTS

Roadside revegetation

Whenever new roads are built, old roads improved, or large-scale, weed-removal processes are undertaken along roadways, the roadside and adjacent lands are drastically altered. This physical and/or chemical disturbance of the landscape requires awareness of, and attention to, the biological, ecological, and engineering requirements necessary for successful construction and maintenance of a properly functioning roadway. When roadsides are left bare, these areas contribute to soil loss and play a key role in the establishment of weeds. Native vegetation imparts greater soil strength and requires less maintenance than weedy competitors. Incorporating native plants into existing roadside maintenance and road-construction strategies promotes sustainability and biodiversity while simultaneously improving roadway stability and roadside aesthetics.

Starting a revegetation program

The successful inclusion of native vegetation in any restoration project requires consideration of detailed site specifics. Each plant species is adapted to specific soil characteristics, including acidity (pH), texture, temperature extremes, moisture, and nutrient content. Water availability and uptake also determine a plant's capacity to germinate, establish, and compete for nutrients and space on road cuts. Accordingly, knowledge about climatic variables, such as temperature and precipitation trends, is important when selecting suitable native plant species for any revegetation program. For all roadside revegetation programs, following several simple steps will increase the success of revegetation efforts.

1. Select suitable species

Survey the prospective revegetation site to determine the native species already present. These are already adapted to the specific climatic and environmental conditions unique to that area. Consider which species would best meet your end-result goals, e.g. grazing, natural area, or simple soil stabilization. If only nonnative weeds are present at the site, refer to regional land managers, plant databases, and this guide to determine the most appropriate native species for your revegetation program. Also, if weeds are present, consider treating them prior to revegetation efforts.

2. Obtain material at the right time

Determine the optimal time for planting your chosen species and acquire seeds, cuttings, or transplants in sync with that. Keep in mind that many species require lengthy seed treatments in order to germinate at the desired time. Plant material can be collected from the site prior to any alterations, other native populations, commercial native plant nurseries, and often from the Forest Service and Bureau of Land Management.

Preserve the soil

3. Incorporate into any construction plans the intent to preserve topsoil and subsoil separate and weed-free until the time of revegetation. These soils have chemical and biological constituents conducive to native plant growth. If soil at the revegetation site is infested with weeds, obtain weed-free topsoil from a different location.

Prepare the site

4. Prior to revegetation, many sites will need to be prepared to receive native plant seeds. Where land- or roadway-usage processes included compaction of the soil, seedbeds can be prepared via shallow chiseling, plowing, harrowing or dragging small chains. Nitrogen fertilizers should be added only to those sites showing gross nitrogen deficiencies. Many native species are well-adapted to low nutrient soils; it is the weedy species which most benefit from nitrogen additions. Supplementing beneficial bacteria, protozoa, and fungi present in the preserved topsoil can be accomplished by collecting the top litter layer from a local weed-free landscape and working it into the topsoil. Some sites may need to be watered temporarily to help establish new native seedlings.

Monitor efforts

5. The site should be monitored regularly following planting. Doing so will demonstrate which species and methods were most successful and also help identify potential problems that could prevent or hinder overall revegetation success. Such problems include the establishment of weeds, preferential grazing by livestock or game, erosion that can damage new plantings, unfavorable moisture, and small areas of revegetation failure that must be supplemented.

For more Information

The information included in this introduction was truncated to meet the needs of this guide. Additional general revegetation guidelines are available in the following documents

- Roadside Revegetation: An Integrated Approach to Establishing Native Plants (Federal Highway Administration 2007)
- Revegetation Guidelines for the Great Basin: Considering Invasive Weeds (Mangold et al. 2005)
- Intermountain Planting Guide (USDA-ARS 2001)
- Restoring Western Ranges and Wildlands (Forest Service, Rocky Mountain Research Station 2004)

Local plant and revegetation experts should be contacted to provide more detailed suggestions specific to your project area.

About this guide

The western U.S. (West) is biologically diverse, with rugged topography and a broad range of climatic regions and unique habitats. This guide highlights native forbs, grasses/grass-likes, and shrubs that exhibit attributes specifically adapted to the soils, terrain, and climate of nine western states, including California, Colorado, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming. It is intended for the benefit of state transportation department roadside managers, native plant enthusiasts, and travelers throughout the West interested in the use of native plant species along roadways.

The plants described in this guide have the capacity to increase road cut stability, decrease soil erosion, diminish the presence of weedy species, and withstand drought, flooding, or extreme temperatures without obstructing roadway visibility. They have a high likelihood of establishment, and many have considerable longevity. Seed and other plant materials can be collected in the wild or purchased throughout the region from a variety of reputable nurseries that specialize in native-plants. It is critical to verify the status, origin, and nativity of each seed or cultivar prior to planting, and to use seed/plant propagules collected or cultivated in close proximity to the project area. If collecting seed from the wild, care must be taken to leave a percentage of seeds so that native populations may persist.

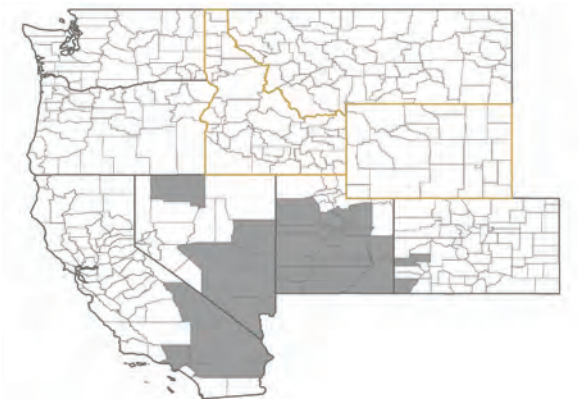
Using this guide

The plant species in this guide are arranged in sections of forbs, grasses/grass-likes, and shrubs and then alphabetically within each section using the accepted scientific name currently used by Missouri Botanical Garden TROPICOS. Botanical naming has undergone extensive reorganization in recent years. Keep in mind that plants with which you are familiar may no longer be assigned a name you recognize. To minimize confusion, synonyms for each species are listed.

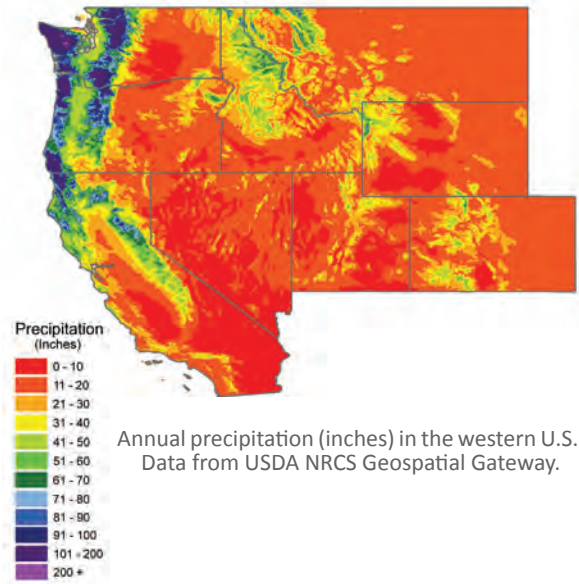
Each species' description page offers tools for identification, along with information about the plant's preferred habitat/environmental requirements; ecological interactions with other species; historical use by people; and propagation techniques including seed collection, scarification, stratification requirements and planting suggestions (including rates of pure live seed PLS per unit area). Current, known distributions of each species are displayed in maps detailed to the county level using information gathered from the USDA NRCS PLANTS Database. Though these distribution maps depict the most current information available, they are rarely up-to-date and may not represent true plant distribution.

Presence of a particular species within a given county is a good indication that the species is a suitable choice for a roadside revegetation project in that same county, but does not guarantee success. Other variables help determine plant suitability, including; soil attributes, climatic conditions, and biological

interactions, all of which may vary tremendously within one county. Precipitation is one of the most important additional variables determining plant establishment. Consequently, a second map depicting suitable precipitation zones (in inches) is included in each species description. Data was collected from the USDA NRCS Geospatial Gateway. Zones showing without color (white) have unsuitable precipitation for the target species.



Sample distribution of firecracker penstemon (Penstemon eatonii) as depicted on the USDA NRCS PLANTS Database. Gray counties represent confirmed presence of firecracker penstemon. States with tan outlines contain the target species; however, exact county locations are unknown.



Annual precipitation (inches) in the western U.S. Data from USDA NRCS Geospatial Gateway.

Quick reference charts listing significant plant attributes are arranged alphabetically by scientific name at the back of the plant guide. The appendix contains drawings of grass, forb, and shrub structure, leaf arrangement, and leaf margination. A glossary and index (both common and scientific names) follow the Appendix.

Western yarrow

Achillea millefolium

SYNONYMS Yarrow, bloodwort, nose-bleed, milfoil, sanguinary, thousand leaf, thousand-seal

BIOLOGY

DESCRIPTION Aromatic and perennial forb with rhizomatous roots. Stems grow upright to 40 in (100 cm) with some side branching. Leaves are fern-like, highly dissected, and grow alternately up to 6 in (15 cm). Branched flowers are clustered in corymbs where lower branches are longer, such that overall the cluster is flat-topped. Flower heads consist of many small, white, ray flowers around margins and tiny, whitish-pink, disc flowers in the center.

BLOOM TIME May to August

ECOLOGY

HABITAT Has a broad ecological extent ranging in elevation from 200 to 9000 ft (61–2742 m) and has the ability to colonize multiple habitat types and climatic zones (f), especially areas of disturbance.

ANNUAL PRECIPITATION 8–60 in (20–152 cm)

SOILS Weakly developed and well-drained.

INTERACTIONS While western yarrow has a low palatability rating, this strongly aromatic plant is eaten by domestic and wild grazers early in the season.

HISTORICAL USE Many Native Americans used western yarrow for pain relief and to stop bleeding; some used it for a stimulant, antiseptic, or fever reduction. It is still an important herb used in natural medicine. Dried and ground western yarrow flowers and seed can be used as seasoning similar to pepper.

Sunflower family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

Seed collection Gather globe-like seed head, mid-August to September into paper bags. The seed is very small, flat, and tan to gray.

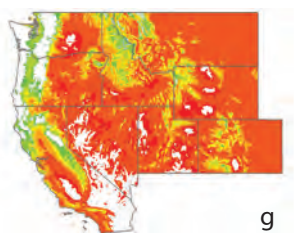
Seed treatment Separate seed from inflorescence by rubbing together and sifting chaff. Small seed lots can be cleaned by hand, while large amounts of seed require specialized equipment, such as an air column separator. Requires no pre-planting seed treatment.

Planting Plant seeds shallow in the soil in early spring at 1–3 lb PLS/acre (1.1–3.4 kg/ha). Permanent establishment may take up to two growing seasons.

Benefits This species has fibrous roots, is extremely drought tolerant, and grows well in disturbed areas , making it an excellent species for roadside revegetation.

Suitability Present in (f); suitable precipitation (g)


f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Credits: a) John Cardina, c) Weed Lab Archive, d) Ken Chamberlain, all Ohio State University, www.bugwood.org); b, e) Richard Old, XID Services Inc.

Heartleaf arnica

Arnica cordifolia

a

SYNONYMS Heart-leaf leopardbane

BIOLOGY

DESCRIPTION Perennial forb growing from a fibrous and rhizomatous root system. Stems grow singly or in small numbers, unbranched, and up to 24 in (60 cm) tall. Leaves are mostly basal. Stem leaves are opposite and a few inches below the inflorescence. Each leaf is heart-shaped at its base, up to 4 in (10 cm) long, somewhat hairy, and has shallowly toothed margins. Flower heads are showy with many large, yellow, ray flowers (up to 1 in or 2½ cm long) around margins and small, yellow, and tube-shaped disc flowers in the center. Seeds are <½ in (1 cm) long, hairy, and transported via wind.

BLOOM TIME May to July

ECOLOGY

HABITAT Usually found in partially to mostly shaded, moist forests at elevations ranging from 1000 to 10,000 ft (300–3000 m). It requires 130 frost-free days and can withstand temperatures as low as -28°F (-48°C).

ANNUAL PRECIPITATION 10–35 in (25–89 cm)

SOILS Fine- to coarse-textured with high moisture content.

INTERACTIONS Considered fair forage for livestock and desirable summer forage for elk and deer.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

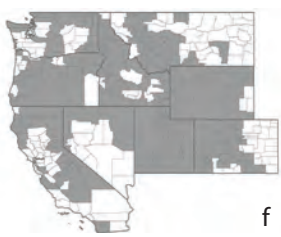
SEED COLLECTION Collect seeds in late summer by hand-clipping the dry flower heads into paper bags for storage and transport prior to cleaning.

SEED TREATMENT Crush flower heads to remove seeds and sift to clean. Store seed in paper bags at 40°F (4.4°C) and 40% humidity. This extended cold and moist stratification is required to break seed dormancy.

PLANTING Broadcast seed in late fall at 10 lb PLS/acre (11.2 kg/ha) to take advantage of natural cold stratification. Alternatively, propagate by corms, cuttings, and sprigs TRANSPLANTED IN EARLY SPRING.

BENEFITS Moderate soil stabilization, though it is limited to open forest understory. It has high aesthetic value as a low ground cover and is shade and fire tolerant.

SUITABILITY Present in (f); suitable precipitation (g)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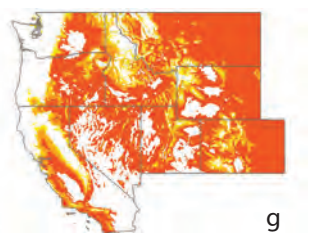
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Credits: a–e) Mary Ellen Harte, www.bugwood.org.

White sage

Artemisia ludoviciana


a

SYNONYMS Cudweed, prairie sage, western mugwort, wormwood, Louisiana sagebrush

BIOLOGY

DESCRIPTION Aromatic and perennial forb/subshrub with rhizomatous, fibrous and tap roots. Stems grow upright to 40 in (100 cm) with some side branching. Leaves are alternate and highly variable with lower leaves usually deeply divided and upper leaves lance-shaped with smooth margins. All foliage is whitish from small hairs and emits a distinct sagebrush odor when crushed. Flower heads consist of many small, yellow, disc flowers sometimes maroon in appearance.

BLOOM TIME May to August

ECOLOGY

HABITAT Occurs widely in the western U.S. (f) from dry, open, grass/shrublands to forests, and from 3000 to 10,000 ft (900 –3000 m) in elevation.

ANNUAL PRECIPITATION 8–60 in (20–152 cm)

SOILS Dry, rocky soils with sandy clay textures; slightly acidic to basic pH

INTERACTIONS Although a late seral species, it establishes quickly following disturbance and provides cover for small mammals and forage for many species of rabbit and deer.

HISTORICAL USE "Ludoviciana" is Latin for Louisiana. This plant was used medicinally by numerous Native Americans for ailments ranging from headaches to stomachaches. The smoke was used by Native Americans in purification ceremonies.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Strip seed head at maturity or cut with a sickle into cloth seed bags.

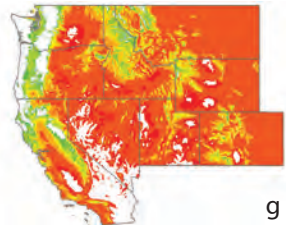
SEED TREATMENT Allow seed to dry in cloth bags; separate seed from seed head by rubbing together, and sift to clean. Two week cold stratification at 35–40°F (1.7–4.4°C) is needed to break seed dormancy.

PLANTING Sow seed in fall or spring by direct broadcast seeding at 1-3 lb PLS/acre (1.1-3.4 kg/ha. Container plants or greenhouse plugs transplant well in spring or fall. Permanent establishment may take up to three years.

BENEFITS Rooting at least 18 in (45 cm), white sage is drought tolerant and plays an important role in initial soil cover and slope stabilization. It is quick to establish, thrives in disturbed areas and dry open sites, and forms a rhizomatous mat, making it excellent for revegetation.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a–c) Mary Ellen Harte, www.bugwood.org; d, e) Richard Old, XID Services Inc.

Arrowleaf balsamroot

Balsamorhiza sagittata

a

SYNONYMS

Arrow-leaved balsamroot

BIOLOGY

DESCRIPTION Aromatic and perennial forb with a large taproot. Stems are unbranched, naked except for flowers, hairy, and grow upright to 30 in (76 cm) tall. Leaves are basal, up to 12 in (30 cm) long, heart-shaped at their base, and have silver hairs on undersides and smooth margins. Flower heads are showy with many large, yellow, ray flowers (up to 1 in or 2½ cm long) around margins and small, yellow, and tube-shaped disc flowers in the center. Seeds resemble those of sunflowers.

BLOOM TIME April to July along altitudinal gradient.

ECOLOGY

HABITAT Distributed across the western U.S. (f) in open, dry areas with a southern exposure. Occurs from sagebrush to forested communities and from 3500 to 8000 ft (1066–2437 m).

ANNUAL PRECIPITATION 8–25 in (20–64 cm), best suited for areas with 10–25 in (25–64 cm)

SOILS Well-drained, medium- to fine-textured.

INTERACTIONS Can withstand grazing pressure, but has a low palatability rating and is not readily selected for forage.

HISTORICAL USE Was integral in Native American diets. Leaves and stems were eaten raw; seeds were roasted and ground; roots were soaked and baked. It was employed to alleviate pain from burns, cuts, and insect bites, and was used to treat tuberculosis, arthritis, and headaches.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

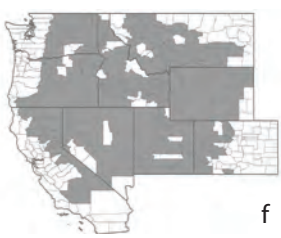
SEED COLLECTION Collect seeds in late summer when flowers are dry, and seeds are dark brown or black.

SEED TREATMENT Crush flower heads to remove seed, and sift to clean. Store seed in paper bags at 40°F (4.4°C) and 40% humidity. This extended cold and moist stratification are required to break seed dormancy.

PLANTING Sow seeds in late fall at 16 lb PLS/acre (18 kg/ha). The germination period will extend from March to April. Tubelings have a higher establishment rate than direct seeding. Plant tubelings in late fall to overwinter outside and adapt to specific environmental conditions.

BENEFITS Excellent for revegetation. Once established, it is extremely drought tolerant and has a large taproot that increases sub-surface soil stability.

SUITABILITY Present in (f); suitable precipitation (g).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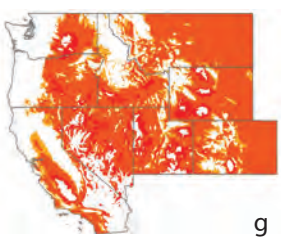
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Credits: a) Chris Evans, River to River CWMA; b–d) Mary Ellen Harte, www.bugwood.org; e) Richard Old, XID Services Inc.

Twolobe larkspur

Delphinium nuttallianum


a

SYNONYMS Nuttall's larkspur, low larkspur

BIOLOGY

DESCRIPTION Perennial forb with fleshy, fibrous roots. Stems are usually single and unbranched, growing upright to 16 in (40 cm). Leaves are sparse, alternate, larger basally, 1 in (2½ cm) across and divided into 2 to 4 narrow segments. Flowers alternate up the stem with five showy, deep purplish-blue sepals up to 1 in (2½ cm) long. A purplish spur extends behind flower. Four small petals in the flower center vary from white to deep purple, are deeply bi-lobed, and have many stamens. Fruits are pod-like follicles (1 in or 2½ cm) with winged seeds.

BLOOM TIME May to July

ECOLOGY

HABITAT Distributed across the western U.S. (f) in dry to moist areas from sagebrush to forested communities and from 3000 to 10,000 ft (900–3000 m) in elevation.

ANNUAL PRECIPITATION 8–24 in (20–60 cm)

SOILS Well-drained, loamy.

INTERACTIONS A late seral species, larkspur is grazed by many types of wildlife. It is also grazed by domestic livestock but is considered toxic to cattle, horses, and sheep.

HISTORICAL USE Some Native Americans used a larkspur poultice to ward off lice and other insects. "Delphinium" is a Latin-derived word meaning "dolphin" in reference to the flower shape resembling a dolphin.

Buttercup Family
Ranunculaceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Clip entire seed pod when flower color fades and allow to dry in the pod. Store pods in paper bags prior to treatment.

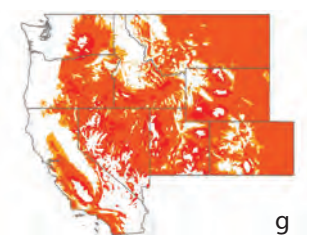
SEED TREATMENT Crush pods to remove seeds, and sift to remove chaff. Larkspur seeds require cold stratification to break seed dormancy and promote germination.

PLANTING Direct seeding in fall at 3 lb PLS/acre (3.4 kg/ha) incorporates natural cold stratification. It can be difficult to transplant this species successfully.

BENEFITS This species adds both color and soil stabilization with its showy flowers and fibrous roots, respectively. It readily colonizes disturbed areas such as roadsides.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a, b, e) Steve Dewey, Utah State University, www.bugwood.org; c, d) Walter Siegmund.

Hoary aster

Dieteria canescens


a

SYNONYMS *Machaeranthera canescens*, hoary tansyaster, purple aster, pinyon aster

BIOLOGY

DESCRIPTION Short-lived perennial forb with a fibrous root system. Multiple stems are often highly branched and grow upright to 24 in (60 cm). Leaves are gray-green, linear to oblong, and have margins lined with tiny teeth. Leaves are larger basally (up to 3 in or 8 cm long) and reduced as they alternate up the hairless stem. Flower heads consist of many showy purple (sometimes white) ray flowers up to ½ in or 1¼ cm long around margins and numerous small, yellow, and tube-shaped disc flowers in the center.

BLOOM TIME July to September

ECOLOGY

HABITAT Found in arid and semi-arid habitats, open areas, north-facing slopes, and open woodlands throughout the western U.S. (f). It ranges from 3000 to 10,000 ft (900–3000 m) in elevation.

ANNUAL PRECIPITATION 8–20 in (20–50 cm)

SOILS Medium- to coarse-textured, dry soils with neutral pH.

INTERACTIONS This species is not readily grazed by livestock, but is a food source for black-tailed hares, and it attracts numerous pollinators.

HISTORICAL USE The specific epithet "canescens" is Latin for "becoming gray," in reference to the grayish-green foliage. There are no known economic or historical uses of this plant.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

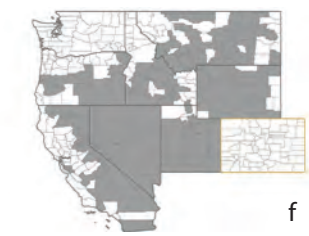
SEED COLLECTION Hand collect seeds when fruits are fully mature. Store seed under refrigeration in sealed containers.

SEED TREATMENT Hoary aster germinates well without pre-planting scarification but needs a cold treatment to break dormancy.

PLANTING Direct seeding in the fall at 5 lb PLS/acre (5.6 kg/ha) incorporates the needed temperature stratification.

BENEFITS With a large rooting depth, hoary aster works well to stabilize surface soils. This species is also extremely cold and drought tolerant. Because it is a late bloomer, it provides attractive color late in the season when other vegetation has already begun dying back.

SUITABILITY Present in (f); suitable precipitation (g)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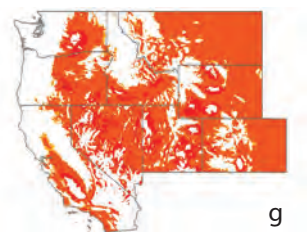
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Credits: a, c–e) Richard Old, XID Services Inc.; b) Jim Pisa Rowicz, National Park Service.

Sulphur-flower buckwheat

Eriogonum umbellatum


a

SYNONYMS
Sulfur buckwheat

BIOLOGY

DESCRIPTION Perennial forb with a fibrous taproot. Stems are usually unbranched, growing upright to 24 in (60 cm) in clusters. Basal leaves form large mats up to 3 ft (90 cm) in diameter. Stem leaves are small and occur in a whorl below the flowering clusters. Leaves are green on upper surface and grayish-hairy on the underside. Flowers are white to bright yellow and arranged in dense clusters of multiple umbels (all flower stalks arising from the same point) at the ends of flowering stems. Individual flowers have no visible petals; the sepals (4 to 6) resemble petals.

BLOOM TIME June to August

ECOLOGY

HABITAT Grows in sagebrush desert, on gravelly ridges, talus slopes, foothills, and mountainous areas through the Intermountain West (f). It ranges from 3000 to 8000 ft (900–2400 m) in elevation.

ANNUAL PRECIPITATION 8–18 in (20–45 cm)

SOILS Weakly developed, well-drained; can tolerate salinity.

INTERACTIONS Some birds eat the seeds of this species and may help with seed dispersal.

HISTORICAL USE Teas and poultices made from this species have a variety of medicinal values including eyewash, ptomaine poisoning, intestinal problems, hip and back pain, and discomfort during childbirth.

Buckwheat Family
Polygonaceae


b


c


d


e

USAGE IN RESTORATION

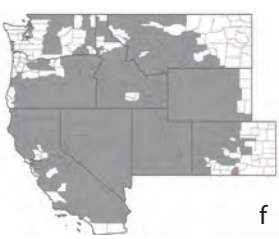
SEED COLLECTION Remove whole flowers when rust-colored and dry. Seeds fall out of the fruit by rubbing flowers together.

SEED TREATMENT Soak seeds in a cold water bath for 24 hours prior to planting. Alternatively, soak seed in a 1 500 mixture of gibberellic acid and water for 5 hours prior to planting.

PLANTING Sow seed directly into soil in the spring at 8–10 lb PLS/acre (9–11.2 kg/ha), covering seed lightly with soil. Seed can be greenhouse-germinated and transplanted as containers or plugs in spring or fall.

BENEFITS This species is very cold- and drought-tolerant, making it an excellent addition to roadside seed mixes.

SUITABILITY Present in (f); suitable precipitation (g)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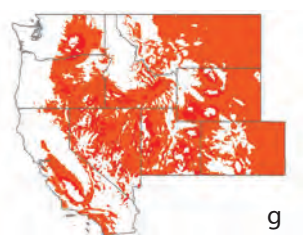
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Credits: a) Dave Powell, USDA Forest Service, www.bugwood.org; c) Stan Shebs; b, d, e) Walter Siegmund.

Common gaillardia

Gaillardia aristata

SYNONYMS

Gaillardia, blanketflower, Indian blanketflower, brown-eyed-Susan

BIOLOGY

DESCRIPTION Perennial forb growing in clumps of multiple stems from a taproot. Stems are branched and more leafy at the base. Leaves are alternate and usually have smooth margins, but occasionally have teeth. Both leaves and stems have coarse, silvery hairs. Flower heads are very showy. Around margins are reddish-orange ray flowers up to ¾ in (2 cm) long and with notched, yellow tips. Disc flowers are small, tubular, and dark orange to brown.

BLOOM TIME May to September

ECOLOGY

HABITAT Often found along roadsides, it tolerates heat and dryness, and thrives in sandy plains and deserts throughout the western U.S. (f). This species ranges from 5000 to 9000 ft (1500–2700 m) in elevation.

ANNUAL PRECIPITATION 16–30 in (40–75 cm)

SOILS Coarse-textured, well-drained.

INTERACTIONS Gaillardia is considered poor grazing forage, but some moths feed on and use gaillardia for camouflaged protection from predators.

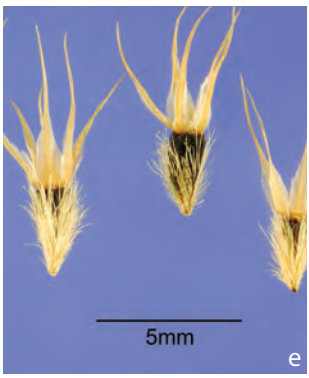
HISTORICAL USE Gaillardia is one of the notable species found by Lewis and Clark. It was used by Native Americans for gastrointestinal problems, skin disorders, and sore eyes. Flowers were used in stew and to waterproof rawhide bags.

Sunflower Family
Asteraceae


b


c


d



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USAGE IN RESTORATION

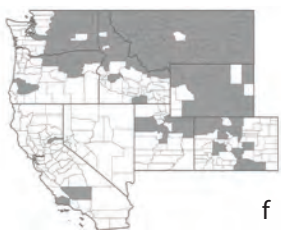
SEED COLLECTION Collect seed by hand from mid-July to late August. The prickly seed head can be clipped from stems; spread out seed heads to dry in a protected environment.

SEED TREATMENT No pre-planting seed treatment is required.

PLANTING Sow seed shallowly into soil in the spring at 10 lb PLS/acre (11.2 kg/ha). Seed can also be germinated in the greenhouse and transplanted from containers and plugs in spring or fall.

BENEFITS This species is a brilliant, late-season roadside flower with quick-rooting capability and moderate drought tolerance. When mature, the taproot penetrates to depths greater than 16 in (40 cm).

SUITABILITY Present in (f); suitable precipitation (g)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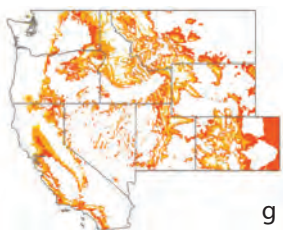
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Credits: a–b) Howard Schwartz, Colorado State University, www.bugwood.org; c) Karel J; d) DOW Gardens Archive, www.bugwood.org; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Sticky purple geranium

Geranium viscosissimum

SYNONYMS
Crane's-bill geranium

BIOLOGY

DESCRIPTION Perennial, aromatic forb growing upright from a taproot. Stems are often covered in small hairs and are forked at tips. Leaves are palmate (divided to resemble a hand), covered in small hairs, toothed, and often sticky. Leaves can be up to 2 in (5 cm) across and are mostly basal, but a few alternate up the stem. Flowers appear in small clusters at the ends of forked stems. Each has five very showy petals (whitish to deep pink or purple) and prominent purple veins. Long fruits split at maturity.

BLOOM TIME May to August

ECOLOGY

HABITAT One of the most widely distributed flowering plants of western rangelands (f), it can be found in a variety of habitat types ranging from sagebrush steppe to woodlands. This species grows at elevations ranging from 1000 to 10,000 ft (300–3000 m).

ANNUAL PRECIPITATION 10–20 in (25–50 cm)

SOILS Dry, well-drained; in a variety of textures.

INTERACTIONS Serves as a food source to small mammals, wild grazers, and bears.

HISTORICAL USE Herbalists have long used members of the Geraniaceae family to diminish bleeding and treat diarrhea, sore eyes, mouth sores, and chapped lips. This species was traditionally used by Native Americans to treat colds and sore throats.

Geranium Family
Geraniaceae


b


c


d

e

USAGE IN RESTORATION

SEED COLLECTION Collect seed by hand in mid-August before the fruits split, and place seeds in paper bags. Spread to dry under fine mesh to capture seed as capsules open.

SEED TREATMENT Scarify seeds with fine-grit sand paper followed by a 24-hour cold water soak.

PLANTING A greenhouse setting provides greater germination success. Transplant seedlings into pots in spring and permanently transplant in the fall when roots are established. If direct seeding, sow seed in fall and cover lightly with soil. Germination will be sporadic and establishment may take up to 3 years. If broadcast seeding, do so at 9 lb PLS/acre (10.1 kg/ha).

BENEFITS Exhibits rapid root formation once established and adds color and diversity.

SUITABILITY Present in (f); suitable precipitation (g)


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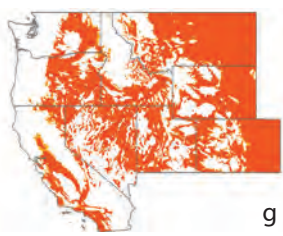
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Credits: a, c) Sheri Hagwood, BLM; b, d) Mary Ellen Harte, all www.bugwood.org; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Northern sweetvetch

Hedysarum boreale

a

SYNONYMS Boreal sweetvetch, Utah sweetvetch, western sweetvetch

BIOLOGY

DESCRIPTION Perennial, aromatic forb growing upright from a deep, fibrous taproot. Multiple stems are only sparsely branched and bear flowers but no leaves. Leaves are basal and divided into multiple (9–15) leaflets 1/3 in (<3/4 cm) long. Flowers are arranged in elongated clusters at stem tips. Each flower is deep purple to blue and is typical of the Fabaceae family in that fused petals form two lips, resembling a ship with a banner and keel.

BLOOM TIME July to August

ECOLOGY

HABITAT Typically occurs on grassy slopes, rocky hillsides, and shrublands throughout the western U.S. (f). It ranges in elevation from 4000 to 9500 (1200–3000 m).

ANNUAL PRECIPITATION 12–18 in (30–45 cm)

SOILS Well-drained, acidic, sandy or loamy soils; prefers sunlight and moist soil conditions.

INTERACTIONS This species is palatable to many native grazers and to livestock though related species are toxic. Northern sweetvetch attracts many pollinators with its color and sweet fragrance.

HISTORICAL USE Appropriately, the scientific name is derived from the Greek root "hedys" meaning sweet, and "arum" for smell, as most plants in this genus are fragrant. The licorice-tasting roots were eaten by Native Americans.

Pea Family
Fabaceae


b


c


d


e

USAGE IN RESTORATION

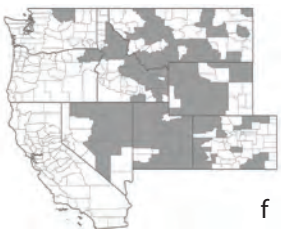
SEED COLLECTION Collect seeds from pods in late August and store in cloth or paper bags. Allow these to dry prior to cleaning.

SEED TREATMENT Remove seeds from pods by rubbing together; sift to remove chaff. Soak seeds in a cold water bath for 24 hours prior to planting.

PLANTING Sow seed directly into soil in spring at 15 lb PLS/acre (16.8 kg/ha), covering seed lightly with soil. Seed can be greenhouse-germinated and transplanted from containers or plugs in spring or fall. Inoculation with bacteria increases the nitrogen-fixing capacity of this legume species.

BENEFITS As with many in the pea family, this plant forms relationships with soil microbes, enhancing its ability to fix nitrogen. The deep taproot establishes quickly and resists disturbances and disease.

SUITABILITY Present in (f); suitable precipitation (g)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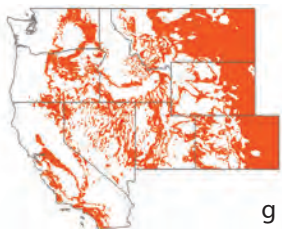
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Credits: a–e) Mary Ellen Harte, www.bugwood.org.

Scarlet gilia

Ipomopsis aggregata

a

SYNONYMS

Skyrocket, skyrocket gilia

BIOLOGY

Description Biennial or short-lived perennial forb growing from a taproot. Stems usually grow singly and unbranched. Leaves are mostly basal but alternate up the stem, becoming smaller as they go. Leaves are up to 4 in (10 cm) long, and very divided into narrow segments. Flowers are scarlet, and with age and pollination fade to white with scarlet spots. Flowers are trumpet-shaped with five petals, can be up to 1½ in (4 cm) long, and are clustered at stem tips.

Bloom time June to August

ECOLOGY

Habitat Found in mountainous areas throughout the Intermountain West (f). It ranges in elevation from 2000 to 8000 ft (400–2500 m) and occurs in dry meadows, open woodlands, rocky or cliff areas.

Annual precipitation 8–20 in (20–50 cm)

Soils Fertile, well-drained, sandy-textured

Interactions Hummingbirds, bees, and butterflies all flock to the vibrant red flowers of this species. Scarlet gilia is susceptible to fungal attack in damp areas.

Historical use Native Americans valued this plant's medicinal value; it was employed for multiple medical ailments. Tea was brewed to treat children's colds and for blood troubles. It was also used to make glue, and a blue dye was made from the roots. When crushed, leaves and flowers have a skunk-like odor.

Phlox Family
Polemoniaceae


b


c


d


e

USAGE IN RESTORATION

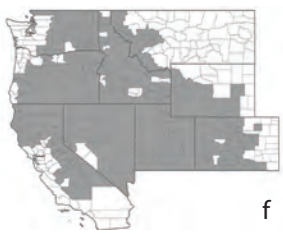
SEED COLLECTION Hand collect seeds in fall.

SEED TREATMENT Soak seed in a 1:500 mixture of gibberellic acid and water for 5 hours. Rinse with water.

PLANTING Sow seeds in fall at 3 lb PLS/acre (3.4 kg/ha); rake them into the soil lightly. Germination is sporadic, and plants generally do not bloom until the second season.

BENEFITS This species is an excellent addition to roadside seed mixes. It is drought tolerant, has minimal requirements for germination and establishment, and is relatively easy to grow. Scarlet gilia is also an easily recognized, colorful plant that occurs naturally along western roadsides and attracts many native wildlife species.

SUITABILITY Present in (f); suitable precipitation (g)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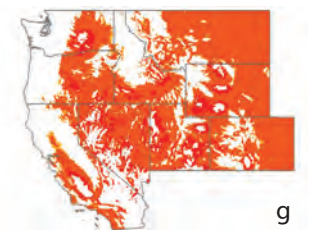
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Credits: a–d) Rachel Winston, MIA Consulting; e) Ken Pei.

Lewis flax

Linum lewisii

SYNONYMS Wild blue flax, blue flax, prairie flax

BIOLOGY

DESCRIPTION Perennial forb growing up to 2 ft (60 cm) tall from a taproot. Stems usually grow unbranched in clumps, but may be slightly forked at tips. Leaves are alternate, narrow elliptic to 1 in (2½ cm) long, undivided, and smooth. Flowers are very showy, consisting of five blue petals with five white or yellow stamens. Flowers are 1 in (2½ cm) across and have prominent, dark blue veins. Once a plant is cut or damaged, its petals quickly fall from the stem. This species has two annual blooming flushes and stays green for long periods of the year.

BLOOM TIME May to July

ECOLOGY

HABITAT Highly adaptable species suitable for elevations from 800 to 10,000 ft (250–3000 m). Can be found in open, hot, dry sites, as well as in sagebrush, juniper, and mountain brush communities throughout the West (f).

ANNUAL PRECIPITATION 10–24 in (25–60 cm)

SOILS Well-drained, basic to slightly acidic pH.

INTERACTIONS Has fair forage value for wildlife and livestock. It is commonly associated with the naturalized European flax Linum perene.

HISTORICAL USE Many flax species are used in textiles because the stems have strong natural fibers, and oil can be pressed from its seed. Seeds and oil of other species are increasingly sold in alternative health-food markets.

Flax Family
Linaceae


b


c


d

e

USAGE IN RESTORATION

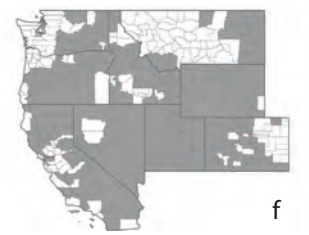
SEED COLLECTION Hand collect seed from July to mid-August. Tennis rackets work well to beat the seed from the plant into a bucket or seed bag.

SEED TREATMENT No pre-planting seed treatment is required.

PLANTING Sow seed directly into soil in the spring at 8 lb PLS/acre (9 kg/ha), covering seed lightly with soil. Seed can also be germinated in the greenhouse and transplanted from containers or plugs once roots establish.

BENEFITS This species is extremely drought- and cold-tolerant. It is useful for increasing roadside soil stability, enhancing plant diversity, and improving roadside aesthetics.

SUITABILITY Present in (f); suitable precipitation (g)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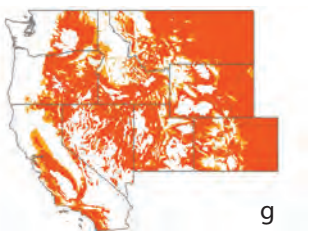
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Credits: a, d) S Koch; b) Steve Dewey, Utah State University, www.bugwood.org; c) Joy Viola, Northeastern University, www.bugwood.org; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Fernleaf biscuitroot

Lomatium dissectum

SYNONYMS

Fernleaf desert parsley

BIOLOGY

Description Long-lived perennial, aromatic, hollow-stemmed forb growing up to 3 ft (90 cm) tall from a deep taproot. Leaves are mostly basal, alternate, up to 1 ft (30 cm) long and up to 1 ft (30 cm) across and finely divided into narrow segments to ½ in (>1 cm) long. Flowers are bright yellow to white to dark maroon and arranged in dense clusters of multiple umbels (all flower stalks arising from the same point) at the ends of flowering stems. Seeds are oval with flattened backs and broad wings and are up to ¾ in (<2 cm) long.

Bloom time May to July

ECOLOGY

Habitat Found on open and rocky slopes and hillsides at elevations from sea level to 10,000 ft (0–3000 m). It requires full sunlight and 240 frost-free days and withstands temperatures to 7°F (-28°C).

Annual precipitation 14–100 in (35–254 cm)

Soils Well-drained, fine-textured to very rocky; can tolerate limestone.

Interactions Considered fair forage for livestock and big game when young and more palatable.

Historical use Of great import to Native Americans; the root was split, dried, and ground into flour to make biscuits. Leaves were dried and used as flavoring similar to parsley. Medicinally it was used to treat bacterial and viral infections.

Parsley Family
Apiaceae


b


c


d


e

USAGE IN RESTORATION

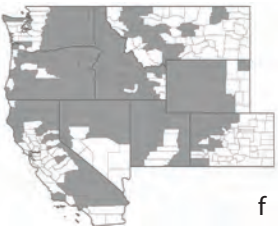
SEED COLLECTION Collect seeds in late fall by hand-clipping when fruits and seeds dry. Thoroughly dry and store in a cold, dry place until seed treatment.

SEED TREATMENT Store seed in paper bags at 40°F (4.4°C). This extended cold stratification is required to break seed dormancy.

PLANTING Shallowly broadcast seed in late fall at 2–4 lb PLS/acre (2.2–4.8 kg/ha) to take advantage of natural cold stratification. Large seed sources may be difficult to find. This species also propagates by tubers and root cuttings; however, only older, mature plants have the large size required for root propagation, and harvesting these kills the plant and may hurt the native population.

BENEFITS Useful in erosion control on rocky slopes, provides aesthetics with its bright green ground cover, and is tolerant of cold winters.

SUITABILITY Present in (f); suitable precipitation (g)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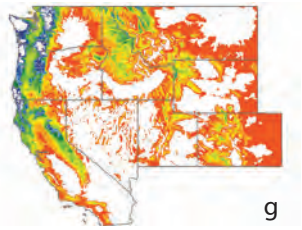
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Credits: a–d) Mary Ellen Harte, www.bugwood.org.

Silky lupine

Lupinus sericeus

SYNONYMS Blue bonnet lupine

BIOLOGY

DESCRIPTION Perennial forb growing up to 2 ft (60 cm) tall from a fibrous taproot. Multiple stems grow erect and are covered with flat, silvery hairs. Leaves are hairy, alternate and divided palmately to resemble the fingers of a hand, growing smaller up the stem. Showy flowers grow in clustered stalks 3-5 in (8-13 cm) at stem tips. Each flower ranges from white to deep purple and is typical of the Fabaceae family in that fused petals form two lips, resembling a ship with a banner and keel. Fruits are silky pods up to 1 in (2½ cm) long.

BLOOM TIME May to August

ECOLOGY

HABITAT Occurs on dry, rocky, and varied slopes throughout the Intermountain West (f) ranging in elevation from 1500 to 10,000 ft (500–3000 m).

ANNUAL PRECIPITATION 8–24 in (20–60 cm); grows best in 10–20 in (25–50 cm)

SOILS Variety of well-drained soils.

INTERACTIONS Very toxic to sheep and moderately toxic to other livestock; may cause birth defects in cattle. Flowers change color after pollination which is why a single plant can have multiple colors. The roots have a nitrogen-fixing ability, allowing this species to grow in areas deficient in nitrogen.

HISTORICAL USE The Latin specific epithet "sericeus" translates to "silky." This species was used by some Native Americans to treat eye irritations.

Pea Family
Fabaceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect seed into paper bags when pods are tan. Lupine can be challenging to collect due to staggered seed maturity. Spread collected seed pods out to dry, and cover with a fine mesh to capture seed as it erupts from pods.

SEED TREATMENT Sift seed to remove chaff. Soak seeds in hot water for 1-3 min; follow directly with 24-hour cold water soak. After water scarification, seed requires a 30-day cold/moist stratification.

PLANTING Sow seed in late fall at 11-35 lb PLS/acre (12.3-39.2 kg/ha) to utilize natural cold stratification during winter. Although it can survive transplanting, it establishes best with direct seeding. Inoculate seed with Rhizobium when planting to promote nitrogen-fixing capacity.

BENEFITS Very long-lived, showy perennial with soil nitrogen-fixing capacity and a substantial taproot.

SUITABILITY Present in (f); suitable precipitation (g)ed as it erupts from pods.


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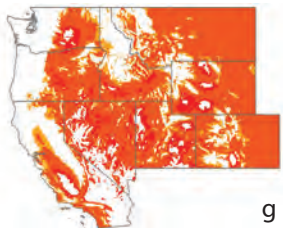
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Credits: a, b, d) Alex Ogg, XID Services Inc.; c) Joy Viola, Northeastern University, www.bugwood.org; e) Mary Ellen Harte, www.bugwood.org.

Firecracker penstemon

Penstemon eatonii

a

SYNONYMS

Eaton's penstemon, Eaton's beard-tongue

BIOLOGY

DESCRIPTION Short-lived perennial forb growing from a fibrous root system. Stems are fleshy, grow erect up to 3 ft (90 cm) tall, and have opposite, decussate leaves (pairs are perpendicular to each other above and below). Leaves are larger at the clumped base. Stem leaves are slightly fleshy, lance-shaped, up to 3 in (8 cm) long, and have irregular, wavy margins. Showy flowers grow in clusters up the stem. Each tubular flower is bright red and has a distinct upper and lower lip made of two and three fused petals, respectively.

BLOOM TIME May to July

ECOLOGY

HABITAT Found in open, sunny, and often disturbed areas in sagebrush, juniper, or ponderosa pine communities ranging in elevation from 3300 to 8000 ft (1000–2400 m).

ANNUAL PRECIPITATION 8–20 in (20–50 cm)

SOILS Well-drained; tolerates slightly saline to slightly acidic soils.

INTERACTIONS This species is considered only incidental forage for livestock as it has poor to fair palatability. It is considered desirable forage for antelope, deer, and BIRDS.

HISTORICAL USE Native Americans used this plant for stomach aches and back aches, healing burns, and in a poultice for spider and snake bites.

Figwort Family
Scrophulariaceae


b


c


d


e

USAGE IN RESTORATION

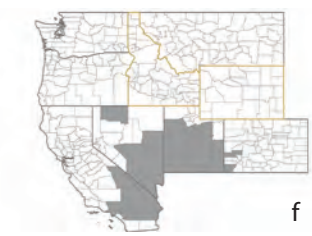
SEED COLLECTION Collect seeds in late fall by hand-clipping the dry fruit when inner seeds are hard and dark. Multiple harvests may be necessary to optimize collection of the staggered, ripe seeds.

SEED TREATMENT Crush seed pods against a screen to remove seed; sift to clean. Store seed in a cool, dry area for 3–4 months for after-ripening. Cold stratification reduces the length of seed dormancy.

PLANTING Shallowly broadcast seed in late fall at 1.5–3 lb PLS/acre (1.7–3.4 kg/ha) to take advantage of natural cold stratification. Penstemons do best when mixed with other seeds, e.g. grasses. Greenhouse starts may be transplanted in spring.

BENEFITS Useful in erosion control and is very tolerant of cold winters and drought in disturbed areas. The bright red flowers have very high aesthetic value.

SUITABILITY Present in (f); suitable precipitation (g)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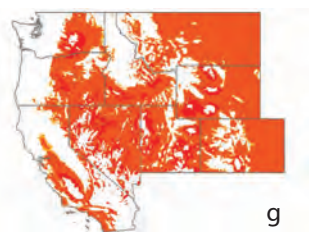
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Credits: a–e) Rachel Winston, MIA Consulting.

Rydberg's penstemon

Penstemon rydbergii

SYNONYMS

Meadow beardtongue

BIOLOGY

DESCRIPTION Perennial forb growing from a fibrous taproot. Single or multiple unbranched stems grow erect up to 2 ft (60 cm) tall. Leaves are mostly basal, but stem leaves are opposite, decussate (pairs are perpendicular to each other above and below), up to 3 in (8 cm) long, and smooth-margined. Showy flowers grow in clustered stalks at stem tips. Each tubular flower ranges from pink to deep purple and has a distinct upper and lower lip made of two and three fused petals, respectively.

BLOOM TIME May to July

ECOLOGY

HABITAT Grows at elevations from 1000 to 8000 ft (300–2500 m) and can be found throughout the western U.S. (f) on moderately moist to dry slopes, meadows, and stream banks in full sun.

ANNUAL PRECIPITATION 20–35 in (50–90 cm)

SOILS Moderately well- to well-drained soils.

INTERACTIONS This species has fair to poor palatability for livestock and is considered to be only incidental forage; however, it is considered desired forage for deer, pronghorn, and birds. It provides cover for select, small bird species and provides diversity to the plant community.

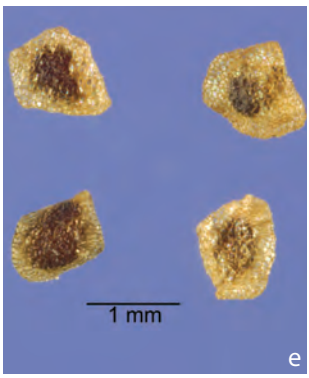
HISTORICAL USE The term "penstemon" is derived from the Greek words "pente" meaning five and "stemon" meaning stamen and referring to the five stamens.

Figwort Family
Scrophulariaceae


b


c


d



e

USAGE IN RESTORATION

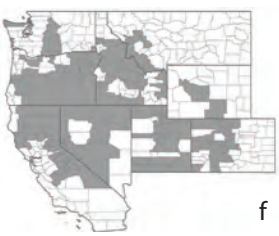
SEED COLLECTION Hand harvest by stripping seed capsules when dry, usually in late summer. Clean seed should be dried and stored in a cool, dry place.

SEED TREATMENT No pre-planting seed treatment is required; however, seeds should be stored for 3–4 months for an after-ripening period.

PLANTING Shallowly broadcast seed in spring or fall at 3 lb PLS/acre (3.4 kg/ha). Early spring seeding will emerge the following season; flowers will develop during the second growing season. It is most successful when planted as part of a mix of species rather than alone.

BENEFITS Rydberg's penstemon is an excellent soil stabilizer and improves roadside aesthetics. It is an excellent choice for locations with moderate amounts of moisture.

SUITABILITY Present in (f); suitable precipitation (g)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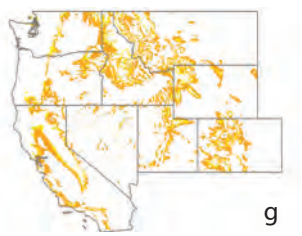
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Credits: a, b, d) Mel Harte, www.bugwood.org; c) Sheri Hagwood, BLM, USDA PLANTS Database; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Rocky Mountain penstemon

Penstemon strictus


a

SYNONYMS None

BIOLOGY

DESCRIPTION Short-lived perennial forb growing from a few underground stems and many fine roots. Stems are fleshy, one to a few from a thick root crown, and grow erect up to 3 ft (90 cm) tall. Leaves are opposite, decussate, (pairs are perpendicular to each other above and below), slightly fleshy, up to 3 in (8 cm) long, and have smooth margins. Showy flowers grow in clusters up the stem. Each flower is somewhat tubular, deep purple to blue with a lighter-colored center, and has a distinct upper and lower lip made of two and three fused petals, respectively.

BLOOM TIME May to June

ECOLOGY

HABITAT Found in open, sunny, or partially shaded areas in sagebrush and juniper communities or openings in spruce-aspen-ponderosa pine forests ranging in elevation from 6000 to 10,000 ft (1800–3000 m).

ANNUAL PRECIPITATION 14–26 in (35–65 cm)

SOILS Well-drained, medium sandy to coarse textured; tolerates slightly saline to slightly acidic soils.

INTERACTIONS Considered fair forage for livestock and desirable forage for antelope, deer, and birds.

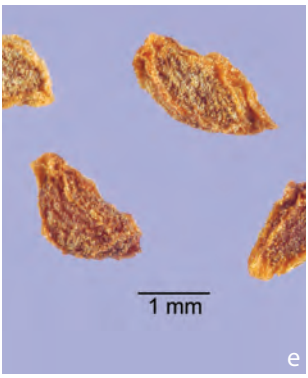
HISTORICAL USE Rocky Mountain penstemon was occasionally used by some Native Americans as a gynecological aid and to support proper kidney function.

Figwort Family
Scrophulariaceae


b


c


d



e

USAGE IN RESTORATION

SEED COLLECTION Collect seeds in late fall by hand-clipping the dry fruit when inner seeds are hard and dark. Multiple harvests may be necessary to optimize collection of the staggered, ripe seeds.

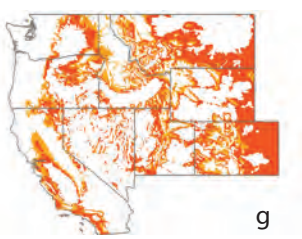
SEED TREATMENT Crush seed pods against a screen to remove seed; sift to clean. Store in cool, dry area for 3-4 months for after-ripening. Cold stratification reduces the length of seed dormancy.

PLANTING Shallowly broadcast seed at 4 lb PLS/acre (4.5 kg/ha) in late fall to take advantage of natural cold stratification. Penstemons do best when mixed with other seeds, e.g. grasses. Greenhouse starts may be transplanted in spring.

BENEFITS Useful in erosion control and is very tolerant of cold winters. The bright purple to blue flowers have very high aesthetic value.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a–d) Mary Ellen Harte, www.bugwood.org; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Scarlet globemallow

Sphaeralcea coccinea

SYNONYMS Slippery elm

BIOLOGY

DESCRIPTION Short-lived perennial forb with several stems growing from deep, woody roots. Stems are erect to spreading and up to 18 in (45 cm) tall/long. Leaves are finely divided in the shape of palms with fingers covered with grayish, star-shaped hairs, giving them a rough, sandpaper texture. Flowers occur near stem tips in small clusters. Each flower is deep salmon-orange to pink to brick red with five notched petals. Numerous stamens are joined into a tube at their bases and give the flower a bright yellow center. Each flower is ¾ in (2 cm) across. Fruits are wedge-shaped capsules.

BLOOM TIME June to July

ECOLOGY

HABITAT Found in dry grassland prairies or sagebrush communities in full sun and ranging in elevation from 3500 to 9000 ft (1000–2700 m).

ANNUAL PRECIPITATION 6–35in (15–89 cm)

SOILS Medium- to coarse-textured; grows best in neutral to slightly alkaline pH.

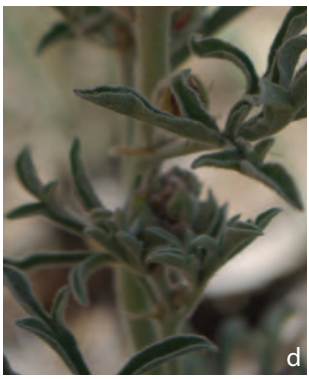
INTERACTIONS Fair forage for grazing livestock and important forage for browsing wildlife with its medium protein content and high palatability.

HISTORICAL USE Some Native Americans chewed aboveground foliage and applied the paste to burns, scalds, and external sores as a cooling agent. Roots were used to stop bleeding, and were also chewed to reduce hunger when food was scarce.

Mallow Family
Malvaceae


b


c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USAGE IN RESTORATION

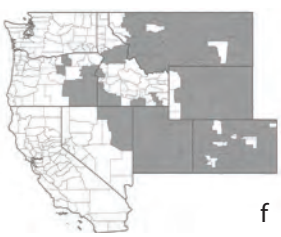
SEED COLLECTION Collect seeds in late summer by hand-clipping the dry fruit into paper bags for transport prior to cleaning.

SEED TREATMENT Crush seed pods against a screen to remove seed; sift to clean. Use 100 grit sandpaper to scarify the thick seed coat. (Alternatively, soak seed in a 1:500 dilution of gibberellic acid for 5 hours prior to planting.) Store in a cold, dry place for 3 to 4 months prior to planting.

PLANTING Shallowly broadcast seed at 4 lb PLS/acre (4.5 kg/ha) in late fall to take advantage of natural cold stratification.

BENEFITS Useful in erosion control and is very tolerant of cold winters and drought conditions. The bright orange flowers have high aesthetic value, and this plant does very well on disturbed soil.

SUITABILITY Present in (f); suitable precipitation (g)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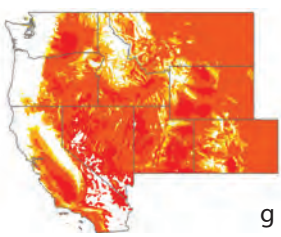
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Credits: a, b, e) Joy Viola, www.bugwood.org; c) Dave Powell, USDA Forest Service, d) Jerry Friedman.

Western mountain aster

Symphyotrichum spathulatum

SYNONYMS None

BIOLOGY

Description Perennial forb growing from a taproot. Highly branched stems grow erect up to 2½ ft (75 cm) tall. Leaves are gray-green, covered in small hairs, are larger basally (up to 3 in or 8 cm long), and reduced as they alternate up the hairless stem. Flower heads consist of many showy purple (sometimes white) ray flowers up to ½ in (1¼ cm) long around margins and numerous small, yellow, and tube-shaped disc flowers in the center.

Bloom time May to August

ECOLOGY

Habitat Found in open, moist areas, north-facing slopes, and open woodlands. Elevations range from 3000 to 10,000 ft (900–3000 m).

Annual precipitation 10–20 in (25–50 cm)

Soils Well-drained.

Interactions This species is not readily grazed by livestock or wildlife, but it attracts numerous pollinators.

Historical use The Latin word "aster" means "star." When used in plant names, it often refers to the appearance of the flower head which is an arrangement of many ray flowers and disk florets. Together, the multiple flowers comprise a compound inflorescence. Scientific names continually change to reflect new-found genetic relationships in the plant kingdom; S. spathulatum is no exception and was once named Aster occidentalis.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect seeds in September using a rechargeable, hand-held vacuum. This method gathers only mature seed, leaving undeveloped seed to ripen. Store seeds in paper bags at room temperature.

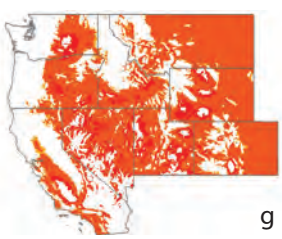
SEED TREATMENT Separate seeds from pappus (feathery attachments) by rubbing over a fine mesh screen. Store clean seed at 40°F (4.4°C). No pre-planting scarification is required.

PLANTING Sow seed in early spring at 5 lb PLS/acre (5.6 kg/ha); germination will occur in 3–4 weeks. Greenhouse germination combined with transplanting in the early spring is an alternative propagation method.

BENEFITS Excellent addition to roadside seed mixes. Once established, it is a prolific seed producer and readily reseeds itself.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a–c) Richard Old, XID Services Inc.; d,e) ©2010 Steve Matson.

Mountain goldenbanner

Thermopsis rhombifolia var. *montana*

a

SYNONYMS

Thermopsis montana, mountain goldenpea, false lupine

BIOLOGY

Description Perennial forb growing from a deep, fibrous taproot and from rhizomes. Branched stems grow erect up to 3 ft (90 cm) tall and have distinct, large stipules (leaf-like growths beneath flowers). Leaves are comprised of 3 smooth leaflets, the stalks of which alternate up the stem. Flowers are in long clusters at branch tips. Each flower is yellow and typical of the Fabaceae family in that fused petals form two lips, resembling a ship with a banner and keel. Fruits are pods 2 to 3 in (5–8 cm) long containing three to seven seeds each.

Bloom time May to August

ECOLOGY

Habitat Found in moist meadows, open forests, and disturbed areas, ranging in elevation from 2500 to 7000 ft (750–2100 m).

Annual precipitation 10–24 in (25–60 cm)

Soils Well-drained, sandy, a variety of textures.

Interactions The roots have a nitrogen-fixing ability, allowing this species to live in areas with degraded soils. This species is highly competitive, can withstand heavy grazing, and can regenerate after fire. It is potentially toxic to livestock.

Historical use "Thermopsis" is derived from the Greek origin of "like a lupine." There is evidence that quinolizidine alkaloids in this species are potentially hazardous to cattle and horses.

Pea Family
Fabaceae


b


c


d

e

USAGE IN RESTORATION

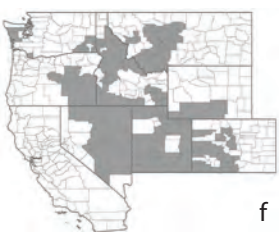
SEED COLLECTION Collect seeds in July and August when dry pods first split. Pods can be collected and stored in paper bags until cleaning.

SEED TREATMENT Crush seed pods by hand to remove seed; sift to clean. Scarify seed in a 180°F (82°C) hot water bath, and allow to cool in water for several hours. Inoculate seeds with the appropriate Rhizobium to enhance nitrogen-fixing properties.

PLANTING Sow seed into tubes in a greenhouse in January, keeping seed amply watered for best germination results. Transplant well-rooted propagules in spring or fall. If broadcast seeding, sow at 11 lb PLS/acre (12.3 kg/ha) in fall; direct seeding has very low germination rates.

BENEFITS Strong underground root system and nitrogen-fixation ability.

SUITABILITY Present in (f); suitable precipitation (g)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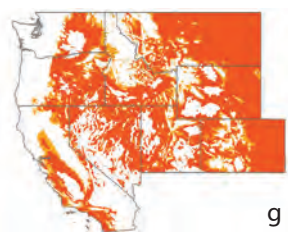
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Credits: a) Steve Dewey, www.bugwood.org; b–d) Richard Old, XID Services, Inc.; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Slender wheatgrass

Agropyron trachycaulum

SYNONYMS *Elymus trachycaulus*, slender wildrye

BIOLOGY

DESCRIPTION Perennial bunchgrass growing up to 2 ft (60 cm) from a fibrous root system. Leaves are flat or rolled slightly and gradually tapered at tips. Lower sheaths occasionally have hair. Ligules are short, membranous, and collar-shaped. Auricles are short to absent. Seed heads are terminal on stems and consist of green or violet-tinged spikes. Spikelets are at least slightly overlapping and contain three to seven florets. Awns are sometimes absent and sometimes present. Glumes are nearly as long as the spikelet.

BLOOM TIME May to July

ECOLOGY

HABITAT Found throughout North America (f), with the exception of the southeastern U.S., at elevations ranging from 4500 to 13,000 ft (1300–3900 m). It is a pioneer species in many habitats and disturbed areas and has a wide ecological amplitude.

ANNUAL PRECIPITATION 8–25 in (20–60 cm)

SOILS Dry to moist, well-drained, variety of textures.

INTERACTIONS Excellent forage value for wild and domestic grazers early in the season before it becomes coarse and stemmy. Serves as cover and feed for many small mammals and birds.

HISTORICAL USE This species was often used by Native Americans for horse fodder; it was sometimes cut and dried for winter hay.

Grass Family Poaceae
Triticeae Tribe


b


c


d

e

USAGE IN RESTORATION

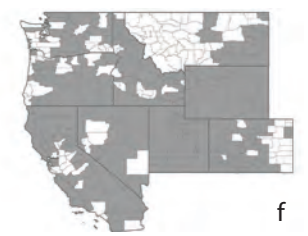
Seed collection Collect seed in late July when dry but prior to seed shatter. Strip the seed from the spike into paper bags for transport and storage prior to cleaning.

Seed treatment Separate seed by rubbing together; sift to remove chaff. Small amounts can be hand processed while large amounts require threshing and air screening equipment. No pre-planting seed treatment is required for germination.

Planting Sow seed at 6– 8 lb PLS/acre (6.7–9 kg/ha) in fall in drier areas. Sow in spring if the annual precipitation exceeds 16 in (37 cm).

Benefits Germinates and establishes rapidly, exhibiting dense, fibrous roots useful for soil erosion control. This species will persist long enough for slower growing species to establish.

Suitability Present in (f); suitable precipitation (g)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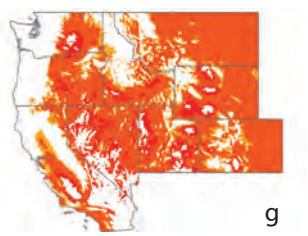
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Credits: a) Robert Soreng, Smithsonian institution, USDA PLANTS Database; b-d) Dave Powell, USDA Forest Service, www.bugwood.org; e) Jose Hernandezs, USDA RRS, USDA PLANTS Database.

Tufted hair grass

Deschampsia caespitosa

SYNONYMS Tussock grass

BIOLOGY

DESCRIPTION Short-lived, perennial bunchgrass growing in clumps to 4 ft (120 cm) tall. Leaves are mostly basal with narrow blades 5 to 8 in (13–20 cm) long, sometimes rolled. Ligules are membranous, tapering to a tip, and up to 3/8 in (1 cm) long. There are no auricles. The seed head is a narrow, often nodding panicle 4 to 8 in (10–20 cm) long. Spikelets are 1/8 in (3 mm) long with two dark brown/black florets. Glumes have no awns; lemma awns do not extend beyond the length of the spikelet.

BLOOM TIME July to September

ECOLOGY

HABITAT Found from grasslands to open forest communities (f), ranging in elevation from sea level to 14,000 ft (0–4200 m). It thrives in more-moist areas, though it rarely occurs in dense shade. It is considered a component of climax communities.

ANNUAL PRECIPITATION 20–40 in (50–100 cm)

SOILS Variety of soil types including sandy loams, silt loams, and clays, often on granitic material.

INTERACTIONS This species is important in wetland communities for filtering sediments and providing food and nesting cover for birds and rodents.

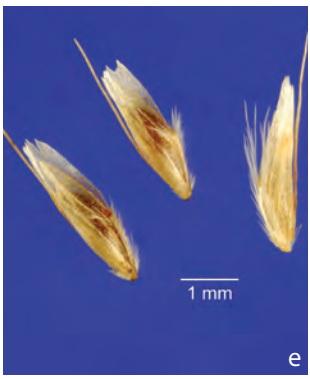
HISTORICAL USE Resistant to toxic wastes, so has long been used in the reclamation of mining sites and other disturbed habitats. Not recommended for revegetation of stream bank areas, since the tufted fibrous roots provide limited bank stabilization.

Grass Family Poaceae
Aveneae Tribe


b


c


d



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USAGE IN RESTORATION

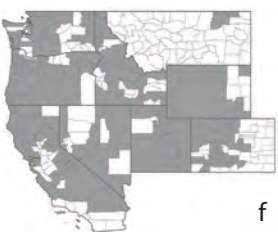
Seed collection Collect seeds from August to September by shaking seed heads into paper bags when seeds are tan, hard, but not yet shattered.

Seed treatment Spread seed on a sheltered tarp for 3 to 5 days, until dry. Cleaning the small seeds is difficult. Large amounts are cleaned with mechanical equipment; small amounts are sifted by hand (very tedious). Seeds require 10-day cold stratification around 32°F (0 °C), followed by warm stratification between 72 to 77°F (22– 25°C).

Planting Direct seeding in the spring or late fall at 1 to 2 lb PLS/acre (1.1–2.2 kg/ha) is best. Keeping the area moist for 14 days enhances establishment.

Benefits Does well in moist environments (not useful along streambanks) and is an excellent competitor, especially on disturbed sites and during fire.

Suitability Present in (f); suitable precipitation (g)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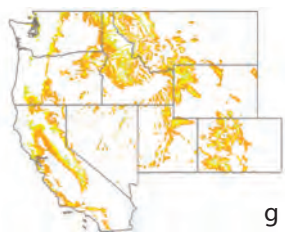
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Credits: a) Christian Fischer; b)Dave Powell, USDA Forest Service, www.bugwood.org; c) Cassondra Skinner, BLM, USDA PLANTS Database; d–e)Jose Hernandez, USDA ARS, USDA PLANTS Database.

Idaho fescue

Festuca idahoensis

SYNONYMS Blue bunchgrass, blue-bunch fescue

BIOLOGY

DESCRIPTION Perennial bunchgrass growing up to 3 ft (90 cm) from a fibrous root system. It reproduces by both seed and tillers. Fine basal leaves are stiff, have a bluish tint, grow 5 to 10 in (13–25 cm) long, and roll inward. Ligules are collar-shaped, fringed and under 1/16 in (<2mm) tall. Auricles are small or absent. Seed heads are open, narrow panicles 4 to 7 in (10–18 cm) long, with ascending branches. Lemmas are longer than glumes and have awns extending up to 3/16 in (5 mm).

BLOOM TIME May to July

ECOLOGY

HABITAT Grows throughout North America's rangelands (f) at elevations from 1300 to 10,000 ft (400–3000 m). It is especially abundant on northern exposures. This species is typically found in landscapes relatively free from disturbance but is also well-suited for seeding on disturbed sites due to its wide ecological amplitude.

ANNUAL PRECIPITATION 12–30 in (30–75 cm)

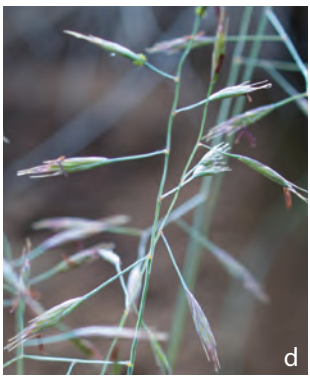
SOILS Commonly occurs on well-drained loams; neutral to slightly alkaline.

INTERACTIONS One of the West's most important grasses because it has excellent forage value and provides green feed longer than associated species.

HISTORICAL USE "Festuca" is an ancient word meaning "straw" or "nothing much."


b


c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USAGE IN RESTORATION

Seed collection Collect seed in August prior to seed shatter when spikelets are light tan. This species is easily hand harvested by stripping seed or clipping the entire seed head into paper bags.

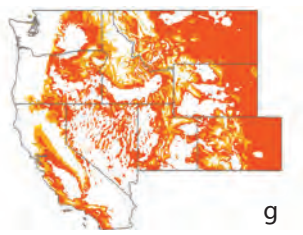
Seed treatment Spread seed on tarps to dry. Separate seed by rubbing and sifting. No pre-planting seed treatment is required, but seed exposed to cold stratification has a higher germination rate.

Planting Sow seed in early spring or late fall at 4 to 8 lb PLS/acre (4.5–9 kg/ha). Planting established plugs is an additional technique to achieve rapid soil stabilization.

Benefits An excellent soil stabilizer on multiple soil types, slopes, and aspects.

Suitability Present in (f); suitable precipitation (g)


f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Credits: a–d) Rachel Winston, MIA Consulting; e) Steve Hurst, USDA ARS, USDA PLANTS Database

Needle and thread

Hesperostipa comata

SYNONYMS

Stipa comata, spear-grass

BIOLOGY

DESCRIPTION Perennial, tufted bunchgrass growing up to 4 ft (120 cm) tall from a fibrous root system. Leaves are narrow, flat, and up to 1 ft (30 cm) long. Ligules are membranous and split. Auricles are absent. Seed heads are contracted panicles that remain partially in the sheath. Lemmas have long (4– 5 in, or 10–12 cm), twisted awns that detach with the sharp seed, resembling a short needle and long thread and giving the plant its common name. May have a second green-up if moisture is sufficient.

BLOOM TIME June to July

ECOLOGY

HABITAT Found throughout western North America (f), usually at elevations from 3500 to 8500 ft (1000–2500 m). It is adapted to numerous conditions including dry sagebrush communities as well as somewhat moist bunchgrass habitats, often associated with sandy textured soils.

ANNUAL PRECIPITATION 7–24 in (18–61 cm)

SOILS Variety of conditions, but does best in sandy or coarse soils.

INTERACTIONS High forage value for wild and domestic animals in early spring or after seed drop. If grazed with seeds present, sharp seeds may injure eyes, tongues, and cheeks of animals.

HISTORICAL USE Some Native Americans used the spreaded appearance of this grass to determine the best time for hunting cow buffalo in fall.

Grass Family Poaceae
Stipeae Tribe


b


c


d


e

USAGE IN RESTORATION

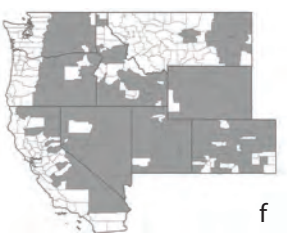
Seed collection Collect seed in late summer. Brush-type seed strippers readily adhere to the awns.

Seed treatment Remove awns quickly to prevent intertwining with seeds of other species, and dry seed immediately. Store in woven plastic bags (never cotton or burlap as sharp seeds will work into fabric). Cold stratification is not necessarily required, but if done, must exceed 120 days for optimum germination.

Planting Sow young seed in fall and old seed in spring at 8 lb PLS/acre (9 kg/ha). To avoid the difficult seed collection and treatment, bale plants with mature seeds and use as mulch at planting sites to promote self-planting.

Benefits Readily colonizes sandy soil in dunes, roadsides, or mines, preventing wind erosion.

Suitability Present in (f); suitable precipitation (g)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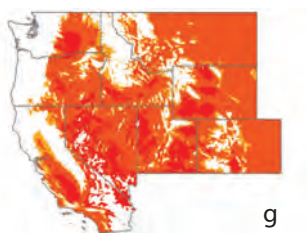
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Credits: a, b, d) Dave Powell, USDA Forest Service, www.bugwood.org; c, e) Richard Old, XID Services, Inc.

Basin wildrye

Leymus cinereus

SYNONYMS Giant wildrye, Great Basin wildrye

BIOLOGY

DESCRIPTION Long-lived, perennial bunchgrass usually growing 3-6 ft (90-180 cm) tall and 3 ft (90 cm) wide from a deep, fibrous root system. Leaves are long (up to 2 ft or 60 cm long) and ¾ in (2 cm) across and often thick and rough. Ligules are membranous, collar-shaped, and up to ¼ in (½ cm) long. Auricles are prominent and clasping. Seed heads are 6 to 10 in (15–25 cm) long, terminal on stout, erect stems and consist of tightly clustered and awnless spikelets. Glumes are needle-like.

BLOOM TIME June to July

ECOLOGY

HABITAT Found throughout the western U.S. (f) at elevations ranging from 2000 to 9000 ft (600–2700 m). It is a pioneer species in many disturbed habitats, preferring open sun to partial shade in sagebrush and bunchgrass communities with wet winters and dry summers.

ANNUAL PRECIPITATION 8–20 in (20–50 cm)

SOILS Deep with high moisture-holding capacity.

INTERACTIONS High forage value for wild and domestic grazers early in the season; however, it is sensitive to grazing during this time. It also serves as good winter forage, recovering well. It is important cover and wind protection for numerous species.

HISTORICAL USE Native Americans used the entire plant for winter forage and the fibers/leaves in bedding and sweat house floor coverings.

Grass Family Poaceae
Triticeae Tribe


b


c


d


e

USAGE IN RESTORATION

Seed collection Collect seed in late August or September prior to seed shatter. Strip the seed from the spikes and dry immediately, storing seed in a cool, dry place.

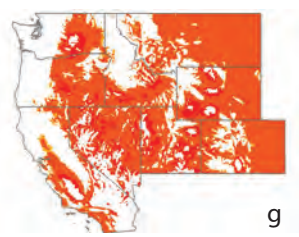
Seed treatment Dry thoroughly, then separate seed by rubbing together; sift to remove chaff. No pre-planting seed treatment is required for germination.

Planting Disc or furrow seed <1 in (2 cm) deep at 9 lb PLS/acre (10.1 kg/ha) in late fall for medium to fine-textured soils and spring for medium to heavy soils. Establishes slowly in 2 to 5 years.

Benefits Although sensitive to grazing during the growing season, it is excellent for wind and soil erosion, provides cover for numerous species, and is important winter forage.

Suitability Present in (f); suitable precipitation (g)


f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Credits: a, b, d) Cassondra Skinner; BLM, c)Robert Mohlenbrock, USDA NRCS, e) Sheri Hagwood, BLM, a–e)USDA PLANTS Database.

Western wheatgrass

Pascopyrum smithii


a

SYNONYMS *Elytrigia smithii, Elymus smithii, Agropyron smithii*

BIOLOGY

DESCRIPTION Long-lived, perennial sodgrass with stems arising singly or in small clumps growing 1 to 3 ft (30-90 cm) tall from a rhizomatous root system. Leaves are flat, blue-green, very rough on the upper sides and margins, and have prominent veins. Sheaths are hairy, ligules are inconspicuous, and auricles are purplish, claw-like, and clasp the stem. Seed heads are terminal on stems and consist of erect spikes 2 to 6 in (5-15 cm) long. Lemmas, paleas, and glumes are smooth to short-hairy. Awns are <¼ in (5 mm) long.

BLOOM TIME July to August

ECOLOGY

HABITAT Found throughout the West (f) at elevations ranging from 1000 to 9000 ft (300–2700 m). It is a commonly used species in revegetation, naturally occurring in grass prairies and bunchgrass communities in open sun to partial shade and in moist soils or along flowing waterways.

ANNUAL PRECIPITATION 10–36 in (25–90 cm)

SOILS Moist, medium- to fine-textured.

INTERACTIONS Excellent forage value for wild and domestic grazers in spring when protein content is high and is utilized by cattle, horses, and elk in the late season. It may be used as fair native hay.

HISTORICAL USE This species was often used by Native Americans for horse fodder.

Grass Family Poaceae
Triticeae Tribe


b


c


d

e

USAGE IN RESTORATION

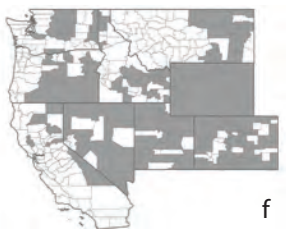
SEED COLLECTION Collect in late summer when dry but prior to shatter by stripping from the spike.

SEED TREATMENT Separate seed by rubbing together; sift to remove chaff. Small amounts can be hand processed while large amounts require threshing and air screening equipment. No pre-planting seed treatment is required for germination.

PLANTING Drill seed ½ in (>1 cm) deep at 10-15 lb PLS/acre (11.2-16.8 kg/ha) in late fall for medium- to fine-textured soils and spring for medium to heavy soils. Sod can be used as well.

BENEFITS It is slow to establish, but once successful, it colonizes rapidly via rhizomes and is an excellent soil stabilizer in disturbed areas. It also withstands cold winters well in a variety of soils.

SUITABILITY Present in (f); suitable precipitation (g)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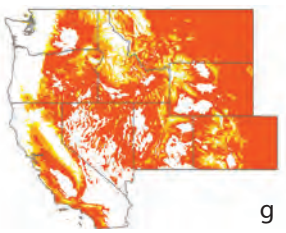
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Credits: a) Sheri Hagwood, BLM, USDA PLANTS Database; b)Alex Ogg, XID Services, Inc.; c) Dave Powell, USDA Forest Service, www.bugwood.org; d) Robert Mohlenbrock, USDA NRCS, USDA PLANTS Database; e) Julia Scher, USDA APHIS, USDA PLANTS Database, www.bugwood.org.

Bluebunch wheatgrass

Pseudoroegnaria spicata

SYNONYMS
Beardless wheat grass

BIOLOGY

DESCRIPTION Long-lived perennial bunchgrass growing up to 3 ft (90 cm) from a fibrous root system and often short rhizomes. Leaf blades have a bluish hue and are flat or rolled slightly inward, 1/8 in (3 mm) wide, and tapering at the tip. Ligules are short, collar-shaped, and membranous. Auricles are small. Seed heads are slender spikes up to 6 in (15 cm) long. Spikelets overlap at most by 1/8 in (3 mm) and contain four to eight florets. Sometimes lacks awns. If awns are present, they are up to ¾ in (2 cm) and diverge at 90° angles at maturity.

BLOOM TIME May to June

ECOLOGY

HABITAT Common throughout the Intermountain West (f), ranging from 300 to 10,000 ft (91–3000 m) in elevation. It has wide ecological amplitude; seasonal development varies with different site characteristics.

ANNUAL PRECIPITATION 8–30 in (20–76 cm)

SOILS Well-drained in a variety of textures.

INTERACTIONS Recovers rapidly after low to moderate grazing and is one of the western rangeland's most important forage species because it is highly palatable to wildlife and livestock.

HISTORICAL USE Some Native Americans used it as a medicinal plant for arthritis and sores. It was also spread on floors of pit houses and stuffed in moccasins for insulation in the cold seasons.

Grass Family Poaceae
Triticeae Tribe


b


c


d


e

USAGE IN RESTORATION

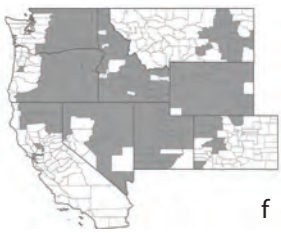
Seed collection Collect seed by clipping the entire seed head into paper bags for transport and storage prior to cleaning.

Seed treatment Separate seeds by rubbing together and sifting to remove chaff. An air column separator may be needed to clean large seed lots. Store clean seed in paper bags at 40°F (4.5 °C) and 40% relative humidity. No other pre-planting seed treatment is required for germination.

Planting Sow seed in late fall at 6 to 8 lb PLS/acre (6.7–9 kg/ha) or plant plugs in the spring or fall. Expect plants to flower in the second growing season.

Benefits Bluebunch wheatgrass is extremely drought tolerant. Its extensive fibrous root system can reach depths greater than 4 ft (120 cm), making it excellent for soil stabilization.

Suitability Present in (f); suitable precipitation (g)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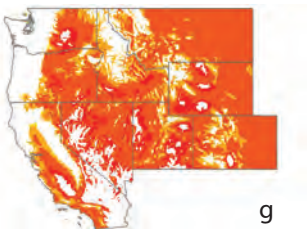
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Credits: a) Howard Schwartz, Colorado State University; b, d) Dave Powell, USDA Forest Service, www.bugwood.org; c) Sheri Hagwood, BLM, USDA PLANTS Database; e) Wikipedia.

Sandberg bluegrass

Puccinellia rupestris

SYNONYMS *Poa secunda*

BIOLOGY

DESCRIPTION Long-lived perennial bunchgrass growing in small tufts up to 12 in (30 cm) from a fibrous root system. It reproduces by seed and tillers. Leaves are mostly basal, blue-green, flat, folded, or rolled slightly inward with a prominent double midrib on the top leaf surface. Leaf tips are boat-shaped. Ligules are prominent, membranous, tapering to a tip, and up to 1/8 in (3 mm) long. Auricles are absent. Seed heads are narrow panicles up to 4 in (10 cm) long with ascending branches of two to three whorls. Spikelets contain two to four florets that are purplish before maturity. Lemmas are awnless.

BLOOM TIME April to June

ECOLOGY

HABITAT Prominent in the arid and semi-arid sagebrush grassland regions of the West (f), ranging from 1000 to 12,000 ft (300–3600 m) in elevation. This species greens up in early spring.

ANNUAL PRECIPITATION 6–20 in (15–50 cm)

SOILS Deep, sandy/silty loams, medium- to fine-textured.

INTERACTIONS It is an important forage species because it is highly palatable and has good grazing value for wild and domestic grazers. The Townsend's ground squirrel (Spermophilus townsendii) helps with propagation as half of its dietary intake is Sandberg bluegrass seed.

HISTORICAL USE Native Americans occasionally used seeds for food and plants for foot gear insulation.

Grass Family Poaceae
Poeae Tribe


b


c


d

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USAGE IN RESTORATION

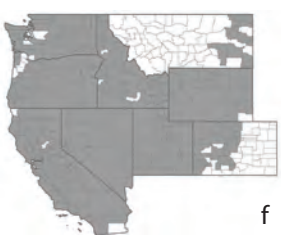
Seed collection Collect ripe seeds in early June when dry but not yet shattered and seed is not completely hardened. To harvest, strip the seed from the plant or clip the entire seed head. Collect and store in paper bags.

Seed treatment Small amounts of seed can be rubbed free and sifted clean. Large amounts of seed require threshing and air screening equipment. Seed germinates well without pre-planting treatment.

Planting Sow seeds 2 months prior to the wet season depending on area precipitation rate and at 2-4 lb PLS/acre (2.2-4.5 kg/ha).

Benefits This species has an extensive and shallow fibrous root system that increases surface soil stabilization.

Suitability Presenit in (f); suitable precipitation (g)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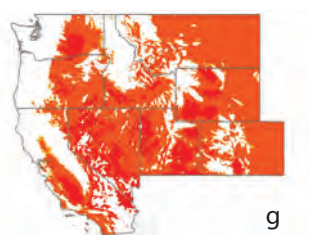
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Credits: a–d) Rachel Winston, MIA Consulting; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Squirreltail

Sitanion hystrix

SYNONYMS *Elymus elymoides*, bottlebrush squirreltail

BIOLOGY

DESCRIPTION Short-lived perennial bunchgrass growing up to 18 in (45 cm) from a fibrous root system. Leaves are narrow, flat or rolled slightly inward, and grow 2 to 8 in (5–20 cm) long. They have raised veins above and a conspicuous midrib below. Ligules are short, membranous and collar-shaped. Auricles are varied or absent. The seed head is a dense, bristly spike 1to 3 in (2½–8 cm) long. There are two spikelets per node, and two to a few florets per spikelet. Awns are harsh, up to 3 in (8 cm) long, and divergent at maturity.

BLOOM TIME May to July

ECOLOGY

HABITAT Common throughout the Intermountain West (f) with elevations ranging from 3500 to 9000 ft (1000–2700 m). This is a dominant species in high desert communities and increases with disturbance.

ANNUAL PRECIPITATION 6–18 in (15–45 cm)

SOILS Well-drained, variety of textures; tolerates salinity.

INTERACTIONS Fair forage for livestock. Sheep prefer it in early spring. It may be consumed in late summer after seed heads have fallen, but not in winter. Sharp awns sometimes harm livestock.

HISTORICAL USE The bushy dried seed heads and awns led to the common names "bottlebrush" and "squirreltail."

Grass Family Poaceae
Triticeae Tribe


b


c


d


e

USAGE IN RESTORATION

Seed collection Collect seed late July to September prior to seed shatter. Hand harvesting is difficult; collect seed in large containers to accommodate the bulky, awned, seed heads. Store dry seed in a cool, dry environment in plastic bags.

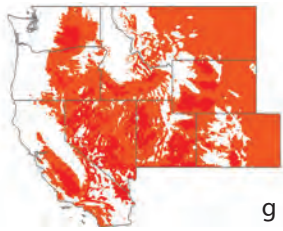
Seed treatment Threshand sift to clean. Clean large seed amounts with mechanical equipment, small amounts sift by hand. No pre-planting stratification or scarification are required for germination.

Planting Sow seed in early spring or late fall at 8-10 lb PLS/acre (9-11.2 kg/ha).

Benefits Priority species for restoring native plant communities in the Great Basin and Columbia River Plateau. Because of its extensive root system, this species thrives on disturbed sites and is effective against cheatgrass and for reducing wind erosion.

Suitability Present in (f); suitable precipitation (g)


f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Credits: a) Sheri Hagwood, BLM USDA PLANTS Database; b, c, e) Dave Powell, USDA Forest Service, www.bugwood.org; d) Jim Pisarowicz.

Sand dropseed

Sporobolus cryptandrus

SYNONYMS None

BIOLOGY

DESCRIPTION Perennial bunchgrass with erect stems from 1to 3 ft (30–90 cm) tall. Leaves are flat, 1/8 in (1/3 cm) wide, tapering at the tip, and rolling inward as the plant matures. Upper leaf sheaths are fringed and partially to entirely enclose seed heads. Each seed head is an open panicle of dense, red-brown spikelets occurring in pairs or small groups. Ligules are conspicuous tufts of long, white hair. Auricles are absent. Spikelets are <1/8 in (1/3 cm) long, with one glume twice as long as the other. Sheaths often enclose the seeds until plant disintegration.

BLOOM TIME June to August

ECOLOGY

HABITAT Found throughout western North America (f) at elevations ranging from 3000 to 8000 ft (900–2400 m). It prefers sandy, disturbed areas in full sun and lower elevations and can be found in sagebrush, saltbush, and bunchgrass communities.

ANNUAL PRECIPITATION 8–16 in (20–40 cm)

SOILS Dry and well-drained; sandy to gravelly coarse-textured soils.

INTERACTIONS Produces considerable forage with fair palatability for most wild and domestic grazing/browsing species. It is one of the few species capable of persevering through grazing and drought conditions.

HISTORICAL USE Seeds of sand dropseed were used in porridge and bread by some Native Americans.

Grass Family Poaceae
Eragrostideae Tribe


b


c


d

e

USAGE IN RESTORATION

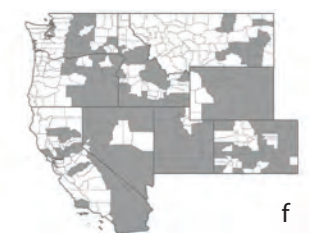
Seed collection Collect seed in late summer when seeds are mature, but prior to plant disintegration. Clip enclosed seed heads from sheaths and into paper bags for transport and storage.

Seed treatment Separate seed by rubbing together against firm and rough surface; sift to remove chaff. Small amounts can be hand processed. No pre-planting seed treatment is required for germination.

Planting Sow seed in spring or fall at 1 lb PLS/acre (1.1 kg/ha); higher germination results may be achieved from fall sowing.

Benefits Excellent for preventing soil erosion via wind and water in sandy areas unsuitable for other plants; tolerates grazing and drought well.

Suitability Present in (f); suitable precipitation (g)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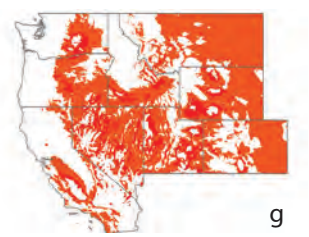
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Credits: a–d) Richard Old, XID Services, Inc.; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Indian ricegrass

Stipa hymenoides

SYNONYMS *Achnatherum hymen-oides, Oryzopsis hymenoides*, sand bunchgrass

BIOLOGY

DESCRIPTION Medium-lived perennial that forms dense clumps up to 2½ ft (75 cm) tall. Leaves are mostly basal with slender, rolled blades. Leaf sheaths are fringed on one margin only. Ligules are membranous, pointed, sometimes split, and up to 3/8 in (1 cm) long with no auricles. The seed head is a spreading panicle with single spikelets (containing one floret each) at ends of hair-like, twisted branches. Lemmas are hard and black and remain around the seed with tufts of white hair. The awn is 3/16 in (5 mm) and readily breaks off, as do the seeds, leaving the glume behind on panicle branches.

BLOOM TIME May to July, depending on elevation.

ECOLOGY

HABITAT One of the most adaptive grasses of the West (f), it is drought tolerant and can be found at elevations from 2000 to 10,000 ft (600–3000 m).

ANNUAL PRECIPITATION 7–20 in (18–50 cm)

SOILS Well-drained, sandy, coarse textured; does not tolerate poorly drained soils.

INTERACTIONS Extremely palatable plant for domestic livestock and wildlife year round, but is not considered a hay species.

HISTORICAL USE The seed of Indian ricegrass is very nutritious and was a staple food of many Native Americans, especially when maize crops failed. It was often ground into flour and made into bread.


b


c


d

e

USAGE IN RESTORATION

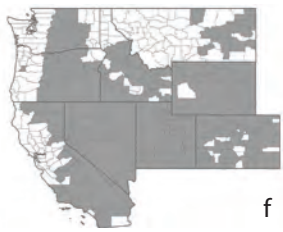
Seed collection Collect seeds in paper bags in late June or early July. Although the seed is very small, when ripe it falls readily from the plant.

Seed treatment Requires a cold stratification or scarification.

Planting Seed Indian ricegrass in very early spring or late fall at 6 to 8 lb PLS/acre (6.7-9 kg/ha). Stands can take up to five years to fully establish.

Benefits Very effective soil stabilizer for areas affected by wind erosion and low rainfall. This species is also very drought tolerant and reproduces by both seed and tillers.

Suitability Present in (f); suitable precipitation (g)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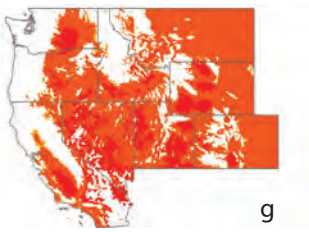
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Credits: a, b) Dave Powell, USDA Forest Service, www.bugwood.org; c) Cassondra Skinner, BLM; d) Richard Old, XID Services Inc., e) Jose Hernandez, USDA ARS; c–e) USDA PLANTS Database.

Nebraska sedge

Carex nebrascensis

SYNONYMS None

BIOLOGY

DESCRIPTION Long-lived perennial sedge growing up to 3 ft (90 cm) from a rhizomatous and fibrous root system. Leaf blades are alternate, linear, up to ½ in (1 cm) wide, and have a v-shaped trough along the midvein. Stems are triangular and erect, typical of all sedges. Seed heads are dense spikes. Terminal spikes consist of male flowers with dark scales. Lateral spikes consist of female flowers with purplish to brown-black scales. The lowest spike is subtended by a leafy bract as long as or longer than the spike.

BLOOM TIME May to July

ECOLOGY

HABITAT Grows in wet meadows, wetlands, and along stream banks, springs, wet marshes, lake shores and ditches throughout the West (f). It can be found at elevations from sea level to 9000 ft (0–2700 m). Water is more of a determining factor than elevation.

ANNUAL PRECIPITATION 12–35 in (30–90 cm)

SOILS Moist clay loams in a variety of textures; tolerates moderately acidic pH values.

INTERACTIONS This species is highly palatable forage for domestic and wild grazers. Because Nebraska sedge is a common riparian species, its presence or absence is an indicator of grazing effects on riparian areas.

HISTORICAL USE Rootstocks were eaten by Native Americans and fibers used for mats and bedding.

Sedge Family
Cyperaceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect seeds in fall by clipping spikes into a paper bag.

SEED TREATMENT Clean seed by rubbing against fine-gauged screen, and sift or fan to remove chaff. Scarify seeds with 100 grit sandpaper. Stratify seeds for 3 days at 37°F (3 °C).

PLANTING Sow seeds in fall at 5 lb PLS/acre (5.6 kg/ha) to initiate natural cold stratification. Plant plugs or containerized plants in early spring or early fall.

BENEFITS The dense, deep root structure enhances soil stability and compaction resistance. This species is very useful for roadways along water bodies. It will stabilize overhanging banks along streams, providing fish habitat.

SUITABILITY Present in (f); suitable precipitation (g)


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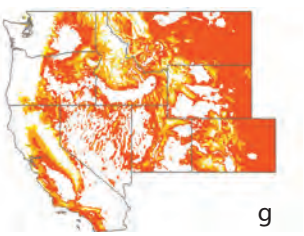
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Credits: a, b) Dave Powell, USDA Forest Service www.bugwood.org; c) Richard Old, XID Services Inc.; e)Hurd *et al.* Field Guide to Intermountain Sedges; c–e) USDA PLANTS Database.

Rocky Mountain maple

Acer glabrum

SYNONYMS Dwarf maple, rock maple, Douglas maple

BIOLOGY

DESCRIPTION Delicate, highly branched shrub growing 6 to 15 ft (2–4½ m) tall with multiple stems. Roots are large and spreading. Bark is reddish when young, and brown with age. Leaves are opposite, up to 3 in (7½ cm) long with three or five palmate lobes. They are bright green with lighter undersides and turn yellow gold to deep crimson in fall. Margins are serrated with many small, double teeth. Male and female flowers are small and non-showy, often produced on separate plants, but sometimes occur on the same. Winged fruits are up to 1 in (2½ cm) long in a long-stalked, wide-spreading pair.

BLOOM TIME April to June

ECOLOGY

HABITAT Found on well-drained seepage sites in rocky areas along stream banks, moist slopes, canyons, ravines, and sometimes dry ridges, normally occurring at elevations from 3000 to 11,000 ft (900–3300 m).

ANNUAL PRECIPITATION 12–25 in (30–63 cm)

SOILS Coarse-textured, well-drained.

INTERACTIONS Important forage for big game and cover for birds and small mammals, especially in winter.

HISTORICAL USE Native Americans used the stems and branches of Rocky Mountain maple in basketry, fishing rods, and building materials. Medicinally, it was used as a cathartic and antiemetic.

Maple Family
Aceraceae


b


c


d


e

USAGE IN RESTORATION

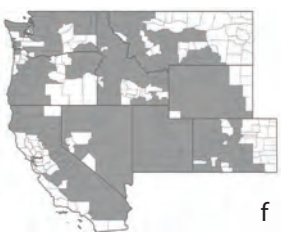
Seed collection Collect seed in late summer after ripening and store at 37 to 41°F (3 to 5°C).

Seed treatment No scarification is needed; however, cold stratification at 37 to 41°F (3 to 5°C) for 6 months is required to break seed dormancy.

Planting Sow seed in partial shade at 3 to 4 lb PLS per acre (3.4-4.5 kg/ha) in early fall to initiate natural cold stratification. Seed germination rates are usually low. Alternatively, sprout seeds in a greenhouse setting and then transplant 2-yr-old stock for better establishment success.

Benefits Spreading roots provide excellent control for soil erosion. Forage is crucial (especially in winter) for big game, and small birds and animals rely on the cover this species provides. The red bark and colored leaves in fall have high aesthetic value.

Suitability Present in (f); suitable precipitation (g)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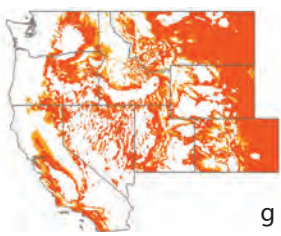
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Credits: a–e) Walter Siegmund.

Saskatoon serviceberry

Amelanchier alnifolia

SYNONYMS Western and Pacific serviceberry

BIOLOGY

DESCRIPTION Sprawling shrub with multiple stems usually growing up to 15 ft (4½ m) tall from a deep, fibrous taproot. Leaves are deciduous, alternate, 1 to 2 in (2½-5 cm) long, oval and with prominent veins extending to leaf margins. The margins are serrated only along the top 2/3 to 1/2 portion of leaves. Flowers consist of five white petals with multiple yellow stamens attached to a cup or tube made of five green sepals. Each petal can be up to 1 in (2½ cm) long. Fruits are fleshy berries up to ½ in (1 cm) wide, turning dark blue with age.

BLOOM TIME May to June

ECOLOGY

HABITAT Abundant across the Rocky Mountains (f) in dry forests, open hillsides, and rocky slopes at elevations from 200 to 10,000 ft (61–3000 m).

ANNUAL PRECIPITATION 12–30 in (30–75 cm)

SOILS Variety of well-drained soils.

INTERACTIONS Serviceberry is a valuable browse plant for livestock and wild ungulates. Additionally, numerous birds and small mammals eat the fleshy fruits and find shelter among the branches.

HISTORICAL USE The fruits of serviceberry are edible but have little taste. They were an important food plant used by Native Americans throughout the Northwest, especially in pemmican of dried serviceberries and meat. The hard, straight-grained wood supplied arrow shafts and tepee poles.

Rose Family
Rosaceae


b


c


d


e

USAGE IN RESTORATION

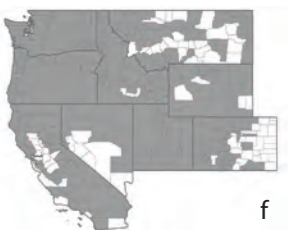
SEED COLLECTION Collect seed when fruits are very ripe or dry, during late summer months. Refrigerate until treatment. Notably, wild collected seed is often not viable and/or is infested by insects.

SEED TREATMENT Soak seeds in a 3:1 water solution with 3% hydrogen peroxide for 20 minutes, followed by a 48-hour water rinse. After, seeds should undergo 120-day cold/moist stratification.

PLANTING Sow seeds in early fall at 1 lb PLS/acre (1.1 kg/ha) after stratification treatments; germination and establishment will be sporadic. Due to extensive warm and cold stratification requirements, planting plugs, cuttings, or potted plants (from spring through fall) yields higher establishment than direct seeding.

BENEFITS Excellent for moist areas and roadsides along rivers or streams.

SUITABILITY Present in (f); suitable precipitation (g)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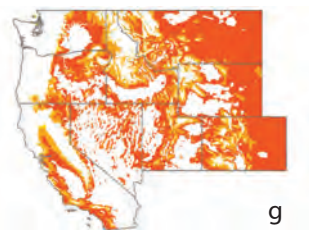
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Credits: a, c, e) Richard Old, XID Services Inc.; b, d) Mary Ellen Harte, www.bugwood.org

Bearberry

Arctostaphylos uva-ursi


a

SYNONYMS Kinnikinnick, bear-grape, creashak, hog cranberry, mountain-box, sand berry

BIOLOGY

DESCRIPTION Creeping, low-growing shrub growing up to 1½ ft (45 cm) tall from a deep, fibrous taproot. Individual mats are up to 6 ft (1¾ m) wide. Stems are short and trailing with velvety, red bark when young. Leaves are evergreen, alternate, leathery, and born on twisted stalks. Leaves are oval, up to ¾ in (2 cm) long, and dark green, at times turning deep purple in the fall. Flowers are pinkish-white, shaped like hanging urns, and appear in terminal clusters. The fruit is bright red, looks similar to a berry, ¼ in (½ cm) long, and contains five seeds.

BLOOM TIME May to June

ECOLOGY

HABITAT Abundant across the Rocky Mountains from low elevations to alpine tundra (f). It is commonly found on sunny, open areas to semi-shaded forests from 2000 to 11,000 ft (600–3300 m).

ANNUAL PRECIPITATION 8–45 in (20–114 cm)

SOILS Variety; sandy, acidic, well- to excessively-drained.

INTERACTIONS The foliage is grazed by deer, elk, moose, and sheep, while the fruits are eaten by various birds, rodents, and bears.

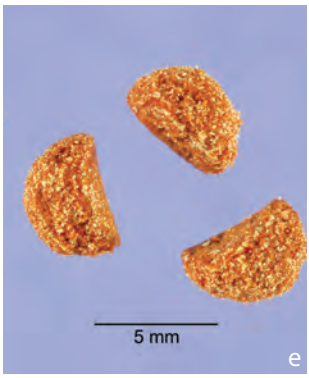
HISTORICAL USE Fruits are edible but bitter. Settlers and many coastal Native Americans used the dried leaves as a tobacco substitute by combining them with dried inner-bark of redosier dogwood. Tannin was also collected from the leaves.

Heath Family
Ericaceae


b


c


d



e

USAGE IN RESTORATION

SEED COLLECTION Collect fruits when deep red or brown in plastic bags, August to October. Refrigerate until cleaning and treatment.

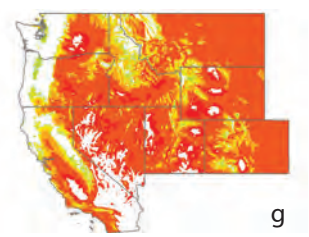
SEED TREATMENT Separate seeds from fruit by maceration; sift and rinse. Allow seed to dry and store in cold, dry place. Pre-planting treatment requires ½- to 2-hr soak in sulfuric acid. After removal, cover seeds in lime and soak in water for 48 hr. Following scarification, seeds need extended warm/moist and cold/moist stratification.

PLANTING Due to the extensive pre-planting seed treatment, it is often more cost effective to plant purchased plugs or potted plants. This species transplants well in early spring or mid-fall.

BENEFITS Useful for steep slope stabilization because of its dense mats; requires little to no maintenance

SUITABILITY Present in (f); suitable precipitation (g)


f


g

Credits: a, b) Dave Powell, USDA Forest Service, www.bugwood.org; c) Mary Ellen Harte, www.bugwood.org d) Joy Viola, Northeastern University, www.bugwood.org; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Silver sagebrush

Artemisia cana

SYNONYMS Hoary sagebrush

BIOLOGY

DESCRIPTION Aromatic, evergreen shrub growing over 3 ft (1 m) tall from a deep taproot and rhizomes. Highly branching stems are green and rigid when young and brown to gray when mature. Leaves are alternate, narrow, covered in silver hairs, have smooth margins, are gray-green, 1 to 2 in (2½–5 cm) long, and sometimes have two lobes at tips. Flower heads consist of clusters of yellow, inconspicuous, non-showy disc flowers at the ends of branches. This species reproduces by seed and through its spreading rhizomes.

BLOOM TIME July to September

ECOLOGY

HABITAT Grows throughout the Great Plains and the Intermountain West (f) on rocky open sites, uplands, and floodplains at elevations from 4000 to 8000 ft (1200–2400 m).

ANNUAL PRECIPITATION 8–40 in (20–101cm)

SOILS Deep, well-drained, coarse-textured; but may be found on a variety of soil textures.

INTERACTIONS This species is important winter forage for livestock and wild ungulates and provides critical cover for wildlife. It is one of the primary components of the sagebrush grasshopper (Melanoplus bowditchi) diet.

HISTORICAL USE Native Americans used a decoction of silver sage to alleviate coughing and to remedy hair loss.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

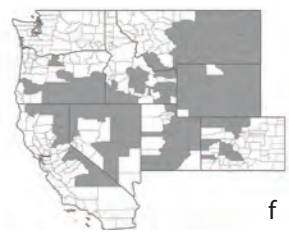
SEED COLLECTION Collect the entire panicle of seed heads into paper bags from August to October.

SEED TREATMENT Silver sage seeds germinate well without pre-planting scarification or temperature stratification. Separate seeds from surrounding coverings by hand, or with the use of a fine screen.

PLANTING Seed directly in fall on moist sites at 1 to 3 lb PLS/acre (1.1–3.4 kg/ha), or transplant containerized stock in early spring. Transplants do especially well in moist areas.

BENEFITS With its extensive rhizomatous root system, silver sage is an excellent species for soil erosion control and is easy to germinate.

SUITABILITY Present in (f); suitable precipitation (g)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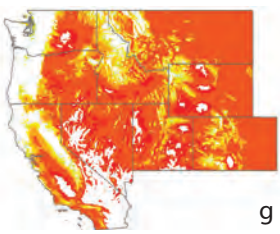
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Credits: a–e) Alex Ogg, taken from XID Services Inc.

Big sagebrush

Artemisia tridentata


a

SYNONYMS Basin sagebrush, sagebrush

BIOLOGY

DESCRIPTION Aromatic, evergreen shrub growing up to 10 ft (3 m) tall from a deep, fibrous taproot. Branching stems are thin and hairy when young and brown to gray when mature, the bark appearing shredded. Leaves appear twice per year in spring and fall. When new leaves emerge, previous season's leaves fall. Leaves are alternate, covered in silver hairs, gray-green, and up to 1 in (2½ cm) long. Newer leaves may be simple, though the majority of leaves have three lobes on tips. Inconspicuous, yellow disc flowers comprise flower heads in panicles at the ends of branches.

BLOOM TIME July to September

ECOLOGY

HABITAT Big sagebrush is a dominant shrub found from 2500 to 10,000 ft (750–3000 m) throughout the American West (f). It occurs on open plains, foothills, and mountain slopes. There are several subspecies, which are difficult to distinguish.

ANNUAL PRECIPITATION 8–30 in (20–75 cm)

SOILS Well-drained, coarse to fine-textured, with neutral to mildly alkaline pH.

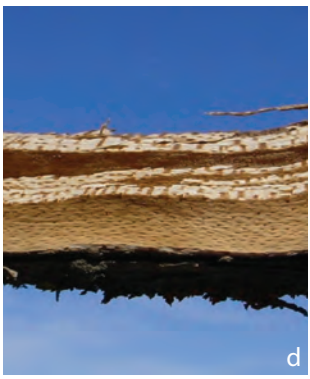
INTERACTIONS Nutritious food source on winter game ranges; provides cover for wild and domestic animals. Increased fire, weeds, and grazing have compromised many sagebrush communities.

HISTORICAL USE Native Americans used leaves and twigs for colds, wound antiseptic, and laxatives.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect the entire cluster of seed heads into paper bags from August to October.

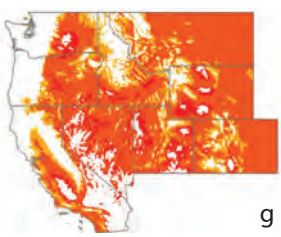
SEED TREATMENT Remove seeds from chaff with tweezers. Although no seed treatment is necessary, the germination rate increases when seed is exposed to sunlight and cold temperatures.

PLANTING Sow seed in early fall 1-3 lb PLS/acre (0.5-1.4 kg/ha) to incorporate natural exposure to light and seasonal temperatures. Greenhouse-propagated plants can be permanently transplanted in early spring or late fall.

BENEFITS Excellent for soil stabilization with roots reaching depths greater than 6 ft (2½ m). The fibrous root system allows the plant to extract moisture throughout the soil profile, improving competitive ability. All subspecies are extremely drought-tolerant and easily propagated.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a, d) Richard Old, XID Services Inc.; b, c) Mary Ellen Harte; e) K. George Beck & James Sebastian, Colorado State University; a–e) www.bugwood.org.

Fourwing saltbush

Atriplex canescens

SYNONYMS

Cenizo, chamiza, white greasewood, saltsage, fourwing shadscale, bushy atriplex

BIOLOGY

DESCRIPTION Small shrub growing to 6½ ft (2 m) tall from a large root system. Stems are highly branched, and have white bark. Leaves are alternate, narrow, usually 1 in (2½ cm) long, have smooth margins, and are covered in fine white hairs. Plants are most often dioecious (male and female flowers on separate plants). Male flowers are red to yellow clusters at branch tips; female flowers are nondescript and at branch tips. Seeds are encompassed in 4-winged capsules.

BLOOM TIME July to September

ECOLOGY

HABITAT Found in dry, open areas at elevations from below sea level to 8000 ft (0–2400 m). It is commonly associated with sagebrush and dry bunchgrass communities. This species tolerates saline, sodic and boron-containing soils. When growing in salinity, salt accumulates in leaf coverings.

ANNUAL PRECIPITATION 5–18 in (18–45 cm)

SOILS Deep, well-drained, loamy to sandy to gravelly; tolerates salinity and some sodic soils.

INTERACTIONS Excellent browse for livestock and big game and provides food and cover for numerous smaller species.

HISTORICAL USE Native Americans used roots for stomach pains, coughs, toothaches, and as a laxative. Leaf lather treated rashes and ant bites.

Goosefoot Family
Chenopodiaceae


b


c


d

e

USAGE IN RESTORATION

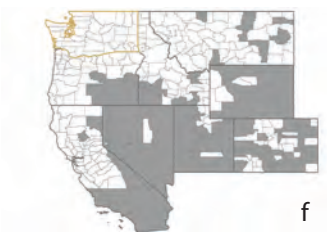
SEED COLLECTION Collect seed from September to December by hand-stripping inflorescences and storing in bags.

SEED TREATMENT Seed requires up to 10 months of after-ripening. De-wing seeds by rubbing against a fine screen prior to planting. (De-winging seeds may shorten this period, but doing so may lower the length of seed viability.)

PLANTING Transplant greenhouse plugs in early spring or direct seed at 6 to 8 lb PLS/acre (6.7–9 kg/ha) in late fall, early winter, or very early spring.

BENEFITS Very drought- and cold-tolerant, provides good soil stabilization and wind protection, as well as excellent winter forage and cover for many species. Plant back from roads, as the attractive winter forage could lead to animal-vehicular death.

SUITABILITY Present in (f); suitable precipitation (g)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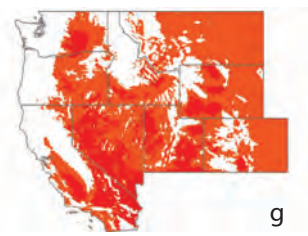
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Credits: a–c) Stan Shebs; d) Richard Old, XID Services, Inc.; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Creeping barberry

Berberis repens

SYNONYMS *Mahonia repens*, creeping Oregon-grape

BIOLOGY

DESCRIPTION Prostrate, creeping, evergreen shrub growing up to 18 in (45 cm) from a fibrous taproot and stolons. Woody stems are scaly, reddish-brown, and rough; inner bark is yellow. Leaves are alternate, up to 7 in (18 cm) long, and pinnately divided into three to seven leaflets. Leaflets are dark green, red in winter, leathery, and holly-like with sharp, toothed margins. Flowers have deep yellow sepals and petals and are tightly clustered in groups of 25 to 50. Fruits are clustered, dusty blue berries.

BLOOM TIME March to June

ECOLOGY

HABITAT Found throughout western North America (f) in a wide range of plant associations from forests to grasslands to shrublands ranging in elevation from 2500 to 11,000 ft (750–3300 m). It grows in full sun and semi-shade.

ANNUAL PRECIPITATION 12–60 in (30–152 cm)

SOILS Moist to dry, well-drained, sometimes shallow.

INTERACTIONS It is poor forage for livestock, but a prime food source for many birds, rodents, and wild ungulates. It is host to a serious cereal pathogen and shouldn't be planted near such crops.

HISTORICAL USE Historical and present uses include: roots and bark to make yellow dye; berries for food; teas to treat infections, kidney problems, fever and inflammation.

Barberry Family
Berberidaceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect seeds when fruits are dark blue. Harvest whole berries, allow to dry, store in plastic bags, and refrigerate prior to cleaning.

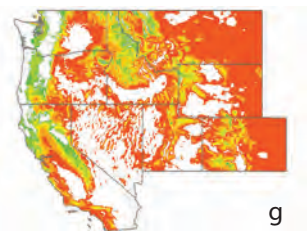
SEED TREATMENT Macerate berries to extract seed. Soak seeds in water for 48 hours, then transfer to fine mesh bags and cover with moistened peat moss for 6 to 8 weeks. Seeds must then go through a cold/moist stratification (cold temperatures with the same covering) for nearly 5 months.

PLANTING Direct seeding (0.25–1 lb PLS/acre or 0.28–0.56 kg/ha) incorporates cold stratification, but due to extensive seed treatment requirements, greenhouse germination followed by seedling plantings in early spring is recommended.

BENEFITS Once established, it is both drought- and heat-tolerant, and spreads via stolons which form a dense, deep, soil-stabilizing mat.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a, b, d, e) Dave Powell, USDA Forest Service; c) Joy Viola, Northeastern University; a–e, www.bugwood.org.

Red-stem ceanothus

Ceanothus sanguineus


a

SYNONYMS Wild lilac

BIOLOGY

DESCRIPTION Long-lived, erect, and loosely branched shrub growing 3-10 ft (1-3 m) from a fibrous taproot. Stems are round, green with soft hairs when young, and turn red then brown and rough with age. Leaves are alternate, dark green, oval to elliptical, and 1½-4 in (3-10 cm) long with serrated margins. Leaves have 3 prominent veins which originate from the leaf base and are quickly deciduous in fall. Flowers are small, white, have five petals, five sepals and are borne in a tight cluster.

BLOOM TIME May to June

ECOLOGY

HABITAT Grows on moist, partially-shaded slopes, and moist to dry, open woods from 2400 to 4000 ft (730–1200 m) throughout the West (f).

ANNUAL PRECIPITATION 13–35 in (33–89 cm)

SOILS Well-drained, medium-textured, rocky outcrops, and areas with shallow soil.

INTERACTIONS This species is important winter browse and year-round shelter for many wildlife species, especially deer and elk. It is also grazed by livestock. Red-stem ceanothus provides cover for bees, birds, and small mammals, and has nitrogen-fixing abilities.

HISTORICAL USE Native Americans used this species extensively. Flowers were brewed for tea and used as an ingredient in soap. Red dye was made from the roots, and stems were woven into baskets.

Buckthorn Family
Rhamnaceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect seeds in June and August using special, polyester, UV-resistant bags. Tie bags onto fruit clusters; bags catch seeds very cleanly as they are ejected from the plant.

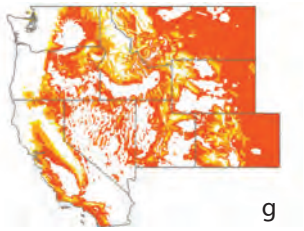
SEED TREATMENT Clean by rubbing seed over a fine-gauge screen. Scarify in a boiling water bath for 5 to 10 seconds, then transfer to a cold water bath to avoid seed damage. Leave seeds in cool water for 24 hours, and follow with a 90-day cold stratification.

PLANTING Sow treated seeds in fall at 0.25 lb PLS/acre (0.28 kg/ha) to incorporate natural temperature stratification. Plant tubelings and potted plants in early spring; deep watering may be necessary for propagule establishment.

BENEFITS Forms a deep root system that serves in soil stabilization and is also a nitrogen fixer that aids in nutrient cycling and increased soil fertility.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a–e) Walter Siegmund.

Snowbrush ceanothus

Ceanothus velutinus

SYNONYMS Snowbush, deer brush

BIOLOGY

DESCRIPTION Long-lived, sprawling, sweetly aromatic, densely branched shrub growing 3–9 ft (<1–3 m) from a fibrous taproot. Young stems are green, slightly flattened, and slightly hairy; older stems have reddish-brown bark. Leaves are alternate, broadly oval-shaped, with serrated margins and up to 3 in (8 cm) long. Each leaf is distinctly three-veined from the base. Leaf tops are dark green, leathery, and often sticky; undersides are pale with some hair. Flowers are small, white, have five petals, five sepals and are borne in a tight cluster.

BLOOM TIME May to June

ECOLOGY

HABITAT Grows on rocky hillsides favoring south-facing slopes in areas where winter snow accumulates throughout the West (f). It is also prominent in draws and on open slopes ranging from 3800 to 9000 ft (1100–2700 m) in elevation.

ANNUAL PRECIPITATION 11–35 in (28–89 cm)

SOILS Well-drained, coarse, shallow, slightly basic.

INTERACTIONS Exhibits browsing tolerance and is a chief year-round shelter and food source for livestock and wild game. Seeds have considerable longevity; germination has occurred after 200 years in the soil profile.

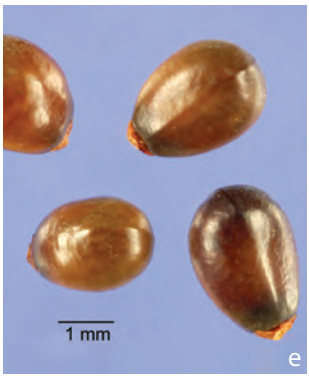
HISTORICAL USE Leaves contain saponins which are soap-like substances used to wash the skin. Leaves have also been used for treating skin irritations.

Buckthorn Family
Rhamnaceae


b


c


d



e

USAGE IN RESTORATION

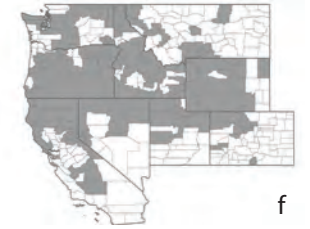
SEED COLLECTION Collect seeds in June and August prior to seed shatter. It is difficult to extract seeds from the fruit. Alternatively, harvest stem cuttings in late April to early June; cuttings should be 8 to 10 in (20-25 cm) long and ¼ in (6 mm) diameter.

SEED TREATMENT Scarify seeds in boiling water for 4 to 5 min; soak in warm water for 12 hours. Cold stratify below 40°F (4.5°C) for up to 90 days. Cuttings are excellent propagules; treat with rooting hormone.

PLANTING Sow seeds in a greenhouse , 1 to 3 lb PLS/acre or 1.1–3.4 kg/ha) and transplant in spring. Place cuttings in a hole slightly larger than the cutting and half as deep. Inoculate cuttings and seedlings with nitrogen-fixing organisms.

BENEFITS The extensive root system and longevity of this species enhances soil stabilization and soil nitrogen fixation over time.

SUITABILITY Present in (f); suitable precipitation (g)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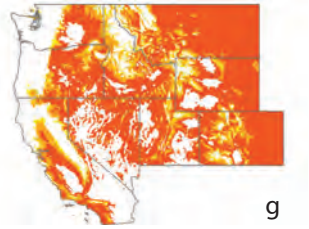
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Credits: a–c) Sheri Hagwood, BLM; d) Dave Powell, USDA Forest Service, www.bugwood.org; e) Steve Hurst, USDA ARS; a–c, e) USDA PLANTS Database.

Redosier dogwood

Cornus sericea

SYNONYMS Red-stem dogwood, American dogwood

BIOLOGY

DESCRIPTION Rapidly growing, loosely spreading and multi-stemmed shrub growing 6-9 ft (<2-3 m) from a deep, fibrous taproot. Young stems are bright red, turning more green with age. Leaves are opposite, dark green, oval to lance-shaped, with smooth or wavy margins and up to 4 in (10 cm) long. Leaves have a distinct midvein and 4-7 lateral vein pairs from which thin, cottony strings stretch if the leaf is torn perpendicular to the midvein (c). Flowers are showy with 4 white petals and are in large, flat-topped clusters. Fruits are white.

BLOOM TIME May to July

ECOLOGY

HABITAT Grows in wet locations along stream banks, ponds, lakes, or in riparian zones of open forests (f) at elevations from 1500 to 9000 ft (450–2700 m).

ANNUAL PRECIPITATION 11–60 in (28–152 cm)

SOILS Well-drained, coarse, shallow, slightly basic.

INTERACTIONS This species is not palatable to large game or domestic livestock, but many bird species eat the berry-like fruits. This shrub also provides valuable cover for small mammals and birds.

HISTORICAL USE Native Americans heavily used this species. Bark extract was used for coughs/fevers, dyes were made from stems, and root tea was used to treat malaria. Some smoked the inner bar as a tobacco substitute.

Dogwood Family
Cornaceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect seeds by hand in early fall. Collect fruits into plastic bags and store under refrigeration prior to cleaning.

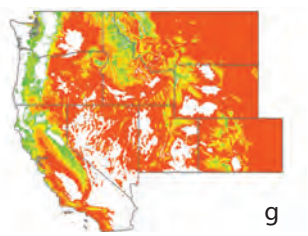
SEED TREATMENT Separate seed by maceration, and clean by screening and rinsing. The seed requires scarification with sulfuric acid for 30 minutes, followed by a 48-hour cold water soak, then a 90-day cold/moist stratification in peat moss.

PLANTING Dogwood does well when planted via cuttings. Soak cuttings in hormonal root inducer, drill a 2 x 18 in (5 x 45 cm) hole, and plant in early spring or late fall. If seeding, fall is best and at rates of 1 lb PLS/acre (1.1 kg/ha); germination is unpredictable and establishment is slow.

BENEFITS A superb soil stabilizer, it is especially useful for roadsides along streams and rivers in disturbed areas and is quick to establish, spreading rapidly.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a) Mary Ellen Harte; b) Terry Spivey, USDA Forest Service; c–e) Paul Wray, Iowa State University; a–e) www.bugwood.org.

Rubber rabbitbrush

Ericameria nauseosa

SYNONYMS

Gray rabbitbrush

BIOLOGY

DESCRIPTION Erect, medium-lived, and sometimes foul-smelling shrub growing 1 to 8 ft (30 cm–2½ m) from a fibrous taproot. Stems are green to yellow, often with dense hair. Bark on older stems is fibrous, brown, and shredded. Leaves are alternate, gray to silver, and narrow with smooth margins. They are not twisted. Flower heads have yellow disc flowers and are found in large clusters on branch tips. Each head is ½ in (1 cm) or longer.

BLOOM TIME June to September

ECOLOGY

HABITAT Highly variable species growing on mesic sites throughout the sagebrush steppe (f). It grows best in openings with sagebrush, juniper and ponderosa pine regions ranging from 2000 to 9000 ft (600–2700 m) in elevation.

ANNUAL PRECIPITATION 6–40 in (15–101 cm)

SOILS Various coarse-textured soils.

INTERACTIONS This species is not highly palatable to wild and domestic grazers, and is considered mildly toxic to livestock. It provides good cover for nesting birds. There are six subspecies.

HISTORICAL USE Some Native Americans used the bark as chewing gum. It was also used as tea, cough syrup, yellow dye, and for chest pains. It is a small commercial source for rubber extraction, and in World War II, it was studied as a substitute for commercial rubber.

Sunflower Family
Asteraceae


b


c


d


e

USAGE IN RESTORATION

SEED COLLECTION Collect seeds in fall, separating specific ecotypes by elevation and site.

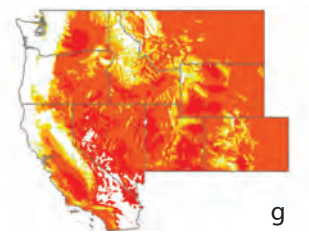
SEED TREATMENT Separate seeds from chaff by hand after rubbing on a screen or other rough surface. Rubber rabbitbrush seed germinates without pre-planting scarification or temperature stratification.

PLANTING Sow seed by hand in early spring at rates of 1 lb PLS per acre (1.1 kg/ha), or transplant tubelings or containerized plants in early spring or early fall.

BENEFITS A good species for erosion control and soil stabilization, the root system establishes quickly. Throughout the growing system, a large volume of leaf litter is produced, which aids in nutrient cycling.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a-c) Richard Old, XID Services Inc.; d) Mary Ellen Harte, www.bugwood.org; e) Steve Dewey, Utah State University, www.bugwood.org.

Oceanspray

Holodiscus discolor


a

SYNONYMS Cream bush, arrow wood

BIOLOGY

Description Long-lived, moderately fast growing shrub typically 3 to 12 ft (1–3½ m) tall with peeling gray bark, an arched-branching form, and fibrous roots. Leaves are triangular, with deep veins and shallow, finely toothed lobes. They are green above and dull green beneath due to fine hairs, turning reddish in fall. Flowers are produced profusely in clusters 4 to 7+ in (10–17¾ cm) long filled with numerous, small, creamy-white flowers. There are five, small, hairy, yellow fruits per flower.

Bloom time July to August

ECOLOGY

Habitat Its habitat varies considerably and includes stream banks, the understory of moist woods, cut-over timberland, and dry rocky soils and talus slopes from sea level to 7000 ft (0–2100 m) in sun or partial shade.

Annual precipitation 9–24 in (22–60 cm)

Soils Medium and fine-textured with pH 5.0 to 7.5.

Interactions Palatability is generally considered low but varies with climate and incidence of fire. It is fed upon by cattle, deer, and elk. It is an important host for beneficial insects and provides cover for birds and mammals.

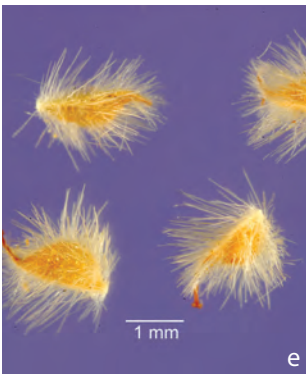
Historical use Native Americans used leaves of this species to treat diarrhea, sores, burns and influenza. Wood was used to make needles, arrows, many cooking tools, and in basketry.

Rose Family
Rosaceae


b


c


d



e

USAGE IN RESTORATION

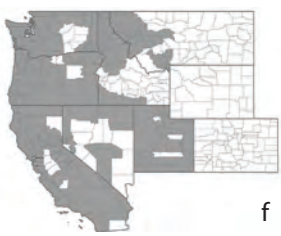
SEED COLLECTION Collect seed in late summer when seeds have ripened on the plant.

SEED TREATMENT Sift seed on screens (rubbing) to separate from chaff. Cold/moist stratify for 15 to 18 weeks to overcome seed dormancy.

PLANTING Sow seed in spring at 1to 2 lb PLS per acre (1.1–2.2 kg/ha). Seed viability is typically <10%. Alternatively, transplant container stock or fall/winter-collected hardwood cuttings in fall. Treat hardwood cuttings with rooting hormone first.

BENEFITS Good for low maintenance riparian plantings, reclamation of droughty, rocky, or disturbed sites and windbreaks. The arching form and large flower clusters make oceanspray a popular ornamental for highway and landscape plantings. Has moderate to high ecological value.

SUITABILITY Present in (f); suitable temperatures (g)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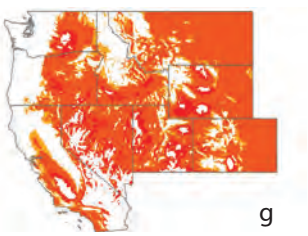
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Credits: a-c) Mary Ellen Harte, www.bugwood.org; d) Steve Dewey, Utah State University; e)Tracey Lottat, USDA ARS, USDA PLANTS Database.

Bush penstemon

Penstemon fruticosus

SYNONYMS Shrubby penstemon

BIOLOGY

DESCRIPTION Mat-forming, sub-shrub growing to 2 ft (60 cm) tall from a fibrous taproot. Leaves are largely basal; those up the stem are opposite and decussate (pairs arranged at right angles to the pair above). Leaves are elliptic, shiny, and often finely toothed. Light purple or blue flowers are arranged in loose clusters at leaf nodes and branch tips. Each flower is tubular with two lobes; the top lobe is made of two fused petals while the lower is made of three and forms a landing pad for insects. Fruits are small capsules.

BLOOM TIME March to August

ECOLOGY

HABITAT Shrubby penstemon is found on rocky, open, or wooded areas ranging from 4000 to 8000 ft (1200–2400 m).

ANNUAL PRECIPITATION 8–18 in (20–45 cm)

SOILS Rocky, dry, well-drained.

INTERACTIONS This species has fair palatability for livestock, but is considered desired forage for deer, pronghorn, and birds. It provides cover for select, small bird species.

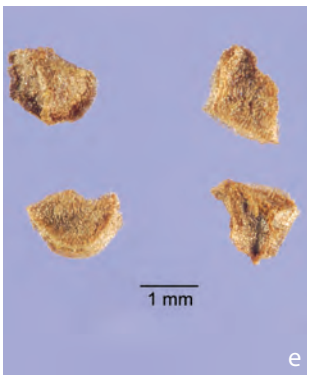
HISTORICAL USE Native Americans used this plant as a wash for women bothered by milk flow, in baths to treat rheumatism and arthritis, and for aches and sores. This plant was also used as a tea for flu, colds, headaches, and internal disorders such as kidney problems and ulcers.

Figwort Family
Scrophulariaceae


b


c


d



e

USAGE IN RESTORATION

SEED COLLECTION Hand collect when capsules are dry and seed is dark. Multiple collections may be necessary because flowers mature at different rates. Sift seeds to clean; store in a cool, dry place.

SEED TREATMENT Cold stratify for 2 months at 39°F (4°C), and 1 to 2 months at 50°F (10°C).

PLANTING Sow seed in fall at 3 lb PLS/acre (3.4 kg/ha) to initiate the natural cold stratification process. Seeds will germinate; however, emergence is sporadic. Vegetative propagules transplant well in early spring or fall.

BENEFITS Shrubby penstemon is an excellent addition to seed mixes for erosion control and for aesthetic value. This species is also cold- and drought-tolerant.

SUITABILITY Present in (f); suitable precipitation (g)


f


g

Credits: a, b) Dave Powell, USDA Forest Service, www.bugwood.org; c, d) Walter Siegmund; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Antelope bitterbrush

Purshia tridentata

SYNONYMS Antelope brush, quinine brush

BIOLOGY

DESCRIPTION Small, highly variable shrub depending on the ecotype in which it grows. Typically 2 to 6 ft (60–180 cm) tall and up to 8 ft (2½ m) wide with a sprawling, branching form. Roots are moderate to very deep. Leaves are alternate, wedge-shaped, and three-lobed. They vary from grayish to bright green and have no odor when crushed (unlike sagebrush) but have a very bitter flavor. Some leaves are persistent in winter. Flowers are produced profusely along branches. Each flower has five petals, yellow to white, with many yellow stamens and is <1/3 in (3/4 cm) wide. Fruits are spindle-shaped and shatter at maturity.

BLOOM TIME June to July

ECOLOGY

HABITAT Found on dry lake beds, alluvial fans or terraces, and low foothills in mixed shrub communities, normally occurring at elevations from 4500 to 8000 ft (1300–2400 m). It can grow in open sun to partial shade.

ANNUAL PRECIPITATION 8–24 in (20–60 cm)

SOILS Deep, coarse, well-drained, neutral to slightly acidic.

INTERACTIONS Important forage/cover for livestock, big game, numerous birds, and small mammals.

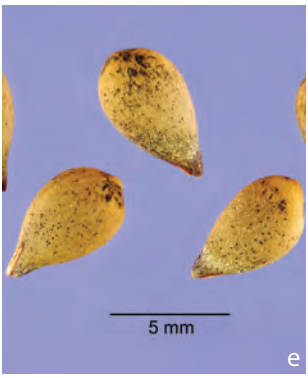
HISTORICAL USE Native Americans used leaves for rashes, bites, coughs, pneumonia, worms, and stomach aches. Aboveground parts were used for laxatives; roots were used for fevers and childbirth.

Rose Family
Rosaceae


b


c


d



e

USAGE IN RESTORATION

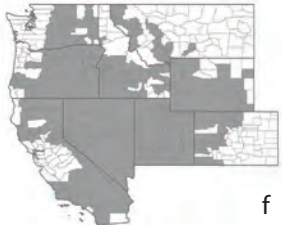
SEED COLLECTION Collect seed in late summer immediately after ripening (mature seed shatters quickly) into seed collection trays beneath plants.

SEED TREATMENT Sift seed on screens (rubbing) to separate from chaff. Cold stratify for 4 months if spring seeding or alternatively treat with hydrogen peroxide to break seed dormancy.

PLANTING Sow seed in early fall at 1 to 3 lb PLS/acre (1.1–3.4 kg/ha) to initiate natural stratification. Spring seedlings are susceptible to late frosts. Alternatively transplant 1-yr-old bare-root or containerized seedlings 6 to 24 in (15–60 cm) tall and ensure sufficient moisture the first year.

BENEFITS Tolerant to drought and cold, it is a crucial forage for big game and small birds and animals, and excellent for livestock (ease them off in summer). It provides cover for animals and soil and has good aesthetic value.

SUITABILITY Present in (f); suitable precipitation (g)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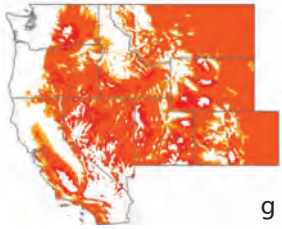
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Credits: a–c) Mary Ellen Harte, www.bugwood.org; d) Steve Dewey, Utah State University; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Golden currant

Ribes aureum

SYNONYMS Missouri currant, buffalo currant, clove currant, spicebush

BIOLOGY

DESCRIPTION Medium shrub growing up to 10 ft (3 m) tall from rhizomes. Stems are arched-branching with reddish-brown to gray bark. Leaves are glossy green, alternate, and three- or five-parted (resembling a goose foot) with large-toothed margins. Flowers form in small clusters, each flower having five yellow sepals fused at the base to form a tube and spreading at tips with five small, red-tipped petals atop. The fruits are berries up to ½ in (1 cm) across and ripening from green to yellow to red to black.

BLOOM TIME April to June (sometimes March)

ECOLOGY

HABITAT Grows in grasslands, coniferous forests, and mountain shrub communities. It occurs on floodplains, along streams, in ravines and washes, by springs, and on mountain slopes, at elevations of 2600 to 8500 ft (800–2600 m). It is somewhat shade-tolerant but is suppressed by a denser canopy.

ANNUAL PRECIPITATION 12–20 in (30–50 cm)

SOILS Dry to slightly moist in a variety of soil types.

INTERACTIONS Fruits are an important food source for numerous wildlife species. IT IS AN ALTERNATE HOST TO WHITE PINE BLISER RUST, SO SHOULD NOT BE PLANTED NEAR WHITE PINE STANDS.

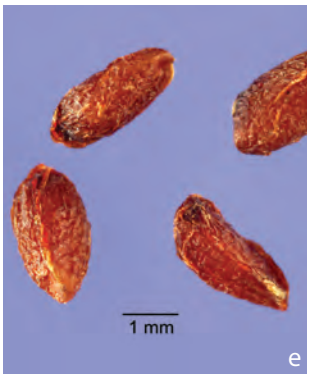
HISTORICAL USE Native Americans ate the fruits and sometimes used them in pemmican. The berries are still popularly used in jams, jellies, and pies.

Currant Family
Grossulariaceae


b


c


d



e

USAGE IN RESTORATION

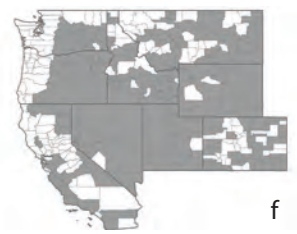
SEED COLLECTION Collect seed in late summer when fruits are ripe. Refrigerate until seed separation.

SEED TREATMENT Macerate fruit to extract seed. The seeds then require cold stratification at 28 to 36°F (-2.2–2.2°C) for 60 days. No scarification treatment is fully necessary to achieve good germination.

PLANTING Sow seed in early fall at 0.25 to 0.5 lb PLS/acre (0.28–0.56 kg/ha) to initiate natural stratification. This species also transplants well and forms suckers. Plants can also be grown from cuttings. It reproduces vegetatively by rhizomes and sprouting after cutting and fire.

BENEFITS Thrives in a variety of conditions, is easily cultivated from seed or cuttings, has high aesthetic value, and provides food and cover for wildlife. IT SHOULD NOT BE USED NEAR WHITE PINE STANDS.

SUITABILITY Present in (f); suitable precipitation (g)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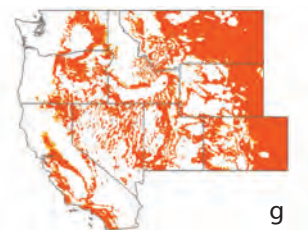
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Credits: a) Ivengol; b) Aung; c, d) Dave Powell, USDA Forest Service, www.bugwood.org; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Common snowberry

Symphoricarpos albus

SYNONYMS Snowberry, white coralberry, corpse berry

BIOLOGY

DESCRIPTION Small shrub growing up to 6½ ft (2 m) tall from rhizomes. Stems are slender with thin, reddish-brown bark. Leaves are opposite, round to oblong, thin, and have smooth or wavy-lobed margins. Flowers are sometimes solitary but are often in clustered in terminal clumps. Each flower has five petals, pink to white, is tubular or bell-shaped, and ¼ in (6 mm) long. Fruits are white and berry-like ¼ to ½ in (6–12 mm) in diameter.

BLOOM TIME May to September; flowers peak in June and July

ECOLOGY

HABITAT Snowberry is found from dry to moist areas, rocky slopes, river terraces, and open forests, ranging in elevation from 2500 to 6500 ft (750–2000 m). It is common in northern bunchgrass communities while its cousin, S. oreophilus, is more common in sagebrush communities.

ANNUAL PRECIPITATION 12–45 in (30–114 cm)

SOILS Coarse, well-drained; tolerates moderate salinity and can withstand low-nutrient conditions.

INTERACTIONS Important forage and cover source for birds/small mammals; not preferred by livestock.

HISTORICAL USE The fruits are largely considered toxic, leading to vomiting and dizziness. Native Americans at times used small amounts to settle stomachs. Fruits crushed in water are soap-like.

Honeysuckle Family
Caprifoliaceae


b


c


d

e

USAGE IN RESTORATION

SEED COLLECTION Collect seed in late fall or early winter by stripping fruit from branches. Separate seed using a rubbing board after fruit has dried.

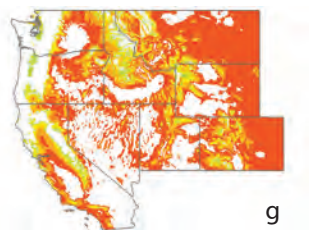
SEED TREATMENT Seed requires up to 3 months of warm stratification followed by a cold stratification period between 3 and 12 months, depending on specific site conditions.

PLANTING Sow seed in early fall at 5 lb PLS/acre (5.6 kg/ha) to initiate natural stratification; establishment will be sporadic. Due to extensive stratification requirements, planting plugs, poles, or potted plants yields higher establishment than direct seeding; plant these from spring to fall.

BENEFITS Snowberry thrives in a variety of ecological conditions. The extending root system is excellent for binding upper soil layers, applicable for projects adjacent to riparian areas.

SUITABILITY Present in (f); suitable precipitation (g)


f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Credits: a) Karel J; b) Art Mechanic; c, d) Frank Vincentz; e) Steve Hurst, USDA ARS, USDA PLANTS Database.

Scientific Name	Common Name	Page Number
Achillea millefolium	western yarrow	6
Arnica cordifolia	heartleaf arnica	8
Artemisia ludoviciana	white sage	10
Balsamorhiza sagittata	arrowleaf balsamroot	12
Delphinium nuttallianum	twoleaf larkspur	14
Dieteria canescens	hoary aster	16
Eriogonum umbellatum	sulphur-flower buckwheat	18
Gaillardia aristata	common gaillardia	20
Geranium viscossimum	sticky-purple geranium	22
Hedysarum boreale	northern sweetvetch	24
Ipomopsis aggregata	scarlet gilia	26
Linum lewisii	Lewis flax	28
Lomatium dissectum	fernleaf biscuitroot	30
Lupinus sericeus	silky lupine	32
Penstemon eatonii	firecracker penstemon	34
Penstemon rydbergii	Rydberg's penstemon	36
Penstemon strictus	Rocky Mountain penstemon	38
Sphaeralcea coccinea	scarlet globemallow	40
Symphyotrichum spathulatum	western mountain aster	42
Thermopsis rhombifolia	mountain goldenbanner	44

Precip. (in)	Elevation (ft)	Bloom Time	Seed Treated	Seed Rate (lb PLS/ac)
8 – 60	200 - 9000	May - Aug		1–3
10 - 35	1000 - 10000	May - Jul	X	10
8 - 60	3000 - 10000	May - Jul	X	1–3
8 - 25	3500 - 8000	Apr - Jul	X	16
8 - 24	3000 - 10000	May - Jul	X	3
8 - 20	3000 - 10000	Jul - Sep	X	5
8 - 18	3000 - 8000	Jun - Sep	X	8 - 10
16 - 35	3000 - 9000	May - Sep		10
10 - 20	1000 - 10000	May - Aug	X	9
12 - 18	4000 - 9500	Jul - Aug	X	15
8 - 20	2000 - 8000	Jun - Aug	X	3
10 - 24	800 - 10000	May - Jul		8
14 - 100	0 - 10000	May - Jul	X	2-4
8 - 24	1500 - 10000	May - Aug	X	11 - 35
8 - 20	3300 - 8000	May - Jul	X	1.5 - 3
20 - 35	1000 - 8000	May - Jul		3
14 - 26	6000 - 10000	May - Jun	X	4
6 - 35	3500 - 9000	Jun - Jul	X	4
10 - 20	3000 - 10000	May - Aug		5
10 - 24	2500 - 7000	May - Aug	X	11

Scientific Name	Common Name	Page Number
Agropyron trachycaulum	slender wheatgrass	46
Deschampsia caespitosa	tufted hair grass	48
Festuca idahoensis	Idaho fescue	50
Hesperostipa comata	needle and thread	52
Leymus cinereus	basin wildrye	54
Pascopyrum smithii	western wheatgrass	56
Pseudoroegnaria spicata	bluebunch wheatgrass	58
Puccinellia rupestris	Sandberg bluegrass	60
Sitanion hystrix	squirreltail	62
Sporobolus cryptandrus	sand dropseed	64
Stipa hymenoides	Indian ricegrass	66
*Carex nebrascensis**	Nebraska sedge	68

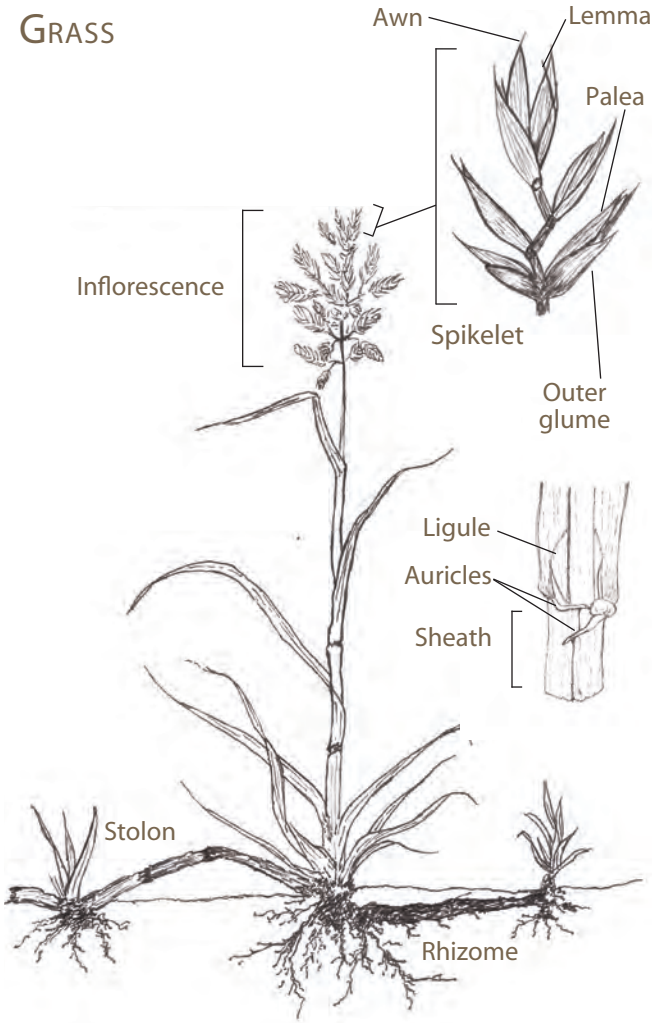
* Grass-like species

Precip. (in)	Elevation (ft)	Bloom Time	Seed Treated	Seed Rate (lb PLS/ac)
8 - 25	4500 - 13000	May - Jul		6 - 8
20 - 40	0 - 14000	Jul - Sep	X	1 - 2
12 - 30	1300 - 10000	May - Jul		4 - 8
7 - 24	1000 - 2500	Jun - Jul		8
7 - 20	2000 - 9000	Jun - Jul		9
10 - 36	1000 - 9000	Jul - Aug		10 - 15
8 - 30	300 - 10000	May - Jun	X	6 - 8
6 - 20	1000 - 12000	Apr - Jun		2 - 4
6 - 18	3500 - 9000	May - Jul		8 - 10
8 - 16	3000 - 8000	Jun - Aug		1
7 - 20	2000 - 10000	May - Jul	X	6 - 8
12 - 35	2000 - 9000	May - Jul	X	5

Precip. (in)	Elevation (ft)	Bloom Time	Seed Treated	Seed Rate (lb PLS/ac)
12 - 25	3000 - 11000	Apr - Jun	X	3 - 4
12 - 30	200 - 10000	May - Jun	X	1
8 - 45	2000 - 11000	May - Jun	X	2 - 3
8 - 40	4000 - 8000	Jul - Sep		1 -3
8 - 30	2500 - 10000	Jul - Sep		1 - 3
5 - 18	0 - 8000	Jul - Sep		6 - 8
12 - 60	2500 - 11000	Mar - Jun	X	0.25 - 1
13 - 35	2500 - 4000	May - Jun	X	0.25
11 - 35	3800 - 9000	May - Jun	X	1 - 3
11 - 60	1500 - 9000	May - Jul	X	1
6 - 40	2000 - 9000	Jun - Sep		1
9 - 24	0 - 7000	Jul - Aug	X	1 - 2
8 - 18	4000 - 8000	Mar - Aug	X	3
8 - 24	4500 - 8000	Jun - Jul	X	1 - 3
12 - 20	2600 - 8500	Mar - Jun	X	0.25 - 0.5
12 - 45	2500 - 6500	May - Sep	X	5

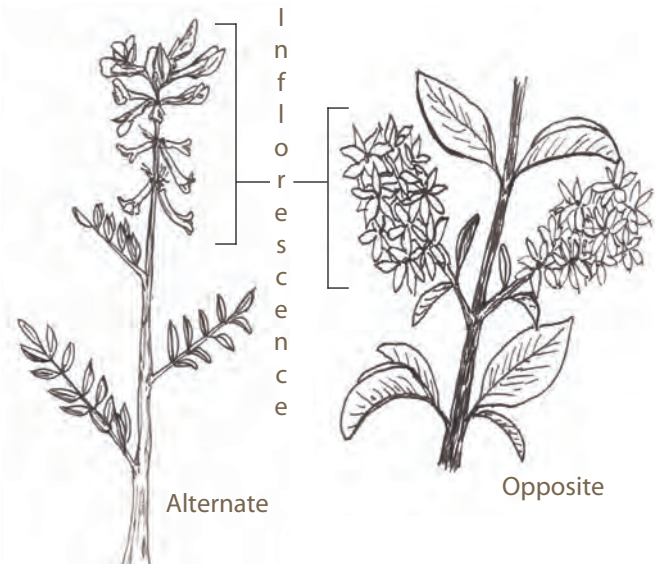
Plant structure

Grass



Forb

Shrub



Drawings Rachel Winston, MIA Consulting

Leaf traits

Type

Simple

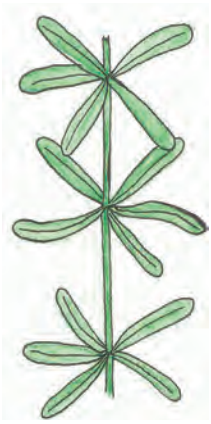
Palmate compound

Pinnate compound

Arrangement

Alternate

Opposite

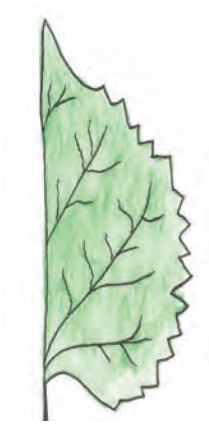


Whorled

Margin

Entire (smooth)

Lobed



Serrated (toothed)

Drawings Jacqi Moulton, MIA Consulting

GLOSSARY

alternate	Leaf arrangement where one leaf arises from the stem at a time
annual	A plant that flowers and dies within a period of one year from germination
auricles	Claw appendages at the base of the blade of some grasses
awn	Bristle-like appendage on grass seeds extending beyond the seed, as throughout the seed heads of wheat
axil	Where a leaf attaches to the stem
basal	At the base of a plant or plant part
biennial	A plant that flowers and dies between its first and second years and often does not flower in its first year
bolting	Plant stage at which the flower stalk begins to grow
bract	A small, leaf-like structure below the flower
decussate	Leaves arranged in pairs and alternately perpendicular to leaf pairs above and/or below
disc flower	Small, tubular flower of an Asteraceae species inflorescence; also called disc floret
divided	A leaf whose margin is not entire but rather extends inward to the midvein, creating numerous small leaflets
entire	Smooth, continuous margin without indentations
floret	One of the small, closely clustered flowers forming the head of a composite flower in the sunflower family
flower head	Cluster of numerous florets which is common of the sunflower family; resembles one individual flower
glumes	Pair of bracts which enclose the floret(s) (as in the grass family)
inflorescence	The flowering part of a plant

lemma	The larger, lower bract which, along with the palea, serves to contain the grass floret(s) held within
ligule	Thin, papery outgrowth at the junction of leaves and leaf stems in grass species
lobed	A leaf with shallow or deep, rounded segments, as in a thistle rosette leaf
opposite	Leaf arrangement where two leaves arise from the stem at the same height but on opposite sides of the stem
palatability	A rating (high, medium, low) given to a plant based on nutritional value and animal preference
palea	Shorter, upper bract which, along with the lemma, serves to contain the grass floret(s) held within
palmate compound	Compound leaf structure with leaflets radiating from a common point, resembling the fingers of a hand
panicle	Inflorescence with a main axis and branches; a pyramidal branched flower cluster
pappus	A group of hairs, scales, or bristles borne on the crown of an achene in an Asteraceae flower
perennial	A plant living more than two years
pinnate compound	Compound leaf structure resembling a feather, where leaflets grow in a row on either side of a mid-rib
prostrate	Lying flat on the ground; having ground trailing stems that do not root
ray flower	Petal-like flower component of Asteraceae flowers
rhizome	A rootlike subterranean stem, commonly horizontal in position, that produces roots below and sends up shoots progressively to the upper surface

rosette	A compact, circular, and normally basal cluster of leaves
scarification	The process of scratching, cutting, or softening a protective seed coat
seed head	Synonym for flower head
sepal	One of the small, modified leaves usually in a ring beneath petals
serrated	With sharp teeth pointing forward
sheath	Portion of a leaf surrounding the stem- especially common in grasses
simple	Not compound or branched
spike	Long, narrow, unbranched cluster of flowers on a central stem
spikelet	Secondary spike, usually applied to grass structures
stamen	Male reproductive structure of a flower
stolon	Horizontal branch from the plant base that gives rise to new plants from buds or nodes
stratification	the process of exposing seeds to extreme high or low temperatures
succulent	Thick and fleshy
tiller	A shoot from an adventitious bud at the base of a plant
tubeling	Seedling grown in a small tubular greenhouse cone
umbel	Cluster of flowers where all flower stalks are of similar length and originate from the same point
whorled	Cluster of three or more leaves arising out of the stem at the same height in a ring around the stem

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Native Plant Network Propagation Protocol Database:
http://www.nativeplantnetwork.org

TROPICOS, Missouri Botanical Garden:
http://www.tropicos.org/

Unites States Department of Agriculture Native Plants Database:
http://plants.usda.gov/

United States Department of Agriculture, Natural Resources Conservation Service Geospatial Gateway:
http://datagateway.nrcs.usda.gov/

Utah State University Extension:
http://extension.usu.edu/range/index.htm

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Species & common names