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## **Propagation, Production, and Management of Selected Plants with Ethnobotanical Uses in Southern Idaho**



# Acknowledgements

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Issued October 2021

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# Introduction

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This Technical Note details the production of a selection of ethnobotanically important native plant species that occur in southern Idaho. This document is intended to be a reference for those interested in successfully propagating, planting, and managing these native species. It includes an overview of the ethnographic use of these plants by Native Americans of the region but is not intended to be a definitive ethnobotany of any tribe, or of the region itself.

## Cultural Setting

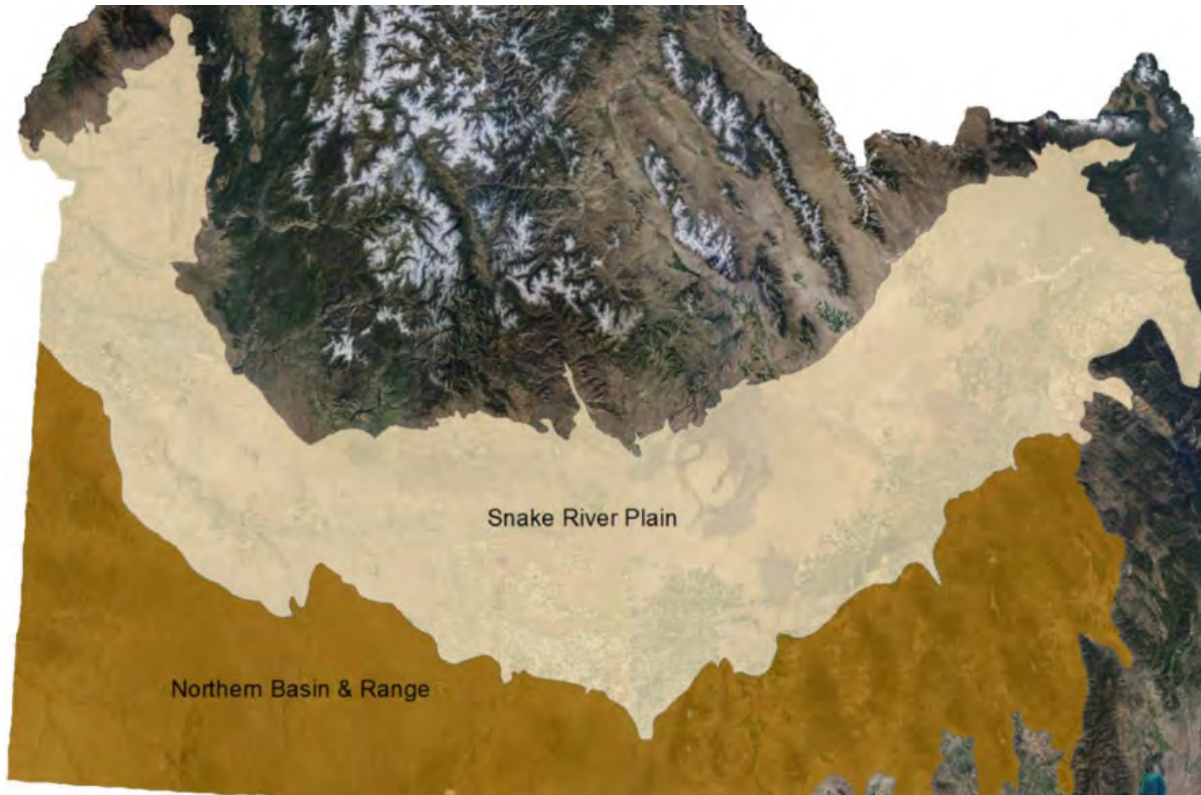
The main cultural groups living in southern Idaho are the Northern Shoshone, Bannock, and Northern Paiute Tribes (Idaho State University, 2021). The descriptions of native plants used in this document are mostly based on the historic ethnobotanical record. This is not to imply that these plants are no longer used by Native people. In fact, native plants have retained their cultural significance and are still used today.



*Culture areas of southern Idaho. Adapted from Digital Atlas of Idaho (Idaho State University, 2021).*

## Ecological Setting

The scope of this guide covers plant species native to the Snake River Plain and Northern Basin and Range Level III Ecoregions of southern Idaho (U.S.-Environmental Protection Agency, 2013b). Much of the Snake River Plain Ecoregion is dominated by sagebrush steppe habitat with interspersed wetland and riparian areas. It is significantly lower and more gently sloping than the surrounding ecoregions. The Northern Basin and Range Ecoregion is a mosaic of lava plains, rocky uplands, valleys, alluvial fans, and isolated mountain ranges. It is on average cooler and has more available moisture than the Snake River Plain and the more southern portions of the Great Basin. The valleys are typically dominated by sagebrush steppe or saltbush vegetation while uplands host a variety of mountain shrub and conifer communities.



*Map of southern Idaho showing the Snake River Plain and Northern Basin and Range Level III Ecoregions (U.S. Environmental Protection Agency, 2013a). Satellite imagery courtesy of Google Earth, 2021.*

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## HARDSTEM BULRUSH

*Schoenoplectus acutus* (Muhl. ex Bigelow) Á. Löve & D. Löve

Plant Symbol = SCAC3

**Alternate Names:** *Scirpus acutus*, tule



*Hardstem bulrush (Schoenoplectus acutus). Photo by Mary Wolf*

### **Description**

**General:** Sedge Family (Cyperaceae). Hardstem bulrush, commonly referred to as tule, is a perennial, rhizomatous, wetland obligate species that reaches up to 10 ft in height and forms very dense stands. The stems are upright, gray-green to dark-green, round, 0.4 to 0.8 in thick and 3 to 10 ft tall. The leaves are few and short, found at or near the base, and commonly have a well-developed sheath. The inflorescence is a terminal panicle of 3 to 10 spikes which are made up of up to 50 or more spikelets. Each spike may be on a short pedicel or sessile. The inflorescence is exceeded by a 1 to 4 in lateral bract. The fruit is a dark brown lenticular achene up to 0.1 in long (Welsh et al., 2003).

### **Habitat and Adaptation:**

Hardstem bulrush grows at low to mid elevations, generally below 7,500 ft, in inundated to periodically wet areas of marshes, swamps, and meadows and along lake, reservoir, and pond shorelines. Hardstem bulrush forms large, often monoculture, stands with the young plants on the outside and the older plants in the center of a stand. It is generally found in areas of standing water ranging from 4 in to more than 5 ft in depth. It does not tolerate long periods of very deep water. Hardstem bulrush grows on soils that range from peat to alkaline and silts to coarse substrates. It grows and spreads on alkaline, saline, and brackish sites and will re-sprout after fire.

Burning increases its production and protein content. Hardstem bulrush reproduces from seed and rhizomes. It will spread more than 18 in in one growing season. Associated plants include cattails (*Typha* spp.) and willows (*Salix* spp.).

### **Ethnobotany**

The young sprouts and basal shoots of hardstem bulrush can be eaten raw or cooked. The rhizomes and unripe flower heads can be boiled as a vegetable. Hardstem bulrush rhizomes can be boiled and made into syrup, or sundried and pounded into flour (Blankinship, 1905; Fowler, 1990). Hardstem bulrush pollen was eaten as a flour in bread, mush or pancakes. The seeds were beaten into baskets or pails, ground into meal, and used as flour. (Fowler, 1990). In some areas, Northern Paiute people derived most of their subsistence from marshes (Fowler, 1990). They used hardstem bulrush stems (tules) to make sandals, clothing, bags and basketry. They also used tules to construct houses and twine mats for the inside of houses. They made hunting nets and duck decoys (either covered with duck skin or with duck feathers attached to the outside) (Fowler, 1990). The Northern Shoshone used hardstem bulrush

and other tules to make mats for houses. They also used tules to make basketry, including gathering and berrying baskets, roasting trays, fans, gambling baskets, and hats for women. Baskets for holding liquids, such as water bottles, drinking cups, and cooking vessels, were sealed with pitch (Lowie, 1909).

Tule houses were common in many parts of the Great Basin culture area. Northern Paiute people typically made tule houses in a conical shape. This type of house was made by the Northern Shoshone and Bannock peoples as well (Fowler, 1990). The basic plan was to cover willow-frame houses with tule mats, which were made of single layers of tule sewed in rows with twine. The tules could be pulled tightly together to form a water-resistant surface. Overlapping tule mats were rain-proof and provided insulation (Fowler, 1990).

Hardstem bulrush stems contain air and are very buoyant. Tule boats were a type of lightweight watercraft intended for use in shallow water in the marshes. Tules were gathered in fall when they are hard, dry, and most buoyant. Even in water, the boats stayed dry for several hours and didn't sink (Fowler, 1990). The Northern Paiute (Fowler, 1990) and Northern Shoshone (Steward, 1938) made boats of hardstem bulrush stems bound together with cordage. Steward (1938) reported that people used these boats for fishing on the Snake River below Twin Falls.

#### **Conservation Uses**

Hardstem bulrush's dense root mass makes this species an excellent choice for soil stabilization. Its above ground biomass provides protection from erosive wave action and stream currents that erode shorelines or stream banks. The rhizomatous root system also forms a matrix for many beneficial bacteria, making this plant an excellent choice for wastewater treatment (Hurd et al., 1994). The seeds provide food for waterfowl. The dense tules provide excellent nesting cover for numerous waterfowl and wetland birds (Boggs et al., 1990). Muskrats and beaver will eat the rootstock and young shoots. Muskrats also use the stems for building their houses.

#### **Seed and Plant Production**

Hardstem bulrush reproduces sexually by seed and asexually through vegetative spread via rhizomes.

*Seed Collection and Cleaning:* Seeds ripen in late August to September. Seeds are not held tightly in the seed head, and high winds, frost, and brushing against the seed head will cause the seeds to dislodge. Seed may be collected by hand stripping from the plant or by clipping the seed head using a pair of hand shears. A handheld power seed harvester may also be used. A hammermill is needed to break up coarse debris and knock seed free from the panicle. Cleaning can be accomplished using a seed cleaner with a No. 12 top screen and a 1/20 in bottom screen. Screens should be sized so desired seed will fall through and debris and weed seed are removed. Air flow and screen size may require adjustment to optimize the cleaning process for each collection.



*Stems of hardstem bulrush, also known as tules. Photo by Mary Wolf.*



*Greenhouse Plant Production:* Improved germination rates have been achieved with cold/wet stratification treatment with the seeds in a mixture of water and sphagnum moss at 36 °F for 30 to 75 days. Others have found success using a 10% acid wash for 45 minutes followed by a thorough washing then wet pre-chilling the seed for 75 days. Seed needs light, moisture, and heat for germination. Place seed on the soil surface and press in lightly to assure good soil contact. Do not bury the seed. Soil should be kept moist. Greenhouse temperatures should be maintained at approximately 95 to 100 °F. Germination should begin within 7 to 10 days. Maintain moisture until plants are to be transplanted (Tilley, 2012).

### **Establishment and Management**

*Wild transplants:* Planting plugs, either from the greenhouse or wild transplants, is the surest way to establish a new stand of hardstem bullrush. Care should be taken to collect plants from weed-free areas so that weeds are not relocated to the transplant site. Plug spacing of 12 to 18 in will fill in the interspaces within one growing season. Soil should be kept saturated. Standing water should be no deeper than 1.5 to 2 in during the first growing season. Larger transplanted plugs can handle more standing water if the stems are cut long enough to ensure they are out of the water. Raising and lowering the water level during the establishment period will speed up spreading. Water levels can be managed to enhance spread and to control weeds.

Water level in a wetland should be fluctuated from saturated conditions up to a maximum depth of 12 in of standing water for establishing plants. The young plants can handle deeper water, but not for an extended period of time. Hardstem bullrush can tolerate periods of drought and total inundation. It will spread into water depths of 3 to 5 ft. Water levels can be managed to either enhance or reduce spread as well as to control terrestrial weeds. Hardstem bullrush may be replaced by cattail (*Typha* spp.) if water levels are dropped for an extended period (Harris and Marshall, 1963). Hardstem bullrush will sprout from rhizomes following fires (Smith and Kadlec, 1985).



*Hardstem bullrush rhizome and shoots. Photo by Mary Wolf.*



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# COMMON THREESQUARE

*Schoenoplectus pungens* (Vahl) Palla

Plant Symbol = SCPU10

**Alternate Names:** American threesquare, basket grass, beach grass, sweet grass, chair-maker's rush, tule



*Common threesquare (Schoenoplectus pungens). Photo by Derek Tilley.*

the stems (tules) of common threesquare to make clothing, mats, and sandals (Fowler, 1990). Lowie (1909) reported that the Northern Shoshone used various “rushes” to make mats and basketry; presumably, common threesquare was one of the plants they used.

Northern Paiute people ate common threesquare shoots fresh in the spring. Later in the season, they gathered the seeds by cutting the stalks. They dried the tops and worked out the seeds with a hand stone. The seeds were then parched, ground into flour and cooked as mush (Fowler, 1990).

## Conservation Uses

Common threesquare is good for stabilizing or restoring disturbed or degraded areas, for erosion and slope control, and for wildlife food and cover.

## Description

General: Sedge Family (Cyperaceae). Common threesquare is an herbaceous, rhizomatous perennial with upright, triangular, rarely concave stems. The stems are erect, 6 to 40 in tall and up to ¼ in wide. The narrow (⅛ in) grass like, basal leaves are all in the lower third of the stem. Flowers are lateral clusters of 1 to 7 sessile spikelets subtended by an involucre bract that appears to be a continuation of the stem. The scales are yellowish to reddish brown. Fruits are small, brown, lenticular achenes.

## Habitat and Adaptation

Common threesquare occurs in estuarine wetlands, playas, salt marshes, freshwater marshes, ponds, streams, reservoirs, and lake fringes below 6,600 ft. It is usually found in standing water 4 to 6 in deep and will tolerate alkaline and saline conditions as well as freshwater. Common threesquare can survive seasonal drought when the water table is more than 3 ft below the surface. It grows in fine silty clay loam to sandy loam soil. Associated plants include cattails (*Typha* spp.), willows (*Salix* spp.), and hardstem bullrush (*Schoenoplectus acutus*).

## Ethnobotany

Many tribes have traditionally used the stems of common threesquare for weaving baskets (Stevens et al., 2012). The Northern Paiute used

*Wildlife:* The seeds are a choice food for wetland birds. The stems provide nesting habitat for blackbirds and marsh wrens (Martin et al., 1951).

### Seed and Plant Production

*Seed Collection and Cleaning:* Seeds ripen from late July through August. Seeds are held in the seed head for a couple of months if not disturbed by high winds or inundation. Seeds may be collected by hand-stripping them from the plant or by clipping the seed heads with a pair of hand shears. Power seed harvesters are also effective. When collecting seed heads, make sure the spikelets feel full and that the seeds have developed. Cleaning can be accomplished using a seed cleaner with a No. 7 screen top screen and a 1/20 in bottom screen. Screens should be sized so desired seeds will fall through and debris and weed seeds are removed. Adjust air velocity so that chaff is blown away. Air flow and screen size may require adjustment to optimize the cleaning process for the given situation.

Wide differences in germination may occur between sites and between different years. Germination of this species is difficult; however, germination rates may be enhanced by light scarification and wet pre-chilling the seeds in a mixture of water and sphagnum moss at 36 °F for 30 days. After pre-chilling, place the seeds on the soil surface in pots or flats and provide light, moisture and warm temperatures for germination. Press seed into soil surface very lightly and do not cover seed. Plants will desiccate if the soil dries out and will either fail to germinate or die as young seedlings. The greenhouse should be kept hot (90 to 100 °F). Germination should begin within a few weeks. Maintain moisture until plants are to be transplanted (Hoag et al., 2011).

*Wild Transplants:* No more than 1/4 of the plants in an area should be collected. If no more than 1 ft<sup>2</sup> is removed from a 4 ft<sup>2</sup> area, the plants will grow back in the hole in one good growing season. A depth of 6 in is sufficiently deep for digging plugs. Take care not to collect plants from weedy areas as these weeds can be relocated to the transplant site.

The Skokomish Tribe of Washington has used a modified clam gun to gather wild transplants. The clam gun consists of a piece of tailpipe with a T-handle and a siphon hole drilled on the top. The edges are sharpened and make a clean cut with the tube approximately 1 ft long and three inches in diameter. Three to twelve tillers are recovered per plug extraction (Stevens et al., 2012).

### Establishment and Management

Planting plugs (either from the greenhouse or wild transplants) is the surest way to establish a new stand of this species. Plug spacing of 12 to 18 in will fill in within one growing season. Soil should be kept saturated. Common



*Common threesquare. Note the three-cornered stems and the inflorescence at the side, rather than the top, of the stem. Photo by Mary Wolf.*

threesquare can tolerate 2 to 3 in of standing water during the first growing season. Fluctuate the water levels during the establishment period to increase the rate of spread. Water levels can be managed to both enhance expansion of threesquare and to control weeds.

Mature common threesquare can tolerate up to 12 to 18 in of standing water if the water level is fluctuated during the growing season. This species can tolerate periods of drought and total inundation. Water levels can be managed to either enhance or reduce spread as well as to control terrestrial weeds (Stevens et al., 2012).



*Common threesquare seed. Photo by Derek Tilley.*

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## CATTAIL

### Broadleaf cattail, *Typha latifolia* L.

Plant Symbol = TYLA

### Narrowleaf cattail, *Typha angustifolia* L.

Plant Symbol = TYAN



Broadleaf cattail (*Typha latifolia*). Photo by Derek Tilley

#### Description

*General:* Cattail Family (Typhaceae). Cattails are herbaceous, rhizomatous, perennial plants with long, slender, green stalks topped with brown, fluffy, sausage-shaped flowering heads. Plants of both species are 60 to 115 in tall. Plants flower in June-July. The spike-like, terminal, cylindric inflorescence is medium to dark brown and has staminate flowers above and pistillate flowers below. *T. angustifolia* has a naked axis of 0.5 to 3 in between the staminate and pistillate flowers. *T. latifolia* has no space between the staminate and pistillate flowers. The basal leaves are thin with parallel veins running their length. Leaves of *T. angustifolia* are 0.15 to 0.5 in wide, while leaves of *T. latifolia* are 0.4 to 1.2 in wide. *T. angustifolia* generally occurs in deeper water than *T. latifolia* and has fewer and larger rhizomes, resulting in a low rate of cloning but enabling it to grow in deeper water. Cattails spread both vegetatively and by seed, particularly under drawdown conditions. *T. angustifolia* has a higher allocation to sexual reproduction. *T. latifolia* is native to North America. *T. angustifolia* may have been introduced from Europe to the Atlantic Coast in colonial times (Smith, 2012a; Smith, 2012b).

**Habitat and Adaptation:** Cattails are an obligate wetland indicator plant species. Cattails are always found in or near water, in marshes, ponds,

lakes and depressions at elevations below 7,500 ft. They tolerate perennial flooding, saturated soil conditions and moderate salinity. Cattails, like many emergent wetland species, tolerate drawdown cycles that occur to varying degrees in different wetland and riparian systems. Compared to *T. angustifolia*, *T. latifolia* clones rapidly and produces a large leaf surface area, which may contribute to its superior competitive ability (Grace & Wetzel, 1982). Associated plants include willows (*Salix* spp.), bulrushes (*Schoenoplectus* spp.), and various sedges.

#### Ethnobotany

All parts of the cattail are edible when gathered at the appropriate stage of growth. Cattail rhizomes are one of the first food sources to become available in early spring. Rhizomes can be eaten fresh or split into strips then roasted and dried. The dried pieces can be ground into flour (Fowler, 1990). The young shoots are cut from the rhizomes in the spring when they are about 4 to 16 in long. These shoots can be eaten raw or steamed. The young flower stalks can be taken out of their sheaths and eaten raw or cooked (Clarke, 1977; Fowler, 1989; Roos-Collins, 1990; Fowler,



*The staminate flowers of cattail contain abundant pollen. Photo by Derek Tilley.*

1990). Cattails produce abundant pollen, which was mixed with water, kneaded, and formed into cakes. The cakes are traditionally cooked in the coals between layers of cattail leaves. These cakes were stored for later use (Fowler, 1990). Cattail seeds are edible once the down is removed by burning and winnowing. The processed seeds can be ground into meal and made into cakes or mush (Fowler, 1990).

In addition to being a valuable food source, cattails had many other uses. The down was used as bedding material and as a poultice applied to burns and scalds (Blankinship, 1905). Cattail leaves were used as a fiber similar to tules. Fowler (1990) details cattail leaf use by the Northern Paiute for basketry fiber, rugs, bedding, and building materials. Cattail leaves were used as twine to make sandals or to secure the edges of mats and woven items. Cattail mats were the preferred material for house walls because the flat leaves shed rain and snow better than round bulrush stems. House mats were made by spreading cattails out 2 in thick and securing them to horizontal willow poles with twine made from sagebrush bark. These mats were overlapped around a house framework like shingles on a roof, then held down with willow rings. A cattail bundle placed at the door kept water from dripping inside the house. Cattail mat houses were cool in summer and warm in winter (Fowler, 1990).

### **Conservation Uses**

Cattails are used widely for wetland restoration and in constructed wetlands for tertiary water treatment.

*Wildlife:* Cattails provide important food and cover for muskrats (Fritzell, 1989). Cattails provide shelter and nesting cover for sandhill cranes (Littlefield, 1995), wrens, redwing blackbirds, and yellow-headed blackbirds (Pojar & MacKinnon, 1994). The multitudes of tiny, wind-carried seeds are too small and hairy to be attractive to most birds (Hotchkiss & Dozier, 1949).

### **Seed and Plant Production**

*Seed Collection and Cleaning:* Harvest seed by taking hand clippers and cutting the stem off below the seed heads or by stripping the seed heads off the stalk. Collect, dry and store seeds in burlap or brown paper bags. Seed is not typically further processed to remove the pappus (fluff).

*Live Plant Collections:* No more than 1/4 of the plants in an area should be collected. If no more than 1 ft<sup>2</sup> is removed from a 4 ft<sup>2</sup> area, the plants will grow back in the hole in one good growing season. A depth of 6 in is sufficiently deep for digging plugs. Donor plants that are drought-stressed tend to have higher revegetation success.



*Greenhouse Plant Production:* Seeds are non-dormant but require light for germination. Seeds germinate at diurnal temperatures of 95 to 77 °F (Baskin, 2003). Keep the soil surface moist. Seeds will begin to germinate after a couple of weeks. Plants are ready to come out as plugs in 100 to 120 days (Stevens & Hoag, 2000a; Stevens & Hoag, 2000b). These plants are very small; growing plants to a larger size will result in increased revegetation success.

### Establishment and Management

Cattails may be planted from bare rootstock, seedlings from container stock, or seeded directly into the soil (Hoag & Sellers, 1995). Cattail seeds germinate readily and are a cost-effective means to propagate cattail on moist soils. Where there is moving water, bare rootstock or seedlings are the preferred method of revegetation. Both *Typha* species can spread aggressively in disturbed wetland situations and can become a monoculture.

*Seeding:* Plant seed in the fall in a clean, moist, weed-free seed bed. Flooded or ponded soils will significantly increase seedling mortality. Broadcast seed and roll in or rake  $\frac{1}{4}$  to  $\frac{1}{2}$  in from the soil surface. Some seed may be lost due to scour or flooding.

*Planting:* Live transplants should be planted in moist (not flooded or saturated) soils as soon as possible after harvest. Plants should be transported and stored in a cool location prior to planting. Plugs can be split into smaller units, generally no smaller than 2.5 x 2.5 in, with healthy rhizomes and tops. For ease in transport, soil may be washed gently from roots. The roots should always remain moist or in water until planted. Clip leaves and stems from 6 to 10 in; this allows the plant to allocate more energy into root production. Plant approximately 3 ft apart. Plants should be planted closer together if the site has fine soils such as clay or silt, steep slopes, or prolonged inundation. Ideally, plants should be planted in moist soils in late fall just after the first rains (usually late October to November). This enables the root systems to become established before winter dormancy occurs.



*Cattail rhizomes with shoots. Photo by Mary Wolf.*

*Management:* Cattails, like many emergent wetland species, tolerate the drawdown cycles that occur in different wetland and riparian systems. Flood and drought are disturbance factors that vary in frequency, magnitude, and predictability. Frequency relates to the number of episodes per unit time while magnitude of flooding can be expressed in terms of water volume, velocity, gradient, depth, duration, and season of inundation. When planting cattails, the flood-draw-down cycles must be taken into consideration for successful revegetation.

Heavy grazing will eliminate cattails, as well as other native species, from riparian corridors. However, cattails are fairly resistant to moderate grazing as long as wet soils are not compacted.

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## INDIAN RICEGRASS

*Achnatherum hymenoides* (Roem. & Schult.) Barkworth

Plant Symbol = ACHY

**Alternate Names:** Indian mountain-ricegrass, Indian millet, wye, silky mountain rice, sandgrass; *Oryzopsis hymenoides*, *Stipa hymenoides*



Indian ricegrass (*Achnatherum hymenoides*). Photo by Mary Wolf.

### Description

**General:** Grass Family (Poaceae). Indian ricegrass is a native perennial bunchgrass that is 8 to 30 in tall. It has many tightly rolled, slender leaves that grow from the base of the bunch, giving it a slightly wiry appearance. The inflorescence is a spreading panicle with a single flower at the end of each hair-like branch. Flowering time is April-June. Seeds are round to elongated, black or brown, and generally covered with a fringe of short, dense, white callus hairs (Columbus et al., 2012; Ogle et al., 2013).

**Habitat and Adaptation:** Indian ricegrass grows in short and mixed grass prairie, desert plains and foothills, especially in rocky or sandy soil. It is found in desert or sagebrush scrub, pinyon-juniper and ponderosa pine forest communities up to 11,000 ft. Indian ricegrass is often an early seral or pioneer species, establishing seedlings in open or disturbed sites and on sandy soils. Drought tolerance combined with fibrous root system and fair to good seedling vigor, make Indian ricegrass common in areas receiving 8 to 14 in annual precipitation. Associated plants include needle and thread (*Hesperostipa comata*), the big sagebrush (*Artemisia tridentata*) complex, saltbush species (*Atriplex* spp.), winterfat (*Krascheninnikovia lanata*), and juniper (*Juniperus* spp.).

### Ethnobotany

Indian ricegrass was a staple food throughout Northern Paiute and Shoshone territory (Steward, 1938) as well as throughout the Great Basin and Intermountain West. Indian ricegrass stands were managed by replanting seeds and burning areas to stimulate regrowth (Steward, 1933; Stoffle et al., 1989). The seed heads were beaten into baskets and the seed was dried, winnowed, and stored for winter use (Stoffle et al., 1989). The chaff was removed by flash burning (Fowler, 1976). Ground seed made a flour used in mush or soup (Steward, 1933; Fowler, 1986; Fowler, 1990). In addition to being a staple food, this soup was considered a healthful food to eat when suffering from stomachaches, colic, or aching bones (Fowler, 1989).

More recently, Indian ricegrass flour was marketed as a gluten-free specialty flour under the trademark 'Montina' by a grower cooperative in Montana (Flaherty, 2002). As of 2021, this product was no longer available on the market.

### Conservation Uses

*Erosion control/reclamation:* One of Indian ricegrass's greatest values is for stabilizing sites susceptible to wind erosion. It is well adapted to stabilization of disturbed sandy soils in mixes with other species. It is naturally an early invader onto disturbed sandy sites (after and in concert with needle and thread grass). It is also one of the first grasses to establish on cut and fill slopes. It does not compete well with aggressive introduced grasses during the establishment period but is compatible with slower developing natives.

*Wildlife:* Indian ricegrass provides wildlife forage as well as an abundance of nutritious seed. It is an excellent food source for birds. Rodents collect the seed for winter food supplies. Indian ricegrass is considered good cover habitat for small animals and birds (Tirmenstein, 1999).

*Grazing/rangeland:* Indian ricegrass is highly palatable to livestock and wildlife (Ogle & Brazee, 2009). It is a preferred feed for cattle, horses and elk in all seasons. It is a preferred feed for sheep, deer and antelope in spring and a desirable feed for sheep, deer, and antelope in late fall and winter (Ogle & Brazee, 2009).



*Indian ricegrass seed. Photo by Mary Wolf.*

### Seed and Plant Production

*Greenhouse Plant Production:* To produce seedlings for transplanting, use seed that is at least 4 to 6 years old that has been stored under cool and dry conditions. Moist-stratify seed at 38 to 40 °F for 30 days prior to planting in the greenhouse. Plant the stratified seed into containers and grow seedlings for approximately 60 to 90 days with typical greenhouse conditions and irrigation before transplanting in the field. If seed is younger than 4 to 6 years of age, modest seed scarification with sandpaper plus a 6-to-10-month moist stratification may be required prior to planting seed (Scianna, et al., 2012).

*Seed Production and Cleaning:* Field seed production of Indian ricegrass has been very successful under cultivated conditions. Seed production of Indian ricegrass is most productive and persistent on coarse-textured soils. Seed fields are productive for about five years. Soil fertility, field moisture during the fall, and plant regrowth in the fall will determine seed yield in the following growing season. Recommended row spacing varies from 24 to 36 in under irrigation and 36 in

under dryland conditions (14 to 16+ in annual precipitation). The recommended seeding rate for seed production in 36 in row spacing is 3.5 PLS lb/ac (Cornforth et al., 2001). Cultivation is needed for weed control and to maintain row culture.

Harvest seed in the hard dough stage, generally mid- to late July, either by direct combining or by windrowing followed by combining. Close inspection is necessary to determine optimum harvest date. Wind can readily shatter the ripe seed. Windrowing followed by combining helps to ensure more complete threshing, but windrows are also



prone to seed loss from wind. Seed yields range from about 100 lb/ac for dryland production to about 200 lb/ac from irrigated fields (Cornforth, et al., 2001). Seed must be dried immediately after combining to 12% bins/15% sacks moisture content.

The Aberdeen Plant Materials Center uses a two-screen scalper to begin the seed cleaning process. The scalper removes larger inert matter. Once the seed has been scalped it is run through a debearder which removes the copious amounts of fuzz (fringe of short, dense, white callus hairs). The seed is then processed through a three-screen clipper and a disc or indent cleaner to complete the seed cleaning process. There are approximately 162,000 seeds/lb.

### Establishment and Management

The major factor limiting establishment of Indian ricegrass is the high percentage of dormant seed. Two types of dormancy have been identified: 1) morphological seed dormancy associated with the hard seed coat, and 2) embryo dormancy (Booth et al., 1980). Research has shown that mechanical scarification of the seed improves germination (Jones & Nielson, 1992). Scianna et al. (2012) found a combination of modest seed coat scarification with sandpaper plus a 6 to 10 month moist chilling period at approximately 38 to 40 °F resulted in the highest germination of Indian ricegrass seeds. Dormant field planting in fall (after soil temperatures reach 40 °F or below) with light seed coat scarification is the preferred method for establishment of Indian ricegrass. However, commercial seed is rarely scarified. Embryo dormancy can be overcome by use of Gibberellic acid, kinetin, thiourea, and hydrogen peroxide but these methods are only slightly effective and not very practical (Robertson, 1976). A practical method to overcome seed coat dormancy is by dormant planting seed that has been properly stored for 4 to 6 years (Booth et al., 1980).

The best seeding results are obtained from seeding in very early spring on heavy to medium textured soils and in late fall on medium to light textured soils. Seed Indian ricegrass at a depth of ½ to 1 in on medium to fine textured soils and 1 to 3 in on coarse textured soils. A deeper planting depth puts the seed in contact with moist soil conditions, which aids in the stratification process and makes the seed less likely to be dug up by rodents. The recommended seeding rate for Indian ricegrass is 8 PLS lb/ac or approximately 30 PLS seeds/ft<sup>2</sup> (Ogle et al., 2011a). For erosion control or reclamation plantings, the seeding rate should be doubled. If used as a component of a mix, adjust to percent of mix desired. When planting seed mixes that include species that require shallower planting depths (0 to ¼ in), two separate seeding operations may be necessary. Plant Indian ricegrass first at the deeper planting depth and then plant the other components of the seed mix at the shallower depth.

Dormant fall seeding may improve germination. Summer and late summer (June-September) seedings are not recommended. Seedling vigor is fair to good, but the seed may have a high percentage of hard seed, and stands may take 2 to 5 years to fully establish. Indian ricegrass stands respond well to light irrigation and light fertilization.

Indian ricegrass establishes slowly and new seedlings should not be grazed before the late summer or fall of the second growing season. New stands should be producing some seed before light grazing is allowed (Ogle et al., 2011b).



*Indian ricegrass inflorescence. Photo by Mary Wolf.*

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## BASIN WILDRYE

*Leymus cinereus* (Scribn. & Merr.) Á. Löve

Plant Symbol = LECI

### Alternate Names:

*Elymus cinereus*



*Basin wildrye (Leymus cinereus). Photo by Mary Wolf.*

### Description

**General:** Grass Family (Poaceae). Basin wildrye is a large, coarse, robust, perennial bunchgrass. It is a long-lived cool season native with an extensive deep, coarse fibrous root system. Basin wildrye has long leaf blades (15 to 25 in) that are wide (up to  $\frac{3}{4}$  in), flat, with long pointed auricles. The reproductive stems are dense, stout, and strongly erect. Seed heads (spikes) are 6 to 10 in long. Basin wildrye clumps may reach 3 ft in diameter and 3 to 6 ft tall (10 ft under excellent soil and climate conditions). Growing points are 10 to 12 in above the crown. Basin wildrye has fair seedling vigor. It is one of the first grasses to initiate spring growth and produces an abundance of basal leaf growth until the development of seed heads in mid-June to mid-July. Following the development of seed heads, basin wildrye produces very little additional basal leaf growth and rapidly becomes coarse and stemmy. Regrowth does not occur following seed production (Ogle, 2000).

**Habitat and Adaptation:** Basin wildrye is found in canyons, roadsides, sagebrush scrub, and open woodlands at elevations between 2,000 and 9,000 ft. (Smith, 2012).

Basin wildrye is very winter hardy and has a rather broad climatic adaptation. It grows best

in areas with 8 to 20+ in annual precipitation. In lower rainfall areas, it grows along gullies or watercourses, or near sites with high seasonal water tables. It does not tolerate areas with extended periods of inundation. It will tolerate short-term winter flooding. It is susceptible to leaf and stem rust in wetter climatic areas. Basin wildrye has a broad soil texture adaptation, but it is not adapted to shallow soils. It is most common on deep soils with high water holding capacities. It is tolerant of low to moderately saline and sodic soil conditions and some low pH soils. Established stands of basin wildrye can tolerate long periods of drought. Basin wildrye prefers cycles of wet winters and dry summers. It tolerates partial shading and wildfire if soil moisture is not too dry. It does well as a pioneer plant and establishes seedlings in disturbed areas, such as recent road fills and areas disturbed by wildlife (e.g., rodent diggings).

### **Ethnobotany**

Basin wildrye seeds were an important food source of the Northern Paiute (Steward, 1933; Fowler, 1990) and Northern Shoshone (Lowie, 1909; Fowler, 1986). The seed heads were beaten with sticks or basketry seed beaters and caught in basketry trays (Fowler, 1986).

The Northern Shoshone used leaves of basin wildrye and similar long grasses to make thatching to cover willow-frame huts, with additional thatching added as insulation in the winter (Lowie, 1909). Some Northern Paiute people made house mats from basin wildrye leaves that were twined or sewn together (Fowler, 1990).



### **Conservation Uses**

Basin wildrye is well adapted to stabilizing disturbed soils. It does not compete well with aggressive introduced grasses during the establishment period, but it is very compatible with slower developing native grasses. Basin wildrye's drought tolerance, fibrous root system, and fair seedling vigor, make it desirable for reclamation in areas receiving 8 to 20 in annual precipitation. It is commonly used as a grass barrier for wind erosion or blowing snow control. It has also been planted on hilly cropland as a vegetative terrace for water erosion control.

*Wildlife:* Basin wildrye's height and upright habit provide cover habitat for birds and deer (Sours, 1983).

*Grazing:* Basin wildrye is palatable to all classes of livestock and wildlife (Ogle & Brazee, 2009). It is a preferred feed for horses and is considered a desirable feed for cattle, sheep, elk, deer, and antelope in spring. It is considered a desirable feed for cattle and horses in early summer, late fall, and winter (Ogle & Brazee, 2009). The plant's tall stature and stiff stems make this forage accessible in areas of deep snow (Ogle, 2000).

### **Seed and Plant Production**

*Seed Production:* Seed production of basin wildrye has been very successful under cultivated conditions. Row spacing of 36 in (3.5 PLS lb/ac) to 48 in (3.0 PLS lb/ac) is recommended. Cultivation is needed for weed control and to maintain row culture. Seed fields are productive for 5 to 7 years. Average production of 150 to 200 lb/ac can be expected under dryland conditions in 14+ in rainfall areas. Average production of 300 to 400 lb/ac can be expected under irrigated conditions. Direct combining is the best method of harvesting. The seed heads are prone to shatter and require close scrutiny of maturing stands. Seed is generally harvested in mid-August to September. Seed must be dried immediately after combining to 12% bins/15% sacks moisture content. There are approximately 130,000 seeds/lb.



### Establishment and Management

**Seeding:** Several cultivars of basin wildrye seed are available on the commercial market. The best seeding results are obtained from seeding in very early spring on heavy to medium textured soils and in late fall on medium to light textured soils. Summer and late summer (July to mid-September) seedings are not recommended. Seedling vigor is fair, and stands may take 2 to 5 years to fully establish. This species should be seeded with a disc or deep furrow drill at a depth of  $\frac{1}{4}$  to  $\frac{3}{4}$  in on medium to fine textured soils and 1 in or less on coarse textured soils. The single species seeding rate recommended for basin wildrye is 8 lb Pure Live Seed (PLS) per acre or 24 PLS per ft<sup>2</sup> or 24 PLS seeds per linear row ft at 12 in row spacing. If used as a component of a mix, adjust to percent of mix desired. For rangeland mixtures, include basin wildrye as approximately 10 to 20% of a mix or 1 to 2 PLS lb/ac.



Coarse, stiff stems of basin wildrye. Photo by Derek Tilley.

For mined lands and other harsh critical planting areas, double the seeding rate. When seeding is for a vegetative windbreak, vegetative terrace, or wildlife cover, 3.0 to 3.5 PLS lb seeded in 36 to 48 in rows is recommended. Stands may require weed control measures during establishment. Broadleaf herbicides may be applied at the 3-4 leaf stage to control young broadleaf weeds. To reduce weed seed development, mow when weeds are beginning to bloom. Grasshoppers and other insects may damage new stands.

Basin wildrye establishes slowly. New seedings should not be grazed or hayed until at least late summer or fall of the second growing season. Basin wildrye makes its initial growth in early spring and matures seed by late summer. Basin wildrye reproduces by seed and tillers. Established stands can be grazed in late spring or fall (leave about 10 in of stubble to protect plant health). Following grazing, little re-growth can be expected, even when the stand is irrigated. Basin wildrye is a low maintenance plant requiring little additional treatment or care. However, it may benefit from low levels of fertilization.

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## UTAH SMALL CAMAS

### *Camassia quamash* (Pursh) Greene ssp. *utahensis* Gould

Plant Symbol = CAQUU



Utah small camas (*Camassia quamash* ssp. *utahensis*). Photo by Rose Lehman.

#### Description

**General:** Lily Family (Liliaceae). Utah small camas is a tall, erect perennial (12 to 28 in) arising from bulbs  $\frac{3}{4}$  to 1.5 in long and  $\frac{1}{2}$  to 1 in wide. Plants have numerous flat leaves, 15 in long and  $\frac{1}{2}$  to 1 in wide. The inflorescence is a many-flowered, slightly irregular raceme 4 to 10 in long, with tepals that are pale blue to deep blue-violet. Anthers are tinged with blue or brown. Bloom occurs April to June depending on location. The fruit is an ovoid capsule, tan,  $\frac{1}{2}$  to 1 in long, with shiny black seeds (Cronquist et al., 1977).

**Habitat and Adaptation:** Utah small camas grows in seasonally moist meadows, moist hillsides, floodplains, and along streambanks. Utah small camas is adapted to areas that are wet in spring but dry by mid-summer. It often grows in dense patches in these areas. Camas reproduces from seed or bulblets. Associated plants include death camas (*Zigadenus* spp.), mule-ears (*Wyethia* spp.), Indian paintbrush (*Castilleja* spp.), willow (*Salix* spp.), balsamorhiza (*Balsamorhiza* spp.), and various sedges.

**Warning:** Death camas (*Zigadenus venenosus*) can be confused with edible camas bulbs and is toxic. Be sure of your identification of camas bulbs before eating them.

#### Ethnobotany

Utah small camas is the subspecies of small camas that occurs in Southern Idaho. The Northern Shoshone, Bannock, and Northern Paiute all relied on camas as a staple food (Fowler, 1986). Camas is still gathered and used today, although changes in land use have greatly

diminished the quantity available. While camas does not grow on the sagebrush steppes of the Snake River Plain, it was available in large quantities at Camas Prairie (near Fairfield, Idaho). Many people traveled to Camas Prairie yearly to obtain camas and to trade other items; some people, such as the Flathead, traveled from outside the Great Basin culture area (Steward, 1938; Hart, 1979).

Steward (1938) and Murphy & Murphy (1960) reported that camas was also locally available around Southern Idaho in smaller quantities. Statham (1975) surveyed and identified thirty-four camas locales around Southern and South-Central Idaho. She found that most of the camas locales occurred on Mollisols between 5,000-7,000 ft. She noted that there were probably many similar locales that were lost during land use conversion to agriculture. Statham concluded that southern Idaho once had an abundance of camas sites, and that Northern Shoshone and Bannock groups would have utilized those sites in addition to Camas Prairie.



The time to dig camas is in the early summer, after it has bloomed (Hart, 1979). Camas was traditionally harvested with hardwood digging sticks (Lowie, 1909). Camas production areas were deliberately managed to maintain their productivity (Thoms, 1989; Anderson, 1997).

After gathering, camas is processed and preserved either by cooking or drying. The most well-known method is to bake the bulbs in a fire pit. Rocks are placed on the burning wood, and after heating the bulbs are placed on the rocks and covered with various types of leafy vegetation. Water is poured on the leaves to produce steam. Dirt is spread on top, and a fire kindled on top of the dirt. In 1 to 3 days, the camas will be ready to eat. Bulbs cooked in this manner turn a dark brown color and are soft and sweet like molasses (Hart, 1979). Camas was also boiled in clay pots, ground on a metate, and spread in the sun to dry in cakes. Processed camas could be stored for long-term use. It was sometimes placed into bark bags and buried. As much camas as possible was transported to the Snake River and stored in the rocks of the canyon walls (Steward, 1938; Murphy & Murphy, 1960). Modern cooking methods include boiling in kettles until the camas reaches a gelatinous consistency (Lowie, 1909) or slow-baking in a modern oven.

#### Conservation Uses

Utah small camas can be used in appropriate sites for prairie restoration or pollinator plantings.

*Wildlife:* Deer, elk, and moose eat camas foliage. Gophers cache and eat the bulbs (Stevens & Darris, 2000; Stevens et al., 2000).

#### Seed and Plant Production

*Seed Collection and Cleaning:* Collect mature seed capsules when they begin to split and turn light tan in color. Mature seeds are black and are easily shaken out of the opened capsules (Luna et al: 2008). Seed can be harvested by conventional direct combining followed by seed drying (Bartow, 2015). Combine harvest when the large majority of capsules have turned from green to tan and only a small percentage have split open to reveal the seeds. If substantial healthy green foliage is present during harvest, plants should be cut high enough to leave as many leaves as possible intact to benefit further bulb development. Optionally, stalks and seed heads nearing maturity can be windrowed onto tarps and then air dried for a week or two. The dry capsules should split and release the seed, negating the need for threshing. Seed requires minimal cleaning but some screening will be necessary. There are approximately 100,000 seeds/lb.

*Plant Production:* Camas seed typically requires 60 to 100 days of cold moist stratification (moist chilling at 34 to 40 °F) for maximum germination (Bartow, 2015). Luna et al. (2008) stratified freshly harvested seeds outdoors in containers for 5 months (cold, moist). Germination occurred in early May under cool and fluctuating temperatures (50 to 68 °F day and 50 to 59 °F night). Seeds germinated equally well in light (surface sown) or dark (covered with mulch). Plants developed 2 true leaves and a small bulb 10 weeks after germination. Plants went dormant by late July, induced by high temperatures. Continued growth and development of seedlings can be extended if seedlings are kept in a controlled environment of air temperatures maintained at 50 to 59 °F during growth and placing



*Utah small camas plant with bulb. Note that flowering is finished, and seed capsules have started to form. Photo by Mary Wolf.*

dormant seedlings into cooler storage for a minimal chilling period. Following the minimum chilling period, seedlings could be taken out of cooler storage and grown in the greenhouse for a second growth phase. Thus, two seasons of growth can be forced in one year (Luna et al., 2008).

### Establishment and Management

**Seeding:** To establish seed production fields, sow seed in the fall at a rate of 6 to 10 lb/ac in 6 to 14 in wide rows at a depth of  $\frac{1}{8}$  to  $\frac{1}{4}$  in (Bartow, 2015). Fall sown fields can be sprayed with a non-specific herbicide to eliminate the first flush of weeds, since seedlings do not typically germinate until early spring in Idaho. Seedlings require moisture through the spring growing period to survive. Warm temperatures during seedling development can be lethal (Stevens & Darris, 2000; Stevens et al., 2000).

If started from seed, common camas will not flower and set seed until the third or fourth growing season. Once the bulbs are large enough to flower, seed yields are likely to increase substantially for several years thereafter, eventually plateauing and then starting to decline as bulbs become more crowded. As stands age, an abundance of foliage with few flowers is an indication that the bulbs have become over-crowded; on a small scale, they can be lifted, separated, and replanted at the proper spacing in the fall (Stevens et al., 2000).

**Wild transplants:** Camas is readily established by transplanting wild or commercially grown bulbs. Wild harvests should be restricted to salvage sites with appropriate approvals or permits. Use of bulbs or seeds from local nurseries or greenhouses is strongly recommended (Stevens & Darris, 2000).

Consistent soil moisture is required every spring, but the soil can be allowed to dry out soon after the pods mature, or the leaves senesce. Moderate soil nutrient levels are beneficial. In natural settings, minor soil disturbance (loosening, surface scarification) adjacent to existing plants may enhance natural regeneration by seed. Late summer field burning may improve stand vigor, reduce competition from brush and certain weeds, and aid in regeneration. For optimal bulb development, avoid mowing or grazing. Camas is favored as forage by deer, so fencing or repellents may be useful, particularly during the first growing season (Stevens & Darris, 2000; Stevens et al., 2000).

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Utah small camas bulbs and bulblets. Scale is in inches. Photo by Mary Wolf.

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## SEGO LILY

*Calochortus nuttallii* Torr. & A. Gray

Plant Symbol = CANU3

**Alternate Name:** mariposa lily



Sego lily (*Calochortus nuttallii*) growing with big sagebrush. Photo by Mary Wolf.

### Description

**General:** General: Lily Family (Liliaceae). Sego lily is a perennial native forb that grows 10 to 20 inches high. It grows from a small egg-shaped bulb, 3/8 to 1 inch in diameter, with a membranous coat. The stem is slender, usually unbranched, and bears 2 to 4 simple, linear, narrow leaves, 7 to 10 inches long. Flowers are very showy, tulip-like, about 3 inches across with 3 petals and 3 sepals. Petals are white, occasionally tinged with lilac or pink, and yellow near the base. There are glands at the base of each petal which are bearded with slender hairs. There is a brownish-purple spot or band above each gland. Sego lilies bloom May to July depending on elevation, and the above ground portion of the plant dries up shortly after blooming. The fruit is an erect, 3-sectioned capsule that splits open to reveal yellowish flat seeds (Hitchcock & Cronquist, 1973; Cronquist et al., 1977).

**Habitat and Adaptation:** Sego lily is found in brushy or grassy slopes in dry areas, typically within open sagebrush country and open ponderosa pine or pinyon-juniper forests. Its elevation range is from 2,300 to 10,000 ft above sea level. Sego lily is adapted to dry, well-drained soils. It blooms early in the season and then the aboveground parts dry up, avoiding high summer temperatures and drought. Associated plants include sagebrush (*Artemisia tridentata* complex), death camas (*Zigadenus* spp.), lupines (*Lupinus* spp.), pinyon pine (*Pinus edulis*, *P. monophylla*), juniper (*Juniperus* spp.), and ponderosa pine (*Pinus ponderosa*).

**Warning:** Death camas (*Zigadenus venenosus*) is toxic and can be confused with sego lily in the absence of flowers. Be sure of your identification of sego lily bulbs before eating them.

### Ethnobotany

The English word “sego” comes from similar words for the plant in various Numic (Great Basin) languages. Many Native American tribes in the Great Basin and surrounding areas harvested and ate the pleasant-tasting bulbs of sego lily (Fowler, 1986). Sego lily bulbs were a common food in the Northern Paiute, Northern Shoshone, and Bannock culture areas of Idaho (Steward, 1938). The Northern Paiute dug the bulbs in the spring and ate them raw or roasted. Surplus bulbs were cached in pits lined with cattail leaves or grass (Fowler, 1990). Sego lily bulbs were also dried

for storage. The dried bulbs can be ground and cooked into soup or porridge (Fowler, 1989). Various other *Calochortus* species have traditionally been used by Native Americans as well.

### Conservation Uses

**Wildlife:** The bulbs are eaten by rodents. A similar species, sagebrush mariposa lily (*C. macrocarpus*) is a documented food source for juvenile sage grouse (Klebenow & Gray, 1968); the authors use “sego lily” as the common name of *C. macrocarpus*.

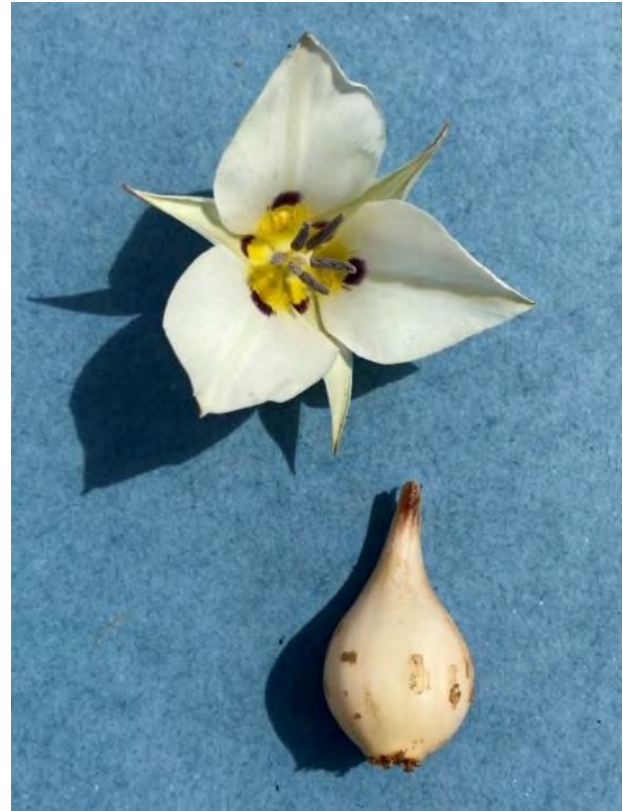
### Seed and Plant Production

**Seed Collection and Cleaning:** Collect seed when the capsules are dry and beginning to open. Remove seeds by crushing the capsules. There are approximately 190,000 seeds per pound (Hassell et al., 1996).

**Wild transplants:** Sego lily is extremely difficult to grow from transplanted bulbs. Collected bulbs are not likely to survive transplanting (Hitchcock & Cronquist, 1973).



Sego lily. Photo by Mary Wolf.



Sego lily flower and bulb. Photo by Mary Wolf.

**Plant Production:** All *Calochortus* species are very difficult to cultivate. Plants must be raised from seed for any success (Cronquist et al., 1977; wildflower.org, 2021). Seed must be cold-moist stratified, either 40-60 days at 36 °F or outdoors over the winter (Blanke & Woodruff, 2011). Bulbs reach maturity in 3 to 5 years (wildflower.org, 2021).

### Establishment and Management

**Seeding:** Seed requires cold-moist stratification to germinate. Blanke et al. (2011) planted seeds in a flat which was placed outdoors over winter (Colorado). The seeds underwent natural stratification and began to germinate in late May. The Aberdeen Plant Materials Center used a similar technique, planting seeds in peat pellets left outside for 90 days (November-February) (Wolf & Tilley, 2021). Pellets were then brought into the greenhouse (75 to 85 °F), where seeds began to germinate. Seeds can also be cold-moist stratified artificially (40 to 60 days at 36 °F) and then transplanted into containers (Blanke et al., 2011).

Sego lilies must be grown in soil that is completely dry from mid-summer to late fall. Bulbs need protection from gophers and moles (wildflower.org, 2021).

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# FERNLEAF BISCUITROOT

## *Lomatium dissectum* (Nutt.) Mathias & Constance

Plant Symbol = LODI

### Alternate Names

*Ferula dissoluta*, *Leptotaenia dissecta*, giant biscuitroot, giant lomatium, giant desertparsley, chocolate-tips, cough root, toza



Fernleaf biscuitroot growing in the Snake River Plain. Photo courtesy of BLM Seeds of Success. Used with permission.

### Description

**General:** Carrot Family (Apiaceae). Fernleaf biscuitroot is the largest member of the *Lomatium* genus. It is a robust perennial, herbaceous forb arising from a thickened woody taproot or caudex. Mature plants can be up to 50 in tall. The several smooth stems are usually ascending, rather than strictly erect, from a branching stem base. The leaves are ternate and pinnately compound. Blades of the larger mature leaves are 6 to 12 in long and the larger ultimate segments are 0.08 to 0.12 in wide. Flowering occurs from April through May. The flowers are yellow to purple and borne in umbels with 10 to 30 rays; each ray is 1.5 to 4 in long. Each umbel is composed of a combination of 50 to 200 male and hermaphroditic flowers (Thompson, 1998). Occasionally, all-male umbels are found, but the species is clearly hermaphroditic with both stamens and

stigmas in the same flower. The flowers are insect pollinated. Seeds are elliptical; 0.6 in long and 0.4 in wide with a thickened lateral wing about 0.04 in wide and inconspicuous dorsal ribs. Fernleaf biscuitroot reproduces by seed (USU, 2017; Tilley et al., 2010).

**Habitat and Adaptation:** Fernleaf biscuitroot grows in open, dry rocky slopes and talus in well-drained soil. Fernleaf biscuitroot is adapted to coarse- to fine-textured soils with pH of 6.5 to 7.5. It can be found in a variety of plant communities in areas receiving 14 to 30+ in annual precipitation. This species is common in mountain and Wyoming big sagebrush, pinyon-juniper, and mountain shrub communities from sea level to 10,000 ft elevation. Associated plants include big sagebrush (*Artemisia tridentata*), pinyon pine (*Pinus edulis*, *Pinus monophylla*), juniper (*Juniperus* spp.), snowberry (*Symphoricarpos albus*), and quaking aspen (*Populus tremuloides*).

**\*NOTE:** Fernleaf biscuit root foliage bears a strong resemblance to poison hemlock (*Conium maculatum*) a very toxic plant. The two can be distinguished vegetatively by the small purple spots found on hemlock stems and petioles. Hemlock also has white flowers instead of yellow or purple.

### Ethnobotany

Many Native Americans consider fernleaf biscuitroot as a panacea to be used for all kinds of illnesses and injuries (Fowler, 1989; Train, 1941). Fowler (1986) reported that in the Great Basin, fernleaf biscuitroot is valued as a cure-all with a semi-sacred connotation. In the 1980's (time of publication) it was still one of the most likely of all plants to be found in Native households. The most common use of fernleaf biscuitroot is a decoction (tea) made from the

root. This decoction has been valued for treating a wide variety of ailments, including colds, hay fever, bronchitis, influenza, pneumonia, and tuberculosis. The roots can also be boiled and eaten for similar purposes. The decoction or mashed root extract can also be used externally to relieve pain and as an antiseptic for wounds, rashes, and sores (Train et al., 1941; Fowler, 1989).

The roots of fernleaf biscuitroot were mixed with tobacco or other medicinal plants and smoked for headaches, colds, or just for pleasure. Root chips can also be thrown on the fire and the fumes inhaled for colds (Train et al., 1941; Fowler, 1989). Boiling roots can be used in an herbal steam for lung or nasal congestion and asthma (Train et al., 1941).



*Fernleaf biscuitroot. Photo by Derek Tilley.*

easily hand collected. Very clean collections can be made by shaking ripened inflorescences over a bag or tarp. Seed can be harvested in production fields via a vacuum type harvester or flail vac. Minor screening to remove sticks provides excellent purity. Additional cleaning can be done with an air-screen cleaner. There are approximately 45,000 seeds/lb (Ogle et al., 2012). Experimental plots at Ontario, Oregon, using supplemental irrigation produced seed in the fourth season with peak yields of 430 lb/ac (Shock et al., 2010).

*Greenhouse Plant Production:* Parkinson & De Bolt (2005) describe the following method of greenhouse plant production: Seeds were soaked in distilled water for 24 hr, placed in clear plastic germination boxes on two layers of blotter paper, thoroughly moistened with distilled water, and placed in a germinator at 40 °F in the dark for a 60-day

Root extract of fernleaf biscuitroot has been shown to inhibit both bacteria and viruses in laboratory studies (McCutcheon et al., 1992; McCutcheon et al., 1995). Fernleaf biscuitroot is currently available in the commercial health market as whole root or as a tincture.

Many tribes in the Inland Northwest used fernleaf biscuitroot to make a fish poison. The extract from pounded roots, when poured into a small stream, temporarily stupefied the fish allowing people to pick the fish up out of the water (Fowler, 1989; Meilleur et al., 1990).

#### **Conservation Uses**

*Wildlife:* Established plants of fernleaf biscuitroot, like other members of the *Lomatium* genus, begin growth very early in the spring, often just following snow melt, providing crucial early forage for wildlife. Fernleaf biscuitroot's early bloom time makes it a valuable food source for pollinators and other insects. It is considered a very valuable forage species due to its large stature and high biomass production levels. Ogle & Brazee (2009) rate members of the genus as desirable spring and summer forage for cattle, sheep, horses, elk, deer and antelope. Fernleaf biscuitroot has been identified as an important plant species in sage-grouse habitat. Pre-laying sage-grouse hens eat the foliage (Barnett & Crawford, 1994), while sage-grouse chicks eat the foliage and associated insects (Drut et al., 1994).

#### **Seed and Plant Production**

*Seed Collection and Cleaning:* Seed matures July-August. Wildland seed disarticulates readily and is

prechill. Blotter paper was remoistened periodically as needed. Germination occurred over a 66-day period. Final germination was 98% of the viable seeds. Upon first signs of germination, seeds were sown in Styrofoam containers filled with a 50% peat:50% vermiculite mixture. Containers were watered from an automatic overhead irrigation system activated when soil saturation levels fell below 80% and turned off when field capacity reached 100%. Greenhouse temperature was a constant 80 °F. Small amounts of fertilizer suitable for seedlings were added periodically. True leaves started to develop 14 days after germination. Skinner (2004) obtained the best results when seed was fall sown into containers that were left outside to overwinter. Germination began in March and growth continued for 3 to 4 months until the plants went dormant in late July or August. Containerized plants should be left outside in a lath house for an additional winter before transplanting the following spring.

### Establishment and Management

**Seeding:** Extended seed stratification is required for successful propagation. At the time of dispersal, the seeds have underdeveloped embryos which require a trigger for growth prior to germination. Scholten et al. (2009) observed that greatest embryo elongation occurred at temperatures of 38 to 42 °F. The best germination percentages occurred at 38° F with approximately 16 weeks of cold/moist stratification. Dormant fall seeding can be used to achieve seed stratification (Tilley et al., 2010). Drill seed in rows at 25-30 PLS seeds per foot or into weed barrier fabric at 18 to 24 in spacing.



Seed of fernleaf biscuitroot (scale is mm). Photo by Derek Tilley.

Jensen & Anderson (2010) investigated techniques regarding the feasibility of growing fernleaf biscuitroot densely in rooting beds prior to field establishment. This method allows a grower to sacrifice a much smaller area in the first 1 to 2 years of plant development while the plants are not producing seed. Trials indicated that taproots transplanted in autumn established well.

Above ground growth is slow, as young plants invest significant resources to produce a substantial taproot. Plants grow in early spring into summer and go dormant in mid-summer, giving the appearance of mortality. During the first year of establishment, most plants will only produce a few leaves. Most plants will not produce flowers or fruit during the first 3-4 years of growth. Seed production fields at Aberdeen, Idaho did not produce flowers or seed until the fourth year of production. Once established, fernleaf biscuitroot is very competitive against weeds due to its long taproot; however, additional measures to control weeds are necessary for seed production. Good weed control can be achieved through the use of weed barrier fabric and hand roguing. Because fernleaf biscuitroot enters dormancy in early summer, foliar herbicide applications to surrounding weeds are possible after senescence.

Highest seed yields have been achieved with the use of supplemental irrigation. Shock et al. (2010) at Ontario, Oregon showed a significant positive response to irrigation with 4 and 8 in of additional water. Ontario has a mean annual precipitation of 9.5 in, bringing the total received water to approximately 18 in for optimum seed production.

Though fernleaf biscuitroot flowers are self-fertile, they still require visitation by pollinators for fertilization to occur. Cane (2007) showed a 60x increase in seed set in the presence of pollinators. Developing a manageable native pollinator population for seed production is unlikely. In cultivation, honeybees and sweat bees may suffice.

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# CURLYCUP GUMWEED

## *Grindelia squarrosa* (Pursh) Dunal

Plant Symbol = GRSQ

**Alternate Names:** rosinweed, resinweed, tarweed



*Curlycup gumweed (Grindelia squarrosa). Photo by Mary Wolf.*

### Description

**General:** Aster family (Asteraceae). Curlycup gumweed is a short-lived perennial or biennial forb averaging 1 to 3 ft high. Numerous branching stems bear alternately arranged leaves, typically 1 to 4 in long with entire to serrate or even somewhat lobed margins. The flower heads are radiate with 25 to 40 yellow rays and a yellow center. The involucre bracts are squarrose-reflexed, or strongly rolled back, and highly resinous. The fruit is a 0.1 in achene bearing 2 to 3 pappus awns (Welsh et al., 2003). Flowering occurs in mid- to late-summer, typically beginning in July and continuing through August and into September. Occasional plants will be seen with flowers persisting into November.

**Habitat and Adaptation:** Curlycup gumweed inhabits a variety of arid plant communities including sagebrush steppe, desert grasslands, prairies and mountain shrub chaparral. It is very commonly found in disturbed roadsides, open fields and in poorly managed pastures and rangelands. Curlycup gumweed is adapted to disturbed sites receiving 10 to 20 in annual precipitation. This species is most commonly

found in rocky, gravelly soils of disturbed roadsides, but can be found in heavier silty clay loam soils to sandy loams. Curlycup gumweed is adapted to neutral to moderately saline conditions. It is very commonly found growing in sites occupied by non-native grasses such as cheatgrass (*Bromus tectorum*) and crested wheatgrass (*Agropyron cristatum*).

### Ethnobotany

Native Americans in the Inland Northwest traditionally used curlycup gumweed for a variety of ailments. A paste made from the flowering tops was applied to skin diseases, scabs and sores (Steward, 1938; Hart, 1992). The Flathead of Western Montana used an infusion of stems and leaves as a tea for colds, pneumonia, fever, cough, or as a tonic (Hart, 1979). Paiute and Shoshone people in the Great Basin used a plant decoction (tea) taken internally in small doses to treat smallpox and measles; this decoction was also used externally as an antiseptic wash (Train et al., 1941). A decoction of the resinous buds was used to treat pneumonia or as an expectorant cough medicine. Curlycup gumweed tea also treated bladder trouble or stomach aches, and a warm poultice made of the plant treated swellings (Train et al., 1941).

At the beginning of the 20<sup>th</sup> century, *Grindelia squarrosa* was listed in the US Pharmacopeia as a remedy for lung problems and to treat poison ivy rashes (Henkel, 1911). Schafer & Schimmer (2000) noted the plant's former

inclusion in both the U.S and German pharmacopeias. They analyzed *Grindelia squarrosa* essential oil composition and determined that based on the compounds present, the use of the plant as an expectorant appeared to be valid. *Grindelia* essential oil and extracts are currently available through the herbal medicine trade.

### Conservation Uses

**Pollinators:** Curlycup gumweed is highly attractive to native bees. ARS Bee Research Laboratory records indicate visitations by species from over 40 genera of native bees (Ikerd, 2016). Its drought tolerance and late-season flowering make it especially valuable for range plantings in the arid west where late-blooming forbs are limited. Curlycup gumweed is also readily visited by European honeybees; however, honey produced from this species has an inferior flavor and can lower the grade (Dalby, 1999). The pollen is considered more valuable than the nectar, as bees visit the plants late in the season to build pollen reserves for winter (Dalby, 1999).



*Curlycup gumweed flowers and buds. Note the abundant white resin on the buds. Photo by Mary Wolf.*

**Wildlife:** Sage grouse have been observed to eat curlycup gumweed. Twenty-eight percent of monitored sage-grouse chicks between 5-8 weeks of age were reported eating curlycup gumweed in central Montana. Curlycup gumweed made up 3% by volume of crop contents. It was used by 39% of 9- to 12-week-old chicks and made up 4% of crop contents. It was not used by chicks younger than 5 weeks old (Peterson, 1970).

### Seed and Plant Production

**Seed Collection and Cleaning:** Small scale production fields and wildland collections can be made by beating the seeds off the plant into a bin or bag, or by clipping the flower heads. Seed is cleaned by running the collected material through a hammer mill followed by sieving and air-screening. Seed often contains small grubs. Placing the seed in a freezer for 24 hours may help eliminate seed-eating insects (Tilley & Pickett, 2016). Two similar species, *Grindelia camporum* and *G. stricta*, are grown for seed production in California. Both have very sticky vegetation like curlycup gumweed. Fields are direct combined; however, the gum must be scraped off of the combine and machine parts periodically to keep it working effectively. The seeds separate from the seed head quite readily. Deer are very fond of the young vegetation and may pose a problem in production settings (Emily Allen, Hedgerow Farms Personal communication, 2016). Tests conducted at Aberdeen Plant Materials Center indicate there are approximately 400,000 seeds/lb and 39 lb/bushel.

**Greenhouse Plant Production:** Nuzzo (1978) used a 10-week moist stratification for propagating curlycup gumweed. They reported first germination occurred after 3 days and peak germination occurred after 14 days. Plants were ready to transplant into the field after 10 weeks. Tilley and Pickett (2021) showed that seed dormancy could be overcome by germinating the seed in an oxygenated water bath.



### Establishment and Management

*Seeding:* Based on a seeding rate of 50 pure live seeds (PLS) per ft, the full stand seeding rate is 5 lb/ac. Seeding rate should be adjusted to match the desired percentage within a seed mixture. McDonough (1975) showed that curlycup gumweed exhibited seed germination polymorphism. Disc achenes (those from the center of the flower) germinated more rapidly and attained higher final germination percentages than did ray achenes (those from the outer, petal-like flowers). It is believed that this allows germination and emergence to occur during different seasons, and subsequently affects the time required for completion of the growth cycle.

Due to its low moisture requirements and limited palatability, curlycup gumweed increases under drought conditions in irrigated pasture as well as under poor grazing management practices and is often associated with pastures and range that have been overgrazed. Curlycup gumweed should be used as a minor component of pollinator and restoration seed mixtures. Management strategies should be based on the key species in the established plant community.

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## WESTERN YARROW

*Achillea millefolium* L. var. *occidentalis* DC.

Plant Symbol = ACMIO

**Alternate Names:** wooly yarrow, *Achillea millefolium* ssp. *occidentalis*, *Achillea millefolium* var. *lanulosa*, *Achillea millefolium* ssp. *lanulosa*



Western yarrow (*Achillea millefolium* var. *occidentalis*). Photo by Mary Wolf.

### Description

**General:** Aster Family (Asteraceae). Western yarrow is a native perennial wildflower that grows erect from creeping rootstocks to a height of 10-36 in. The leaves are finely dissected into numerous, short and narrow divisions not over 0.04 in wide, densely hairy, and fern-like. The somewhat rounded terminal clusters of flower heads of western yarrow are normally white to cream-colored and have an extended bloom period from May to September. Western yarrow is a self-incompatible, insect-pollinated species (Clausen et al., 1958).

Western yarrow is not to be confused with the introduced, invasive plant, common yarrow (*Achillea millefolium* var. *millefolium*). Common yarrow is originally from Europe and Central Asia. It is considerably different from western yarrow in that it has a much taller stature, aggressive vigor, and weedy characteristics. Common yarrow also initiates a later sequence of flowering and seed ripening. Western yarrow should be considered noninvasive when used within a diverse plant community in its anticipated area of adaptation (Winslow, 2006).

**Habitat and Adaptation:** Western yarrow prefers full sun on roadsides, hills, canyons, pastures, and disturbed areas. It is scattered in

sagebrush areas, open timber, and subalpine zones. Western yarrow thrives in droughty conditions on gravelly loam and on thin or sandy soils. It is one of the most abundant and widely distributed wildflowers in the western United States.

### Ethnobotany

Yarrows are used worldwide to treat wounds, infections, burns, sores, and other problems of the skin. Yarrows were used internally as well by Native Americans as a diuretic, for fevers, colds, coughs; and for diarrhea (Applequist & Moerman, 2011). Western yarrow was used by people in the Snake River Plain and Great Basin for a wide variety of medicinal needs. The green plant was crushed and smelled for headaches (Train et al., 1941). Various decoctions (tea) of the flower, leaves, or root were taken for stomachaches, indigestion, or diarrhea (Train; 1941; Steward, 1938). Yarrow decoctions were also taken for headaches, colds, and coughs or gargled for sore throats (Train et al., 1941; Fowler, 1989). The dried roots were chewed for colds (Fowler, 1989).

Poultices of mashed roots, mashed leaves, or whole, boiled plants treated cuts, sores or painful areas (Steward, 1938; Train et al., 1941; Fowler, 1989). Poultices were also used as a topical anesthetic (e.g., before extracting splinters) (Train et al., 1941). The green leaves or roots were used in various ways to alleviate toothaches (Train et al., 1941).

Western yarrow leaves were also used by Great Basin tribes to make a green dye (Nickerson, 1966). The leaves were soaked and sprinkled on hot rocks in the sweat lodge (Fowler, 1989).

### Conservation Uses

Western yarrow is an early successional species that readily establishes on disturbed sites. It is recommended for adding species diversity in native seed mixtures for rehabilitation of disturbed sites such as rangelands, mined lands, and roadsides. It is also appropriate for pollinator habitat and in low maintenance, or naturalized landscapes.

*Forage and Wildlife:* Western yarrow is a food source for cattle, domestic sheep, horses, and elk (Ogle & Brazee, 2009). Sage-grouse adults and chicks rely on western yarrow as a food source. Sage-grouse chicks also benefit from eating the insects associated with yarrow (Dahlgren et al., 2015).

### Seed and Plant Production

*Seed Collection and Cleaning:* Harvest seed by swath and combining from the cured windrows, or direct combining. The indeterminate ripening may necessitate periodic mechanical stripping as seed heads mature. Seed is processed over a 2 to 3-screen fanning mill (slotted mesh screens), with final cleaning over an indent cylinder or gravity table. Seed production of 100 to 150 lb/acre can be expected under irrigated conditions. Seed longevity is at least 5 years when stored at moderate temperatures and low humidity (USDA, 2004). There are approximately 4.4 million seeds/lb.

*Containers:* Containers should be sown in fall for outside nursery production and in spring for production in the greenhouse. Pots are filled with a well-drained soilless medium and wetted prior to seeding. Seeds are placed directly on the surface and lightly covered with a thin layer of the medium, perlite, or pea gravel, and then thoroughly irrigated. Containers are kept moist with light irrigation or misting during the establishment phase. Germination occurs in 6 to 14 days at approximately 70 °F, followed by rapid root and shoot development over the next 60 days. Supplemental nutrition is not necessary but may be applied at the recommended rate as a controlled release, encapsulated fertilizer (Luna et al., 2004).



*Western yarrow inflorescence. Photo by Derek Tilley.*

### Establishment and Management

*Direct Seeding:* Viability of fresh western yarrow seed is generally high, and seeds germinate under normal test conditions in 2 to 8 days, with 75% germination occurring in 5 days (Sorenson & Holden, 1974). Seed of western yarrow is non-dormant and readily germinates when spring planted at a very shallow depth. Seed should be planted into a firm, weed-free seedbed with a drill that will ensure uniform seed placement to a depth of  $\frac{1}{8}$  to  $\frac{1}{4}$  or broadcast seeded, then harrowed or raked, and firmed with a packer or roller. Field conditions during seedling emergence must be monitored for impermeable crusts, especially on sites with clayey soils. If crusting is observed, the soil crust can be fractured with a roller or periodic sprinkler irrigation. The full seeding rate is  $\frac{1}{4}$  to  $\frac{1}{2}$  PLS lb/ac, but western yarrow would seldom be seeded in a pure stand. It is recommended that western yarrow be included as a component of a native seed mixture, where the seeding rate is adjusted to the desired percent of the plant community. Spring seeding is preferred over a dormant fall planting date. Periodic mowing during the establishment year is one option for weed suppression. Western yarrow tends to be less competitive in early development and becomes more so with



age. It produces very few flowers the establishment year but will easily set seed in subsequent years. It is moderately rhizomatous, developing as a scattered colony that maintains a semi-evergreen state when dormant. New seedlings may need protection from trampling and weeds during establishment. Clipping weeds above the seedlings is a preferred method of weed suppression as there are no herbicides selective for broadleaf plants. Western yarrow vigor, aesthetics, and stand persistence after establishment may be sustained with properly timed grazing or defoliation of associated species.

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# BIG SAGEBRUSH

## *Artemisia tridentata* Nutt.

Plant Symbol = ARTR2



Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*). Photo by Mary Wolf.

### Taxonomy

Currently there are seven subspecies of *Artemisia tridentata* recognized by the National Plant Data Center. Each is highly variable with multiple ecotypes but can generally be separated using a number of morphological, geographical and topographical characters. For the purposes of this technical note, we focus the three subspecies most associated with the Snake River Plain: basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) and mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) and treat them generally. For further discussion, see Tilley et al. (2006).

### Description

**General:** Aster Family (Asteraceae). Although big sagebrush plants generally have a similar growth form, the species does have considerable morphological variation with several subspecies and ecotypes. Big

sagebrush are evergreen shrubs ranging in size from less than 2 ft tall to as large as 13 ft tall. Branches are spreading, arising from numerous main stems in the lower growing subspecies or from one main trunk in the larger forms. Leaves are blue-gray to blue-green in color due to dense gray hairs. They are typically cuneate (wedge-shaped, triangular and gradually tapering to the base) or flabelliform (bell shaped) depending on subspecies and have three lobes at the apex on the majority of the persistent foliage. Leaves vary in length from 0.2 to 2.0 in and can be 0.08 to 0.8 in wide. Leaves are spirally arranged with internodes short in young vegetative stems making the leaves very dense. Panicles overtop plants of mountain and spicate big sagebrush or can grow throughout the crown in basin and Wyoming big sagebrush. Floral heads contain from three to 18 perfect (both male and female parts present) flowers per head. Big sagebrush plants are very aromatic with the smell being described as bitter pungent to pleasant, the odor varying by subspecies.

**Habitat:** The subspecies of the big sagebrush complex are adapted to a wide range of precipitation zones, elevations, and soil conditions. In general, basin big sagebrush is adapted to deeper soils in areas receiving 8 to 16 in annual precipitation. Wyoming big sagebrush prefers shallower soil. Mountain big sagebrush is most often associated with higher elevations and greater precipitation.

### Ethnobotany

Big sagebrush is a plant with many uses including fiber, fuel, and medicine. It is a respected plant whose burning signifies purification. Crushed sage can be an offering for health after an illness (Fowler, 1986). Big sagebrush has been used as a ceremonial medicine by dancers to pat themselves to be made spiritually clean (Train et al., 1941). Big sagebrush's use in the Snake River Plain goes back thousands of years. In prehistoric times, bison meat was packed in leafy sagebrush branches in ice caves on the Snake River Plain in Idaho, a practice that started over 8,000

years ago (Henrikson, 2002). Prehistoric mats made of sagebrush bark were found in Aviators Cave in Idaho (INL, 2009).



*Shredded big sagebrush bark. Photo by Mary Wolf.*

Sagebrush bark was widely used as a general-purpose fiber for making twine and rope (Lowie, 1923; Fowler, 1990). Thick sagebrush bark cordage twined together the cattail or tule mats that covered willow-frame houses (Fowler, 1990). Big sagebrush bark was made into clothing, sandals, and twined bags (Steward, 1938; Fowler, 1990). The bark was also used as insulation material, either stuffed in moccasins in winter or added to willow-branch huts in winter as additional insulation (Lowie, 1909). Big sagebrush provided material for making fires. The bark was used as portable tinder, while the wood was used for firewood and to construct fire drills (Lowie, 1909; Steward, 1938). Steward (1933) reported that big sagebrush seed was eaten in times of food shortage. It was generally mixed with other seeds to make it more palatable.

Shoshone and Paiute people valued big sagebrush for a wide variety of medicinal uses. They chewed the raw leaves for indigestion. Decoctions (tea) were used to treat stomachaches, colds (with salt), to break a fever, or as a tonic after childbirth. Decoctions were also used as an antiseptic wash for maladies such as inflamed eyes and ant bites, or to treat headaches. A poultice of

hot branches and leaves could be applied to aches, sores, wounds, or for chest colds. Dried, powdered branches treated sores or wounds. The smoke from burning branches was inhaled for headaches or head colds (Train et al., 1941). The efficacy of big sagebrush as a medicine is supported by science. An extract of basin big sagebrush branches was shown to inhibit bacterial growth in the laboratory (McCutcheon et al., 1992).

### Uses

*Revegetation/reclamation:* Because of its wide range of adaptation and ease of establishment, big sagebrush can be a very important species for use in revegetation efforts. Seedlings are able to compete with grasses and forbs as well as other shrubs allowing it to be used as a component of a wide range of seed mixes. Seedlings are very easy to establish when planted correctly (see Establishment and Management section). Because sagebrush plants spread readily by seed, it can be seeded at relatively low rates and allowed to spread by natural recruitment. Big sagebrush plants provide many benefits to the plant community. The dense canopy protects understory herbaceous plants from grazing. Healthy sagebrush communities provide a multi-tiered ecosystem with high levels of biodiversity. Big sagebrush plants also have a two-part root system with a deep tap root and a shallow, diffuse root system. Sagebrush plants create “hydraulic lift” where deep soil moisture is brought to near the soil surface by the tap root system during the day and then released into the upper soil at night (Richards & Caldwell, 1987). This water is then available to the diffuse root system of big sagebrush as well as to the roots of other understory plants. Sagebrush plants also increase water retention by trapping and holding windblown snow.



*Forage/Wildlife:* Big sagebrush is perhaps the most important shrub on western rangelands. Evergreen leaves and abundant seed production provide an excellent winter food source to numerous species of large mammals including deer, antelope, and elk (Ogle & Brazee, 2009). Sage-grouse depend on sagebrush for their survival; in the winter it is their only food (Dahlgren et al., 2015).

### Seed and Plant Production

*Seed Collection and Cleaning:* The vast majority of big sagebrush seed used in revegetation is wildland collected material. Seed collection occurs in late fall to early winter (early October through the end of December) depending on the subspecies. Collections are commonly made by hand stripping, beating or clipping seed heads into containers or by using a reel type harvester. Seed can be cleaned with a hammermill, debarker, air-screen or gravity table with varying results. Most sagebrush seed lots used for rangeland seeding are only cleaned to a purity of 15-20% due to the small seed size. This practice requires less time for cleaning and also allows for easier seed flow and metering in seeding equipment. Pure seed yields are approximately 1.7 to 2.5 million seeds/lb.

Seed production varies greatly between years and between stands due to differences in climate, stand density and maturity, soil and genetics. It has been estimated that an average stand of big sagebrush could potentially produce 100-300 PLS lb/ac annually (Tilley et al., 2006). Seed production declines as plants and stands mature to contain larger amounts of woody biomass. Greater seed yields can be achieved by thinning decadent stands to encourage new flower stalk production. Sagebrush seed that has been dried to a minimum of 9% moisture content will remain viable for many years when stored under cool, dry conditions. Welch et al (1996) reported seed viabilities above 90% for seed stored at 50 °F and relative humidity of 20% after nine years of storage. Seed stored at higher humidity levels are susceptible to germination or damage by insects or microorganisms.

*Greenhouse Plant Production:* For nursery plantings, pre-stratified seed can be planted in greenhouse conditions, or seed can be allowed to naturally stratify after being planted in containers outdoors. Keep soil medium slightly moist during germination. Greenhouse sprayers or misters are commonly used during daylight hours at a rate of 10 seconds every 15 minutes. Uniform germination occurs after two weeks of temperatures over 70 °F. Seedlings are ready for field transplanting approximately 5 months after germination.

### Establishment and Management

*Seeding:* Big sagebrush is not recommended for pure seedings. It should be a small component of range plantings. Appropriate seeding depth is critical to sagebrush establishment. Big sagebrush seed should be broadcast on the soil surface. Drill seeding below the soil surface can significantly reduce germination. Broadcast big sagebrush seed at 0.05 to 0.075 PLS lb/ac (approximately 2-3 viable seeds/ft<sup>2</sup>). Other species in the planting can be drill seeded separately or broadcast in a mix with big sagebrush seed. Packing or imprinting the broadcast seed can improve seed to soil contact and improve establishment.



*Basin big sagebrush branches with inflorescences. Photo by Mary Wolf.*

*Wild transplants:* Collect and transplant field harvested wildings during dormancy in fall or very early spring, when soil moisture conditions are optimal. For best cost efficiency, “mother plants” should be placed in key locations throughout the planting site to allow for natural seed dispersal and recruitment over time.

Historically, sagebrush communities have been poorly managed, mostly in attempts to reduce or eliminate sagebrush stands to increase forage production for livestock. Recently, however, the value of sagebrush to the western rangelands is being recognized, and practices are evolving to better manage healthy and productive sagebrush community.

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# COYOTE WILLOW

*Salix exigua* Nutt.

Plant Symbol = SAEX

## Alternate Names

Sandbar willow, narrowleaf willow, gray willow



Thicket of coyote willow (*Salix exigua*). Photo by Derek Tilley.

## Description

**General:** Willow Family (Salicaceae). Coyote willow, with its long, thin leaves, is the most distinctive of the region's willow species. The leaves have a very short petiole, and mature blades are 2 to 5 in long, linear, with an acuminate leaf tip and either a serrate or entire margin. Coyote willow is a shrub 3 to 15 ft in height with multiple branches and deciduous leaves. It spreads clonally by root-sprouting (suckering). Twigs are yellow to red-brown. Inflorescences consists of staminate (male) and pistillate (female) catkins that appear with or after the leaves in the spring (March-June). The catkins are approximately 1 to 2.75 in long. The flower bracts are a tawny color (Stevens et al., 2000; Argus, 2012).

**Habitat and Adaptation:** Coyote willow is found in wetlands, along alluvial bottomlands and streambanks at elevations below 8,900 ft. It is adapted to sandy soils in stream and shoreline sites. Coyote willow dominates the riparian forests of lower terrace deposits and stabilized gravel bars. It is resilient to disturbance such as high velocity floodwaters, sediment deposition, flooding, and wildlife browsing. Coyote willow reproduces by suckering and seed. Associated plants include other willows (*Salix* spp.), cattails (*Typha* spp.), and cottonwood (*Populus* spp.).

## Ethnobotany

Basketry was an essential tool for subsistence in the Great Basin and Snake River Plain, considering the type of foods that were harvested, transported, and stored (Fowler, 1986). Basketry is extremely important to people who gather small seeds (Steward, 1940). For the Northern Paiute, coyote willow was the preferred species of willow for basketry (Fowler, 1990). Women habitually cut first-year canes for baskets, which produced vigorous and straight canes the next year (Fowler, 1986). Other Great Basin tribes managed willow harvests to ensure supplies and transplanted willows to advantageous locations (Stoffle et al., 1989). Baskets were used as hats, fans, water jugs and cooking vessels, gathering and storage containers, and trays. Small seeds were harvested using a stick to beat the seeds into trays. Trays were also used for winnowing and for parching (burning) seeds. The Northern Shoshone made a type of berry-picking basket that was suspended around the neck so that the picker could use both hands



(Fowler, 1986). Water containers and cooking vessels were made watertight by applying pitch (Murphy & Murphy, 1986). Water was boiled by placing hot stones in the watertight baskets (Steward, 1940).



*Coyote willow stems in spring. Photo by Mary Wolf.*

The Northern Shoshone made fishing weirs out of closely woven willows. These weirs were built in shallow creeks rather than in large rivers. Fish were driven into the structure and then speared (Lowie, 1909). The Northern Shoshone also made basket traps to get salmon from the Snake River and other streams (Steward, 1938).

Dwellings in the Snake River Plain and Great Basin were often circular houses with a frame of willow branches covered by tules or long grass (Fowler, 1990; Lowie, 1909; Stoffle et al., 1989). Willow poles were also used for building sweat lodge frames and willow fiber used extensively for cordage (Blankinship, 1905). Coyote willow was also used to make cradle-boards (Stoffle et al., 1989).

Train et al. (1941) reported that for medicinal purposes, most Native Americans they interviewed did not distinguish between different species of willow. Root decoctions were considered to be a good 'blood purifier' and a solution made from boiled root bark was a spring tonic (Train et al., 1941). Willow bark was either boiled or chewed as an aspirin-type medicine (Stoffle et al., 1989). Decoctions were taken for fevers (Blankinship, 1905). Burned roots were ground to a powder, made

into pills and used to treat dysentery (Train et al., 1941). Ground stem bark was applied as a healing agent to the navels of young babies (Train et al., 1941). A poultice of mashed roots was applied to the gums for toothaches (Train et al., 1941).

### **Conservation Uses**

Coyote willow is commonly planted for streambank and lakeshore stabilization, maintenance of channel morphology, water quality improvement, ground-water recharge, and flood abatement.

*Wildlife:* Deer, moose, elk and antelope browse on willow twigs, foliage and bark (Stevens et al., 2000; Ogle & Brazeel, 2009). Beavers eat willow branches, while several species of birds eat willow buds and young twigs (Stevens et al., 2000).

### **Plant Production**

*Plant Collection:* Coyote willow roots readily by either stem or root cuttings, so there is little need to use other propagation methods. The preferred timing for harvesting willow cuttings is when they are dormant; however, transplanting of actively growing cuttings can also be successful. To minimize storage time, harvest cuttings in late winter to early spring and plant immediately. If this is not possible, cuttings can be harvested in late fall or winter and stored in a cooler for 3 to 4 months at 33 to 40 °F under moist and dark conditions. Cuttings stored in plastic bags will retain moisture and viability up to four months.

### Establishment and Management

*Cuttings:* Cuttings of coyote willow should range between 2 and 4 ft in length and have a diameter of at least 0.5 in at the base. Soaking the cuttings for 1 to 7 days in cool water prior to planting will increase survival in addition to root and shoot production. Pre-soaking improves stem water content and early root and shoot initiation (Schaff et al., 2002). Approximately 2/3 of the cutting should be planted into the soil. Plant cuttings about 1 to 3 feet apart for suckering willows such as coyote willow. In areas where erosion is anticipated, plant 1 to 2 feet apart to ensure better protection of the banks. If the holes are large enough, multiple stems can be planted together. General ideas on spacing can be found in Idaho Plant Materials Technical Note No. 43: Tree Planting Care and Management (Ogle et al., 2012).

Make sure the willow cuttings can reach the water table. Once coyote willow is planted, it requires little care. Blowouts along the stream should be repaired when they occur. Temporary fencing may be required to prevent grazing during the establishment period, which can take 2 to 5 years depending on growing conditions. After establishment, a grazing plan should be established.

Cuttings can be planted with a waterjet stinger, power auger or by hand. Preferably, cuttings should be planted in early spring after spring runoff occurs in streams or after high water drops to typical levels on reservoirs, ponds, or lakes. See Idaho Plant Materials Technical Note No. 43 for additional information. Avoid planting cuttings during the heat of summer because of the stress it places on them. It is essential to have good contact between cutting and soil for roots to sprout. Air pockets around the cutting will kill the roots. Additional soil may be needed to ensure good soil to stem contact. Preference should be given to native soil nearby to encourage mycorrhizal formation and/or nodule formation by nitrogen-fixing organisms. Mud the cuttings in after they are placed in the hole. Use a bucket and mix soil and water together to get the consistency of syrup. Pour the mix into the hole around the cutting until it reaches the surface. As the water leaches into the surrounding soil, the soil will settle out around the cutting and will ensure good soil to stem contact.

Clump plantings wherein a backhoe is used to scoop and transplant entire clumps of vegetation can be used in areas where heavy runoff occurs or where the water column directly impacts vertical banks. See Idaho Plant Materials Technical Note 42: Planting Willow Clumps (Hoag, 2003) for more information.



*Coyote willow with female catkins. Photo by Derek Tilley.*

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## WESTERN CHOKECHERRY

*Prunus virginiana* L. var *demissa* (Nutt.) Torr

Plant Symbol = PRVID

## BLACK CHOKECHERRY

*Prunus virginiana* L. var *melanocarpa* (A. Nelson) Sarg.

Plant Symbol = PRVIM



Western chokecherry (*Prunus virginiana* var. *demissa*) fruit. Photo by Mary Wolf.

### Description

**General:** Rose Family (Rosaceae). Chokecherry is a native, deciduous, thicket-forming large shrub or small tree reaching heights up to 30 ft. The crown is irregular and 10 to 20 ft wide when mature. Leaves are dark green, glabrous, alternate, oval to broadly elliptic in shape with a serrulate margin, 1 to 4 in long, and  $\frac{3}{4}$  to 2 in wide. The bark varies from gray to reddish brown. Chokecherry has perfect flowers arranged in cylindrical racemes 3 to 6 in long. The racemes always grow on the current year's leafy twig growth. Individual flowers are  $\frac{1}{4}$  to  $\frac{3}{8}$  in in diameter with 5 white petals. The flowers start appearing before the leaves are fully developed. Flowers may appear from April to July and fruits form a couple of months later. The fruits are spherical drupes,  $\frac{1}{4}$  to  $\frac{3}{8}$  in diameter. Small ripe cherries range in color from dark red to almost black. Chokecherry can reproduce by seed or rhizomes (Crowder et al., 2004).

Two varieties of chokecherry are found in Western North America: Western chokecherry (*Prunus virginiana* var. *demissa*) produces dark red fruit. Black chokecherry (*Prunus virginiana* var. *melanocarpa*) produces black fruit. Both occur in Idaho with black chokecherry being the more common of the two in our range.

**Habitat and Adaptation:** Chokecherry is found in a wide range of habitats and soil types. It grows best in areas with 13 to 65 in annual precipitation. It occurs at elevations up to 10,000 ft. Chokecherry is intolerant of shade, poor drainage, frequent flooding and heavy clay soils. Chokecherry is well adapted to fire disturbance. It can be top-killed by fire, but re-sprouts readily from root crowns and rhizomes. Associated plants include antelope bitterbrush (*Purshia tridentata*), serviceberry (*Amelanchier alnifolia*), and big sagebrush (*Artemisia tridentata*).

### Ethnobotany

Chokecherries were extensively used by Native Americans in the Snake River Plain and Great Basin, as well as in surrounding areas.

The gathered berries were mashed with stones, then the pulp was formed into small cakes that were dried in the sun (Lowie, 1909; Steward, 1939; Fowler, 1989). Sometimes the whole berries were sun dried and stored (Fowler, 1986). The dried berries were eaten dry or mixed with other food such as mush or pemmican (Steward, 1938; Blankinship, 1905).

In the northern Great Basin, chokecherry bark and dried roots were boiled in water to treat coughs and colds. This tea also treated indigestion. Pulverized dried bark was used as a drying powder for sores. (Train et al., 1941).

**NOTE: The leaves, bark, stem, and seed of chokecherry all contain toxic compounds and should only be used by qualified practitioners. The flesh of the fruit is not toxic.**



*Western chokecherry in bloom. Photo by Mary Wolf.*

#### **Conservation Uses**

*Wildlife:* Chokecherry is a valuable component of windbreaks and hedgerows. Chokecherry provides food, cover and nesting habitat for a variety of birds. Chokecherries are an important source of food for wildlife. Bears, coyotes, rabbits, and rodents eat the fruit (Crowder et al., 2004). Deer and antelope browse the leaves (Ogle & Braze, 2009).

#### **Seed and Plant Production**

Chokecherry can be propagated by seed, rhizome cuttings, suckers, crown division, semi-hardwood cuttings and grafting.

*Seed Collection and Cleaning:* Luna et al. (2008) collected the fruits in September when flesh color is deep red to black. Fruits were collected in plastic bags and kept under refrigeration prior to cleaning. Seeds were extracted from pulp by maceration and screening. The seeds are tan at maturity. Seed longevity is 5-10 years at 37-41 °F in sealed containers. There are approximately 4,800 seeds/lb.

*Greenhouse Plant Production:* Luna et al. (2008) placed seeds in a 3:1 (v:v) water:3% hydrogen peroxide soak for 10 minutes, followed by a 48 hour running water rinse. Seeds were then placed into a 90-day cold, moist stratification by placing the seed in fine mesh bags after pretreatment and buried in moist peat moss in a ventilated containers under refrigeration at 37 °F. Seeds often begin to crack or

germinate at 37 °F during cold, moist stratification after 90 days, and are planted as germinants. Do not sow a seed lot until there is visible cracking in at least 50% of stratified seeds. Some seed sources may require a longer stratification period (up to 150 days). Greenhouse temperatures are maintained at 70 to 77 °F during the day and 61-65 °F at night. Seedlings are hand watered and remain in greenhouse until mid-May. Seedlings are then moved to outdoor nursery for the remainder of the growing season.

*Cuttings:* Scianna (2003) describes a process for propagating cuttings. Their use of summer cuttings reflects limited access to plants in the winter months in Yellowstone National Park. Cuttings collected at other times of the year may propagate as well or better. They collected summer cuttings in early August from semi-hardwood sprouts. Cuttings were collected from numerous individual plants in an attempt to sample to the diversity of the ecotype. Cuttings were 6-8 in long with a basal diameter of at least ¼ in. Cuttings were placed inside a Ziplock bag moistened with

water, and then stored in a portable cooler packed with ice. Collected cuttings were held in the portable cooler less than 16 hours before being moved to a walk-in cooler maintained at 34 to 37 °F and at least 80% relative humidity. The cuttings were trimmed to a 5 to 6 in length and all buds, leaves, and branches from the basal 2 to 3 in of each cutting were removed. The cuttings were stored in moistened paper towels during processing. The base of each stem cutting was re-cut at an angle with a sharp knife and the basal end of the stem was wounded with a shallow 1 to 1.5 in wound just below the cambium. The wound was lightly sprayed with water from a mist bottle, and the base placed into rooting compound. Treatments included semi-hardwood cuttings treated with 16,000 ppm IBA, 30,000 ppm IBA, or 2,000 ppm NAA + 40,400 ppm ThiramT (fungicide). The number of cuttings per treatment ranged from 10-68. Rooting ranged from 58% (26 cuttings, 16,000 ppm IBA) to 87% (68 cuttings, 2,000 ppm NAA + 40,400 ppm ThiramT).

### Establishment and Management

*Seeding:* Chokecherry has seed dormancy. About 50% of non-stratified seed will germinate within a couple of months. Freshly harvested seed requires an after-ripening period in the presence of oxygen and moisture for a majority of seed to germinate. Delayed germination may occur up to 4 months after planting. Good germination depends on a cool, moist stratification regime lasting 90 to 160 days at 36 to 41 °F. If seeds are planted in the spring, they should be pre-chilled for 3 months, then placed about ½ in deep. Sow 25 seeds per ft of drill row (Crowder et al., 2004).

*Transplants:* Nursery grown seedlings establish satisfactorily in areas having 15 in or more annual precipitation. Saplings are not tolerant of weedy competition for the first 2 to 3 years after planting. Use of weed barrier fabric, cultivation, or herbicide treatment is necessary for successful establishment.

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## SERVICEBERRY

*Amelanchier alnifolia* (Nutt.) Nutt. ex M Roem.

Plant Symbol = AMAL2

### Alternate Names

Saskatoon, saskatoon service-berry, service-berry, juneberry, shadbush



Serviceberry (*Amelanchier alnifolia*) fruit. Photo by Mary Wolf.

### Description

**General:** Rose Family (Rosaceae). Native shrubs or small trees growing to 20 ft high, variable in growth form, forming thickets, mats, or clumps, the underground portions including a massive root crown, horizontal and vertical rhizomes, and an extensive root system. The bark is thin, light brown and tinged with red, smooth or shallowly fissured. Leaves are deciduous, simple, alternate, ovate to nearly round, 1 to 1.25 in long, with lateral, parallel veins in 8 to 13 pairs, the margins coarsely serrate or dentate to below middle or sometimes entire or with only a few small teeth at the top. Flowers are in short, dense, upright racemes with 5 to 15 flowers. The petals are white, ½ to ¾ in long and strap-like, sepals more or less long-hairy on the inside, reflexing in age. Flowering occurs April-June; fruit ripens July-August. Fruit is ¼ to ½ in long, smooth, purple-black, slightly gray-blue waxy, the pulp fleshy and sweet; seeds 4 to 10 (Nesom, 2000).

**Habitat and Adaptation:** Serviceberry is common in lower-elevation coniferous forests but grows sporadically up to 10,000 ft. It also occurs in montane chaparral, mountain shrub, and the upper limits of pinyon-juniper communities. In

grasslands, it mostly occurs in wooded draws, woodland interfaces, and riparian zones. Serviceberry occurs in open to lightly shaded disturbed sites such as thickets, fencerows, clearings, and edges of woods, and it is conspicuous after disturbances such as fire, logging, or insect outbreak. Associated plants include fernleaf biscuitroot (*Lomatium dissectum*), golden currant (*Ribes aureum*), snowberry (*Symphoricarpos* spp.), ponderosa pine (*Pinus ponderosa*), pinyon pine (*Pinus monophylla*), juniper (*Juniperus* spp.) and quaking aspen (*Populus tremuloides*).

### Ethnobotany

Serviceberry fruit was widely used in the Great Basin culture area, including the Snake River Plain (Fowler, 1986). The berries were eaten fresh or added to meat to make pemmican (Nickerson, 1966). The berries were also mashed and dried in strips for winter use (Blankinship, 1905). The Shoshone boiled the green inner bark with sugar. The cooled solution was used as eyedrops to treat snow blindness. Sometimes the root was boiled with the inner bark for this purpose (Train, 1941). In addition to using the berries for food, people used the wood to make bows, basket rims, and diggings sticks (Steward, 1938).

### Conservation Uses

Serviceberry is an important species for reclamation, watershed, and shelterbelt plantings. It is also used as an attractive ornamental shrub.

*Wildlife:* The berries are an important food source for many bird species, squirrels, and chipmunks (Nesom, 2000). The foliage is browsed by elk, deer, and antelope (Ogle & Brazee, 2009).

### Seed and Plant Production

*Seed Collection and Cleaning:* Barner (2007) describes the following method for collecting and cleaning seed: Hand collected seeds are cleaned by maceration, pulp and debris are floated off, and seeds are dried on mesh trays. Seed was then air-screened using an office Clipper, with a top screen, 6 or 7 round or a 10 triangle and a bottom screen, 1/23 round, medium to high speed, with medium air. There are approximately 102,000 seeds/lb. Seeds may remain viable for 10 or more years (Nesom, 2000).

*Vegetative cuttings:* Luna & Hosokawa (2008) found that rooting success of cuttings was very dependent on correct timing. They cut semi-hardwood stems in May-June. Cuttings were kept moist and under refrigeration prior to pretreatment with rooting powder. Cuttings were placed in 50:50 sand and perlite rooting medium under mist and bottom heat maintained at 70 °F for 8 weeks. Bottom heat was maintained at 70 °F with heating cables buried 5 in beneath rooting medium. Intermittent mist was applied according to daily outdoor temperature and wind. Too frequent misting will result in leaf and stem rot. The mist bed was covered with shade cloth during rooting. After cuttings were potted, they were moved to an outdoor shade house for 4 weeks. The cuttings were later moved to full sun exposure in the outdoor nursery and irrigated each morning until the containers were thoroughly watered.

### Establishment and Management

Seedlings can take up to 5 years before they start to produce fruit, but vegetative cuttings may begin to produce fruit at 2 to 4 years old. With proper management, fruit yields can reach 7,000 to 9,000 lb/ac. Flowers are produced almost every year, but good seed crops may be produced only every 3 to 5 years because of drought, spring frost, and/or juniper rust (Nesom, 2000).

*Seeding:* Seeds require cold stratification to break dormancy. For greenhouse production, cold moist chill for 120 days at 34 to 37 °F (Scianna, 2003a; Luna et al., 2008). Luna et al. (2008) describe the following method: Prior to stratification, place seeds into a 3:1 water: hydrogen peroxide (3%) rinse for 10 minutes followed by a 48 hour running water rinse. They placed the seed in mesh bags for stratification and removed the bags weekly for a wash to remove any mucilaginous material. Lower germination percentages were noted with seed lots that did not receive the hydrogen peroxide rinse prior to stratification. Fall field sowing of fresh seed usually results in good germination (~50%) the next spring, although small amounts of additional germination may occur the second spring (Scianna, 2003b).



*Serviceberry in bloom. Photo by Derek Tilley.*

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