



WESTERN FORBS

BIOLOGY, ECOLOGY, & USE IN RESTORATION



A FIELD GUIDE COMPANION

RECOMMENDED CITATION FOR THE FIELD GUIDE

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FOREWORD

Forbs (wildflowers) are essential components of resilient, biologically and functionally diverse communities, but their use in restoration and rehabilitation in the Intermountain West remains limited. This guide is a companion field resource to *Western Forbs: Biology, Ecology, and Use in Restoration*, an online book that synthesizes existing research on and practical experience with western forb species. This first volume field guide summarizes plant, seed, and fruit identification information, general species ecology, and important tips related to seed collection and planting. It is designed to aid seed collectors, seed growers, nursery staff, landowners, restoration practitioners, and land managers as they increase the supply and use of native forbs.

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BACKGROUND

This field guide is the first volume of a companion resource to the online Western Forbs: Biology, Ecology, and Use in Restoration project (westernforbs.org), which provides a comprehensive synthesis of knowledge, literature, and practical experience related to work with western forb species. Because our knowledge of the ecology and use of native forbs is constantly increasing, the Western Forbs project serves as a living resource that is updated to include both additional species of interest for restoration and content updates to the existing species reviews based on the availability of new information.

The Western Forbs project synthesizes the current knowledge related to the native plant materials development process and the use of native forbs in restoration. It provides relevant information to a variety of end users, including seed collectors, seed growers, nursery staff, landowners, restoration practitioners, and land managers. Each species reviewed on the website outlines the current knowledge related to the biology, ecology, seed technology, and use in restoration as gathered from publications, reports, guides, management recommendations, seed testing and plant propagation protocols, and producer and practitioner experience available at the time of publication.

FOCAL SPECIES

The species presented in this first volume of the field guide were prioritized by federal land managers based on their importance to degraded Great Basin sites in the greatest need of restoration. These plants were selected based on a variety of factors, including their broad geographic distributions; their ability to provide resources for wildlife, including pollinators; their known ability to persist in disturbed or invaded areas; and sufficient available knowledge and technology to support the economic collection, production, and deployment of their seed. Traits of these species are described within the text to enable selection of adapted species that would add diversity (e.g., structural, functional, phenological) to seed mixes and the resulting plant community. For many of these species, seed is or will soon become available for use in restoration.

BACKGROUND

IMPORTANCE OF FORBS

Forbs add species diversity to many semi-arid and arid land plant communities and are essential for supporting ecosystem function, resistance to invasion by nonnative species, and resilience to disturbance. Forbs play a vital role in providing food and cover resources for wildlife, including native pollinators. They are also important for providing other ecosystem services, including aesthetics, medicinal values, and low-maintenance and waterwise landscaping.

There is a desire to include forbs in restoration, but many practitioners lack access to important information about their use in the Intermountain West. Over the last decade, the need for the development of genetically diverse native plant materials for use in restoration has been recognized as a national priority. Research in support of the use of forbs in restoration is ongoing and aims to facilitate both access to genetically appropriate and diverse native plant materials and best practices for improving restoration outcomes. This companion field guide is designed to connect practitioners with the best available knowledge related to native forbs and their use in seedings and plantings. Organization of the field guide as well as WesternForbs.org follows the steps of the Seed Supply Chain (Fig. 1).



Figure 1. The Seed Supply Chain, adapted from McCormick et al. 2021.

BACKGROUND

SEED SOURCING AND PLANNING

Climate change is generally causing areas to become warmer and drier and creating more variability in extreme weather events. These climate-related changes cause native plants to experience increased stress and shifts in phenology, as well as potentially promote the growth of nonnative species. These environmental changes make it even more important to select plant material for restoration from populations adapted to the current levels of climate change at the planting site.

Using ecoregions and seed transfer zones as guidance for seed sourcing will improve restoration outcomes by identifying seeds that come from an origin that aligns with the environmental conditions found at the restoration site. Ecoregions represent ecological environmental filters, like soils and plant communities, and seed transfer zones represent climate filters, like temperatures and moisture availabilities, that describe the environments where plants have grown and adapted. Using both ecoregions and seed transfer zones as guidance is a useful approach for selecting genetically appropriate seed for restoration.



In the United States, we typically use EPA ecoregions to describe ecological environments. More information about EPA ecoregions can be found at www.epa.gov/eco-research/ecoregions. This guide provides maps showing presence locations, based on herbarium records, where each species has been found across the western US and how these locations relate to EPA ecoregions.



A variety of seed transfer guidance is available. Provisional seed transfer zones provide general guidelines for movement of seed for all plants based on climatic data (temperature and aridity) but are not species-specific. Empirical seed transfer zones are based on species-specific research to correlate variation in plant traits with local climates to suggest adaptation. More information about seed transfer guidance can be found using the Western Wildland Environmental Threat Assessment Center (WWETAC) – TRM Seed Zone Applications website at <https://www.fs.usda.gov/wwetac/seedzoneGISdata.php>.

HOW TO USE THIS GUIDE

Scientific and common names used within this guide follow the Flora of North America (FNA). Common names and four-letter codes follow the USDA PLANTS database (<https://plants.usda.gov/>).

The forb species in this guide are arranged alphabetically by scientific name. Flowering phenology of each species is provided in the lower right of each page, using the color-coding below:

FLOWERING PHENOLOGY

SPRING

SUMMER

FALL

Each forb profile contains a QR code that links to the complete species synthesis housed at

WesternForbs.org. QR codes can be read by most smart devices by opening the camera app, focusing on the QR code, and tapping the notification that appears on the screen.

Wildlife and livestock use corresponds to the following animal symbols*:



Ungulates



Large Mammals (Non-ungulate)



Livestock



Small Mammals



Birds



Insects



Reptiles

*Deer: native ungulates (deer, elk, moose, pronghorn); Bear: large non-ungulate mammals; Sheep: livestock (cattle, sheep, horses); Mouse: any small mammal; Birds: any bird including gamebirds, songbirds, and hummingbirds; Bee: any insects (bees, butterflies, moths, beetles); Lizard: any reptile (lizard, snake, tortoise).

Common Name

Scientific Name

4-Letter Code

ARROWLEAF BALSAMROOT

(*Balsamorhiza sagittata*)

DESCRIPTION

Plants are large (± 2.5 ft tall in flower), tufted, erect, **perennials** from a deep, partially woody **taproot**. **Leaves** (± 18 in long, 6 in wide) are primarily basal and silvery green with short soft hairs. The large yellow flowerheads (2.5-4 in wide) are terminal on the stems and **bloom** early in the growing season. **Hybridization** is common for the genus where species distributions overlap.

Plants **reproduce** entirely from seed. Flowers are **self- and cross-pollinated**, but seed production is improved with cross-pollination. Important **pollinators** include native ground-dwelling mason bees (*Osmia* spp.), mining bees (*Andrena* spp.), longhorned bees (*Eucera* spp.), furrow bees (*Halictus* spp.), sweat bees (*Lasioglossum* spp.), and cuckoo bees (*Nomada* spp.). Fruits are achenes commonly referred to as seeds. **Seeds** are large and **ripen** relatively uniformly in early summer. They are not dispersed far from the mother plant.

ECOLOGY

Plants are **long-lived**, most common in **mid- to late-seral** communities and are **disturbance tolerant**, but abundance decreases following particularly severe or continual disturbances.

Wildlife and Livestock Use



01: Asteraceae



Arrowleaf balsamroot plants in full bloom growing in Wyoming. Photo: USDI BLM WY 050 SOS.



Large stand of plants with flowers in full bloom. Photo: USDI BLM WY040 SOS.

SPRING EARLY SUMMER

ARROWLEAF BALSAMROOT

(*Balsamorhiza sagittata*)

Plant Associations SD Grass, Sage, Mtn Brush, PI, Dry Forest, Aspen. **Elevation:** 330-9,850 ft. **Soils:** deep, well-drained, fine- to coarse-textured, and neutral. Mean annual **precipitation:** ≥ 12 in.

REVEGETATION NOTES

- Seed **damage** from late frosts, herbivory, and insect predation is common. Conduct a **cut test** to check seed fill and determine whether collection should proceed.
- Harvest** when the seed heads are dry and seeds are dark brown to black and not dented by fingernail pressure.
- Seed is easily **hand collected** by stripping, clipping, or plucking the seed heads or beating them over a container.
- Seeding** should occur in the fall to provide the required cool, moist stratification (± 70 d).
- Drill seeding** (± 1 in deep) is recommended.
- Seed in separate rows from rapidly establishing species as **seedlings** are slow growing.
- Persistence** is excellent once plants are established. Plants are **reproductively mature** at three to four years of age and produce seed for decades.
- Most **marketed seed** is obtained from wildland collections. Plants are rarely grown in seed fields.
- Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Seedhead and individual seeds (achenes). Photo: USDI BLM OR030 SOS.



North American distribution of arrowleaf balsamroot. Map: M. Risk, USDI USGS.

SPRING EARLY SUMMER

02: Asteraceae

Family Name

Flowering Phenology

PLANT ASSOCIATIONS

This guide identifies the plant associations that provide habitat for each forb species. Below is a list of the short-hand names for the plant associations referred to in the species summaries. Ideally, this information can be used to identify forb species that align with the pre-disturbance plant communities found in areas in need of restoration. Complete descriptions of these plant associations are provided on pages 6-20.

- **SD Grass** – Intermountain semi-desert grasslands
- **Prairie** – Prairie grasslands
- **Low Sage** – Low sagebrush shrublands
- **Salt Desert** – Salt desert shrublands
- **Sage** – Cool desert sagebrush shrublands
- **Warm Desert** – Warm desert shrublands
- **Chaparral** – Chaparral shrublands
- **Riparian** – Riparian vegetation
- **Mtn Brush** – Mountain tall shrublands or woodlands
- **PJ** – Pinyon-juniper woodlands
- **Aspen** – Aspen woodlands
- **Oak** – Oak woodlands
- **Dry Forest** – Dry conifer forests
- **Mesic Forest** – Mesic conifer forests
- **Sub-Alpine M/S** – Meadows and shrublands in the subalpine or alpine zones
- **Sub-Alpine F** – Forests in the subalpine or alpine zones

PLANT ASSOCIATIONS

INTERMOUNTAIN SEMI-DESERT GRASSLANDS (SD GRASS)



Bluebunch wheatgrass (*Pseudoroegneria spicata*)-dominated semi-desert grassland, Jacks Creek Wilderness, Idaho. Photo: USDA Forest Service.

Shrubs: *Artemisia tridentata* subsp. *tridentata*, *A. t.* subsp. *wyomingensis*, *Atriplex*, *Chrysothamnus*, *Ephedra*, *Ericameria*, *Gutierrezia sarothrae*, *Rosa*

Forbs: *Astragalus*, *Balsamorhiza sagittata*, *Dieteria canescens*, *Eriogonum*, *Lupinus*, *Penstemon*, *Sphaeralcea*
Nonnative forbs: *Bassia scoparia*, *Salsola tragus*, *Sisymbrium altissimum*

Grasses: *Achnatherum*, *A. hymenoides*, *Bouteloua gracilis*, *Festuca*, *F. idahoensis*, *Hesperostipa comata*, *Koeleria macrantha*, *Pascopyrum smithii*, *Pleuraphis jamesii*, *Poa*, *P. secunda*, *Pseudoroegneria spicata*, *Sporobolus cryptandrus*
Nonnative grasses: *Bromus tectorum*, other annual *Bromus*

Intermountain semi-desert bunchgrass grasslands extend from southwestern Canada to northern Utah and Nevada and from eastern Washington and Oregon to western Montana and Wyoming, although there are scattered pockets beyond this range. Terrain is highly variable and includes basins, plateaus, foothills, and river drainages. These grasslands occur at elevations from 1,150 to 7,600 ft. The climate is cold temperate with hot summers and cold winters. Annual precipitation typically ranges from 8 to 20 in. Soils in the north are generally deep and derived from windblown loess but are variable elsewhere. Excessive grazing, cheatgrass (*Bromus tectorum*) invasion, and wildfire have altered these grasslands. They have experienced a loss of native bunchgrasses and increases in nonnative grasses and forbs.

PLANT ASSOCIATIONS

PRAIRIE GRASSLANDS (PRAIRIE)



Short-grass prairie, Pawnee Grasslands, Wyoming. Photo: A. Hild.

Forbs: Perennials: *Calochortus*, *Eriophyllum*, *Papaver*, *Scutellaria*

Fire annuals: *Antirrhinum*, *Allophyllum*, *Lotus*, *Lupinus*, *Phacelia*

Opportunistic to persistent annuals: *Camissonia micrantha*, *Crassula connata*, *Filago californica*, *Cryptantha*, *Lotus*

Nonnative: *Medicago*

Grasses: North: *Festuca*, *Hesperostipa*, *Poa*, *Pseudoroegneria spicata*

South: *Aristida*, *Bouteloua*, *Eragrostis*, *Pleuraphis mutica*, *Setaria*, *Sporobolus*

Vast North American prairies stretch from the Rocky Mountains to the eastern U.S. and from the Canadian Provinces to the Rio Grande plains. Prairie composition diverges primarily as a function of latitude and precipitation. Eastern tallgrass prairies average about 35 in of annual precipitation and western shortgrass prairies average 8 to 10 in. Prairies in western coastal states associated with cold winter precipitation support high percentages of cool season species. The relative ratio of ground cover to bare interspaces and the forb species present both shift with moisture availability. Prior to Euro-American settlement and fire control activities, the common occurrence of drought conditions and frequent burning placed important limits on the encroachment of woody species (*Artemisia*, *Atriplex*, *Juniperus*, *Prosopis*, *Sarcobatus*) into the prairies.

PLANT ASSOCIATIONS

LOW SAGEBRUSH SHRUBLANDS (LOW SAGE)



Low sagebrush (*Artemisia arbuscula*) community in southern Colorado.
Photo: B. Richardson.

Shrubs: *Artemisia arbuscula* subsp. *arbuscula*, *A. a.* subsp. *longiloba*, and *A. a.* subsp. *thermopola*

Forbs: *Antennaria*, *Astragalus*, *Collinsia*, *Eriogonum*, *Navarretia*, *Phlox*

Grasses: *Achnatherum nelsonii*, *Elymus elymoides*, *Pseudoroegneria spicata*

Nonnatives: *Bromus tectorum*, *Taeniatherum caput-medusae*

Low sagebrush shrublands occur from central Washington to central California and east to Wyoming and Colorado. They often occur within larger stands of big sagebrush (*Artemisia tridentata*) on adapted sites at 2,300 to 11,500 ft in elevation. They occupy rocky, shallow, alkaline clay soils that often overlay an impermeable hardpan or bedrock. Soils may be saturated in spring but are dry in early summer, limiting the growing season. Low sage (*A. arbuscula* subsp. *arbuscula*) grows on shallow rocky soils at high elevations, early or alkali sagebrush (*A. a.* subsp. *longiloba*) grows on alkaline clay soils with poor drainage, and cleftleaf sagebrush (*A. a.* subsp. *thermopola*) grows on soils derived from igneous rock. Low sagebrush communities recover slowly following disturbance. Although the open vegetation is not conducive to fire spread, fires do occur where annual grasses have invaded.

PLANT ASSOCIATIONS

SALT DESERT SHRUBLANDS (SALT DESERT)



Salt desert shrubland dominated by shadscale saltbush (*Atriplex confertifolia*) in Utah. Photo: USDA Forest Service.

Shrubs: *Atriplex*, *Ephedra*, *Grayia spinosa*, *Krascheninnikovia lanata*, *Sarcobatus*

Sub-shrubs: *Allenrolfea occidentalis*, *Salicornia utahensis*, *Suaeda*

Forbs: Perennial: *Sphaeralcea*. Annual: *Atriplex*, *Chenopodium*
Nonnative annuals: *Halogeton glomeratus*, *Lepidium*, *Salsola*

Grasses: *Achnatherum hymenoides*, *Distichlis spicata*, *Elymus elymoides*, *Leymus cinereus*, *Sporobolus aeroides*
Nonnative: *Bromus tectorum*

Large expanses of salt desert shrublands occur in the Intermountain West on the saline soils of pluvial lake basins. Smaller salt desert areas occur in seasonally flooded playas, marshlands, and uplands with deep water tables. Vegetation is low growing. Cover is generally less than 25% and clustered in areas of nutrient accumulation. Moisture and salinity gradients often sort shrub species into bands of near monocultures. Soils are often finer textured than the adjacent grasslands and may be covered with biological soil crusts. Precipitation is low and highly variable (<9 in/yr). Summers are very hot, and winters are cold. Excessive spring grazing by livestock, insect infestations, and precipitation shifts have contributed to invasion by nonnative annual forbs (e.g., halogeton [*Halogeton glomeratus*], prickly Russian thistle [*Salsola tragus*]) and grasses, which have increased the occurrence of wildfire in areas that rarely burned historically.

PLANT ASSOCIATIONS

COOL DESERT SAGEBRUSH SHRUBLANDS (SAGE)



Big sagebrush shrubland (*Artemisia tridentata* subsp. *tridentata*) in Nevada.
Photo: USDI BLM NV030 SOS.

Shrubs: *Artemisia*, primarily *A. tridentata* subsp. *tridentata*, *Chrysothamnus*, *Ephedra*, *Ericameria*, *Kraschinnikovia lanata*, *Purshia*, *Tetradymia*

Forbs: *Achillea*, *Balsamorhiza*, *Crepis*, *Erigeron*, *Eriogonum*, *Lupinus*, *Penstemon*, *Phlox*

Grasses: *Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus elymoides*, *Festuca*, *Hesperostipa comata*, *Leymus cinereus*, *Pleuraphis jamesii*, *Poa*, *Pseudoroegneria spicata*, *Sporobolus cryptandrus*

Nonnative: *Bromus tectorum*, *Taeniatherum caput-medusae*

Sagebrush, particularly big sagebrush (*Artemisia tridentata*), dominates millions of acres in basins, plains, plateaus, and foothills from eastern Washington to Wyoming and south to northern Arizona and New Mexico. Shrublands occupying the northern part of this range receive late spring rain and snow that promote a cool season perennial bunchgrass and forb understory. Those further south are more arid but receive summer precipitation. They support smaller-sized big sagebrush and warm season grasses with more open canopies. Biological soil crusts dominate the interspaces. The introduction and spread of nonnative annual grasses (cheatgrass [*Bromus tectorum*] and medusahead [*Taeniatherum caput-medusae*]) in big sagebrush shrublands has increased the frequency of fires, which has resulted in the loss of non-sprouting sagebrush plants and depleted native seed banks.

PLANT ASSOCIATIONS

CHAPARRAL SHRUBLANDS (CHAPARRAL)



Chaparral shrubland on northwestern slopes of Mt. San Jacinto in southern California. Photo: R. Cox.

Shrubs: *Adenostoma fasciculatum*, *Arctostaphylos glandulosa*, *A. pungens*, *Ceanothus*, *C. vestitus*, *Cercocarpus betuloides*, *Garrya flavescens*, *Quercus berberidifolia*, *Q. gambelii*, *Q. turbinella*

Sub-shrubs: *Eriogonum fasciculatum*, *Salvia apiana*, *S. mellifera*

Annual forbs: Fire annuals: *Allophyllum*, *Antirrhinum*, *Lotus*, *Lupinus*, *Phacelia*

Opportunistic to persistent annuals: *Camissonia micrantha*, *Crassula connata*, *Cryptantha*, *Filago californica*, *Lotus*

Perennials: *Calochortus*, *Eriophyllum*, *Papaver*, *Scutellaria*

Nonnative: *Medicago*

Grasses: California chaparral: Annual *Bromus*, *Festuca*

Arizona chaparral (grasses less common): *Elymus*, *Eragrostis*, *Poa*

Chaparral communities are fire maintained and dominated by resprouting shrub species. There are two chaparral types: California and Arizona. They differ primarily in the weather-driven timing of plant growth. California chaparral grows with winter moisture, while Arizona chaparral grows with summer monsoons. Chamise (*Adenostoma fasciculatum*) is dominant in the denser, almost impenetrable California chaparral, where cover of herbaceous annuals and suffrutescent shrubs is greatest in the first 5 years after fire. Without fire, encroachment by conifers can occur at upper elevations and by oakbrush (*Quercus* spp.) at lower elevations. Manzanita (*Arctostaphylos*) is dominant in the widely spaced, more sparsely vegetated Arizona chaparral. These communities border desert grasslands at their lower limits and ponderosa pine and mountain brush communities at their upper limits. Risk of wildfire is lower in Arizona chaparral but has increased with the proliferation of nonnative grasses. Threats to chaparral include climate change, drought, urban expansion, increased fire frequencies, nonnative grasses, feral hogs, and fragmentation.

PLANT ASSOCIATIONS

RIPARIAN VEGETATION (RIPARIAN)



Riparian vegetation growing along the Salmon River in central Idaho.
Photo: N. Shaw.

Trees: *Alnus*, *Betula*, *Populus*, *P. tremuloides*, *Salix*

Shrubs: *Cornus*, *Prunus*, *Rhus trilobata*, *Ribes*, *Rosa*, *Spiraea*, *Symphoricarpos*, *Vaccinium*

Forbs: *Achillea millefolium*, *Aster*, *Conium*, *Polygonum bistortoides*, *Rumex*, *Saxifraga*, *Thalictrum fedleri*, *Veratrum californicum*, *Veronica*

Grasses: *Deschampsia caespitosa*, *Elymus glaucus*, *Glyceria*, *Phleum*

Nonnative: *Phalaris arundinacea*, *Poa pratensis*

Grasslikes: *Carex*, *Cyperus*, *Equisetum*, *Juncus*, *Scirpus*

Complexes of riparian vegetation form the interface between aquatic and terrestrial communities. They are highly variable both spatially and temporally, and individual species are adapted to specific conditions of water availability and inundation. Riparian communities occur at all elevations. Soils develop from sediments carried downstream or are derived from the surrounding areas. Riparian vegetation provides bank stability, shading for fish and other aquatic organisms, flood control, and acts as a pollution filter. Plant and animal diversity are high, and the vegetation provides important habitat and migration corridors. Excessive grazing, water diversions, and other human activities degrade riparian habitats and result in a loss of associated services. Good condition riparian vegetation without high cover of nonnative species recovers rapidly following fire, especially when protected from high levels of use.

PLANT ASSOCIATIONS

MOUNTAIN TALL SHRUBLANDS OR WOODLANDS (MTN BRUSH)



Mountain shrubland dominated by curl-leaf mountain mahogany (*Cercocarpus ledifolius*). Photo: M. Lavin.

Trees: *Juniperus*, *Pinus*, *Populus tremuloides*, *Pseudotsuga menziesii*

Tall shrubs: *Acer grandidentatum*, *Amelanchier*, *Cercocarpus ledifolius*, *Quercus*

Short shrubs: *Arctostaphylos*, *Artemisia tridentata* subsp. *vaseyana*, *Fallugia paradoxa*, *Purshia*, *Quercus*, *Rhus trilobata*, *Symphoricarpos*

Forbs: *Achillea millefolium*, *Balsamorhiza*, *Eriogonum*, *Heliomeris multiflora*, *Lomatium*, *Lupinus*, *Osmorhiza*, *Penstemon*

Grasses and grasslikes: *Achnatherum hymenoides*, *A. nelsonii*, *Carex*, *Elymus*, *Festuca idahoensis*, *Koeleria macrantha*, *Nassella viridula*, *Pascopyrum smithii*, *Poa*, *Pseudoroegneria spicata*

Nonnative: *Bromus tectorum*

Diverse mountain brush communities occupy foothills, cliffs, canyons, ridges, and steep slopes on the flanks of the Wasatch Mountains, mountains of the Great Basin, and on the Colorado Plateau. Vegetation is characterized by patches of tall shrubs with a diversity of associated herbaceous species that dominate locally. They are bounded by or intermix with sagebrush shrublands, pinyon-juniper (*Pinus-Juniperus*) or aspen (*Populus tremuloides*) woodlands, and montane forests. These shrublands occur at elevations of 5,000 to 9,000 ft. Undifferentiated soils over bedrock are common. Soils are deeper on more level terrain, and aridisols are common at lower elevations. Annual precipitation ranges from about 15 in at lower elevations to 26 in at upper elevations. The frost-free season averages 80 to 120 days. Mountain brush communities provide valuable winter habitat for ungulates and spring and fall grazing for livestock.

PLANT ASSOCIATIONS

ASPEN WOODLANDS (ASPEN)



Quaking aspen (*Populus tremuloides*) woodland on the Wasatch Front, Utah.
Photo: N. Shaw.

Trees: *Populus tremuloides*

Successional species: *Abies concolor*, *A. lasiocarpa*, *Picea engelmannii*, *P. pungens*, *Pinus contorta*, *P. ponderosa*, *Pseudotsuga menziesii*

Shrubs: *Artemisia*, *Amelanchier alnifolia*, *Berberis repens*, *Clematis angustifolia*, *Crataegus douglasii*, *Prunus virginiana*, *Rosa*, *Symphoricarpos*

Forbs: *Achillea millefolium*, *Aster*, *Fragaria*, *Galium*, *Geranium*, *Heracleum*, *Lupinus*, *Maianthemum*, *Osmorhiza*, *Thalictrum*, *Vicia*

Grasses and grasslikes: *Bromus*, *Calamagrostis*, *Carex*, *Elymus*, *Poa*

Aspen (*Populus tremuloides*) woodlands are distributed across the western U.S. from valley bottoms near forest boundaries to high-elevation forests. Some aspen stands are stable climax communities. Others are successional to conifers and depend on fire for their persistence through the production of even-aged clones from post-fire sprouting. Undergrowth is abundant and diverse as light penetrates the canopy more than in adjacent coniferous forests. Species vary geographically, but include shrubs, tall and low-growing forbs, and less often, grasses and grasslikes. Aspen woodlands occur at elevations of 6,500 to 10,500 ft on a variety of soil types, though they often occupy wet soils and exposures. They provide important summer forage and habitat for wildlife. Threats to aspen woodlands include excessive grazing, drought, pests, pathogens, and a lack of fire.

PLANT ASSOCIATIONS

OAK WOODLANDS (OAK)



Revegetated open growth oak woodland in Oregon. Photo: T. Kaye.

Trees: *Pinus sabiana*, *Pseudotsuga menziesii*, *Quercus agrifolia*, *Q. chrysolepis*, *Q. douglasii*, *Q. engelmannii*, *Q. garryana*, *Q. kelloggii*, *Q. lobata*

Shrubs: *Arctostaphylos*, *Ceanothus cuneatus*, *Rhamnus californica*, *Salvia leucophylla*, *Symphoricarpos albus*, *Toxicodendron diversilobum*
Nonnative: *Cytisus scoparius*

Forbs: *Camassia quamash*, *Eschscholzia*, *Lupinus*
Nonnative: *Erodium*

Grasses and grasslikes: *Carex inops* subsp. *inops*, *Elymus glaucus*, *Festuca idahoensis*, *Melica subulata*
Nonnative: *Avena*, *Bromus*, *Lolium*, *Poa pratensis*

Ferns: *Polystichum imbricans*

Oak (*Quercus*) woodlands referenced in this guide are distributed from the Puget Trough and Willamette Valley of the Pacific Northwest to the Central Valley, North Coast, Central Coast, and Transverse Ranges of California. Northwestern oak woodlands and savannas dominated by Oregon white oak (*Q. garryana*) occur on dry to mesic well-drained sites and are maintained by frequent low-severity fire. Shrub and tree densities increase and conifers encroach without fire. California's Central Valley blue oak (*Q. douglasii*) woodlands include various densities and combinations of live and deciduous oaks. Foothill pine species intergrade at high elevations and on steep slopes. In coastal areas, Oregon white oak, California live oak (*Q. agrifolia*), and Engelmann oak (*Q. engelmannii*) are dominant from north to south. Canyon live oak (*Q. chrysolepis*), mixed hardwood and conifer forests intergrade at high elevations. Understories, particularly at low elevations and in open stands, include a dense cover of nonnative herbaceous species. Recruitment of oak seedlings and persistence of oak woodlands are limited by the proliferation of nonnative grasses, predation, and fire

PLANT ASSOCIATIONS

DRY CONIFER FORESTS (DRY FOREST)



Dry conifer forest dominated by ponderosa pine (*Pinus ponderosa*) near Idaho City, Idaho. Photo: C. Gucker.

Trees: *Larix occidentalis*, *Pinus contorta*, *P. ponderosa*, *Populus tremuloides*, *Pseudotsuga menziesii*

Shrubs: *Acer*, *Arctostaphylos*, *Ceanothus*, *Cercocarpus*, *Holodiscus*, *Physocarpus malvaceus*, *Purshia tridentata*, *Spirea*, *Symphoricarpos*, *Rosa*

Forbs: *Achillea millefolium*, *Antennaria*, *Astragalus*, *Geranium*, *Lupinus*, *Potentilla*

Grasses and grasslikes: *Blepharoneuron tricholepis*, *Calamagrostis rubescens*, *Carex geyeri*, *Festuca*, *F. idahoensis*, *Hesperostipa comata*, *H. occidentalis*, *Muhlenbergia montana*, *Poa*, *Pseudoroegneria spicata*

Dry forests dominated by ponderosa pine (*Pinus ponderosa*) occur in mountain ranges across the western U.S. from British Columbia to Mexico and west of the Continental Divide. They occupy low- and mid-elevation sites where winter snow is common and annual precipitation averages 15 in or more. Low moisture conditions prevent more mesic forest trees from establishing. Growing seasons are long, and there can be dry spells in the winter and summer. Dry conifer forests may be limited by drought at their lower edge and cold temperatures at their upper extent. Soils vary but are often poorly developed with high levels of organic matter in the surface layer. Surface fires that were common historically kept these forests open and parklike. Livestock grazing and fire exclusion have contributed to greater tree densities and more severe fires.

PLANT ASSOCIATIONS

MESIC CONIFER FORESTS (MESIC FOREST)



Mesic mixed-conifer forest growing near Priest River, Idaho. Photo: C. Gucker.

Trees: *Abies grandis*, *Acer macrophyllum*, *Picea sitchensis*, *Pinus contorta*, *P. monticola*, *Populus tremuloides*, *Prunus emarginata*, *Pseudotsuga menziesii*, *Thuja plicata*, *Tsuga heterophylla*

Shrubs: *Acer cercinatum*, *Gaultheria shallon*, *Holodiscus discolor*, *Mahonia nervosa*, *Philadelphus lewisii*, *Rhododendron macrophyllum*

Forbs: *Epilobium paniculatum*, *Opolopanax horridus*, *Oxalis oregana*, *Polystichum munitum*, *Xerophyllum tenax*

Grasses: *Bromus*, *Calamagrostis rubescens*, *Carex*, *C. geyeri*, *Festuca*, *Poa*

Mesic conifer forests occur throughout the Northwest and the Rocky Mountains. They are dominated by various conifers including Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*). Overstory and understory composition varies with moisture availability, successional status, and disturbance history. Early seral forests are dominated by Douglas-fir, which may remain dominant on dry sites. On moist sites, it is typically replaced over a period of centuries by western hemlock or other late-seral species. Western hemlock and western red cedar (*Thuja plicata*) dominated forests are common in the Pacific Northwest and in parts of northern Idaho and western Montana. In the Rocky Mountains, Douglas-fir dominates on dry sites between shrublands or dry conifer forests and more mesic or subalpine forests. Post-fire colonizers include lodgepole pine (*Pinus contorta*) on dry sites and quaking aspen (*Populus tremuloides*) on moist sites.

PLANT ASSOCIATIONS

SUBALPINE-ALPINE MEADOWS AND SHRUBLANDS (SUB-ALPINE M/S)



Dwarf shrubs: *Cassiope*, *Ledum*, *Juniperus*, *Phyllodoce*, *Salix*, *Vaccinium*

Forbs: *Antennaria*, *Arenaria*, *Aster*, *Castilleja*, *Geum rossii*, *Pedicularis*, *Polygonum*, *Potentilla*, *Senecio*, *Smilacina*, *Valeriana*

Grasses and grasslikes: *Calamagrostis*, *Carex*, *Deschampsia*, *Festuca*, *Juncus*, *Phleum alpinum*, *Poa*

Lichens, mosses: Common and many species represented

Subalpine shrubland dominated by pink mountainheath (*Phyllodoce empetriformis*) in the Cascade Mountains of Oregon. Photo: S. Garrett.

Subalpine to alpine meadows and shrublands are scattered throughout the West in high-elevation forests and in alpine vegetation above treeline. Vegetation consists largely of mosses, lichens, and low-growing perennial grasses, grasslikes, forbs, and dwarf evergreen or deciduous shrubs. Species composition varies from north to south with high endemism due to the isolation of many high-elevation locations. Vegetation is adapted to surviving low temperatures, desiccation, high snow accumulations, and short growing seasons. These meadows and shrublands may be associated with accumulations of fine sediments or peat in valley bottoms, meltwater areas, and drainage areas on slopes. Tree establishment in these communities is limited by the thick root mats produced by the herbaceous species or by site conditions that include harsh weather exposure and thin soils. In fire-free intervals, aspen (*Populus tremuloides*), willows (*Salix*), or conifers may establish during wet years.

PLANT ASSOCIATIONS

SUBALPINE-ALPINE FORESTS (SUB-ALPINE F)



Alpine forest with Sierra lodgepole pine (*Pinus contorta* var. *murrayana*), mountain hemlock (*Tsuga mertensiana*), and whitebark pine (*Pinus albicaulis*) on the east slope of the Cascade Mountains in Oregon. Photo: S. Garrett.

Trees: *Abies lasiocarpa*, *Picea engelmannii*, *Tsuga mertensiana*
Subalpine white firs: *Pinus albicaulis*, *P. aristata*, *P. flexilis*, *P. longaeva*, *P. strobiformis*

Successional species: *Pinus contorta*, *Populus tremuloides*

Shrubs: *Lonicera involucrata*, *Rhododendron*, *Vaccinium*, *V. myrtillus*, *V. scoparium*

Forbs: *Anemone*, *Arnica cordifolia*, *Cardamine*, *Erigeron*, *Mertensia*, *Pedicularis racemosa*, *Polemonium pulcherrimum*, *Saxifraga*, *Senecio*, *Thalictrum*, *Veratrum*, *Xerophyllum tenax*

Grasses and grasslikes: *Calamagrostis rubescens*, *Carex*, *C. geyeri*, *C. rossii*, *Festuca*, *Poa*

Moss: Common

Subalpine forests occur above montane forests and below the treeline in western mountain ranges from British Columbia to New Mexico. Alpine forests occur in this same area but above the treeline. Dominant conifers include Englemann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), mountain hemlock (*Tsuga mertensiana*), and white pines. The lower margin of these forests occurs at progressively higher elevations from north to south. At mid-elevations, subalpine forests mix with Douglas-fir (*Pseudotsuga menziesii*) and western larch (*Larix occidentalis*). Fringes, islands, and bands of dwarf conifers, largely subalpine fir, occur along the alpine-subalpine interface. Understory diversity can be limited by canopy shading, and generally decreases from north to south and with dry conditions. Subalpine and alpine forests experience very cold winters, short growing seasons, deep snowpacks, and cool summers. They often occur on somewhat shallow, moist, loamy soils. Wind and fire are the major disturbances, and post-disturbance recovery is very slow. Insect and disease problems are increasing with climate change.

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ARROWLEAF BALSAMROOT

(*Balsamorhiza sagittata*)

DESCRIPTION

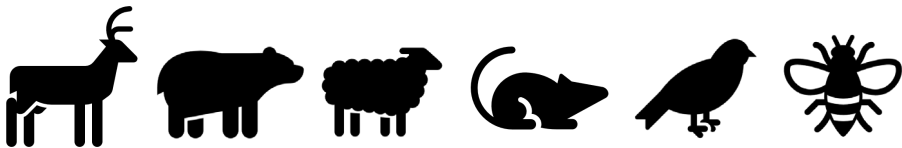
Plants are large (≤ 2.5 ft tall in flower), tufted, erect, **perennials** from a deep, partially woody **taproot**. **Leaves** (≤ 18 in long, 6 in wide) are primarily basal and silvery green with short, soft hairs. The large yellow flowerheads (2.5–4 in wide) are terminal on the stems and **bloom** early in the growing season. **Hybridization** is common for the genus where species distributions overlap.

Plants **reproduce** entirely from seed. Flowers are **self- and cross-pollinated**, but seed production is improved with cross-pollination. Important **pollinators** include native ground-dwelling mason bees (*Osmia* spp.), mining bees (*Andrena* spp.), longhorned bees (*Eucera* spp.), furrow bees (*Halictus* spp.), sweat bees (*Laioglossum* spp.), and cuckoo bees (*Nomada* spp.). Fruits are achenes, commonly referred to as seeds. **Seeds** are large and **ripen** relatively uniformly in early summer. They are not dispersed far from the mother plant.

ECOLOGY

Plants are **long-lived**, most common in **mid- to late-seral** communities, and **disturbance tolerant**, but abundance decreases with particularly severe or continual disturbances.

Wildlife and Livestock Use



Large stand of plants with flowers in full bloom.
Photo: USDI BLM WY040 SOS.



Arrowleaf balsamroot plants in full bloom
growing in Wyoming.
Photo: USDI BLM WY050 SOS.

Lookalikes include Hooker's balsamroot (*B. hookeri*) and deltoid balsamroot (*B. deltoidea*).

ARROWLEAF BALSAMROOT

(*Balsamorhiza sagittata*)

Plant Associations SD Grass, Sage, Mtn Brush, PJ, Dry Forest, Aspen.
Elevation: 330–9,850 ft. **Soils:** Deep, well-drained, fine- to coarse-textured, and neutral. Mean annual **precipitation:** ≥ 12 in.

REVEGETATION NOTES

- Seed **damage** from late frosts, herbivory, and insect predation is common. Conduct a **cut test** to check seed fill and determine whether collection should proceed.
- **Harvest** when the seedheads are dry and seeds are dark brown to black and not dented by fingernail pressure.
- Seed is easily **hand collected** by stripping, clipping, or plucking the seedheads or beating them over a container.
- **Seeding** should occur in the fall to provide the required cool, moist stratification (≥ 70 d).
- **Drill seeding** (~ 1 in deep) is recommended.
- Seed in separate rows from rapidly establishing species as **seedlings** are slow growing.
- **Persistence** is excellent once plants are established. Plants are **reproductively mature** at 3 to 4 years of age and produce seed for decades.
- Most **marketed seed** is obtained from wildland collections. Plants are rarely grown in seed fields.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



BASA



Seedhead and individual seeds (achenes).
Photo: USDI BLM OR030 SOS.



North American distribution of arrowleaf balsamroot. Map: M. Fisk, USDI USGS.

DOUGLAS' DUSTYMAIDEN

(*Chaenactis douglasii*)

DESCRIPTION

Plants are typically **biennials**, short-lived **perennials**, or in rare cases **annuals**. They are **taprooted** with erect to spreading **stems** (6–36 in tall). Herbage is covered in sparse to dense, cobwebby hairs. **Leaves** are gray-green, alternate, and finely dissected. Ten to fifty tiny, tubular, pinkish to white **flowers** are clustered in leafy, flat-topped **inflorescences** (cymes < 1 in wide). **Flowering** commonly occurs in June and July. **Chromosome number** varies, but $2n = 12$, 24, and 36 predominate. The varieties **hybridize**.

Reproduction is exclusively from seed. Although self-pollinated flowers can produce seed, production is greatly improved by cross-pollination. **Pollinators** include native bees, especially nonsocial univoltine bees. Mason bees (*Osmia californica*) and European honeybees (*Apis mellifera*) can be managed and used to pollinate seed production crops. **Fruits** are indehiscent achenes, commonly referred to as seeds. They are small (5–8 mm long), elongate, and gold to black with stiff hairs and a pappus that facilitates **wind dispersal**. **Seeds mature** about 4 to 5 weeks after flowering, commonly in mid-summer, but this varies widely with elevation and latitude and among individual plants and populations.

ECOLOGY

Plants are **early seral**, highly **tolerant of disturbance**, common on rocky areas, and may play a role in advancing successional development.

Wildlife and Livestock Use



Douglas' dusty maiden growing in natural rangeland habitat.
Photo: USDA USFS.

Common yarrow (*Achillea millefolium*) is a **lookalike**.



Inflorescences and individual flowers.
Photo: J. Cane, USDA ARS.

DOUGLAS' DUSTYMAIDEN

(*Chaenactis douglasii*)

Plant Associations SD Grass, Prairie, Salt Desert, Sage, PJ, Dry Forest.

Elevation: 0–13,100 ft. **Soils:** Medium- to coarse-textured, gravelly, dry clays, silts, or sands. Mean annual **precipitation:** ≥ 7 in.

REVEGETATION NOTES

- **Harvest** seed when the inflorescence is dry, pappi are expanded into a white fluffy ball, and seeds are dry, firm, and detach easily.
- Seed can be **hand collected** by plucking, stripping, or shaking the inflorescence into a container.
- Vegetative material should be removed promptly and the seed kept dry without **overheating**.
- Freeze or pesticide-treat seed lots after drying and before **storing**.
- **Seeding** should occur in fall or winter to provide cool, moist stratification (60–90 d).
- **Drill seeding** (0–0.1 in deep) is recommended.
- Good establishment (66–98%) has been reported the first spring following fall **seeding**.
- Plants reach **reproductive maturity** in the first year.
- **Seed production** is variable after year one.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



CHDO



Seed with attached pappus.
Photo: J. Cane, USDA ARS.



North American distribution of Douglas' dustymaiden. Map: M. Fisk, USDI USGS.

TAPERTIP HAWKSBEARD

(*Crepis acuminata*)

DESCRIPTION

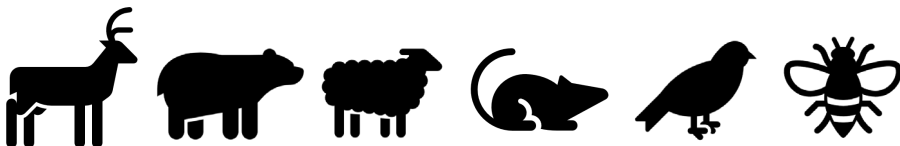
Plants are erect **perennials** with deep, branching **taproots** and single to multiple **stems** (8–33 in tall) with short dense hairs. **Leaves** are gray-green, lobed, and covered with cottony hairs. Stems and leaves contain a milky sap. Many small, yellow **flowers** (20–100) are produced in compound flat-topped inflorescences that typically **bloom** in June or July. **Chromosome numbers** vary: $2n = 22, 33, 44, 55, 88$. Diploid and polyploid forms are difficult to distinguish morphologically, and **hybridization** with nakedstem hawksbeard (*C. pleurocarpa*) has been described.

Seed is produced **sexually** in diploid forms and **asexually** through apomixis in polyploid forms. Diploid plants require pollination for seed production. Primary **pollinators** include mason bees (*Osmia* spp.), mining bees (*Andrena* spp.), bumble bees (*Bombus* spp.), and furrow bees (*Halictus* spp.). **Fruits** (achenes), often referred to as **seeds**, are small (6–9 mm long), cylindrical, ribbed, and yellow to brown with a stiff white pappus that facilitates long-distance **wind dispersal**. Mature seed is **harvested** from mid-June through July, depending on location.

ECOLOGY

Plants tolerate **early- to late-seral** conditions but are generally most abundant in **mid-seral** communities. Plants often appear soon after **disturbances**.

Wildlife and Livestock Use



Tapertip hawksbeard growing on a gravelly site.
Photo: USDA USFS PSSS.

Limestone hawksbeard (*C. intermedia*)
is a **lookalike**.



Seedheads with aphids.
Photo: USDI BLM CA170 SOS.

TAPERTIP HAWKSBEARD

(*Crepis acuminata*)

Plant associations SD Grass, Prairie, Sage, Mtn Brush, PJ, Aspen, Dry Forest. **Elevation:** 2,600–10,800 ft. **Soils:** Well-drained, neutral to slightly alkaline, non-saline, fine to coarse texture. Mean annual **precipitation:** 8–20 in.

REVEGETATION NOTES

- Flowering is **indeterminate**; multiple collections may be necessary.
- **Harvest** seedheads with pappi that are spreading and appear white and fluffy and seeds that are dry and hard. This limits the amount of non-viable seed collected.
- Mature seed can be **hand collected** by gently plucking them from the seedheads or by swatting the seedheads over a container.
- **Insect damage** to seeds is common and should be evaluated prior to making collections.
- Remove vegetative material promptly to prevent **molding**.
- Freeze or pesticide-treat seed lots as soon as possible before **storing**.
- **Seeding** should occur in the fall to provide the necessary cold stratification.
- **Drill seeding** (0.13–0.5 in deep) is recommended.
- Seedling **establishment** in crop and wildland settings can be highly variable.
- Plants are **reproductively mature** at 3 to 5 years of age.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Individual seeds with pappi.
Photo: USDI BLM OR030 SOS.



North American distribution of tapertip hawksbeard. Map: M. Fisk, USDI USGS.

LIMESTONE HAWKSBEARD

(*Crepis intermedia*)

DESCRIPTION

Limestone hawksbeard is a **multi-stemmed perennial** (10–28 in tall) that develops from a slender **taproot**. Plants are covered in fine cottony hairs and exude a milky sap when damaged. **Leaves** are gray-green and pinnately lobed. Plants produce 10 to 60 flowerheads in mostly flat-topped, compound **inflorescences**. Each flowerhead contains 7 to 16 yellow ray florets. Flowers typically **bloom** in May and June. Plants are polyploid ($2n = 33, 44, 55, 88$), and **hybridization** is common.

Most **seed** is produced **asexually** without pollination, resulting in the production of clones. **Fruits** are narrow, ribbed, yellow to brown achenes (0.2–0.4 in long) that are referred to as seeds. **Seeds** have a dusky white pappus that facilitates long-distance **wind dispersal**. Seed often **matures** in June or July.

ECOLOGY

Plants are **long-lived** and often found on recently **disturbed sites** where they may spread rapidly.

Wildlife and Livestock Use



Robust limestone hawksbeard plant.
Photo: USDA USFS PSSSL.

Tapertip hawksbeard (*C. acuminata*)
is a **lookalike**.



Inflorescences exhibiting indeterminate flowering.
Photo: USDA USFS PSSSL.

LIMESTONE HAWKSBEARD

(*Crepis intermedia*)

Plant associations SD Grass, Sage, PJ, Dry Forest. **Elevation:** 1,500–12,800 ft. **Soils:** Well-drained, stony soils of various textures and parent materials. Mean annual **precipitation:** ≥10.5 in.

REVEGETATION NOTES

- Plants reach **reproductive maturity** in 2 to 3 years.
- Seed is generally **mature** when the pappus is developed and the seeds are firm (often June or July).
- Planning, monitoring, and inspection are important for seed collection because of **indeterminate seed set** and high potential for **insect damage**.
- Seed can be **hand collected** by plucking, clipping, or knocking the inflorescences over a container.
- Vegetative material contains a milky sap and should be separated from the seed soon after collection to prevent **molding**.
- Seed should be fall **planted** (0.13–0.25 in deep) to allow for cold stratification, which improves germination.
- Use of row cover in seed fields limits **seed predation** by birds.
- **Predation** of seedlings and seedheads of mature plants can limit establishment, growth, and seed yield.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Seedhead (left) and individual seeds with fluffy pappi (right).
Photos: USDI BLM NV030 SOS (left);
USDI BLM CA170 SOS (right).



North American distribution of limestone hawksbeard. Map: M. Fisk, USDI USGS.

BLUE MOUNTAIN

OR WESTERN PRAIRIE CLOVER

(*Dalea ornata*)

DESCRIPTION

Plants are **perennial, tap-rooted** legumes that emit a strong scent when bruised. **Stems** (12–24 in tall) are glandular and clustered. **Leaves** are glabrous and pinnately compound with five to seven thick, oval leaflets. Plants produce cylindrical **spikes** (diameter ~0.5 in) with perfect, densely packed, five-petaled pink to purple **flowers**. Individual flowers **bloom** upward from the base to the tip in May to July. **Chromosome number** is commonly $2n = 14$, but $2n = 16$ can also occur. **Hybridization** has not been reported.

Plants **reproduce** from seed. Pollination is required for maximum seed production. Primary **pollinators** are bees, mainly carder or potter bees (*Anthidium* spp.), bumblebees (*Bombus* spp.), and long-horned bees (*Eucera* and *Melissodes* spp.). **Seeds** are borne singly in **pods** (3–3.5 mm long). Seed **ripens** from July to August, depending on location.

ECOLOGY

This species is **long-lived** and **disturbance tolerant**.

Wildlife and Livestock Use



DAOR2

Blue mountain prairie clover with some spikes beginning to flower.
Photo: M. Fisk, USDI USGS.

Lookalikes include weedy clovers (*Melilotus* and *Trifolium* spp.).



Flower opening begins at the base of the inflorescence.
Photo: G.A. Monroe, hosted by the USDA NRCS PLANTS database.

BLUE MOUNTAIN

OR WESTERN PRAIRIE CLOVER

(*Dalea ornata*)

Plant associations Sage, PJ. **Elevation:** 330–6,000 ft. **Soils:** Soft clay and sandy soils from weathered basalt and volcanic ash. Mean annual **precipitation:** ≥12 in.

REVEGETATION NOTES

- **Harvest** pods that are dry and detach readily. Ripening is highly indeterminate and progresses from the base upward. Multiple harvests may be necessary.
- Seed can be **hand collected** by stripping the seedheads.
- Pods that appear mature but are not easily stripped may be **insect infested**.
- Seed-feeding **insects** are common. Insecticidal strips, fumigation, or freezing should be used immediately following harvest to prevent seed loss.
- Seed is physically dormant and requires scarification to **germinate**.
- Drill **seeding** (0.25–0.5 in deep) is recommended. This species can be seeded in the spring.
- Inoculating seed with *Rhizobium* bacteria may improve **establishment**.
- Seeding in clusters is recommended for cross-pollination and bee visitation, which is required for good **seed production**.
- Plants reach **reproductive maturity** in year 2 and produce harvestable crops for 6 or more years.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Bulk seed collection from a wildland harvest.
Photo: J. Cane, USDA ARS.



North American distribution of Blue Mountain prairie clover. Map: M. Fisk, USDI USGS.

SEARLS' PRAIRIE CLOVER

(*Dalea searlsiae*)

DESCRIPTION

Plants are **perennial**, **tap-rooted** legumes that emit a strong scent when bruised. **Stems** (10–24 in tall) are glabrous and clustered. **Leaves** (0.8–2.2 in long) are alternate and odd-pinnately compound, typically with five to seven, thick, oval leaflets (5–18 mm long). Plants produce cylindrical **spikes** (0.6–5 in long) with perfect, densely packed, five-petaled pink to purple **flowers**. Flowers **bloom** upward from the base to the tip in May to July. **Chromosome number** is commonly $2n = 14$, but $2n = 16$ also occurs. **Hybridization** has not been reported.

Plants **reproduce** from seed, and seed production requires pollination. Primary **pollinators** include carder or potter bees (*Anthidium* spp.), bumblebees (*Bombus* spp.), plasterer bees (*Colletes* spp.), and long-horned bees (*Eucera* and *Melissodes* spp.). **Fruits** are small, hairy pods with two ovules, but just one **seed** matures. Seed **ripens** in June and July.

ECOLOGY

This species is a **long-lived** perennial that is **fire tolerant** but sensitive to early spring grazing and trampling.

Wildlife and Livestock Use



Searls' prairie clover growing at the edge of the Great Salt Lake Desert, NV.
Photo: USDA USFS.

Lookalikes include weedy clovers (*Melilotus* and *Trifolium* spp.).



Inflorescences at various stages of blooming.
Photo: S. Bushman, USDA ARS.

SEARLS' PRAIRIE CLOVER

(*Dalea searlsiae*)

Plant associations Salt Desert, Sage, PJ, Mesic Forest. **Elevation:** 3,300–9,200 ft. **Soils:** Lime-rich, sandstone, or bedrock substrates with sandy or gravelly texture. Mean annual **precipitation:** 6–14 in.

REVEGETATION NOTES

- **Harvest** pods that dehisce readily and contain firm, dry seeds. Seed maturation begins at the base of the inflorescence. Multiple harvests may be necessary.
- Seed can be **hand collected** by stripping the seedheads.
- Seed-feeding **insects** are common. Insecticidal strips, fumigation, or freezing should be used immediately following harvests to limit damage to collections.
- Seed is hard, physically dormant, and requires scarification to **germinate**.
- **Drill seeding** (0.25–0.5 in deep) in the fall is recommended.
- Seeding in clusters is recommended to facilitate cross-pollination and bee visitation, which is required for good **seed production**.
- Plants reach **reproductive maturity** in year 2 and produce harvestable crops for 6 or more years.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Field-collected seeds and chaff.
Photo: USDI BLM CP3 SOS.



North American distribution of Searls' prairie clover. Map: M. Fisk, USDI USGS.

HOARY TANSYASTER

(*Dieteria* [*Machaeranthera*] *canescens*)

DESCRIPTION

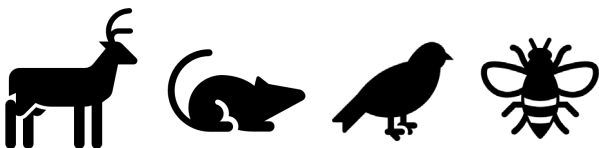
Plants are **annuals, biennials, or short-lived perennials** with **taproots** and one to many erect to spreading **stems** up to 30 or 40 in tall. Herbage is covered with a sticky and pungent resin. **Leaves** are alternate, simple, linear to oblong, and sparsely to densely hairy. Basal leaves (≤ 4 in long) are often shriveled or absent at the time of flowering. Stem leaves are slightly smaller and persistent. Plants produce numerous terminal **flowerheads** each with 8 to 25 purple to pink ray **flowers** surrounding 10 or more yellow disk flowers. Flowers **bloom** from July to October. **Hybridization** within the genus and among the many varieties is common.

Plants **reproduce** from seed, and pollination is required. **Pollinators** include sweat bees (*Halictus* and *Agapostemon* spp.), honey bees (*Apis mellifera*), bee flies (Bombyliidae), western white butterflies (*Pontia occidentalis*), and garden white butterflies (*Pieris* spp.). **Fruits** (achenes) are commonly called seeds. **Seeds** are small (2.5–4 mm long), elongate, and have a dirty white, hair-like pappus that facilitates long-distance **wind dispersal**. Seed typically **ripens** in late summer or early fall, but timing varies with location and among varieties.

ECOLOGY

Plants are fast-growing, early-reproducing, **disturbance-tolerant**, and typically grow in **early** and **mid-seral** communities.

Wildlife and Livestock Use



DICA18 (MACA2)



Hoary tansyaster plant in flower.
Photo: USDI BLM NM930N SOS.

Russian knapweed (*Rhaponticum repens*) is a **lookalike**.



Flowerheads with disk and ray florets and bracteate receptacles. Photo: USDI BLM UT080 SOS.

HOARY TANSYASTER

(*Dieteria* [*Machaeranthera*] *canescens*)

Plant associations SD Grass, Low Sage, Sage, Dry Forest.

Elevation: 1,000–11,000 ft. **Soils:** Medium- to coarse-textured (≥ 10 in deep).
Mean annual **precipitation:** ≥ 8 in.

REVEGETATION NOTES

- Seed **matures** about 4 to 5 weeks after flowering.
- Seed **disperses** readily when mature, so planning and timing are critical for collecting large quantities of seed.
- Flowering and seed maturation are **indeterminate**, which allows for several collections over the ripening period.
- Mature seed can be **hand collected** by stripping or shaking branches over a container.
- **Gloves** are recommended because of the sticky stems and seedheads.
- Seed collected late in the growing season or during cool, moist conditions requires careful drying before **storing** or cleaning.
- Fall **seeding** is recommended because seed from more northern or continental populations requires stratification.
- **Drill seeding** (≤ 0.25 in deep) is recommended, although seed can be broadcast using heavier seeding rates and practices to ensure good seed-to-soil contact.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



DICA18 (MACA2)



Individual seeds with attached pappi.
Photo: USDI BLM ID931 SOS.



North American distribution of hoary tansyaster.
Map: M. Fisk, USDI USGS.

NAKEDSTEM SUNRAY

(*Enceliopsis nudicaulis*)

DESCRIPTION

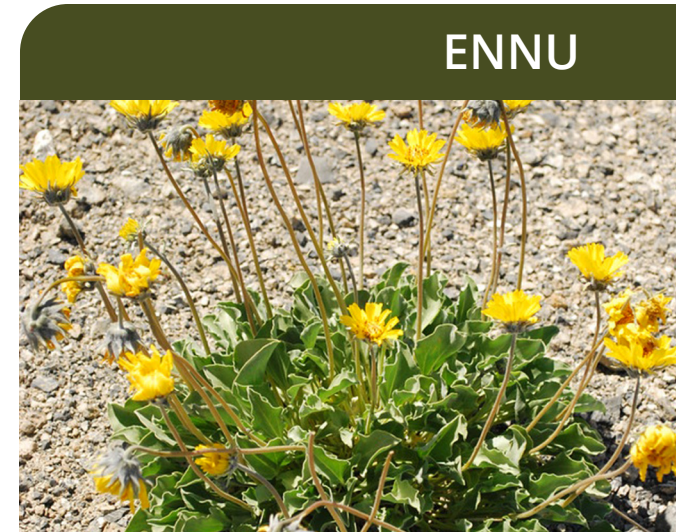
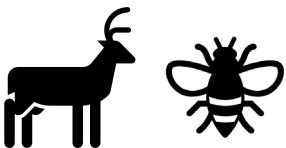
Plants are tufted **perennials** with thick, woody **taproots** and erect **stems** (4–16 in tall). Foliage is covered with short white hairs giving it a dull gray appearance. **Leaves** are spatulate and entirely basal. **Flowerheads** (1.6–3.5 in diameter) are solitary and terminal with 200 to 500+ yellow disk florets and 11 to 28 sterile, yellow ray florets. **Flowering** occurs in spring. **Chromosome numbers** are: $2n = 32, 34$, and 36. **Hybrids** occur.

Plants **reproduce** from seed, and pollination improves seed production. **Fruits** (achenes), commonly referred to as **seeds**, are wedge-shaped, dark brown to black, and 0.4–0.5 in long. They are covered with long silky hairs and have stout awl-shaped appendages at each end. Seeds **ripen** in spring and early summer.

ECOLOGY

Plants tolerate dry conditions and are considered persistent and **long-lived** once established.

Wildlife and Livestock Use



Nakedstem sunray growing at a gravelly site in Utah. Photo: USDI BLM UT020 SOS.

Lookalikes include arrowleaf balsamroot (*Balsamorhiza sagittata*) and clustered goldenweed (*Pyrracoma racemosa*).



Flowerhead with sterile ray flowers and fertile disk flowers. Photo: USDA USFS PSSSL.

NAKEDSTEM SUNRAY

(*Enceliopsis nudicaulis*)

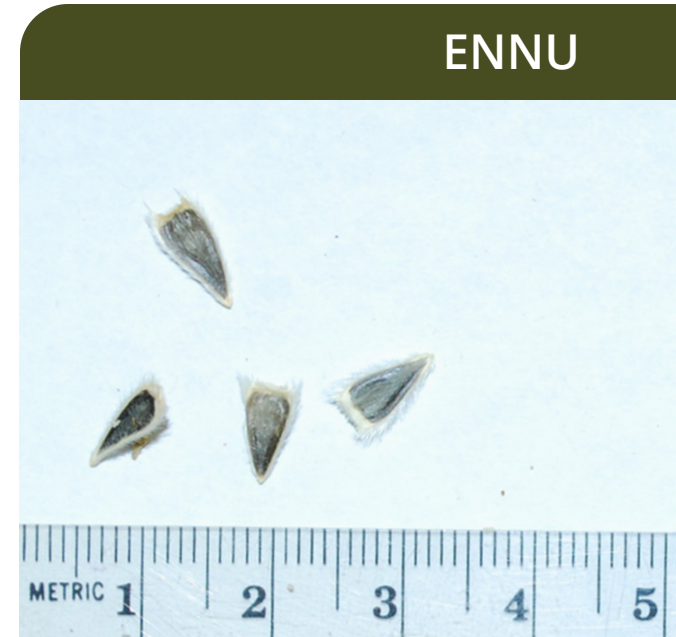
Plant associations Salt Desert, Sage, Warm Desert, PJ. **Elevation:** 2,300–7,600 ft. **Soils:** Deep, well-drained, dry, sandy to clay soils that can be alkaline or saline. Mean annual **precipitation:** Unknown but the species grows in dry areas receiving ≤ 8 in.

REVEGETATION NOTES

- Seed **disperses** quickly when ripe, and the presence of seed on the ground indicates seed maturity. Populations should be monitored frequently to estimate the collection window.
- Seeds are dark colored and firm when **mature**.
- Flowering and seed production are **indeterminate**.
- **Hand collecting** by swatting seedheads over a container allows for the harvest of only mature seed and provides a collection that is easy to clean.
- Remove vegetative material and dry collections thoroughly before **storing**.
- Freeze collections (48 hrs) or add pest strips to prevent **insect damage**.
- **Drill seeding** (< 0.25 in deep) in fall is recommended.
- Prevent **root rot** by seeding at sites with good soil drainage.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



North American distribution of nakedstem sunray. Map: M. Fisk, USDI USGS.



Individual seeds (achenes) with awl-like appendages. Photo: USDI BLM UT020 SOS.

DWARF YELLOW FLEABANE

(*Erigeron chrysopsidis*)

DESCRIPTION

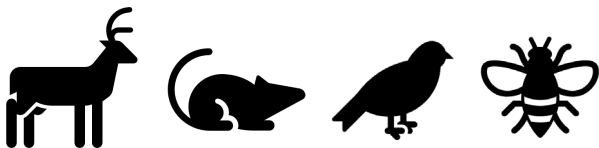
Plants are **perennial** forbs with slender **taproots** and typically erect **stems** (1–6 in tall). Herbage is covered in short or long-spreading hairs. **Leaves** are very hairy, narrow, linear (≤ 3.5 in long), and almost entirely basal. Plants produce **flowerheads** that are terminal and solitary with yellow florets. Ray florets are pistillate, while disk florets are perfect. Ligules of ray florets, if present, are up to 11 mm long. Flowers **bloom** from May to July. **Hybridization** between the varieties occurs where distributions overlap.

Plants **reproduce** from seed. Seed production is likely improved with **pollination**, but research is lacking. **Fruits** (achenes), commonly referred to as seeds, are tiny and straw colored. **Seeds** are two-nerved and hairy with an outer pappus of a few slender inconspicuous bristles and an inner pappus of 15 to 25 bristles that facilitate **wind dispersal**. Seed generally **matures** in early summer.

ECOLOGY

Plants occur on open sites, which suggests an ability to colonize disturbed areas. Plants may be sensitive to growing-season fires, but **few ecological studies** exist for this species.

Wildlife and Livestock Use



ERCH4



Dwarf yellow fleabane in flower and bud stage growing on a rocky site.
Photo: ©2018 John Doyen, hosted by CalPhotos.
Rayless shaggy fleabane (*E. aphanactis*) is a **lookalike**.



Flowers: Note this specimen has well developed ray florets. Photo: ©2018 John Doyen, hosted by CalPhotos.

DWARF YELLOW FLEABANE

(*Erigeron chrysopsidis*)

Plant associations SD Grass, Prairie, Low Sage, Sage, Mtn. Brush, PJ, Dry Forest, Sub-Alpine M/S. **Elevation:** 2,600–8,500 ft. **Soils:** Dry and gravelly or rocky. Mean annual **precipitation:** Range not reported, but its habitats are often described as dry.

REVEGETATION NOTES

- Seeds are adapted for wind dispersal making population **monitoring** and revisiting necessary to maximize harvest yields.
- Seed can be **hand collected** by stripping or plucking them from the seedheads or by knocking the seed into a container.
- Seed should be **dried** thoroughly before storing.
- Freezing collections (48 hrs) or adding pest strips can prevent insect **damage**.
- **Establishment** was not reported in the literature.
- Fall **seeding** (0.13–0.25 in deep) is recommended for other *Erigeron* spp.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



North American distribution of dwarf yellow fleabane. Map: M. Fisk, USDI USGS.

ERCH4



Seedhead of variety *austiniiae*. Note the indeterminate flowering and fruit development.
Photo: ©2006 Steve Matson, hosted by CalPhotos.

DESERT YELLOW FLEABANE

(*Erigeron linearis*)

DESCRIPTION

Plants are **perennial** forbs from a woody caudex and a branching **taproot** system (≥ 12 in deep). Plants are strongly tufted with many erect **stems** (mostly 2–8 in tall). Stems and leaves are sparsely to densely hairy with enlarged bases that range from straw to purple colored. **Leaves** are alternate, entire, linear (< 3.5 in long, 3 mm wide), and primarily basal. Plants exude a watery juice when injured. **Flowerheads**, usually one, but up to three per stem, are bright yellow to cream colored. Ray florets (4–11 mm long, 1.3 to 2.5 mm wide) are typically present and are pistillate and fertile. Disk florets (15–45) are bisexual and fertile. Flowers **bloom** between May and August, depending on location. **Chromosome numbers** are: $2n = 18, 27, 36, 45$, and **hybridization** with related species can occur.

Plants **reproduce** from seed. Flowers attract bees and butterflies. **Fruits** are tiny, brown, elongate achenes (~2 mm) commonly referred to as seeds. The **seed** has a double pappus that facilitates wind dispersal. Seeds typically **mature** in June, July, or later, depending on location.

ECOLOGY

Plants are **slow growing** and **drought tolerant**. They tolerate early seral conditions, grazing, and fire, but fire tolerance may be lower when plants are actively growing.

Wildlife and Livestock Use



40 | Asteraceae

ERLI



Desert yellow fleabane plant in full bloom.
Photo: USDI BLM NV020 SOS.

Lookalikes include scabland fleabane (*E. bloomeri*) and blue dwarf fleabane (*E. elegantulus*).



Seedhead development is indeterminate.
Photo: USDI BLM ID931 SOS.

SPRING

DESERT YELLOW FLEABANE

(*Erigeron linearis*)

Plant associations SD Grass, Sage, PJ, Low Sage, Dry Forest, Sub-Alpine M/S and F. **Elevation:** 2,300–10,000 ft. **Soils:** Shallow, dry, rocky, medium- to coarse-textured sandy loams to clay loams, pH 6–8. Mean annual **precipitation:** 6–16 in.

REVEGETATION NOTES

- **Monitor** indeterminate flowering, check for insects, and revisit sites to maximize wildland seed collections.
- **Harvest** when the pappus is open and seeds are dry and hard, this is likely earlier at low- than at high-elevation sites.
- Mature seed can be **hand collected** by stripping or plucking the seedheads.
- Remove any vegetative material from the collection and dry thoroughly before storing in an area protected from rodents.
- Freeze collections (48 hrs) or add pest strips to prevent insect damage to dry seed lots.
- **Seed** in clusters or rows with other slow-growing forbs and away from more rapidly growing species.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Individual seeds with some pappi attached (scale in cm). Photo: USDI BLM ID931 SOS.



North American distribution of desert yellow fleabane. Map: M. Fisk, USDI USGS.

SHAGGY FLEABANE

(*Erigeron pumilus*)

DESCRIPTION

Plants are slender to stout **perennials** from a woody caudex and **taproot**. Herbage is covered in spreading hairs (> 1 mm long), giving the plant a shaggy appearance. **Stems** are erect (2–20 in tall). **Basal leaves** are oblanceolate while **stem leaves** are linear-lanceolate. Petioles are indistinct and ciliate. Plants produce up to 50 solitary, terminal, flat-topped to hemispheric **flowerheads** of fertile, white to lavender ray florets that surround fertile, yellow to orange disk florets. Flowers **bloom** in April to July, with a second round of flowering possible in the fall with favorable moisture conditions. **Chromosome numbers** are: $2n = 18, 36$. **Hybridization** has not been reported.

Plants reproduce from **seed**. Common **pollinators** are carder bees (*Anthidium dammersi*), fairy bees (*Perdita fallugiae*), sweat bees (*Lasioglossum sisymbrium*), and a butterfly (*Amblyscirtes simius*). **Fruits** are tiny (< 2 mm long), elongate, dark brown achenes, commonly referred to as seeds. The **seed** has a double white pappus that facilitates wind dispersal. Seeds **mature** 1 to 2 months after flowering, generally from mid-May to late July.

ECOLOGY

Plants occur in **early- to late-seral** communities and are **disturbance tolerant**.

Wildlife and Livestock Use



Shaggy fleabane with fuzzy stems and leaves growing in Oregon.
Photo: USDI BLM OR030 SOS.

Lookalikes include threadleaf fleabane (*E. filifolius*) and desert yellow fleabane (*E. linearis*).



Flowers and open seedheads exhibiting indeterminate flowering and seed ripening.
Photo: USDI BLM ID120 SOS.

SHAGGY FLEABANE

(*Erigeron pumilus*)

Plant associations SD Grass, Sage, Mtn Brush, PJ, Dry Forest. **Elevation:** 2,690–9,700 ft. **Soils:** Well-drained soils of variable substrates with sandy to gravelly textures. Mean annual **precipitation:** 6–17 in.

REVEGETATION NOTES

- **Monitor** indeterminate flowering, check for insects, and revisit sites to maximize wildland seed collections. Harvests are time consuming.
- **Harvest** as seedheads begin to open because mature seed is easily detached when the seedhead is disturbed. Seeds should be dry and hard.
- Wildland seed is **hand collected** by plucking them from the seedhead or by shaking or knocking the seedheads over a container.
- **Dry** seed thoroughly after harvest.
- Freeze collections (48 hrs) or add pest strips to prevent **insect damage** to dry seed collections.
- Exposure to light, afterripping, stratification, and warm incubation have all been shown to improve **germination**.
- Fall **seeding** at depths of 0.13 to 0.25 in is recommended. Field emergence can be good.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Individual seeds with pappi.
Photo: USDI BLM ID230 SOS.



North American distribution of shaggy fleabane.
Map: M. Fisk, USDI USGS.

ASPEN FLEABANE

(*Erigeron speciosus*)

DESCRIPTION

Plants are **perennial** with a woody caudex, rhizomes, and a taproot and fibrous **root system**. Plants grow as clusters or colonies with many erect, leafy **stems** (6–40 in). Stem and basal **leaves** are variable but are mostly glabrous with clasping petioles and three main veins. **Flowerheads** (≤ 2 in wide) are terminal and occur 1 to 20+ per stem. They are comprised of pistillate purple to pink or white ray florets (75–150) that surround perfect bright yellow disk florets. Flowers **bloom** from June to October, depending on location. **Chromosome numbers** are $2n = 18, 36$. Plants **hybridize** with threenerve fleabane (*E. subtrinervis*).

Plants **reproduce** from seed. **Pollinators** from a wide variety of insect families are associated with aspen fleabane. **Fruits** are tiny (< 1.8 mm), elongate, dark brown achenes, commonly called seeds. **Seeds** have well-developed pappi that facilitate wind dispersal. Seeds **mature** about 1 month after flowering, typically from July to mid-September (earlier at low- than high-elevation sites).

ECOLOGY

Plants are **long-lived** (>10 yrs), somewhat shade tolerant, and grow in **early-seral** to **late-seral** communities. Plants are fire tolerant but sensitive to grazing.

Wildlife and Livestock Use



Aspen fleabane plant growing in Utah. Photo: USDI BLM UT933 SOS.

Lookalikes include subalpine fleabane (*E. peregrinus*), Uinta fleabane (*E. uintahensis*), and western mountain aster (*Symphyotrichum spathulatum*).



Seedheads and relatively uniform seed ripening. Photo: USDI BLM OR932 SOS.

ASPEN FLEABANE

(*Erigeron speciosus*)

Plant associations: SD Grass, Sage, Mtn Brush, PJ, Aspen, Dry Forest, Sub-Alpine M/S and F. **Elevation:** 2,000–11,220 ft. **Soils:** Dry to moist, well-drained sandy, gravelly, or clay-loam, and calcareous or non-calcareous. Mean annual **precipitation:** Likely a broad tolerance, but abundance decreases at soil moisture extremes.

REVEGETATION NOTES

- **Seed matures** quite uniformly, but it is common for a plant to have mature seedheads near the top and flowers near the base.
- Be aware of co-occurring lookalike species, and **verify plant vouchers** before collecting in quantity.
- **Collect** when seeds begin to turn brown and do not release moisture upon squeezing.
- Seeds germinate readily with moisture, **avoid collecting** from wet seedheads.
- **Hand collect** seed by clipping mature seedheads into a container.
- Avoid **collecting** in revegetated areas (e.g., roadsides, recreation areas, mine sites).
- Immediate and thorough **drying** of seed collections is critical to successful storage and cleaning.
- Freeze collections (48 hrs) or add pest strips to prevent **insect damage**.
- Fall drill **seeding** (< 0.5 in deep) is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



North American distribution of aspen fleabane.
Map: M. Fisk, USDI USGS.



Individual seeds with pappi.
Photo: USDI BLM ID130 SOS.

PARSNIPFLOWER BUCKWHEAT

(*Eriogonum heracleoides*)

DESCRIPTION

Plants are **perennial**, spreading mats (≤ 3 ft across) with woody caudices and extensive **root systems** (≤ 15 ft deep, ≥ 3 ft wide). Herbage is typically covered in short, dense hairs giving it a gray- or blue-green hue. Flowering **stems** can reach 30 in tall and often have a whorl of leaflike bracts at their midpoint. Vegetative stems are low growing with linear to broadly oblanceolate, petiolate **leaves** in a loose basal rosette. Leaves are at least three and often four times as long as wide. Tiny flowers (4–9 mm) are clustered in simple or compound **umbels**. **Flowers** are cup-shaped and have six cream-colored, petal-like structures (tepals) that turn reddish with age. Flowers typically **bloom** in summer. **Hybridization** with sulphur-flower buckwheat (*E. umbellatum*) has been reported.

Plants **reproduce** from seed. Flowers are **insect-pollinated** by a variety of insects including bees and beetles. **Seeds** (achenes) are small (2–5 mm long), light to dark brown, and pointed at both ends. Seed is generally **mature** in July or August, though it has been collected from June to October at different locations.

ECOLOGY

Plants colonize disturbed sites where they may act as nurse plants. They grow in **early- to mid-seral** communities and are **long-lived**. Plants generally recover within several years following fire or other top-killing **disturbances**.

Wildlife and Livestock Use



ERHE2



Parsnipflower buckwheat in flower.
Photo: USDA USFS PSSL.

Sulphur-flower buckwheat (*E. umbellatum*) is a **lookalike**.



Compound umbel with interior umbellet flowering first. Photo: USDI BLM OR030 SOS.

PARSNIPFLOWER BUCKWHEAT

(*Eriogonum heracleoides*)

Plant associations SD Grass, Sage, Mtn Brush, PJ, Dry Forest. **Elevation:** 660–11,500 ft. **Soils:** Dry, shallow, gravelly, and rocky fine sands to clays. Mean annual **precipitation:** 9–25 in.

REVEGETATION NOTES

- **Check** carefully for the presence of intact seed before collecting.
- **Harvest** when flowers are dry and rust-colored and seed detaches easily. Seeds should be hard and dry.
- Mature seed is **retained** on the plant for up to 3 weeks.
- Wildland seed can be **hand collected** by shaking, hand-stripping, or beating seedheads over a container.
- **Insect** seed predators are common. Freezing seeds (0–10 °F for 7–10 d) or use of pesticide strips will limit damage to collections.
- **Planting** seed in fall or early winter provides for needed stratification (1–3 mo).
- **Drill seed** (< 0.2 in deep) in rows away from rapidly growing species.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



North American distribution of parsnipflower buckwheat. Map: M. Fisk, USDI USGS.



Seeds (achenes) under magnification.
Photo: USDI BLM OR030 SOS.

SULPHUR-FLOWER BUCKWHEAT

(*Eriogonum umbellatum*)

DESCRIPTION

Plants are highly variable, ranging from herbaceous to woody **perennials**. Growth habit ranges from small, low growing, spreading forms to large, erect shrubs. **Root systems** range from semi-taprooted to strong, woody taproots (≥ 40 in deep). **Stems** are slender and spreading to erect with flowering stems taller than the persistent vegetative stems. **Leaves** are oval to elliptic (0.5–1.5 in long), bright green, glabrous to white wooly, and arranged in loose to compact basal rosettes. **Inflorescences** are umbellate or capitate with spherical clusters of 2 to 10 tiny flowers that are sessile or terminal on the rays. Individual **flowers** are white to cream to bright yellow and turn reddish with age. **Flowering** typically occurs from May to September depending on the variety and location. Many of the recognized varieties (~40) **hybridize**.

Plants **reproduce** from seed, and pollinator visitation increases seed production. Important **pollinators** include a diversity of bees, wasps, flies, butterflies, and beetles. **Fruits** are achenes, commonly referred to as **seeds**. They are small (2–7 mm long), brown, three-sided with a sparsely hairy beak, and **ripen** from June to September.

ECOLOGY

Plants are **early colonizers** of disturbed sites and grow in open areas in **early- to late-seral** communities. Plants are **long-lived**. Growing points are above ground; thus, plants may be **damaged** by fire and other top-killing disturbances with recovery requiring several years.

Wildlife and Livestock Use



48 | Polygonaceae

ERUM



Sulphur-flower buckwheat (variety *dichrocephalum*) in flower.
Photo: USDI BLM OR931.

Parsnipflower buckwheat (*E. heracleoides*) is a **lookalike**.



Umbel setting seed.
Photo: USDI BLM CO932 SOS.

SUMMER

SULPHUR-FLOWER BUCKWHEAT

(*Eriogonum umbellatum*)

Plant associations SD Grass, Prairie, Sage, PJ, Dry Forest, Mesic Forest.

Elevation: 300–12,100 ft. **Soils:** Dry, coarse-textured, and well-drained. Parent material, nutrient content, and pH vary widely.

Mean annual **precipitation:** 8–18 in.

REVEGETATION NOTES

- Check **seed fill** carefully before collecting. Good seed crops are produced in some years, but production or fill may be very low in others.
- Seed is **retained** on the plant for up to 3 weeks once mature.
- **Harvest** when seedheads are dry, papery, and tan or rust colored. Mature seeds should be hard and not crushed by thumbnail pressure.
- Wildland seed can be **hand collected** by rubbing dry seedheads together or stripping, beating, or clipping seedheads into a container.
- Freeze collections (48 hrs) once dried or add pest strips to prevent **insect damage**.
- **Afterripening** (> 30 d) improves seed germination.
- Plant seed in fall or early winter to provide cool, moist **stratification** (> 3 mo).
- **Drill seeding** (0.25 in deep) with late-seral or slow-growing species is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Seeds (achenes). Photo: USDI BLM ID210 SOS.



North American distribution of sulphur-flower buckwheat. Map: M. Fisk, USDI USGS.

COMMON WOOLLY SUNFLOWER

(*Eriophyllum lanatum*)

DESCRIPTION

This species is highly variable, growing as an **annual**, **biennial**, **perennial**, or **subshrub**, with longer-lived individuals found at higher altitudes. Some varieties grow as clumping, long-lived, perennials with extensive fibrous **root systems**, abundant root buds, and roots that develop from prostrate **stems**. One variety grows as an annual, biennial, or short-lived perennial with slight **taproots**. Plants (4–40 in tall) have several to many upright to decumbent stems covered in fine white hairs, and slender, grayish-green **leaves** (0.4–3 in long) that are entire to two- or three-pinnate with irregular lobes and toothed, serrate, or entire margins. **Flowerheads** (diameter 1–2.5 in) have 0 to 15 yellow ray florets and 20 to 300 yellow disk florets. Flowerheads occur singly or in arrays of five or more at stem ends and **bloom** from April to August depending on the variety, elevation, and site conditions. The species is a **polyploid** complex of intergrading varieties. **Chromosome numbers** are $2n = 16, 32, 48, 64$, and **hybridization** occurs among the 10 varieties and with golden yarrow (*E. confertiflorum*) where ranges overlap. Plants **reproduce** prolifically from seed, but high percentages of seed may be sterile or lost to predation. **Pollinators** include sweat bees (Halictidae), mining bees (Andrenidae), mason bees (*Osmia* spp.), hover or syrphid flies (Syrphidae), tachinid flies (Tachinidae), and wasps (Vespidae). The **fruits** (achenes) are commonly referred to as **seeds**. They are small (2–5 mm), linear, four-sided, and gray to black with a pappus of 6 to 12 scales. Seed usually **matures** in July and August depending on location and site conditions.

ECOLOGY

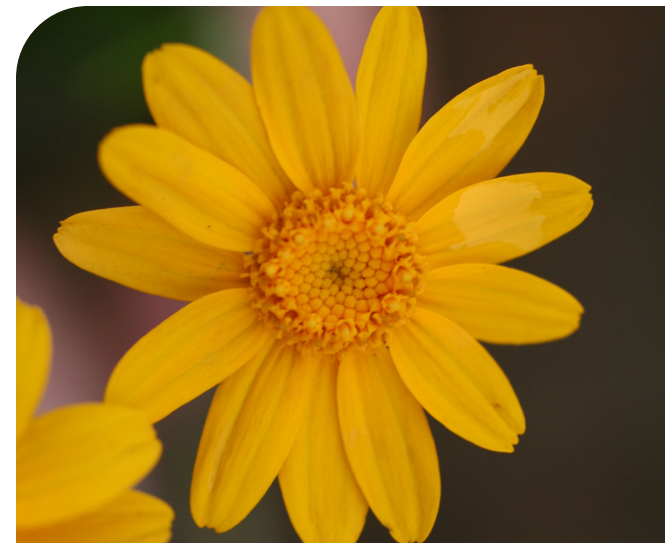
Populations establish quickly from seed in open, dry sites with coarse soils. The species is **disturbance tolerant**, provides soil stabilization, and can persist for decades in disturbed areas. Plants occur in canopy openings of **early-** to **late-seral** communities.

ERLA6



Small-statured common woolly sunflower (< 6 in tall) in full bloom in Idaho.
Photo: USDI BLM ID230 SOS.

Lookalikes include hairy cat's ear (*Hypochaeris radicata*) and cutleaf silverpuffs (*Microseris laciniata*).



Close-up of a single flowerhead.
Photo: USDI BLM CA180 SOS.

COMMON WOOLLY SUNFLOWER

(*Eriophyllum lanatum*)

Wildlife and Livestock Use



Plant associations SD Grass, Prairie, Salt Desert, Sage, Chaparral, Mtn Brush, PJ, Oak, Dry Forest, Mesic Forest, Sub-Alpine M/S and F. **Elevation:** 0–11,500 ft. **Soils:** Dry, shallow to deep, sandy to rocky soils from variable parent materials. Mean annual **precipitation:** ≥ 9 in.

REVEGETATION NOTES

- Seed is **retained** in the inflorescence longer than for many other Asteraceae and is not wind dispersed.
- **Low seed fill** is common, requiring large collections to meet seed needs.
- **Harvest** when seeds are firm and dark gray to nearly black.
- Mature seed can be **hand collected** by clipping entire seedheads into a container.
- Collections should be **protected** from rodents and inspected for insects before storing.
- Dry seed can be **stored** in paper bags at room temperature for up to 2 years.
- Fall or early winter **seeding** is required to provide natural stratification (1–3 mo).
- **Drill seeding** (< 0.25–0.5 in deep) is recommended.



Seedhead opened to show individual seeds.
Photo: USDI BLM ID230 SOS.



North American distribution of common woolly sunflower. Map: M. Fisk, USDI USGS.

SHOWY GOLDENEYE

(*Heliomeris multiflora*)

DESCRIPTION

Plants are multi-stemmed **perennials** with a somewhat woody caudex. The **root system** ranges from a short taproot to a mostly fibrous network. **Stems** (< 51 in tall) are slender, wiry, and branching with small, linear to egg-shaped **leaves** (0.4–3.5 in long). Glands dot the leaf undersides. Plants produce numerous (6–30+) terminal, yellow, sunflower-like **inflorescences** that **bloom** from May to October. **Chromosome numbers** are $2n = 16, 18, \text{ or } 32$. **Hybridization** has not been reported.

Plants **reproduce** by seed, and good seed production requires pollination.

Pollinators include cherry plum miner (*Andrena cerasifolii*), Brooks andrenas (*A. brooksi*), sweat bees (*Halictus cressonii* and *H. oryx*), mining bees (*Panurginus porterage*), bumblebees (*Bombus* spp.), and domestic honeybees (*Apis mellifera*). **Fruits** are achenes, commonly referred to as seeds. **Seeds** are small (1.2–3 mm long) with black or gray striations and lack scales or pappi. Wildland seed **matures** in summer, typically between July and September.

ECOLOGY

Plants are **pioneer species** on disturbed sites and occur in **early- to late-seral** communities. They establish quickly on disturbed sites and thrive in burned areas. Grazing tolerance is variable.

Wildlife and Livestock Use



HEMU3



Showy goldeneye in a subalpine forest opening in Utah. Photo: USDI BLM UT931 SOS.

Lookalikes include hairy cat's ear (*Hypochaeris radicata*) and cutleaf silverpuffs (*Microseris laciniata*).



Plant in full bloom.
Photo: USDA USFS PSSSL.

SHOWY GOLDENEYE

(*Heliomeris multiflora*)

Plant associations Prairie, Sage, PJ, Riparian, Mtn Brush, Aspen, Dry Forest, Sub-Alpine M/S. **Elevation:** 3,000–11,800 ft. **Soils:** Shallow to deep, slightly basic to slightly acidic, ranging from moist to dry with heavy clay to sandy or gravelly textures. Mean annual **precipitation:** 14–26 in.

REVEGETATION NOTES

- Seed is typically **mature** when most flowers are dry and individual seeds are dry, hard, and have begun to disperse.
- Mature seed can be **hand collected** by stripping, shaking, or beating the seedheads over a container.
- Properly and thoroughly **drying** this seed is critical as seed collected late in the growing season may have a high moisture content.
- Seed can be **stored** in cool, dry conditions for up to 6 years.
- Optimal **germination** conditions differ by collection site. Afterripening (1–12 mo) and cold stratification (up to 8 wks) can improve germination.
- Fall or early winter **seeding** allows for natural stratification.
- **Broadcast or drill seeding** (< 0.25 in deep) is recommended. Broadcast seed should be pressed into the soil to provide good seed to soil contact.
- Seedlings are **slow growing**. Seed in separate rows from rapidly establishing species.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



HEMU3



Clean seeds (achenes) under magnification.
Photo: USDA USFS BSE.



North American distribution of showy goldeneye.
Map: M. Fisk, USDI USGS.

FERNLEAF BISCUITROOT

(*Lomatium dissectum*)

DESCRIPTION

Plants are large **perennials** with thick, woody **taproots** (≤ 2 in thick, 2 ft deep). **Stems** (≤ 5 ft tall) are hollow and ascending. Herbage is aromatic and glabrous to puberulent or scabrous. **Leaves** are finely dissected and fern-like. The largest are 4 to 12 in long with petioles 12 in long. Stem leaves lack petioles and are less common and much smaller than basal leaves. Small greenish, yellow, or purple staminate and perfect **flowers** (50–200) are produced in large compound **umbels** and **bloom** in spring or early summer. **Hybridization** has not been documented.

Plants **reproduce** from seed, and pollination, primarily by bees, greatly increases fruit production. Native bees are important **pollinators**, especially mining bees (*Andrena* spp.) and mini-mining bees (*Micrandrena* spp.). **Fruits** are two-seeded schizocarps (0.4–0.6 in long, 0.2–0.4 in wide). They are oblong to oval and flattened dorsally with winged borders. **Seed matures** between May and August depending on location.

ECOLOGY

Plants are **long-lived**, **early-season**, and grow in **mid- to late-seral** communities. Large taproots allow them to survive fire and heavy aboveground predation. Seedlings grow slowly, and first seed may not be produced until year 4.

Wildlife and Livestock Use



54 | Apiaceae

LODI



Fernleaf biscuitroot in flower, note very tall flower stalks from the last season. Photo: USDI BLM ID230 SOS.

Lookalikes include sweet fennel (*Foeniculum vulgare*), nine-leaf biscuitroot (*L. triternatum*), northern biscuitroot (*L. farinosum*), and Gray's biscuitroot (*L. grayi*).



Seedhead with some seed dispersed. Photo: USDA USFS RMRS.

SPRING

FERNLEAF BISCUITROOT

(*Lomatium dissectum*)

Plant associations SD Grass, Prairie, Low Sage, Sage, Riparian, Mtn. Brush, PJ, Aspen, Oak, Dry Forest, Mesic Forest, Sub-Alpine M/S and F.

Elevation: 490–10,700 ft. **Soils:** Well-drained, dry, rocky to fine-textured, acidic to alkaline (pH 6.5–7.5). Mean annual **precipitation:** ≥12 in.

REVEGETATION NOTES

- Seeds **mature** 5 to 8 weeks after flowering and are ready for harvest when schizocarps are brown, papery, and easily detached.
- Mature seed can be **hand collected** by stripping, shaking, or clipping seedheads into a container.
- Keep **collections** in a dry, shaded place until they can be moved to a cool, dry environment protected from rodents and other seed predators.
- Freeze collections (48 hrs) or add pest strips to prevent **insect damage** during storage.
- Seeds contain underdeveloped embryos and require cold stratification (≥ 60 d) to **germinate**.
- **Plant** seed in fall to provide cool, moist stratification.
- **Broadcast or drill seeding** (0.15–0.5 in deep) away from rapidly growing species is recommended. Broadcast seed should be pressed into the soil to provide good seed-to-soil contact.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Cleaned seeds (mericarps).
Photo: USDI BLM OR030 SOS.



North American distribution of fernleaf biscuitroot.
Map: M. Fisk, USDI USGS.

GRAY'S BISCUITROOT

(*Lomatium grayi*)

DESCRIPTION

Plants are large (up to 3 ft tall), bushy, acaulescent **perennials** with woody **taproots** (≥ 5 ft deep). Herbage is glabrous to scabrous with a strong, parsley-like odor when crushed. **Leaves** (4–10 in long, petioles 1–9 in long) are basal and tri-pinnately divided into numerous fern-like segments that are turned in different planes. Small bright yellow **flowers** (100s) are produced in large, flat-topped compound **umbels** that have either all staminate or a mixture of perfect and staminate flowers. **Blooming** occurs between April and June. **Hybridization** has not been documented.

Plants **reproduce** sexually from seed. Annual flowering and seed production are highly variable, and good seed production requires pollination. **Pollinators** include sweat bees (*Halictus* spp.) and flies. **Fruits** are flattened, oblong (0.3–0.6 in long), schizocarps with tan to brown stripes and flat-winged edges. Each schizocarp consists of two one-seeded mericarps. **Seed** is generally **mature** in June or July.

ECOLOGY

Plants are **early season**, moderately **long-lived** (7+ yrs), and grow in **mid- to late-seral** communities. Taproots are susceptible to belowground feeding by small mammals but support sprouting following herbivory or other top-killing **disturbances**. Seedlings grow slowly, but plants are **competitive** with weeds once established. Plants are reproductively mature in year 2 or 3.

Wildlife and Livestock Use



Gray's biscuitroot in flower.
Photo: USDI BLM OR931 SOS.

Lookalikes include sweet fennel (*Foeniculum vulgare*), nine-leaf biscuitroot (*L. triternatum*), northern biscuitroot (*L. farinosum*), and fernleaf biscuitroot (*L. dissectum*).



Compound umbel.
Photo: USDI BLM OR030 SOS.

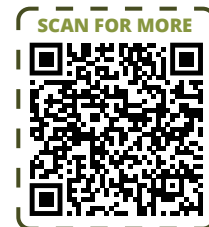
GRAY'S BISCUITROOT

(*Lomatium grayi*)

Plant associations SD Grass, Prairie, Low Sage, Salt Desert, Sage, Riparian, Mtn. Brush, PJ, Oak, Dry Forest. **Elevation:** Sea level to subalpine, but most common below 6,800 ft. **Soils:** Rocky, shallow, well-drained of various textures. Mean annual **precipitation:** 8–20 in.

REVEGETATION NOTES

- **Seed production** is highly variable among years.
- **Harvest** when schizocarps are dry and brown, parchment colored, and detach readily.
- Mature seed is easily **hand collected** by stripping inflorescences over a container.
- Keep **collections** in a dry, shaded place until they can be moved to a cool, dry environment protected from rodents and other seed predators.
- Freeze collections (48 hrs) once dried or add pest strips to prevent **insect damage**.
- Seeds are **fragile** and can break under too much pressure during the cleaning process. Seeds are not removed from the mericarps.
- Seeds contain immature embryos and require cold stratification (> 4 wks) to **germinate**.
- **Broadcast or drill seed** (< 0.5 in deep) in fall and plant in separate rows or areas from rapidly growing species.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Mature one-seeded mericarps (scale is mm).
Photo: USDI BLM OR931 SOS.



North American distribution of Gray's biscuitroot.
Map: M. Fisk, USDI USGS.

BARESTEM BISCUITROOT

(*Lomatium nudicaule*)

DESCRIPTION

Plants are glabrous **perennials** with long, thick **taproots** and stout, blue-green **stems** (< 28 in tall) that are swollen just below the inflorescence. **Leaves** are chiefly basal, petiolate, sheathing, and pinnately compound with 3 to 30 oval to round (> 2 in. wide) leaflets. Tiny five-petaled **flowers** are produced in large compound **umbels** with 7 to 27 unequal rays measuring 2 to 8 in long. Outer rays produce primarily bisexual flowers. Those on the inner rays are primarily male. **Blooming** typically occurs from April to June. **Hybridization** has not been documented.

Plants **reproduce** from seed. Good seed production requires pollination. Common **pollinators** are mining bees (*Andrena* and *Micrandrena* spp.). **Fruits** are schizocarps consisting of two single-seeded mericarps (commonly referred to as seeds). Fruits are oblong, strongly flattened, and 0.4 to 0.6 in long with thin wings. **Seed** generally **matures** in July or August.

ECOLOGY

Plants are **early season**, **long-lived**, and common in **mid-seral** communities. Their large taproots allow for survival following aboveground **herbivory or disturbances**. Plants are susceptible to belowground feeding by small mammals. Seedlings are slow growing and establish more readily away from competing vegetation, but once mature, plants are **competitive** with nonnative annuals.

Wildlife and Livestock Use



Barestem biscuitroot in flower, note the entire rounded leaves. Photo: USDI BLM OR090A.

Lookalikes include sweet fennel (*Foeniculum vulgare*), nine-leaf biscuitroot (*L. triternatum*), northern biscuitroot (*L. farinosum*), and fernleaf biscuitroot (*L. dissectum*).



Compound umbel, note the weedy site. Photo: USDI BLM ID931 SOS.

BARESTEM BISCUITROOT

(*Lomatium nudicaule*)

Plant associations Prairie, SD Grass, Low Sage, Sage, Mtn. Brush, PJ, Oak, Dry Forest, Sub-Alpine M/S. **Elevation:** 590–8,300 ft. **Soils:** Fine- to coarse-textured, often shallow with high gravel or rock content that may be saturated in spring but dries quickly. Mean annual **precipitation:** ≥14 in.

REVEGETATION NOTES

- **Harvest** seeds when the schizocarps are dry, wings are parchment colored, and they detach easily.
- Seed is commonly **hand collected** by stripping inflorescences over a container.
- Keep **collections** in a dry, shaded place until they can be moved to a cool, dry environment protected from rodents and other seed predators for drying and storage.
- Freeze collections (48 hrs) once dried or add pest strips to prevent **insect damage**.
- Seeds are **fragile** and too much pressure during the cleaning process can damage them.
- Seeds contain immature embryos and require cold stratification (> 6 wks) to **germinate**.
- **Broadcast or drill seed** (0.2–0.5 in deep) in fall. If drill seeded, plant in separate rows from rapidly growing species.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



North American distribution of barestem biscuitroot. Map: M. Fisk, USDI USGS.



Individual mericarps, each contains one seed.
Photo: USDI BLM OR030 SOS.

NINELEAF BISCUITROOT

(*Lomatium triternatum*)

DESCRIPTION

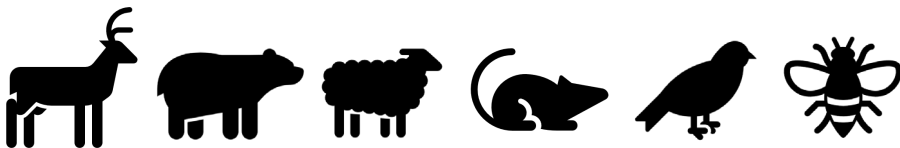
Plants are **perennial** herbs with long, thick **taproots** that can reach several feet deep. Slender, hollow, blue-green **stems** (8–32 in) are unbranched and nearly hairless or with fine, soft hairs. **Leaves** are primarily basal, sheathing, and pinnately compound with 9 to 21 linear leaflets (0.4–5 in long). Tiny, five-petaled, yellow **flowers** are produced in large compound **umbels** that **bloom** in April and May. **Chromosome numbers** are $2n = 22, 44$. **Hybridization** has not been reported.

Plants **reproduce** sexually from seed. Good seed production requires pollination. Flowers are visited by a variety of **pollinators**. Mining bees (*Andrena* and *Micrandrena* spp.) are particularly important pollinators. **Fruits** (schizocarps, 0.2–0.6 in long) are oblong to elliptic with tan and brown stripes and flattened winged edges. Each schizocarp consists of two single-seeded mericarps (commonly referred to as seeds). **Seed** is generally **mature** in June or July.

ECOLOGY

Plants are **long-lived** (20+ yrs) and typically grow in **mid- to late-seral** communities. They are **early-maturing** and have a well-developed taproot, which allows for the avoidance or survival of drought, fire, aboveground predation, and other **disturbances**. Plants reach reproductive maturity in year 2 or 4.

Wildlife and Livestock Use



60 | Apiaceae

LOTR2



Nineleaf biscuitroot in flower, note the linear leaflets. Photo: USDI BLM OR030 SOS.

Lookalikes include sweet fennel (*Foeniculum vulgare*), northern biscuitroot (*L. farinosum*), and fernleaf biscuitroot (*L. dissectum*).



Compound umbel with unequal rays in full flower. Photo: USDI BLM ID931 SOS.

SPRING

NINELEAF BISCUITROOT

(*Lomatium triternatum*)

Plant associations Prairie, SD Grass, Sage, Mtn. Brush, PJ, Dry Forest, Mesic Forest, Sub-Alpine M/S and F. **Elevation:** 660–10,000 ft. **Soils:** Dry, rocky, well-drained, and relatively neutral sandy to clay loams. Mean annual **precipitation:** 8–25 in.

REVEGETATION NOTES

- **Harvest** when inflorescences are dry and schizocarps are tan and easily detached.
- Seed can be **hand collected** by stripping, shaking, or clipping inflorescences over a container.
- Keep **collections** in a dry, shaded place until they can be moved to a cool, dry protected location.
- Freeze collections (48 hrs) or add pest strips to prevent **insect damage**.
- Seeds are **fragile** and brittle and need gentle cleaning to prevent damage.
- Seeds contain immature embryos and require cold stratification (9+ wks) to **germinate**.
- **Plant** seed in fall to provide cool, moist stratification.
- **Broadcast or drill** seeding (0.1–0.2 in deep) away from rapidly growing species is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Single-seeded mericarps (left, loose), schizocarps (right, attached to stem). Photo: USDA USFS.



North American distribution of nineleaf biscuitroot. Map: M. Fisk, USDI USGS.

SAGEBRUSH FALSE DANDELION

(*Nothocalais troximoides*)

DESCRIPTION

Plants are single to multi-stemmed, erect **perennials** that produce a milky juice. They have a thick caudex and stout, fleshy **taproots**. **Stems** (2–16 in tall) are slender and generally leafless and glabrous. Basal **leaves** (2–6 in long) are crowded, linear or occasionally divided, and glabrous to villous with wavy and ciliate margins. **Flowerheads** are solitary, terminal, and erect with 13 to 90 yellow ligulate ray **florets**. Ligules sometimes have an orange midrib that may become pinkish with age. The outer series of involucre bracts are shorter than the inner series. **Flowering** occurs from March to June depending on location.

Plants **reproduce** from **wind-dispersed** seed. Halictidae, Megachilidae, and Apidae bees are considered likely **pollinators**. **Fruits** (achenes, commonly referred to as seeds) are grey to brown, beakless, cylindric or fusiform, 0.3 to 0.5 in long, and apically puberulent. The pappus consists of 10 to 30 lustrous, white scales nearly equal in length. **Seed** is typically **mature** in May or June.

ECOLOGY

Plants are **disturbance** tolerant and grow in **early-seral**, weedy, and recently burned sites and persist in **mid-** to **late-seral** communities. Plants recover by basal sprouting following fall fires but may be sensitive to spring burning.

Wildlife and Livestock Use



NOTR2



Single-stemmed sagebrush false dandelion plant.

Photo: M. Lavin, Montana State University.

Lookalikes include annual agoseris (*Agoseris hetrophylla*) and orange agoseris (*A. aurantiaca*).



Sagebrush false dandelion flowerheads.

Photos: M. Lavin, Montana State University.

SPRING

SAGEBRUSH FALSE DANDELION

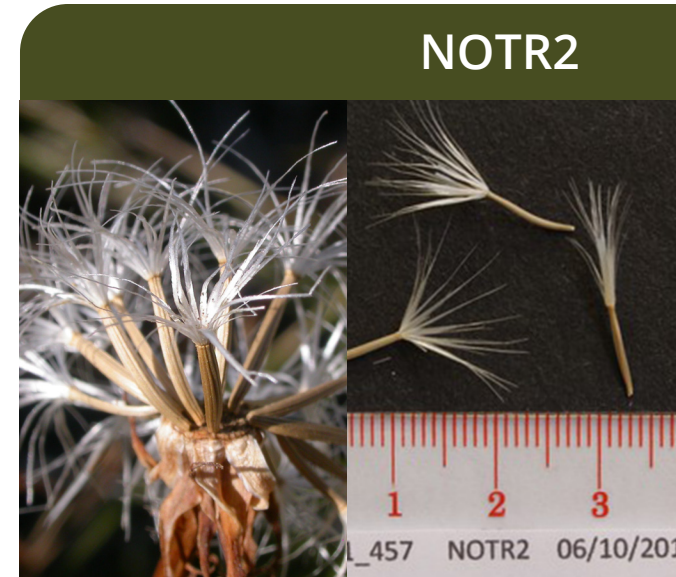
(*Nothocalais troximoides*)

Plant associations SD Grass, Sage, PJ, Oak, Dry Forest.

Elevation: 160–6,600 ft. **Soils:** Often stony clayey to sandy loams of various depths.

REVEGETATION NOTES

- **Mature** fruiting heads are white and spherical. Mature seeds are brown and firm.
- Seeds can be **hand-collected** by plucking them from mature seedheads.
- **Seed quality** can be estimated prior to collection using cut or X-ray tests.
- **Seed collection** is time consuming. Large harvests are rare, and the seed collection window is narrow (2–14 d).
- **Molding** can occur if harvests include leaves and stems. Remove vegetative material promptly by hand or with sieves, and air dry thoroughly in a rodent-free area.
- Freeze collections for 48 hours or use appropriate chemicals to prevent **insect damage**.
- Seeds are small and should be shallowly **seeded** in fall.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Sagebrush false dandelion seedhead (left) and individual achenes with pappus bristles (right, scale in mm).

Photos: M. Lavin, Montana State University.



North American distribution of sagebrush false dandelion. Map: M. Fisk, USDI USGS.

FIRECRACKER PENSTEMON

(*Penstemon eatonii*)

DESCRIPTION

Plants are clumping, semi-evergreen **perennials** with **taproots** and **fibrous roots**. They produce one to several upright to reclining **stems** (1–4 ft tall) from a short-branched woody caudex. **Leaves** are leathery, glabrous to puberulent, and entire with wavy margins. Lower leaves (1–8 in long) are clustered, dark green, and oblanceolate. Stem leaves (2–4 in long) are opposite, lanceolate to oblong, and clasping to sessile upward. The **inflorescence** is terminal and about half the length of the stem with 4 to 12 whorls of flowers, mostly on one side. Individual **flowers** (0.9–1.3 in long) are red orange to bright red and slightly two-lipped with two upper and three lower lobes. Flowers **bloom** from early spring through early fall depending on location. Several subspecies and hybrids are recognized.

Plants **reproduce** from seed. The flowers are **pollinated** by hummingbirds, bees, and butterflies. **Fruits** are egg-shaped capsules that contain numerous **seeds**. Seeds **mature** in summer or fall.

ECOLOGY

Plants are **short-lived** and common on **disturbed** sites but also grow in later successional communities.

Wildlife and Livestock Use



Firecracker penstemon growing out of a sandstone cliff edge in Colorado.
Photo: M. Lavin, Montana State University.

Lookalikes include bearlip penstemon (*P. barbatus*), bridge penstemon (*P. rostriflorus*), and beardtongue (*P. x jonesii*).



Terminal inflorescence in flower and in fruit.
Photo: M. Lavin, Montana State University.

FIRECRACKER PENSTEMON

(*Penstemon eatonii*)

Plant associations Sage, Mtn Brush, Warm Desert, PJ, Dry Forest, Aspen.

Elevation: 1,600–11,000 ft. **Soils:** Well-drained, gravelly or rocky silt loams to sands with pH 7 to 8. Mean annual **precipitation:** 10–16 in.

REVEGETATION NOTES

- Seed is **mature** when capsules and stalks are dry and straw colored and seeds are hard and dark, often in early July to late August.
- Pods do not **shatter** readily unless disturbed by wind or other disturbance.
- **Seed fill** can be checked with a cut or X-ray test.
- Seed is **hand collected** by hand stripping or clipping mature inflorescences over a container.
- Gloves are recommended to **protect hands** from cuts and splinters.
- Remove all vegetative material from the collection and **dry** in a rodent-free area.
- Freeze collections for 48 hours or use appropriate chemicals to prevent **insect damage**.
- **Longevity** of dry seed is 7 years or more in warehouse conditions.
- **Drill seeding** (0.13–0.25 in deep) in the fall away from rapidly developing species is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



PEEA



Individual seeds (scale is in).
Photo: USDI BLM NV052 SOS.



North American distribution of firecracker penstemon. Map: M. Fisk, USDI USGS.

THICKLEAF BEARDTONGUE

(*Penstemon pachyphyllus*)

DESCRIPTION

Plants are erect **perennials** from a branching woody caudex and **taproot**. Plants produce single or multiple stems to 24 in tall. Herbage is glabrous to glaucous with a pale green to blue color. **Leaves** are entire, thick, and waxy. Basal leaves (0.7–7.1 in long) are petiolate, spatulate to lanceolate, and persistent. Stem leaves (0.6–3 in long) are ovate to lanceolate, occur in two to five pairs, and become sessile or clasping up the stem. **Inflorescences** making up a third to half of the plant height are terminal, cylindric, congested to interrupted thyruses with 4 to 10 secondary inflorescences. Individual **flowers** (0.6–0.8 in long) are bisexual, lavender to blue, short campanulate, bilaterally symmetrical, and held horizontally. **Flowering** occurs from June to August.

Plants **reproduce** from **seed**. Flowers are **pollinated** by a variety of butterflies, wasps, and bees. **Fruits** are ovate, glabrous, pale brown capsules (10–14 mm by 5–7 mm). **Seeds** (2–3 mm long) are cinnamon-brown, glistening, semi-winged, and have curved outlines and sharp angles at the ends.

ECOLOGY

Plants occur in **early-seral** communities and **disturbed sites**, but also grow in **late-seral** woodlands. Plants have been described as short- and long-lived.

Wildlife and Livestock Use



66 | Scrophulariaceae

PEPA6



Thickleaf beardtongue growing on a rocky outcrop in a sagebrush and pinyon-juniper habitat in Utah. Photo: USDI BLM UT933 SOS.

Lookalikes include fleshy beardtongue (*P. carnosus*), Flowers' beardtongue (*P. flowersii*), handsome penstemon (*P. lentus*), and broadbeard beardtongue (*P. angustifolius*).



Plant with two flowering stems and many shriveled flowering stems (likely from a freeze event). Photo: USDI BLM UT080 SOS.

SUMMER

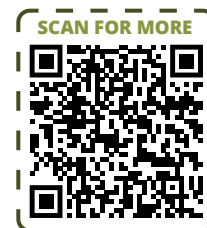
THICKLEAF BEARDTONGUE

(*Penstemon pachyphyllus*)

Plant associations Sage, Mtn Brush, PJ, Aspen, Dry Forest. **Elevation:** 3,900–10,500 ft. **Soils:** Dry, gravelly, sands to loams, shallow soils with rocky outcrops. Mean annual **precipitation:** 6–27 in.

REVEGETATION NOTES

- Seed is **mature** when stems and capsules are dry and tan and seeds are firm and brown.
- Seeds are **hand collected** by hand stripping, beating, or cutting inflorescences over a container.
- Keep **collections** in a dry, shaded place until they can be moved to a cool, dry environment protected from rodents and other seed predators.
- Freeze collections (48 hrs) once dried or add pest strips to prevent **insect damage**.
- **Seed viability** is retained after 10 or more years of storage.
- Seeds from colder climates exhibit physiological dormancy and require cool, moist **stratification**, whereas seeds from warmer climates do not.
- **Broadcast or drill seed** (<0.14 in deep) in fall and provide good seed-to-soil contact.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Thickleaf beardtongue capsules (left) and seeds (right). Photo: USDI BLM UT080 SOS.



North American distribution of thickleaf beardtongue. Map: M. Fisk, USDI USGS.

ROYAL PENSTEMON

(*Penstemon speciosus*)

DESCRIPTION

Plants are highly-variable, herbaceous **perennials** with **taproots**. Erect to ascending **stems** (6–16 in tall), are few to several and puberulent to glabrous. **Leaves** are entire, thick, opposite, and somewhat sinuate. Basal leaves (up to 6 in long) are variable in shape, clustered, and somewhat evergreen. Stem leaves are linear to lanceolate, subcordate, and clasping. Flowers are produced in thyrses **inflorescences**, where the main axis flowers indeterminately and sub-axes flower determinately. Individual **flowers** are bilabiate with five fused blue to purple petals and occur in whorls of 4 to 12. Flowers **bloom** between May and August.

Plants **reproduce** from seed. Important **pollinators** are native mason bees (*Osmia* spp.) and solitary pollen wasps (*Pseudomasaris vespoides*). **Fruits** are capsules (0.2–0.6 in long) that opening apically. **Seeds** (2–2.5 mm long) are brown, three-angled, slightly elongate, and gravity dispersed. Seed is typically **mature** in July and August.

ECOLOGY

Plants **colonize disturbed areas**, such as steep eroding slopes and road cuts with well-drained soils and low competition. They are **short-lived** and grow in **early- to late-seral** communities.

Wildlife and Livestock Use



Immature capsules (left) and a mature seed capsule (right). Photo: USDA USFS RMRS.

PESP



Royal penstemon flowering on a burned site. Photo: M. Fisk, USDI USGS.

Lookalikes include Payette penstemon (*P. payettensis*), very beautiful penstemon (*P. perpulcher*), and dark-blue penstemon (*P. cyaneus*).

ROYAL PENSTEMON

(*Penstemon speciosus*)

Plant associations Sage, Mtn Brush, PJ, Dry Forest, Sub-Alpine F.

Elevation: 700–11,300 ft. **Soils:** Well-drained, loams to sands with neutral to slightly alkaline pH. **Mean annual precipitation:** 8–24 in.

REVEGETATION NOTES

- **Monitor** potential collection sites early and often because seed production varies widely from year to year.
- **Harvest** when stems and capsules are dry and straw colored and seeds are brown and firm.
- **Seed fill** should be checked using a cut or X-ray test.
- Seed can be **hand collected** over a 2- to 3-week period by clipping mature inflorescences into a container.
- Remove any green leaves and stems from **collections** and dry thoroughly.
- Freeze collections (48 hrs) once dried or add pest strips to prevent **insect damage**.
- **Seed** in fall away from more rapidly establishing species.
- **Broadcast or drill seed** near the soil surface but provide good seed-to-soil contact.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



PESP



Individual seeds under magnification.
Photo: J. Cane USDA ARS.



North American distribution of royal penstemon.
Map: M. Fisk, USDI USGS.

YELLOW BEEPLANT

(*Peritoma* [*Cleome*] *lutea*)

DESCRIPTION

Plants are malodorous **annuals** with long **taproots** and one to several erect **stems** (1–5 ft tall). Stems are glabrous to sparsely pilose and simple or with a few branches developing from the upper leaf axils. **Leaves** are alternate, widely spaced, and petiolate. They are palmately compound, normally with five narrow leaflets (0.3–2 in long). Plants produce terminal **racemes** densely crowded with yellow flowers that give the inflorescence a brush-like appearance. Individual **flowers** are produced on ascending pedicels. They are perfect or staminate with four narrow, ovate petals (~0.2 in long). **Flowering** is highly indeterminate, beginning at the raceme base, and occurs from spring to early fall. **Chromosome numbers** are $2n = 32, 34$.

Plants **reproduce** from seed. Perfect flowers are self-fertile, but outcrossing increases seed production. **Pollinators** include a large variety of primarily generalist bees, wasps, and butterflies. **Fruits** are pods (0.6–1.6 in long) containing 8 to 20 rugose, ovoid seeds. **Seeds** (~0.1 in long) are gray to black, coiled, and kidney shaped. Seeds **mature** over an extended period from May to October.

ECOLOGY

Plants occur as scattered populations that **colonize disturbed sites** where few other species have established and are not tolerant of competition. They **spread** readily from seed and grow rapidly, but population size fluctuates annually. Seedlings are not frost tolerant.

PELU5 (CLLU2)



A large yellow beeplant population growing on an open, disturbed site.
Photo: J. Cane, USDA ARS.

Rocky Mountain beeplant (*P. serrulata*) is a **lookalike**.



Inflorescence with immature fruits near the base and progressively less mature flowers toward the top.

Photo: M. Lavin, Montana State University.

YELLOW BEEPLANT

(*Peritoma* [*Cleome*] *lutea*)

Wildlife and Livestock Use



Plant associations Warm Desert, Sage, Salt Desert, Riparian, PJ, and Dry Forest. **Elevation:** 1,970–7,875 ft. **Soils:** Well-drained, medium-textured, rocky, sandy to loamy, dry to ephemerally wet. Mean annual **precipitation:** 8–18 in.

REVEGETATION NOTES

- **Monitor** sites in advance of the expected collection period as population size and seed yields vary widely from year to year.
- Use an x-ray or cut test to check **seed quality** as seeds begin to ripen.
- **Fruit ripening** is highly indeterminate and irregular. Pods at the base of the raceme ripen earliest.
- **Harvest** when capsules dehisce readily or are already dehiscing along the valves. Seeds should be firm and dark brown.
- Wildland seed can be **hand collected** by hand stripping or beating inflorescences with mature fruits over a container using a flat beater or racquet.
- Wear gloves to **protect the skin** from abrasion.
- Thoroughly **dry collections** and protect them from insect and rodent damage.
- **Drill or broadcast seed** (0.1–0.5 in deep) in the fall in patches or rows separate from other species.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



PELU5 (CLLU2)



Perfect flowers (left) with stamens and stalked pistil (top) and staminate flowers (bottom). Mature black, coiled seed (right). Photos: J. Cane, USDA ARS.



North American distribution of yellow beeplant. Map: M. Fisk, USDI USGS.

ROCKY MOUNTAIN BEEPLANT

(*Peritoma* [*Cleome*] *serrulata*)

DESCRIPTION

Plants are malodorous, tall (up to 6.6 ft), upright, **taprooted** (12–14 in deep) **annuals**. **Stems** are glabrous and may branch above, creating an open, rangy structure. **Leaves** are alternate, glabrous when mature, and palmate with three entire to slightly sinuate or serrulate leaflets (0.8–2.4 in long, 0.2–0.6 in wide). Leaflets range from lanceolate to elliptic or oblanceolate with mucronate to long acuminate tips. Plants produce terminal, densely crowded, bracteate **racemes** (0.4–1.6 in long in flower, 1.6–11.9 in long in fruit). Individual perfect and pistillate **flowers** are regular to irregular with four narrow purple to pink, oblong to ovate petals. They produce six long, equal, threadlike stamens with purple filaments and green anthers that are exserted as flowers open. Typically flowering occurs from late spring to mid- or late summer. **Chromosome numbers** are $2n = 16, 17, 32, 34, 60$. Hybrids may occur.

Plants **reproduce** from seed. Perfect flowers are self-fertile, but outcrossing results in greater seed production. Important **pollinators** include a large number of generalist bees, wasps, and butterflies. **Fruits** are dehiscent, striated, glabrous capsules (1–3 in long, 0.1–0.2 in wide) with pointed ends. **Seeds** are small, dark brown or black and spherical to horseshoe-shaped with rough surfaces. Seed **maturation** commonly occurs from July to September.

ECOLOGY

Plants **colonize disturbed sites** and can form monocultures. They grow rapidly and can produce large amounts of seed, but population size and seed production vary widely year to year.

PESE7 (CLSE)



Rocky Mountain beeplant growing near an agricultural field in Montana.

Photo: M. Lavin, Montana State University.

Yellow beeplant (*Peritoma* [*Cleome*] *lutea*) is a **lookalike**.



Inflorescence with darker colored buds at the apex and flowers and pods further down the raceme.

Photo: M. Lavin, Montana State University.

ROCKY MOUNTAIN BEEPLANT

(*Peritoma* [*Cleome*] *serrulata*)

Wildlife and Livestock Use

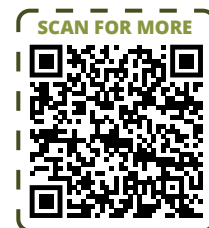


Plant associations Prairie, SD Grass, Salt Desert, Sage, Warm Desert, PJ.

Elevation: 980–9,500 ft. **Soils:** Well-drained, moist to dry, medium-textured to sandy with pH 6 to 7.6. Mean annual **precipitation:** ≥ 8–10 in.

REVEGETATION NOTES

- **Monitor** sites in advance of the expected collection period as annual yields are highly variable.
- Use an x-ray or cut test to check **seed quality** as seeds begin to ripen.
- **Fruit ripening** is highly indeterminate and irregular. Pods at the base of the raceme ripen earliest.
- **Harvest** when capsules dehisce readily or are already dehiscing along the valves. Seeds should be firm and dark brown.
- Wildland seed can be **hand collected** by hand stripping or beating (with a flat beater or racquet) inflorescences with mature fruits over a container.
- Wear gloves to **protect the skin** from abrasion.
- Thoroughly **dry collections** and protect them from insect and rodent damage.
- **Drill or broadcast seed** (0.1–0.5 in deep) in the fall away from rapidly growing species or seed separately in disturbed areas.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



PESE7 (CLSE)



Fruits (pods) (left) and horseshoe-shaped seeds with rough surfaces (right).

Photos: Matt Lavin, Montana State University (left) and USDA USFS BSE (right).



North American distribution of Rocky Mountain beeplant. Map: M. Fisk, USDI USGS.

SCARLET GLOBEMALLOW

(*Sphaeralcea coccinea*)

DESCRIPTION

Plants are ascending to low, spreading **perennials** with a branched, woody caudex, deep **taproots** (≤ 13 ft deep), and sometimes well-developed rhizomes. **Stems** (< 12 in long) are slender, unbranched, or with short branches that arise from the caudex or occasionally from rhizomes, forming colonies. Herbage is often covered in dense stellate hairs, making it appear light green to grayish. Stem **leaves** are alternate, petiolate, 0.5 to 2 in wide and long with three to five narrow to broad lobes. Leaf thickness, divisions, and pubescence vary. Flowers occur in narrow terminal **racemes**. Individual **flowers** (~ 1 in wide) are perfect, radially symmetric with five deep orange petals and numerous yellow stamens that are joined at the base. Flowers often **bloom** in late spring or early summer, but flowering can occur from March to October. Additional flowering may occur following rainstorms. **Chromosome numbers** are $2n = 10, 20$. **Hybridization** within the genus is common.

Plants **reproduce** by seed and can spread by rhizomes. Plants are strongly outcrossing. Important **pollinators** are bees, especially sunflower bees (*Diadasia* spp.). **Fruits** are segmented schizocarps containing 8 to 14 one- to two-seeded mericarps. Seeds are small (4.8–6.7 mm in diameter), brown to black, and kidney-shaped. Seeds typically mature in July or August.

ECOLOGY

Plants are early **colonizers** of **disturbed sites** but grow in **early- to late-seral** communities. Plants are **long-lived**. Droughts, burning, grazing, and other soil disturbances are often associated with increased plant abundance.

SPCO



Scarlet globemallow in flower growing in Utah.
Photo: USDI BLM UT080 SOS.

Lookalikes include gooseberryleaf globemallow (*S. grossulariifolia*), Munro's globemallow (*S. munroana*), and small-leaf globemallow (*S. parvifolia*).



Small specimen showing individual flowers.
Photo: USDI BLM WY020 SOS.

SCARLET GLOBEMALLOW

(*Sphaeralcea coccinea*)

Wildlife and Livestock Use



Plant associations SD Grass, Prairie, Salt Desert, Sage, Warm Desert, PJ, Mtn Brush, and Dry Forest. **Elevation:** 980–9,020 ft. **Soils:** Dry, sandy and gravelly. Tolerates a variety of soil types and textures and some salinity but does not tolerate sodic or waterlogged soils. Mean annual **precipitation:** 7–12 in.

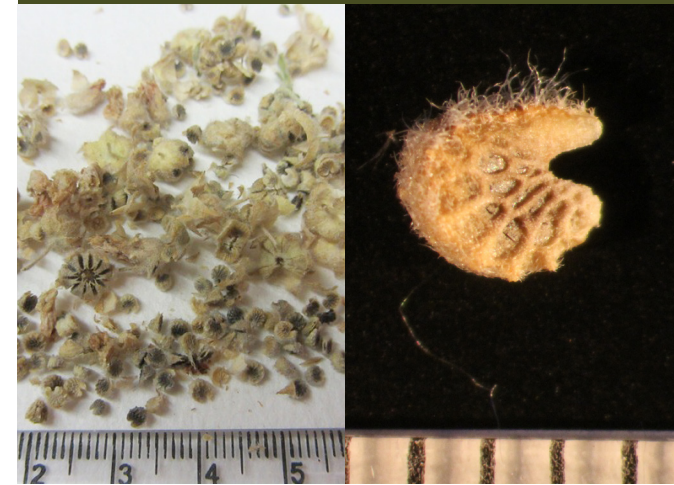
REVEGETATION NOTES

- **Indeterminate** seed production, and in some years repeated seed production, allows for many collections at a single site for weeks and across sites for months.
- **Harvest** when fruits are dry and papery and seeds are black and firm.
- **Seed is released** once fruits are fully mature, so careful monitoring is needed to maximize collections.
- Seed is **hand collected** by stripping or knocking fruits over a container.
- **Protect** the skin, eyes, and airways from the irritating stellate hairs covering the schizocarps.
- Thoroughly dry collections and protect them from **insect and rodent damage**.
- Scarification is required for **germination**, and **fall seeding** (≤ 0.25 in deep) is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



North American distribution of scarlet globemallow. Map: M. Fisk, USDI USGS.

SPCO



Scarlet globemallow schizocarps (left) and mericarps (left, right). Photos: USDI BLM WY050 SOS (left), USDI BLM WY932A SOS (right).

GOOSEBERRYLEAF GLOBEMALLOW

(*Sphaeralcea grossulariifolia*)

DESCRIPTION

Plants are morphologically diverse **perennials** from a branching woody base and large, deep, branching **taproot**. **Stems** (24–39 in long) are few to many and erect to spreading in loose tufts. Plants are hairless or covered with short white hairs and appear gray-green or whitish. Stem **leaves** are alternate, typically triangular (0.4–2 in long and wide) with three to five irregularly pointed to rounded lobes divided nearly to the midvein. Inflorescence is an elongate **thyse**. **Flowers** (8–20 mm wide) have five red to orange petals and numerous yellow joined stamens that form a column. **Flowering** is episodic and can be extensive; it is most common in late spring or early summer but can occur from March to October. **Hybridization** occurs within the genus.

Plants **reproduce** from **seed**. Important **pollinators** include the specialist globemallow bee, *Diadasia diminuta*, and other bees and wasps (*Apis*, *Agapostemon*, *Calliopsis*, *Halictus*, *Mellissodes*, and *Ammoplanus* spp.). **Fruits** are densely pubescent schizocarps (2–2.5 mm in diameter), each containing 10 to 12 one- or two-seeded mericarps arranged in a ring. **Seeds** are gray to black, kidney shaped, and hairless or covered with short, soft hairs. Seeds **mature** in summer to fall.

ECOLOGY

Plants **colonize disturbed sites** and grow in **early-** to **late-seral** communities. Plants are typically **short-lived**, though some may be long-lived. Open or recently **disturbed** sites are often associated with high plant abundance, but population size often appears to vary greatly among years.

SPGR2



Flowering gooseberryleaf globemallow growing on the Colorado Plateau. Photo: USDI BLM CP2 SOS.

Lookalikes include scarlet globemallow (*S. coccinea*), Munro's globemallow (*S. munroana*), and small-leaf globemallow (*S. parvifolia*).



Inflorescence with unopened, opened, and shriveled flowers. Photo: USDI BLM ID931 SOS.

GOOSEBERRYLEAF GLOBEMALLOW

(*Sphaeralcea grossulariifolia*)

Wildlife and Livestock Use



Plant associations Salt Desert, Sage, Warm Desert, PJ, Mtn. Brush, Dry Forest. **Elevation:** 330–6,600 ft. **Soil:** Volcanic, rocky, gravelly sands to clay loams with basic pH, can be slightly saline. Mean annual **precipitation:** 7–14 in.

REVEGETATION NOTES

- Seed **matures unevenly** within plants and populations and production may vary greatly among years.
- **Harvests can be maximized** by collecting when the lowest fruits are dehiscing and the majority are just starting to open. At this point fruits will be light green to brown.
- Seed can be **hand collected** by stripping or swatting seedheads over a container.
- Wildland seed can be **collected in amounts** large enough for local restoration needs.
- **Protect** the skin, eyes, and airways from the irritating stellate hairs covering the fruits.
- Thoroughly dry collections and protect them from **insects and rodents**.
- Scarification and cool stratification are required for **germination**, and **fall seeding** (≤ 0.25 in deep) is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



SPGR2



Whole fruits (schizocarps [left]) and individual seeds (right). Photos: USDI BLM NM930 SOS (left) and USDA USFS BSE (right).



North American distribution of gooseberryleaf globemallow. Map: M. Fisk, USDI USGS.

MUNRO'S GLOBEMALLOW

(*Sphaeralcea munroana*)

DESCRIPTION

Plants are erect **perennials** with woody, branching crowns, long, thick, woody **taproots**, and multiple surface roots. **Stems** are slender, erect, sparsely to densely hairy, and unbranched or with short branches. Stem **leaves** (0.4–2 in long) are alternate, thin, egg-shaped to triangular, and distinctly but shallowly three- to five-lobed with round-toothed margins and stellate pubescence. **Inflorescences** are narrow, leafy, and spike-like. Individual **flowers** (~2 cm in diameter) have five pale-orange to brick-red petals and numerous yellow stamens that form a column around the pistil. **Flowering** is indeterminate and occurs in spring and summer. Duration of flowering and seed **ripening** vary among years and locations. **Hybridization** occurs where *Sphaeralcea* species overlap.

Plants reproduce from **seeds**. Plants are strongly outcrossing and **insect-pollinated** by specialist (*Diadasia diminuta*, *D. lutzii*, and *Colletes sphaeralcea*) and generalist (*Agapostemon*, *Halictus*, *Ammoplanus*, *Apis*, *Calliopsis*, and *Melissodes* spp.) bees and wasps. **Fruits** are rounded schizocarps divided into 10 to 13 single-seeded segments (mericarps). **Seeds** (~1.7 mm in diameter) are brown, kidney-shaped, slightly hairy, and first produced when plants reach 2 years.

ECOLOGY

Plants often occupy **disturbed or open sites** and occur in **early- to late-seral** communities. Warm temperatures and disturbances may encourage seedling growth. Population sizes may fluctuate widely over time, but populations persist in the seed bank.

SPMU2



Munro's globemallow in flower growing in Idaho. Photo: USDI BLM UT931 SOS.

Lookalikes include gooseberryleaf globemallow (*S. grossulariifolia*), scarlet globemallow (*S. coccinea*), and small-leaf globemallow (*S. parvifolia*).

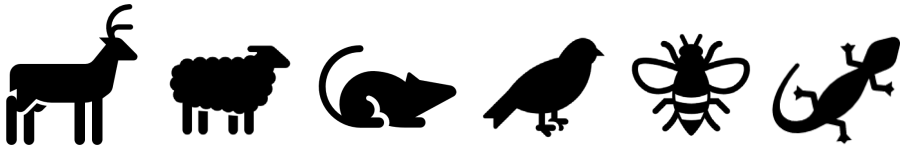


Spike-like inflorescence with flowers in the leaf axils. Photo: USDI BLM UT931 SOS.

MUNRO'S GLOBEMALLOW

(*Sphaeralcea munroana*)

Wildlife and Livestock Use



Plant associations Sage, Salt Desert, Mtn. Brush, PJ. **Elevation:** 330–8,000 ft. **Soils:** Gravelly sandy to clay-loams, often of volcanic origin. Mean annual **precipitation:** 6–14 in.

REVEGETATION NOTES

- Seed is generally **mature** and ready for harvest in June or July, but harvest dates and duration of the harvest window vary widely with location and weather conditions.
- Seed maturation is **indeterminate** and more than one flowering event may occur; thus, more than one collection might be made from the same population during the season.
- Seed can be **hand collected** by stripping mature fruits from the inflorescence.
- **Protect** skin and airways from fine irritating hairs on the fruits.
- Fully **dry** seeds before cleaning or moving them to cold storage. **Store** collections in breathable sacks in a protected, dark, dry area.
- Freeze or insecticide treat stored seeds to prevent **insect and rodent damage**.
- Natural or artificial scarification is required for **germination**, and fall seeding (≤ 0.25 in deep) is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



SPMU2



Fruits (schizocarps) and mericarps (left) and seed (right). Photos: USDI BLM ID931 SOS (left) and J. Cane, USDA ARS (right).



North American distribution of Munro's globemallow. Map: M. Fisk, USDI USGS.

SMALL-LEAF GLOBEMALLOW

(*Sphaeralcea parvifolia*)

DESCRIPTION

Plants are erect **perennials** or **subshrubs** from a stout, branching, woody caudex and large **taproot**. Herbage is often covered with a dense stellate pubescence. **Stems** (up to 3.3 ft tall) are several to many, slender, and commonly short-branched. Stem **leaves** are alternate, petiolate, thick, and prominently five-veined dorsally. They have three (sometimes five) shallow, broad, rounded lobes with regularly toothed margins. **Flowers** are produced in crowded **panicles**. They have five orange to red petals and many united yellow stamens that surround the pistil. **Flowering** occurs from April through July and is indeterminate. **Polyploidy and hybridization** are common for the *Sphaeralcea* genus.

Plants **reproduce** from seed. Plants are **insect-pollinated**, largely by bees. **Fruits** (schizocarps) are 4 to 5.5 mm in diameter and made up of 9 to 12 two-seeded mericarps. **Seeds** (1.7–2 mm in diameter) are kidney shaped, dark brown to black, and somewhat pubescent with a fine network of veins.

ECOLOGY

Plants are **disturbance tolerant**. They grow rapidly and flower in spring. Plants typically go dormant in summer but green up again with summer or fall moisture. Increased moisture is associated with increased plant **abundance** and **seed production**.

SPPA2



Small-leaf globemallow growing in Utah.
Photo: USDI BLM UT040 SOS.



Inflorescence with flower buds, open flowers, and shriveled flowers.
Photo: S. Young, Utah State University.

SMALL-LEAF GLOBEMALLOW

(*Sphaeralcea parvifolia*)

Wildlife and Livestock Use



Plant associations Salt Desert, Sage, PJ, Warm Desert, Mtn Brush.

Elevation: 2,000–9,000 ft, but rare below 4,000 ft. **Soils:** Shallow (≥ 6 in), dry, well drained, rocky sands to clay loams. Mean annual **precipitation:** ≥ 6 in.

REVEGETATION NOTES

- **Inspect** fruits for weevils (Apionidae), some of which are specialist globemallow seed predators.
- **Monitoring** at the flowering stage is important because seeds are dispersed soon after fruits are mature.
- **Collect** when most fruits are just starting to open and lowest fruits are splitting. At this point, fruits will be light green to brown and about 25% of the seeds will be mature.
- Wildland seed can be **hand collected** by clipping or plucking fruits.
- Dense stands near the Utah-Arizona border have been **harvested mechanically** using strippers with hoppers.
- Fully dry collections and pesticide treat or freeze them to prevent **insect damage**.
- Natural or artificial scarification is required for **germination**, and **fall seeding** (0.12–0.25 in deep) in medium to coarse soils is recommended.
- **Protect seeded areas** from rodents, native grazers, and livestock until plants reach reproductive maturity.



Fruit (schizocarp) and individual seeds (left). Many individual seeds with scale (right). Photos: USDI BLM UT040 SOS (left) and USDI BLM CP2 SOS (right).



North American distribution of small-leaf globemallow. Map: M. Fisk, USDI USGS.

ADDITIONAL RESOURCES

This list of resources provides additional information useful to each stage of the seed supply chain (see Figure 1 on page 2). The list is not exhaustive.

SEED PLANNING AND SPECIES SELECTION

Ecological Site Descriptions (ESDs)



This resource provides a framework for classifying soils and vegetation and is often used when planning management activities. The ESD reports provide information in four major sections: Site Characteristics, Plant Communities, Site Interpretations, and Supporting Information. The website contains an informative webinar series and links to helpful tools. ESD information can also be obtained through the Web Soil Survey.

Link: <https://www.nrcs.usda.gov/getting-assistance/technical-assistance/ecological-sciences/ecological-site-descriptions>

Environmental Protection Agency (EPA) Ecoregions



Ecoregions are areas with differing ecosystem characteristics and help provide an ecological filter for the movement of plant materials. The EPA Ecoregions website provides resources for incorporating ecoregions at different spatial scales and contains downloadable files compatible with geospatial tools.

Link: <https://www.epa.gov/eco-research/ecoregions>

ADDITIONAL RESOURCES



Fire Effects Information System (FEIS)

This website provides a searchable collection of reviews of scientific literature regarding fire effects on plants and animals.

Link: <https://www.feis-crs.org/feis/>



Flora of North America (FNA)

Information on the names, taxonomic relationships, distributions, and morphological characteristics of plants native and naturalized in North America north of Mexico.

Link: http://www.efloras.org/flora_page.aspx?flora_id=1



USDA Plants

This website provides a wealth of information on vascular plants, mosses, liverworts, hornworts, and lichens within the United States, including helpful distribution maps, fact sheets, and plant guides.

Link: <https://plants.usda.gov>

ADDITIONAL RESOURCES



Web Soil Survey (WSS)

This tool provides soil data for much of the United States and is an authoritative source of soil survey information. Detailed soil reports can be created based on point locations or polygons.

Link: <https://websoilsurvey.nrcs.usda.gov/app/>

SEED SOURCING



Climate Smart Restoration Tool (CSRT)

This tool was designed to provide information to facilitate seed collection and seed transfer for native plants. This geospatial tool can depict both current and future seed transfer limits, using future climate change predictions and data provided by ClimateNA.

Link: <https://climaterestorationtool.org/csrt/>



Native Plant Seed Mapping Toolkit

Tools that help meet objectives pertinent to restoration planning and implementation.

Link: <https://www.usgs.gov/apps/seed-toolkit/>

ADDITIONAL RESOURCES



Western Wildland Environmental Threat Assessment Center (WWETAC) TRM Seed Zone Applications

This website contains a compilation of available provisional and empirical seed zone maps in various formats and a mobile mapping application.

Link: <https://www.fs.usda.gov/wwetac/threat-map/TRMSeedZoneMapper.php>

SEED COLLECTION



ENSCONET: Seed Collecting Manual for Wild Species

This manual outlines seed collecting techniques for the conservation of European wild plants, but it is globally applicable.

Link: <https://www.publicgardens.org/resources/ensconet-seed-collecting-manual-wild-species>



Protocol for the Collection, Study, and Conservation of Seeds from Native Plant Species

This protocol outlines the procedures for making seed collections for Seeds of Success (SOS), the national native seed collection program, led by the Bureau of Land Management (BLM) in partnership with many other federal and non-federal partners.

Link: <https://www.blm.gov/sites/default/files/docs/2021-12/SOS%20Technical%20Protocol.pdf>

ADDITIONAL RESOURCES

SEED PRODUCTION



Forb and Shrub Seed Production Guide for Utah

Describes site preparation, planting methods, stand management, harvesting, and seed lot management for increasing priority forbs and shrubs used for restoration in Utah (includes native and non-native species).

Link: https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1058&context=extension_histall



Pollinating Bees Crucial to Farming Wildflower Seed for US Habitat Restoration

Describes pollinator requirements of 15 commonly increased native forbs.

Link: <https://www.fs.usda.gov/research/treesearch/33735>



Wildflower Seed Production

Lists reports and publications on native forb seed production research conducted at the Oregon State University Malheur Experiment Station.

Link: <https://agsci.oregonstate.edu/mes/crops/wildflower-seed-production>

ADDITIONAL RESOURCES

SEED CLEANING, TESTING, AND CERTIFICATION



Ensuring Seed Quality in Ecological Restoration: Native Seed Cleaning and Testing

Seed cleaning and testing principles and practices are described.

Link: <https://onlinelibrary.wiley.com/doi/10.1111/rec.13217>



How AOSCA Tracks Wildland Sourced Seed and Other Plant and Propagating Materials

The Association of Official Seed Certification Agencies offers pre-variety germplasm certification for indigenous and non-indigenous plants to ensure their identity, origin and purity. This booklet provides a step-by-step outline of the procedures involved in certifying wildland collected and field- or nursery-grown plant materials and includes an extensive glossary.

Link: <https://aosca.org/wp-content/uploads/2023/04/HOW-AOSCA-TRACKS-updated-Final-9-7-22.pdf>

ADDITIONAL RESOURCES

How to be a Seed Connoisseur



This bulletin will explain how to find out what is in that container of seed. It is divided into three sections:

- 1) How to decipher a seed analysis label
- 2) How to comprehend a certified seed label
- 3) How to take a representative seed sample for analysis

Link: <http://www.utahcrop.org/wp-content/uploads/2015/05/How-to-be-a-seed-connoisseur-04May2015-4.pdf>



State Seed Testing Laboratories

This website provides Association of Official Seed Analysts (AOSA) educational resources and lists of state seed testing laboratories.

Link: <https://analyzeseeds.com>



US Seed Certification Agencies

This document provides a list of Association of Official Seed Certifying Agencies (AOSCA) state seed certification organizations.

Link: <https://aosca.org/wp-content/uploads/2023/01/Seed-Cert-Agencies-US-11.18.22.pdf>

ADDITIONAL RESOURCES

SEED STORAGE



Millennium Seed Bank Partnership Technical Information: Post-Harvest Handling of Seed Collections

Link: <http://brahmsonline.kew.org/Content/Projects/msbp/resources/Training/04-Post-harvest-handling.pdf>



Millennium Seed Bank Partnership Technical Information: Measuring Seed Moisture Status Using a Hygrometer

Link: <http://brahmsonline.kew.org/Content/Projects/msbp/resources/Training/05-eRH-moisture-measurement.pdf>



Seed Storage: Maintaining Seed Viability and Vigor for Restoration Use

Seed longevity and affecting factors, storage recommendations and cautions, and management of seed lot moisture content are provided.

Link: <https://onlinelibrary.wiley.com/doi/10.1111/rec.13174>

ADDITIONAL RESOURCES

NURSERY PRODUCTION



Reforestation, Nurseries, and Genetic Resources

This website hosts publications and technical information on production and use of nursery stock.

Link: <https://rnggr.net/>

SEEDING, PLANTING, AND MONITORING



Roadside Revegetation

This manual describes all aspects of stabilizing, revegetating, and monitoring roadsides and provides wide applicability to restoration of other disturbances.

Link: https://www.nativerrevegetation.org/learn/manual_2017/



Revegetation Equipment Catalog

This website provides helpful information to guide the selection of equipment for use in seed collection and cleaning, site preparation, revegetation, and vegetation management.

Link: <https://revegetation.greatbasinfirescience.org>

ADDITIONAL RESOURCES



Shrub-Steppe and Grassland Restoration Manual for the Columbia River Basin

In addition to restoration guidelines, this manual includes pollinator resources, a seedling identification guide, monitoring forms, and seed mix and drill calibration tools.

Link: <https://wdfw.wa.gov/publications/01330>