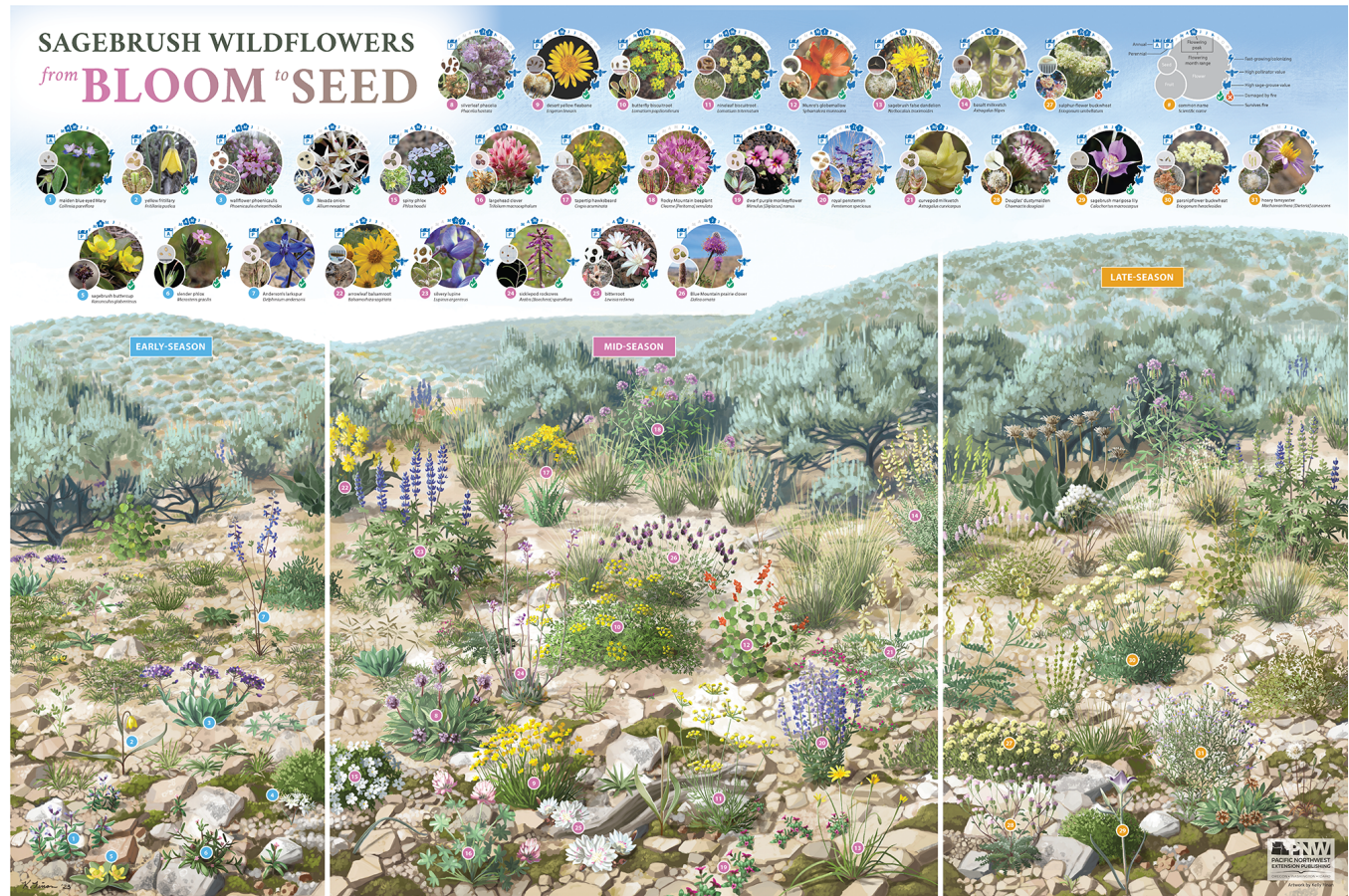


Sagebrush wildflowers: From bloom to seed

Stella Copeland, Vanessa Schroeder, Alison Agneray, Sarah Barga, Corey Gucker, Sarah Kulpa and Eugénie MontBlanc



The poster illustrates 31 common wildflower species potentially useful in restoration. These species represent the variety of size, height, flowering timing and taxonomy found in typical sagebrush communities. *Note: These species rarely, if ever, occur as closely together as shown.*

Credit: Kelly Finan, © Oregon State University

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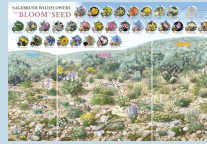
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Background

Sagebrush ecosystems, broadly distributed across western North America (see map), are imperiled due to a combination of modern and historical factors causing widespread degradation and habitat loss. Sagebrush shrubs (scientific name: *Artemisia* spp.) are so common in these ecosystems that they create a “sea” across the landscape. **This poster highlights wildflowers (forbs) common in sagebrush vegetation of the Great Basin.**

These wildflowers support countless wildlife species, including some species only found in sagebrush ecosystems, such as the greater sage-grouse. (See “High sage-grouse value.”) Many forb species (including most featured here) are highly valued and used for food, medicine and ceremony by the many Indigenous peoples of the Great Basin. There are hundreds of forb species in sagebrush ecosystems, all with their own unique characteristics. The 31 species on this poster highlight common species potentially useful in restoration. These species also represent the variety of size, height, flowering timing and taxonomy (evolutionary relationships) found in typical sagebrush communities. *Note: These species rarely, if ever, occur as closely together as shown in this poster.*



The Great Basin and the larger Sagebrush Sea encompass much of the West.

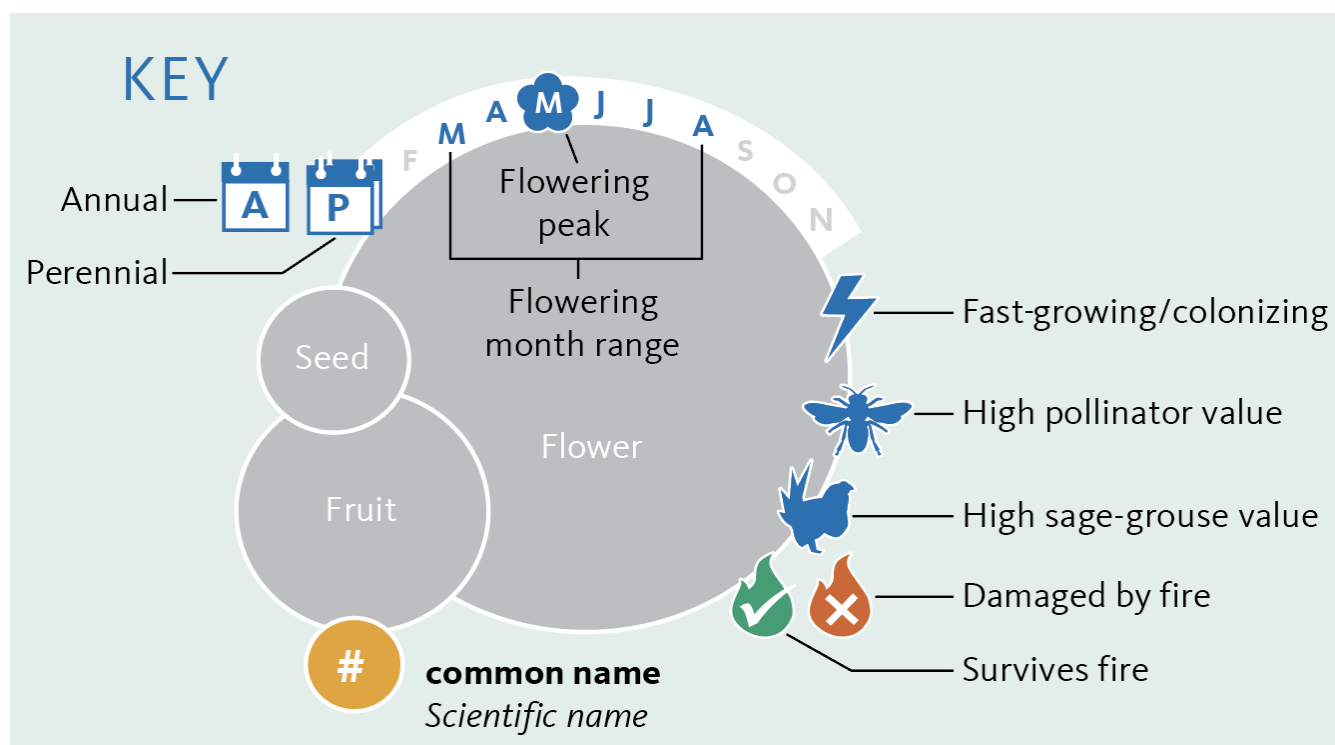
Credit: Stella Copeland

Most of the common forbs in the sagebrush ecosystem bloom from early spring (March) through midsummer (July). Early-season forbs begin flowering when temperatures start to warm and soils are still moist from winter precipitation. Exact flowering dates vary by year, due to weather patterns, and by site, due to factors like elevation and aspect. **This poster shows the progression of these wildflowers from bloom to seed through the growing season.** The wildflowers appear in color-coded panels according to their peak flowering timing (early-season: blue, mid-season: pink, late-season: orange).

The poster also includes **key management and restoration traits** for each species: fire response, colonization rate and value to sage-grouse and pollinators. The small icons surrounding the flower photos at the top of the poster indicate different species traits. Traits are based on existing information. However, the amount of available information varies widely across species. See “Additional resources” for details like specific plant-pollinator relationships and responses to fires by severity or season.

Wildflower

A nongrass flowering plant, often called a forb. Wildflowers are mostly nonwoody, but can be slightly woody at the base.



Credit: Kelly Finan, © Oregon State University

Fruit and seeds

We included photos of the fruit of each species on the lower left and of the seeds of each species to the central left of the flower photo. Fruiting structures like pods or seedheads are often distinctive and useful for identifying species. Seed shape and size can help with restoration, by indicating whether a species will be easy to seed with standard machinery. No seed photo was available for sagebrush buttercup (*Ranunculus glaberrimus*).

Lifespan

Annual plants live for one year, which means they emerge from the seedbank, produce flowers and fruits, and die in the same year. Perennial species can live for multiple years. They often survive and resprout in subsequent years from roots or tubers. The single-paged calendar symbol with an “A” indicates annual species, and the multi-paged calendar symbol with a “P” indicates perennial species. Some wildflower species are biennials, which means they live for two growing seasons. This poster categorizes biennial species as perennial.

Timing of flowering

Wildflower species are arranged by peak flowering times across the poster panels: early- (blue), mid- (pink) or late- (orange) season. The number in the panels can help you find the species on the top, or vice versa. The letters across the top of the flower photos (at left) depict months from February (F) to November (N). Months when the species flowers are highlighted in blue, with nonflowering months in gray. The blue flower symbol highlights peak flowering, or the month or months when a plant is most likely to have flowers.

Many species are shown in different phenological stages, such as leaf growth, flowering and fruiting, across panels. For example, wallflower phoenicaulis (*Phoenicaulis cheiranthoides*), species No. 3, is flowering in the early-season panel. It is fruiting, with long pods, in the mid-season panel. Try searching for the species across the seasons to see it at different phenological stages.

How did we determine peak bloom? Timing of flowering depends on the year, seasonal weather patterns and the environmental characteristics of the site, such as elevation. We estimated flowering months with species records from iNaturalist, a crowdsourced biodiversity database. We examined records across sagebrush ecosystems and adjoining regions.

Only a small fraction of iNaturalist forb observations include notes on plant phenology, like whether a plant is flowering. We supplemented these limited observations by scanning species' photos for flowers in the months before or after observations with phenology notes. We excluded observations in hot deserts or high-elevation mountains because flowering in these areas is often much earlier or later than in low-elevation sagebrush sites.

The number of observations varied widely by species, from 83 for sicklepod rockcress to 7,269 for arrowleaf balsamroot (as of June 8, 2023, “verifiable” category; see “Additional resources”).

Phenology

Cyclical patterns in nature, like the timing of flowering or fruiting for plants.

Fast-growing or colonizing species

Fast-growing or colonizing species may be especially useful for restoration in places with lots of soil disturbance or where rapid growth is needed. The blue lightning bolt highlights those species reported as fast-growing or colonizers, or both, generally occurring on disturbed sites, or capable of rapid reproduction. These plants are often short-lived and herbaceous, as opposed to semi-woody. Some species not in this category, arrowleaf balsamroot, for example, may be relatively tolerant of disturbance once established, but slow to return once lost from a site.

High sage-grouse value

The greater sage-grouse (*Centrocercus urophasianus*) is a bird species found only in sagebrush ecosystems. Sage-grouse are in severe decline due to habitat loss.

Unlike many other bird species, sage-grouse do not eat seeds. Instead, they eat the softer leaves, stems, and buds of wildflowers and the insects attracted to them. They require forbs throughout the growing season to sustain themselves and their chicks.

The sage-grouse icon identifies wildflower species with moderate to high food value for sage-grouse. This rating is based on a combination of sources, including both general preference groups and diet records.

Fire response

Annuals usually survive fires as seed stored in the soil (often referred to as the seedbank). Some perennial species easily resprout following fire; others do not.

For perennial species, the location of growth points is critical to the potential for survival through post-fire resprouting. Species with growth points deep below the soil surface are more likely to survive or even benefit from fire. Species with growth points near or above the soil surface are more likely to be damaged or killed by fire.

The flame symbols describe a species' response to fire. The green flame with a checkmark indicates a species that tends to survive fire, whereas the orange flame with an "X" indicates a species that is damaged by fire.

These estimates are for a typical fire in the sagebrush ecosystem, which is a moderate fire burning in late summer or early fall when most perennial forbs are dormant. "Survival" species may die in higher severity fires or fires that burn during the growing season.

Dormant

Alive, but temporarily inactive and not growing. Many sagebrush perennial forbs go dormant after producing fruit in June or July. They remain dormant until the following spring.

Pollinator

An animal that transfers pollen between flowers, leading to fertilization and seed production.

High pollinator value

Most forbs attract one or multiple types of pollinators to fertilize their flowers. Pollinators may be insects, like flies, bees, butterflies, or moths, as well as birds and bats. The bee symbol indicates forb species recommended or described as moderately to highly valuable for at least one type of pollinator.

Species by plant family

Scientific or Latin names (in italics) uniquely describe a species' taxonomic classification in two parts. The first word is the genus, and the second word is the species description (technically, the specific epithet). Common names in English (body text on the poster) are not unique. One species can have multiple common names, and the same common name can be used for multiple species. Scientific names are more precise and related to taxonomy, but common names are often more widely known. The forb species in this poster are also known by many different names in Great Basin Indigenous languages. Often, there are unique Indigenous words for different phenological stages of the same species.

The nationwide database [USDA PLANTS \(https://plants.usda.gov/home\)](https://plants.usda.gov/home) is the source for most scientific names on this poster, but scientific names can change with new research on taxonomic relationships. Updated names from the latest Flora of North America (in progress) are shown in brackets.

We also used the name *Lomatium papilioniferum* instead of *Lomatium grayi*. Recent research indicates that the name *L. grayi* was previously applied to multiple distinct species and *L. papilioniferum* is the most widespread of those in the Great Basin. Below are the species grouped by their plant family (the taxonomic group above genera).

Additional resources

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Taxonomy

Formal scientific classification system. For example, plants are classified into families, then genera and species.

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Acknowledgments

We thank Eastern Oregon Agricultural Research Center staff for design feedback, Jon Bates for species' natural history details, The Nature Conservancy field crew for locating ALNE in fruit and anonymous reviewers for general comments.

Photo credits

Abbreviations — first two letters of the genus and species

Sarah Garvin, Bend Seed Extractory (BSE): seed, ASCU, CLSE, DAOR, DEAN, FRPU, LERE, LUAR, MINA, MACA, PESP, PHCH, PHHA, PHHO, TRMA. **Sarah Barga:** seed, COPA, MIGR. **Jim Cane:** seed, CHDO, SPMU. **Gerald Carr:** flower, ALNE, CAMA, ERLI; fruit, ARSP, CAMA, COPA, LOPA, MIGR. **Stella Copeland:** flower, DEAN, ERHE, LERE, LOTR, PHHO, TRMA; fruit, ALNE, DEAN, MINA, RAGL. **Matt Lavin:** flower, ASCU, ASFI, BASA, CHDO, CLSE, ERUM, LUAR, MACA, MINA, PHCH, PHHA, RAGL; fruit, CLSE, LUAR. **Adam Schneider** (<https://adamschneider.net/photos/>): flower, ARSP, COPA, CRAC, DAOR, LOPA, MIGR, NOTR, PESP, SPMU; fruit, ASFI, CHDO, DAOR, ERLI, FRPU, LOTR, NOTR, PESP, PHHA, SPMU, TRMA. **Seeds of Success (BLM field office or other):** fruit, CRAC (OR030), ERHE (UT931), ERUM (CO932), MACA (ID230); seed, ARSP (Western Regional Plant Introduction Station), ASFI (OR030), BASA (OR010), CAMA (OR010), CRAC (OR030), ERHE (OR030), ERLI (ID931), ERUM (WY030), LERE (BSE), LOPA (OR030), LOTR (ID931), NOTR (ID931). **Lori Ziegenhagen:** flower, FRPU; fruit, ASCU, PHCH, PHHO.

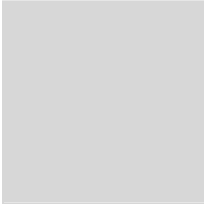
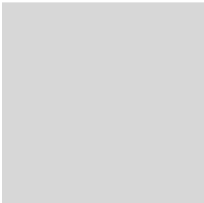
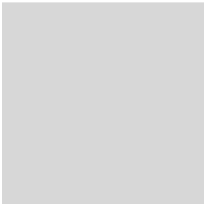
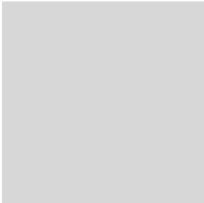
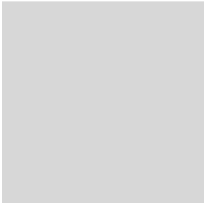
Map credits

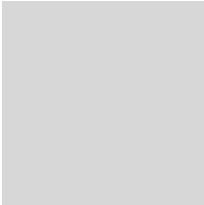
Sagebrush sea: Jeffries, M. I., and S. P. Finn. 2019. The Sagebrush Biome Range Extent, as Derived from Classified Landsat Imagery, U.S. Geological Survey data release.

Great Basin: Central Basin and Range & Northern Basin and Range EPA ecoregions, U.S. Environmental Protection Agency (2013) Level III ecoregions of the continental United States. U.S. EPA-National Health and Environmental Effects Research Laboratory.

Projection: WGS 1984, EPSG:4326.

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Great Basin Fire Science Exchange

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