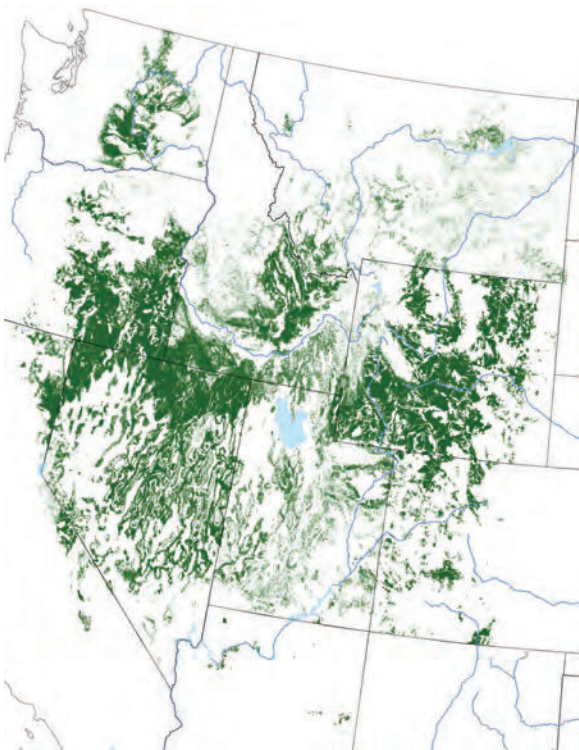


Pocket Guide to Sagebrush



Point Blue Conservation Science



Generalized map of the primary distribution of sagebrush in the American West (*map courtesy of Laura Quattrini, Rocky Mountain Bird Observatory*)

Pocket Guide to Sagebrush

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Maps, layout, and production by Scott W. Gillihan, author of Rocky Mountain Bird Observatory's *Pocket Guide to Prairie Birds*.

How to Use the Guide

This guide is written for anyone interested in learning more about sagebrush species and habitats. The introduction provides descriptions of some of the remarkably diverse sagebrush communities in western North America. The purpose of the guide is to give identifying characteristics and range maps for 18 species of sagebrush, encompassing 27 different kinds (including subspecies and hybrids). More detailed information can be obtained from the taxonomic and ecological treatises mentioned, and it is our hope that this guide will stimulate further examination of species and their habitats.

Appendices at the back of the book provide a list of names in common use, with citations and synonyms. Taxonomy follows the recent treatment for the *Flora of North America* (Shultz 2006) and a monograph of sagebrush (Shultz 2009).

Introduction

Sagebrush dominates much of western North America, with approximately 165 million acres of potential habitat. It is the “gray sea” or “sagebrush ocean” familiar to all who travel in western North America. In spite of its prevalence, it is considered a fragile ecosystem that is under siege from a combination of forces. Estimates of habitat loss vary widely depending on region, but since settlement by Europeans, at least half of the area once covered by sagebrush has been lost.

Sagebrush steppe is prized for its diversity of flowering plants, shrubs, and associated grasses. It grows where there

is little rain, winters are harsh, and trees are restricted to streams or protected mountain slopes. Sagebrush provides critically important habitat for a number of wildlife species as well as domestic animals. It provides rangeland for cattle and sheep in areas where they co-exist with endemic wildlife such as the iconic greater sage-grouse, sage thrasher, sage sparrow, and pygmy rabbits. Large animals such as mule deer, Rocky Mountain elk, moose, black bear, pronghorn, mountain lions, coyotes, and gray wolves also share the broad expanses of sagebrush steppe with human inhabitants.

The different kinds of sagebrush are identified in this guide primarily through pictures and dialogue. The description of communities is intended to give a brief overview of the habitat diversity within the sagebrush ecosystem and the diagram on the last page—in combination with maps—shows where you might find the species in the landscape. For those interested in delving further, an internet search on “*Artemisia*” or “Sagebrush” reveals an astonishing number of published reports on medicinal, managerial, genetic, and ecological research.

Sagebrush species go by several different names, often with the shorthand of “sage” (which is applied to the genus *Salvia* in the Mint family as well as *Artemisia* of the Sunflower family) or “wormwood,” which includes the herbaceous species of *Artemisia*. Five species usually classified as herbaceous have been added here because they are woody at the base and, for identification purposes, look like sagebrush. These species are Fringed sage, Fuzzy

sage, Birdfoot sage, Porter's sage, and Bud sagebrush (*Artemisia frigida*, *A. papposa*, *A. pedatifida*, *A. porteri*, and *A. spinescens*). Interested readers can find more in the literature, and the selected references and websites will serve as a beginning guide. To navigate the different plant names, the appendix at the end of this book provides a cross-reference to scientific names as well as common names.

A Changing Landscape

The recent increase in severe droughts has affected the health of native grasses. While sagebrush is amazingly resilient to climatic extremes, the shrublands are being replaced by exotic annual grasses and other invasive species after disturbances such as wildfire. As a consequence of these changes, the Western Association of Fish and Wildlife Agencies has called for new conservation measures to increase the resiliency of the sagebrush steppe habitats and sage grouse populations they support. Land managers are being called on to monitor sagebrush steppe habitats and implement programs to minimize impacts and manage the risks to humans and other wildlife.

Estimates of how much sagebrush steppe remains depend on the geographic region. Loss of habitat appears to be accelerating, especially with the changes following wildfire or urban expansion, and an estimated 50% of sagebrush habitat has been lost in the Great Basin in the past 50 years. In California, recent reports suggest that as much as 90% of coastal sagebrush scrub has been lost. Even so, with millions of acres remaining, the common Big Sagebrush

is not in danger of extinction, but there is growing concern about the fragmentation of habitat and loss of migration routes and feeding grounds for wildlife. A few of the sagebrush species treated in this book are very limited in geographic range. They, and the changing boundaries (both expanding and shrinking) of some of the more widespread species, may be useful in monitoring ecological change.

Sagebrush Biology

Sagebrush species belong to the Sunflower family, or Asteraceae. They do not have the showy flowers that are common to most members of this family. Rather than depending on insect pollination under cold desert condition, sagebrush depends on wind for pollination. It produces massive amounts of pollen in the late summer and early fall. The flowers are tiny but abundant: hundreds of flower heads are on a single flowering stem of big sagebrush, and each flowering head has between two and ten florets. Each flower produces only one microscopic seed (about 1 mm in length), but each plant potentially produces many thousands of seeds. Flowers mature in late summer (except for early low sagebrush) and seeds mature in the fall. The seeds disperse after they pass through animals that eat the seed heads, or by winds that blow across the snow crusts that are littered with the tiny seeds during winter months.

Most of the sagebrush species are evergreen, but a few are deciduous, and some are just plain opportunistic—keeping leaves on in a wet year but dropping them when it gets dry. Early spring is when the leaves are most bitter (and the characteristic sagebrush odor is strongest)—a strategy that

works to reduce insect predation and grazing by wildlife when the plants are coming into flower. As fall and flowering season approach, the bitter terpenes, camphors, and other secondary compounds start to break down and the seed heads become more palatable. Seeds have approximately 20% protein content and the seed heads provide an important winter food for wildlife as well as some domestic animals. Sage grouse species are among the few animals that rely almost exclusively on sagebrush foliage as a food source throughout the year.

For identification purposes, it is important to know that there are two kinds of leaves produced on the evergreen species. Big sagebrush (*Artemisia tridentata* and its subspecies) is the most widespread and abundant of all the species. It produces early spring leaves that expand rapidly and are sometimes irregular in shape—exposing a large surface area to capture as much sunlight as possible, like a sucker shoot on a tree. These leaves tend to yellow and drop by mid-summer and they should be ignored for measurement purposes. The leaf lengths given in the descriptions are for the perennial leaves. These are the leaves that occur in tight little evergreen bundles.

The evergreen habit is part of what makes sagebrush species so successful. They are able to photosynthesize during cold winter months, growing slowly but steadily when most other woody plants are dormant. This growth strategy provides a competitive edge over species that develop leaves later in the spring. The upright position of the leaves helps to reduce the heat load during summer months.

The roots of sagebrush also display an opportunistic growth strategy. Sagebrush produces two kinds of roots: a taproot that elongates rapidly after seed germination, reaching great depths in order to reach readily available soil moisture.

The second root system is a network that spreads laterally, exploiting surface soil moisture, redistributing water from lower to upper levels, and effectively out-competing other shrub species as well as grasses and herbs. Thin threads of mycorrhizal fungi occur in association with the roots and they account for some of the success of sagebrush by enhancing nutrient uptake.

Sagebrush Chemistry

There are many volatile compounds in sagebrush which give sagebrush its characteristic odor. Many are produced in the glands on the leaves, which is why sagebrush smells so strong when you crush the leaves in your hand. Some of these compounds confer protection through the deterrence of insects and other predators, and some of the compounds actually attract grazing animals. Water-soluble coumarins and other compounds fluoresce under ultraviolet light, and the presence of these compounds is correlated with increased palatability. Determining the presence of coumarins can thus be used as a measure of relative importance to wildlife.

There is a simple black light test that is often used by people in management that can help distinguish species and subspecies of sagebrush. Species with high coumarin content will fluoresce bright blue when leaves are crushed in alcohol or water then illuminated with a black light (total

darkness is necessary). This bright blue glow will identify Low and Early sagebrush, Mountain big sagebrush, and Snowfield sagebrush. Species that glow very faintly are Bigelow sagebrush, Pygmy sagebrush, Silver sagebrush, and Threetip sagebrush. Members of the hybrid complex called “Bonneville” sagebrush, “Xeric” sagebrush, and “Lahontan” sagebrush will glow light blue. Species that have no fluorescence are Wyoming and Basin big sagebrush, Bud sage, Fuzzy sagebrush, and Scabland sagebrush.

The volatile compounds as well as other secondary compounds also have antibacterial properties that have contributed to numerous medicinal uses of sagebrush as well as ritualistic cleansing.

Sagebrush Communities

Big sagebrush is the most widespread of all the species. It has several subspecies that are ecologically distinct and are used extensively in management to indicate different soil types as well as moisture and temperature regimes.

Basin big sagebrush occurs in the valleys, usually in deep, well-drained soils. It also occurs along highways where soils have been deepened or disturbed by digging and there is additional drainage. **Mountain big sagebrush** is found almost exclusively in the mountains—in meadows and slopes—usually in zones with annual precipitation greater than 14". **Wyoming big sagebrush** is found both in the valleys and in the mountains, but always in dry sites, even if it seems as minor as a small rocky hummock within Basin big sagebrush or Mountain big sagebrush populations.

“Bonneville sagebrush” is a hybrid of Wyoming and Mountain big sagebrush, and the combination of the two



Mountain big sagebrush
north of Lake Tahoe, California

genotypes seems to have an enhanced effect on palatability for wildlife. It grows in an ecological zone between the two parents, and has been of particular interest in the management of wildlife habitats.

Black sagebrush occurs on sites that are very dry, with rocky and very shallow soils. A layer of white carbonates impervious to root penetration is usually found several inches below the surface.

Silver sagebrush subspecies are fairly clearly delineated geographically. **Mountain silver sagebrush** grows where moisture accumulates locally (ravines, streamsides, snow melt basins) or in higher precipitation zones, and usually in coarse-textured soils. **Bolander silver sagebrush** grows in fine-textured clay basins and playas, and is restricted to the



Mountain silver sagebrush
in western Wyoming

western part of the range. **Plains silver sagebrush** occurs mostly east of the continental divide, in the grasslands of central North America.

Low sagebrush has several subspecies, each using different ecological strategies. These subspecies often occur as small populations that are inclusions within Big sagebrush populations, but always on distinctly different soil microsites.

Early low sagebrush grows on poorly drained clay soils, sometimes where fine particles aggregate in ravines or basins. This plant blooms in the spring, a reproductive strategy that isolates it from all other members of the sagebrush complex. Typical **Low sagebrush** grows on rocky soils (usually limestone or dolomite), usually on windswept sites in the mountains, and it blooms in mid to late summer.

Hot springs low sagebrush also grows on rocky soils, usually in soils of igneous origin.



Threetip sagebrush on benches above Pocatello, Idaho

Threetip sagebrush has two subspecies: the more common one grows in igneous-derived soils, primarily in Idaho and western Wyoming. The less common **Wyoming threetip** grows on rocky or loamy sites, mostly east of the continental divide where there is more summer precipitation.

Scabland sagebrush is restricted to the volcanic soils of the Columbia River Basin of Washington and Oregon, with some isolated populations in extreme western Idaho.

Sand sage grows in sandy soils that are south and east of the cold desert interior basins. It occurs in the Mohave and Chihuahuan desert zones, the Colorado Plateaus, and into the short-grass prairie grasslands of the central U.S.



Sand sage in
southeastern Utah

Fringed sage is the most widespread of all the sages listed here, growing in cold arctic grasslands, high mountain plains, and the central grasslands. It avoids warm areas and is never as conspicuous as members of the big sagebrush complex.

California sagebrush is a major component of the coastal and inland sage scrub of California, but it never leaves the moderating climatic effect of the Pacific Ocean. **Channel Island sagebrush** is closely related, but occurs only on the islands off the coast of California.

Bud sagebrush occurs in fine clay soils with salt-loving plants like shadscale and salt bush.

Species that are extremely restricted in geographic range, as relatively isolated populations, are **Pygmy sagebrush** (small outcrops of tuffaceous ash), **Birdfoot sage** (Wyoming and Montana), **Porter's sage** (Wyoming), and **Fuzzy sagebrush** (Oregon, Idaho, and Nevada). Each of these is considered narrowly endemic—some considered for protected status—and all are interesting examples of the narrow habitat-specific specialization that can occur among sagebrush species.

Species Accounts



***Artemisia arbuscula* — Low Sagebrush**

Description: Low-growing evergreen shrubs usually less than 2 ft tall; with multiple stems that appear to rise from the ground, often lacking an apparent trunk. Plants are usually found on shallow clay or rocky soil “islands” amid large stands of Big



sagebrush. Low sagebrush is capable of sprouting from underground stems after a disturbance, though this condition is rare. Evergreen. Aromatic.

Vegetative Leaves: Broadly wedge-shaped, 2–4 mm wide X 3–10 mm long, shallowly or deeply 3-lobed depending on the subspecies (shallow for typical Low sagebrush, deeply lobed for the Early and Cleftleaf subspecies), usually 1.5–2 times as long as wide. Gray-green.

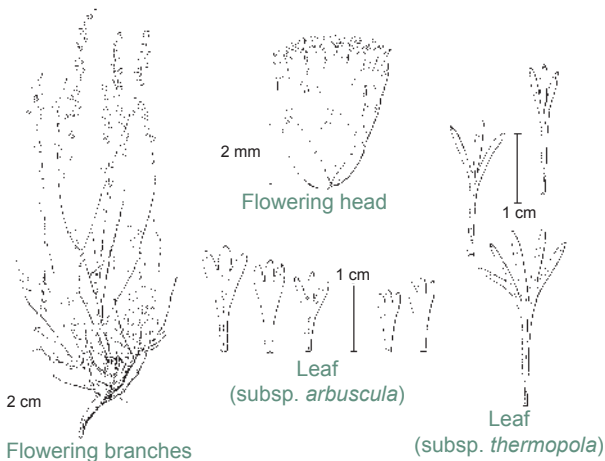
Leaves of flowering stems: Deeply lobed and early deciduous, a characteristic that distinguishes it from other species. Gray-green.

Inflorescences: Narrow, ca. 2 cm wide X 2–10 cm long, with mostly sessile heads (lowermost sometimes on short stalks), attached singly or in pairs.

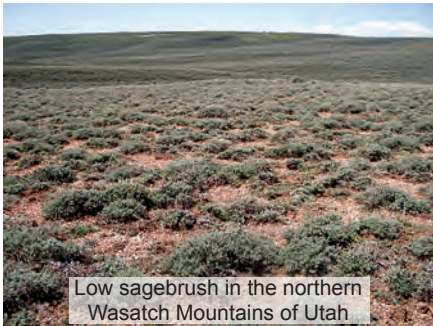
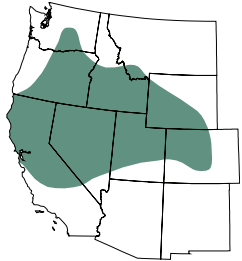
Flowering heads: Ovate to broadly bell-shaped, 2–5.0 (–6) mm wide X (2–) 4–7 mm high; florets mostly 5–10 per head, involucral bracts densely hairy.

Flowering period: Spring (subsp. *longiloba*) or late summer to early fall (subsp. *thermopola* and subsp. *arbuscula*).

The three subspecies of Low sagebrush grow in different types of habitats. These are important in defining ecological sites, even though it is frustratingly difficult to distinguish subspecies with certainty. The three subspecies are (1) *arbuscula*: the typical low sagebrush that grows on shallow rocky soils at high elevations; (2) *longiloba*: “Early” or “Alkali” sagebrush that blooms earlier than the other two subspecies and grows in alkaline clay soils with poor drainage, from high to low elevations; and (3) *thermopola*: the “Cleftleaf” or “Hot springs” sagebrush that has deeply cleft leaves with narrow



lobes and grows on igneous-derived soils such as basalt or granite. Sage Grouse are often found associated with Low sagebrush “islands” within Big sagebrush stands, due in part to the more open stands. It is easy to overlook Low sagebrush populations because on first glance, they appear to be short patches amid taller plants of Big sagebrush.



***Artemisia bigelovii* — Bigelow Sagebrush**

Description: Short to medium-sized shrubs, mostly 1–2 ft tall. Usually not resprouting after disturbance. Briefly deciduous in winter. Aromatic.

Vegetative leaves:

Mostly narrowly wedge-shaped with three sharply pointed lobes (rarely 5-lobed), 2–5 mm wide X 5–30 mm long. Silvery green.

Leaves of flowering

stems: Mostly entire and blunt-tipped, shorter than vegetative leaves.

Inflorescences:

Narrow, mostly 1–2 cm wide X 6–25 cm long.

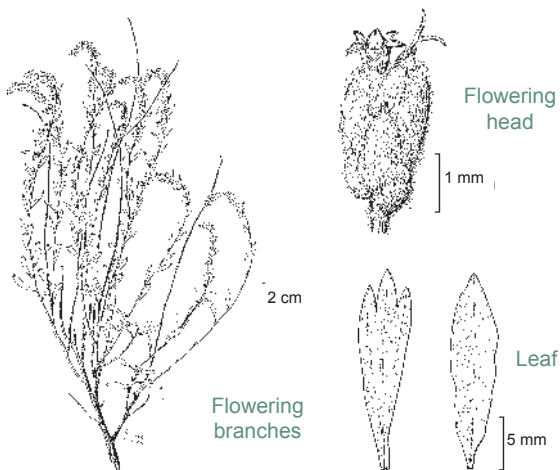
Flowering heads: Small, orbicular, 1.5–2 mm wide X 1.5–3 mm high, nodding; florets mostly 2–4 per head, bisexual and fertile, but sometimes with a marginal floret that is ray-like and has no stamens; involucre bracts hairy.

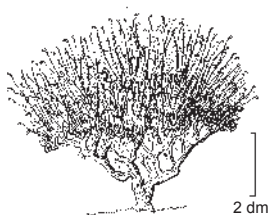
Flowering period: Early summer to late fall.

Bigelow sagebrush is distinctive with its small, round (not

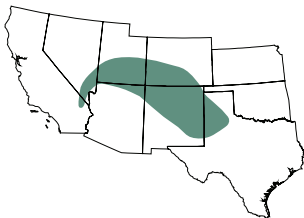


bell-shaped) flowering heads, wand-like stems, and leaves with pointed lobes. Even so, this lovely silvery-leaved shrub is often overlooked because it can blend in with other gray-colored sagebrush. It grows primarily in sandy or rocky soils of warm deserts. It is sometimes called “Plateau sagebrush” for its occurrence in slick rock habitats of the Colorado Plateau region of Arizona and Utah. Bigelow sagebrush also occurs in the short grass shrub land of west Texas and New Mexico, the Mohave Desert of Arizona, California, and southern Nevada, and it extends north into the frigid clay soils of the Uinta Basin of Utah.





Habit



Bigelow sagebrush
in Canyonlands, Utah

***Artemisia californica* — California Sagebrush**

Description: Medium-sized to tall shrubs, mostly 4–6 ft tall, sprouting from underground stems. Evergreen, but drought-deciduous. Aromatic.

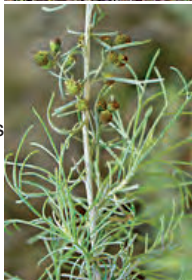
Vegetative leaves: Narrow, linear or linear-ovate in outline, mostly 5–20 mm wide and 30–50 mm long, with 3–5 threadlike lobes that are <1 mm wide; margins slightly revolute (turned back on the edges). Gray-green to green.

Leaves of the flowering stem: Mostly entire and shorter than vegetative leaves.

Inflorescences: Narrow, sparsely branched, 1–3 cm wide X 6–20 cm long.

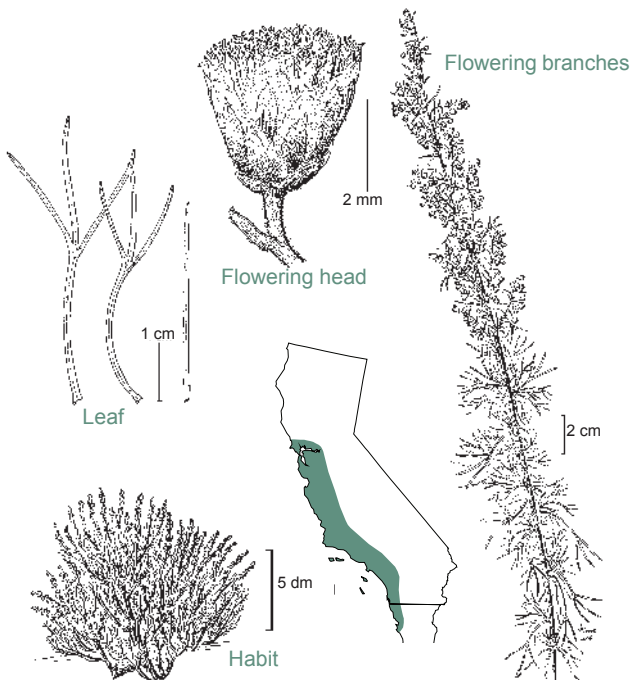
Flowering heads: Broadly bell-shaped or rounded, 2–5 mm wide and as high as wide, nodding at maturity; marginal florets without stamens, central florets bisexual; florets mostly 20–30 per head; involucre bracts with conspicuously membranous margins, hairy.

Flowering period: Early to late summer.



California sagebrush is prevalent in much of the California chaparral, especially near the coast. It is a fire-adapted species that drops its leaves in dry periods and freely resprouts after fire. Recent studies suggest a close genetic relationship to Big sagebrush, and because of that, California sagebrush is now included in the sagebrush alliance, as

section *Nebulosae* in *Artemisia* subgenus *Tridentatae* (Shultz 2009). California sagebrush occupies a small fraction of the land surface it covered prior to the 20th century.



***Artemisia cana* — Silver Sagebrush**

Description: Low-growing to tall shrubs, 1–6 ft tall, depending on the subspecies (short for Bolander sagebrush, medium-sized for Mountain sagebrush, taller for Plains sagebrush subspecies). Deciduous. Faintly aromatic.

Vegetative leaves: Mostly entire (sometimes with 1 or 2 irregular lobes), linear or lance-shaped, deciduous, 2–10 mm wide X 15–80 mm long, tips blunt or acute tips. Silver-gray or dull-gray, either viscid with sticky glands and yellowish-green, or with white-pubescent.

Leaves of the flowering stem: Entire, shorter than the vegetative leaves.

Inflorescences: Narrow, with 2–3 flowering heads per branch; 1–5 cm wide X 10–20 cm long.

Flowering heads: Narrowly to broadly bell-shaped, 4–5 mm wide X 3–4 mm high, subtended by a narrow bract; florets 8–20 per head, sometimes as few as 4 in drought-stressed habitats; involucral bracts hairy.



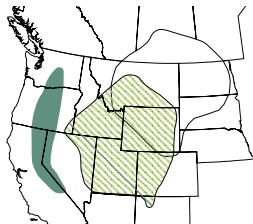
Flowering period: Mid–late summer.

Silver sagebrush has long, mostly entire leaves, and it freely resprouts after disturbance. Its deciduous habit and tendency to grow in sites that are wet or seasonally waterlogged distinguishes it clearly from the evergreen Big sagebrush. Great Plains weather influences its distribution. *A. cana* resprouts from fire and other disturbances. There are three subspecies of Silver sagebrush that are geographically distinct: (1) Bolander sagebrush (subsp. *bolanderi*) occurs from the Sierras of California to Oregon, usually on poorly drained clay soils or in standing water. It is highly variable in morphology, ranging from short to tall plants with narrow or broad leaves;

(2) Mountain silver sagebrush (subsp. *viscidula*) is the most abundant of the three subspecies of Silver sagebrush and is distinguished by its somewhat sticky (viscid) yellow-green or gray



leaves. It is found in mountain meadows, along streams, or in depressions with late-lying snows; (3) Plains silver sagebrush (subsp. *cana*) is taller and bushier than the other two subspecies and is found in areas with summer rain, primarily east of the Continental Divide in deep loamy soils.



Solid: *A. cana bolanderi*
Green lines: *A. cana viscidula*
Blue lines: *A. cana cana*



Mountain silver sagebrush
in western Wyoming

***Artemisia filifolia* — Sand Sage**

Description: Medium to tall shrub, mostly 2–5 ft tall. Crowns rounded with slender stems that curve upward. Usually resprouts after disturbance. Deciduous in winter, usually as new leaves are emerging. Aromatic.



Vegetative leaves:

Linear and threadlike, entire or deeply 3-lobed, blade or segments mostly <1.5 mm wide X 20–40 mm long. Gray-green.

Leaves of flowering stem: Mostly entire and linear, shorter than vegetative leaves.

Inflorescences: Narrow and leafy, 2–5 cm wide X 8–17 cm long.

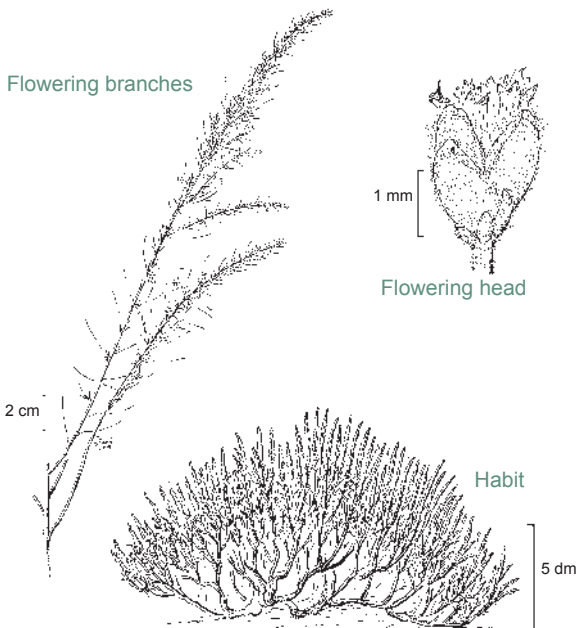
Flowering heads: Globose, 1.5–2 mm wide X 1–2 mm high, usually nodding; florets 4–8 per head, central florets sterile, marginal florets producing seed, involucre bracts hairy.

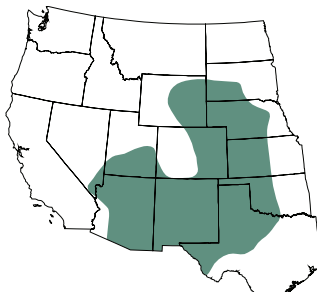
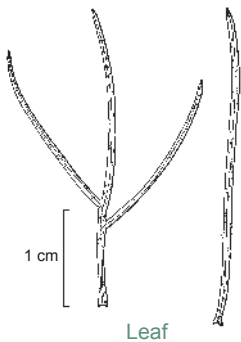
Flowering period: Late summer to early winter.



Sand sagebrush has narrow threadlike leaves and curving wand-like stems that give this species a rounded shape and

generally delicate appearance. Rarely associated with clay, it prefers deep sandy soil habitats and freely resprouts after disturbance. It is briefly deciduous, dropping its leaves as new ones develop in winter. It occurs in the Mohave desert and extends eastward through the Colorado Plateaus, to the short grass prairie of the central plains.





Sand sage in the Mohave
Desert of southwestern Utah

***Artemisia frigida* — Fringed Sage**

Description: Low subshrub that forms mats or small mounds, vegetative portion usually less than 10 inches tall. Evergreen. Aromatic.

Vegetative leaves: Deeply divided or “fringed” with multiple lobes, 2–3 times tri-lobed (usually with 9 divisions, hence the “fringed” appearance of the leaves), triangular or obovate in outline, mostly 5 mm wide X 10–15 mm long, densely hairy, silver-gray.

Leaves of the flowering stems: Entire or if divided, then with only 3 divisions; shorter than leaves of the vegetative portion.

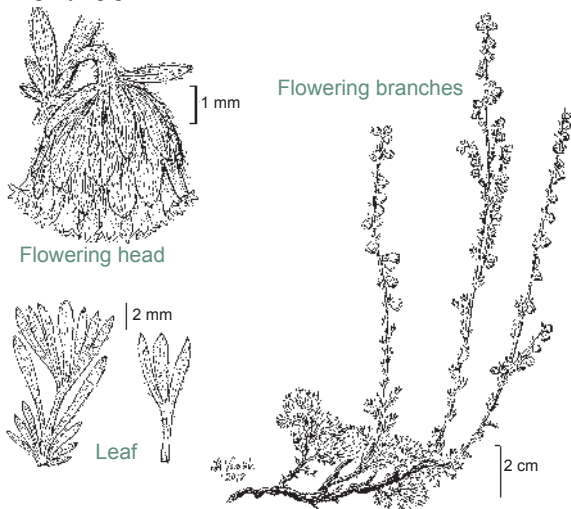
Flowering stalks: Narrow, highly variable in size, 1–5 (–12) cm wide X 5–25 (–46) cm long.

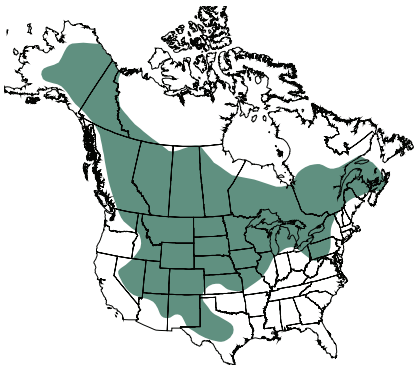
Flowering heads: Bell-shaped or globose, mostly nodding at maturity, highly variable in size, 3–7 mm wide X 2–7 mm high, many-flowered, with hairs between the flowers, involucre bracts hairy.

Flowering period: Late summer to early fall.



Fringed sage forms distinctive mounds and it is the most widely distributed of all the species of *Artemisia*. It is found throughout the northern hemisphere from boreal regions near the Arctic Circle to the cool season grasslands of Asia and North America. It is found in shallow soils that are regularly disturbed either by natural forces (e.g., wind) or mechanical disturbance. Widely distributed and highly variable, this species has recently been marketed in the horticultural trade. Fringed sage is the only species included in this guide that has a hairy receptacle. The short hairs between the individual flowers can be seen with a magnifying glass.





Fringed sage on the high
plains of central Wyoming

***Artemisia nesiotica* — Channel Island Sagebrush**

Description: Short shrubs, mostly 1–2 ft tall, sprouting from underground stems with regrowth after fire. Evergreen. Faintly aromatic.

Vegetative leaves: Linear or ovate in outline, mostly 10–40 mm wide X 30–40 mm long, entire or with 3–5 narrow lobes that are 1.2–3 mm wide; margins flat. Green to gray-green.

Leaves of the flowering stems: Entire or absent, shorter than vegetative leaves.

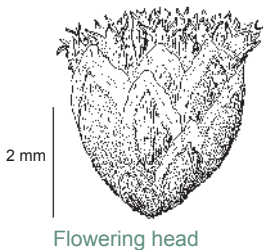
Inflorescences: Narrow, sparsely branched, 2–7 cm wide X 10–25 cm long.

Flowering heads: Broadly bell-shaped, 3–4.5 mm wide X 3–5 mm high, erect or nodding at maturity; marginal florets pistillate, central florets bisexual, mostly 30–55 per head, involucre bracts hairy.

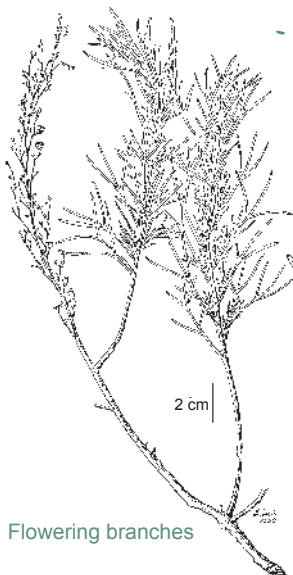
Flowering period: Late summer to early winter.



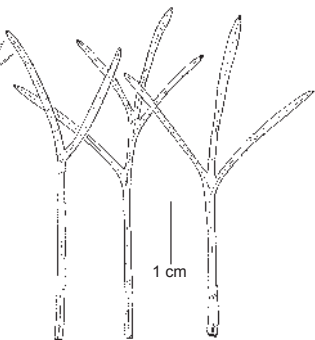
Closely related to California sagebrush, Channel Island sagebrush is restricted to the Channel Islands off the coast of California — known only from Santa Catalina, San Clemente, and San Nicolas islands. It differs from California sagebrush primarily in its shorter stature and wider leaves with non-revolute margins. Its close genetic relationship has been demonstrated with molecular studies even though the two species are not known to hybridize. How and when Channel Island sagebrush became genetically and ecologically isolated from the more common California Sagebrush remains a mystery.



California



Flowering branches



Leaf

***Artemisia nova* — Black Sagebrush**

Description: Short shrubs 1–2 ft tall, crowns flat-topped, not resprouting after disturbance. Evergreen. Strongly aromatic.

Vegetative leaves:

Wedge-shaped, mostly 2–4 mm wide X 4–7 mm long, shallowly 3-lobed, often with conspicuous glands on the leaves. Dark green.

Leaves of the flowering stems: Narrow, mostly entire.

Inflorescences: Narrow, sparsely branched, 0.5–3 cm wide X 4–10 cm long.

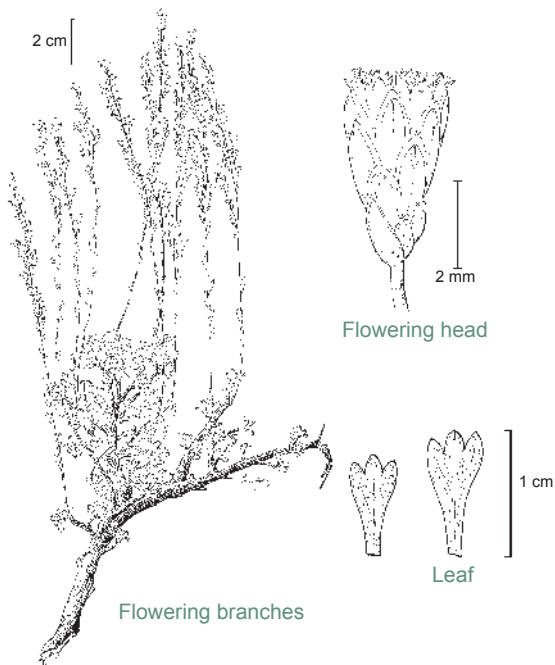
Flowering heads: Narrowly turbinate, 1–2 mm wide X 2–4 mm high, erect; florets 2–6 per head; inner involucre bracts mostly resinous, not hairy.

Flowering period: Mid-summer to late fall.



Black sagebrush has leaves that are darker green than other species of sagebrush. The dark green glands exposed on the sparsely hairy surface are often used as a way to identify the species. The glossy flower bracts and reddish-brown persistent flowering stalks also help to identify this species. Black sagebrush is highly drought-tolerant and often found on dry microsites such as west- or south-facing slopes, usually in shallow, rocky, calcareous soils. One variant, a plant described as var. *duchesnicola*, has hairy

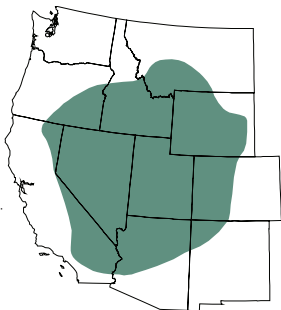
flowering bracts and somewhat larger than normal flowering heads, characteristics that may indicate hybrid origin and/or polypoidy.



2 dm



Habit



Black sagebrush in the White Mountains of California

Artemisia papposa — Fuzzy Sagebrush

Description: Short sub-shrub or woody herb, vegetative portion mostly less than 6 inches tall, not resprouting. Deciduous. Aromatic.

Vegetative leaves:

Wedge-shaped, deeply 3–5-lobed with narrow divisions, 5–2 mm wide X 15–35 mm long, densely hairy (fuzzy). Whitish-gray.

Leaves of the flowering stems:

Entire

Inflorescences:

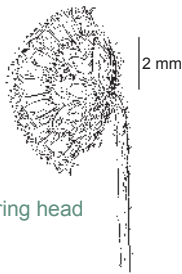
Narrow panicles with large heads attached singly or 2 per branch, leafless.

Flowering heads: Orbicular, nodding, and unusually large (3–) 5–6 mm wide X 5–6 mm high, on short stalks, or sessile; florets usually 20–25 per head (and red or reddish-yellow), sometimes more, involucral bracts hairy.

Flowering period: Early to late spring.



Distinctive for its “fuzzy” appearance, this species is relatively uncommon and occurs primarily from the Owyhee plateau from eastern Oregon to southern Idaho and northern Nevada. Its seeds differ from other sagebrush in that they are longer (up to 2 mm long) and they have a small “fringe.” It occurs on soils of volcanic origin, often in soil pockets amid barren lava fields or basalt. The vestigial pappus for which the species is named is a rare occurrence in the genus *Artemisia*, and because of this, the seeds appear to have a minute apical fringe.

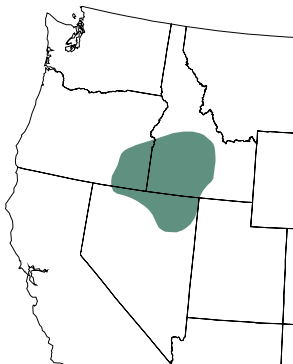


Flowering head



Leaf

Flowering branches



Fuzzy sagebrush in lava fields near the Camas Prairie in Idaho (Mountain big sagebrush in foreground)

***Artemisia pedatifida* — Birdfoot Sage**

Description: Miniature subshrub, less than 4" tall (including flowering stems). Not resprouting. Deciduous. Not aromatic.

Vegetative leaves: Deeply 3-lobed with filiform divisions, small, mostly 5–10 mm long X 2–5 mm wide; drying in the fall and becoming brittle before dropping. Whitish-gray.

Leaves of the flowering stems: Mostly entire, bract-like, smaller than vegetative leaves.

Inflorescences: Narrow, mostly 2–3 cm long X 0.5 cm wide.

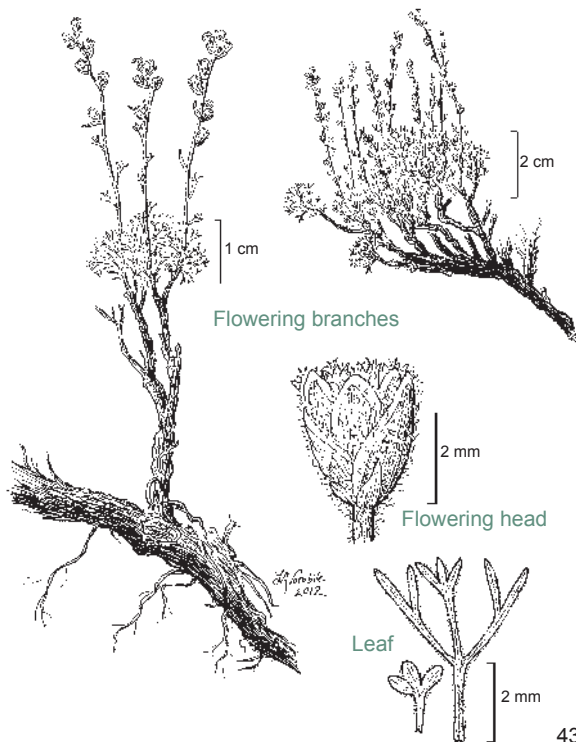
Flowering heads: Narrowly wedge-shaped, ca. 2 mm wide X 2 mm high, erect, attached singly or in 2's; central florets are sterile, marginal florets fertile, mostly 6–12 per head, involucre bracts hairy.

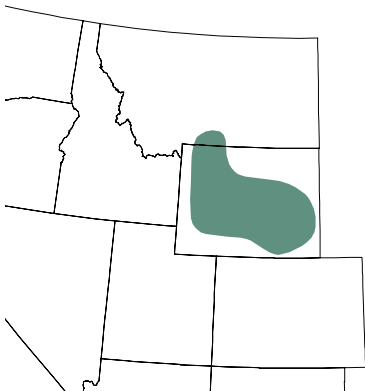
Flowering period: Early to late spring.



Birdfoot sage has a very limited distribution. It occurs primarily on the high, windswept plains of the central Rocky Mountains, in seasonally wet clay barrens. The monsoonal rain patterns of the basins in which it occurs may determine its distribution. It is distinctive for its dwarf stature and finely

divided, threadlike leaves. It is usually considered a member of the herbaceous species of *Artemisia* and only distantly related to other sagebrush.





Birdfoot sage in clay soils
west of Cody, Wyoming

***Artemisia porteri* — Porter's Sage**

Description: Dwarf shrub mostly <10" tall, thick-stemmed woody caudex. Evergreen. Not aromatic.

Vegetative leaves: Broadly obovate in outline, deeply divided into 3 segments, 5–30 mm wide X 20–50 mm long. Silvery-white.

Leaves of the flowering stems: Mostly entire, somewhat reduced but mostly 20–30 mm long.

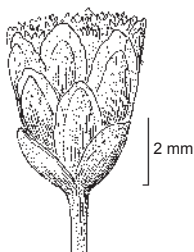
Inflorescences: Narrow, 2–8 cm long X 1–1.5 cm wide, leafy.

Flowering heads: Narrowly bell-shaped, 3–4 mm wide X 4–6 mm long, erect, heads 1–5 per branch, on short stalks; florets 15–40 per head, central florets are sterile, only the few marginal florets produce seeds, involucre bracts hairy.

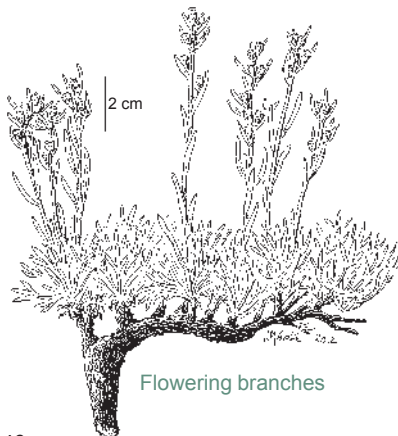
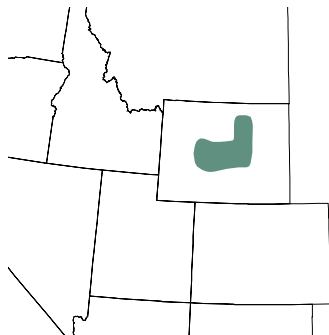
Flowering period: Late summer to early fall.



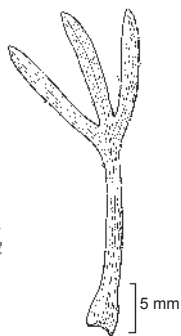
Porter's sage is a bright silver plant that is found only in the badlands of central Wyoming. Although it can be locally abundant on barren, powdery clay soils, it is considered extremely rare because of its restricted habitat. It is more closely related to herbaceous species of *Artemisia* than to woody sagebrush.



Flowering head



Flowering branches



Leaf

Artemisia pygmaea — Pygmy Sage

Description: Small mound-forming shrub, mostly less than 6" tall, not sprouting from roots. This is the only species of sagebrush without hairs on the leaves. Deciduous. Faintly aromatic.



Vegetative leaves:

Oblong to ovate in outline, mostly 2–6 mm wide X 2–6 (–8) mm long, deeply lobed with 3–7 pinnate divisions, rigid. Bright green (but turning rusty-red in the fall).

Leaves of the flowering stems: Pinnately 3-lobed (rarely entire), smaller than vegetative leaves, turning rusty brown after flowers mature.

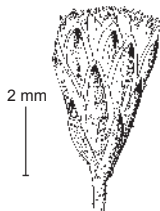
Inflorescences: Narrow, 0.5–1 cm wide X 2–3 cm long.

Flowering heads: Narrowly wedge-shaped, 2–3 mm wide X 4–5 mm high; florets 2–6 per head, involucre bracts green, not hairy

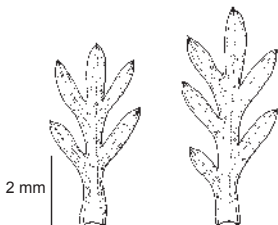
Flowering period: Late spring to fall.

Pygmy sage is a bright green shrub that can be mistaken for a young juniper. Although it grows over a broad geographic range, Pygmy sage is rare, and known only from a few isolated populations occurring from Nevada to Colorado. It is usually found on small barren outcrops of fine-textured clay soils or cemented volcanic ash mounds known as

“tuffs.” It co-occurs with several narrowly endemic species and is considered an indicator of rare and fragile habitats. Unlike other species in the sagebrush complex, its leaves are pinnately lobed and bright green.



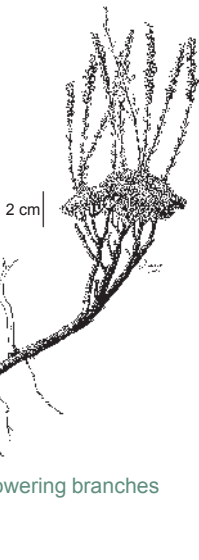
Flowering head



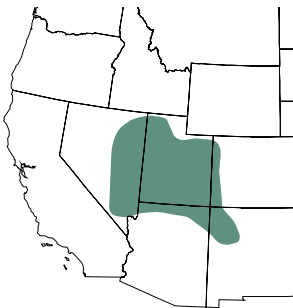
Leaf



Habit



Flowering branches



Pygmy sagebrush on ash
soils north of Wells, Nevada

***Artemisia rigida* — Scabland Sagebrush**

Description: Low-growing shrubs, usually less than 2 ft tall, not resprouting after disturbance. Deciduous. Faintly aromatic.

Vegetative leaves:

Broadly obovate in outline, deeply 3–5 parted (>1/2 length) though occasionally entire and linear, 5–7 mm wide X 15–40 mm long. Silver-gray to dull-gray.



Dave Powell, USDA Forest Service, Bugwood.org

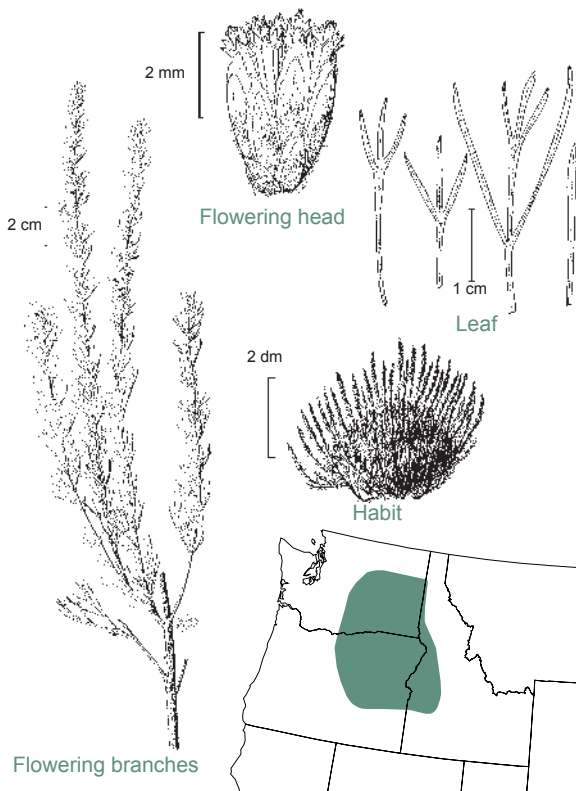
Leaves of the flowering stems: Usually deeply 3-parted, slightly smaller than leaves of vegetative branches.

Inflorescences: Narrow, 2–20 cm long X 2 cm wide, conspicuously leafy.

Flowering heads: Narrowly bell-shaped, 2.5–3.5 mm wide X 4–5 mm high; florets 4–8 per head, sometimes reddish-yellow (unlike the usual pale yellow), involucre bracts hairy.

Flowering period: Late summer to late fall.

Scabland sagebrush has silvery leaves that turn brittle during drought. It is restricted to soils of volcanic origin and is often called “Scabland sagebrush” in reference to its distinctive habitat. It grows on the Columbia Plateau of Washington, Oregon, and western Idaho. Its seeds are about 2 mm in length, larger than the common 1–1.5 mm sized seeds of other sagebrush species.



***Artemisia rothrockii* — Sticky Sagebrush**

Description: Small to medium-sized shrubs, 0.5 to 3 ft. tall. Not resprouting. Evergreen. Aromatic.

Vegetative leaves: Narrowly wedge-shaped, shallowly 3-lobed, 8–15 mm long X 2–3 mm wide, usually sticky with resin. Dark green in the Sierras, leaves are whitish-gray in easternmost part of its range.

Leaves of the flowering

stems: Entire, much shorter than vegetative leaves, bract-like.

Inflorescences: Narrow, 1–3 cm wide X 5–15 cm long.

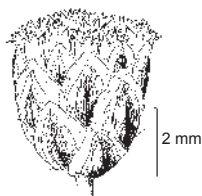
Flowering heads: Broadly bell-shaped or ovate, 3–6 mm wide X 3–5 mm high, sessile or short-stalked; florets 10–20 per head, involucre bracts hairy or sticky-resinous.

Flowering period: Late summer to late fall.

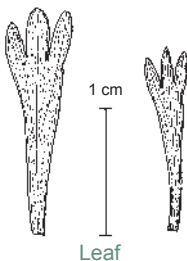
Sticky sagebrush has been confused with Snowfield



sagebrush (*A. spiciformis*) in some floras. Distinguishing features are its regularly 3-lobed leaves that are usually dark-green and sticky with resin, and it is restricted to the mountains of California. A white-hairy form occurs near and above treeline in the White Mountains of California. Sometimes called Timberline sagebrush, *Artemisia rothrockii* grows on rocky soils near treeline down to wet meadows at lower elevations.



Flowering head

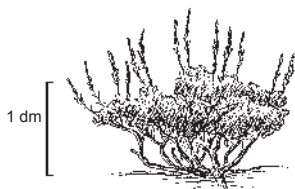


Leaf

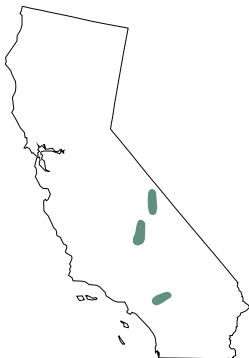
2 cm



Flowering branches



Habit



Sticky sagebrush at treeline in the White Mountains, California

***Artemisia spiciformis* — Snowfield Sagebrush**

Description: Medium-sized shrubs, 3–4 ft tall. Resprouting after disturbance. Semi-deciduous. Faintly aromatic.

Vegetative leaves:

Lance-shaped to oblong, 8–12 mm wide X 25–55 mm long, 3-lobed or entire. Lobes rounded or sharply-pointed. Some leaves persist through the winter, but most turn yellow and drop as the shrubs begin to flower. Green to gray-green.

Leaves of the flowering

stems: Mostly entire and shorter than vegetative leaves.

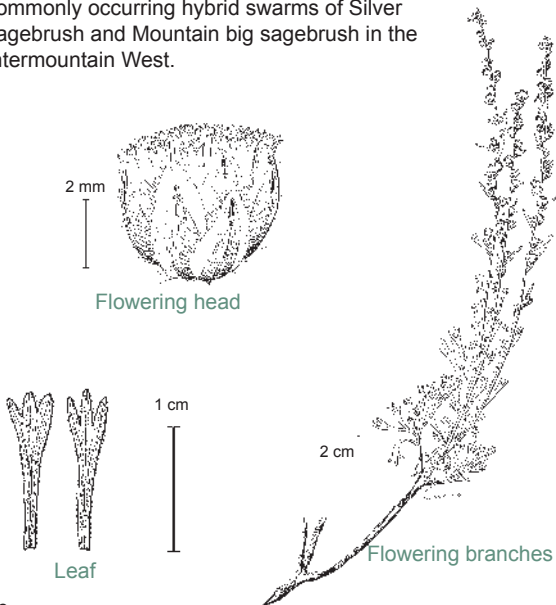
Inflorescences: Narrow 0.5–4 cm wide X 8–25 cm long.

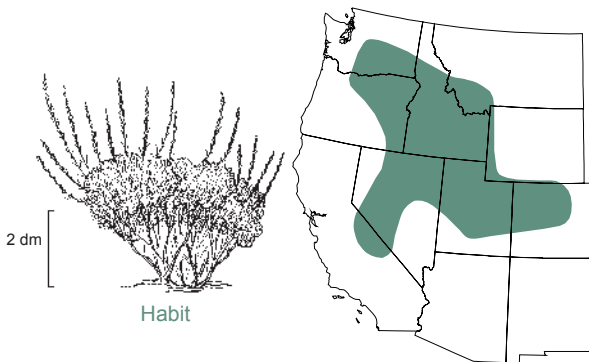
Flowering heads: Broadly bell-shaped, 6–7 mm wide X 2.5–4 mm high, sessile or short-stalked; florets 8–27 per head, involucre bracts hairy.

Flowering period: Late summer to late fall.



Highly variable in leaf size and shape, Snowfield sagebrush occurs at high elevations in areas where there are usually late-melting snow banks. Its narrow flowering stalks, large heads, and deciduous leaves that are entire or irregularly 3-lobed are distinguishing features. It has been treated as a subspecies of Big sagebrush, but it appears to be a distinct species. Snowfield sagebrush is sometimes confused with the Sticky sagebrush of California, or the more commonly occurring hybrid swarms of Silver sagebrush and Mountain big sagebrush in the Intermountain West.





Snowfield sagebrush in the southern
Sierra Mountains of California

***Artemisia spinescens* — Bud Sagebrush**

Description: Low-growing mounded subshrub, mostly <10" tall, coarsely branched, young stems felt-like with white hairs, older stems bare and spine-tipped. Deciduous. Aromatic.



Vegetative leaves: Deeply and finely divided, orbicular in outline, 6–9-lobed (rarely 3-lobed), mostly 1–5 (–20) mm wide X 1–5 mm long (but as much as 20 mm), densely hairy. Light yellow-green to gray-green.

Leaves of flowering stems: Entire and narrowly linear, inconspicuous.

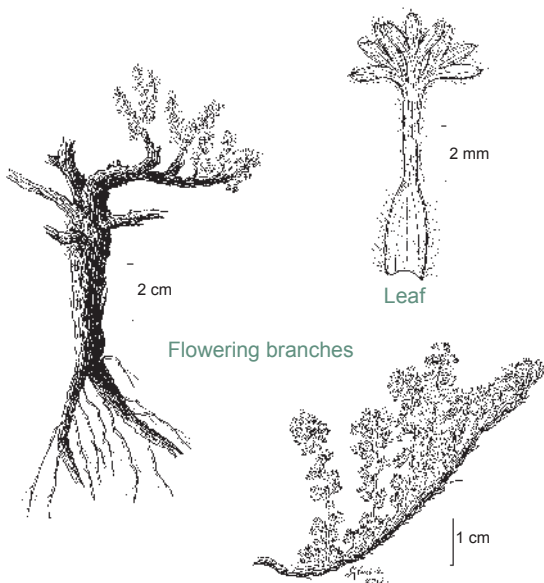
Inflorescences: Small mound-shaped clusters that appear immersed in the vegetative branches.

Flowering heads: Bell-shaped heads that are relatively large; florets mostly 8–20 per head, broadly flared and hairy; marginal florets produce seeds, central florets sterile, involucre bracts hairy.

Flowering period: Early spring to late spring.

Bud sagebrush is distinctive in a number of ways: it has spine-tipped branches (for which the species is named), flowers in the spring, and has large-headed yellow flower stalks tucked within the vegetative portion. The spiny stems,

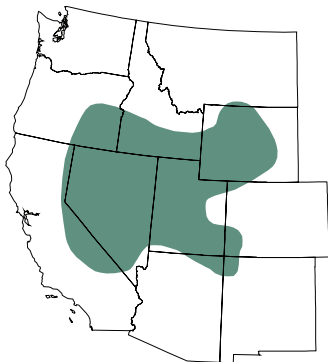
short flower stalks, and multi-lobed leaves make it unlike anything else in the sagebrush complex. It is extremely drought tolerant, often growing with saltbush, and is remarkably palatable to domestic livestock. It provides good forage during winter months, but is potentially poisonous to young livestock if consumed in great quantities. It grows primarily in valleys, often in saltbush or greasewood communities.





2 mm

Flowering head



Bud sagebrush in clay basin, western Wyoming

***Artemisia tridentata* — Big Sagebrush**

Big sagebrush is the most abundant and widespread of all the species of sagebrush. By most estimates, it occupies more area and has more biomass than any other species of shrub in the world (Shultz 2009). It has four distinctive subspecies, each with multiple geographic races that are sometimes named as varieties. Hybridization between subspecies is common, often making clear identification next to impossible. There has been a temptation to give hybrids names for each geographic area in which they occur, but the practice cannot be justified on the basis of relationships. Several hybrids have been given formal names that are both widespread, ecologically distinct, and important in the delineation of different habitat types.

The three most common types of Big sagebrush are (1) Basin big sagebrush (subsp. *tridentata*); (2) Mountain big sagebrush (subsp. *vaseyana*); and (3) Wyoming big sagebrush (subsp. *wyomingensis*). There are distinctly different habitat preferences among the subspecies, making accurate identification important for land managers. Basin big sagebrush is the tallest of all and it is found on deep, well-drained soils in cool air valleys throughout western North America. Mountain big sagebrush is the medium-sized, flat-topped shrub found on mountain slopes. Wyoming big sagebrush is the short to medium-sized shrub found on harsh, dry sites from lowest elevations in the valleys to mountain slopes. The fourth subspecies (4) is Parish big sagebrush (subsp. *parishii*). It is similar to Basin big sagebrush in form and habitat, except that it extends

southward from the Great Basin into the Mohave Desert shrublands, is more heat-tolerant than the other subspecies, and it has drooping inflorescence branches and hairy seeds.

All of the Big sagebrush subspecies are pungently aromatic due to the monoterpenoids that they contain. Mountain big sagebrush contains higher concentrations of camphor and cineole, giving it a characteristically sweeter smell than the other subspecies which have higher concentrations of chemicals that confer a different smell and bitter taste.

The following illustrations and descriptions will help to show the distinctions among the subspecies of Big sagebrush. Be

aware that because these subspecies are so common and widespread they are often talked about as if each one was a separate species.



***Artemisia tridentata* subsp. *tridentata* — Basin Big Sagebrush**

Description: Medium-sized to tall shrubs, mostly 5–7 ft tall, but sometimes taller or shorter; crowns irregular, rounded. Not resprouting after disturbance. Evergreen. Strongly aromatic.

Vegetative leaves: Narrowly wedge-shaped and shallowly 3-lobed (rarely entire), 2–6 mm wide X 5–25 mm long, lobes rounded or slightly pointed, gray-green. *More than 3 times longer than wide.

Leaves of the flowering stems: Mostly shorter than vegetative leaves, entire (some 3-lobed), attached singly.

Inflorescences: Broad and long, triangular in shape with erect side branches, mostly 5–6 cm wide X 8–15 cm long (but ranging from 6–30).

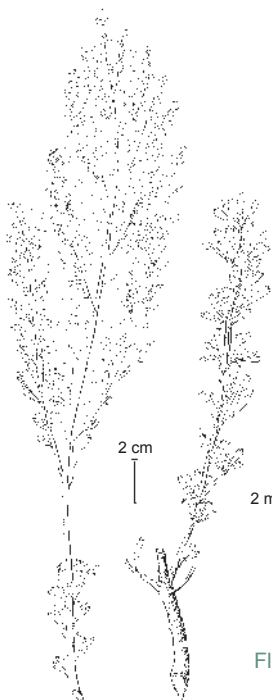
Flowering heads: Narrowly bell-shaped, 2–4 mm high X 1–2 mm wide, mostly erect, bracts hairy; florets 3–7 per head, involucre bracts hairy.



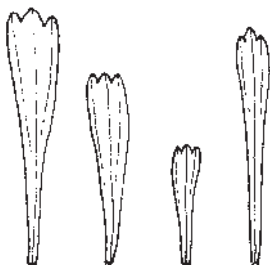
Flowering period: Late summer to late fall

Basin big sagebrush is the majestic shrub found throughout the valleys of the Intermountain Region Great Basin, and ranging from the southern Rocky Mountains of New Mexico to coastal ranges of Baja California, to the northern Rockies of Canada. Settlers in the 19th century recognized that the presence of Basin big sagebrush indicated good agricultural soils, and as a consequence, most of the habitat for Basin big sagebrush was plowed under by the early 20th century. Remnants of this habitat can now be seen along fencerows and roadsides, where big sagebrush often overtops the fence posts and reaches heights of 6–9 feet.

The closely related subsp. *parishii* is included here in the map and illustration for Basin big sagebrush even though it is relatively uncommon and poorly understood genetically. It grows primarily in hotter and drier areas than typical subsp. *tridentata*. Parish, or “Mohave,” sagebrush is distinguished primarily by the drooping branches of its inflorescences, pubescent seeds, and longer leaves that reach 3.5 cm in length. More work is needed in order to determine the genetic and ecological differences.



Flowering branches

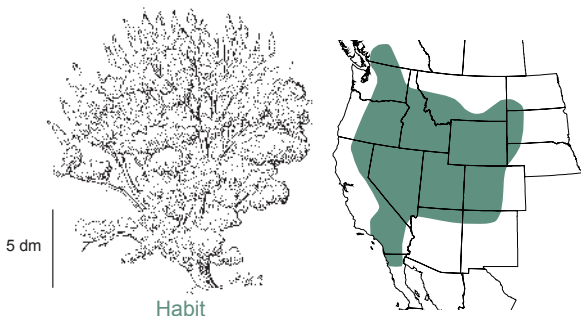


Leaf



Flowering head

Flowering branches
(subsp. *parishii*)



Transition zone between Basin big sagebrush (lower slope) and Bonneville sagebrush (mid-slope) in Curlew Valley, southern Idaho, with Wyoming big sagebrush near summit

***Artemisia tridentata* subsp. *vaseyana* — Mountain Big Sagebrush**

Description: Medium-sized to tall shrubs, mostly 2–4 ft tall, but sometimes taller; crowns flat-topped. Not resprouting. Evergreen. Strongly aromatic.

Vegetative leaves: Broadly wedge-shaped and shallowly 3-lobed (rarely entire), 3–7 mm wide X 12–15 mm long, lobes rounded with side lobes slightly flared, gray-green. *Less than 4 times longer than wide.

Leaves of the flowering stems: Mostly shorter than vegetative leaves, entire or 3-lobed.

Inflorescences: Narrow with erect side branches, mostly 2–6 cm wide X 10–15 cm long.

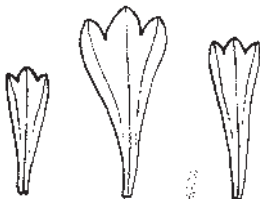
Flowering heads: Bell-shaped, 1.5–3 mm wide X 2–3 mm high, erect; florets 3–9 per head, involucral bracts hairy.

Flowering period: Late summer to late fall.



Mountain big sagebrush grows at mid to high elevations throughout the western mountains and by most estimates, it is the most abundant of the subspecies of Big sagebrush.

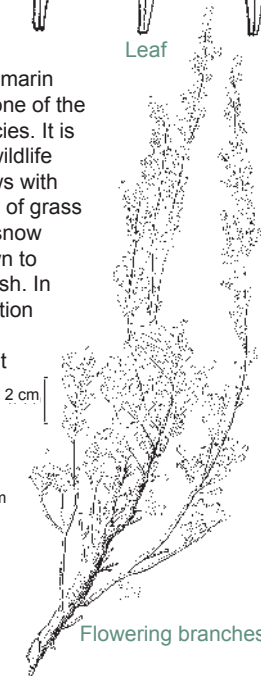
It has a flat-topped crown with flowering stalks that rise above the crown in elongated, narrow spikes (sometimes called the “cake with candles” look). It can be distinguished by height and habit, and also by its smell. The leaves are pungently aromatic due to the high phenolic and coumarin content in the leaves, making it one of the most palatable of all the subspecies. It is of extraordinary importance for wildlife habitat. Characteristically, it grows with other shrubs and a high diversity of grass species — places where winter snow is plentiful. In dry sites, it is known to hybridize with Wyoming sagebrush. In these habitats, positive identification can be difficult. For that reason, land managers often rely on what is known as the “black light test” to distinguish the high coumarin Mountain sagebrush (which fluoresces bright blue when crushed in water) from Wyoming sagebrush (which does not fluoresce).



Leaf

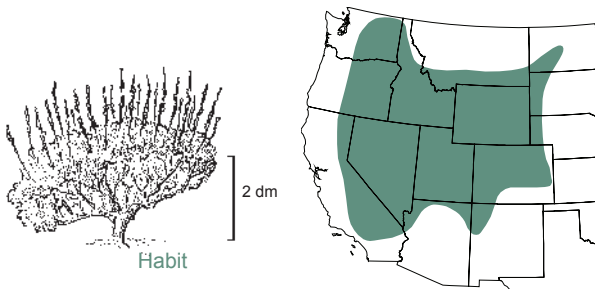


Flowering head



Flowering branches

Hybrids will have a pale blue fluorescence — making the lines between hybrids and parents nearly impossible to draw.



Mountain big sagebrush in the
Wind River Mountains of Wyoming

***Artemisia tridentata* subsp. *wyomingensis* — Wyoming Big Sagebrush**

Description: Low to medium-sized to tall shrubs, mostly 2–4 ft tall; crowns unevenly rounded. Not resprouting. Evergreen. Strongly aromatic.

Vegetative leaves: Narrowly to broadly wedge-shaped, shallowly or deeply 3-lobed with a middle lobe slightly longer than lateral lobes; mostly 7–11 mm long X 1–3 mm wide, lobes rounded, gray-green. *Less than 3 times longer than wide.

Leaves of the flowering

stems: Mostly shorter than vegetative leaves, entire or 3-lobed.

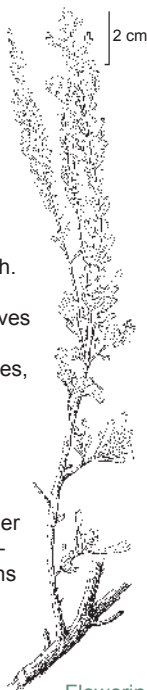
Inflorescences: Short, narrow panicles with erect side branches, mostly 2–10 cm long X 2–4 cm wide; old inflorescence branches persisting on the shrubs, giving a characteristic “shaggy” or “twiggy” appearance to the plants.



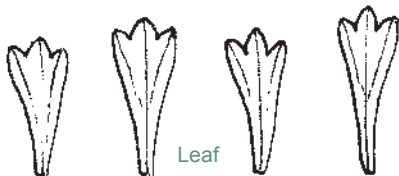
Flowering heads: Narrowly bell-shaped, 1.5–2. mm high X 1.5–2 mm wide, erect; florets 4–8 per head, involucral bracts hairy.

Flowering period: Late summer to late fall.

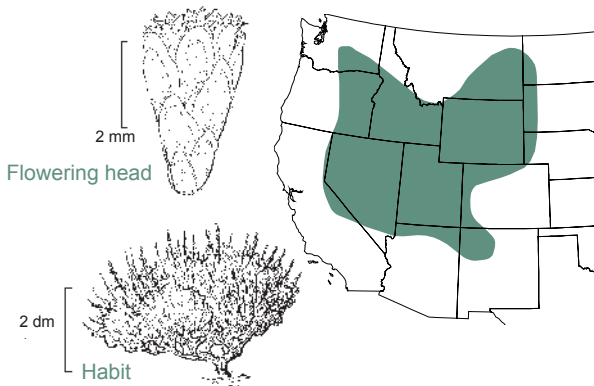
Wyoming big sagebrush grows on drier sites than typical Basin or Mountain big sagebrush. Wyoming big sagebrush has the rounded crown of Basin big sagebrush but the shorter stature of Mountain big sagebrush. Its leaves look much like “Mountain sage” except that the middle lobe of its 3-lobed leaves is slightly extended and offset from the two neighboring lobes. Unlike the other subspecies, it has very short flowering stalks that tend to remain on the shrubs for many years, giving the plant an outline with many bare, upright twigs. It is not as palatable as Mountain big sagebrush (which has a high coumarin content) and the leaves do not fluoresce under a black light. It grows from the valleys to mid-elevation in the mountains. Hybrid populations involving Mountain big sagebrush go by the common name of “Bonneville sagebrush.”



Flowering
branches



Leaf



Wyoming big sagebrush in the
Powder River Basin of Wyoming

***Artemisia tripartita* — Threetip Sagebrush**

Description: Short or medium-sized shrubs, 1–4 ft tall (Common threetip is sometimes taller, Wyoming threetip is typically ca. 1 ft tall); crowns rounded. Plants usually resprout after disturbance. Deciduous or evergreen. Faintly aromatic.

Vegetative leaves: Broadly wedge-shaped and deeply 3-lobed, sometimes entire, 15–40 mm long X 5–20 mm wide. Lobes narrow, only 1–1.5 mm wide, usually pointed. Briefly deciduous. Gray-green.

Leaves of the flowering stems: Mostly shorter than vegetative leaves, entire or 3-lobed, deciduous or evergreen.

Inflorescences: Narrow, mostly 6–15 cm long (but up to 35 cm) X 4–5 cm wide, densely leafy.

Flowering heads: Globose or narrowly bell-shaped, 1.5–3 mm wide X 2–4 mm high, erect, sessile or short-stalked; florets 3–8 (–11), involucre bracts hairy.



Flowering period: Early or late summer to late fall.

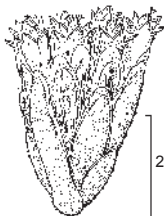
There are two subspecies of Threetip sagebrush: (1) the common Threetip sagebrush (subsp. *tripartita*) occurs west of the Continental Divide, primarily on soils of volcanic origin, and it begins to bloom in mid to late summer. Much of its natural habitat in Idaho has been plowed for agricultural use; (2) Wyoming threetip (subsp.

rupicola) blooms early in the summer and differs in being shorter



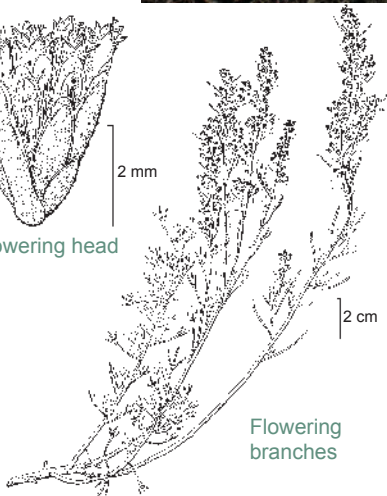
Leaf

1 cm



2 mm

Flowering head



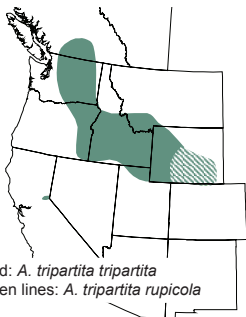
2 cm

Flowering branches

(<1 ft tall), with larger flowering heads, and it occurs east of the Continental Divide in an area with summer rains. Threetip sagebrush is absent from the alkaline soils of the Great Basin and is found on loamy soils that are shallow or deep, sometimes rocky.



Habit



Solid: *A. tripartita tripartita*
Green lines: *A. tripartita rupicola*



Wyoming threetip sagebrush
south of Lander, Wyoming

Appendix of Names

Sagebrush species have been called a variety of names, and some of the ones treated in this handbook have been called varieties or subspecies instead of species. This list provides the full author citations for the accepted names plus the date of publication [given in brackets]. It provides a condensed reference to scientific names and the common names—often with several alternatives—that are in current use. Synonyms are also shown since these are often found in literature or older floras.

Artemisia arbuscula Nuttall subsp. *arbuscula* [1841]

Common Names: Low sagebrush, Little sagebrush, Dwarf sagebrush

Synonyms: *Artemisia tridentata* subsp. *arbuscula* Hall & Clements [1923]; *A. tridentata* var. *arbuscula* McMinn [1939]; *Seriphidium arbusculum* W. A. Weber [1984]

Artemisia arbuscula subsp. *longiloba* (Osterhout) Shultz [2005]

Common Names: Early sagebrush, Alkali sagebrush, Long-lobed low sagebrush

Synonyms: *Artemisia spiciformis* var. *longiloba* Osterhout [1908]; *A. longiloba* Beetle [1959]; *Seriphidium arbusculum* subsp. *longilobum* W.A. Weber [1984]; *Artemisia arbuscula* var. *longiloba* Dorn [1988]; *Seriphidium longilobum* K. Bremer & Humphries [1993]

Artemisia arbuscula subsp. *thermopola* Beetle [1959]

Common Names: Cleftleaf low sagebrush, Hot springs sagebrush, Three-tipped low sagebrush

Synonyms: *Seriphidium arbusculum* var. *thermopolum* (Beetle) Y. R. Ling [1995]

Artemisia bigelovii A. Gray [1857]

Common Names: Bigelow sagebrush, Plateau sagebrush

Synonyms: *Artemisia petrophila* Wootton & Standley [1913]; *Seriphidium bigelovii* K. Bremer & Humphries [1993]

Artemisia californica Lessing [1831]

Common Names: Coastal sagebrush, California sagebrush

Synonyms: *Crossostephium californicum* Rydberg [1916]; *Artemisia fischeriana* Besser [1834]; *A. foliosa* Nuttall [1841], *A. abrotanoides* Nuttall [1841].

Artemisia cana Pursh subsp. *cana* [1814]

Common Names: Plains silver sagebrush, Silver sagebrush

Synonyms: *Artemisia columbiensis* Nuttall [1818], *Seriphidium canum* W.A. Weber [1984]

Artemisia cana subsp. *bolanderi* (A. Gray) G. H. Ward [1953]

Common Names: Bolander silver sagebrush, California silver sagebrush, Bolander wormwood

Synonyms: *Artemisia bolanderi* A. Gray [1883]; *A. tridentata* subsp. *bolanderi* Hall & Clements [1923]; *A. cana* var. *bolanderi* McMinn [1939]; *Seriphidium canum* subsp. *bolanderi* W. A. Weber [1984]; *S. bolanderi* Y. R. Ling [1985]

Artemisia cana subsp. *viscidula* (Osterhout) Beetle [1959]

Common Names: Mountain silver sagebrush, Sticky sagebrush

Synonyms: *Artemisia cana* var. *viscidula* Osterhout [1900]; *A. viscidula* Rydberg [1906]; *Seriphidium canum* subsp. *viscidula* W.A. Weber [1984]

Artemisia filifolia Torrey [1827]

Common Names: Sand sagebrush, Sand sage

- Synonyms: *Oligosporus filifolius* Pojakov [1961]; *Artemisia plattensis* Nuttall [1841]
- Artemisia frigida* Willdenow [1803]
Common Names: Fringed sage, or Fringed sagebrush
Synonyms: none in common use
- Artemisia nesiotica* P. H. Raven [1963]
Common Name: Island sagebrush
Synonyms: *Crossostephium insulare* Rydberg [1914];
Artemisia californica var. *insularis* Munz [1935]
- Artemisia nova* A. Nelson [1900]
Common Names: Black sagebrush; Black sage
Synonyms: *Artemisia tridentata* subsp. *nova* Hall & Clements [1923]; *A. arbuscula* subsp. *nova* G. H. Ward [1953]; *A. arbuscula* var. *nova* Cronquist [1955];
Seriphidium novum W. A. Weber [1984]; *Artemisia nova* var. *duchesnicola* Welsh & Goodrich [1995] (the hairy variety known from the Uinta Basin of Utah).
- Artemisia papposa* Blake & Cronquist [1950]
Common Names: Owyhee sagebrush; Fuzzy sagebrush
Synonyms: none
- Artemisia pedatifida* Nuttall [1841]
Common Names: Birdfoot sagebrush; Birdfoot sage
Synonyms: none
- Artemisia porteri* Cronquist [1951]
Common Name: Porter sage
Synonyms: none
- Artemisia pygmaea* A. Gray [1866]
Common Name: Pygmy sagebrush; Pygmy sage
Synonyms: *Seriphidium pygmaeum* W. A. Weber [1984]
- Artemisia rigida* (Nuttall) A. Gray [1883]
Common Name: Stiff sagebrush; Scabland sagebrush;

Columbia Plateau sagebrush

Synonyms: *Artemisia trifida* var. *rigida* Nuttall [1841];

Seriphidium rigidum W. A. Weber [1984]

Artemisia rothrockii A. Gray [1876]

Common Names: Timberline sagebrush; Rothrock sagebrush; Sticky sagebrush; White Mountain low sagebrush.

Synonyms: *Artemisia tridentata* subsp. *rothrockii* Hall & Clements [1923]; *A. tridentata* var. *rothrockii* McMinn [1939]; *Seriphidium rothrockii* W. A. Weber [1984]

Artemisia spiciformis Osterhout [1900]

Common Names: Snowfield sagebrush; Subalpine sagebrush

Synonyms: *Artemisia tridentata* forma *spiciformis* Beetle [1959]; *A. tridentata* subsp. *spiciformis* Kartesz & Gandhi [1991]; *Seriphidium spiciforme* Y. R. Ling [1995]

Artemisia spinescens D.C. Eaton

Common Names: Bud sagebrush; budsage

Synonyms: *Picrothamnus desertorum* Nuttall [1841]

Artemisia tridentata subsp. *parishii* (A. Gray) Hall & Clements [1923]

Common Names: Parish big sagebrush; Mojave sagebrush

Synonyms: *Artemisia parishii* A. Gray [1882]; *A. tridentata* var. *parishii* Jepson [1925]; *A. tridentata* f. *parishii* Beetle [1959]; *Seriphidium tridentatum* subsp. *parishii* W. A. Weber [1984]

Artemisia tridentata Nuttall subsp. *tridentata* [1841]

Common Names: Basin big sagebrush; Great Basin sagebrush; Big sage; Basin big sage

Synonyms: *Artemisia tridentata* var. *angustifolia* A.

Gray [1883]; *A. angusta* Rydberg [1914]; *Seriphidium tridentatum* W. A. Weber [1984]

Artemisia tridentata subsp. *vaseyana* (Rydberg) Beetle [1959]

Common Names: Mountain big sagebrush; Mountain sage; Vasey sage

Synonyms: *Artemisia vaseyana* Rydberg [1916]; *A. tridentata* var. *vaseyana* Boivin [1972]; *Seriphidium vaseyanum* W. A. Weber [1985]; *A. tridentata* var. *pauciflora* Winward & Goodrich [1985]

Artemisia tridentata subsp. *wyomingensis* Beetle & Young [1965]

Common Names: Wyoming big sagebrush; Wyoming sagebrush; Wyoming sage

Synonyms: *Artemisia tridentata* var. *wyomingensis* S. L. Welsh [1983]; *Seriphidium tridentatum* subsp. *wyomingense* W. A. Weber [1984]

Artemisia tripartita Rydberg subsp. *tripartita* [1900]

Common Names: Threetip sagebrush; Common threetip

Synonyms: *Artemisia trifida* Turczaninow [1832], *A. trifida* Nuttall [1841]; *A. tridentata* subsp. *trifida* Hall & Clements [1923]; *A. tridentata* var. *trifida* McMinn [1939]; *Seriphidium tripartitum* W. A. Weber [1984]

Artemisia tripartita subsp. *rupicola* Beetle [1959]

Common Name: Wyoming threetip sagebrush

Synonyms: *Artemisia tripartita* var. *rupicola* Dorn [1988]; *Seriphidium tripartitum* var. *rupicola* [1995]

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Terms Used in This Book

Inflorescence: A cluster of flower heads, or the whole stalk of flowering heads.

Involucres: The tiny leaf-like bracts that surround the flowering head (a composite head with multiple flowers).

Leaf arrangements: Perennial leaves persist through the growing season and usually occur in clusters (bundled as “fascicles”); these are the leaves described by measurements. Ephemeral leaves are attached below the fascicle of perennial leaves, and they are generally ignored in measurements because they elongate in spring and fall off during summer, and tend to be highly irregular in shape and size.

Sessile: Without a stalk.

Sagebrush Ecology (opposite page). This graphic shows where different kinds of sagebrush occur along a temperature and moisture gradient. The elevation/temperature gradient (vertical axis) assumes low elevation as the warmest and high elevation as the coldest habitats. The horizontal axis shows a moisture gradient from dry soils to moist soils—a gradient which can be a reflection of precipitation as well as specific soil properties.

In the lower left corner, for instance, you will find Bud sage (*A. spinescens*), Pygmy sage (*A. pygmaea*), and Porter's sage (*A. porteri*)—species that occur in mountain valleys in sites that are very dry. In the upper right corner you will find Snowfield sagebrush (*A. spiciformis*) and Sticky sagebrush (*A. rothrockii*), two species that grow at high elevations (cold sites) with high levels of snow accumulation (i.e. wet soils).

Sagebrush Habitats: Generalized Gradients

