Ten Things You Always Wanted to Know About Sagebrush (But Were Afraid to Ask)

By Walter Fertig

Originally published in the Washington Native Plant Society journal, *Douglasia,* Summer 2023

Sagebrush is one of the most widely distributed and iconic plants of the American West, and yet also one of the least understood and appreciated. In the interest of increasing the SIQ (Sagebrush Intelligence Quotient) of our readers, *Douglasia* offers the following ten sagebrush factoids:

 # 1. Not all "sages" are sagebrush. True sagebrush belongs to the genus *Artemisia*, a group of more than 100 species in the sunflower family (Asteraceae) distributed across northern Asia, Europe, North America, and South America. The common name sage comes from the aromatic foliage that resembles culinary sage (see factoid # 3) and its relatives in the genus *Salvia*, which are all in the mint family (Lamiaceae). Pioneers traveling across the western prairies and deserts applied the term "sage" somewhat indiscriminately to a number of shrubby species that had bluish-green herbage, inconspicuous flowers, or odoriferous leaves. For example, purple sage is the mint *Poliomintha incana* and white sage the chenopod relative *Krascheninnikovia lanata*. The Latin name for sagebrush comes from Artemisia, queen of Caria (in modern Turkey) in the 4th Century BC, who was an amateur botanist and herbalist. She in turn was named after Artemis, the Greek goddess of the moon, wild animals, vegetation, hunting, chastity, and childbirth (quite the multi-tasker).

 # 2. There isn't just one kind of sagebrush in North America, there are 77! Dr. Leila Shultz, sagebrush maven from Utah State University and author of the *Artemisia* treatment in the *Flora of North America* (2006) accepts 51 species and 18 subspecies of *Artemisia* and *Picrothamnus* (bud sagebrush, traditionally included in *Artemisia*) in North America north of Mexico. More recently, the genus *Sphaeromeria* (chicken-sage) has been lumped into *Artemisia* based on molecular data, adding 8 more species to the total. Washington State has 28 native sagebrush taxa (21 full species and 7 varieties) and 4 introduced species. Only nine of the 28 taxa from Washington are shrubs, while the remainder are annual or perennial herbs (often called sageworts or mugworts, to distinguish them from the shrubby sagebrushes). Within the sunflower family (Asteraceae), sagebrushes are most closely related to yarrow (*Achillea*), ox-eye daisy (*Leucanthemum*), tansy (*Tanacetum*) and other members of the Anthemideae tribe.

 # 3. If the recipe calls for "sage", don't add sagebrush! Culinary sage (*Salvia officinalis*) is the spice used for seasoning foods with a sage smell. Native Americans did not cook with sagebrush but did use it as a medicinal plant. Most often it was used as a tea or poultice to treat colds, fever, or toothache, or to induce vomiting (an outcome most chefs are not looking for!). Branches were also burned to purify the air.

 # 4. Sagebrush really is a flowering plant. Individual sagebrush flowers are quite tiny (1.5-3 mm), lack showy petal-like rays, and are brownish green. Like other members of the sunflower family, the flowers are aggregated into small heads, each enclosed in a cup-like involucre of greenish gray leaf-like bracts (phyllaries). These flower heads are themselves arranged in

branching, panicle-like flower stalks (inflorescences) that often jut out well above the foliage. The flowers are designed for wind pollination. Nearly all sagebrush species flower in late summer or early fall (the exception being bud sagebrush, *Artemisia spinescens*, of the Great Basin and Colorado Plateau, that flowers in mid spring). Wind-pollinated plants typically produce large quantities of very small pollen that waft through the breeze to randomly reach receptive stigmas on other plants. Many people with fall hay fever are allergic to pollen of sagebrush or ragweed (*Ambrosia* species). Old flowering stalks typically persist for nearly a year and are useful for distinguishing some species. Sagebrush can produce large crops of tiny seeds each fall, which can be spread large distances by wind gusts, or more frequently fall near the parent plant. Unlike many composites, sagebrush seeds lack a feathery or hairy pappus to aid in wind dispersal (the exception is *Artemisia papposa* of SE Oregon and adjacent Nevada and Idaho which has a shallow fringe of pappus-like scales atop the achenes).

 # 5. Some sagebrush species and subspecies can be identified by their unique leaf chemistry. Scientists have discovered that the presence of coumarin in leaf tissues can be used to differentiate some sagebrush taxa based on fluorescence of twigs placed in water under ultraviolet light. The higher the concentration of coumarin, the brighter the sample will fluoresce, while specimens without coumarin won't fluoresce at all. Presence of coumarin is also correlated with palatability. Those taxa with high concentrations generally are favored over those without (one exception is Wyoming big sagebrush, *Artemisia tridentata* subsp. *wyomingensis*, which does not fluoresce, but is one of the more tasty taxa for animals).

All sagebrushes get their distinctive sage aroma from chemical compounds such as terpenes and sesquiterpene lactones. The intent of these chemicals is to reduce herbivory by insects and large mammals (including livestock). But not all chemicals are the same – their quantity and type directly influences the palatability of sagebrush foliage. Sage grouse and mule deer preferentially forage on sagebrush species with lower concentrations of these compounds. The amount of leaf chemicals differs between plants based on genetics but can also vary seasonally and even from morning to evening.

 # 6. Big sagebrush produces two different kinds of leaves. Like most shrubby sagebrushes, big sagebrush (*Artemisia tridentata*) is evergreen, but individual leaves may be relatively short-lived. Overwintering leaves last for about a year and are short and typically clustered. These are capable of undergoing photosynthesis at low winter temperatures. Longer, ephemeral leaves are formed in the spring and occur singly on the stems. These leaves are shed when hot, droughty conditions occur in the summer, as their larger surface area makes them more prone to water loss. Overwintering and ephemeral leaves usually have three lobes across their tip, while leaves associated with flowering stalks are often unlobed (entire). Leaf shape (elongate vs bell-shaped) and length are used for distinguishing big sagebrush subspecies but can often be extremely variable on the same plant.

The distinctive bluish-green color of big sagebrush and other shrubby species comes from the dense mat of hairs that cover most of its foliage. These hairs reflect some sunlight and provide shade to the leaf and stem surface, keeping them cooler and reducing water loss through transpiration. The hairs may also interfere with herbivory by insects.

Sagebrush can be completely defoliated and survive. During severe drought, big sagebrush can shed all of its leaves to reduce water stress from evaporation. While the plants may appear to be dead, they can sprout new leaves the following year if drought conditions are abated. Big sagebrush does not survive after a fire, however, and is not able to resprout from its roots. The related silver sagebrush (*Artemisia cana*) is able to resprout if burned.

 # 7. Not all sagebrushes occur in typical sagebrush communities. Big sagebrush, threetip sagebrush (*Artemisia tripartita*) and stiff sagebrush (*A. rigida*) are commonly found in prototypical "sagebrush" habitats in dry basins, scablands, and lower montane slopes across much of eastern Washington. Prairie sagebrush (*A. ludoviciana*) occurs widely from lowlands to montane meadows, often associated with big sagebrush communities. Some native sagebrushes are adapted to moist habitats along streams and rivers. Silver sagebrush can be a community dominant on terraces with a high water table in mountain foothills. The critically endangered Northwestern endemic, Wormskiold's northern wormwood (*A. campestris* var. *wormskioldii*) is restricted to sandy or cobblestone shores along the Columbia River which are now largely inundated by reservoirs or which no longer have natural flooding cycles. Several herbaceous *Artemisia* species are adapted to disturbed habitats created by humans, including the native species biennial wormwood (*A. biennis*) and tarragon (*A. dracunculus*), as well as non-natives, like mugwort (*A. vulgaris*) and absinthe (*A. absinthinum*). A few herbaceous taxa are also adapted to talus slopes and tundra in the alpine to upper montane zones in western Washington, including boreal wormwood (*A. norvegica* subsp. *saxatilis*), forked wormwood (*A. furcata*), and Michaux's mugwort (*A. michauxiana*).

 # 8. Big sagebrush produces two kinds of roots. Like many aridic shrubs, big sagebrush grows deep taproots up to 20 feet long. In general, root depth is 3-4 times greater than the height of the plant and varies depending on the depth and rockiness of the soil. Big sagebrush also produces lateral roots that radiate out from the plant a short distance below the soil surface. These roots are especially effective at capturing surface moisture following rain or snowmelt. The range of big sagebrush strongly correlates with areas where precipitation comes mostly from snow. This accounts for the rarity or absence of sagebrush vegetation in grass-dominated ecosystems such as the Great Plains where most precipitation comes as summer rain.

The presence of lateral roots and competition for water may help explain the natural spacing of sagebrush and the gaps that form between plants. In the past, range managers suspected that sagebrush leaves and roots exuded chemicals into the soil that inhibited growth of competing plants (a condition called allelopathy). Scientific analysis of leaf and soil chemicals, however, provides no basis for this assumption. In fact, grass and forb species are more likely to grow under the canopy of sagebrush where they are partly protected from herbivores and provided shade (which also keeps the soil moister). Rather than inhibiting other plants, sagebrush acts as a nurse plant that improves the probability of seedling survival.

 # 9. Big sagebrush produces wood and annual growth rings, just like trees. Although not especially thick, the main stems of big sagebrush regularly grow a new ring of woody tissue (water-conducting xylem) each year. These growth rings reflect climatic conditions, with thicker rings produced during wetter years and thin rings during times of drought. Patterns in the annual

production of rings can be used to date the age when a sagebrush plant became established and to assess variations in past climate. Researchers studying age rings within sagebrush populations typically find that shrubs are of similar ages, suggesting that seedling establishment is infrequent and episodic. They have also found that stem size does not reflect age – large sagebrushes attain their size because they grow in favorable environments and not because of their longevity.

 # 10. Contrary to what you may have heard, sagebrush is quite valuable to wildlife for food and shelter. As discussed under # 5, aromatic chemicals in sagebrush foliage are designed to reduce herbivory, but many animals (especially mule deer and sage grouse) are able to tolerate sagebrush browse, and in fact rely on it extensively in their diet. Sagebrush is an important source of protein for mule deer on their winter range. Greater and Gunnison sage grouse feed almost exclusively on sagebrush from October to April (their gizzards are not adapted for grinding hard seeds like other upland game birds). Sage grouse also rely on sagebrush for nesting cover and feed their chicks insects, grasses, and forbs that grow under the sagebrush canopy. Brewer's sparrows, Sage sparrows, and Sage thrashers are other "sagebrush obligates" because of their reliance on *Artemisia* for hiding cover, nesting sites, and feeding areas. More than a dozen other bird species are highly dependent on sagebrush and grassland habitats, including Black-throated sparrows, Vesper sparrows, Lark sparrows, Green-tailed towhees, Burrowing owls, Short-eared owls, Long-billed curlews, Sharp-tailed grouse, Prairie falcons, Ferruginous hawks, and Swainson's hawks. At least 16 species of rodents and rabbits feed on sagebrush, as well as hundreds of insect taxa (52 species of aphids alone according to one study).

Big sagebrush is also less responsible for the decline of native grasses and deterioration of range conditions than is often depicted. Anecdotal evidence that sagebrush is significantly more common today than in pre-settlement times in much of the West is not substantiated by historical accounts of pioneers and early photographs. One famous photo used in textbooks for years to illustrate the increase of big sagebrush in the last century actually depicts an area that had been recently burned (and was thus devoid of sagebrush) rather than a site naturally dominated by grasses. Changes in the abundance, density, and composition of native perennial grasses and forbs since European settlement are better explained by past grazing history and changes in climate and fire regimes. Despite decades of removing sagebrush by chaining, thinning, burning, and applying herbicides, sagebrush habitats have rarely been permanently converted to perennial grasslands because the shrubs are better adapted to winter precipitation, drought, and grazing pressure. Modern sagebrush systems are being impacted by changes in natural fire frequency from invading annual weeds (such as cheatgrass, medusa head, and ventenata) and conversion to agriculture and urbanization to such a degree that many sagebrush obligate species (such as the sage grouse and pygmy rabbit) are in significant rangewide decline. It is surprisingly difficult to find large expanses of unaltered sagebrush vegetation anymore!

Walter Fertig searches for sagebrush stands in eastern Washington from his base at the Marion Ownbey Herbarium of Washington State University in Pullman.

2145 words