



Should Ranchers Value Sagebrush? Why We Need Sagebrush

Beth Burritt, USU Dept. of Wildland Resources; *Thomas Monaco*, USDA-ARS, Logan, Utah; and *Eric Thacker*, USU Dept. of Wildland Resources

Big sagebrush (*Artemisia tridentata*) grows in arid and semiarid areas throughout the Intermountain West. It is a long-lived, slow-growing, evergreen shrub that typically grows 2 to 4 feet in height but can grow to 13 feet. Leaves have three lobes and are blue-gray to gray-green. The shrub is very aromatic due to its terpene content. It is perhaps the most common shrub on western rangelands (West 1979). Yet many ranchers try to rid their land of big sagebrush to increase forage for livestock.

Repeated wildfire has killed many big sagebrush plants across the West because big sagebrush doesn't re-sprout after fire. Sagebrush communities are typically slow to recover after fire. Recovery may take as long as 20 years for sagebrush growing at high elevation to 100 years on low elevation sites (Figure 1). When sagebrush is eliminated from an area, forbs and grasses may increase

in the short term, depending on their density and whether seeds are present in the soil to produce new plants. However, if invasive annual grasses like cheatgrass are present (Figure 2), they often increase after fire and the removal of sagebrush. The spread of cheatgrass has increased with the increase in wildfire intensity (heat). Fire frequency has increased from every 15–100 years to as often as every 3 years. These fires are eliminating sagebrush throughout the West. Good riddance? Maybe not—big sagebrush has big benefits for plant communities as well as for wildlife and livestock.

Sagebrush Benefits Other Plants

The canopy of sagebrush provides a favorable environment for many plants growing in the understory. It also protects grasses and forbs in the understory from overgrazing. Sagebrush plants increase water retention by trapping and holding windblown snow. Contrary to long-standing beliefs, complete removal of sagebrush often negatively affects biodiversity and has few long-term benefits on the productivity of perennial grasses and forbs. Forage production may actually decline when sagebrush is completely removed from rangeland (Tilley et al. 2006).



Figure 2. Sagebrush invaded by cheatgrass. Wildfire would likely kill the sagebrush resulting in a cheatgrass monoculture. (Photo by Justin Williams)

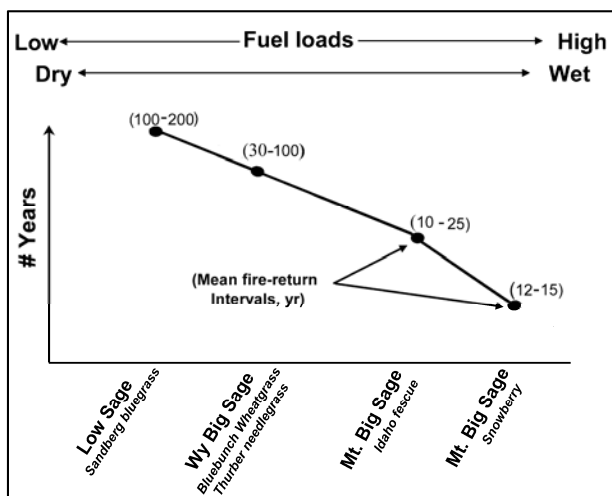


Figure 1. Fire return intervals in sagebrush systems without cheatgrass. (Adapted from Knick et al. 2006)

Big sagebrush plants provide

benefits to other plants growing near the shrub. Big sagebrush improves soils. The nutrient content of soils – nitrogen, phosphorus, potassium, calcium, etc. – directly under the canopy of big sagebrush is higher than in the interspaces. Soils beneath sagebrush also have more organic matter than soils in the interspaces between sagebrush plants (Mack 1977). As a result, big sagebrush creates islands of fertility that can be used by other plant species. These islands may persist for 6 to 14 years after sagebrush removal (Bechtold and Inouye 2007).

Big sagebrush plants are long-lived, evergreen species that produce new leaves early each spring when moisture is likely most available in the soil. These leaves remain on plants year-round. Big sagebrush canopies reduce heat from the sun and prolong the period favorable for seedling establishment for perhaps as long as 28 days (Tilley et al. 2006).

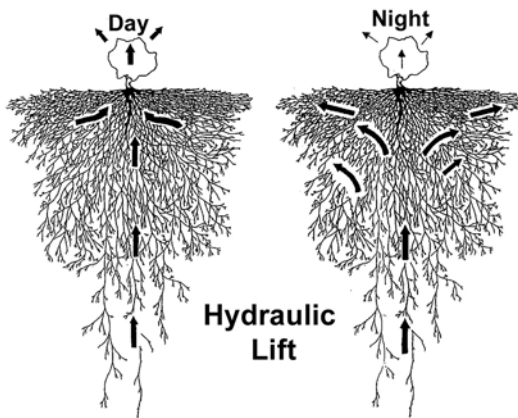


Figure 3. During the day, sagebrush roots deep in the soil absorb water. At night, water moves through the sagebrush root system to drier soil layers closer to the soil surface making it available to grasses and forbs. (Caldwell et al. 1998).

Big sagebrush plants have a two-part root system with a deep tap root and a shallow, diffuse root system. A number of studies have shown that sagebrush can extract soil moisture and nutrients from deep in the soil and bring them to the soil surface. The tap root system brings up water and nutrients during the day and releases them near soil surface at night. This water is available to the shallow diffuse root system of big sagebrush as well as to the roots of grasses and forbs in the sagebrush understory (Figure 3). Big sagebrush can extend water near the soil surface by 2 weeks compared to the interspaces between sagebrush plants (Caldwell et al. 1998; Bilbrough and Caldwell 1997).

Big sagebrush subspecies are often indicators of soil characteristics. Generally, a subspecies of sagebrush indicates the soils at a site, thus correct identification of

big sagebrush subspecies can provide useful information on the soils and ecological site characteristics of the area. The abundance of sagebrush subspecies also varies along gradients of elevation and soil moisture. In general, mountain big sagebrush dominates at higher elevations, Wyoming big sagebrush at mid-elevations, and basin big sagebrush at the lowest elevations (Figure 4). As soil moisture increases, Wyoming big sagebrush will be replaced by basin or mountain big sagebrush. Soil depth and texture also strongly determine which subspecies dominates an area. For example, deeper, well-drained soils at lower elevations provide more favorable conditions for basin big sagebrush than Wyoming big sagebrush (Halvorson et al. 1997).

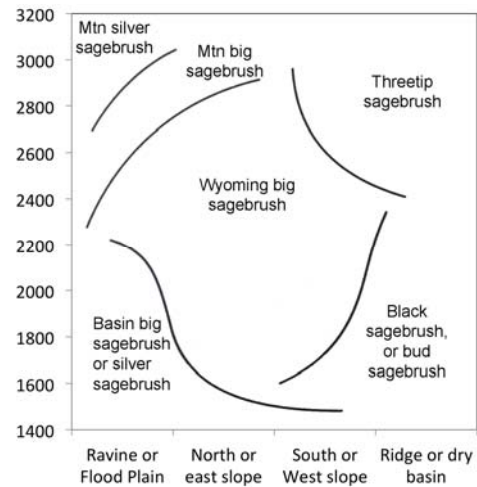


Figure 4. The approximate distribution of different species of sagebrush in relation to elevation and topography. (Adapted from Knight 1994)

Forage and Habitat for Wildlife

Sagebrush is an excellent winter food source for a number of wildlife species including mule deer, black-tailed deer, white-tailed deer, elk, pronghorn antelope, bighorn sheep and jackrabbits. Sagebrush made up 78% of the annual diet for antelope in Wyoming and 52% of the winter diet of mule deer in Montana (Tilley et al. 2006).

Nearly 100 bird species depend on sagebrush ecosystems for their habitat needs. There are also several animal species that require big sagebrush for survival including sage-grouse, sharp-tailed grouse, pygmy rabbits, sage thrashers, sage sparrows and Brewer's sparrow. Sagebrush makes up close to 100% of the winter diet of sage grouse and up to 50% of their summer diet (Wallestad et al. 1975)

Sagebrush provides habitat and food for many insects and other invertebrates, which in turn feed birds, reptiles and small mammals. Sagebrush also provides excellent thermal or security cover for wildlife. This includes nesting and escape cover for sage-grouse, sharp-tailed grouse, pheasants, chukars, and other upland birds.

During most winters, sagebrush plants remain above snow, making forage available for grazing by wildlife. In fall and winter, sagebrush leaves are relatively high in crude protein compared to dormant grass and forbs or twigs of deciduous shrubs. Protein in sagebrush complements the energy provided by mature grasses and forbs (Table 1).

Table 1. Percent protein and in-vitro dry matter digestibility (IVDMD) of sagebrush as a percentage of dry matter (Welch 2005).

	Crude Protein	IVDMD
Spring	12.6	58.1
Summer	13.2	-
Winter	11.7	57.8

Winter Grazing for Cattle and Sheep

Many sheep already use sagebrush as winter forage, but cattle can also learn to eat sagebrush. Grazing dense stands of sagebrush accomplishes two objectives, decreasing winter forage costs and improving the productivity of grass and forbs in the understory the following spring. It is good forage in late fall and winter provided livestock are supplemented. Providing livestock with about 50% of their daily nutrient requirements from hay or other feeds will encourage them to begin eating sagebrush and enable them to detoxify the terpenes found in sagebrush. Cattle with experience eating sagebrush eat more of the shrub than cattle without experience. Cattle from mothers that ate sagebrush actually gained weight eating a diet of half sagebrush and half meadow hay plus a supplement, while cattle from mothers that did not eat sagebrush lost weight on the same diet (Petersen 2012).

Revegetation

Big sagebrush can be a very important species in revegetation, because of its wide range of adaptation (Booth 2005). Seedlings can compete with grasses and forbs as well as other shrubs allowing it to be used as part of a wide range of seed mixes. Seedlings are easy to establish when planted correctly and can be successfully

drilled or broadcasted. Sagebrush can be seeded at relatively low rates and allowed to spread by natural recruitment, because it spreads readily by seed. Sagebrush is also considered a necessary plant species in the Great Basin and Snake River Plains because in its absence, other less desirable deep-rooted species and invasive weeds like spotted knapweed can take hold (Prevéy et al. 2010).

Mixtures of range grasses, forbs and shrubs, such as sagebrush, may help control black grass bugs, which are harmful to many grass species including crested wheatgrass. A mix of range plants may include plants that are repugnant or harmful to insects. When reseeding rangelands, leaving islands of native plants including sagebrush provides habitat for beneficial insectivores to help control black grass bugs in nearby newly established range seedings (Ostlie 1979).



Figure 5. A healthy stand of sagebrush, grasses and forbs in spring. (Photo by Justin Williams)

Grazing Management

Sagebrush is often blamed for reducing grasses and forbs on rangeland. However, poorly managed livestock grazing, that doesn't consider the physiological requirements of perennial grasses and forbs, is often the real cause of reduced forage production in sagebrush communities. When grazing always occurs in the spring and is either too often and/or severe, perennial grasses and forbs in the understory decline. Repeated spring grazing often results in dense stands of sagebrush with little or no understory or the understory is replaced by less desirable annuals like cheatgrass. Fall and winter grazing of sagebrush communities reduces the number of old sagebrush plants and increases grasses and forbs in the understory (Petersen 2012).

What Good Is Sagebrush?

Big sagebrush is beneficial to grasses and forbs growing under its canopy by supplying them water, nutrients,

organic matter and protection from overgrazing. It provides food and cover for a number of birds, reptiles, small mammals and beneficial insects. It can provide winter forage for both wildlife and livestock. Lastly, it is an important plant for revegetation efforts in the West.

References

- Bilbrough, C.J., and M.M. Caldwell. 1997. Exploitation of springtime ephemeral N pulses by six Great Basin plant species. *Ecology* 78: 231-243.
- Bechtold, H.A., and R.S. Inouye. 2007. Distribution of carbon and nitrogen in sagebrush steppe after six years of nitrogen addition and shrub removal. *Journal of Arid Environments* 71: 122-132.
- Booth, D.T. 2005. Wyoming big sagebrush seed orchards on reclaimed mined land. *Native Plants Journal* 6:247-253.
- Caldwell, M.M., T.E. Dawson, and J.H. Richards. 1998. Hydraulic lift: Consequences of water efflux from the roots of plants. *Oecologia* 113:151-161.
- Halvorson J.J., H. Bolton Jr., and J.L. Smith. 1997. The pattern of soil variables related to *Artemisia tridentata* in a burned shrub-steppe site. *Soil Science Society of America Journal* 61: 287-294.
- Knick, S.T., A.L. Holmes, and R.F. Miller. 2006. The role of fire in structuring sagebrush habitats and bird communities. *Studies in Avian Biology* 30:1-13.
- Knight, D.H. 1994. *Mountains and Plains: The Ecology of Wyoming Landscapes*. p. 94. Thomas-Shore, Dexter, MI.
- Mack, R.N. 1977. Mineral return via the litter of *Artemisia tridentata*. *American Midland Naturalist* 97:189-197.
- Ostlie, K.R. 1979. *Labops hesperius* Uhler: Abundance and dispersal in relation to vegetation. MS Thesis, Utah State University, Logan, UT. 184 p.
- Petersen, C.A. 2012. Cattle browsing sagebrush steppe during fall: Effects on plant community structure and influence of experience on cattle foraging behavior and body weights. MS Thesis, Utah State University, Logan, UT. 94 p.
- Prevéy J.S., M.J. Germino, and N.J. Huntly. 2010. Loss of foundation species increases population growth of exotic forbs in sagebrush steppe. *Ecological Applications* 20: 1890-1902.
- Tilley, D., D. Ogle, L. St John, and B. Benson. 2006. Plant Guide for Big Sagebrush (*Artemisia tridentata*). USDA-Natural Resources Conservation Service Idaho Plant Materials Center.
- Wallestad, R., J.G. Peterson, and R.L. Eng. 1975. Foods of adult sage grouse in central Montana. *Journal of Wildlife Management* 39:628-630.
- Welch, B.L. 2005. Big sagebrush: A sea fragmented into lakes, ponds, and puddles. General Technical Report RMRS-GTR-144. USDA, Forest Service, Rocky Mountain Research Station. Fort Collins, CO. 210 p.
- West, N.E. 1979. Basic synecological relationships of sagebrush-dominated lands in the Great Basin and the Colorado Plateau. *The Sagebrush Ecosystem: A Symposium*. Utah State University, Logan, Utah. pp. 33-41.

Utah State University is committed to providing an environment free from harassment and other forms of illegal discrimination based on race, color, religion, sex, national origin, age (40 and older), disability, and veteran's status. USU's policy also prohibits discrimination on the basis of sexual orientation in employment and academic related practices and decisions.

Utah State University employees and students cannot, because of race, color, religion, sex, national origin, age, disability, or veteran's status, refuse to hire; discharge; promote; demote; terminate; discriminate in compensation; or discriminate regarding terms, privileges, or conditions of employment, against any person otherwise qualified. Employees and students also cannot discriminate in the classroom, residence halls, or in on/off campus, USU-sponsored events and activities.

This publication is issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Kenneth L. White, Vice President for Extension and Agriculture, Utah State University.