

MONTANA SAGEBRUSH: A TAXONOMIC KEY AND HABITAT DESCRIPTIONS

Carl L. Wambolt, Department of Animal and Range Sciences, Montana State University, Bozeman MT 59717

Michael R. Frisina, Montana Fish, Wildlife & Parks, 1330 West Gold Street, Butte MT 59701

ABSTRACT

We describe the 16 sagebrush (woody *Artemisia* L.) occurring in Montana and summarize their habitat characteristics, distributions, and relative importances. A taxonomic key and photographs for their identification also are provided.

Key Words: *Artemisia*, characteristics, distribution, habitat, Montana, sagebrush taxonomy.

INTRODUCTION

Sagebrush (woody *Artemisia* L.) also known as wormwood, mugwort, and sagewort are arguably the most important rangeland plants in Montana and the other western States. Sagebrush taxa occur on an estimated 109 million ha in the region (Beetle 1960, McArthur and Plummer 1978). Most of Montana's more than 25 million ha of rangeland contains at least one of the 16 different sagebrush taxa that occur within the state (Table 1).

Generally, the most important sagebrush are those that are widely distributed and/or dominate their communities. These dominant sagebrush taxa belong to the Asteraceae family, genus *Artemisia* within the subgenus *Tridentatae* (McArthur et al. 1981) (Table 1). The *Tridentatae* is endemic to western North America (Beetle 1960, McArthur et al. 1981). In a classification of western Montana grasslands and shrublands, Mueggler and Stewart (1980) recognized six distinct habitat types in which sagebrush taxa are dominants. Society for Range Management (1994) includes six and seven distinct rangeland cover types dominated by sagebrush in the northern Rocky Mountain and Great Basin regions, respectively, without partitioning for subspecies.

Our objective was to differentiate the 16 sagebrush taxa that occur in Montana by

contrasting their habitats, distributions, and relative importance (Table 2) and to create a taxonomic key to their identification (Table 3).

SAGEBRUSH TAXA

Low Sagebrush

One subspecies of low sagebrush (*Artemisia arbuscula* Nutt. *arbuscula*) occurs in Montana (Fig. 1). Low sagebrush is a small, stiff, many-branched shrub. Its distribution is limited to the southwestern part of the state, generally on well-drained alkaline soils. These soils usually have either a B horizon that is impermeable or bedrock near the surface. This taxon may occasionally layer and is found on dry plains and hilly sites where it may be the community dominant.

Silver Sagebrush

Two subspecies occur in Montana, plains silver sagebrush (*Artemisia cana* Pursh. *cana*) and mountain silver sagebrush (*A. c. viscidula* [Osterhout] Beetle) (Fig. 2). The plains taxon is distributed mainly throughout central and eastern Montana and occasionally west of the continental divide whereas the mountain taxon is limited to mesic mid to high elevations mostly in southwestern Montana. Both taxa are associated with well-drained soils. Plains silver sagebrush is more prevalent on clayey

Table 1. Sagebrush¹ (*Artemisia*) taxa found in Montana.

Taxon	Common name
<i>Tridentatae</i> (subgenus of ARTEMISIA)	
<i>A. arbuscula</i> Nutt. <i>arbuscula</i>	low sagebrush
<i>A. cana</i> Pursh. <i>cana</i>	plains silver sagebrush
<i>A. c. viscidula</i> (Osterhout) Beetle	mountain silver sagebrush
<i>A. longiloba</i> (Osterhout) Beetle	alkali sagebrush
<i>A. nova</i> Nels.	black sagebrush
<i>A. rigida</i> (Nutt.) Gray	scabland sagebrush
<i>A. tridentata</i> Nutt. <i>tridentata</i>	basin big sagebrush
<i>A. t. wyomingensis</i> Beetle and Young	Wyoming big sagebrush
<i>A. t. vaseyana</i> (Rydb.) Beetle	mountain big sagebrush
<i>A. t. spiciformis</i> (Osterhout) Goodrich and McArthur	subalpine big sagebrush
<i>A. tripartita</i> Rydb. <i>tripartita</i>	tall threetip sagebrush
<i>A. t. rupicola</i> Beetle	Wyoming threetip sagebrush
Non – <i>Tridentatae</i> subshrubs and shrubs	
<i>A. frigida</i> Willd.	fringed sagewort
<i>A. longifolia</i> Nutt.	longleaf sage
<i>A. pedatifida</i> Nutt.	birdfoot sage
<i>A. spinescens</i> Eat.	bud sage

¹ There are an additional 11 *Artemisia* taxa in Montana that grow as forbs and are not included in this table.

sites, whereas mountain silver sagebrush is commonly associated with rocky sites near streams or areas that collect snow pack. Although subspecies were not designated, Hansen et al. (1995) recognized 2 silver sagebrush habitat types associated with riparian areas as follows: The [plains] silver sagebrush/western wheatgrass (*Agropyron smithii* Rydb.) habitat type is a major type throughout central and eastern Montana. This habitat type occurs on nearly level older alluvial terraces and alluvial fans in valleys. The other habitat type, [mountain] silver sagebrush/Idaho fescue (*Festuca idahoensis* Elmer), is incidental at mid-to-high elevations throughout the mountains and foothills of central and southwestern Montana. Not all sites dominated by silver sagebrush are considered riparian; some are considered upland sites.

Alkali Sagebrush

As the name of this small shrub implies, alkali sagebrush (*Artemisia longiloba* [Osterhout] Beetle) is associated with alkaline and clayey soils on poorly drained sites in southwest Montana (Fig. 3).

This low shrub often layers from its lax spreading stems. Alkali sagebrush is distinctly separated from other sagebrushes by its large flower heads and early flowering habit. It also is known as early sagebrush because it flowers and sets seed much ahead of other sagebrush taxa with flowering beginning in early June and seeds ripening in August. Its habitat is often unusual for sagebrush as it grows in heavy, highly impermeable soils derived from very alkaline shales. However, it is sometimes found on light, limestone soils.

Black Sagebrush

Black sagebrush (*Artemisia nova* Nels.) is distributed throughout southwest and southcentral Montana (Fig. 4). It is sometimes a community dominant on shallow sites rich in limestone. Typical plants have many erect branches that arise from a spreading base. Although the form of this taxon is similar to low sagebrush, the flower stalks are more numerous, darker, and more persistent on black sagebrush. Montana plants also have a darker leaf color than does low sagebrush. The leaves have a

Table 2. Habitat relationships of the 16 sagebrush (woody *Artemisia*) that occur in Montana.

Species	<i>arbuscula</i>	<i>cana</i>	<i>cana</i>	<i>longiloba</i>	<i>nova</i>	<i>rigida</i>	<i>tridentata</i>	<i>tridentata</i>	<i>tridentata</i>	<i>tridentata</i>	<i>tridentata</i>	<i>tripartita</i>	<i>tripartita</i>	<i>frigida</i>	<i>longifolia</i>	<i>pedatifida</i>	<i>spinescens</i>
Subspecies	<i>arbuscula</i>	<i>cana</i>	<i>viscidula</i>				<i>tridentata</i>	<i>wyomingensis</i>	<i>vaseyana</i>	<i>spiciformis</i>	<i>tripartita</i>	<i>tripartita</i>	<i>rupicola</i>	<i>frigida</i>	<i>longifolia</i>	<i>pedatifida</i>	<i>spinescens</i>
Range ¹	8	3	7	7	10	3	11	11	10	5	6	2	2	10	3	3	10
Montana distribution	SW	NC	SW	SW	SW	SW	SW	SW	SW	SW	SW	SC	SC	SW	NC	SC	SW
		SC		SC	NC		SC	NC	NW					NC	NE		SC
		NE			SC		SE	SC	NC					SC			
		SE			NE			NE	SC					NE			
					SE		SE							SE			
Landform ²	F	P, B	M	F	F, B	F	F	P, F, B	F, M	M	F	F	F	P, F, B	B	F	F
Soils	Well drained, Alkaline	Well drained, Clayey	Well drained, Rocky	Poorly drained, Clayey	Shallow, Lime- stone	Rocky	Deep, Well drained	Shallow clay, Xeric, Sometimes silt	Variety	Mesic	Deep, Well drained	Shallow	Shallow	Variety	Alkaline	Xeric	Saline
Precipitation ³	2	2	3	2	2	2	2	2	3	3	2	1	1	2	2	1	1
Growth-form	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Shrub	Subshrub	Subshrub	Subshrub	Subshrub
Relative ⁴ browsing tolerance	L	M	M	U	M	U	L	L	L	M	L	L	L	M	U	U	M
Relative fire ⁴ tolerance	L	M	M	L	L	L	L	L	L	M	M	L	L	L	L	L	L
Height at maturity (dm) ⁵	Small	Medium	Medium	Small	Small	Small	Large	Medium	Medium	Medium	Small	Dwarf	Dwarf	Dwarf	Small	Dwarf	Dwarf
Vegetative reproduction	N	Y	Y	N	N	N	N	N	N	Y	Y	?	?	N	N	N	N

¹Number of states within the 11 western states (WA, OR, ID, MT, CA, NV, UT, WY, CO, AZ, NM).

²P = plains, F = foothills, M = mountains, B = breaks.

³1 = 25 cm (10 in.), 2 = 25-36 cm (10-14 in.), 3 = 36+ cm (14 in.+)

⁴L = Low, M = Moderate, U = Unknown.

⁵Exclusive of inflorescences. Dwarf = ≤ 1 dm, small = 1 to 4 dm, medium = 4 dm to 1 m, large = > 1 m.

Table 3. Key to Montana woody *Artemisia*

- 1. Low shrubs or subshrubs.
 - 2. Leaves mostly entire, linear and lance-linear, with silvery tomentose underneath; suffruticose base; alkaline soils of plains. *A. longifolia*
 - 2. Leaves divided.
 - 3. Base suffrutescent; leaves pinnatifid with 5-10+ divisions and silky-canescens; prairies and foothills primarily. *A. frigida*
 - 3. Base suffruticose.
 - 4. Branches spiny; base forms a low cushion; leaves 3-5 parted with divisions 3 lobed, deciduous; saline desert areas. *A. spinescens*
 - 4. Branches not spiny; low shrub < 1 dm from thick woody caudex; basal leaves cleft 3-5 times nearly to base; xeric soils. *A. pedatifida*
- 1. Obvious shrubs.
 - 5. Leaves mostly entire.
 - 6. Leaves broadly lanceolate, generally > 2 cm long, densely canescent; rhizomatous; plains, especially lowlands. *A. cana cana*
 - 6. Leaves narrowly lanceolate, generally < 2 cm long, perhaps with acute lobes, canescent to green, rhizomatous; along mountain streams and areas with heavy snow pack. *A. cana viscidula*
 - 5. Leaves not entire.
 - 7. Leaves cleft.
 - 8. Spike also has 3-cleft leaves similar to rest of plant; leaves deciduous; rocky scablands. *A. rigida*
 - 8. Panicle has only entire leaves.
 - 9. Plants relatively tall, > 2 dm, up to 2 m; leaves seldom > 2 cm long with lobes 0.5 –0.75 mm wide; mostly west of the continental divide on deep well drained dry soils. *A. tripartita tripartita*
 - 9. Short plants usually < 1.5 dm tall; leaves commonly 3 cm long with lobes 1 mm wide; east of the continental divide often on ridges with shallow soils. *A. tripartita rupicola*
 - 7. Leaves lobed.
 - 10. Mature plants usually < 50 cm tall.
 - 11. Persistent brown seed stalks arising to quite even lengths above crown; leaves dark green, viscid and flabelliform; shallow soils rich with limestone. *A. nova*
 - 11. Weakly persistent gray seed stalks; leaves gray and not viscid.
 - 12. Involucres narrow, heads few-flowered; not layering; most leaves cuneate; well drained, dry, commonly alkaline sites. *A. arbuscula arbuscula*
 - 12. Involucres broad, heads many flowered; often layering; the earliest flowering sagebrush with seed ripe in August (October for other *Artemisia* except some subshrubs); poorly drained, usually clay soils with high alkalinity. *A. longiloba*
 - 10. Mature plants usually > 50 cm tall.
 - 13. Tall plants 1-3 m at maturity; leaves long in relation to width and wedge shaped; panicles arise throughout a relatively uneven crown; deep, well-drained soils or along edges of talus slopes. *A. tridentata tridentata*
 - 13. Plants generally < than 1 m tall; leaves not wedge shaped with bases strongly tapered.
 - 14. Crown rounded with panicles arising throughout a relatively uneven crown; leaves are bell-shaped and shorter than other big sagebrush taxa; xeric soils that are shallow and heavy in clay or sometimes silt. *A. tridentata wyomingensis*
 - 14. Crown flat-topped with panicles arising to quite even lengths above the foliage.
 - 15. Leaves intermediate in size; crown relatively compact; 4-6 flowers per head, each <1.5 mm wide; not layered; a variety of soils receiving precipitation levels associated with mountains and foothills. *A. tridentata vaseyana*
 - 15. Leaves large; crown relatively open; >6 flowers per head, each > 1.5 mm wide; often layered; mesic sites compared to other big sagebrush, usually above 2100m elevation. *A. tridentata spiciformis*

viscid nature when touched that is provided by the high density of glandular trichomes on the surface and can often be seen as in Fig. 4.

Scabland Sagebrush

Scabland sagebrush (*Artemisia rigida* [Nutt.] Gray) is a small shrub that prefers dry rocky scablands (Fig. 5). Although reported to be scarce, its Montana distribution is in the northwest portion of the state. Scabland sagebrush was named for its common habitat in the Pacific northwest of lava outcrops (Van Dersal 1938). This plant is rigid in stature with heavy branches that break up easily. It has a deciduous habit unlike most sagebrush that are evergreen. Leaves are usually spatulate and divided deeply into 3-5 narrow lobes. Infrequently linear-entire leaves may occur.

Big Sagebrush

Big sagebrush (*Artemisia tridentata*) is the most common and widely distributed sagebrush species in Montana and the western United States (Fig. 6). The genus and species for big sagebrush were described by Nuttall in 1841 based on a specimen collected by him on the Snake River Plain of Idaho. Big sagebrush is also the most important sagebrush species due to the large areas its four subspecies occupy and often dominate under natural conditions. Although the subspecies may occasionally be found growing together, generally they require different environmental conditions (Table 2). Understanding of these requirements provides insight to the ecological variation that exists among the many communities occupied by big sagebrush.

It has been often stated that the land occupied by basin big sagebrush (*Artemisia tridentata* Nutt. *tridentata*) could be farmed. That is the case because this subspecies occupies deep, well-drained soils usually found in valley bottoms or other locations where such soils occur.

At the other habitat extreme among the big sagebrush taxa, Wyoming big sagebrush (*A. t. wyomingensis* Beetle and Young) occupies the most xeric locations. These

sites are usually the product of shallower soils and a large amount of clay or sometimes silt in the soil profile. The taxon does not do well on coarse-textured soils.

Mountain big sagebrush (*A. t. vaseyana* [Rydb.] Beetle), like basin big sagebrush, requires more moisture than does the Wyoming subspecies. However, mountain big sagebrush usually obtains its moisture by growing in localities with greater amounts of precipitation, rather than occupying very deep soils like basin big sagebrush grows in. The soils occupied by mountain big sagebrush range from sandy through silty and clayey textures, and may often be cobbly. However, generally finer textured soils appear to be favored by the taxon. Compared to surrounding upland community types, mountain big sagebrush usually occupies the deeper, more mesic locations.

The fourth subspecies of big sagebrush, subalpine sagebrush (*A. t. spiciformis* [Osterhout] Goodrich and McArthur) is of minor importance in Montana, as it is only known to occur in southwestern Montana near the Idaho border. It is found in the Centennial Valley and at the mouth of Cabin Creek near Hebgen Lake. Although it may occur occasionally elsewhere in southwestern Montana, it must be considered rare. Originally this taxon was considered to be a high elevation form of mountain big sagebrush. Subalpine big sagebrush is the only subspecies known to commonly root-sprout.

Threetip Sagebrush

In general both subspecies, tall threetip sagebrush (*Artemisia tripartita* Rydb. *tripartita*) and Wyoming threetip sagebrush (*A. t. rupicola* Beetle) occur west and east of the continental divide, respectively (Fig. 7). However, tall threetip sagebrush is found in the southwest portion of Montana, both east and west of the continental divide, whereas Wyoming threetip sagebrush is only known to occur in the southcentral portion of the state. Tall threetip sagebrush is a mid-sized sagebrush preferring deep well drained soils. Wyoming threetip

sagebrush is a dwarf associated with shallow rocky, ridgeline soils. Both subspecies are known to layer in the field. This habit is most common in Wyoming threetip sagebrush. Only tall threetip sagebrush is known to be a prolific stump-sprouter under the right conditions such as following fire or herbicide application.

Fringed Sagewort

The most widely distributed sagebrush subshrub in Montana, fringed sagewort (*Artemisia frigida* Willd.), occurs, throughout the state on relatively dry plains, foothills and breaks except in the northwest (Fig. 8). This mat-forming species is found on a variety of soil types and may readily pioneer recently disturbed sites. It occurs throughout successional stages to climax.

Longleaf Sagebrush

Longleaf sagebrush (*Artemisia longifolia* Nutt.), a subshrub, is mostly limited in distribution to small populations in northcentral and northeastern Montana. It

is usually found on alkaline sites associated with river breaks (Fig. 9).

Birdfoot Sagebrush

Birdfoot sagebrush (*Artemisia pedatifida* Nutt.), is a subshrub with limited distribution in southcentral Montana associated with xeric alkaline sites on plains and foothills (Fig. 10).

Bud Sagebrush

Bud sagebrush (*Artemisia spinescens* Eat.) is a subshrub associated with xeric saline areas on plains and foothills sites in southwest and southcentral Montana (Fig. 11). The deciduous leaves on this subshrub fall during the dry period in midsummer. This exposes a stout many branched base with the same white-tomentum on the leaders as occurs on the leaves. In the Great Basin, new leaves occur early in February or March and blooming is also very early, generally occurring from late April through late May. In Montana, the same phenological stages occur somewhat later.



Figure 1. Low sagebrush (*Artemisia arbuscula arbuscula*).

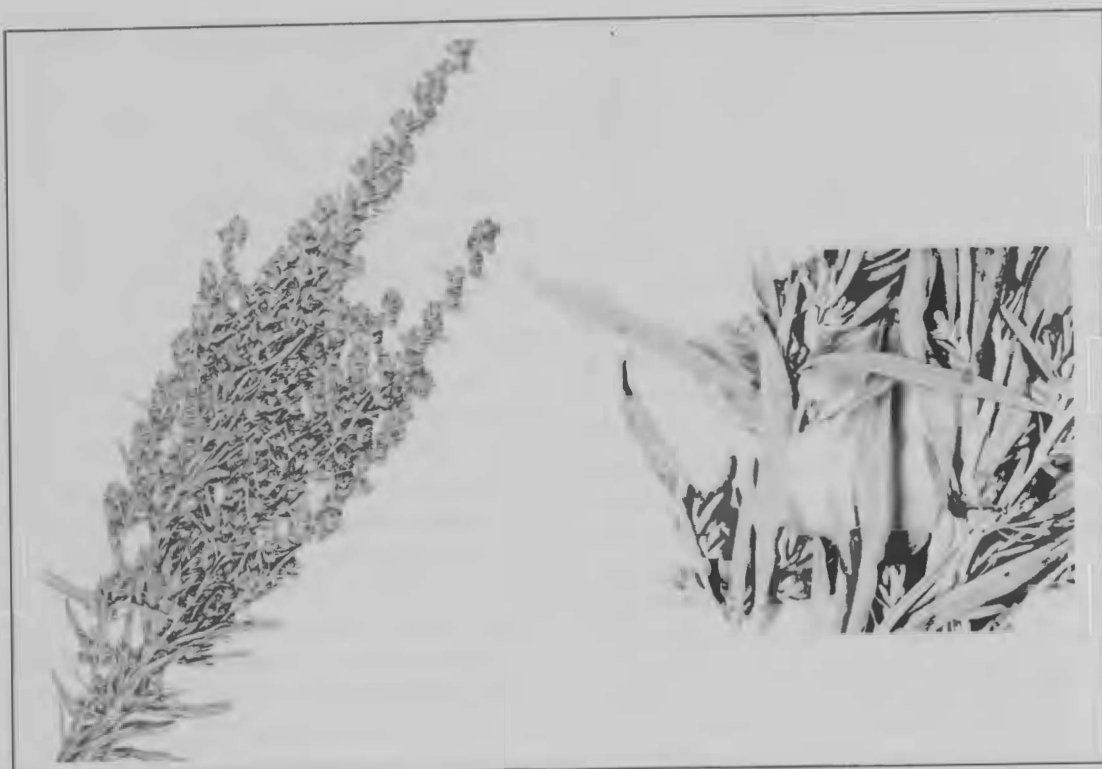


Figure 2. Plains silver sagebrush (*Artemisia cana cana*) top; Mountain silver sagebrush (*A.c. viscidula*) bottom.



Figure 3. Alkali sagebrush (*Artemisia longiloba*)



Figure 4. Black sagebrush (*Artemisia nova*)



Figure 5. Scabland sagebrush (*Artemisia rigida*).



Figure 6. Basin big sagebrush (*Artemisia tridentata tridentata*).



Figure 6 (continued). Wyoming big sagebrush (*A.t. wyomingensis*) top; Mountain big sagebrush (*A.t. vaseyana*) bottom.



Figure 6 (continued). Alpine sagebrush (*A.t. spiciformis*).



Figure 7. Tall threetip sagebrush (*Artemisia tripartita tripartita*) top.



Figure 7 (continued). Wyoming threetip sagebrush (*A.t. rupicola*).



Figure 8. Fringed sagewort (*Artemisia frigida*).



Figure 9. Longleaf sage (*Artemisia longifolia*).



Figure 10. Birdfoot sage (*Artemisia pedatifida*).



Figure 11. Bud sage (*Artemisia spinescens*)

LITERATURE CITED

- Beetle, A. A. 1960. A study of sagebrush-section *Tridentatae* of *Artemisia*. Wyo. Agricultural Experiment Station Bulletin B-779. 68 pp.
- Hansen, P. J., R. D. Pfister, K. Boggs, B. J. Cook, J. Joy, and D. K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Miscellaneous Publication No. 54. Montana Forest and Conservation Experiment Station, Missoula. 646 pp.
- McArthur, E. D., and A. P. Plummer. 1978. Biogeography and management of native western shrubs: a case study, section *Tridentatae* of *Artemisia*. Pp. 229-243 in Great Basin Naturalist Memoirs, No. 2. Brigham Young University. Provo, UT.
- _____, C. L. Pope, and D. C. Freeman. 1981. Chromosomal studies of subgenus *Tridentatae* of *Artemisia*: Evidence for autopolyploidy. American Journal of Botany 68:589-605.
- Mueggler, W. F. and W. L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA General Technical Report INT-66. Intermountain Forest and Range Experiment Station, USDA Forest Service, Ogden, UT. 154 pp.
- Society for Range Management. 1994. Rangeland cover types of the United States. Denver, CO. 152 pp.
- Van Dersal, W. R. 1938. Native woody plants of the United States. Their erosion-control and wildlife values. USDA Miscellaneous Publication No. 303. United States Government Printing Office, Washington D.C. 362 pp.

Received 20 November 2001

Accepted 8 May 2002