11240
Columbia Plateau Low Sagebrush Steppe
BpS Model/Description Version: Aug. 2020

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Reviewer: Louisa Evers

Vegetation Type
Steppe/Savanna

Map Zones
1, 7, 8, 9

Geographic Range
This type occurs across the Great Basin, Columbia Plateau, Snake River Plains, and Modoc Plateau. It may be present on the eastern edge of map zone (MZ) 1. Black, pygmy, and Bigelow sagebrush are most common in MZ12 and the western edge of MZ17, with Bigelow sagebrush found only in the southern part of MZ12 and intermingled with other low sagebrush species. Owyhee sagebrush is limited to the far southern and the western edges of MZ09, in the western half of MZ18.

Biophysical Site Description
The soils are very shallow to shallow clayey or stony loams. Somewhat more productive sites have coarser textured soils such as pumice claypans or sandy alluvium. Soils are typically less than 13in (33cm) deep to bedrock or a restrictive layer and often saturate to the surface in winter and spring. Soils may also be calcareous or alkaline. Because this biophysical setting (BpS) is controlled by soil depth and saturation, the soil-temperature regime ranges from mesic to cryic and the soil-moisture regime from aridic to xeric. Soils are mostly Aridisols or Mollisols. Bare ground, rock, or pavement is typically extensive, often exceeding 50%.

Slopes are typically gradual (0-30%). Precipitation ranges from 8-30in (20-76cm), mostly falling as winter snow at higher elevations and mixed rain and snow at lower elevations. Effective moisture is limited because of shallow soils.

Vegetation Description
The BpS supports a variety of dwarf sagebrush species, of which little sagebrush (*Artemisia arbuscula*) and its many subspecies are the most widespread. Other dwarf sagebrush species within this BpS include black sagebrush (*A. nova*), Bigelow sagebrush (*A. bigelovii*), early sagebrush (*A. a.* spp. *longiloba*), Owyhee sagebrush (*A. papposa*), and pygmy sagebrush (*A. pygmaea*). Black sagebrush sites are often alkaline and can be calcareous. Soils supporting early sagebrush are typically alkaline. Pygmy sagebrush is found mostly in geologic strata that weather to badlands and form calcareous soils. These sagebrush species are typically short, rarely >0.6m

tall, and usually <0.4m. Crowns may be narrow or spreading and frequently touch the ground. Some sites support widely scattered Wyoming big sagebrush or a mix of Wyoming big sagebrush and a low sagebrush species.

Total plant cover is never very high, and shrub cover rarely exceeds 15%. Sagebrush plants are distributed evenly across the site. Grasses are shallow-rooted bunchgrasses, with Sandberg's bluegrass the most commonly encountered species. Scattered, deeper-rooted bunchgrasses can appear on the more productive end of this BpS but are usually intermingled with shallow-rooted bunchgrasses. This BpS is not capable of producing 600lbs/ac (672kg/ha) and frequently produces <400lb/ac (454kg/ha). A variety of forbs can be present, including phlox, *Lomatium*, *Crepis*, buckwheat, bighead clover, and lupine, but forb cover and species composition is highly variable from year to year, depending on the timing and amount of precipitation. In dry years, forbs may be almost completely absent.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
ARAR8	*Artemisia arbuscula*	Little sagebrush
ARNO4	*Artemisia nova*	Black sagebrush
ARPY2	*Artemisia pygmaea*	Pygmy sagebrush
POSE	*Poa secunda*	Sandberg bluegrass
PSSP6	*Pseudoroegneria spicata*	Bluebunch wheatgrass

Species names are from the NRCS PLANTS database. Check species codes at http://plants.usda.gov.

Disturbance Description

Lack of fuel means that fires are rare in this BpS. Fires do not carry well, but may be possible after a couple of wet years and combined with high temperatures, very low relative humidity, and high wind conditions. Whether deliberate burning by Native Americans was common in this BpS is unknown, but many sagebrush ecologists believe it was minimal or absent. Any fires set by Native Americans that burned into this BpS were likely limited in extent and occurrence. In most years, this BpS would serve as a fuel break, and fires may not have been able to originate in this BpS under historical conditions. Fires that burned into this BpS likely create a patchy burn pattern with long fingers, but the very low productivity would result in the relatively small patches functioning more like a stand-replacement fire in more productive sagebrush settings.

Other disturbances may have been more influential on community dynamics than fire. Drought and ungulate browsing during severe winters were likely important -- drought because it is a sub-regional to regional event and ungulate browsing because the sagebrush species that comprise this BpS are largely palatable and nutritious. Aroga moths will feed on little sagebrush and possibly other sagebrush species in this BpS, but the impacts of outbreaks are much less clear than in big sagebrush BpSs.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	220	100		

Moderate (Mixed)				
Low (Surface)				
All Fires	220	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Patch size in this BpS ranges from 1ac to thousands of acres, and it is intermixed with other plant communities.

Adjacency or Identification Concerns

The Columbia Plateau Low Sagebrush Steppe is intermixed with both the Inter-Mountain Basins Big Sagebrush Steppe and Inter-Mountain Basins Montane Sagebrush Steppe, but most commonly with the Big Sagebrush Steppe. It may also occur in stringer stands intermixed with mixed-conifer forest. The edges of this BpS can be abrupt, creating what appears to be burn scar, potentially leading to misclassification as an earlier seral stage of a big sagebrush BpS. Soil depth or effective rooting depth is a key element distinguishing the Low Sagebrush Steppe.

Because very-low-productivity Wyoming big sagebrush sites can fall into this BpS, it may be misclassified as Inter-Mountain Basins Big Sagebrush Steppe. Which grasses are dominant (shallow-rooted vs. deep-rooted) and expected grass productivity are the key indicators that distinguish the two BpSs.

Because productivity varies across the sites where the low sagebrush species that comprise this BpS grow, more productive low sagebrush sites may be misclassified as Inter-Mountain Basins Low Sagebrush Steppe. Sites dominated by low sagebrush but where deep-rooted perennial bunchgrasses are the dominant grass species belong either to the Big Sagebrush Steppe or to the Montane Sagebrush Steppe, depending on which bunchgrasses are dominant and grass productivity in the different types of years. Typically, low sagebrush shrub cover is >15% on those settings as well. Shallow-rooted bunchgrasses may dominate the very early seral stages in the big sagebrush BpSs, potentially leading to misclassification as this BpS. It may not be possible to determine which BpS is more appropriate until several years have passed; soil or effective rooting depth may be the best indicator of which BpS is correct.

Invasive annual grasses, particularly cheatgrass, are an increasing problem in this BpS. As atmospheric carbon dioxide concentrations increase, the annual grasses are better able to invade these naturally drought-prone sites.

Issues or Problems

Community dynamics in the dwarf sagebrush communities that comprise this BpS remain little studied, requiring a great deal of inference without much evidence.

Native Uncharacteristic Conditions

Juniper and pinyon are encroaching into some Columbia Plateau Low Sagebrush Steppe sites. Lack of fire does not explain this encroachment and it may be due to increasing atmospheric carbon dioxide concentrations. Rising carbon dioxide concentrations appear to be increasing the

drought tolerance of junipers in particular, as they are not particularly limited by soil depth and periodic saturation.

Comments

During the 2016 model review, Louisa Evers made descriptive and quantitative changes to this model. Model changes included decreasing the fire frequency and adding transitions for drought and ungulate grazing. Evers suggested that this model and description could adequately represent the BpS not only in MZ01, MZ07, MZ08, and MZ09, but also in MZ12, MZ17, and MZ18. LANDFIRE staff reviewed the models in question, but found substantial differences in the descriptions, especially in the species, and determined that further expert review was need to determine whether lumping these zones would be appropriate.

In the quantitative model, the successional pathway is from Early All to Mid Open to Late Closed. Establishment of sagebrush is episodic. Favorable conditions for low sagebrush establishment occur approximately every 7yrs. Due to limited water, below-ground competition is particularly intense in this BpS, resulting in stands that appear to be open above-ground with extensive bare ground; this is why the Late class is described as "closed." In the model, wind/weather/stress transitions represent drought, and native grazing represents the effect of increased pronghorn population combined with a severe winter. The Native Grazing transitions should reset the class age, but LANDFIRE rules prohibit the use of age reset for "maintenance" transitions (i.e., a transition that does not change the class). K. Blankenship ran the model with and without age reset and there was no change in the results.

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41 - 50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	UN	UN	UN	UN	UN	UN	UN
Herb	0.5-1.0	B	B	B	UN	UN	UN	UN	UN	UN	UN
Herb	>1.0	B	B	B	UN	UN	UN	UN	UN	UN	UN
Shrub	0-0.5	B	C	C	C	C	C	C	C	C	C
Shrub	0.5-1.0	B	C	C	C	C	C	C	C	C	C
Shrub	1.0-3.0	B	C	C	C	C	C	C	C	C	C
Shrub	>3.0	B	C	C	C	C	C	C	C	C	C
Tree	0-5	C	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	C	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	C	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	C	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	C	UN	UN	UN	UN	UN	UN	UN	UN	UN

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A **26** **Early Development 1 - All Structures**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
POSE	Poa secunda	Sandberg bluegrass	Upper
LOMAT	Lomatium spp.	Desert parsley	Low-Mid
BALSA	Balsamorhiza spp.	Balsamroot	Upper
LUPIN	Lupinus spp.	Lupine	Mid-Upper

Description

Zero percent to 1% low sagebrush cover. Herbaceous cover of bunchgrasses and forbs would fill to about 15-30% within a few years.

Maximum Tree Size Class

None

Class B **14** **Mid Development 1 - Open**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ARAR8	Artemisia arbuscula	Little sagebrush	Upper
ARNO4	Artemisia nova	Black sagebrush	Upper
ARPY2	Artemisia pygmaea	Pygmy sagebrush	Upper
POSE	Poa secunda	Sandberg bluegrass	Low-Mid

Description

Scattered and usually small sagebrush are present, but perennial grasses and forbs continue to dominate visually. The general formation is that of a shrub savannah. Sagebrush cover is usually 1-5% in this stage. Only one species of dwarf sagebrush (*Artemisia arbuscula*, *Artemisia nova*, or *Artemisia pygmaea*) is usually present.

Maximum Tree Size Class

None

Class C **60** **Late Development 1 - Closed**

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ARAR8	Artemisia arbuscula	Little sagebrush	Upper
ARNO4	Artemisia nova	Black sagebrush	Upper
ARPY2	Artemisia pygmaea	Pygmy sagebrush	Upper
POSE	Poa secunda	Sandberg bluegrass	Low-Mid

Description
Sagebrush is co-dominant, with perennial grasses and forbs above ground and dominant below ground. Sagebrush and herbaceous cover are variable, depending on site productivity. Bare ground and rock in the interspaces increase as site productivity decreases. Forb cover ranges from 0-5% and grass cover from 5-20%. The general formation is that of a shrub steppe. Only one species of dwarf sagebrush (*Artemisia arbuscula*, *Artemisia nova*, or *Artemisia pygmaea*) is usually present.

Maximum Tree Size Class
None

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:OPN	55
Mid1:OPN	56	Late1:CLS	76
Late1:CLS	77	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Replacement Fire	Early1:ALL	Early1:ALL	0.0045	222	Yes	0
Wind or Weather or Stress	Early1:ALL	Early1:ALL	0.0067	149	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.0045	222	Yes	0
Wind or Weather or Stress	Mid1:OPN	Mid1:OPN	0.0067	149	No	0
Native Grazing	Mid1:OPN	Mid1:OPN	0.02	50	No	0
Replacement Fire	Late1:CLS	Early1:ALL	0.0045	222	Yes	0
Wind or Weather or Stress	Late1:CLS	Mid1:OPN	0.0067	149	Yes	0
Native Grazing	Late1:CLS	Late1:CLS	0.02	50	No	0

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