

10940

Western Great Plains Sandhill Steppe

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Shrubland

Map Zone

34

Geographic Range

This system is found in south-central areas of the Western Great Plains Division ranging from New Mexico, east across the panhandle of Texas to western Oklahoma.

Biophysical Site Description

The climate is semi-arid to arid for much of the region in which this system occurs. This system is found on somewhat excessively to excessively well-drained, deep sandy soils that are often associated with dune systems and ancient floodplains, referred to as blowing sands, deep sands, or sandy or limy breaks in the Texas panhandle.

Vegetation Description

Havard oak or shinnery oak (*Q. havardii*) is a vigorous resprouter following a fire and thus persists for long periods of time, representing the permanent cover type. Growth of resprouts following disturbance (often related to fire) within these *Q. havardii* shrublands causes a structural change, moving from early short resprouts and developing into taller shrublands to ~2-3m in height. The original version of this Biophysical Setting (BpS) indicated sand sagebrush (*Artemisia filifolia*) can be a significant component of this system but rarely achieves dominance of the canopy. During the 2017 review, one reviewer submitted this comment: “. . . there were large expanses of sandhill steppe that *have* no Havard (shinnery) oak but *contains* a near monoculture (in the shrub layer) of sand sagebrush. An example is the portion of Hemphill County Texas north of the Canadian River. There are a few small areas of Havard Oak, but I would estimate that 90%-95% of the sandhill steppe BpS in this area is represented by sand sagebrush as a dominant shrub.” The comment was included here to represent this reviewer’s opinion; however, the present tense of the comments may indicate that this is a current condition, not a historic condition. Modelers were unable to resolve this question during the 2017 review but will revisit the question in the following continuous model improvement process.

Composition can vary with geography, amount and season of precipitation, disturbance, and soil texture. Several graminoid species such as sand bluestem (*Andropogon hallii*), little bluestem (*Schizachyrium scoparium*), sand dropseed (*Sporobolus cryptandrus*), giant sandreed (*Calamovilfa gigantea*), needle-and-thread grass (*Hesperostipa comata*), and grama grass

(*Bouteloua* spp., including *hirsuta*, *gracilis*, and *curtipendula*) can be connected with this system. Other shrub species may also be present including yucca (*Yucca elata*), mesquite (*Prosopis glandulosa*), skunkbush sumac (*Rhus trilobata*), catclaw mimosa (*Mimosa biuncifera*), and Chickasaw plum (*Prunus angustifolia*). Shinnery oak occurs as extensive clones. Shinnery oak areas tend to have more diverse shrub components than nearby areas dominated by sand sagebrush.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
ARFI2	<i>Artemisia filifolia</i>	Sand sagebrush
YUEL	<i>Yucca elata</i>	Soaptree yucca
BOUTE	<i>Bouteloua</i>	Grama
QUHA3	<i>Quercus havardii</i>	Havard oak
SCSC	<i>Schizachyrium scoparium</i>	Little bluestem
CAGI3	<i>Calamovilfa gigantea</i>	Giant sandreed
SPCR	<i>Sporobolus cryptandrus</i>	Sand dropseed

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

Disturbance Description

Edaphic and climatic factors (drought and extreme winds) are the most important processes of this type. Drought and extreme winds act in a synergistic way with fire in this BpS. Once cover is removed, sand is easily eroded by the common and significant wind events. Fire does occur, especially during drought. Fires may be very patchy because of the patchy distribution of fine fuels; however, stand-replacement (>75% topkill of canopy vegetation) fires do occur. Historical grazing may have been a factor, particularly during early resprouting of the shrubs. With continuous grazing, development of fine fuels attributable to graminoid cover is reduced, and fire frequency may be controlled by the development of litter from shinnery oak leaves, which may take a minimum of 5yrs. Bison probably grazed the BpS, especially following resprouting (Class A) and was probably mediated by the productivity of surrounding prairie types.

One reviewer added about the disturbance regime: Some early explorations -- e.g., Marcy -- found diminutive oak overtopped by tall grasses. Present-day research has shown that this growth form can be temporarily brought about by fire. Given variable topography, fine fuel loading, etc., the historical shinnery landscape -- in the eastern portion of the range -- was composed of a shifting mosaic of plant community structural forms and that heterogeneity was associated with time since last fire. Whether or not you have a short or long fire interval will have a meaningful impact on what the shinnery landscape looks like.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	43	100	10	
Moderate (Mixed)				
Low (Surface)				
All Fires	43	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

This BpS can occur as small patches of 10-100s of hectares but can sometimes occupy areas as large as 1,000ha+.

Adjacency or Identification Concerns

This BpS occurs adjacent to the matrix shortgrass, mixedgrass, or tallgrass prairie, depending on soil type of the surrounding landscape and climatic conditions affecting moisture availability. It also occurs as a mosaic with grasslands occurring on similar deep sand situations (modeled separately, BpS 1148). However, the shrublands modeled for the present BpS are stable shrublands that do not transition with the grassland BpS.

Issues or Problems

In map zone (MZ) 34, the Western Great Plains Sand Prairie (BpS 1148) is treated as a separate BpS, modeled separately. There will be a class within 1148 that resembles this BpS in species composition but generally expressing an increased cover of *Artemisia filifolia* relative to the BpS modeled here and to a lesser (but still significant) extent of shrub cover.

Chemical treatment of areas (sometimes large areas) of the BpS results in at least a temporary shift toward the Western Great Plains Sand Prairie and may take decades to recover. Such treatment has occurred at numerous locations throughout the range of the BpS. Complete removal of shinnery oak (killing of entire clones) may result in a longer-term shift toward shrublands dominated by other species, such as *Rhus trilobata*, *Prunus angustifolia*, and *Artemisia filifolia*. During the 2017 review, one reviewer expressed agreement with the previous comment that a sandhill steppe dominated by sand sagebrush is also a widespread, naturally occurring condition not brought on by chemical treatment.

If drought cycles are more prolonged due to changes in weather and climate patterns, then precipitation events may be scattered but more intense, causing sheet erosion and thus decreasing soil stability and water-holding capacity for grass species.

Native Uncharacteristic Conditions

This BpS will appear on the landscape as an uncharacteristic native condition for Western Great Plains Sand Prairie (BpS1148).

Comments

One reviewer suggests: In the eastern portion of the shinnery oak range, dense shinnery resprouts following fire, but these resprouts were often soon overtopped by perennial grasses giving a more grassland-like appearance. Depending on season and frequency of burn, this community then shifted to dominance or co-dominance by shinnery within a time frame of several years. At the landscape scale, these temporary grass or grass/shrub mix communities could play an important role in providing habitat for some wildlife species (e.g., ground-nesting birds).

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	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	A	A	A	A	A	A	A	A	A	A
Shrub	0.5-1.0	B	B	B	B	B	B	B	B	B	B
Shrub	1.0-3.0	B	B	B	B	B	B	B	B	B	B
Shrub	>3.0	B	B	B	B	B	B	B	B	B	B
Tree	0-5	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	5-10	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	10-25	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	25-50	UN	UN	UN	UN	UN	UN	UN	UN	UN	UN
Tree	>50	UN	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 28 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
ARFI2	<i>Artemisia filifolia</i>	Sand sagebrush	Upper
QUHA3	<i>Quercus havardii</i>	Havard oak	Upper
YUEL	<i>Yucca elata</i>	Soaptree yucca	Upper
BOUTE	<i>Bouteloua</i>	Gramma	Upper

Description

This early development stage is characterized by early sprouting shrubs (*Quercus havardii*). In areas dominated by *Quercus havardii*, the early developmental stages will be almost completely dominated by *Q. havardii* resprouts, with some development of scattered graminoid cover. Very little fire disturbance occurs within Class A. Wind events, especially directly following a fire, will cause significant erosion and may slow the rate of succession.

During the 2017 review, one reviewer indicated that this S-class should be much shorter than the original BpS model, perhaps <5yrs, and that a mid-succession state may be needed to represent the increased grass component in the mature shrubland until it is choked out by the shrubs; this would increase fire behavior and likely the size of the fires. The current reviewer sees no evidence that sand sagebrush ever undergoes succession to shinnery oak or vice versa. Modelers were unable to resolve this suggestion with other reviewers, so no changes to the model will occur in the 2017 review. The reviewer's concerns will be revisited in the following continuous model improvement process.

Maximum Tree Size Class

None

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
QUHA3	Quercus havardii	Havard oak	Upper
ARFI2	Artemisia filifolia	Sand sagebrush	Upper
PRAN3	Prunus angustifolia	Chickasaw plum	Upper
YUEL	Yucca elata	Soaptree yucca	Upper

Description

Fire disturbance is stand-replacement (sending the system back to Class A) and is commonly wind-driven. This class is the dominant class. *Q. havardii* resprouts vigorously following a fire and thus persists for long periods of time. Succession within these *Q. havardii* shrublands manifests as a structural change, moving from early short resprouts and developing into taller shrublands to ~2-3m in height. Replacement fire sends this class back to A.

During the 2017 review, one reviewer indicated that shinnery oak only rarely is >1m.

Maximum Tree Size Class

None

Model Parameters**Deterministic Transitions**

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Late1:CLS	12
Late1:CLS	13	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	Late1:CLS	Early1:ALL	0.033	30	Yes	0

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