10800

Inter-Mountain Basins Big Sagebrush Shrubland

BpS Model/Description Version: Aug. 2020

|  |  |  |  |
| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
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| None | None | None | None |
| None | None | None | None |

Vegetation Type

Shrubland

Map Zones

13, 14

Geographic Range

This ecological system is found in eastern California and central/southern Nevada and Utah and is distinct from sagebrush steppe (Inter-Mountain Basins Big Sagebrush Steppe) found on the Columbia Plateau and in Wyoming. This Biophysical Setting (BpS) extends into map zone (MZ) 13 but at higher elevations than in central Nevada and is not a common system.

Biophysical Site Description

This widespread system is common to the Basin and Range province but much less widespread in the Mojave Desert. In elevation, it ranges from 3,000-7,000ft (>4,000ft at lower latitudes) and occurs on well-drained soils on foothills, terraces, slopes, and plateaus. It is found on soil depths >18in and up to 60in+. Elevationally, it is found between low-elevation salt desert shrub or blackbrush and mountain big sagebrush zones where pinyon and juniper can establish. Occurs from 4-14in precipitation zones, however. Thus, other site characteristics (e.g., aspect, drainage) should be considered in identifying this ecotype. At the precipitation extremes, this system generally occurs as small patches and stringers.

Vegetation Description

Shrub canopy cover generally ranges from 5-25% but can exceed 30% at the upper elevation and precipitation zones. Basin big and/or Wyoming big sagebrush sites have fewer understory species relative to other big sagebrush types. Wyoming big sagebrush is absent from many parts of MZ13, whereas basin big sagebrush is the diagnostic shrub (USDA-NRCS 2003b). Rubber rabbitbrush is co-dominant.

Perennial forb cover is usually <10%, with perennial grass cover reaching 20-25% on the more productive sites. Sandberg bluegrass (*Poa secunda*) may be a dominant species following replacement fires and as a co-dominant after 20yrs but only in precipitation zones >10in. Bottlebrush squirreltail, Indian ricegrass, James galleta, or sandy needle-and-thread grasses are common on more xeric sites. Percent cover and species richness of understory are determined by site limitations. Pinyon (generally *Pinus monophyla*) and juniper (generally *Juniper osteosperma*) are present, occasionally reaching 50% canopy cover in areas that have escaped fire.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ARTR2 | *Artemisia tridentata* | Big sagebrush |
| CHVI8 | *Chrysothamnus viscidiflorus* | Yellow rabbitbrush |
| ACHY | *Achnatherum hymenoides* | Indian ricegrass |
| HECO26 | *Hesperostipa comata* | Needle and thread |
| ATCO | *Atriplex confertifolia* | Shadscale saltbush |
| ELELE | *Elymus elymoides ssp. elymoides* | Squirreltail |
| POSE | *Poa secunda* | Sandberg bluegrass |
| PLJA | *Pleuraphis jamesii* | James' galleta |

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

Disturbance Description

This ecological system is characterized by replacement fires. Fires are more continuous as shrub or herb cover increases. Where pinyon or juniper has encroached after 100yrs without fire, mean fire return interval of fire replacement increases. Reduced shrub cover associated with more xeric sites pushes fire return interval to longer periods.

Weather stress: Prolonged drought on the more xeric sites will reduce woody cover.

Herbivory (non-insect): Herbivory can remove the fine fuels that support mixed-severity fires and result in woody fuel build up that leads to severe replacement fires.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 109 | 100 | 30 | 200 |
| Moderate (Mixed) |  |  |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 109 | 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 occupies small areas (<1,000ac). Historic disturbance (fire) likely ranged from small (<10ac) to moderate (<1,000ac) depending on conditions, time since last ignition, and fuel loading. The average fire patch size is assumed to be 100ac.

Adjacency or Identification Concerns

This community may be adjacent to mountain big sagebrush at elevations >6,500ft or adjacent to pinyon-juniper and ponderosa pine at mid- to high elevations and salt desert shrub and blackbrush at low elevations. Low sagebrush or black sagebrush (BpS 1079) may form large islands within this community where soils are shallow or have root-restrictive layers. Black sagebrush is very common in the Desert National Wildlife Refuge and forms matrix communities.

Post-settlement conversion to red brome with cheatgrass is common and results in change in fire frequency and vegetation dynamics. Fire suppression can lead to pinyon-juniper encroachment with subsequent loss of shrub and herbaceous understory. Disturbance of this community may result in establishment of annual grasslands (e.g., red brome) and/or noxious weeds. Lack of disturbance can result in pinyon-juniper encroachment where adjacent to pinyon-juniper woodlands.

Post-settlement issues center on the high amount of big sagebrush with minimal to no understory and whether these decadent stands are related to fire exclusion, historic livestock overgrazing, or natural physiological/ecological progression.

Issues or Problems

There is uncertainty about whether or not Wyoming big sagebrush is present at all in MZ13. NRCS considers Wyoming big sagebrush absent from the Mojave Desert, whereas a recent flora for the Desert National Wildlife Refuge describes Wyoming big sagebrush as the only big sagebrush subspecies. While recognizing the difficulty of identifying big sagebrush species, Dr. Wes Niles from University of Nevada, Las Vegas (wniles@ccmail.nevada.edu, personal communication) confirmed that all his Mojave Desert herbarium specimens, including those from the Desert National Wildlife Refuge, are basin big sagebrush. Similarly, older flora for the Spring Mountains National Recreation Area describes basin big sagebrush, not Wyoming big sagebrush. The problem with the absence of Wyoming big sagebrush is that basin big sagebrush looks like Wyoming big sagebrush and occupies what appears to be "classic" Wyoming big sagebrush sites as seen in the Great Basin.

There are no data, although abundant opinions, for the percentage of replacement and mixed-severity fires, especially during mid-development, or whether non-replacement fires occurred at all during early development under reference (pre-settlement) condition.

NOTE regarding depleted sagebrush: Late seral stage was not modeled as it was identified that sagebrush depletion rate is much slower than the rate of juniper invasion. Further, sagebrush systems are unable to exclude grass/forb so they can maintain fire, which can move the system back to earlier classes

Native Uncharacteristic Conditions

Shrub cover >50% is uncharacteristic. Tree cover >50% is uncharacteristic.

Comments

Alan Sands reviewed this BpS in 2017 and generally agreed with the model and description. One area of disagreement was that he felt that the surface and mixed-severity fire transitions should be removed from the model. Kori Blankenship reevaluated the use of non-replacement severity fire and decided to change the Early to Early surface fire and Mid Open to Mid Open mixed fire to replacement severity fires to comply with LANDFIRE fire severity definitions. LANDFIRE defines replacement severity fire as a fire that top-kills >75% of the upper-layer lifeform. Because the dominant shrub species in this BpS are generally top-killed by fire (Tirmenstein 1999a; Tirmenstein 1999b; Simonin 2001), Blankenship assumed that the modelers used surface and mixed fire in grass and shrub succession classes to represent very patchy fires. But because where fire occurred it probably top-killed most plants, it met LANDFIRE’s replacement fire criteria. MZs 13 and 14 were combined during 2015 BpS Review.

During the BpS Review in 2017, this model was part of a “macro-review” where all models representing this BpS were reviewed and evaluated relative to one another. One goal of the review was to check for logical consistency between the models. Outstanding questions from this review that should be evaluated in the future include:

* Has LANDFIRE appropriately identified and classified the big sage shrubland (BpS 10800) relative to big sage steppe (BpS 11250)? In his system-wide review of these BpSs, Alan Sands indicated that what was mapped and modeled as Big Sage Shrubland should be Big Sage Steppe in the following MZs: 10, 19, 21, 22, 31, and 33. Kori Blankenship consulted NatureServe range maps to evaluate this suggestion and found that they reported Big Sage Shrubland occurring in all these zones. Blankenship felt that more input was needed from local ecologists and NatureServe on the distribution of the types and the distinctions between them before changing the classification. This suggestion should be considered in future review.
* What is an appropriate fire frequency and severity for this BpS? Estimates for these fire regime parameters vary widely, and during LANDFIRE National, there was considerable debate about these values in some areas (see 10801-21-22-28 and 10802-21-22-28).
* Does the Wyoming big sagebrush versus basin big sagebrush split applied in the model representing MZs 21, 22, and 28 apply elsewhere, and can it be successfully mapped from 30m imagery? Descriptions for this BpS in some other zones indicated a need for distinct BpS models and mapping units for the different big sagebrush subspecies, but questions arose about the ability to map the distinctions from satellite imagery.
* Does the upland verss semi-desert split applied in the model representing MZs 06, 12, 15, 16, 17, 18, 23, 24, and 25 apply elsewhere? The split helps distinguish differences in species, fire frequency, and management options for sites on upland soils that receive enough precipitation to support trees from semi-desert sites that cannot.

The first three development classes chosen for this ecological system correspond to the early, mid-, and late seral stages familiar to range ecologists. The two classes with conifer invasion (classes D and E) approximately correspond to Miller and Tausch's (2001) phases 2 and 3 of pinyon and juniper invasion into shrublands. Prolonged drought in the model was estimated at occurring 1 in 50yrs (20-30yr Pacific cycle modified by 7yr El Nino/El Nina cycle).

BpS 131080 is based on BpS 1080 from MZs 12 and 17 with modifications for species composition, smaller spatial scale, disturbances, and geographic range. Wyoming big sagebrush is uncommon to absent in many parts of the Mojave Desert mountain ranges, whereas basin big sagebrush is the dominant shrub for BpS 131080. Model was changed because defoliation by Aroga moth and prolonged flooding were removed, and the drought cycle was shortened from 100 to 50yrs to reflect the different climate cycles of the Mojave Desert compared to the Great Basin.

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 | UN | UN | UN | UN | UN | UN |
| Herb | 0.5-1.0 | A | A | A | A | UN | UN | UN | UN | UN | UN |
| Herb | >1.0 | A | A | A | A | UN | UN | UN | UN | UN | UN |
| Shrub | 0-0.5 | A | B | C | C | C | UN | UN | UN | UN | UN |
| Shrub | 0.5-1.0 | A | B | C | C | C | UN | UN | UN | UN | UN |
| Shrub | 1.0-3.0 | B | B | C | C | C | UN | UN | UN | UN | UN |
| Shrub | >3.0 | B | B | C | C | C | UN | UN | UN | UN | UN |
| Tree | 0-5 | D | D | E | E | E | UN | UN | UN | UN | UN |
| Tree | 5-10 | D | D | E | E | E | 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 15 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACHY | Achnatherum hymenoides | Indian ricegrass | Upper |
| HECOC8 | Hesperostipa comata ssp. comata | Needle and thread | Upper |
| CHVI8 | Chrysothamnus viscidiflorus | Yellow rabbitbrush | Upper |
| ARTR2 | Artemisia tridentata | Big sagebrush | Upper |

Description

Post-replacement disturbance; dominated by grasses and forbs, with scattered shrubs representing <10% upper canopy cover. Shrubs are between 0-1m. Fuel loading discontinuous.

*Maximum Tree Size Class*  
None

Class B 46 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ARTR2 | Artemisia tridentata | Big sagebrush | Upper |
| ACHY | Achnatherum hymenoides | Indian ricegrass | Lower |
| CHVI8 | Chrysothamnus viscidiflorus | Yellow rabbitbrush | Mid-Upper |
| HECO26 | Hesperostipa comata | Needle and thread | Lower |

Description

Shrubs and herbaceous vegetation can be co-dominant; fine fuels bridge the woody fuels, but fuel discontinuities are possible.

*Maximum Tree Size Class*  
None

Class C 27 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ARTR2 | Artemisia tridentata | Big sagebrush | Upper |
| CHVI8 | Chrysothamnus viscidiflorus | Yellow rabbitbrush | Mid-Upper |
| ELEL5 | Elymus elymoides | Squirreltail | Lower |
| HECO26 | Hesperostipa comata | Needle and thread | Lower |

Description

Shrubs dominate the landscape; fuel loading is primarily woody vegetation. Shrub density sufficient in old stands to carry the fire without fine fuels. Establishment of pinyon and juniper seedlings and saplings widely scattered. Prolonged drought can thin shrubs.

*Maximum Tree Size Class*  
None

Class D 9 Late Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| JUNIP | Juniperus | Juniper | Upper |
| PIMO | Pinus monophylla | Singleleaf pinyon | Upper |
| ARTR2 | Artemisia tridentata | Big sagebrush | Mid-Upper |
| HECO26 | Hesperostipa comata | Needle and thread | None |

Description

Pinyon-juniper encroachment where disturbance has not occurred for at least 100yrs (tree species cover <15%). Shrubs may still represent the dominant lifeform (<25% cover), with pinyon and juniper saplings common. Sagebrush cover and herbaceous cover decreasing compared to Class C. Prolonged drought thins both trees and shrubs.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5" DBH

Class E 3 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| JUNIP | Juniperus | Juniper | Upper |
| PIMO | Pinus monophylla | Singleleaf pinyon | Upper |
| SYOR | Symphoricarpos orbiculatus | Coralberry | Lower |
| HECO26 | Hesperostipa comata | Needle and thread | Lower |

Description

Shrubland encroached with mature pinyon and/or juniper (cover 16-90%) where disturbance does not occur for some time in Class D. Shrub cover <10% and graminoids scattered. Prolonged drought thins trees.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:OPN | 19 |
| Mid1:OPN | 20 | Mid1:CLS | 59 |
| Mid1:CLS | 60 | Late1:OPN | 99 |
| Late1:OPN | 100 | Late1:CLS | 149 |
| Late1:CLS | 150 | 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 | 0.005 | 200 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Mid1:OPN | 0.002 | 500 | No | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.008 | 125 | Yes | 0 |
| Insects or Disease | Mid1:CLS | Mid1:OPN | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Mid1:CLS | Mid1:OPN | 0.02 | 50 | Yes | 0 |
| Insects or Disease | Late1:OPN | Mid1:CLS | 0.001 | 1000 | Yes | 0 |
| Replacement Fire | Late1:OPN | Early1:ALL | 0.0083 | 120 | Yes | 0 |
| Wind or Weather or Stress | Late1:OPN | Mid1:CLS | 0.02 | 50 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.008 | 125 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:OPN | 0.02 | 50 | Yes | 0 |

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