11260

Inter-Mountain Basins Montane Sagebrush Steppe

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Vegetation Type

Steppe/Savanna

Map Zones

6, 12, 17, 18, 28

Geographic Range

Montane and subalpine elevations across the western United States from 1,000m in eastern Oregon and Washington to over 3,000m in the Southern Rockies, and within the mountains of Nevada, western Utah, southeast Wyoming and southern Idaho. This model applies to an area centered on the Central Basin and Range ecoregion (US EPA 2013).

Biophysical Site Description

This ecological system occurs in many of the western United States, usually at middle elevations (1,000-2,500m). Within the Great Basin mapping zone, elevation ranges from 1,370m in Idaho to 3,200m in the White Mountains of California (Winward and Tisdale 1977, Blaisdell et al. 1982, Cronquist et al. 1994, Miller and Eddleman 2000). However, elevations are predominantly between 1,525-2,750m in the mountains of Nevada and western Utah. The climate regime is cool, semi-arid to sub-humid, with precipitation ranging from 25-90cm/year (Mueggler and Stewart 1980, Tart 1996). Much of this precipitation falls as snow. Temperatures are continental with large annual and diurnal variation. In general, this system shows an affinity for mild topography, fine soils, and some source of subsurface moisture. Soils generally are moderately deep to deep, well-drained, and of loam, sandy loam, clay loam, or gravelly loam textural classes; soils often have a substantial volume of coarse fragments and are derived from a variety of parent materials. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops and mountain slopes. Soils are typically deep and have well developed dark organic surface horizons (Hironaka et al. 1983, Tart 1996). However, at the high ends of its precipitation and elevation, ranges mountain big sagebrush occurs on shallow and/or rocky soils. All aspects are represented, but the higher elevation occurrences may be restricted to south or west-facing slopes.

At lower elevations, mountain big sagebrush occurs on upper fan piedmonts, where it typically intermixes with Wyoming big sagebrush on north facing slopes. On mountain sideslopes at this elevation, it occurs on north-facing slopes. Where pinyon and juniper are present, it is usually on south-facing slopes with pinyon and juniper generally increasing on north-facing slopes within the sagebrush community. At mid-level elevations, mountain sagebrush begins to move into more southerly slopes intermingling with black sagebrush and low sagebrush and with mountain mahogany occurring on north-facing slopes. With continued elevation gain, curlleaf mountain mahogany generally crowds it out. Mountain big sagebrush then occupies drier sites at higher elevations.

Vegetation Description

Vegetation types within this ecological system are usually <1.5m tall and dominated by *Artemisia tridentata* ssp. *vaseyana*, *Artemisia cana ssp. viscidula* or *Artemisia tridentata* ssp. *spiciformis*. A variety of other shrubs can be found in some occurrences, but these are seldom dominant. They include *Artemisia rigida, Artemisia arbuscula, Ericameria nauseosa, Chrysothamnus viscidiflorus, Ephedra viscidiflorus, Symphoricarpos oreophilus, Purshia tridentata, Peraphyllum ramosissimum, Ribes cereum*, and *Amelanchier alnifolia*. The canopy cover is usually between 20-80%.

The herbaceous layer is usually well-represented, but bare ground may be common in particularly arid or disturbed occurrences. Graminoids that can be abundant include *Festuca idahoensis, Festuca thurberi, Festuca ovina, Elymus elymoides, Deschampsia caespitosa, Danthonia intermedia, Danthonia parryi, Stipa spp, Pascopyrum smithii, Bromus carinatus, Elymus trachycaulus, Koeleria macrantha, Pseudoroegneria spicata, Bromus anomalus, Achnatherum therburianum, Poa fendleriana,* or *Poa secunda*. Forbs are often numerous and an important indicator of health. Forb species may include *Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus, Eriogonum, Balsamorhiza sagittata, Achillea millefolium, Antennaria rosea, Eriogonum umbellatum, Fragaria virginiana, Artemisia ludoviciana, Hymenoxys hoopesii* (=*Helenium hoopesii*), etcetera. Mueggler and Stewart (1980), Hironaka et al. (1983) and Tart (1996) described several of these types.

This ecological system is critical summer habitat for greater sage grouse. Moreover, resprouting bitterbrush in mountain big sagebrush types is potentially important to wildlife in early stand development.

BpS Dominant and Indicator Species

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

Disturbance Description

Mean fire return intervals (MFRI) in and recovery times of mountain big sagebrush have been subjects of lively debate in recent years (Welch and Criddle 2003). Mountain big sagebrush communities were historically subject to stand-replacing fires, with a MFRI ranging from 40yrs+ at the Wyoming big sagebrush ecotone, and up to 80yrs in areas with a higher proportion of low sagebrush in the landscape (Crawford et al. 2004, Johnson 2000, Miller and Rose 1999, Burkhardt and Tisdale 1969 and 1976, Houston 1973, Miller and Rose 1995, Miller et al. 2000). Under pre-settlement conditions, mosaic burns generally exceeded 75% topkill due to the relatively continuous herbaceous layer. Brown (1982) reported that fire ignition and spread in big sagebrush is largely (90%) a function of herbaceous cover. These communities were also subject to periodic mortality due to insects, disease, rodent outbreaks, drought and winterkill (Anderson and Inouye 2001, Winward 2004). Periodic mortality events may result in either stand-replacement or patchy die-off depending on the spatial extent and distribution of these generally rare (50-100yrs) events.

Recovery rates for shrub canopy cover vary widely in this type, depending on post-fire weather conditions, sagebrush seed-bank survival, abundance of resprouting shrubs (e.g., snowberry, bitterbrush), and size and severity of the burn. Mountain big sagebrush typically reaches 5% canopy cover in 8-14yrs. This may take as little as 4yrs under favorable conditions and longer than 25yrs in unfavorable situations (Pedersen et al. 2003, Miller unpublished data). Mountain big sagebrush typically reaches 25% canopy cover in about 25yrs, but this may take as few as 9 years or longer than 40yrs (Winward 1991, Pedersen et al. 2003, Miller unpublished data). Mountain snowberry and resprouting forms of bitterbrush may return to pre-burn cover values in a few years. Bitterbrush plants <50yrs old are more likely to resprout than older plants (Simon 1990).

Fire Frequency

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 type occupies areas ranging in size from 10s-10,000s of acres. Disturbance patch size can also range from 10s-1,000s of acres. The distribution of past burns was assumed to consist of many small patches in the landscape.

Adjacency or Identification Concerns

For map zones (MZ)s 12 and 17, mountain big sagebrush communities fall into this model (biophysical setting [BpS] 1126), while mountain low sagebrush communities fall into the Columbia Plateau Low Sagebrush Steppe BpS (1124). In MZ16, BpS 1126 was separated into two very distinct montane sagebrush steppe systems not distinguished by NatureServe: Inter-Mountain Basins Montane Sagebrush Steppe dominated by mountain big sagebrush (11261) and Inter-Mountain Basins Montane Sagebrush Steppe dominated by low sagebrush (12262). Both systems cover large high-elevation areas in the Intermountain West. Mountain big sagebrush is a tall shrub with an MFRI from 10-70yrs, whereas high-elevation low sagebrush is a dwarf shrub with an MFRI of 200yrs+.

The NatureServe description does not distinguish between mountain big sagebrush that can be invaded by conifers at mid to high elevations (i.e., within the tolerance of pinyon and juniper) and mountain sagebrush steppe that is in an elevation too high for pinyon to encroach. The ability for pinyon to invade has a large effect on the predicted historical range of variability and management.

This type may be adjacent to forests dominated by aspen, Douglas-fir, limber pine, and bristlecone pine. It also occurs adjacent to pinyon-juniper woodlands. The ecological system, where adjacent to conifers, is readily invaded by conifers (Douglas-fir, sub-alpine fir, whitebark pine, limber pine, pinyon-pine and juniper spp.) in the absence of historic fire regimes (Miller and Rose 1999). This type probably served as an ignition source for adjacent aspen stands. Mountain big sagebrush is commonly found adjacent to or intermingled with low sagebrush and mountain shrublands.

At lower elevational limits on southern exposures there is a high potential for cheatgrass invasion/occupancy where the native herbaceous layer is depleted. This post-settlement, uncharacteristic condition is not considered here.

Issues or Problems

This was initially 11261 (Mountain Big Sagebrush) model from MZ16, which was itself based on Rapid Assessment models R2SBMT and R2SBMTwc where the reviewers and modelers had very different opinions on the range of MFRIs and mountain big sagebrush recovery times (see Welch and Criddle 2003). It is increasingly agreed upon that a MFRI of 20yrs, which used to be the accepted norm, is simply too frequent to sustain populations of greater sage grouse and mountain big sagebrush ecosystems whose recovery time varies from 10-70yrs. Reviewers consistently suggested longer FRIs and recovery times. The revised model is a compromise with longer recovery times and FRIs. Modeler and reviewers also disagreed on the choice of fire regime group: high frequency, high severity (modeler) vs. moderate frequency, high severity (reviewers). For MZs 12 and 17, modelers place this system in the moderate frequency, high severity fire regime group.

If conifers are not adjacent to this system, such as in the Tuscarora range, Santa Rose range, and similar regions, use a three-box model with the following percentages per box: 20% A, 45% B, 35% C.

Native Uncharacteristic Conditions

Uncharacteristic conditions in this type include herbaceous canopy cover <40% and dominance of the herbaceous layer by mulesears (*Wyethia amplexcaulis*) on clayey soils.

Comments

The first three development classes chosen for this BpS 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.

MZs 06, 12, 17, 18, and 28 were combined during BpS Review in 2017. S-class rules from MZ 06 were used in the combined description because they were corrected to comply with LANDFIRE rules.

During LANDFIRE National review, a model was not created for MZ33, so it was lumped with the MZ06 et al. group. During the 2017 BpS review, Sands suggested that MZ33 did not fit with the MZ06 et al. model, which is centered on the Central Basin and Range ecoregion (US EPA 2013), because of its location on the plains where it is subject to different moisture patterns (e.g. more growing season precipitation). As a result of this review, Kori Blankenship lumped MZ33 with MZ29, which is primarily within a prairie ecoregion (US EPA 2013, Level 2, West-Central, Semi-Arid Prairie). It is unclear whether MZ28 belongs with the MZ06 et al. group, but because modelers in MZ28 specifically chose to use the MZ06 et al. model, Blankenship made no changes. Future review should reevaluate the best representative model for MZs28 and 33, including the possibility that a new model may be needed for these geographies. During the 2017 BpS review, one reviewer suggested that MZ18 be included with the MZ01 et al. model, while another suggested that it belonged with the MZ06 et al. model. Blankenship decided to lump MZ18 with MZ06 et al. because they had identical models. In the future, a finer level spilt of MZ 18 could be considered: the northern part of MZ18, which falls within the Snake River Plain ecoregion (US EPA 2013), could be lumped with MZ01 et al., and the southern part, within the Northern Basin and Range ecoregion, could be lumped with MZ06 et al.

During the 2017 BpS review, 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:

-Should all models for this BpS include a tree succession class? The current model set includes models that have tree succession classes and those that do not. The models representing MZ06 et al. and MZ13 note that the Ecological Systems classification does not distinguish between mid- to high-elevation mountain big sagebrush communities that can be invaded by conifers and those at elevations too high for tree encroachment. The MZ06 et al. description also notes that where tree encroachment is impossible a three-box model (i.e., this model without tree classes D and E) should be used. Sands, during the 2017 BpS review, suggested that all models for this BpS include a tree succession class.

-Does the low sagebrush vs. mountain big sagebrush split applied in the model representing MZs16, 23 and 24 apply elsewhere? This split was implemented by modelers to allow low sagebrush communities to have a much lower fire frequency than mountain big sagebrush communities. MZ06 et al. notes that mountain low sagebrush communities should be classified as Columbia Plateau Low Sagebrush Steppe **(**BpS 1124). MZ13 notes that extensive areas of low/black sagebrush should be considered Great Basin Xeric Mixed Sagebrush Shrubland (BpS 1079).

-What is an appropriate fire frequency and severity for this BpS? Estimates for these fire regime parameters vary widely (see Innes 2017), and during LANDFIRE National there was considerable debate about these values in some areas (see LANDIFRE z21 description for this BpS).

Succession Classes

**Mapping Rules**

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 22 Early Development 1 - Open

Indicator Species

Description

Herbaceous vegetation is the dominant lifeform. Herbaceous cover is variable but typically >50% (50-80%). Shrub cover is 0-5%, height 0-.5 meters tall.

*Maximum Tree Size Class*  
None

Class B 48 Mid Development 1 - Open

Indicator Species

Description

Shrubs are the dominant lifeform. Mountain big sagebrush cover up to 20%. Herbaceous cover is typically >50%. Initiation of conifer seedling establishment. Conifer species vary depending on adjacent tree communities.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class C 13 Late Development 1 - Closed

Indicator Species

Description

Shrubs are the dominant lifeform. Herbaceous cover is typically <50%. Conifer (juniper, pinyon-juniper, ponderosa pine or white fir) cover <10%.

*Maximum Tree Size Class*  
None

Class D 11 Late Development 1 - Open

Indicator Species

Description

Conifers are the upper lifeform (juniper, pinyon-juniper, ponderosa pine, limber pine or white fir). Shrub cover generally less than mid-development classes, but remains between 26-40%. Herbaceous cover <30%. Insects/diseases thin the sagebrush, but not the conifers.

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

Class E 6 Late Development 2 - Closed

Indicator Species

Description

Conifers are the dominant lifeform (juniper, pinyon-juniper, ponderosa pine, limber pine, or white fir). Conifer cover ranges from 26-80% (pinyon-juniper 36-80% (Miller and Tausch 2001), juniper 26-40% (Miller and Rose 1999), white fir 26-80%). Shrub cover 0-20%. Herbaceous cover <20%. Conifers are susceptible to insects/diseases that cause diebacks.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Model Parameters

Deterministic Transitions

Probabilistic Transitions

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