

LANDFIRE Biophysical Setting Model

Biophysical Setting 0911260

Inter-Mountain Basins Montane Sagebrush Steppe

- ☐ This BPS is lumped with:
☐ This BPS is split into multiple models:

General Information

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Vegetation Type	Dominant Species	Map Zone	Model Zone	
Upland Savannah/Shrub Steppe	ARTRV ARTR4	9	☐ Alaska ☐ California ☐ Great Basin ☐ Great Lakes ☐ Hawaii ☐ Northeast	☐ Northern Plains ☐ N-Cent.Rockies ☒ Pacific Northwest ☐ South Central ☐ Southeast ☐ S. Appalachians ☐ Southwest

General Model Sources

☒ Literature ☐ Local Data ☒ Expert Estimate	PUTR2 CHRY9 PSSP6 FEID ACNE9 POSE
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Geographic Range

This type occurs in eastern OR.

Biophysical Site Description

Montane sagebrush steppe consists of three intermingled tall shrub communities: mountain big sagebrush, threetip sagebrush and mountain shrub. Of these, mountain big sagebrush is the principal community type.

Mountain big sagebrush occurs in the cooler, moister portion of the sagebrush zone with elevation ranges from 3500-9000ft on Steens Mountain. However, this community type is most prevalent between 5000-7000ft elevation.

Threetip sagebrush is intermingled with the mountain big sagebrush community at lower elevations, growing in pockets of moister soils at 3300-7000ft elevation. At higher elevations, the mountain shrub community intermingles with the mountain big sagebrush community.

Mean annual precipitation is typically between 14-22in, but ranges from 10-30in (Mueggler and Stewart 1980, Tart 1996).

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Mountain big sagebrush mostly occupies moist, productive rolling upland sites. Soils are typically moderately deep to deep, well-drained 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. Mountain big sagebrush is typically found where winter snows melt late and summer moisture occurs.

Threetip sagebrush typically occurs on shallower soils than mountain big sagebrush, but soils still tend to be moderate to deep, well-drained and loamy to sandy loam soils (Tirmenstien 1999).

Vegetation Description

Mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*) is the dominant shrub in the montane sagebrush steppe. At higher elevations mountain big sagebrush, while still dominant, becomes mixed with a variety of sprouting species such as antelope bitterbrush, rabbitbrush, serviceberry and mountain snowberry. At lower elevations, mountain big sagebrush may be intermingled with pockets of threetip sagebrush.

Dominant graminoids include Idaho fescue, bluebunch wheatgrass, Columbia needlegrass and Sandberg's bluegrass. Common forbs may include sulphur buckwheat, pussytoes, lupine, phlox, arrowleaf balsamroot, prairie smoke, yarrow and sticky geranium.

Threetip sagebrush can resprout following fire, with the resprouting ability apparently increasing towards the northern part of the species range (Tirmenstien 1999). Threetip sagebrush tends to be more evenly distributed over a site than mountain big sagebrush or the mountain shrubs.

Disturbance Description

This biophysical setting is subject to stand replacing fires historically with a mean return interval ranging from 10yrs at the ponderosa pine ecotone to 40yrs at the Wyoming big sagebrush ecotone (Crawford et al. 2004, Johnson 2000, Miller et al. 1994, Burkhardt and Tisdale 1969 and 1976, Houston 1973, Miller and Rose 1995, Miller et al. 2000). Under presettlement conditions mosaic burns generally exceeded 75% topkill due to the relatively continuous herbaceous layer. The mosaic burn pattern is largely a function of fires of 100-5000ac in size, creating several age classes across the larger landscape that shifted from place to place. Brown (1982) reported that fire ignition and spread in big sagebrush is largely (90%) a function of herbaceous cover. Montane sagebrush communities are also subject to periodic mortality due to insects, diseases, winter kill, rodent outbreaks and drought (McArthur 1983, Anderson and Inouye 2001). These disturbances in combination may have significantly reduced the cover of dense stands about every 50-100yrs.

Recovery rates for shrub canopy cover vary widely in this type, depending on post fire weather conditions, abundance of resprouting shrubs, and size and severity of the burn. Mountain big sagebrush typically reaches 5% canopy cover in 8-14yrs. This may take as little as four years 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 nine 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 less than fifty years old are more likely to resprout than older plants (Simon 1990).

Adjacency or Identification Concerns

This type may be adjacent to forests dominated by aspen, ponderosa pine, or lodgepole pine and juniper and mountain-mahogany woodlands. At the lower elevation, dry end of the type, this type could be confused

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with Inter-Mountain Basins Big Sagebrush Steppe.

The montane sagebrush type often has scattered trees intermixed at the ecotone with forests and woodlands, but not enough to warrant development of a different BpS. Tree cover does not exceed 10%. Greater tree cover would indicate an uncharacteristic condition within this type. This uncharacteristic type could be confused with juniper woodland or open ponderosa pine.

Other uncharacteristic conditions in this type include herbaceous canopy cover <40% and dominance of western juniper on deep soils. Dominance by knapweeds and other perennial invasive plants may be another uncharacteristic condition just beginning to appear in the Pacific Northwest modeling area. Cheatgrass appears to be increasing as well.

This BpS lies adjacent to a wide variety of other BpSs (too numerous to list).

Native Uncharacteristic Conditions

Greater than 10% tree cover indicates an uncharacteristic type if the trees are juniper or a change to a different BpS if the trees are ponderosa pine or Douglas-fir.

Columbia Plateau Low Sagebrush Steppe is intermingled with this BpS, but occurs on shallow soils as opposed to deep soils.

Scale Description

This type occupies areas ranging in size from 100s to 10,000's of acres. Disturbance patch size can range from 100s to 1,000's of acres.

Issues/Problems

There has been discussion of how to treat the ecotone between montane sagebrush steppe and adjacent woodlands and forests. There is need to clearly describe the dynamics of pine and Douglas-fir encroachment into mountain big sagebrush from locations where mountain big sagebrush is an understory component in ponderosa or lodgepole pine or Douglas-fir.

Western juniper encroachment is a major concern in this BpS due to fire exclusion. Encroachment in some locations is so extensive that areas formerly Montane Sagebrush Steppe may be mapped as juniper woodland. Loss of the understory on steeper south and west-facing slopes is also resulting in significant erosion and decreases in site potential. Restoration problems in these areas are approaching insurmountable.

Comments

Additional Modeler: Rod Clausnitzer - rclausnitzer@fs.fed.us.

Peer reviewers commented that three-tip sagebrush occurs in the northeastern portion of MZ09, and is unknown in the south. Two other sagebrush species with limited distribution may be included in this description. Subalpine big sagebrush (*Artemisia tridentata* ssp. *spiciformis*) occurs at higher elevations (7000ft). Xeric big sagebrush (*A. tridentata* ssp. *xericensis*) occurs in the northeastern portions of MZ09, mainly in ID.

The primary successional pathway is from A to C to D. Alternative successional pathways are created when sprouting shrubs are an important component of the overall type or where at least two fire return

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intervals are missed. In class A, the missed interval is expressed as a probability, essentially that two percent of the pixels move into a closed state. In class B the probability is that one percent of the pixels move into a closed condition.

The cool sagebrush system tends to move to class B from class A and C when sprouting shrubs are especially important. Movement from class A to class B results when the sprouting shrub component is greater than the mountain big sagebrush component. Movement from class C to class B results when the sprouting shrub component is about equal to the mountain big sagebrush component or when at least two fire return intervals are skipped. Movement from class A to class C occurs when the mountain big sagebrush component is greater than the sprouting shrub component and where the herbaceous understory responds well to fire. Movement from class D to class E occurs when at least two fire return intervals are missed.

Vegetation Classes

Class A 20 %

Early Development 1 All Structure

Upper Layer Lifeform

- ☒ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

1

Indicator Species and Canopy Position

FEID
 Mid-Upper
 PSSP6
 Upper
 ACNE9
 Mid-Upper
 LUPIN
 Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	70 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Shrub canopy cover is 0-5%. Herbaceous canopy cover is variable but typically >50%. Apparent dominance of sprouting shrubs at the upper elevations and possibly threetip sagebrush at the lower elevations. Typically present for approximately five years post-fire.

Succession to class C after five years. Replacement fire (MFRI=20years) resets. AltSuccession (see comments above; annual probability 0.02) causes transition to class B.

Class B 15 %

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Fuel Model

6

Indicator Species and Canopy Position

CHRY9
 Upper
 SYOR2
 Upper
 FEID
 Middle
 ARTRV
 Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	60 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Shrub canopy cover is >20%. Herbaceous cover is still moderately high but may be as low as 20% Mountain big sagebrush may be dominant or sprouting shrubs may be more dominant in the shrub layer. Plants have little or no dead crown.

Approximate age range 5-65yrs. Succession to class E at age 65yrs. Replacement fire (MFRI=20yrs) resets to

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class A.

Class C 35 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Fuel Model

2

Indicator Species and Canopy Position

CHRS9

Upper

SYOR2

Upper

ARTRV

Upper

PSSP6

Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	20 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

- ☒ Upper layer lifeform differs from dominant lifeform.

Dominant lifeform is herb. Min canopy closure = 30%; max canopy closure = 70%.
Min height = 0.5m; max height = 1.0m.

Description

Shrub canopy cover is 6-20%. Herbaceous canopy cover is typically >50%. Sprouting shrubs may be more apparent where intermingled with mountain shrub or threetip sagebrush. Mountain big sagebrush is scattered throughout. Formation is sagebrush savannah.

Succession to class D after 15yrs. Replacement fire (MFRI= 20yrs) resets to class A. Alternate succession (annual probability = 0.01) to class B. After 40yrs with no fire, the stand will transition to class B.

Class D 20 %

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Fuel Model

2

Indicator Species and Canopy Position

ARTRV

Upper

ARTR4

Upper

SYOR2

Upper

PSSP6

Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	30 %
Height	Shrub 0.6m	Shrub 3.0m
Tree Size Class	None	

- ☒ Upper layer lifeform differs from dominant lifeform.

Dominant lifeform is herb. Min canopy closure = 30%; max canopy closure = 70%.
Min height = 0.5m; max height = 1.0m.

Description

Shrub canopy cover is 20-30% with mountain big sagebrush dominant. Species such as snowberry, rabbitbrush, and serviceberry may be present in groups. Mature mountain big sagebrush and threetip sagebrush, where it occurs, are widespread. Plants have noticeable dead material in the crowns. Herbaceous cover is moderate to high, typically ranging from 30-50%. Formation is sagebrush steppe.

Age range about 20-65yrs, after which there is succession to class E. Replacement fire (MFRI=20yrs) resets to class A. After 40yrs without fire, the stand will transition to class E.

Class E 10 %

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Fuel Model

4

Indicator Species and Canopy Position

ARTRV

Upper

ARTR4

Upper

SYOR2

Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	60 %
Height	Shrub 0.6m	Shrub 3.0m
Tree Size Class	None	

- ☐ Upper layer lifeform differs from dominant lifeform.

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AMAL

Description

Upper

Shrub canopy cover >20% with mountain big sagebrush dominant. Dead shrubs, either sagebrush or other species, may be present and crowns of living shrubs contain a significant proportion of dead material in their crowns. Herbaceous cover is <30%.

Age greater than about 65yrs. Replacement fire (MFRI=20yrs) resets to class A. Either insect/disease or wind/weather/stress (annual probability 0.026; about once every 40yrs) have the same chance to occur and cause a transition to class D.

Disturbances

Fire Regime Group:** II

Historical Fire Size (acres)

Avg

Min

Max

Sources of Fire Regime Data

- ☒ Literature
☐ Local Data
☒ Expert Estimate

Additional Disturbances Modeled

- ☒ Insects/Disease ☐ Native Grazing ☐ Other (optional 1)
☒ Wind/Weather/Stress ☐ Competition ☐ Other (optional 2)

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	20	10	40	0.05	100
Mixed					
Surface					
All Fires	20			0.05002	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

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