

## Rapid Assessment Reference Condition Model

The Rapid Assessment is a component of the LANDFIRE project. Reference condition models for the Rapid Assessment were created through a series of expert workshops and a peer-review process in 2004 and 2005. For more information, please visit [www.landfire.gov](http://www.landfire.gov). Please direct questions to [helpdesk@landfire.gov](mailto:helpdesk@landfire.gov).

### Potential Natural Vegetation Group (PNVG)

**R#SBMT** Mountain Big Sagebrush (Cool Sagebrush)

#### General Information

**Contributors** (additional contributors may be listed under "Model Evolution and Comments")

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##### Vegetation Type

Shrubland

##### General Model Sources

- Literature  
 Local Data  
 Expert Estimate

##### Rapid Assessment Model Zones

- California       Pacific Northwest  
 Great Basin       South Central  
 Great Lakes       Southeast  
 Northeast       S. Appalachians  
 Northern Plains       Southwest  
 N-Cent. Rockies

##### Dominant Species\*

ARTR  
ARTR  
PUTR2  
CHRY

##### LANDFIRE Mapping Zones

1      8  
2      9  
7

#### Geographic Range

Eastern Oregon and Washington, primarily southeastern Oregon and central Washington

#### Biophysical Site Description

Within the Pacific Northwest modeling zone, the cool sagebrush PNVG 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 feet to 9000 feet on Steens Mountain. However, this community type is most prevalent between 5000 and 7000 feet elevation.

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

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

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

\*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit <http://plants.usda.gov>.

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 cool sagebrush PNVG. 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 is intermingled with pockets of threetip sagebrush.

Dominant graminoids include Idaho fescue, bluebunch wheatgrass, Columbia needlegrass, and bottlebrush squirreltail. 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), making the species more common in central Washington than southeastern Oregon. Threetip sagebrush tends to be more evenly distributed over a site than mountain big sagebrush or the mountain shrubs.

### **Disturbance Description**

The cool sagebrush PNVG is subject to stand replacing fires historically with a mean return interval ranging from 10 years at the ponderosa pine ecotone to 40 years 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 pre-settlement 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 100-5000 acres 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. Cool 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 to 100 years.

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 to 14 years. This may take as little as 4 years under favorable conditions and longer than 25 years in unfavorable situations (Pedersen et al. 2003, Miller unpublished data). Mountain big sagebrush typically reaches 25% canopy cover in about 25 years, but this may take as few as nine years or longer than 40 years (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, the cool sagebrush PNVG could be confused with the warm sagebrush PNVG (Wyoming big sagebrush).

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

Other uncharacteristic conditions in this type include herbaceous canopy cover less than 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 PNVG may be similar to the PNVG R0SBMT for the Northern and Central Rockies model zone, but their fire regimes differ significantly (R0SBMT is Fire Regime Group IV). This may be due to geographic variability, but there is discrepancy among experts and in the literature about the frequency of fire in this system.

**Scale Description**

**Sources of Scale Data**  Literature  Local Data  Expert Estimate

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

**Issues/Problems**

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

**Model Evolution and Comments**

Low sagebrush complex is intermingled with the cool sagebrush PNVG, but occurs on shallow soils as opposed to deep soils.

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 PNVG or where at least 2 fire return intervals are missed. In class A, the missed interval is expressed as a probability, essentially that 2% of the pixels move into a closed state. In class B the probability is that 1% 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 2 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 2 fire return intervals are missed.

<b>Succession Classes**</b>														
<i>Succession classes are the equivalent of "Vegetation Fuel Classes" as defined in the Interagency FRCC Guidebook (www.frcc.gov).</i>														
<p><b>Class A    20 %</b></p> <p>Early1 PostRep</p> <p><b>Description</b></p> <p>Shrub canopy cover is 0 to 5%. Herbaceous canopy cover is variable but typically &gt;50%. Apparent dominance of sprouting shrubs at the upper elevations and threetip sagebrush at the lower elevations. Typically present for approximately 5 years post-fire.</p>	<p><b>Dominant Species* and Canopy Position</b></p> <p>FEID PSSP9 ACNE9 LUPIN</p> <p><b>Upper Layer Lifeform</b></p> <p><input type="checkbox"/> Herbaceous <input type="checkbox"/> Shrub <input type="checkbox"/> Tree</p> <p><b>Fuel Model</b> no data</p>	<p><b>Structure Data (for upper layer lifeform)</b></p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th></th> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Cover</td> <td>0 %</td> <td>5 %</td> </tr> <tr> <td>Height</td> <td>no data</td> <td>no data</td> </tr> <tr> <td>Tree Size Class</td> <td colspan="2">no data</td> </tr> </tbody> </table> <p><input type="checkbox"/> Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:</p>		Min	Max	Cover	0 %	5 %	Height	no data	no data	Tree Size Class	no data	
	Min	Max												
Cover	0 %	5 %												
Height	no data	no data												
Tree Size Class	no data													

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**Class B 10 %**

Mid1 Closed

**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.

**Dominant Species\* and Canopy Position**

CHRY5  
SYOR2  
FEID  
ARTRV

**Upper Layer Lifeform**

- Herbaceous
- Shrub
- Tree

**Fuel Model** no data

**Structure Data (for upper layer lifeform)**

	Min	Max
Cover	20 %	60 %
Height	no data	no data
Tree Size Class	no data	

Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

**Class C 35 %**

Mid1 Open

**Description**

Shrub canopy cover is 6 to 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.

**Dominant Species\* and Canopy Position**

CHRY5  
SYOR2  
ARTRV  
PSSP9

**Upper Layer Lifeform**

- Herbaceous
- Shrub
- Tree

**Fuel Model** no data

**Structure Data (for upper layer lifeform)**

	Min	Max
Cover	6 %	20 %
Height	no data	no data
Tree Size Class	no data	

Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

**Class D 30 %**

Late1 Open

**Description**

Shrub canopy cover is 6-20% 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%.

**Dominant Species\* and Canopy Position**

ARTRV  
ARTR4  
SYOR2  
AMAL

**Upper Layer Lifeform**

- Herbaceous
- Shrub
- Tree

**Fuel Model** no data

**Structure Data (for upper layer lifeform)**

	Min	Max
Cover	6 %	20 %
Height	no data	no data
Tree Size Class	no data	

Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

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**Class E 5%**

Late I Closed

**Description**

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 less than 30%.

**Dominant Species\* and Canopy Position**

ARTRV  
ARTR4  
SYOR2  
AMAL

**Upper Layer Lifeform**

- Herbaceous
- Shrub
- Tree

**Fuel Model** no data

**Structure Data (for upper layer lifeform)**

	Min	Max
Cover	20 %	60 %
Height	no data	no data
Tree Size Class	no data	

Upper layer lifeform differs from dominant lifeform. Height and cover of dominant lifeform are:

**Disturbances**

**Disturbances Modeled**

- Fire
- Insects/Disease
- Wind/Weather/Stress
- Native Grazing
- Competition
- Other:
- Other

**Historical Fire Size (acres)**

Avg: no data  
Min: no data  
Max: no data

**Fire Regime Group: 2**

- I: 0-35 year frequency, low and mixed severity
- II: 0-35 year frequency, replacement severity
- III: 35-200 year frequency, low and mixed severity
- IV: 35-200 year frequency, replacement severity
- V: 200+ year frequency, replacement severity

**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. All values are estimates and not precise.

**Sources of Fire Regime Data**

- Literature
- Local Data
- Expert Estimate

	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	

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