

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. Please direct questions to helpdesk@landfire.gov.

Potential Natural Vegetation Group (PNVG)

R0SBMT Mountain Big Sagebrush Steppe and Shrubland

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
 PASM
 FEID
 ERUM

LANDFIRE Mapping Zones

10	21
19	22
20	29

Geographic Range

Occurs throughout foothills and at higher, cooler elevations of Wyoming. Mountain big sagebrush (*Artemisia tridentata* ssp. *Vaseyana*) occurs throughout most of the western United States.

Biophysical Site Description

This vegetation type is found on all aspects. Pure stands are found in areas with deeper soils and less topographic relief, but it is also common on slopes with a gradual shift to a mixed mountain shrub community on steeper slopes and in drainages. Elevation ranges from 6,000 feet to 10,000 feet and precipitation from 12-20 inches. Soils are deep, well drained with a pH +/- 7.0. Soil moistures are udic (not dry for as long as 90 cumulative days) and soil temperatures cryic (very cold soils of the Rocky Mountain Region).

Vegetation Description

Mountain sagebrush steppe dominated by mountain sage, western snowberry and bitterbrush with a grass and forb understory is believed to be a major pre-settlement vegetation type for Wyoming, although the exact composition of the community before settlement is unknown.

Dominant shrubs include mountain big sagebrush (*Artemisia tridentata* ssp. *Vaseyana*), antelope bitterbrush (*Purshia tridentata*), and mountain snowberry (*Symphoricarpos oreophilus*). In the Big Horn Basin of Wyoming, yellow rabbitbrush (*Chrysothamnus viscidiflorus*) may be a common co-dominant. Other common shrubs include serviceberry (*Amelanchier alnifolia*), mountain mahogany (*Cercocarpus montanus*), spineless horsebrush (*Tetradymia canescens*) and black sagebrush (*Artemisia nova*). Other shrubs may be locally common.

Herbaceous cover is moderate to abundant ranging from 40-85%. Common grasses include: *Festuca idahoensis*, *Elymus elymoides*, *Pascopyrum smithii*, *Elymus trachycaulus*, *Hesperostipa comata*, *Nassella viridula*, *Poa fenderiana*, and *Poa juncifolia* var *ampla*. Indicative forbs include *Eriogonum umbellatum*,

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

Antennaria rosae, *Balsamorhiza sagittata*, *Lupinus argenteus*, *Delphinium nuttallianum*, *Phlox multiflora*, *Viola nuttallii*.

Disturbance Description

Fire is a major disturbance factor for mountain sage (Blaisdell et al 1984, Johnson 2000). Mountain big sagebrush has the fastest recovery rate of the three subspecies of big sagebrush (Johnson 2000; local data). Fire size for this type is larger than other big sagebrush species because of greater fine fuel load, but some unburned pockets remain after fires, often resulting in a patchy mosaic.

The fire return intervals reported in the literature for this type vary from 10 -200 years (Baker in press, Bunting et al 1987, Harniss and Murray 1973, Hironaka et al 1983, Miller and Rose 1999, Wright and Bailey 1982). However, estimating historic fire regimes for sagebrush ecosystems is tenuous at best and often based on fire scar and age structure data from adjacent forest types (e.g., ponderosa pine and pinyon/juniper), shrub age structure, and fuel characteristics. Fire regimes also vary considerably across the biogeographic range of mountain big sagebrush, based on factors like elevation, soil depth, slope, aspect, adjacent vegetation, frequency of lightning, and climate.

Recent data from long term vegetation transects collected over a twenty year period in Wyoming suggest that the recovery of mountain sagebrush steppe communities following fire requires at least 25 years in northwestern Wyoming and at least 40 years in southern Wyoming to reach a late seral state with > 30% sagebrush cover (Grand Teton National Park/Bridger Teton National Forest Fire Effects Monitoring Data, Southern Wyoming Fire Zone BLM Fire Effects Monitoring Data). If recovery rates are correlated with composite fire return intervals, fire return intervals may lie somewhere between 40-60 years. However, recent data show that fire return intervals may be twice or more as long as recovery periods, indicating a fire return interval of 70-200 years (Baker in press). Reviewers of this type disagreed about the frequency of fire in mountain big sagebrush systems, and suggested MFIs ranged from 25 years to 135 years. An MFI of 70 years was used here.

The severity of fire is also contested in this system. While the majority of fires were likely stand-replacing, some mixed severity fire may have occurred, though there is little data documenting mixed severity fires (Sapsis and Kaufmann 1991). Mixed severity fires were likely small in area, but ignitions may have occurred as frequently as 5-20 years. There were probably also portions of this system that never carried fire because of sparse fuels (Bushey 1987). Historic fires likely occurred during the summer months and were wind-driven events.

Mountain big sagebrush does not resprout following fire and recolonization of burned areas must come from either a short-lived seed bank or seed dispersed by plants in unburned patches or adjacent stands (Johnson and Payne 1968, Bushey 1987). Sagebrush may also establish during recruitment pulses related to precipitation in single or successive growing seasons (Anderson and Inouye 2001).

Other disturbances, including drought stress, insects, and native grazing, were present under pre-settlement conditions in this type. Most of these disturbances were mixed-severity, resulting in thinning of sagebrush.

Adjacency or Identification Concerns

Differentiation of Mountain Big Sagebrush Steppe from Wyoming Big Sagebrush may be difficult at the ecotone due to physical similarities and hybridization zones (i.e., species concepts become blurred).

Nearly all sagebrush communities today have been grazed and there are no refugia to use as reference conditions.

This PNVG is similar to the PNVG R2SBMT for the Great Basin model zone. This PNVG may be similar to the PNVG R#SBMT for the Pacific Northwest model zone, but their fire regimes differ significantly

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(R#SBMT is Fire Regime Group II). 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

Fires burn in patchy mosaics in this type, and scales ranged from small (tens of acres) to very large (possibly hundreds of thousands of acres). Landscape-scale assessments should probably be in the order of 10,000 acres for mountain sagebrush steppe communities because of the mosaic nature of vegetation communities, the moderate to long fire mean return intervals, and the size and amount of vegetation community.

Issues/Problems

There is a limited amount of information available on fire regimes and reference conditions in sagebrush due to modern overgrazing (the herbaceous component is severely impacted and current information cannot exclude the effects of cattle). Nearly all sagebrush communities today been grazed - there are no refugia to use as reference conditions.

Model Evolution and Comments

Workshop code was ARTRV1. This model was combined with two other Rapid Assessment models after peer-review: ROMTSBsb (workshop code MSHB2), modeled by Diane Abendroth (Diane_Abendroth@nps.gov) and reviewed by Dennis Knight (dhknight@uwyo.edu), Don Bedunah (bedunah@forestry.umt.edu), Shannon Downey (shannon_downey@blm.gov), Bill Baker (bakerwl@uwyo.edu), Ken Stinson (ken_stinson@blm.gov), Thor Stephenson (thor_stephenson@blm.gov), Curt Yanish (curt_yanish@blm.gov), and Gavin Lovell (gavin_lovell@blm.gov); and ROSBCL (workshop code CSAG1) modeled by George Soehn (george_soehn@blm.gov) and reviewed by Eldon Rash (erash@fs.fed.us) and Reggie Clark (rmclark@fs.fed.us). Peer review suggested lumping ROSBMT with ROMTSBsb as their disturbance regimes and vegetation composition were nearly identical. ROSBMT was very different from the model, ROSBCL in fire regime, but the other characteristics were the same. Based on the abundant peer review for ROSBMT, ROSBCL was combined here.

Peer review was incorporated on 4/30/2005. Additional reviewers included Thor Stevenson (thor_stephenson@blm.gov), Gavin Lovell (gavin_lovell@blm.gov), Curt Yanish (curt_yanish@blm.gov), and Eve Warren (eve_warren@blm.gov). Additional information from the author, Mark Williams, was also incorporated. Reviewers disagreed about the range of fire frequency for this vegetation type, suggesting MFIs ranging from 25-135 years. The model was originally developed with an MFI of 50 years; based on peer review it was increased to 70 years. This resulted in the following changes in each vegetation class: class A was unchanged; class B changed from 35% to 45%; class C changed from 25% to 20%; class D changed from 35% to 30%.

Succession Classes**														
<i>Succession classes are the equivalent of "Vegetation Fuel Classes" as defined in the Interagency FRCC Guidebook (www.frcc.gov).</i>														
<p>Class A 10%</p> <p>Early1 PostRep</p> <p>Description</p> <p>Sagebrush cover ranges from 0 to 5%. Herbaceous cover is variable, but is typically at least 30%. This class lasts approximately 5 years, and then succeeds to mid-development open (class C).</p>	<p>Dominant Species* and Canopy Position</p> <p>FEID PASM ELSM MEVI</p> <p>Upper Layer Lifeform</p> <p><input type="checkbox"/> Herbaceous <input type="checkbox"/> Shrub <input type="checkbox"/> Tree</p> <p>Fuel Model no data</p>	<p>Structure Data (for upper layer lifeform)</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 45 %

Late1 Closed

Description

Sagebrush cover is greater than 30% and rarely exceeds 60%.

Insects, drought stress, and native grazing cause transitions to class D by thinning sagebrush cover. If no disturbance occurs, this condition can persist.

Dominant Species* and Canopy Position

ARTRV
ELSP
FEID
ERUM

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	30 %	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 20 %

Mid1 Open

Description

Sagebrush cover ranges from 5 to 15%. Insects, drought stress, and native grazing are replacement disturbances, causing transitions to class A. If no disturbance occurs, this condition succeeds to late-development open (class D).

Dominant Species* and Canopy Position

ARTRV
ELSP
ELSM
ERUM

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	5 %	15 %
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 25 %

Late1 Open

Description

Sagebrush cover ranges from 15-30%. Insects, drought stress, and native grazing cause a transition to mid-development conditions (class C). Otherwise, this class succeeds to late-development closed (class B).

Dominant Species* and Canopy Position

ARTRV
ELSP
ERUM
FEID

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model no data

Structure Data (for upper layer lifeform)

	Min	Max
Cover	15 %	30 %
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 E 0 %

Late1 Closed

Description

Dominant Species* and Canopy Position

Structure Data (for upper layer lifeform)

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

Upper Layer Lifeform

- Herbaceous
- Shrub
- Tree

Fuel Model no data

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

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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: 4

- 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	70	30	200	0.01429	100
Mixed					
Surface					
All Fires	70			0.01431	

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