

LANDFIRE Biophysical Setting Model

Biophysical Setting 2211260

Inter-Mountain Basins Montane Sagebrush Steppe

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

General Information

Contributors (also see the Comments field) **Date** 2/8/2006

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<u>Vegetation Type</u>	<u>Dominant Species</u>	<u>Map Zone</u>	<u>Model Zone</u>	
Upland	ARTRV	22	☐ Alaska	☐ Northern Plains
Savannah/Shrub	FEID		California	N-Cent. Rockies
Steppe			☐	☒
<u>General Model Sources</u>	POA		☐ Great Basin	☐ Pacific Northwest
☒ Literature	HECO6		☐ Great Lakes	☐ South Central
☐ Local Data			☐ Hawaii	☐ Southeast
☒ Expert Estimate			☐ Northeast	☐ S. Appalachians
				☐ Southwest

Geographic Range

Occurs throughout foothills and at higher, cooler elevations of WY and the mapzone. Mountain big sagebrush (*Artemisia tridentata* spp. *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 5000-10000ft and precipitation from 12-20in. 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 presettlement vegetation type for WY, 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 WY, green 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

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shrubs may be locally common.

Herbaceous cover is moderate to abundant ranging from 40-85%. Common grasses include: *Festuca idahoensis*, *Elymus elymoides*, *Pascopyrum smithii*, *Hesperostipa comata*, *Nassella viridula*, *Poa fenderiana* and *Poa juncifolia* var. *ampla*. Indicator forbs include *Eriogonum umbellatum*, *Antennaria rosea*, *Balsamorhiza sagittata*, *Lupinus argenteus*, *Delphinium nuttallianum* and *Phlox multiflora*.

Disturbance Description

See MZ21 disturbance description for further discussion of this BpS.

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.

Uncorrected composite fire intervals reported in the literature for this type vary from 10-100yrs (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 (eg, ponderosa pine and pinyon/juniper), shrub age structure and fuel characteristics. Baker (in press) corrected earlier reports and estimate that low estimates of fire rotations are 70-200yrs or more. 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 WY suggest that the recovery of mountain sagebrush steppe communities following fire requires at least 25yrs in northwestern WY and at least 40yrs in southern WY 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 40-60yrs. However, recent data show that fire return intervals may be twice or more as long as recovery periods, indicating a fire return interval of 70-200yrs (Baker in press). Reviewers of this type for MZ22 disagreed about the frequency of fire in mountain big sagebrush systems, and suggested MFIs ranged from 25yrs to 135yrs. An MFI of 80yrs was used here. It is also thought that FRI in WY in this area could be longer than MFIs for mountain big sagebrush in other areas, such as Yellowstone, as recovery times in this area are longer than in Yellowstone (Williams, pers comm). Because mountain big sagebrush extends throughout Cody, Lande and, Rawlins, very different FRIs for mountain big sagebrush are seen in the different areas. Cody conceivably has a more frequent FRI than the other areas; however, overall in WY, it was thought that an 80yr interval is a good median (Williams, pers comm).

Baker (in press) suggests the low estimate of the fire interval would be 70-200yrs, and an anonymous contributor suggested that 80yrs, used in the modeling group, was too low. The group chose to use a low estimate of the return interval, in part so the estimate would be less than that for basin big sagebrush.

The RA model on which this model for MZ22 is based, used a 70yr FRI. (However, during the RA, reviewers disagreed about the range of fire frequency for this vegetation type, suggesting MFIs ranging from 25-135yrs. The model was originally developed with an MFI of 50yrs; based on peer review it was increased to 70yrs for the RA. This resulted in the following changes in each vegetation class in the RA:

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

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%.)

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 5-20yrs. There were probably also portions of this system that never carried fire because of sparse fuel (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 presettlement 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 (ie, species concepts become blurred).

Nearly all sagebrush communities today have been grazed and there are few refugia to use as reference conditions.

Probably cannot be distinguished from black sagebrush in satellite imagery.

Native Uncharacteristic Conditions

Greater than 60% cover of mountain big sagebrush in class D is uncharacteristic

Scale Description

Fires burn in patchy mosaics in this type, and scales ranged from small (tens of acres) to very large (possibly tens of thousands of acres). Landscape-scale assessments should probably be in the order of 10000ac 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 few refugia to use as reference conditions.

Can experience invasions of some weed species (eg, Canada thistle and musk thistle) under certain grazing regimes. Can also have cheatgrass in some stands in the lower part of the elevational gradient.

Comments

This model for MZ22 was adapted from RA model R0SBMT created by Mark Williams (mark_a_williams@blm.gov) and reviewed by Bill Baker, Dennis Knight and Ken Stinson. Other modeler

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for MZ22 included Dave Roberts (dave_a_roberts@blm.gov).

Workshop code was ARTRV1. This model was combined with two other Rapid Assessment models after peer-review: R0MTSBSb (workshop code MSHB2), modeled by Diane Abendroth (Diane_Abendroth@nps.gov) and reviewed by Dennis Knight (dhknight@uwyo.edu), Don Bedunah (bedunah@forestry.umd.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 R0SBCL (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 R0SBMT with R0MTSBSb as their disturbance regimes and vegetation composition were nearly identical. R0SBMT was very different from the model, R0SBCL in fire regime, but the other characteristics were the same. Based on the abundant peer review for R0SBMT, R0SBCL was combined here.

Peer review was incorporated on 4/30/2005. Additional reviewers included Thor Stephenson (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.

Vegetation Classes

Class A		5 %	<u>Indicator Species and Canopy Position</u>	<u>Structure Data (for upper layer lifeform)</u>									
Early Development 1		All Structure	FEID	<table><tr><td></td><td>Min</td><td>Max</td></tr><tr><td>Cover</td><td>0 %</td><td>60 %</td></tr><tr><td>Height</td><td>Herb 0m</td><td>Herb 0.5m</td></tr></table>		Min	Max	Cover	0 %	60 %	Height	Herb 0m	Herb 0.5m
	Min	Max											
Cover	0 %	60 %											
Height	Herb 0m	Herb 0.5m											
<u>Upper Layer Lifeform</u>			Upper										
☒ Herbaceous			PASM										
☐ Shrub			Upper										
☐ Tree			MEVI										
<u>Fuel Model</u>			Middle										
2			LUAR										
<u>Description</u>				☒ Upper layer lifeform differs from dominant lifeform. Herbs dominate this class, but shrubs are growing up and do not yet dominate the class. Shrub cover less than five percent belongs in this class.									

Sagebrush cover ranges from 0-5%. Herbaceous cover is variable, but is typically at least 30%. This class lasts approximately five years, and then succeeds to mid-development open (class B).

Grazing (0.001 probability) and wind/weather stress (every 100yrs) occurs.

Replacement fire occurs every 200yrs.

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Class B 15 %

Mid Development 1 Open

Upper Layer Lifeform☐ Herbaceous☒ Shrub☐ Tree**Fuel Model**

2

Description

Sagebrush cover ranges from 5-15%. If no disturbance occurs, this condition succeeds to late-development open (class C) after 15yrs.

Insect/disease and grazing occur with a probability of 0.001 but do not cause a transition. Wind/weather stress occurs every 500yrs and takes this class back to A.

Replacement fire occurs every 80yrs.

Indicator Species and Canopy Position

ARTRV

Upper

FEID

Mid-Upper

ERUM

Middle

PSSP

Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	20 %
Height	Shrub 0.6m	Shrub 1.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Class C 30 %

Late Development 1 Open

Upper Layer Lifeform☐ Herbaceous☒ Shrub☐ Tree**Fuel Model**

2

Description

Sagebrush cover ranges from 15-30%. If no disturbance occurs, this class succeeds to late-development closed (class D) after 30yrs.

Insect/disease (0.001 probability), grazing (0.001 probability) and wind/weather stress (0.002 probability) occur but do not cause a transition to another class.

Replacement fire occurs every 80yrs.

Indicator Species and Canopy Position

ARTRV

Upper

FEID

Mid-Upper

PASM

Mid-Upper

ERUM

Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	30 %
Height	Shrub 0.6m	Shrub 1.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Class D 50 %

Late Development 1 Closed

Upper Layer Lifeform☐ Herbaceous☒ Shrub☐ Tree**Fuel Model**

2

Indicator Species and Canopy Position

ARTRV

Upper

FEID

Mid-Upper

PASM

Mid-Upper

ERUM

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	60 %
Height	Shrub 0.6m	Shrub 1.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

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Low-Mid

Description

Sagebrush cover is >30% and rarely exceeds 60%. If no disturbance occurs, this class can persist.

Insect/disease (0.001 probability), grazing (0.001 probability), occur but do not cause a transition to another class. Wind/weather stress occurs every 500yrs and causes a transition to the open late stage.

Replacement fire occurs every 80yrs.

Class E **0 %**

[Not Used] [Not Used]

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

	Min	Max
Cover	%	%
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** IV

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	80	50	200	0.0125	100
Mixed					
Surface					
All Fires	80			0.01252	

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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