

LANDFIRE Biophysical Setting Model

Biophysical Setting 1911260

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 11/18/2005

Modeler 1 Kathy Geier-Hayes
kgeierhayes@fs.fed.us

Reviewer Dana Perkins
dana_perkins@blm.gov

Modeler 2 Steve Rust
srust@idfg.idaho.gov

Reviewer Carly Gibson
cgibson@fs.fed.us

Modeler 3 Susan Miller
smiller03@fs.fed.us

Reviewer Mary Manning
mmanning@fs.fed.us

Vegetation Type

Upland
Savannah/Shrub
Steppe

Dominant Species

ARTRV
PSSP6

Map Zone

19

Model Zone

☐ Alaska
☐ California
☐ Northern Plains
☐ N-Cent. Rockies

General Model Sources

☒ Literature
☐ Local Data
☒ Expert Estimate

FEID
POSE
SYMPH
BASA

☐
☐ Great Basin
☐ Great Lakes
☐ Hawaii
☐ Northeast
☒
☐ Pacific Northwest
☐ South Central
☐ Southeast
☐ S. Appalachians
☐ Southwest

Geographic Range

Occurs throughout foothills and at higher, cooler elevations of the Boise, Salmon River, Seven Devils mountains, and throughout western MT and central ID.

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 4000-10000ft and precipitation from 12-20 in/year. Soils are deep, well drained. 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 big sagebrush, mountain snowberry and bitterbrush (specifically in MZ10) with a continuous grass and forb understory is believed to be a major presettlement vegetation type within this map zone, 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*, MZ10) and mountain snowberry (*Symphoricarpos* spp.). Other common shrubs include serviceberry (*Amelanchier alnifolia*), wild cherry (2 species), rose and currant. Other shrubs may be locally common.

**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.

Herbaceous cover is moderate to abundant ranging from 40-85%. Common grasses include: *Festuca idahoensis*, *Agropyron spicata* (now *Pseudoroegneria spicata*), *Elymus elymoides*, *Elymus trachycaulus*, *Hesperostipa comata*, *Festuca campestris*, *Koeleria cristata* and *Poa secunda*. Indicative forbs include *Eriogonum umbellatum*, *Antennaria microphyla*, *Balsamorhiza sagittata*, *Lupinus* spp, *Delphinium* spp, *Castilleja* spp and *Geranium viscosissimum*. *Astragalus purshii* may be present in the early growing season.

Low sagebrush and basin big sagebrush may be present, forming mosaics with mountain big sagebrush.

This vegetation type may be inclusions within forested types.

Disturbance Description

Fire is a major disturbance factor for mountain big sagebrush (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 10-200yrs (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 (eg, 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 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 disagreed about the frequency of fire in mountain big sagebrush systems, and suggested MFIs ranged from 25yrs to 135yrs.

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. Lightning ignitions are variable and affect fire frequency on regional landscapes in the Northern Rockies. Fire may spread from adjacent forested communities.

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).

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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. Native grazing by deer and elk in MZs 10 and 19 favors the increase of sagebrush cover.

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). This is not a very big issue for MZs 10 and 19.

Adjacent plant associations on shallow clay soils are dominated by Wyoming sagebrush. Some of these communities may be small enough to occur as inclusions.

Conifer encroachment may occur on this vegetation type (especially *Juniperus scopularum* to the east and *Juniperus occidentalis* to the west).

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

Native Uncharacteristic Conditions

Greater than 10% canopy cover by conifers can be considered uncharacteristic. Potential causes of encroachment include lack of fire and livestock grazing.

Scale Description

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 10000ac for mountain sagebrush steppe communities because of the mosaic nature of vegetation communities, the moderate to long fire mean return intervals and the extent of the 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 have been grazed - there are few known refugia to use as reference conditions.

Comments

Additional reviewers were Lois Olsen (lolsen@fs.fed.us) and Robert Wooley (rwooley@fs.fed.us). Modifications were made to the structural data to adhere to LANDFIRE standards (Pohl 11/14/2005).

This BpS was adapted from the Rapid Assessment model R0SBMT (Mountain Sagebrush) by Mark Williams and reviewed by Bill Baker (bakerwl@uwyo.edu), Dennis Knight (dhknight@uwyo.edu), Ken Stinson (ken_stinson@blm.gov), 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).

For the Rapid Assessment, this model combined two additional 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.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

****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.

(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).

Rapid Assessment 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. 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. 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%.

10/02/07: As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

Vegetation Classes

Class A 20 %

Early Development 1 All Structure

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Fuel Model

Indicator Species and Canopy Position

FEID
Lower
PSSP6
Lower
ARTRV
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.

Grasses and forbs are the dominant lifeform in this class.

Description

Shrub cover is low, and typically ranges from 0-20%. Herbaceous cover is variable, but is typically at least 30%. This class lasts approximately 10yrs, and then succeeds to mid-development open (class C).

Class B 15 %

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Fuel Model

Indicator Species and Canopy Position

ARTRV
Upper
PSSP6
Lower
FEID
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	60 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

- ☐ Upper layer lifeform differs from dominant lifeform.

Description

Sagebrush cover is >40% and rarely exceeds 60%. Understory vegetation has low cover in this class. Insects, drought stress and mixed severity fire cause transitions to class C by thinning sagebrush cover. If no disturbance occurs, this condition can persist.

In ID, *Purshia tridentata* may be present.

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Class C 65 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
☒ Shrub
☐ Tree

Fuel Model**Indicator Species and Canopy Position**

ARTRV
Upper
FEID
Lower
PSSP6
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	40 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

- ☐ Upper layer lifeform differs from dominant lifeform.

(This class would also include shrubs >0.5m tall but <20% cover.)

Description

Shrub cover is <40%. Insects, drought stress and replacement fire are replacement disturbances, causing transitions to class A. Mixed severity fire maintains this class in C. Herbaceous cover is variable in this class. Native grazing of herbaceous species by elk and deer cause succession to class B. In ID, Purshia tridentata may be present.

Class D 0 %

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model**Indicator Species and Canopy Position****Structure Data (for upper layer lifeform)**

	Min	Max
Cover	%	%
Height		
Tree Size Class		

- ☐ Upper layer lifeform differs from dominant lifeform.

Description**Class E 0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

- ☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model**Indicator Species and Canopy Position****Structure Data (for upper layer lifeform)**

	Min	Max
Cover	%	%
Height		
Tree Size Class		

- ☐ Upper layer lifeform differs from dominant lifeform.

Description**Disturbances**

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Fire Regime Group:** I

Historical Fire Size (acres)

Avg 0

Min 0

Max 0

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	100	100	166	0.01	26
Mixed	35			0.02857	74
Surface					
All Fires	26			0.03858	

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.

References

Anderson, J., and R. Inouye. 2001. Landscape-scale changes in plant species abundance and biodiversity of a sagebrush steppe over 45yrs. Ecological Monographs 71: 531-556.

Baker, W. L. In press. Fire and restoration of sagebrush ecosystems. Wildlife Society Bulletin, in press.

Blaisdell, J.P., R.B. Murray and E. Durant. 1982. Managing Intermountain rangelands -- sagebrush-grass ranges. GTR INT-134. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station 41p.

Bunting, S.C., B.M. Kilgore and C.L. Bushey. 1987. Guidelines for prescribed burning sagebrush-grass rangelands in the northern Great Basin. GTR-INT-231. USDA Forest Service, Intermt. Res. Stat. .

Bushey, C.L. 1987. Short-term vegetative response to prescribed burning in the sagebrush/grass ecosystem of the northern Great Basin: three years of postburn data from the demonstration of prescribed burning on selected Bureau of Land Management districts. Final Report. Cooperative Agreement 22-C-4-INT-33. Missoula, MT: Systems for Environmental Management. 77 pp.

Dorn, R.D. 2001. Vascular plants of Wyoming. Cheyenne, WY: Mountain West Publishing. 4120 pp.

Gates, D.H. 1964. Sagebrush infested by leaf defoliating moth. J. Range Management. 17: 209-210.

Harniss, R.O. and R.B. Murray. 1973. 30 years of vegetal changes following burning of sagebrush-grass range. Journal of Range Management 26: 322-325.

Hironaka, M., M.A. Fosberg and A.H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Bull.35. Univ. of Idaho, Forest, Wildlife and Range Experiment Station. Moscow, ID 44 pp.

Johnson, K.A. 2000. Artemisia tridentata spp. vaseyana. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: <http://www.fs.fed.us/database/feis/> [2004, September 10].

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Johnson, J.R. and G.F. Payne. 1968. Sagebrush reinvasion as affected by some environmental influences. *Journal of Range Management*. 21: 209-213.

Miller, F.F. and J. A. Rose. 1999. Fire history and western juniper encroachment in sagebrush steppe. *J. Range Management* 52: 550-559.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Sapsis, D.B. and J.B. Kauffman. 1991. Fuel consumption and fire behavior associated with prescribed fires in sagebrush ecosystems. *Northwest Science*. 65(4): 173-179.

Tisdale, E.W. 1994. SRM 402: Mountain big sagebrush. Pages 41-42 in: T.N. Shiflet, ed. *Rangeland cover types of the United States*. Denver, CO: Society for Range Management.

Welch, B. and C. Criddle. 2003. Countering misinformation concerning big sagebrush. Research Paper RMRS-RP-40. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 28 pp.

Wright, H. and A. Bailey. 1982. *Fire Ecology: United States and Southern Canada*. John Wiley and Sons, N.Y., N.Y.

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