LANDFIRE Biophysical Setting Model

Biophysical Setting 2110801 Inter-Mountain Basins Big Sagebrush Shrubland - Basin Big Sagebrush

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *Differences in fire regime, floral component and habitat. Soils are deeper, vegetative structure is taller/larger than Wyoming big sagebrush. Split so that Wyoming big sagebrush could be modeled separately. Basin big sagebrush is found at lower elevations and is usually restricted to comparatively moist ravines or valleys (Barker and McKell 1986 in Knight 1994). It also grows taller than any other species of Artemisia (up to two meters or more.). Wyoming big sagebrush is the most common shrub of the intermountain basins. It is normally less than 0.5 m tall and occupies the drier uplands, with the taller basin big sagebrush occurring in adjacent ravines (Knight 1994). Basin big sagebrush is more common on sandy soils, and Wyoming big sagebrush is more common on fine-textured soils (Knight 1994). There is more available moisture in basin big sagebrush sites than Wyoming big sagebrush sites. Basin big sagebrush - drainages, greater soil depth (moderately deep to deep soils). Shallower on Wyoming big sagebrush sites. Basin big sagebrush tends to grow in deep, fertile soils and is an indicator of productive sites.*

General Information

Contributors (also see the Comments field) **Date** 7/12/2006

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Vegetation Type
Upland Savannah/Shrub Steppe

Dominant Species
ARTRT
PSSP6

Map Zone
21

Model Zone
☐ 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

ELTR7
CHRYS9
FEID

Geographic Range

Basin big sagebrush is found throughout WY. It does not occur in Grand Teton and Yellowstone National Parks.

Biophysical Site Description

This type is found between 3000-7000ft elevation on deep, well drained, alluvial soils and have been

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observed on sandy sites where soil moisture prevails until August.

This type can be a few meters wide on ephemeral streams. This could be 100m wide on larger streams. It tends to follow the stream. This system is in a riparian setting, but not wet enough to support willows, cottonwoods and other riparian vegetation.

Vegetation Description

A dense canopy of basin big sagebrush (Artemisia tridentata ssp. tridentata) dominates the shrub layer, except on alkaline soils, where greasewood (Sarcobatus vermiculatus) makes up as much as 25%. Greasewood, however, is not a significant component of the basin big sagebrush community in MZ21. Some greaewood may occur in the southern portion but not in significant quantities. Rabbitbrush (Chrysothamnus spp) and Wyoming big sagebrush (Artemisia tridentata ssp. wyomingensis) may also be present. This type may intergrade with the Wyoming big sagebrush. Some stands have silver sagebrush (Artemisia cana ssp. cana) intermixed (Williams, pers. comm.) and in early seral states Artemesia dracunculus may occur in the understory.

Understory grasses include, needle and thread (Hesperostipa comata), basin wildrye (Leymus cinerius), squirreltail (Elymus elymoides), slender wheatgrass (Elymus trachycaulus), bluebunch wheatgrass (Pseudoroegneria spicata) and Idaho fescue (Festuca idahoensis).

Forbs were sparse, and included hawksbeard (Crepis acuminata), bird's beak (Cordylanthus spp) , blue bell (Mertensia spp), lupine (Lupinus spp), buckwheat (Eriogonum spp), Rocky Mountain aster (Aster spp), Daisier (Erigeron spp) and Phlox species.

Disturbance Description

Fire regime group IV. Fire return intervals are estimated to average approximately 100yrs, and range from 50-150yrs. Fires were mostly replacement severity (Tirmenstein 1999, Sapsis and Kauffman 1991).

Reviewers for MZ21 recommended a FRI of 50yrs, or between 15-70yrs as per Sapsis (1990). However, it was noted by another reviewer that Sapsis (1990) is not a study of fire frequency and has no primary data about that. The two primary sources of information about fire frequency are fire scars on trees nearby and the recovery rate of sagebrush after fire. Neither has been measured adequately for basin big sagebrush. All we have to go on to estimate FRI in basin big sagebrush is that it seems to recover more quickly than does Wyoming big sagebrush, so maybe that implies that it might burn somewhat more often, but probably not much. The occurrence of basin big sagebrush in small patch sizes next to mountain big sagebrush stands in this mapzone may result in a shorter return interval than basin big sagebrush next to Wyoming big sagebrush in other mapzones. However, more research is needed.

Drought may have caused replacement disturbances rarely. Mortality by drought is more common in Wyoming big sagebrush than basin big sagebrush, due to better soils, better water availability and a possibly deeper rooting habit. Death by drought in basin big sagebrush is more isolated than in Wyoming big sagebrush. The frequency of a drought that would be severe enough to broadly affect basin big sagebrush probably occurs once every 100-200yrs, not considering global warming. (Williams, personal correspondence).

Insects and disease would have been replacement and mixed-severity disturbances in this type, but little information exists on the frequency of these disturbances under reference conditions. They are not modeled here.

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Normal, relatively less severe native grazing by large ungulates, including bison, elk, mule deer and pronghorn might have maintained more of an open condition and caused rare, small degraded sites (ie, wallows) that may have occupied less than five percent of the landscape. This disturbance is not modeled here.

Some believe that sagebrush is fire-adapted (Harrell, personal correspondence), although others believe it does not show classic types of fire adaptation. Fine fuel in the shrub canopy and on the ground along with grasses and forbs will help carry the fire; in sagebrush it is considered a canopy fire (Harrell, personal correspondence). The later the successional stage, the more likely it will be stressed by competition and drought. This may decrease live fuel moisture and cause drought mortality or dry fuel conditions, which could increase the flammability of the fuel and, after a fire, send the BpS to an earlier seral stage or state. The fire frequency may be shorter for later seral conditions and longer for earlier seral stages (Harrell, personal correspondence).

Some state that the fire return intervals are over 100yrs on average. Some stands will burn more frequently; especially those at higher elevations that are surrounded by mountain big sagebrush - it is generally accepted that the surrounding vegetation will have a large effect on fire regimes. For additional evidence, Williams presents a graph on recovery rates in basin big sagebrush communities following prescribed fires - some of the burns are almost 20yrs old now. The mean data points have a linear pattern. Extrapolating, the data suggest that it will take at least 50yrs on average for these communities to reach 40% cover. This is the threshold we have defined as required to enter the late seral closed class. This community was “aged” an additional 20-30yrs and following the advice of Baker (in press), an estimate of 140-160yrs FRI was reached. Since this data was collected from southern WY, which is probably on the high end within MZ22 with respect to recovery, we averaged the FRI to 110yrs. This number may be higher than the folks in the northern part of the MZ22 may want to use – in the south we are looking at mainly a 6-12in precipitation zone for basin big sagebrush and it is generally confined to riparian areas. This methodology has been debated by some researchers.

Basin big sagebrush rarely burned due to lack of fuel. It is possible that prior to grazing, there was more frequent burning, but due to poor clay and low precipitation, the basin big fire interval was probably well over 100yrs (Romme, personal correspondence).

Tart (personal correspondence) states that Johnson (2000) reports an FRI of 12-43yrs based on the thesis of Sapsis (1990). Where basin big sagebrush occupies small draws and swales, as in MZ21, its return interval would be controlled by the adjacent vegetation.

Fire scars provide little information on low elevation sage where there are no forests nearby; fire scar estimates are therefore low estimates of fire rotation as they come from locations that would have had more fire than is typical of sagebrush (Baker, personal correspondence).

We have no means to accurately measure historic fire frequency in sagebrush communities (Kitchen, personal correspondence), and there are conflicting opinions as to the approaches taken to determine MFI for these systems. Based on what has been shown through different approaches and field experience of those who know the system, the estimate of total MFI for Basin big sagebrush shrubland is between 75-150yrs (Kitchen, personal correspondence). We really don't know how fire might have behaved across the fuel threshold at the forest/shrubland ecotone. Therefore, we don't know how accurately proxy fire chronologies derived from fire-scarred trees predict fire regimes in nearby shrublands (Kitchen, personal correspondence).

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For MZ22, basin big sagebrush is influenced by the surrounding vegetation, including riparian areas. The FRI could be longer than in other areas, as basin big sagebrush extends from Cody through Rawlins. The Cody area probably burns more often than Rawlins; however, the 120yr interval for MZ22 was retained, as it is thought that overall the FRI might be higher in this area of WY, versus, for instance, Yellowstone or other areas (Williams, pers comm). Some reviewers for MZ22, however, felt that 120yr interval was too long for basin big sagebrush (Warren, pers comm); however, the interval was retained since the majority of review did not request a change of the interval - since it varied so much in this area. In MZ21 in the Yellowstone area, recovery is much faster than in this part of WY (Williams, pers comm).

For the Rapid Assessment (RA), there was disagreement about the frequency of fire in this system. Estimates ranged from 40yrs to 150yrs. For the RA, FRI was modeled at 60yrs.

After an extensive model review process, LF leadership/guidance determined that the MZ22 modelers used an interpretation of the fire information available on sagebrush systems that did not represent the majority expert opinion/interpretation of the fire literature used for MZ21. The original MZ21 model was therefore altered to reflect majority opinion/interpretation of literature regarding the fire regime of this sagebrush system. For MZ21, an interval of 70yrs was chosen. This interval is still considered on the longer side of the range by some (A Winward, pers comm). This interval was similar to that used in MZs 18, 23,10 and 19 and R0SBBB (if mixed fire removed). This is also in line with Kitchen's estimate of 75-150 year interval for basin big sagebrush. This interval, although on the high end of what the reviewers of MZ21 recommended (15-70yrs), represents a compromise between the differing views and reflects majority opinion. Also, because this interval must be longer than that for mountain big sage (50yrs), 70yrs seemed an appropriate value.

Adjacency or Identification Concerns

Basin big sagebrush grows along streams, sometimes with greasewood or silver sagebrush intermixed or adjacent, often with Wyoming big sagebrush and mountain big sagebrush on adjoining drier slopes. Distribution is a result of local soil characteristics on a fine scale (1-500ac). This type occurs on deeper soils than Wyoming or mountain big sagebrush types.

In MZ21, there is very little, if any PJ or greasewood.

Much of this type has been lost due to land clearing for agriculture. Some stands have been converted to cheatgrass (Bromus tectorum), others have substantial cheatgrass component. Occasionally, in some areas, stands may have been replaced by greasewood after burning (Williams, Pers. Comm.).

Sometimes, incised channels may decrease the contact with the watertable and the resulting terrace may provide conditions for basin big sagebrush. This type may occur in small patches and may best be mapped by soil characteristics.

Native Uncharacteristic Conditions

Scale Description

Fuel may be continuous resulting in spread throughout patches. Disturbance size therefore probably resembles the patch size of the vegetation. Smaller patches throughout the map zone compared to the other sagebrush subspecies.

This type may occur in small patches and may best be mapped by soil characteristics.

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Issues/Problems

It is difficult to map and identify the subspecies of big sagebrushes (Artemesia tridentata) without the aid of field assessments.

Comments

This model for MZ21 was adapted from the draft model from MZ22 for BpS 10801, created by Mark Williams, Vicki Herren, Destin Harrell, Tim Kramer and an anonymous contributor. Quantitative revisions and changes in cover and structure were made to the model by reviewers for MZ21 who were Steve Kilpatrick (steve.kilpatrick@wgf.state.wy.us), Mack McFarland (mack_mcfarland@nps.gov), Klara Varga (klara@ida.net), Don Delong and Tristan Fluharty. These reviewers therefore became the modelers for MZ21. After an extensive model review process, LF leadership/guidance determined that the modelers for MZ22 used an interpretation of the fire information available on sagebrush systems that did not represent the majority expert opinion/interpretation of the fire literature for MZ21. The original MZ21 model was therefore altered to reflect majority opinion/interpretation of literature regarding the fire regime of this sagebrush system. RL implemented model changes based on guidance.

The model for MZ22 was adapted and changed quantitatively from Rapid Assessment (RA) model R0SBBB created by Diane Abendroth. Other modelers for MZ22 included Dave Roberts: dave_a_roberts@blm.gov, Destin Harrell (Destin_harrell@blm.gov), Tim Kramer (tim_kramer@blm.gov) and Eve Warren (eve_warren@blm.gov).

Workshop code for RA model was BSAG.

Additional reviewers during RA included: Karen Clause (karen.clause@wy.usda.gov), Dennis Knight (dhknight@uwyo.edu); Thor Stephenson (thor_stephenson@blm.gov), Curt Yanish (curt_yanish@blm.gov), Gavin Lovell (gavin_lovell@blm.gov) and Eve Warren (eve_warren@blm.gov).

Peer review for RA was incorporated 4/26/2005. There was considerable disagreement among reviewers about how to model this type. All comments were incorporated into the description. The following changes were made to the quantitative model based on peer review for RA model. See that model for details.

Vegetation Classes

Class A **20 %**

Early Development 1 All Structure

Upper Layer Lifeform

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

Fuel Model

Indicator Species and Canopy Position

PSSP6
Upper
ELTR7
Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	30 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	no data	

- [x] Upper layer lifeform differs from dominant lifeform.

The upper layer lifeform are shrubs with cover of approximately 10-15%. Grasses are dominant.

Description

Grass-dominated community. Shrub cover is approximately 0-10% or 15%.

If soils are alkaline, resprouting greasewood may also be present. This class lasts up to approximately 15yrs

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(10yrs was suggested based on recovery rates in Big Horn Basin) post disturbance and succeeds to mid-development open (class B) unless drought (not modeled) or replacement fire (every 70yrs) cause stand-replacing disturbance.

The upper layer lifeform is shrubs. However, per new direction from MFSL the dominant lifeform is indicated in the structural data boxes.

Class B **35 %**

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

Indicator Species and Canopy Position

ARTRT
Upper
PSSP6
Lower
ELTR7
Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	11 %	20 %
Height	Shrub 0.6m	Shrub 3.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Sagebrush dominated open shrub community with abundant grasses. This class lasts approximately 20-50yrs post disturbance and succeeds to late-development closed (class C) unless replacement fire causes a transition to class A, approximately every 70yrs.

Maximum height in this class is more like 1.5 m.

Class C **45 %**

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

Indicator Species and Canopy Position

ARTRT
Upper
PSSP6
Lower
ELTR7
Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	21 %	40 %
Height	Shrub 0.6m	Shrub 3.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Mature and overmature sagebrush with suppressed understory. This class begins at approximately age 50yrs and can perpetuate until disturbance causes a transition to another class. Replacement fire may cause a transition to class A, approximately every 75yrs.

Wind/weather/stress/drought can also cause a transition back to A at 0.005 probability.

Greasewood is not necessarily an indicator of all classes.

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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

Fire Regime Group:** **IV**

Historical Fire Size (acres)

Avg
Min
Max

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	72	30	150	0.01389	100
Mixed					
Surface					
All Fires	72			0.01391	

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.

Additional Disturbances Modeled

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

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