**LANDFIRE Biophysical Setting Model**

**Biophysical Setting 1511250**  
Inter-Mountain Basins Big Sagebrush Steppe

- **Contributors**: (also see the Comments field)
- **Date**: 2/23/2005
- **Reviewer**: Tim Christiansen  
tchristiansen@tnc.org

### General Information

**Model Zone**  
15

**Dominant Species**
- Upland: ARTRW8
- Savannah/Shrub Steppe: PSSP6

**General Model Sources**
- Literature
- Local Data
- Expert Estimate

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

### Geographic Range

This widespread matrix-forming ecological system occurs throughout much of the Columbia Plateau, northern Great Basin and WY. It is found at slightly higher elevations farther south.

### Biophysical Site Description

Sagebrush steppe is found in continental, semi-arid climate where annual precipitation generally ranges from 7-12in (~180-300mm) (McArthur 2000), but occasionally ranging into the 14in precipitation zone. This system is common on foothills, undulating terraces, slopes and plateaus, but also in basins and valley bottoms. Soil depths range from shallow to moderately deep, well-drained with an effective rooting depth of less than 40in (~ 1m). NRCS Range Site is (Droughty) Loamy 8-10in precipitation zone.

### Vegetation Description

This shrub-steppe is dominated by perennial grasses and forbs (>25% cover) with Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. xericensis, Artemisia tridentata ssp. wyomingensis, Artemisia tripartita ssp. tripartita and/or Purshia tridentata dominating or codominating the open to moderately dense (10-40% cover) shrub layer. In southern ID and northern UT, Artemisia tridentata ssp. wyomingensis dominates large landscape. Atriplex confertifolia, Chrysanthemum viscidiflorus, Ericameria nauseosa, Tetradyemia spp or Artemisia frigida may be common, especially in disturbed stands. Associated graminoids include Achnatherum hymenoides, Calamagrostis montanensis, Elymus lanceolatus ssp. lanceolatus, Festuca idahoensis, Festuca campestris, Koeleria macrantha, Poa secunda and Pseudoroegneria spicata. Common forbs are Phlox hoodii, Arenaria spp and Astragalus spp. Areas with deeper soils more commonly support Artemisia tridentata ssp. tridentata but have largely been converted for other land uses.

**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.
The sagebrush steppe landscape is a mosaic of shrub-dominated and herbaceous-dominated phases (West 2000). Forbs have low diversity but are important for wildlife, including the greater sage grouse. Species diversity is lower in Wyoming big sagebrush communities than in other big sagebrush types (Howard 1999). Wyoming big sagebrush communities are critical habitat for greater sage grouse and other sagebrush obligate species.

**Disturbance Description**

Historically, fire was the principal disturbance within this vegetation type. Intervals between natural wildfires varied between 25yrs (eg, northern Yellowstone National Park, West 2000) and 100yrs+ (West 2000). West (1983) and Miller and Eddelman (2000) cite mean FRIs of <100yrs for replacement fire. Howard (1999) cites mean FRIs of 10 to 70yrs with a mean of 40yrs for Wyoming sagebrush steppe. Studies cited in Howard (1999) may underestimate FRIs or not hold up to scrutiny (Welch and Criddle 2003). This BpS was modeled with a MFI of 75yrs for the system as a whole. Eighty percent of fires modeled were replacement severity. Re-establishment following fire is from seed germination and establishment. Establishment is dependent upon soil seedbank and/or proximity of seed sources, fire size and continuity, and climatic conditions.

Other disturbances included insects (eg, moths and grasshoppers that eat leaves, moth larval grubs that eat roots) with an average return interval of 75yrs. Periods of drought, wet cycles and shifts in climate would have also affected this system with an average return interval of 100yrs.

**Adjacency or Identification Concerns**

The NatureServe description of Inter-Mountain Basin Big Sagebrush Steppe (1125) includes different species of sagebrush and steppe ecosystems that are structurally and ecologically different such as Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. wyomingensis and Artemisia tripartita ssp. tripartita. We highly recommend that, at least, Artemisia tridentata ssp. tridentata, which is a taller shrub found in drainages and deeper soils, be separated from the other shrubs. Ultimately, all three sagebrush species should be modeled separately.

Wyoming big sagebrush is known to hybridize with other subspecies of the big sagebrush complex; ie, basin big sagebrush A. tridentata ssp. tridentata and mountain big sagebrush A. tridentata ssp. vaseyana (Freeman et al 1991, McArthur et al 1998). Across ecotones, populations of Wyoming big sagebrush probably intergrade with basin big sagebrush and mountain big sagebrush. Soils and elevation may help determine which species is present.

Invasion of cheatgrass has transformed this ecological system into large areas of uncharacteristic annual grasslands and shrublands with understories where annual grasses replaced perennial grasses.

**Native Uncharacteristic Conditions**

**Scale Description**

Sagebrush steppe covers vast landscapes >10000ac with inclusions of low sagebrush and basin big sagebrush. Historic disturbance (fire) likely ranged from small (<10ac) to large (>10000ac) depending on conditions, time since last ignition and fuel loading. The average patch size was assumed to be approximately 250ac.

**Issues/Problems**


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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.
recommend a FRI of <100 yrs for replacement fire. Howard (1999) gives 10-70 yr range (40 yr average) (but see Welch and Criddle 2003). Current scientific opinion (Mike Pellant, BLM Range Ecologist on the Great Basin Restoration Initiative, Stephen Bunting, and David Pyke, personal communication) puts the natural fire return interval at about 100 yrs. Given uncertainties and opinions of reviewers, a MFI of 75 yrs was modeled. Without this shorter MFI and differences in fire behavior, there would be no difference between Wyoming sagebrush steppe from the Snake River plains and Wyoming big sagebrush semi-desert from central NV, UT, and eastern CA. Because replacement fire is by far dominant over mixed severity fire, a FRG IV was selected by recommendation of reviewers.

**Comments**

This model is identical to the model for the same BpS in MZ16 (Utah High Plateaus) with minor descriptive changes based on peer review for MZ23 and MZ24. BpS 1125 is completely based on the Rapid Assessment PNVG R2SBWySe developed by Eric Limbach (eric_limbach@blm.gov) for Wyoming big sagebrush steppe and reviewed by Krista Waid-Gollnick, Sarah Heidi (krista_waid@blm.gov), Stanley Kitchen (skitchen@fs.fed.edu), Michael Zielinski (mike_zielinski@nv.blm.gov), Jolie Pollet (jpollet@blm.gov) and Gary Back (gback@srk.com).

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

<table>
<thead>
<tr>
<th><strong>Class A</strong></th>
<th>20 %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early Development 1 Open</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Upper Layer Lifeform</strong></td>
<td></td>
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<tr>
<td>☐ Herbaceous</td>
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<tr>
<td>☑ Shrub</td>
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<td>☐ Tree</td>
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<tr>
<td><strong>Fuel Model</strong></td>
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<td>1</td>
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<tr>
<td><strong>Indicator Species and Canopy Position</strong></td>
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<tr>
<td>PSSP6</td>
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<tr>
<td>Upper</td>
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<tr>
<td>STTH2</td>
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<td>POSA12</td>
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<tr>
<td>Upper</td>
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<tr>
<td>ARTRW8</td>
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<tr>
<td>Upper</td>
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<tr>
<td><strong>Structure Data (for upper layer lifeform)</strong></td>
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<tr>
<td>Min</td>
<td>Max</td>
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<tr>
<td>Cover</td>
<td>0 %</td>
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<tr>
<td>Tree Size Class</td>
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</tr>
</tbody>
</table>

**Description**

Perennial grasses and forbs dominate where woody shrub canopy has been top killed / removed by wildfire. Shrub cover less than five percent. Replacement fire every 120 yrs on average resets succession back to zero. Succession to class B after 20 yrs.

<table>
<thead>
<tr>
<th><strong>Class B</strong></th>
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<td>☐ Herbaceous</td>
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<td>☑ Shrub</td>
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<td>☐ Tree</td>
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<td>1</td>
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<tr>
<td><strong>Indicator Species and Canopy Position</strong></td>
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<td>Lower</td>
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<td>STTH2</td>
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<tr>
<td><strong>Structure Data (for upper layer lifeform)</strong></td>
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<tr>
<td>Min</td>
<td>Max</td>
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<tr>
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<td>5 %</td>
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<tr>
<td>Height</td>
<td>Shrub 0m</td>
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</tbody>
</table>

**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.

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**Thursday, February 06, 2014**
Shrubs dominate (5-25% cover) with diverse perennial grass and forb understory. MFI is 75yrs with 80% replacement fire (mean FRI of 94yrs) and 20% mixed severity fire (mean FRI of 375yrs). Mixed severity fire, insect/disease (return interval of 75yrs) and weather related stress (return interval of 100yrs) maintains vegetation in class B. Succession to class C after 40yrs.

**Disturbances**

**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.

<table>
<thead>
<tr>
<th>Class C</th>
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<td>☑ Shrub</td>
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<td>Min 26 % Max 35 %</td>
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<td>Height</td>
<td>Tree Size Class None</td>
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</tbody>
</table>

**Description**

Mature shrub canopy >25% cover with proportional reduction in understory productivity as canopy cover increases. The mean FRI for replacement fire is 75yrs. Insect/diseases (return interval of 75yrs) and weather related stress (return interval of 100yrs) thin the shrub canopy, causing a transition to class B. Otherwise, this class persists indefinitely.

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<td>Cover</td>
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<td>Height</td>
<td>Tree Size Class</td>
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**Description**

**Disturbances**

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<td>Cover</td>
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<td>Height</td>
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**Description**

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<tr>
<th>Class</th>
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<tr>
<td>Cover</td>
<td>%</td>
</tr>
<tr>
<td>Height</td>
<td>Tree Size Class</td>
</tr>
</tbody>
</table>
**Fire Regime Groups**: IV

**Historical Fire Size (acres)**
- Avg: 250
- Min: 10
- Max: 10000

**Sources of Fire Regime Data**
- Literature
- Local Data
- Expert Estimate

**Additional Disturbances Modeled**
- Insects/Disease
- Wind/Weather/Stress
- Competition
- Other (optional 1)

**References**


Peters, E.F. and S.C. Bunting. 1994. Fire conditions pre- and post-occurrence of annual grasses on the Snake River plain. Pages 31-36. in Proceedings - Ecology, management, and restoration of Intermountain...
rangelands symposium. USDA Forest Service INT-GTR-313, Ogden, Utah.


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