**LANDFIRE Biophysical Setting Model**

**Biophysical Setting 1710800**

Inter-Mountain Basins Big Sagebrush Shrubland

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

### General Information

<table>
<thead>
<tr>
<th>Contributors</th>
<th>Date</th>
</tr>
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<tbody>
<tr>
<td>Modeler 1 Don Major</td>
<td>3/17/2005</td>
</tr>
<tr>
<td>Modeler 2 Gary Medlyn</td>
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<tr>
<td>Modeler 3 Crystal Kolden</td>
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<table>
<thead>
<tr>
<th>Vegetation Type</th>
<th>Dominant Species</th>
<th>Map Zone</th>
<th>Model Zone</th>
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<tr>
<td>Upland Shrubland</td>
<td>ARTRW8 CHVI8 ACHY HECO26 ELELE</td>
<td>17</td>
<td>Alaska California Great Basin Great Lakes Hawaii Northeast Northern Plains N-Cent.Rockies Pacific Northwest South Central Southeast S. Appalachians Southwest</td>
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<table>
<thead>
<tr>
<th>General Model Sources</th>
<th>Map Zone</th>
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<tr>
<td>Literature</td>
<td>Alaska</td>
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<tr>
<td>Local Data</td>
<td>California</td>
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<td>Expert Estimate</td>
<td>Great Basin</td>
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### Geographic Range

This ecological system is found in eastern CA, central NV and UT and is distinct from sagebrush steppe (Inter-Mountain Basins Big Sagebrush Steppe) found on the Columbia Plateau and in WY.

### Biophysical Site Description

This widespread system is common to the Basin and Range province. In elevation it ranges from 3000-7000ft (above 4000ft at lower latitudes), and occurs on well-drained soils on foothills, terraces, slopes and plateaus. It is found on soil depths >18in and up to 60in+. Elevationally it is found between low elevation salt desert shrub and mountain big sagebrush zones where pinyon and juniper can establish. Occurs from 4-14in precipitation zones, however, Wyoming big sagebrush requires 8-12in of effective moisture within this broader range. Thus, other sites characteristics (eg, aspect, drainage) should be considered in identifying this ecotype. At the precipitation extremes, this system generally occurs as small patches and stringers.

### Vegetation Description

Shrub canopy cover generally ranges from 5-25%, but can exceed 30% at the upper elevation and precipitation zones. Wyoming big sagebrush sites have fewer understory species relative to other big sagebrush types. Rubber rabbitbrush is co-dominant.

Perennial forb cover is usually <10% with perennial grass cover reaching 20-25% on the more productive sites. Bluebunch wheatgrass may be a dominant species following replacement fires and as a co-dominant after 20yrs, but only in precipitation zones >10in. Bottlebrush squirreltail and Indian ricegrass are common on more xeric sites. Percent cover and species richness of understory are determined by site limitations. Pinyon (generally Pinus monophylla) and juniper (generally Juniper osteosperma) are present,

**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.**
occasionally reaching 90% canopy cover in areas that have escaped fire. Wyoming big sagebrush semi-desert is critical habitat for the greater sage grouse and many sagebrush obligates.

For MZs 12 and 17: In more xeric zones in central NV, basin big sagebrush is dominant with rabbitbrush co-dominant and shadscale sub-dominant. On the sodic sites, greasewood may also co-dominate, with spiny hopsage (Grayia spinosa). Shrub cover in these regions is reduced compared to more mesic sites, with the herbaceous understory consisting of Indian rice grass, bottlebrush squirreltail and Great Basin wildrye (Elymus elymoides).

**Disturbance Description**

This ecological system is characterized by replacement fires where shrub canopy exceeds 25% cover (ie, class C) or where grass cover is >15% and shrub cover is >20% (ie, class B). Mixed severity fires account for 20% of fire activity (mean FRI of 500yrs) where shrub cover ranges from 10-20% (ie, class B). Surface fires occur where shrub cover is <10% (ie, class A) and is generally uncommon (FRI of 200yrs). Where pinyon or juniper has encroached after 100yrs without fire, mean FRI of fire replacement increases from 100 to 125yrs. In MZs 12 and 17, reduced shrub cover associated with more xeric sites pushes FRI to longer periods.

The Aroga moth is capable of defoliating large acreages (ie, >1000ac; mean return interval of 75yrs), but usually 10-100 acres.

Weather stress: Prolonged drought (1 in 100yrs) on the more xeric sites may reduce shrub cover. Flooding may also cause mortality if the soil remains saturated for an extended period of time (ie, 1 in 300yr flood events). In years with high winter precipitation, flooding (ie, soil saturation for extended periods) results in mortality and die-back.

Herbivory (non-insect); Herbivory can remove the fine fuel that supports mixed severity fires and results in woody fuel build up that leads to severe replacement fires.

**Adjacency or Identification Concerns**

Identification concerns include instances of low-statured Wyoming big sagebrush due to reduced rooting zone. Low-statured Wyoming big sagebrush can be confused with black sagebrush (Bp$ 1079) from a distance or satellite.

This community may be adjacent to mountain big sagebrush at elevations above 6500ft., or adjacent to pinyon-juniper, ponderosa pine, at mid- to high-elevations, and salt desert shrub at low elevations. Low sagebrush or black sagebrush may form large islands within this community where soils are shallow or have root-restrictive layers.

Post-settlement conversion to cheatgrass is common and results in change in fire frequency and vegetation dynamics. Fire suppression can lead to pinyon-juniper encroachment with subsequent loss of shrub and herbaceous understory. Disturbance of this community may result in establishment of annual grasslands (eg, cheatgrass) and/or noxious weeds. Lack of disturbance can result in pinyon-juniper encroachment where adjacent to pinyon-juniper woodlands.

Post-settlement issues center around the high amount of big sagebrush with minimal to no understory, and whether these decadent stands are related to fire suppression or natural physiological/ecological progression.

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**Fire Regime Groups are:**

<table>
<thead>
<tr>
<th>Group</th>
<th>Frequency</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>0-35 year</td>
<td>surface</td>
</tr>
<tr>
<td>II</td>
<td>0-35 year</td>
<td>replacement</td>
</tr>
<tr>
<td>III</td>
<td>35-100+ year</td>
<td>mixed severity</td>
</tr>
<tr>
<td>IV</td>
<td>35-100+ year</td>
<td>replacement severity</td>
</tr>
<tr>
<td>V</td>
<td>200+ year</td>
<td>replacement severity</td>
</tr>
</tbody>
</table>
Native Uncharacteristic Conditions

Scale Description
BpS can occupy vast areas (>100000ac). 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 is assumed to be 250ac.

Issues/Problems
This ecological system represents the merging of basin big sagebrush (R2SBBB) and all Wyoming big sagebrush ecological systems from the Rapid Assessment: R2SBWY and R2SBWYwt. The NatureServe description of Intermountain Basins Big Sagebrush Shrubland (BPS 1080) includes both Artemesia tridentata spp. tridentata AND Artemesia tridentata spp. wyomingensis. Evaluation of plot-level data was of limited use as no distinction was made between big sagebrush types. Strong concerns were voiced that these two big sagebrush species should and can be mapped separately (especially areas currently invaded by adjacent trees).

There are no data, although abundant opinions, for the percentage of replacement and mixed severity fires, especially during mid-development, or whether surface fires occurred at all during early development under reference (pre-settlement) condition.

Comments
This ecological system is closely based on R2SBWY and R2SBWYwt originally modeled by Gary Back (gback@srk.com) and modified by Louis Provencher (lprovencher@tnc.org) based on reviews by Stanley G. Kitchen (skitchen@fs.fed.us), Peter Weisberg (pweisberg@cabnr.unr.edu) and Jolie Pollet (jpollet@blm.gov). This model assumes the sites are near pinyon-juniper savanna or woodlands and without frequent fire, pinyon or juniper will encroach into the sagebrush range site. In areas without a potential for tree invasion (e.g., lower elevation), the Historic Range of Natural Variability for classes A, B, and C, respectively, is 10%, 55%, and 35% (results of R2SBWY).

NOTE regarding depleted sagebrush: Late seral stage was not modeled as it was identified that sagebrush depletion rate is much slower than the rate of juniper invasion. Further, sagebrush systems are unable to exclude grass/forb so they can maintain fire, which can move the system back to earlier classes.

The first three development classes chosen for this ecological system correspond to the early, mid, and late seral stages familiar to range ecologists. The two classes with conifer invasion (classes D and E) approximately correspond to Miller and Tausch's (2001) phases 2 and 3 of pinyon and juniper invasion into shrublands.

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed and surface severity fires were deleted because they were not consistent with the modeled fire return intervals for these fire severity types.

Vegetation Classes

**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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**Class A** 15 %

Early Development 1 All Structure

**Upper Layer Lifeform**
- **Herbaceous**
- **Shrub**
- **Tree**

**Fuel Model** 1

**Description**
Post-replacement disturbance; grass dominated with scattered shrubs. Fuel loading discontinuous. Surface fire occurs every 200yrs on average but has no effect on succession. Succession to class B after 20yrs.

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**Class B** 50 %

Mid Development 1 Open

**Upper Layer Lifeform**
- **Herbaceous**
- **Shrub**
- **Tree**

**Fuel Model** 2

**Description**
Shrubs and herbaceous vegetation can be co-dominant, fine fuel bridges the woody fuel, but fuel discontinuities are possible. Replacement fire accounts for 80% of fire activity (mean FRI of 125yrs), whereas mixed severity fire occurs every 500yrs on average (20% of fire activity) and maintains vegetation in class B. Succession to class C after 40yrs.

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**Class C** 25 %

Mid Development 1 Closed

**Upper Layer Lifeform**
- **Herbaceous**
- **Shrub**
- **Tree**

**Fuel Model** 2

**Description**
Shrubs dominate the landscape; fuel loading is primarily woody vegetation. Shrub density sufficient in old stands to carry the fire without fine fuel. Establishment of pinyon and juniper seedlings and saplings widely scattered. Replacement fire (mean FRI of 100yrs) and rare flood events (return interval of 333yrs) cause a transition to class A. Prolonged drought (mean return interval of 100yrs) and insect/disease (every 75yrs on average) cause a transition to class B. Succession to class D after 40yrs.
**Fire Regime Groups**: 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.

### Disturbances

#### Fire Intervals

<table>
<thead>
<tr>
<th>Fire Intervals</th>
<th>Avg FI</th>
<th>Min FI</th>
<th>Max FI</th>
<th>Probability</th>
<th>Percent of All Fires</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement</td>
<td>137</td>
<td>30</td>
<td>200</td>
<td>0.0073</td>
<td>84</td>
</tr>
<tr>
<td>Mixed</td>
<td>1000</td>
<td>0.001</td>
<td>11</td>
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<tr>
<td>Surface</td>
<td>2500</td>
<td>0.0004</td>
<td>5</td>
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<tr>
<td>All Fires</td>
<td>115</td>
<td></td>
<td>0.0087</td>
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</tr>
</tbody>
</table>

**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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### Class D 5%

**Late Development 1 Open**

**Upper Layer Lifeform**

- ☑ Tree

**Fuel Model**

- 2

**Description**

Pinyon-juniper encroachment where disturbance has not occurred for at least 100yrs (tree species cover <15%). Saplings and young trees are the dominant lifeform. Sagebrush cover (<25%) and herbaceous cover decreasing compared to class C. Replacement fire occurs every 125yrs on average. Insect/disease (every 75yrs) and prolonged drought (every 100yrs) thin both trees and shrubs, causing a transition to class C. Succession to class E after 50yrs.

#### Indicator Species and Canopy Position

- JUNIP
- Upper
- PIMO
- Upper
- ARTRW8
- Mid-Upper
- HECO26

#### Structure Data (for upper layer lifeform)

- **Cover**
  - **Min**: 0 %
  - **Max**: 15 %
- **Height**
  - **Tree 0m**: 30 ft
  - **Tree 5m**: 150 ft
- **Tree Size Class**
  - Sapling >4.5ft; <5”DBH

- Upper layer lifeform differs from dominant lifeform.

Shrubs may still represent the dominant lifeform with pinyon and juniper saplings common (1-15% upper canopy cover).

### Class E 5%

**Late Development 1 Closed**

**Upper Layer Lifeform**

- ☑ Tree

**Fuel Model**

- 6

**Description**

Shrubland encroached with mature pinyon and/or juniper (cover 16-90%) where disturbance does not occur for at least 50yrs in Class D. Shrub cover <10% and graminoids scattered. Replacement fire occurs every 125yrs on average. Prolonged drought thins trees, causing a transition to class B. In the absence of disturbance class E maintains itself.

#### Indicator Species and Canopy Position

- JUNIP
- Upper
- PIMO
- Upper
- SYOR
- Lower
- HECO26
- Lower

#### Structure Data (for upper layer lifeform)

- **Cover**
  - **Min**: 16 %
  - **Max**: 90 %
- **Height**
  - **Tree 0m**: 30 ft
  - **Tree 10m**: 150 ft
- **Tree Size Class**
  - None

- Upper layer lifeform differs from dominant lifeform.
**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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