

# LANDFIRE Biophysical Setting Model

**Biophysical Setting 0610800**

**Inter-Mountain Basins Big Sagebrush Shrubland**

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

## General Information

**Contributors** (also see the Comments field)      **Date** 3/17/2005

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<u>Vegetation Type</u>	<u>Dominant Species</u>	<u>Map Zone</u>	<u>Model Zone</u>	
Upland Shrubland	ARTRW8 CHVI8	6	<input type="checkbox"/> Alaska	<input type="checkbox"/> Northern Plains
<b><u>General Model Sources</u></b>	ACHY		<input checked="" type="checkbox"/> California	<input type="checkbox"/> N-Cent. Rockies
<input checked="" type="checkbox"/> Literature	HECO26		<input type="checkbox"/> Great Basin	<input type="checkbox"/> Pacific Northwest
<input type="checkbox"/> Local Data	ATCO		<input type="checkbox"/> Great Lakes	<input type="checkbox"/> South Central
<input checked="" type="checkbox"/> Expert Estimate	ELELE		<input type="checkbox"/> Hawaii	<input type="checkbox"/> Southeast
			<input type="checkbox"/> Northeast	<input type="checkbox"/> S. Appalachians
				<input type="checkbox"/> Southwest

## 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 Wyoming.

## Biophysical Site Description

This widespread system is common to the Basin and Range province. It ranges in elevation 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 greater than 18in and up to 60+ inches. It is found between low elevation salt desert shrub and mountain big sagebrush zones where pinyon and juniper can establish. Occurs from four to 14in precipitation zones; however, Wyoming big sagebrush requires eight to 12in of effective moisture within this broader range. Thus, other sites characteristics (e.g. 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 five to 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 20 years, but only in precipitation zones above 10". 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 monophyla*) and juniper (generally *Juniper*

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osteosperma) present, 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 MZ 12 and 17: In more xeric zones in central Nevada, 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 (i.e., class C) or where grass cover is >15% and shrub cover is > 20% (i.e., class B). Mixed Severity fires account for 20% of fire activity (MFRI=500yrs) where shrub cover ranges from 10- 20% (i.e., class B). Surface fires occur where shrub cover is <10% (i.e., class A) and is generally uncommon (FRI of 200 years). Where pinyon or juniper has encroached after 100yrs without fire, MFRI increases from 100 to 125yrs. In MZs 12 and 17, reduced shrub cover associated with more xeric sites pushes MFRI to longer periods.

### **Adjacency or Identification Concerns**

Identification concerns include instances of low-statured Wyoming big sagebrush due to reduced effective rooting zone. Low-statured Wyoming big sagebrush can be confused with black sagebrush (BpS 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 (e.g., 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.

### **Native Uncharacteristic Conditions**

#### **Scale Description**

BpS can occupy vast areas (>100,000 acres). Historic disturbance (fire) likely ranged from small (<10ac) to large (>10,000 ac) 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 RA: R2SBWY and R2SBWYwt. The NatureServe description of Intermountain Basins Big Sagebrush Shrubland (BpS 1080) includes both *Artemisia tridentata* spp

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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 RA models 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). The MZ12 model and description were imported into MZ06 unchanged.

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 modelled as it was identified that sagebrush depletion rate is much slower than the rate of juniper invasion. Further, sagebrush is unable to exclude grass/forb, thereby maintaining fire and moving 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 two and three 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 fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

<b>Vegetation Classes</b>															
<b>Class A</b>	<b>15 %</b>	<b>Indicator Species and Canopy Position</b>	<b>Structure Data (for upper layer lifeform)</b>												
Early Development 1 All Structure		ACHY	<table border="1"> <thead> <tr> <th></th> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Cover</td> <td>0 %</td> <td>40 %</td> </tr> <tr> <td>Height</td> <td>Herb 0m</td> <td>Herb 0.5m</td> </tr> <tr> <td>Tree Size Class</td> <td colspan="2">None</td> </tr> </tbody> </table>		Min	Max	Cover	0 %	40 %	Height	Herb 0m	Herb 0.5m	Tree Size Class	None	
	Min	Max													
Cover	0 %	40 %													
Height	Herb 0m	Herb 0.5m													
Tree Size Class	None														
<b>Upper Layer Lifeform</b>		Upper													
<input checked="" type="checkbox"/> Herbaceous		HECOC8													
<input type="checkbox"/> Shrub		Upper													
<input type="checkbox"/> Tree		CHVI8	<input checked="" type="checkbox"/> Upper layer lifeform differs from dominant lifeform.												
<b>Fuel Model</b>		Upper	Early development is dominated by grasses and forbs with scattered shrubs representing <10% upper canopy cover.												
	1	ARTRW8													
<b>Description</b>		Upper	Upper lifeform originally input as shrubs 0-10% cover, 0-1 meter. However, due to												

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mapping rules, it was changed to Herbaceous 0-40% cover, 0-.5 meters, as in MZ13 revised MTDB.

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.

<p><b>Class B 50 %</b></p> <p>Mid Development 1 Open</p> <p><b>Upper Layer Lifeform</b></p> <p><input type="checkbox"/> Herbaceous</p> <p><input checked="" type="checkbox"/> Shrub</p> <p><input type="checkbox"/> Tree</p> <p style="text-align: right;"><b>Fuel Model</b></p> <p style="text-align: right;">2</p> <p><b>Description</b></p> <p>Shrubs and herbaceous vegetation can be co-dominant, fine fuels bridge the woody fuels, but fuel discontinuities are possible. Replacement fire accounts for 80% of fire activity (MFRI=125 years), whereas mixed severity fire occurs every 500 years on average (20% of fire activity) and maintains vegetation in class B. Succession to class C after 40yrs.</p>	<p><b>Indicator Species and Canopy Position</b></p> <p>ARTRW8 Upper</p> <p>ACHY Lower</p> <p>CHVI8 Mid-Upper</p> <p>HECO26 Lower</p>	<p><b>Structure Data (for upper layer lifeform)</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Min</th> <th style="text-align: center;">Max</th> </tr> </thead> <tbody> <tr> <td>Cover</td> <td style="text-align: center;">11 %</td> <td style="text-align: center;">20 %</td> </tr> <tr> <td>Height</td> <td style="text-align: center;">Shrub 0m</td> <td style="text-align: center;">Shrub 1.0m</td> </tr> <tr> <td>Tree Size Class</td> <td colspan="2" style="text-align: center;">None</td> </tr> </tbody> </table> <p><input type="checkbox"/> Upper layer lifeform differs from dominant lifeform.</p>		Min	Max	Cover	11 %	20 %	Height	Shrub 0m	Shrub 1.0m	Tree Size Class	None	
	Min	Max												
Cover	11 %	20 %												
Height	Shrub 0m	Shrub 1.0m												
Tree Size Class	None													

Cover originally input as 11-25% shrub cover; however, due to new breakpoints, changed to 11-20%.

<p><b>Class C 25 %</b></p> <p>Mid Development 1 Closed</p> <p><b>Upper Layer Lifeform</b></p> <p><input type="checkbox"/> Herbaceous</p> <p><input checked="" type="checkbox"/> Shrub</p> <p><input type="checkbox"/> Tree</p> <p style="text-align: right;"><b>Fuel Model</b></p> <p style="text-align: right;">2</p> <p><b>Description</b></p> <p>Shrubs dominate the landscape; fuel loading is primarily woody vegetation. Shrub density sufficient in old stands to carry the fire without fine fuels. Establishment of pinyon and juniper seedlings and saplings widely scattered. Replacement fire (MFRI=100yrs) and rare flood events (return interval=333yrs) cause a transition to class A. Prolonged drought (mean return interval=100yrs) and insect/disease (every 75yrs on average) cause a transition to class B. Succession to class D after 40yrs.</p>	<p><b>Indicator Species and Canopy Position</b></p> <p>ARTRW8 Upper</p> <p>CHVI8 Mid-Upper</p> <p>ELEL5 Lower</p> <p>HECO26 Lower</p>	<p><b>Structure Data (for upper layer lifeform)</b></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Min</th> <th style="text-align: center;">Max</th> </tr> </thead> <tbody> <tr> <td>Cover</td> <td style="text-align: center;">21 %</td> <td style="text-align: center;">40 %</td> </tr> <tr> <td>Height</td> <td style="text-align: center;">Shrub 0m</td> <td style="text-align: center;">Shrub 1.0m</td> </tr> <tr> <td>Tree Size Class</td> <td colspan="2" style="text-align: center;">None</td> </tr> </tbody> </table> <p><input type="checkbox"/> Upper layer lifeform differs from dominant lifeform.</p>		Min	Max	Cover	21 %	40 %	Height	Shrub 0m	Shrub 1.0m	Tree Size Class	None	
	Min	Max												
Cover	21 %	40 %												
Height	Shrub 0m	Shrub 1.0m												
Tree Size Class	None													

Cover originally input as 26-35% shrub cover; however, due to new breakpoints, changed to 21-40%.

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**Class D 5 %**

Late Development 1 Open

**Upper Layer Lifeform**

- Herbaceous
- Shrub
- Tree

**Fuel Model**  
2

**Indicator Species and Canopy Position**

JUNIP  
Upper  
PIMO  
Upper  
ARTRW8  
Mid-Upper  
HECO26

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

	Min	Max
Cover	0 %	20 %
Height	Tree 0m	Tree 5m
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).

**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.

Cover originally input as 0-15% shrub cover; however, due to new breakpoints, changed to 0-20%.

**Class E 5 %**

Late Development 1 Closed

**Upper Layer Lifeform**

- Herbaceous
- Shrub
- Tree

**Fuel Model**  
6

**Indicator Species and Canopy Position**

JUNIP  
Upper  
PIMO  
Upper  
SYOR  
Lower  
HECO26  
Lower

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

	Min	Max
Cover	21 %	90 %
Height	Tree 0m	Tree 10m
Tree Size Class	None	

Upper layer lifeform differs from dominant lifeform.

**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. Succession from class E to E.

Cover originally input as 16-90% shrub cover; however, due to new breakpoints, changed to 21-90%.

**Disturbances**

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**Fire Regime Group\*\*:** IV

**Historical Fire Size (acres)**

Avg 500

Min 10

Max 10000

**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	137	30	200	0.0073	84
Mixed	1000			0.001	11
Surface	2500			0.0004	5
All Fires	115			0.0087	

**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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