

# LANDFIRE Biophysical Setting Model

**Biophysical Setting 1410800**

**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** 9/8/2005

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**Modeler 2**      **Reviewer**

**Modeler 3**      **Reviewer**

### Vegetation Type

Upland Shrubland

### Dominant Species

ARTR2

CHVI8

ACHY

HECO26

ATCO

ELELE

POSE

PLJA

### Map Zone

14

### 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

## Geographic Range

This ecological system is found in eastern CA, central/southern NV and UT and is distinct from sagebrush steppe (Inter-Mountain Basins Big Sagebrush Steppe) found on the Columbia Plateau and in Wyoming. This BpS extends into MZ 13 but at higher elevations than in central NV and is not a common system.

## Biophysical Site Description

This widespread system is common to the Basin and Range province, but much less widespread in the Mojave Desert. 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 or blackbrush and mountain big sagebrush zones where pinyon and juniper can establish. Occurs from 4-14in precipitation zones, however. 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. Basin big and/or Wyoming big sagebrush sites have fewer understory species relative to other big sagebrush types. Wyoming big sagebrush is absent from many parts of MZ13, whereas basin big sagebrush is the diagnostic shrub (NRCS 2003b). Rubber rabbitbrush is co-dominant.

Perennial forb cover is usually <10% with perennial grass cover reaching 20-25% on the more productive sites. Sandberg bluegrass (*Poa secunda*) may be a dominant species following replacement fires and as a co-dominant after 20yrs, but only in precipitation zones above 10in. Bottlebrush squirreltail, Indian

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ricegrass, James galleta or sandy needle and thread grasses 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, occasionally reaching 50% canopy cover in areas that have escaped fire.

### **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 100-125yrs. In MZ12 and MZ17, reduced shrub cover associated with more xeric sites pushes FRI to longer periods.

Weather stress: Prolonged drought (1 in 50yrs; 20-30yr Pacific cycle modified by 7yr El Nino/El Nina cycle) on the more xeric sites will reduce woody cover.

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

### **Adjacency or Identification Concerns**

This community may be adjacent to mountain big sagebrush at elevations above 6500ft, or adjacent to pinyon-juniper and ponderosa pine at mid- to high-elevations and salt desert shrub and blackbrush at low elevations. Low sagebrush or black sagebrush (BpS 1079) may form large islands within this community where soils are shallow or have root-restrictive layers. Black sagebrush is very common in the Desert National Wildlife Refuge and forms matrix communities.

Post-settlement conversion to red brome with 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, red brome) 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 exclusion, historic livestock overgrazing, or natural physiological/ecological progression.

### **Native Uncharacteristic Conditions**

Shrub cover >50% is uncharacteristic. Tree cover >50% is uncharacteristic.

### **Scale Description**

BpS occupies small areas (<1000ac). Historic disturbance (fire) likely ranged from small (<10ac) to moderate (<1000ac) depending on conditions, time since last ignition and fuel loading. The average fire patch size is assumed to be 100ac.

### **Issues/Problems**

There is uncertainty about whether or not Wyoming big sagebrush is present at all in MZ13. NRCS considers Wyoming big sagebrush absent from the Mojave Desert, whereas a recent flora for the Desert National Wildlife Refuge describes Wyoming big sagebrush as the only big sagebrush subspecies. While

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recognizing the difficulty of identifying big sagebrush species, Dr. Wes Niles from University of Nevada, Las Vegas (wniles@ccmail.nevada.edu) (pers. comm.) confirmed that all his Mojave Desert herbarium specimens, including those from the Desert National Wildlife Refuge, are basin big sagebrush. Similarly, older flora for the Spring Mountains National Recreation Area describes basin big sagebrush, not Wyoming big sagebrush. The problem with the absence of Wyoming big sagebrush is that basin big sagebrush looks like Wyoming big sagebrush and occupies what appears to be "classic" Wyoming big sagebrush sites as seen in the Great Basin.

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.

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

## Comments

BpS 131080 is based on BpS 171080 (or 121080), which was adapted to MZ12 and MZ17 by Don Major (dmajor@tnc.org), Gary Medlyn (gmedlyn@nv.blm.gov) and Crystal Kolden (ckolden@gmail.com). Modifications to BpS 121080 for MZ13 are about species composition, smaller spatial scale, disturbances and geographic range. Wyoming big sagebrush is uncommon to absent in many parts of the Mojave Desert mountain ranges, whereas basin big sagebrush is the dominant shrub for BpS 131080. Model was changed because defoliation by Aroga moth and prolonged flooding were removed, and the drought cycle was shortened from 100 to 50yrs to reflect the different climate cycles of the Mojave Desert compared to the Great Basin. New dynamics changed results, but not dramatically (5% less or class B and 5% mode of class D).

S-class height and cover rules should be rectified to match MZ12 and MZ17.

BpS 121080 (171080) was 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 (eg, lower elevation), the Historic Range of Natural Variability for classes A, B and C, respectively, is 10%, 55% and 35% (results of R2SBWY).

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

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**Class A 15 %**

Early Development 1 All Structure

**Upper Layer Lifeform**

- Herbaceous  
 Shrub  
 Tree

**Fuel Model**

1

**Description****Indicator Species and Canopy Position**

ACHY  
 Upper  
 HECOC8  
 Upper  
 CHVI8  
 Upper  
 ARTR2  
 Upper

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

	Min	Max
Cover	0 %	40 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- Upper layer lifeform differs from dominant lifeform.

Early development is dominated by grasses and forbs with scattered shrubs representing <10% upper canopy cover. Shrubs are between 0-1m.

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.

**Class B 45 %**

Mid Development 1 Open

**Upper Layer Lifeform**

- Herbaceous  
 Shrub  
 Tree

**Fuel Model**

2

**Description****Indicator Species and Canopy Position**

ARTR2  
 Upper  
 ACHY  
 Lower  
 CHVI8  
 Mid-Upper  
 HECO26  
 Lower

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

	Min	Max
Cover	11 %	20 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

- Upper layer lifeform differs from dominant lifeform.

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 (mean FRI of 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 40 years.

**Class C 25 %**

Mid Development 1 Closed

**Upper Layer Lifeform**

- Herbaceous  
 Shrub  
 Tree

**Fuel Model**

2

**Description****Indicator Species and Canopy Position**

ARTR2  
 Upper  
 CHVI8  
 Mid-Upper  
 ELEL5  
 Lower  
 HECO26  
 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.

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 (mean FRI of 100yrs) causes a transition to class A. Prolonged drought (mean return interval of 50yrs) causes a transition to class B. Succession to class D after 40yrs.

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**Class D 10 %**

Late Development 1 Open

**Upper Layer Lifeform**

- Herbaceous
- Shrub
- Tree

**Fuel Model**  
2

**Indicator Species and Canopy Position**

JUNIP  
Upper  
PIMO  
Upper  
ARTR2  
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. Prolonged drought (every 50yrs) thins both trees and shrubs, causing a transition to class C. Succession to class E after 50yrs.

**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 %	50 %
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 (about every years) thins trees, causing a transition to class B. Succession maintains class E.

**Disturbances**

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

**Historical Fire Size (acres)**

- Avg 100
- Min 10
- Max 1000

**Sources of Fire Regime Data**

- Literature
- Local Data
- Expert Estimate

**Additional Disturbances Modeled**

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	135	30	200	0.00741	86
Mixed	1111			0.00090	10
Surface	3333			0.00030	3
All Fires	116			0.00861	

**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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- Insects/Disease       Native Grazing       Other (optional 1)  
 Wind/Weather/Stress       Competition       Other (optional 2)

## References

- Ackerman, T.L. 2003. A flora of the Desert National Wildlife Range, Nevada. Edited by J. Bair and A. Tiehm. *Mentzelia* 7.
- Barbour, M.G. and J. Major eds. 1977. *Terrestrial vegetation of California*. John Wiley and Sons, New York.
- Brown, J.K. and J. Kapler-Smith, eds. 2000. *Wildland fire in ecosystems: effects of fire on flora*. Gen. Tech. Rep. RMRS-GTR-42-vol. 2. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 257 pp.
- Cook, J. G., T.J. Hershey and L.L. Irwin. 1994. Vegetative response to burning on Wyoming mountain-shrub big game ranges. *Journal of Range Management* 47: 296-302.
- Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal and P.K. Holmgren. 1994. *Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A. Asterales*. Volume 5. New York Botanical Garden, Bronx, NY.
- Gruell, G.E. 1999. Historical and modern roles of fire in pinyon-juniper. P. 24-28. In: S.B. Monsen and R. Stevens, compilers. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997, Provo, UT*. Proc. RMRS-P-9. Ogden, UT. USDA Forest Service, Rocky Mountain Research Station.
- Kinney, W.C. 1996. *Conditions of rangelands before 1905. Sierra Nevada ecosystem project: Final report to Congress, Vol. II*. Davis: University of California, Centers for water and wildland resources. 31-45.
- Kuchler, A.W. 1985. Potential natural vegetation (map at scale of 1:7,500,000). In: U.S. Geological Survey, *The National Atlas of the USA*. U.S. Govt. Print. Off. Washington, D.C.
- Miller, R.F. and J.A. Rose. 1999. Fire history and western juniper encroachment in sagebrush-steppe. *Journal of Range Management*. 550-559.
- Miller, R.F. and L.L. Eddleman. 2000. Spatial and temporal changes of sage grouse habitat in the sagebrush biome. *Oregon State Univ. Agr. Exp. Stat. Technical Bull.* 151. 35 pp.
- Miller, R.F. and R.J. Tausch. 2001. The role of fire in juniper and pinyon woodlands: a descriptive analysis. Pages 15-30 in: *Proceedings: The First National Congress on Fire, Ecology, Prevention, and Management*. San Diego, CA, Nov. 27- Dec. 1, 2000. Tall Timbers Research Station, Tallahassee, FL. Miscellaneous Publication 11.
- NatureServe. 2007. *International Ecological Classification Standard: Terrestrial Ecological Classifications*. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.
- Tausch, R.J. and R.S. Nowak. 1999. Fifty years of ecotone change between shrub and tree dominance in the Jack Springs Pinyon Research Natural Area. Pages 71-77 in: E.D. McArthur, W.K. Ostler and C.L.

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Wambolt, compilers. Proceedings: shrubland ecotones. 1998. Ephram, UT. Proc. RMRS-P-11. Ogden, UT. U.S. Dept. Ag., Forest Service, Rocky Mountain Research Station.

Tiltsdale, E.W. 1994. Great Basin region: sagebrush types. P. 40-46. In: T.N. Shiflet (ed.) Rangeland Cover Types. Soc. Range Manage., Denver, CO.

USDA-NRCS. 2003a. Major Land Resource Area 28B Central Nevada Basin and Range. Nevada Ecological Site Descriptions. Reno, NV. Available online:  
<http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx..>

USDA-NRCS. 2003b. Major Land Resource Area 29 Southern Nevada Basin and Range. Nevada Ecological Site Descriptions. Reno, NV. Available online:  
<http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

Vale, T.R. 1973. The sagebrush landscape of the intermountain west. Dissertation. Berkeley: University of California. 508 pp.

Vale, T.R. 1975. Presettlement vegetation in the sagebrush-grass area of the intermountain west. Journal of Range Management 28(1): 32-36.

West, N.E. 1983. Western Intermountain sagebrush steppe. Pages 351-297 in: N.E. West, ed. Ecosystems of

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