

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

Contributors (also see the Comments field) **Date** 3/17/2005
Modeler 1 Don Major dmajor@tnc.org **Reviewer**
Modeler 2 Gary Medlyn gmedlyn@nv.blm.gov **Reviewer**
Modeler 3 Crystal Kolden ckolden@gmail.com **Reviewer**

<u>Vegetation Type</u>	<u>Dominant Species</u>	<u>Map Zone</u>	<u>Model Zone</u>	
Upland Shrubland	ARTRW8 CHVI8	17	<input type="checkbox"/> Alaska	<input type="checkbox"/> Northern Plains
<u>General Model Sources</u>	ACHY		<input type="checkbox"/> California	<input type="checkbox"/> N-Cent. Rockies
<input checked="" type="checkbox"/> Literature	HECO26		<input checked="" 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 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 monophyla*) and juniper (generally *Juniper osteosperma*) are present,

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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 300yrflood 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 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 (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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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 *Artemisia tridentata* spp. *tridentata* AND *Artemisia 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

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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.

Indicator Species and Canopy Position

ACHY
 Upper
 HECOC8
 Upper
 CHVI8
 Upper
 ARTRW8
 Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub 1.0m
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.

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.

Indicator Species and Canopy Position

ARTRW8
 Upper
 ACHY
 Lower
 CHVI8
 Mid-Upper
 HECO26
 Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	25 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

- Upper layer lifeform differs from dominant lifeform.

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.

Indicator Species and Canopy Position

ARTRW8
 Upper
 CHVI8
 Mid-Upper
 ELEL5
 Lower
 HECO26
 Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	26 %	35 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

- Upper layer lifeform differs from dominant lifeform.

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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 %	15 %
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.

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	16 %	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. In the absence of disturbance class E maintains itself.

Disturbances

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

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

References

- Brown, J.K. and J. Kapler-mith, 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 Wyoimng 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. Pages 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. Wambolt, compilers. Proceedings: shrubland ecotones. 1998. Ephram, UT. Proc. RMRS-P-11. Ogden, UT. USDA Forest Service, Rocky Mountain Research Station.
- Tiltsdale, E.W. 1994. Great Basin region: sagebrush types. Pages 40-46 in: T.N. Shiflet, ed. Rangeland Cover Types. Soc. Range Manage., Denver, CO.

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USDA-NRCS. 2003. Major Land Resource Area 24 Humboldt Area. Nevada Ecological Site Descriptions. Reno, NV. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

USDA-NRCS. 2003. Major Land Resource Area 25 Owyhee High Plateau. Oregon and Nevada Ecological Site Descriptions. Reno, NV. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

USDA-NRCS. 2003. Major Land Resource Area 27 Fallon-Lovelock Area. Nevada Ecological Site Descriptions. Reno, NV. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

USDA-NRCS. 2003. Major Land Resource Area 28A Great Salt Lake Area. Nevada Ecological Site Descriptions. Reno, NV. Available online: <http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx>.

USDA-NRCS. 2003. 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. 2003. 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 the World 5: Temperate deserts and semi-deserts*. Elsevier Scientific Publishing Company, New York, NY.

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