LANDFIRE Biophysical Setting Model

Biophysical Setting 2310800 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** 2/22/2005

Modeler 1 Don Major dmajor@tnc.org **Reviewer** Tim Christiansen tchristiansen@tnc.org
Modeler 2 **Reviewer**
Modeler 3 **Reviewer**

Vegetation Type
Upland Shrubland

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
ARTRW8
CHVI8
ACHY
HECO26

Map Zone
23

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

Geographic Range
This ecological system is found in western CA, central NV, UT, CO and WY, and is common to the Basin and Range province. It is distinct from Inter-Mountain Basins Big Sagebrush Steppe (1125) found on the Columbia Plateau and in WY.

Biophysical Site Description
This widespread system ranges in elevation from 3000-7000ft, and occurs on well-drained soils on foothills, terraces, slopes and plateaus. It is found on soil depths >18in and up to 60in+. It is found between salt desert shrub at lower elevations and mountain big sagebrush at higher elevations where pinyon and juniper can establish. Occurs from 4-14in precipitation zones.

Vegetation Description
This ecological system is commonly referred to as Wyoming big sagebrush semi-desert. 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. Rabbit rubberbrush may be co-dominant. Perennial forb cover is usually <10%. Perennial grass cover may reach 20-25% on the more productive sites. Bluebunch wheatgrass may be a dominant species following replacement fires and as a co-dominant after 20yrs. Bottlebrush squirreltail and Indian ricegrass are common. Percent cover and species richness of understory are determined by site limitations. Pinyon (generally Pinus monophyla) and juniper (generally Juniper osteosperma) are present, infrequently reaching 90% canopy cover in areas that have escaped fire. This system is critical habitat for the greater sage grouse and many sagebrush obligates.

Disturbance Description
This ecological system is typically Fire Regime Group IV. It is characterized by replacement fires in mid-

**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.

and late-development stages. Where shrub cover ranges from 10 to 20% (class B), mixed severity fires account for 20% of fire activity (mean FRI of 500yrs). Surface fires occur where shrub cover is <10% (class A), but are generally uncommon (FRI of 200yrs). Where pinyon or juniper has encroached after 100yrs without fire (classes D and E), mean FRI of replacement fire increases from 100 to 125yrs.

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

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).

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

Adjacency or Identification Concerns

The NatureServe description of Intermountain Basins Big Sagebrush Shrubland (BPS 1080) includes both Artemesia tridentata ssp. tridentata AND Artemesia tridentata ssp. wyomingensis. Strong concerns were voiced that these two big sagebrush species should and can be mapped separately (especially areas currently invaded by adjacent trees). This BpS does not distinguish between sagebrush systems too low in elevation to allow tree invasion (eg, as Humboldt River drainage of NV) and where trees can readily invade under fire exclusion (above 4500ft in NV). These two types of sagebrush systems need to be separated, especially for management of greater sage grouse.

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 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 cheatgass 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.

Native Uncharacteristic Conditions

Scale Description

Historic disturbance (fire) likely ranged from small (<10ac) to large (>10000ac) depending on conditions, time since last ignition and fuel loading. Assumed the average patch size is 250ac.

Issues/Problems

The NatureServe description of Intermountain Basins Big Sagebrush Shrubland (1080) includes both Artemesia tridentata ssp. tridentata AND Artemesia tridentata ssp. wyomingensis. 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.

**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.

Comments

This model is identical to the model for the same BpS in MZ16 (Utah High Plateaus) with minor descriptive edits based on peer review for MZ23 and MZ24. This ecological system merged and is closely based on to Rapid Assessment 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).

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.

This model was subject to a bug in version 5.0.53 of VDDT and was corrected in version 5.0.55 on 4/6/2005 by Pohl.

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

Class A **15 %**

Early Development 1 All Structure

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

1

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.

Description

Post-replacement disturbance; grass dominated with scattered shrubs. Fuel loading discontinuous. Surface fire occurs every 200yrs on average. Succession to class B after 20yrs.

**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.

Class B 50 %

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

2

Indicator Species and Canopy Position

ARTRW8
Upper
ACHY
Lower
CHVI8
Mid-Upper
HECO26
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	10 %	30 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

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 in this class (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.

Class C 25 %

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

2

Indicator Species and Canopy Position

ARTRW8
Upper
CHVI8
Mid-Upper
ELEL5
Lower
HECO26
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	40 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

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.

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	10 %	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.

Description

Pinyon-juniper encroachment where disturbance has not occurred for 100+ years (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 120 years on average. Insect/disease (every 75

**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.

years) and prolonged drought (every 100 years) thin both trees and shrubs, causing a transition to class C. Succession to class E after 50 years.

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%). Shrub cover <10% and graminoids scattered. Replacement fire occurs every 125 years on average. Prolonged drought thins trees, causing a transition to class B.

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

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.

Additional Disturbances Modeled

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

References

Brown, J.K. and J.K. 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.

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.

**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.

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.

Tilsdale, E.W. 1994. Great Basin region: sagebrush types. Pages 40-46 in: T.N. Shiflet, ed. Rangeland Cover Types. Soc. Range Manage., Denver, CO.

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 25 Owyhee High Plateau. Nevada Ecological Site Descriptions. Reno, NV. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

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 27 Fallon-Lovelock Area. Nevada Ecological Site Descriptions. Reno, NV. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

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.

**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.