LANDFIRE Biophysical Setting Model

Biophysical Setting 1811260 Inter-Mountain Basins Montane Sagebrush Steppe

☐ *This BPS is lumped with:*
☐ *This BPS is split into multiple models:*

General Information

Contributors (also see the Comments field) **Date** 5/31/2005

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Modeler 2		**Reviewer**	
Modeler 3		**Reviewer**	

Vegetation Type
Shrubland

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
ARTRV
PUTR2
SYOR2
ARAR8

Map Zone
18

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
Montane and subalpine elevations across the western US from 1000m in eastern OR and WA to over 3000m in the southern Rockies, and within the mountains of NV, western UT, southeast WY and southern ID.

Biophysical Site Description
This ecological system occurs in many of the western United States, usually at middle elevations (1000-2500m). Within the Great Basin mapping zone, elevation ranges from 1370m in Idaho to 3200m in the White Mountains of CA (Windward and Tisdale 1977, Blaisdell et al. 1982, Cronquist et al. 1994, Miller and Eddleman 2000). The climate regime is cool, semi-arid to subhumid, with yearly precipitation ranging from 25-90cm/year (Mueggler and Stewart 1980, Tart 1996). Much of this precipitation falls as snow. Temperatures are continental with large annual and diurnal variation. In general this system shows an affinity for mild topography, fine soils and some source of subsurface moisture. Soils have well developed dark organic surface horizons (Hironaka et al. 1983, Tart 1996) and generally are moderately deep to deep, well-drained and of loam, sandy loam, clay loam or gravelly loam textural classes; soils often have a substantial volume of coarse fragments, and are derived from a variety of parent materials. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridge tops and mountain slopes. However, at the high ends of its precipitation and elevation ranges mountain big sagebrush occurs on shallow and/or rocky soils. All aspects are represented, but the higher elevation occurrences may be restricted to south- or west-facing slopes.

At lower elevations, mountain big sagebrush occurs on upper fan piedmonts, where it typically intermixes with Wyoming big sagebrush on north-facing slopes. On mountain side-slopes at this low elevation, it

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also occurs on north-facing slopes. Pinyon and juniper are usually present where mountain big sagebrush occurs on south-facing slopes and PJ will generally increase on north-facing slopes within the sagebrush community. At mid-level elevations, mountain sagebrush begins to move into more southerly slopes intermingling with black sagebrush and low sagebrush and with mountain mahogany occurring on north-facing slopes. With continued elevation, curlleaf mountain mahogany generally crowds it out. Mountain big sagebrush then occupies drier sites at higher elevations.

Vegetation Description

Vegetation types within this ecological system are usually <1.5m tall and dominated by Artemisia tridentata ssp. vaseyana, Artemisia cana ssp. viscidula or Artemisia tridentata ssp. speciformis. A variety of other shrubs can be found in some occurrences, but these are seldom dominant. They include Artemisia rigida, Artemisia arbuscula, Ericameria nauseosa, Chrysothamnus viscidiflorus, Ephedra viscidiflorus, Symphoricarpos oreophilus, Purshia tridentata, Peraphyllum ramosissimum, Ribes cereum and Amelanchier alnifolia. The canopy cover is usually between 20-80%. The herbaceous layer is usually well represented, but bare ground may be common in particularly arid or disturbed occurrences. Graminoids that can be abundant include Festuca idahoensis, Festuca thurberi, Festuca ovina, Elymus elymoides, Deschampsia caespitosa, Danthonia intermedia, Danthonia parryi, Stipa spp, Pascopyrum smithii, Bromus carinatus, Elymus trachycaulus, Koeleria macrantha, Pseudoroegneria spicata, Bromus anomalus, Achnatherum therburianum, Poa fendleriana or Poa secunda. Forbs are often numerous and an important indicator of health. Forb species may include Castilleja, Potentilla, Erigeron, Phlox, Astragalus, Geum, Lupinus, Eriogonum, Balsamorhiza sagittata, Achillea millefolium, Antennaria rosea, Eriogonum umbellatum, Fragaria virginiana, Artemisia ludoviciana, Hymenoxys hoopesii (=Helenium hoopesii), Hydrophyllum capitatum, etc. Mueggler and Stewart (1980), Hironaka et al. (1983) and Tart (1996) described several of these types. This ecological system is critical summer habitat for greater sage grouse. Moreover, resprouting bitterbrush in mountain big sagebrush types is potentially important to wildlife during early stand development.

Disturbance Description

Mean fire return intervals in and recovery times of mountain big sagebrush are subjects of lively debate in recent years (Welch and Criddle 2003). Mountain big sagebrush communities were historically subject to stand replacing fires with a mean return interval ranging from 40yrs+ at the Wyoming big sagebrush ecotone, and up to 80yrs in areas with a higher proportion of low sagebrush in the landscape (Crawford et al. 2004, Johnson 2000, Miller et al. 1994, Burkhardt and Tisdale 1969 and 1976, Houston 1973, Miller and Rose 1995, Miller et al. 2000). Under presettlement conditions mosaic burns generally exceeded 75% top kill due to the relatively continuous herbaceous layer. Therefore, replacement fire with a mean FRI of 40-80yrs was adopted here. Brown (1982) reported that fire ignition and spread in big sagebrush is largely (90%) a function of herbaceous cover and wind speed where ground cover exceeds 50%. These communities were also subject to periodic mortality due to insects, disease, rodent outbreaks, drought and winterkill (Anderson and Inouye 2001, Windward 2004). Periodic mortality events may result in either stand-replacement or patchy die-off depending on the spatial extent and distribution of these generally rare (50-100yrs) events.

Recovery rates for shrub canopy cover vary widely in this type, depending post fire weather conditions, sagebrush seed-bank survival, abundance of resprouting shrubs (eg, snowberry and bitterbrush) and size and severity of the burn. Mountain big sagebrush typically reaches five percent canopy cover in 8-14yrs. This may take as little as four years under favorable conditions and longer than 25yrs in unfavorable situations (Pedersen et al. 2003, Miller unpublished data). Mountain big sagebrush typically reaches 25% canopy cover in about 25yrs, but this may take as few as nine years or longer than 40yrs (Windward 1991, Pedersen et al. 2003, Miller unpublished data). Mountain snowberry and resprouting forms of bitterbrush

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may return to pre-burn cover values in a few years. Bitterbrush plants less than fifty years old are more likely to resprout than older plants (Simon 1990).

Adjacency or Identification Concerns

BpS 1126 includes a high elevation low sagebrush component, which can be important. BpS 1124 (Columbia Plateau Low Sagebrush Steppe) also represents this higher elevation low sagebrush type. Therefore, 1126 and 1124 may often be intermingled and difficult to determine whether or not low sagebrush is a component of BpS 1126 or 1124.

The NatureServe description does not distinguish between mountain big sagebrush that can be invaded by conifers at mid to high elevations (ie, within the tolerance of pinyon and juniper) and mountain sagebrush steppe that is too high elevation for pinyon to encroach. The ability for pinyon to invade has a large effect on predicted HRV and management.

This type may be adjacent to forests dominated by aspen, Douglas-fir, limber pine and bristlecone pine. It also occurs adjacent to pinyon-juniper woodlands. The ecological system, where adjacent to conifers, is readily invaded by conifers (Douglas-fir, sub-alpine fir, whitebark pine, limber pine, pinyon-pine and juniper spp) in the absence of historic fire regimes (Miller and Rose 1999). This type probably served as an ignition source for adjacent aspen stands. Mountain big sagebrush is commonly found adjacent to or intermingled with low sagebrush and mountain shrublands.

Uncharacteristic conditions in this type include herbaceous canopy cover less than 40% and dominance of the herbaceous layer by mules ears (Wyethia amplexcaulis) on clayey soils.

At lower elevational limits on southern exposures there is a high potential for cheatgrass invasion/occupancy where the native herbaceous layer is depleted. This post-settlement, uncharacteristic condition is not considered here.

Native Uncharacteristic Conditions

Scale Description

This type occupies areas ranging in size from 10s-10000s of acres. Disturbance patch size can also range from 10s-1000s of acres. The distribution of past burns was assumed to consist of many small patches in the landscape.

Issues/Problems

If conifers are not adjacent to this system use a three-box model with the following percentages per box: 20% A, 45% B and 35% C.

Comments

D Major made changes to vegetation class structural values in response to MTD v3.1 updates (K Pohl 7/18/05 request). These changes have not been reviewed and accepted by model developers as of 7/24/05. Jon Bates (jon.bates@oregonstate.edu) made minor changes in accepting BpS 1126 for MZ18 from MZs 12 and 17: 1) Editorial changes were made to the biophysical description. 2) Hydrophyllum was added to the species list for vegetation description. 3) Under disturbance, wind speed was added as an important factor increasing fire spread. 4) Max fire size was increased to 30000ac from 10000ac based on recent fires in mountain ranges in good condition in southeastern OR. 5) Average fire size was increased to 500ac from 100ac.

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BpS 1126 for MZs 12 and 17 was developed by Gary Medlyn (Gary_medlyn@nv.blm.gov) and Crystal Kolden (ckolden@gmail.com) based on BpS 1126big from LF MZ16. BpS 1126big is essentially PNVG R2SBMTwc (mountain big sagebrush with potential for conifer invasion) developed by Don Major (dmajor@tnc.org), Alan R. Sands (asands@tnc.org), David Tart (dtart@fs.fed.us) and Steven Bunting (sbunting@uidaho.edu). R2SBMTwc was itself based on R2SBMT developed by David Tart. R2SBMtwc was revised by Louis Provencher (lprovencher@tnc.org) following critical reviews by Stanley Kitchen (skitchen@fs.fed.us), Michele Slaton (mslaton@fs.fed.us), Peter Weisberg (pweisberg@cabnr.unr.edu), Mike Zielinski (mike_zielinski@nv.blm.gov) and Gary Back (gback@srk.com).

Reviewers and modelers of R2SBMT and R2SBMTwc had very different opinions on the range of mean FRIs and mountain big sagebrush recovery times (see Welch and Criddle 2003). It is increasingly agreed upon that a MFI of 20yrs, which used to be the accepted norm, is simply too frequent to sustain populations of greater sage grouse and mountain big sagebrush ecosystems whose recovery time varies from 10-70yrs. Reviewers consistently suggested longer FRIs and recovery times. The revised model is a compromise with longer recovery times and FRIs. Modeler and reviewers also disagreed on the choice of FRG: II (modeler) vs. IV (reviewers). For MZs 12 and 17, modelers place this system in Fire Regime Group IV.

The first three development classes chosen for this PNVG correspond to the early, middle 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.

Vegetation Classes

Class A **20 %**

Early Development 1 Open

Upper Layer Lifeform

- ☑ Herbaceous
- ☐ Shrub
- ☐ Tree

Fuel Model

1

Description

Indicator Species and Canopy Position

PSSP6
Upper
FEID
Upper
SYOR2
Lower
ARTRV
Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	80 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	None	

☑ Upper layer lifeform differs from dominant lifeform.

Herbaceous cover is the dominant life form (50-80% cover) with scattered shrubs. Originally input with shrubs as layer 0-10% and 0-1m, but due to mapping rules, changed to herb class.

Herbaceous vegetation is the dominant life form. Herbaceous cover is variable but typically >50% (50-80%). Shrub cover is 0-5%. Replacement fire occurs every 80yrs on average. Succession to class B after 12yrs.

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Class B **50 %**

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

1

Indicator Species and Canopy Position

ARTRV
Upper
PUTR2
Upper
CONIFER
Lower
SYMPH
Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	11 %	20 %
Height	Shrub 0.6m	Shrub >3.1m
Tree Size Class	Seedling <4.5ft	

☑ Upper layer lifeform differs from dominant lifeform.

Herbaceous cover is the dominant life form with canopy >50%. Shrub cover is 6-25% and the upper life form.

Description

Shrub cover 6-25%. Mountain big sagebrush cover up to 20%. Herbaceous cover is typically >50%. Initiation of conifer seedling establishment. Replacement fire mean FRI is 40yrs. Succession to class C after 38yrs.

Class C **15 %**

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

2

Indicator Species and Canopy Position

ARTRV
Upper
PUTR2
Upper
SYMPH
Low-Mid
CONIFER
Mid-Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	21 %	50 %
Height	Shrub 0.6m	Shrub >3.1m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Shrubs are the dominant life form. Shrub cover 26-45%+. Herbaceous cover is typically <50%. Conifer (juniper, pinyon-juniper, ponderosa pine or white fir) cover <10%. Insects and disease every 75yrs on average will thin the stand and cause a transition to class B. Replacement fire occurs every 50yrs on average. In the absence of fire for 80yrs, vegetation will transition to class D. Otherwise, succession keeps vegetation in class C.

Class D **10 %**

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

2

Indicator Species and Canopy Position

CONIFER
Upper
ARTRV
Mid-Upper
PUTR2
Mid-Upper
SYMPH
Low-Mid

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	11 %	30 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

☑ Upper layer lifeform differs from dominant lifeform.

Shrub cover generally decreasing but remains between 26-40% Conifer cover 11-25%.

Description

Note: Incorporate only if conifer stands are adjacent.
Conifers are the upper life form (juniper, pinyon-juniper, ponderosa pine, limber pine or white fir). Conifer cover is 11-25%. Shrub cover generally decreasing but remains between 26-40%. Herbaceous cover <30%. The mean FRI of replacement fire is 50yrs. Insects/diseases thin the sagebrush, but not the conifers, every 75yrs on average, without causing a transition to other classes. Succession is from C to D after 50yrs.

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Class E **5 %**

Late Development 2 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

6

Indicator Species and Canopy Position

CONIFER
Upper
ARTRV
Mid-Upper
PUTR2
Mid-Upper
SYMPH
Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	80 %
Height	Tree 0m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Note: Incorporate only if conifer stands are adjacent.
Conifers are the dominant life form (juniper, pinyon-juniper, ponderosa pine, limber pine or white fir). Conifer cover 26-80% (pinyon-juniper 36-80% (Miller and Tausch 2000), juniper 26-40% (Miller and Rose 1999) and white fir 26-80%). Shrub cover 0-20%. Herbaceous cover <20%. The mean FRI for replacement fire is longer than in previous states (75yrs). Conifers are susceptible to insects/diseases that cause diebacks (transition to class D) every 75yrs on average. Succession from class E to E.

Disturbances

Fire Regime Group:** **IV**

Historical Fire Size (acres)

Avg 500
Min 10
Max 30000

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	49	15	100	0.02041	100
Mixed					
Surface					
All Fires	49			0.02043	

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 ☐ Native Grazing ☐ Other (optional 1)
☐ Wind/Weather/Stress ☐ Competition ☐ Other (optional 2)

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