

LANDFIRE Biophysical Setting Model

Biophysical Setting 0611250

Inter-Mountain Basins Big Sagebrush Steppe

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

General Information

Contributors (also see the Comments field) **Date** 2/23/2005

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Modeler 2 Louis Provencher lprovencher@tnc.org **Reviewer**

Modeler 3 **Reviewer**

<u>Vegetation Type</u>	<u>Dominant Species</u>	<u>Map Zone</u>	<u>Model Zone</u>	
Upland Savanna and Shrub-Steppe	ARTRW8 AGSP	6	<input type="checkbox"/> Alaska California	<input type="checkbox"/> Northern Plains N-Cent.Rockies
<u>General Model Sources</u>	STTH2 POSA12		<input checked="" type="checkbox"/> <input type="checkbox"/> Great Basin <input type="checkbox"/> Great Lakes <input type="checkbox"/> Hawaii <input type="checkbox"/> Northeast	<input type="checkbox"/> <input type="checkbox"/> Pacific Northwest <input type="checkbox"/> South Central <input type="checkbox"/> Southeast <input type="checkbox"/> S. Appalachians <input type="checkbox"/> Southwest
<input checked="" type="checkbox"/> Literature <input checked="" type="checkbox"/> Local Data <input checked="" type="checkbox"/> Expert Estimate				

Geographic Range

This widespread matrix-forming ecological system occurs throughout much of the Columbia Plateau and northern Great Basin and Wyoming and is found at slightly higher elevations farther south.

Biophysical Site Description

Sagebrush steppe is found in continental, semi-arid climate with highly variable annual precipitation greater than 7-12in (~180-300mm) (McArthur 2000) that may also include 14in precipitation zone. Common on foothills, undulating terraces, slopes, and plateaus, but also in basins and valley bottoms. Soil depths range from shallow to moderately deep, well-drained with an effective rooting depth of <40in (~1m). NRCS Range Sites: Loamy 8-10in and 10-12in precipitation zones, and shallow loam 10-14in precipitation zones.

Vegetation Description

This shrub-steppe is dominated by perennial grasses and forbs (>25% cover) with *Artemisia tridentata* ssp *tridentata*, *Artemisia tridentata* ssp *wyomingensis*, and/or *Purshia tridentata* dominating or codominating the open to moderately dense (10-40% cover) shrub layer. In southern Idaho and northern Utah, *Artemisia tridentata* ssp *wyomingensis* dominates large landscape. *Atriplex confertifolia*, *Chrysothamnus viscidiflorus*, *Ericameria nauseosa*, or *Tetradymia* spp may be common especially in disturbed stands. Associated graminoids include *Achnatherum hymenoides*, *Elymus lanceolatus* ssp. *Lanceolatus*, *Festuca idahoensis*, *Festuca campestris*, *Koeleria macrantha*, *Poa secunda*, and *Pseudoroegneria spicata*. Common forbs are *Phlox hoodii*, *Arenaria* spp., and *Astragalus* spp. Areas with deeper soils more commonly support *Artemisia tridentata* ssp *tridentata* but have largely been converted

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for other land uses.

The sagebrush steppe landscape is a mosaic of shrub-dominated and herbaceous-dominated phases (West 2000). Forbs have low diversity but are important for wildlife, including the Greater Sage Grouse. Species diversity is lower in Wyoming big sagebrush communities than in other big sagebrush types (FEIS).

Wyoming big sagebrush communities are critical habitat for Greater Sage Grouse and other sagebrush obligate species.

Disturbance Description

Historically, fire was the principal disturbance within this vegetation type; other disturbances included insects (e.g., moths and grasshoppers that eat leaves, moth larval grubs that eat roots; return interval of 75yrs), periods of drought and wet cycles and shifts in climate (return interval of 100yrs). Intervals between natural wildfires varied between 25yrs (northern Yellowstone National Park [Houston 1973], cited in West 2000) and 100+yrs (West 2000). West (1983) and Miller and Eddelman (2000) cite MFRI<100yrs for replacement fire. FEIS cites fire return interval ranges between 10-70yrs with mean of 40yrs for Wyoming sagebrush steppe. Studies cited in FEIS may underestimate FRIs or not hold up to scrutiny (Welch and Criddle 2003). It was assumed that dominant fires were stand replacement (MFRI of 75-94yrs) due to the continuity of fine fuels typical of steppe ecosystems. Mixed severity (25-75% of area inside burn perimeter topkilled) played a minor role during mid-development. Assuming a MFRI=75yrs (from the total fire probability), the MFRI of mixed severity fire was 20% of fires, thus a MFRI=375yrs, during mid-development. Re-establishment following fire is from seed germination and establishment. Establishment is dependent upon soil seedbank and/or proximity of seed sources, fire size and continuity, and climatic conditions.

Adjacency or Identification Concerns

The NatureServe description of BpS 1125 includes different species of sagebrush and steppe ecosystems that are structurally and ecologically different such as *Artemisia tridentata* ssp *tridentata* and *Artemisia tridentata* ssp *wyomingensis*. We highly recommend that, at least, *Artemisia tridentata* ssp *tridentata*, which is a taller shrub found in drainages and deeper soils, be separated from the other shrubs. Ultimately, the two sagebrush species should be modeled separately. *Artemisia tripartita* ssp *tripartita* is not part of this system in Nevada because it is generally associated with frigid soils (thus more typically mountain big sagebrush) under snow pockets. Bitterbrush is not found in a large area of northcentral Nevada on the more alkaline soils of Pleistocene Lake Lahontan.

Wyoming big sagebrush is known to hybridize with other subspecies of the big sagebrush complex; i.e., basin big sagebrush (*A. tridentata* ssp *tridentata*) and mountain big sagebrush (*A. tridentata* ssp *vaseyana*) (Freeman et al. 1991, McArthur et al. 1998). Across ecotones, populations of Wyoming big sagebrush probably intergrade with basin big sagebrush and mountain big sagebrush. Soils and elevation may help determine which species is present.

Invasion of cheatgrass has transformed this ecological system into large areas of uncharacteristic annual grasslands and shrublands with understories where annual grasses replaced perennial grasses.

Native Uncharacteristic Conditions

Scale Description

Sagebrush steppe covers vast landscapes >10,000 acres with inclusions of low sagebrush and basin big sagebrush. Historic disturbance (fire) likely ranged from small (<10ac) to large (>10,000 acres) depending on conditions, time since last ignition, and fuel loading. Assumed the average patch size is 250 acres.

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Issues/Problems

West (2000) cites wide range in MFRI (25 to +100yrs). West (1983) and Miller and Eddelman (2000) recommend a MFRI of <100yrs for replacement fire. FEIS gives 10 to 70 range (40yr average) (but see Welch and Criddle 2003). Current scientific opinion (Mike Pellant, BLM Range Ecologist on the Great Basin Restoration Initiative) puts the natural fire return interval at about 100yrs (confirmed by Stephen Bunting and Dave Pyke). Given uncertainties and opinions of reviewers, a MFRI=75yrs was chosen. Without this shorter MFRI and differences in fire behavior, there would be no difference between Wyoming sagebrush steppe from the Snake River plains and Wyoming big sagebrush semi-desert from central Nevada, Utah, and eastern California. Because replacement fire is by far dominant over mixed severity fire, a FRG IV was selected by the recommendation of reviewers.

Comments

BPS 1125 for MZs12 and 17 was obtained by slightly modifying the description of BpS 1125 for MZ16 developed by Don Major (dmajor@tnc.org). The model and description for MZ06 was imported unchanged from MZ12. BPS 1125 for MZ16 is completely based on R2SBWYse developed by Eric Limbach (eric_limbach@blm.gov) for Wyoming big sagebrush steppe and reviewed by Krista Waid-Gollnick/Sarah Heidi (krista_waid@blm.gov, Stanley Kitchen (skitchen@fs.fed.edu), Michael Zielinski (mike_zielinski@nv.blm.gov), Jolie Pollet (jpollet@blm.gov), and Gary Back (gback@srk.com).

As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for mixed severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

Vegetation Classes															
<p>Class A 20 %</p> <p>Early Development 1 Open</p> <p><u>Upper Layer Lifeform</u></p> <p><input type="checkbox"/> Herbaceous</p> <p><input checked="" type="checkbox"/> Shrub</p> <p><input type="checkbox"/> Tree</p> <p><u>Fuel Model</u></p> <p>1</p> <p><u>Description</u></p> <p>Perennial grasses and forbs dominate where woody shrub canopy has been top killed / removed by wildfire. Shrub cover <6%. (~ 0-19yrs). Replacement fire every 120yrs on average resets succession back to zero. Succession to class B after 20yrs.</p>	<p><u>Indicator Species and Canopy Position</u></p> <p>AGSP Upper STTH2 Upper POSA12 Upper ARTRW8 Upper</p>	<p><u>Structure Data (for upper layer lifeform)</u></p> <table border="1"> <thead> <tr> <th></th> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Cover</td> <td>0 %</td> <td>5 %</td> </tr> <tr> <td>Height</td> <td>Shrub 0m</td> <td>Shrub 1.0m</td> </tr> <tr> <td>Tree Size Class</td> <td colspan="2">None</td> </tr> </tbody> </table> <p><input checked="" type="checkbox"/> Upper layer lifeform differs from dominant lifeform.</p> <p>Vegetation is primarily herbaceous with a few scattered shrubs accounting for <5% cover.</p>		Min	Max	Cover	0 %	5 %	Height	Shrub 0m	Shrub 1.0m	Tree Size Class	None		
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<p>Class B 50 %</p> <p>Mid Development 1 Open</p> <p><u>Upper Layer Lifeform</u></p> <p><input type="checkbox"/> Herbaceous</p> <p><input checked="" type="checkbox"/> Shrub</p> <p><input type="checkbox"/> Tree</p> <p><u>Fuel Model</u></p> <p>1</p>	<p><u>Indicator Species and Canopy Position</u></p> <p>AGSP Lower STTH2 Lower ARTRW8 Upper</p>	<p><u>Structure Data (for upper layer lifeform)</u></p> <table border="1"> <thead> <tr> <th></th> <th>Min</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Cover</td> <td>5 %</td> <td>25 %</td> </tr> <tr> <td>Height</td> <td>Shrub 0m</td> <td>Shrub 3.0m</td> </tr> <tr> <td>Tree Size Class</td> <td colspan="2">None</td> </tr> </tbody> </table> <p><input type="checkbox"/> Upper layer lifeform differs from dominant lifeform.</p>		Min	Max	Cover	5 %	25 %	Height	Shrub 0m	Shrub 3.0m	Tree Size Class	None		
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POSA12

Lower

Description

Shrubs dominate (5-25% cover) with diverse perennial grass and forb understory (20-60yrs). MFRI=75yrs with 80% replacement fire (MFRI=94yrs) and 20% mixed severity fire (mean FRI of 375 years). Mixed severity fire, insect/disease (return interval=75yrs), and weather related stress (return interval of 100yrs) maintains vegetation in class B. Succession to class C after 40yrs.

Class C 30 %

Late Development 1 Closed

Indicator Species and Canopy Position

ARTRW8

Upper

AGSP

Lower

STTH2

Lower

POSA12

Lower

Structure Data (for upper layer lifeform)

	<i>Min</i>	<i>Max</i>
Cover	25 %	35 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	None	

Upper Layer Lifeform

Herbaceous

Shrub

Tree

Fuel Model

2

Upper layer lifeform differs from dominant lifeform.

Description

Mature shrub canopy >25% cover with proportional reduction in understory productivity as canopy cover increases. The MFRI for replacement fire is 75yrs. Insect/diseases (return interval=75yrs), and weather related stress (return interval=100yrs) thin the shrub canopy, causing a transition to class B. Succession from class C to C.

Class D 0 %

[Not Used] [Not Used]

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	<i>Min</i>	<i>Max</i>
Cover	%	%
Height		
Tree Size Class		

Upper Layer Lifeform

Herbaceous

Shrub

Tree

Fuel Model

Upper layer lifeform differs from dominant lifeform.

Description

Class E 0 %

[Not Used] [Not Used]

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	<i>Min</i>	<i>Max</i>
Cover	%	%
Height		
Tree Size Class		

Upper Layer Lifeform

Herbaceous

Shrub

Tree

Fuel Model

Upper layer lifeform differs from dominant lifeform.

Description

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Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 250

Min 10

Max 10000

Sources of Fire Regime Data

- Literature
- Local Data
- Expert Estimate

Additional Disturbances Modeled

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

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	92	30	120	0.01087	89
Mixed	714			0.00140	11
Surface					
All Fires	81			0.01228	

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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