LANDFIRE Biophysical Setting Model

Biophysical Setting 2210802 Inter-Mountain Basins Big Sagebrush Shrubland - Wyoming Big Sagebrush

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *Difference from basin big sagebrush in fire regime, floral composition and occurs in drier uplands. See 10801 for split reasons also.*

Basin big sagebrush is found at lower elevations and is usually restricted to comparatively moist ravines or valleys (Barker and McKell 1986 in Knight 1994). It also grows taller than any other species of Artemisia (up to two meters or more.). Wyoming big sagebrush is the most common shrub of the intermountain basins. It is normally less than 0.5 m tall and occupies the drier uplands, with the taller basin big sage occurring in adjacent ravines (Knight 1994). Basin big sagebrush more common on sandy soils, and Wyoming big sagebrush more common on fine-textured soils (Knight 1994).

Wyoming big sagebrush tends to grow on shallower, well-drained, and xeric soils when compared to mountain and basin big sagebrush (Barker and McKell 1983). When Wyoming big sagebrush occurs with black, longleaf (A. longiloba) and threetip sagebrush communities, it often occupies the relatively deeper soils (Tweit and Houston 1980).

General Information

Contributors (also see the Comments field) **Date** 2/8/2006

Modeler 1	Mark Williams	mark_a_williams@blm.gov	**Reviewer**	Tim Kramer	tim_kramer@blm.gov
Modeler 2	Vicki Herren	vicki_herren@blm.gov	**Reviewer**	Destin Harrell	destin_harrell@blm.gov
Modeler 3	anonymous		**Reviewer**	Eve Warren	eve_warren@blm.gov

Vegetation Type
Upland
Savannah/Shrub
Steppe

Dominant Species
ARTRW8
PSSP6

Map Zone
22

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

POSE
CHRYS9
STAC
PHHO

Geographic Range

Wide-ranging, common to Basin and Range province, extending into the Columbia Plateau and east into the northern and central Rockies and the western edge of the short grass prairie. Common throughout MZ22.

**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.

Biophysical Site Description

Wyoming big sagebrush occupies foothills, terraces, slopes, plateaus and basin edges. Soils are shallow to moderately deep and well drained. Wyoming big sagebrush generally occurs in the 5-14in precipitation zones. Soil depth and accumulation of snow enhances these communities in lower precipitation zones (Knight 1994).

Wyoming big sagebrush tends to grow on shallower, well-drained, and xeric soils when compared to mountain and basin big sagebrush (Barker and McKell 1983). In WY, a considerable amount of Wyoming big sagebrush occurs in the 5-9in and the 10-14in precipitation zones. Accumulation of snow enhances these communities in lower precipitation zones (Knight 1994).
When Wyoming big sagebrush occurs with black, longleaf (A. longiloba) and threetip sagebrush communities, it often occupies the relatively deeper soils (Tweit and Houston 1980).

Vegetation Description

Wyoming big sagebrush is the dominant mid-to late seral species within this plant assemblage. Cool season grasses such as Indian ricegrass, bluebunch wheatgrass, needle-and-thread, blue grama, Sandberg bluegrass, squirreltail and infrequently, Thurber's needlegrass. Rhizomatous wheatgrasses, such as western wheatgrass, are common species within this map zone. Common forbs are species of Astragalus, Crepis, Delphinium, Phlox and Castilleja, while associated shrubs and shrub-like species can be small green rabbitbrush, black sagebrush, spiny hopsage, winterfat and broome snakeweed. Herbaceous species usually dominate the site prior to re-establishment. Site re-establishment is by seed bank, seed production from remnant plants and seeds from adjacent (untreated) plants. Cryptobiotic organisms (VAM) are important.

Wyoming big sagebrush sites have fewer understory species relative to other big sagebrush subspecies, though at higher elevations or moister areas of this vegetation community there is a higher potential for herbaceous species. On the southeastern side of the mapzone, in subsections 342 Fj, 342Fl, 342Fi, 342Ff and 331Gb, herbaceous cover increases transitioning into the short-grass prairie.

Disturbance Description

Many researchers believe fire was the primary disturbance factor within this plant assemblage.

Other disturbance factors may include insects, rodents and lagomorphs, drought, wet cycles, gradual changes in climate and native grazing (Wyoming Interagency Vegetation Community 2002).

Drought may have been more significant disturbance than native grazing or insects, so was included at 500yr intervals.

Native grazing by large ungulates (eg, bison), and insects were included, but at 1000yr intervals.

Following fire or other significant disturbance, herbaceous species will dominate the ecological site post-burning and recovery to prefire canopy cover is quite variable and may generally take 50-120yrs, but occasionally occurs within a decade (Baker, in press). Site re-establishment is by seed bank, seed production from remnant plants and seeds from adjacent (untreated) plants. Discontinuity of fuel in Wyoming big sagebrush communities can result in mosaic burn patterns, leaving remnant plants for seed, but can be large expanses of complete mortality (Bushey 1987, Baker, in press). Fire does not stimulate germination of soil-stored Wyoming big sagebrush, but neither does it inhibit its germination (Champlin and Winward 1982). Regeneration may occur in pulses linked to high precipitation events (Maier et al. 2001).

**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.

Overall fire return intervals in Wyoming big sagebrush appear to have ranged from 100-240yrs or more (Baker in press), and some feel that they appear to have ranged from 10-110yrs or more, and recovery to 20% canopy cover from a burn may take more than 40yrs (Young and Evans 1981,Winward 1991). Bunting et al. (1987) found that the average recovery time following fire in Wyoming big sagebrush communities was 30yrs.

Reviewers for MZ22 felt that 130-year interval was justified, as Wyoming big sagebrush does not re-establish for multiple decades, and fire was therefore likely infrequent (Warren, pers comm).

For the Rapid Assessment, reviewers disagreed about the frequency of fire and severity of fire, suggesting MFIs of 90-140yrs. The majority of reviewers agreed with the model's original 90yr MFI and it was unchanged. Descriptive information was added to capture the disparate opinions of reviewers.

Adjacency or Identification Concerns

This type merges into various other types and Wyoming big sagebrush may hybridize with mountain sagebrush and basin big sagebrush. Local data show that hybridized taxa may have more resiliency to prescribed fire than non-hybridized Wyoming big sagebrush (Eve Warren, Wyoming BLM).

Secondary shrub and herbaceous components may vary considerably across the range of its extent. Wyoming big sagebrush sites may be a mosaic with or abut juniper, limber pine-juniper, ponderosa pine, mountain sagebrush, salt desert shrub and grassland vegetation types across its range.

Cheatgrass now dominates the herbaceous layers of many Wyoming big sagebrush communities, creating more frequent fire regimes. Broom snakeweed and halogeton may dominate sites disturbed by overgrazing, oil and gas development or other disturbances.

Juniper invasion into Wyoming big sagebrush systems could possibly be occurring in some locations today, but this does not appear to be a common occurrence in this map zone. In some cases apparent invasions are simply recovery from past fires or temporary fluctuations along ecotones (Pers. Comm., Mark Williams, anonymous contributor).

Native Uncharacteristic Conditions

Greater than 60% canopy cover of Wyoming big sagebrush. In drier sites, canopy cover may not exceed >50%.

Scale Description

Occurrences may cover thousands of hectares.

Issues/Problems

Difficult to identify where hybrids occur with other big sagebrush taxa.

Comments

This model for MZ22 was adapted from Rapid Assessment model R0SBWYwy created by Tim Kramer (tim_kramer@blm.gov) and reviewed by Bill Baker, Don Bedunah and Dennis Knight.

Workshop code for Rapid Assessment was WYSB. This model was combined with another Rapid Assessment model, R0SBWA (workshop code was WSAG1), modeled by George Soehn (george_soehn@blm.gov) and reviewed by Sarah Heide (sarah_heide@blm.gov) and Krista Gollinick-

**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.

Waid (krista_waid@blm.gov). The two were combined based on peer-review and the similarity of disturbance regimes and species composition.

RA Model is based on the original FRCC PNVG (WYSB1) with modifications from Wyoming Interagency Vegetation Committee (2002) and expert estimates.

Peer review incorporated for RA 4/30/2005. Additional reviewers were Karen Clause (karen.clause@wy.usda.gov), Ken Stinson (ken_stinson@blm.gov) and Eve Warren (eve_warren@blm.gov).

Vegetation Classes

Class A 20 %

Early Development 1 All Structure

Upper Layer Lifeform

- [x] Herbaceous
- [ ] Shrub
- [ ] Tree

Fuel Model

2

Indicator Species and Canopy Position

PSSP6
Upper
ACHY
Upper
PASM
Upper
HECO26
Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	60 %
Height	Herb 0m	Herb 0.5m
Tree Size Class		

- [x] Upper layer lifeform differs from dominant lifeform.

Herbs dominate this class, but shrubs are growing up and do not yet dominate the class. Shrub cover less than five percent belongs in this class.

Description

Herbaceous dominated. Primarily grasses with forbs. Exact species will vary depending on location. Western wheatgrass, Sandberg bluegrass, Indian ricegrass, needle and thread, bluebunch wheatgrass, squirreltail and blue grama would be dominant grasses. Forbs may include Astragalus, Crepis, Castelleja, Delphinium, Agoseris, Phlox and others. There may also be a significant component of small green rabbitbrush.

This class succeeds to mid-development open stage after 30yrs.

Insect/disease and grazing occur with a probability of 0.001. Wind/weather stress occurs every 100yrs.

Replacement fire occurs every 180yrs.

Class B 20 %

Mid Development 1 Open

Upper Layer Lifeform

- [ ] Herbaceous
- [x] Shrub
- [ ] Tree

Fuel Model

2

Indicator Species and Canopy Position

ARTRW8
Upper
ACHY
Middle
PASM
Middle
HECO26
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	30 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Sagebrush canopy is greater than five percent but less than 25%. Understory is well represented by herbaceous species as described for class A. Bottlebrush squirrel tail may also be an indicator.

**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.

This class succeeds to an open stage with taller shrubs in 40yrs, although it can succeed to a closed stage with taller shrubs with a probability of 0.01.

Insect/disease and grazing occur with a probability of 0.001 and wind/weather stress occurs every 500yrs, but do not cause a transition.

Replacement fire occurs every 160yrs.

Class C **30 %**

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

2

Indicator Species and Canopy Position

ARTRW8
Upper
ACHY
Middle
PASM
Middle
HECO26
Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	11 %	30 %
Height	Shrub 0.6m	Shrub 1.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Sagebrush canopy is greater than five percent but less than 25%, occasionally reaching 30%. Understory is well represented by herbaceous species as described for class A. This class is more common on drier sites. Bottlebrush squirrel tail may also be an indicator.

This class persists, although it could succeed to a closed stage with a 0.01 probability.

Insect/disease and grazing occur with a probability of 0.001 and wind/weather stress occurs every 500yrs, but do not cause a transition.

Replacement fire occurs every 160yrs.

Class D **30 %**

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model

2

Indicator Species and Canopy Position

ARTRW8
Upper
ACHY
Middle
PASM
Middle
PSSP6
Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	31 %	60 %
Height	Shrub 0.6m	Shrub 1.0m
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Sagebrush canopy is greater than 25%. All primary components of the herbaceous community are present with significant component of other shrubs. This class is more common on moister sites. Squirreltail could also be an indicator.

This class will persist.

**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.

Insect/disease and grazing occur with a probability of 0.001, but do not cause a transition. Wind/weather stress occurs every 200yrs and causes a transition to an open stage.

Replacement fire occurs every 100yrs.

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Indicator Species and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

☐ Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

Fire Regime Group:** **IV**

Historical Fire Size (acres)

Avg
Min
Max

Fire Intervals

	Avg FI	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	130	80	240	0.00769	100
Mixed					
Surface					
All Fires	130			0.00771	

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.

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)

References

Anderson, J.E. and R.S. Inouye. 2001. Landscape-scale changes in plant species abundance and biodiversity of a sagebrush steppe over 45 years. Ecological Monographs. 71(4): 531-556.

Baker, W.L. In press. Fire and restoration of sagebrush ecosystems. Wildlife Society Bulletin, in press.

Barker, J.R. and C.M. McKell. 1983. Habitat differences between basin and Wyoming big sagebrush in continuous populations. J. Range Manage. 36(4): 450-454.

Bunting, S.C., B.M Kilgore and C.L. Bushey. 1987. Guidelines for prescribed burning sagebrush-grass rangelands in the northern Great Basin. Gen. Tech. Rep. INT-231. Ogden, UT: USDA Forest Service. 33 pp.

Bushey, C.L. 1987. Short-term vegetative response to prescribed burning in the sagebrush/grass ecosystem

**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.

of the northern Great Basin; three years of postburn data from the demonstration of prescribed burning on selected Bureau of Land Management districts. Final Report. Cooperative Agreement 22-C-4-INT-33. Missoula, MT: Systems for Environmental Management. 77 pp.

Champlin, M.R. and A.H. Winward. 1982. The effect of simulated fire on emergence of seeds found in the soil of big sagebrush communities. Abstract of Papers. Society for Range Management. Calgary, Alberta. 37 pp.

Fire Regime Condition Class (FRCC) Interagency Handbook Reference Conditions, Modeler: Doug Havlina, Date: 8/15/03, PNVG Code: WSAG1. 2.

Knight, D.H. 1994. Mountains and Plains: The Ecology of Wyoming Landscapes. Yale University Press, New Haven/London. 338 pp.

Maier et al 2001

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Perryman, L., A.M. Maier, A.L., Hild and R.A. Olson. 2001. Demographic characteristics of three Artemisia tridentata Nutt. subspecies. Journal of Range Management. 54(2): 166-170.

Sturges, D.L. 1994. High-elevation watershed response to sagebrush control in southcentral Wyoming. Res. Pap. RM-318. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 19 pp.

Tweit, S.J. and K.E. Houston. 1980. Grassland and shrubland habitat types of the Shoshone National Forest. Cody, WY: USDA Forest Service, Shoshone National Forest. 143 pp.

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

Welch, B.L and C. Criddle. 2003. Countering Misinformation Concerning Big Sagebrush. Research Paper RMRS-RP-40. Ogden, UT: USDA Forest Service, Rocky Mountain Research Station. 28 pp.

Winward, A.H. 1991. A renewed commitment to management of sagebrush grasslands. In: Research in rangeland management. Corvallis, OR: Oregon State University. Ag Exper. St. Special Rep. 880. 7 pp.

Wyoming Interagency Vegetation Committee. 2002. Wyoming Guidelines for Managing Sagebrush Communities with Emphasis on Fire Management. Wyoming Game and Fish Department and Wyoming BLM. Cheyenne, WY. 53 pp.

Young, J.A. and R.A. Evans. 1978. Population dynamics after wildfires in sagebrush grasslands. Journal of Range Management. 31: 283-289.

Young, J.A. and R.A. Evans. 1981. Demography and fire history of a western juniper stand. Journal of Range Management. 34:501-506.

**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.