LANDFIRE Biophysical Setting Model

***Biophysical Setting:* 1010110** **Rocky Mountain Aspen Forest and Woodland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 3			**Reviewer**		

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

POTR5
SYOR2
RIBES

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This widespread ecological system is more common in the southern and central Rocky Mountains, but occurs throughout much of the western US and north into Canada, in the montane and subalpine zones. Also found in the Great Basin and throughout the western US on drier sites.

Biophysical Site Description

Elevations generally range from 1525-3050m (5000-10000ft), but occurrences can be found at lower elevations in some regions. Distribution of this ecological system is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand, and secondarily is limited by the length of the growing season or low temperatures.

Vegetation Description

These are upland forests and woodlands dominated by Populus tremuloides without a significant conifer component (<25% relative conifer tree cover). On many ranges of NV, southwestern ID and southeastern OR, conifers other than pinyon and juniper (eg, limber pine, white fir and subalpine fir) are largely absent or uncommon. In southeastern OR and southwestern ID, western juniper will be infrequent and between 6000-7000ft. Stable aspen is often used to name BpS 1011.

The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs. Common shrubs include Acer glabrum, Amelanchier alnifolia, Artemisia tridentata, Juniperus communis, Prunus virginiana, Rosa woodsii, Shepherdia canadensis, Symphoricarpos oreophilus and the dwarf-shrubs Mahonia repens and Vaccinium spp. The herbaceous layers may be lush and diverse. Common graminoids may include Bromus carinatus, Calamagrostis rubescens, Carex siccata (=Carex foenea), Carex geyeri, Carex rossii, Elymus glaucus, Elymus trachycaulus, Festuca thurberi and Hesperostipa comata. Associated

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forbs may include Achillea millefolium, Eucephalus engelmannii (=Aster engelmannii), Delphinium spp, Geranium viscosissimum, Heracleum sphondylium, Ligusticum filicinum, Lupinus argenteus, Osmorhiza berteroi (=Osmorhiza chilensis), Pteridium aquilinum, Rudbeckia occidentalis, Thalictrum fendleri, Valeriana occidentalis, Wyethia amplexicaulis and many others.

Disturbance Description

Replacement fire and ground fire were common in stable aspen and both depended heavily on native burning. It is important to understand that aspen is considered a fire-proof vegetation type that does not burn during the normal lightening season, yet evidence of fire scars and historical studies show that native burning was the only source of fire that occurred mostly during the spring and fall.

This BpS has elements of Fire Regime Groups III, II and IV. Replacement fire has a mean annual FRI of 60yrs. Mean annual fire return intervals for mixed severity fire may have been as frequent as 20yrs, averaging approximately 50yrs. With the encroachment of conifers following extended periods of fire exclusion, the mean FRI of mixed severity fire increased to 20yrs while that of replacement fire remained unchanged. Under presettlement conditions, disease and insect mortality did not appear to have major effects, however older aspen stands would be susceptible to outbreaks every 200yrs on average. We assumed that 20% of outbreaks resulted in heavy insect/disease stand-replacing events (average return interval 1000yrs), whereas 80% of outbreaks would thin older trees >40yrs (average return interval 250yrs). Disturbance effects would also have varied from clone to clone. Many aspen clones situated on steep slopes are prone to disturbance caused by avalanches and mud/rock slides. Riparian aspen is prone to flooding and beaver clear cutting. Conifers, where co-dominant in aspen stands, would experience insect/disease outbreaks every 300yrs on average.

Adjacency or Identification Concerns

If conifers are present in significant amount, please review BpS 1061, 1045, 1050 or 1056. On mountain ranges of the Columbia Plateau that do not support fir trees, stable aspen occurs at all elevations but tend to be more common at higher elevations and in the draws on more mesic sites. Sagebrush groups, especially mountain big sagebrush and high elevation Wyoming big sagebrush, occurred below and in places around this group. Forest types such as ponderosa pine or warm/dry mixed conifer with more frequent fire may influence fire frequency in stable aspen to facilitate regeneration.

Aspen decline varies across the region. Declines have been documented in UT, NV, AZ, NM, but not in CO (especially SW CO). Drought is currently impacting many stands in the Great Basin and Columbia Plateau. Nearly a hundred years of fire suppression and uncharacteristic ungulate grazing have reduced clones or created senescent stands lacking suckers for regeneration (Kay 2001 a, b and c).

Native Uncharacteristic Conditions

Scale Description

Patch size for this type ranges from the 10s-100s of acres. Patches may be linear along riparian areas and cover large areas with aspen reaching on side slopes.

Issues/Problems

East of the Great Basin, Baker (1925) studied closely the presettlement period for aspen and noted fire scars on older trees and evidence of frequent fire. Bartos and Campbell (1998) support these findings. We interpreted ground fires that scarred trees, probably started by Native Americans, as mixed severity fire that also promoted abundant suckering.

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Comments

This model is identical to the model from MZ18 with minor changes in the description to adhere to LANDFIRE mapping rules.

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.

For MZ18, BpS 1011 from MZ 12 and 17 was accepted with only minor revisions by K. Waid and S. Heide on 5/19/05. BpS 1011 for MZ 12 and 17 was developed by Julia H. Richardson (jhrichardson@fs.fed.us) and Louis Provencher (lprovencher@tnc.org). Reviewer Jon Bates suggested minor changes for MZ 18: 1) Added western juniper to the list of uncommon conifers. 2) Aspen max height description was increased to 12' from 6' in class A (adjusted also in class B) based on field observations.

BpS 1011 for zones 17 and 12 was intended to represent stable aspen as found on many ranges of Nevada. BpS 1011 for zones 12 and 17 is different from BpS 1011 for zone 16. The model and description for MZ 12 and 17 is a compromise between VDDT model R2ASPN from the Rapid Assessment and the model for MZ 16. One class (D) representing moderate conifer encroachment to stable aspen (as per NatureServe description of ecological system 1011) was added to R2ASPN and the mean annual FRIs and insect/disease probabilities of BpS 1011 for MZ16 were adopted. R2ASPN was modeled by Linda Chappell (lchappell@fs.fed.us), Robert Campbell (rbcampbell@fs.fed.us), and Bill Dragt (William_Dragt@nv.blm.gov). R2ASPN was reviewed by Cheri Howell (chowell02@fs.fed.us), Wayne Shepperd (wshepperd@fs.fed.us), and Charles Kay (ckay@hass.usu.edu). BpS 1011 for MZ 16 was modeled by Linda Chappell, Robert Campbell, Stanley Kitchen (skitchen@fs.fed.us), Beth Corbin (ecorbin@fs.fed.us), and Charles Kay.

Aspen stands tend to remain dense throughout most of their life-span, hence the open stand description was not used unless it described conifer coverage. These are typically self-perpetuating stands. While not dependent upon disturbance to regenerate, aspen was adapted to a diverse array of disturbances.

Under current conditions, herbivory can significantly effect stand succession. Kay (1997, 2001a, b, c) found the impacts of burning on aspen stands were overshadowed by the impacts of herbivory. In the reference state the density of ungulates was low due to efficient Native American hunting, so the impacts of ungulates were low. Herbivory was therefore not included in the model.

Vegetation Classes

Class A **14 %**

Early Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model 5

Indicator Species* and Canopy Position

POTR5	Upper
SYOR2	Middle
RIBES	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Aspen suckers <12ft tall. Grass and forbs present. No fire at this stage. Succession to class B after 10yrs.

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Class B **40 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 9

Indicator Species* and Canopy Position

POTR5 Upper
SYOR2 Lower
RIBES Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Aspen >12ft tall dominate. Canopy cover highly variable. Replacement fire occurs every 60yrs on average. Mixed severity fire (mean FRI 50yrs) does not change the successional age of these stands, although this fire consumes litter and woody debris and may stimulate suckering. Succession to class C after 30yrs.

Class C **45 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 9

Indicator Species* and Canopy Position

POTR5 Upper
SYOR2 Lower
RIBES Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Aspen trees 5-16in DBH. Canopy cover is highly variable. Replacement fire occurs every 60yrs on average. Mixed severity fire (mean FRI 50yrs), while thinning some trees, promotes suckering and maintains vegetation in this class. Insect/diseases outbreaks occur every 200yrs on average with 80% of times causing stand thinning (transition to class B) and 20% of times causing stand replacement (transition to class A). Succession maintains vegetation in this class, however a lack of fire for 100yrs will allow moderate conifer encroachment with a transition to class D.

Class D **1 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model 10

Indicator Species* and Canopy Position

POTR5 Upper
ABLA Upper
ABCO Upper
PIFL2 Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Aspen 5-16in+ DBH and conifers co-dominate, with conifers present in the mid-story and overtopping aspen in older stands. 80% aspen overstory in younger stands, whereas conifers can reach up to 40% cover in overstory in older stands. Mean FRIs for replacement and mixed severity fire are 60yrs and 20yrs, respectively. Mixed severity fire and insect/disease outbreaks (mean return interval of 300yrs) thin conifers, thus causing a return to class C.

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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:** I

Historical Fire Size (acres)

Avg 10
Min 1
Max 100

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	68	50	300	0.01471	46
Mixed	57	20	60	0.01754	54
Surface					
All Fires	31			0.03226	

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

Baker, F.S. 1925. Aspen in the Central Rocky Mountain Region. USDA Department Bulletin 1291: 1-47.

Bartos, D.L. 2001. Landscape dynamics of aspen and conifer forests. Pages 5-14 in: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Bartos, D.L. and R.B. Campbell, Jr. 1998. Decline of quaking aspen in the interior west –examples from Utah. Rangelands 20(1): 17-24.

Bradley, A.E., N.V. Noste and W.C. Fischer. 1992. Fire ecology of forests and woodlands in Utah. GTR-INT-287. Ogden, UT: USDA Forest Service, Intermountain Research Station. 128 pp.

Bradley, A.E., W.C. Fischer and N.V. Noste. 1992. Fire ecology of the forest habitat types of eastern Idaho and western Wyoming. GTR- INT-290. Ogden, UT: USDA Forest Service, Intermountain Research Station. 92 pp.

Brown, J.K. and D.G. Simmerman. 1986. Appraisal of fuels and flammability in western aspen: a prescribed fire guide. General technical report INT-205. Ogden, UT: USDA Forest Service, Rocky Mountain Research

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Station.

Brown, J.K. and J. Kapler-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.

Campbell, R.B. and D.L. Bartos. 2001. Objectives for sustaining biodiversity. In: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Debyle, N.V., C.D. Bevins and W.C. Fisher. 1987. Wildfire occurrence in aspen in the interior western United States. Western Journal of Applied Forestry 2: 73-76.

Kay, C.E. 1997. Is aspen doomed? Journal of Forestry 95: 4-11.

Kay, C.E. 2001a. Evaluation of burned aspen communities in Jackson Hole, Wyoming. In: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Kay, C.E. 2001b. Long-term aspen exclosures in the Yellowstone ecosystem. In: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Kay, C.E. 2001c. Native burning in western North America: Implications for hardwood forest management. General Technical Report NE-274. USDA Forest Service, Northeast Research Station. 8 pp.

Mueggler, W.F. 1988. Aspen community types of the intermountain region. USDA Forest Service, General Technical Report INT-250. 135 pp.

Mueggler, W.F. 1989. Age distribution and reproduction of intermountain aspen stands. Western Journal of Applied Forestry 4(2): 41-45.

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

Romme, W.H., M.L. Floyd, D. Hanna and J.S. Redders. 1999. Landscape condition analysis for the South Central Highlands Section, southwestern Colorado & northwestern New Mexico. Draft report to San Juan National Forest, Durango, Colorado.

Shepperd, W.D. 1990. A classification of quacking aspen in the central Rocky Mountains based on growth and stand characteristics. Western Journal of Applied Forestry 5: 69-75.

Shepperd, W.D. and E.W. Smith. 1993. The role of near-surface lateral roots in the life cycle of aspen in the central Rocky Mountains. Forest Ecology and Management 61: 157-160.

Shepperd, W.D. 2001. Manipulations to Regenerate Aspen Ecosystems. Pages 355-365 in: W.D. Shepperd, D. Binkley, D.L. Bartos, T.J. Stohlgren and L.G. Eskew, compilers. 2001. Sustaining aspen in western

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landscapes: symposium proceedings; 13-15 June 2000; Grand Junction, CO. Proceedings. RMRS-P-18. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 460 pp.

Shepperd, W.D., D.L. Bartos and A.M. Stepen. 2001. Above- and below-ground effects of aspen clonal regeneration and succession to conifers. Canadian Journal of Forest Resources; 31: 739-745.

USDA Forest Service. 2000. Properly Functioning Condition: Rapid Assessment Process (January 7, 2000 version). Intermountain Region, Ogden, UT. Unnumbered.

Welsh, S.L, N.D. Atwood S.L. Goodrich and L.C. Higgins. 2003. A Utah Flora, Third edition, revised. Print Services, Brigham Young University, Provo, UT. 912 pp.

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LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010451** **Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Ponderosa Pine-Douglas-fir**

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *This BpS is split into three types based on dominance: one dominated by ponderosa pine with Douglas-fir; one dominated by western larch; and one dominated by grand fir.*

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Vegetation Type

Forest and Woodland

Dominant Species*

PIPO	CAGE
PSME	PHMA5
PICO	ABGR
CARU	LAOC

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

Northern Rocky Mountains in western MT, eastern WA and northern ID, extending south to the Great Basin.

Biophysical Site Description

Generally found in the montane zone on well-drained, thin soils, generally on relatively warm, steep settings in the non-maritime influenced portion of the mapping zones. Elevation ranges from >4000ft in the southern area and >2500ft in the northern extent. Sites can range from nearly flat to steep on all aspects.

Common habitat types include: PSME/CARU - all phases, PSME/PHMA, PSME/SYAL, ABGR/LIBO and ABGR/XETE

Vegetation Description

Ponderosa pine is generally the dominant species on southerly aspects and drier sites, with Douglas-fir dominating on northerly aspects. Southerly aspects support relatively open stands. Northerly aspects support more closed stands. On mesic sites with longer fire return intervals, Douglas-fir often co-dominates the upper canopy layers. In the absence of fire, Douglas-fir and grand fir dominate stand understories. Western larch and lodgepole pine may also be present and become more abundant throughout the northern range of the BpS.

Understory can be dominated by shrubs such as ceanothus, ninebark, spiraea, willow and ocean spray, or

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open grass dominated by carex and pinegrass. Ninebark can have high cover (>30%) in some stands.

Disturbance Description

Consists of Fire Regime Groups I and III with surface and mixed severity fires at varying intervals (MFIs range from 7-80yrs). Occasional replacement fires may also occur. Mixed severity fire increases and surface fires decrease further north and higher elevations.

Insects and disease play an important role, especially in the absence of fire. Bark beetles such as mountain pine beetle, western pine beetle, and Douglas-fir beetle are active in the mid and late structural stage, especially in closed canopies. Weather related disturbances, including drought, tend to affect the late closed structure more than other structural stages.

Root rot is a minor concern in the northern extent of this BpS.

Mistletoe is present in the southern portion of this BpS and increases in occurrence with a lack of fire.

Adjacency or Identification Concerns

The mixed conifer zone in the Northern Rockies is broad, and represents a moisture gradient that affects fire regimes and species dominance. The Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland system was thus split into three BpS to represent differences in species dominance and fire regimes. 10451 represents the drier sites and is dominated by ponderosa pine and Douglas-fir with a very frequent, low severity fire regime. 10452 is dominated by western larch and represents slightly more mesic sites. The fire regime is dominated by moderately frequent, mixed severity fires. 10453 is dominated by grand fir and represents more mesic, cool sites with longer mixed severity fire regimes.

At lower elevations or southerly aspects, this type generally borders dry ponderosa pine or shrub systems. At higher elevations or northerly aspects, it borders larch, grand fir, spruce, and subalpine fir. At ecotones, it may be very difficult to distinguish between this BpS and 1053 (Northern Rocky Mountain Ponderosa Pine Woodland) in mid and late closed seral states.

This BpS corresponds to Pfister et al. (1977) and Steele et al. (1981) warm dry Douglas-fir (PSME/AGSP, PSME/ARUV PSME/FESC, PSME/SPBE and PSME/SYAL) and grand fir habitat types (ABGR/PHMA and ABGR/SPBE). In the western portion of MZ10, this type may occupy portions of habitat type PSME/SYOR.

This BpS generally occupies moderate environmental settings between more xeric ponderosa pine or shrub communities at lower elevations and moist grand fir or Douglas-fir communities at higher elevations.

Because of fire suppression, xeric ponderosa pine types may be disproportionally invaded by Douglas-fir today. It may be especially difficult in fire suppressed areas to distinguish between ponderosa pine and ponderosa pine-Douglas-fir BpS. It is also very difficult to distinguish between this BpS and the 1053 (Northern Rocky Mountain Ponderosa Pine Woodland) mid and late closed seral states.

Native Uncharacteristic Conditions

Canopy closure of >80% is considered to be uncharacteristic for this BpS.

Scale Description

Patch sizes were probably highly variable. Surface and mixed severity fires may have been variable in size (10s to 100s of acres).

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Issues/Problems

In the northern range of this BpS, the younger age/size classes (class A, B and C) may be more extensive owing to larger and more frequent mixed or stand-replacement fires (relative to surface fires).

This type is extensive on the Colville National Forest, but has not been captured adequately in previous national mapping projects.

Comments

Additional reviewers included Cathy Stewart (cstewart@fs.fed.us), Pat Green (pgreen@fs.fed.us), Steve Rawlings (srawlings@fs.fed.us), Catherine Phillips (cgphillips@fs.fed.us), Lyn Morelan (lmorlan@fs.fed.us), Susan Miller (smiller03@fs.fed.us) and Steve Barrett (sbarrett@mtdig.net).

Peer review resulted in changes to the description and a slight reduction in the overall fire frequency (from 15yrs to 20yrs).

This BpS was adapted from RA PNVG R0PPDF by Lynette Morelan and Jane Kapler Smith, which was reviewed by Pat Green, Cathy Stewart and Steve Barrett. Modifications to the Rapid Assessment model included a slightly increased fire frequency (from approximately 20yrs to 15yrs). Relative proportions of surface, mixed and replacement fire were unchanged. The resulting percentages in classes C and D changed slightly.

The Rapid Assessment included two additional grand fir types. There was some disagreement among modelers and reviewers about whether two or three types should be developed from this BpS to capture slight differences in fire regimes. The BpS was not split at that time.

Vegetation Classes

Class A 10%

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIPO	Upper
LAOC	Upper
PSME	Upper
PICO	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 10m
Tree Size Class	Sapling >4.5ft; <5"DBH	

☑ Upper layer lifeform differs from dominant lifeform.

Some sites exhibit resprouting shrubs (physocarpus malvaceus) as the dominant lifeform. Other sites may be dominated by pine grass (calamagrostis rubescens).

Description

Openings of grass and forbs that are created by infrequent, stand replacement fire. Seedlings and saplings of ponderosa pine, western larch, Douglas-fir and lodgepole pine may be present; grand fir would be rare in the early succession stage. On the moist end of the BpS's range, western larch will be dominant; on the drier end ponderosa pine will be dominant. Following very severe replacement fires, this class may be dominated by lodgepole pine on the moist end of the BpS's range.

Additional dominant species (low in the canopy) will include ninebark (PHMA5; Physocarpus malvaceus) and ceanothus (CESA; Ceanothus sanguineus). Spiraea may also be present. Elk sedge and pine grass are also present.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

After 30yrs, this class succeeds to C (mid-development open) unless a replacement or mixed severity fire occurs.

Class B **15 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIPO	Upper
PSME	Upper
PICO	Middle
LAOC	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	61 %	80 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Pole and medium sized Douglas-fir and ponderosa pine. Larch regeneration will decrease due to shade intolerance. Grand fir as a minor component will remain or increase due to shade tolerance.

Replacement fire will return this class to A. Mixed fire can open the stand and convert this class to class C (mid-development open). Surface fires are rare, but would maintain the class. Pathogens can create gaps and cause a transition to class C (mid-development open).

Class C **30 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIPO	Upper
PSME	Upper
LAOC	Upper
PICO	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	60 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Pole and medium sized ponderosa pine or Douglas-fir are the dominant trees. Western larch may also be present on the moist end of the BpS's range.

Additional dominant species (low in the canopy) will include ninebark (PHMA5; Physocarpus malvaceus) and ceanothus (CESA; Ceanothus sanguineus). Spiraea may also be present in the shrub layer. Elk sedge and pinegrass are also major components of the understory.

Replacement fire, though rare, will cause a transition to class A (early development). Surface fires, mixed fires and insects will maintain the open condition. If this class escapes fire for 35yrs, it will succeed to class B (mid-development closed). If fires do occur, it will succeed at 115yrs to class D (late-development open).

Class D **35 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIPO	Upper
PSME	Upper
LAOC	Upper
	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	60 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Description

Large and very large sized ponderosa pine and Douglas-fir are the dominant trees. Western larch (on the moist end of the BpS's range) and grand fir may also be present in small proportions. Structure may be patchy depending on fire severities in previous class. Ceanothus will be decreasing and willow, spiraea, ninebark, elk sedge and pine grass will still be present.

Replacement fire, though rare, will cause a transition to class A (early development). Surface fires, mixed fires and insects will maintain the open condition. If this class escapes fire for 35yrs, it will succeed to class E (late-development closed).

Class E **10 %**

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIPO	Upper
PSME	Upper
ABGR	Middle
LAOC	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	61 %	80 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Large and very large diameter ponderosa pine, Douglas-fir, grand fir and western larch (on the moist end of the BpS's range). Ninebark and spiraea will be present, but ceanothus will be absent. Some pinegrass and elk sedge will be present.

Replacement fire will return this class to A. Mixed fire can open the stand and convert this class to class D (late-development open). Surface fires are rare, but would maintain the class. Pathogens can create gaps and cause a transition to class D (mid-development open).

Disturbances

Fire Regime Group:** **I**

Historical Fire Size (acres)

Avg 1000
Min 100
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	300	167	500	0.00333	7
Mixed	60	40	75	0.01667	34
Surface	35	25	85	0.02857	59
All Fires	21			0.04857	

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

Agee, J.K. 1993. Fire ecology of Pacific Northwest Forest. Island Press: Washington, DC. 493 pp.

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**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.

Ager, A., D. Scott and C. Schmitt. 1995. UPEST: Insect and disease risk calculator for the forests of the Blue Mountains. File document. Pendelton, OR: USDA Forest Service, Pacific Northwest Region, Umatilla and Wallowa-Whiman National Forests. 25 pp.

Allen, R.B., R.K. Peet and W.L. Baker. 1991. Gradient analysis of latitudinal variation in southern Rocky Mountain forests. Journal of Biogeography 18: 123-139.

Amman, G.D. 1977. The role of mountain pine beetle in lodgepole pine ecosystems: impact on succession. In: W.J. Mattson, ed. The role of arthropods in forest ecosystems. Springer-Verlag, New York, New York, USA.

Anderson, L., C.E. Carlson and R.H. Wakimoto. 1987. Forest fire frequency and western spruce budworm outbreaks in western Montana. Forest Ecology and Management 22: 251-260.

Arno, S.F. 1980. Forest fire history in the northern Rockies. Journal of Forestry 78(8): 460-465.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Arno, SF., J.H. Scott and M. Hartwell. 1995. Age-class structure of old growth ponderosa pine/Douglas-fir stands and its relationship to fire history. Research Paper INT-RP-481. Ogden, UT: USDA Forest Service, Intermountain Research Station: 25 pp.

Baker, W.L. and D. Ehle. 2001. Uncertainty in surface fire history: the case of ponderosa pine forests in the western United States. Canadian Journal of Forest Research 31: 1205-1226.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Barrett, S.W. 1993. Fire regimes on the Clearwater and Nez Perce National Forests north-central Idaho. Final Report: Order No. 43-0276-3-0112. Ogden, UT: USDA Forest Service, Intermountain Research Station, Fire Sciences Laboratory. 21 pp. Unpublished report on file with: USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT.

Barrett, S.W. 1988. Fire suppression's effects on forest succession within a central Idaho wilderness. Western Journal of Applied Forestry. 3(3): 76-80.

Barrett, S.W. 1984. Fire history of the River of No Return Wilderness: River Breaks Zone. Final Report. Missoula, MT: Systems for Environmental Management. 40 pp. + appendices.

Brown, J.K., S.F. Arno, S.W. Barrett and J.P. Menakis. 1994. Comparing the Prescribed Natural Fire Program with Presettlement Fires in the Selway-Bitterroot Wilderness. Int. J. Wildland Fire 4(3): 157-168.

Brown, P.M. and W.D. Shepperd. 2001. Fire history and fire climatology along a 5 degree gradient in latitude in Colorado and Wyoming, USA. Palaeobotanist 50: 133 -140.

Brown, P.M., M.R. Kaufmann and W.D. Shepperd. 1999. Long-term, landscape patterns of past fire events in a montane ponderosa pine forest of central Colorado. Landscape Ecology 14: 513-532.

Brown, P.M., M.G. Ryan and T.G. Andrews. 2000. Historical surface fire frequency in ponderosa pine stands in Research Natural Areas, central Rocky Mountains and Black Hills, USA. Natural Areas Journal 20: 133-139.

Byler, J.W., M.A. Marsden and S.K. Hagle. 1992. The probability of root disease on the Lolo national Forest, Montana. Can. J. For. Res. 20: 987-994.

Byler, J.W. and S.K. Hagle. 2000. Succession Functions of Pathogens and Insects. Ecoregion sections M332a and M333d in northern Idaho and western Montana. Summary. R1-FHP 00-09. USDA Forest Service, State and Private Forestry. 37 pp.

Crane, M.F. 1982. Fire ecology of Rocky Mountain Region forest habitat types. Final Report to the USDA Forest Service, Region Two, 15 May 1982. Purchase order NO. 43-82X9-1-884.

Filip, G.M. and D.J. Goheen. 1984. Root diseases cause severe mortality in white and grand fir stands of the Pacific Northwest. Forest Science 30: 138-142.

Furniss, M.M., R.L. Livingston and M.D. McGregor. 1981. Development of a stand susceptibility classification for Douglas-fir beetle (Dendroctonus pseudotsugae). Pages 115-128 in: R.L. Hedden, S.J. Barres and J.E. Coster, tech. coords. Hazard rating systems in forest insect pest management. Symposium proceedings; 1980 July 31- August 1; Athens, Georgia. Gen. Tech. Rep. WO-27. Washington, D.C.: USDA Forest Service.

Goheen, D.J. and E.M. Hansen. 1993. Effects of pathogens and bark beetles on forests. Pages 176-196 in: Beetle- pathogen interactions in conifer forests. Academic Press Ltd.

Hagle, S., J. Schwandt, T. Johnson, S. Kegley, C. Bell Randall, J. Taylor, I.B. Lockman, N. Sturdevant and M. Marsden. 2000. Successional functions of pathogens and insects; Ecoregion sections M332a and M333d in northern Idaho and western Montana. Volume 2: Results. R1-FHP 00-11. USDA Forest Service, State and Private Forestry, Northern Region. 262 pp. plus appendices.

Hagle, S., T. Johnson, M. Marsden, L. Lewis, L. Stipe, J. Schwandt, J. Byler, S. Kegley; C. Bell Randall, J. Taylor, I.B. Lockman, N. Sturdevant and S. Williams. 2000. Successional functions of pathogens and insects; Ecoregion sections M332a and M333d in northern Idaho and western Montana. Volume 1: Methods. R1-FHP 00-10. USDA Forest Service, State and Private Forestry, Northern Region. 97 pp.

Hagle, S.K. and J.W. Byler. 1993. Root diseases and natural disease regimes in a forest of western U.S.A. Pages 606-617. in: M. Johansson and J. Stenlid. Proceedings of the Eighth International Conference on Root and Butt Rots, Wik, Sweden and Haikko, Finland, August 9-16, 1993.

Hagle, S.K., J.W. Byler, S. Jeheber-Matthews, R. Barth, J. Stock, B. Hansen and C. Hubbard. 1994. Root disease in the Coeur d'Alene river basin: An assessment. Pages 335-344 in: Interior Cedar-Hemlock-White pine forests: Ecology and Management, 2-4 March 1993; Spokane, WA: Washington State University, Pullman, WA.

Haig, I.T., K.P. Davis and R.H. Weidman. 1941. Natural regeneration in the western white pine type. USDA Tech. Bull. 767. Washington, DC. 99 pp.

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Holah, J.C., M.V. Wilson and E.M. Hansen. Impacts of a native root-rotting pathogen on successional development of old-growth Douglas-fir forests. Oecologia (1977) 111: 429-433.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Kaufmann, M.R., C.M. Regan and P.M. Brown. 2000. Heterogeneity in ponderosa pine/Douglas-fir forests: age and size structure in unlogged and logged landscapes of central Colorado. Canadian Journal of Forest Research 30: 698-711.

Keane, R.E., S.F. Arno and J.K. Brown. 1990. Simulating cumulative fire effects in ponderosa pine/Douglas-fir forests. Ecology 71(1): 189-203.

Kurz, W.A., S.J. Beukema and D.C.E. Robinson. 1994. Assessment of the role of insect and pathogen disturbance in the Columbia River Basin: a working document. Prepared by ESSA Technologies, Ltd., Vancouver, B.C. USDA Forest Service, Coeur d'Alene, ID, 56 pp.

Laven, R.D., P.N. Omi, J.G. Wyant and A.S. Pinkerton. 1981. Interpretation of fire scar data from a ponderosa pine ecosystem in the central Rocky Mountains, Colorado. Pages 46-49 in M.A. Stokes and J.H. Dieterich, technical coordinators. Proceedings of the Fire History Workshop, October 20-24, 1980, Tucson, AZ. General Technical Report RM-81. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 142 pp.

Morgan, P. and R. Parsons. 2001. Historical range of variability of forests of the Idaho Southern Batholith Ecosystem. University of Idaho. Unpublished.

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

Peet, R.K. 1988. Forests of the Rocky Mountains. Pages 64-102 in: M.G. Barbour and W.D. Billings, eds. Terrestrial Vegetation of North America. Cambridge: Cambridge University Press.

Peet, R.K. 1978. Latitudinal variation in southern Rocky Mountain forests. Journal of Biogeography 5: 275-289.

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Schellhaas, R., A.E. Camp, D. Spurbeck and D. Keenum. 2000a. Report to the Colville National Forest on the Results of the South Deep Watershed Fire History Research. USDA Forest Service, Pacific Northwest Research Station, Wenatchee Forestry Sciences Laboratory. 4 August 2000.

Schellhaas, R., A.E. Camp, D. Spurbeck, and D. Keenum. 2000b. Report to the Colville National Forest on the Results of the Quartzite Planning Area Fire History Research. USDA Forest Service, Pacific Northwest Research Station, Wenatchee Forestry Sciences Laboratory. 26 September 2000.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale

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**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.

spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Steele, R., S.F. Arno and K. Geier-Hayes. 1986. Wildfire patterns change in central Idaho's ponderosa pine-Douglas-fir forest. Western Journal of Applied Forestry. 1(1): 16-18.

Steele, R., R.D. Pfister, R.A. Ryker and J.A. Kittams. 1981. Forest habitat types of central Idaho. Gen. Tech. Rep. INT-114. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 138 pp.

Swetnam, T.W. and A. Lynch. 1989. A tree-ring reconstruction of western spruce budworm history in the southern Rocky Mountains. For. Sci. 35: 962-986.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ Accessed 06/14/2004.

Veblen, T.T., K.S. Hadley, M.S.; Reid and A.J. Rebertus. 1991. The response of subalpine forests to spruce beetle outbreak in Colorado. Ecology 72(1): 213-231.

Williams, C.K., B.F. Kelley, B.G. Smith and T.R. Lillybridge. 1995. Forest plant associations of the Colville National Forest. Gen. Tech. Rep. PNW-GTR-360. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 375 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1010452 **Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Larch**

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models:* *This BpS is split into three types based on dominance: one dominated by ponderosa pine with Douglas-fir; one dominated by western larch; and one dominated by grand fir.*

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Cathy Stewart	cstewart@fs.fed.us	**Reviewer**	Steve Barrett	sbarrett@mtdig.net
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Vegetation Type

Forest and Woodland

Dominant Species*

LAOC
PICO
PSME
ABLA

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

Western MT and northern ID, west of the Continental Divide.

Biophysical Site Description

Montane and lower subalpine zones, approximately 3000-6000ft primarily on north-facing aspects west of the Continental Divide. Lower subalpine sites typically occur as relatively moist subalpine fir habitat types.

Vegetation Description

Western larch occurs on more mesic/northerly Douglas-fir habitat types and more moist, productive subalpine fir habitat types. Larch is mixed in with seral Douglas-fir, lodgepole pine or some ponderosa pine in the overstory. At lower elevations within this BpS, lodgepole pine can be the dominant seral species and will persist in areas where the fire return intervals are <~80yrs (Williams et al. 1995, observation of White Mountain 1988 fire area in the Colville National Forest). Longer fire intervals promote the development of Engelmann spruce and subalpine fir stands. Mountain pine beetles often reduce the lodgepole pine component, possibly promoting mixed severity fires and inclusions of stand-replacing fires.

Understory species include: Vaccinium globulare, Clintonia uniflora, Menziesia ferruginia, Linnea borealis, Alnus sinuata and Physocarpus malvaceus.

Disturbance Description

Fire Regime Group III, with a mean fire return interval of approximately 40yrs. The fire regime is dominated by mixed severity fire, with more rare replacement fire and occasional small, patchy surface fires.

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**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.

Mountain pine beetle will reduce canopy cover of lodgepole pine. Mistletoe may affect western larch stands, but is not included in the quantitative model.

Adjacency or Identification Concerns

The mixed conifer zone in the Northern Rockies is broad, and represents a moisture gradient that affects fire regimes and species dominance. The Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland system was thus split into three BpS to represent differences in species dominance and fire regimes. 10451 represents the drier sites and is dominated by ponderosa pine and Douglas-fir with a very frequent, low severity fire regime. 10452 is dominated by western larch and represents slightly more mesic sites. The fire regime is dominated by moderately frequent, mixed severity fires. 10453 is dominated by grand fir and represents more mesic, cool sites with longer mixed severity fire regimes.

This system equates with Pfister et al. (1977) moist Douglas-fir, subalpine fir and mesic grand fir habitat types: ABLA/CLUN, all phases, ABLA/LIBO, ABLA/MEFE, ABGR/CLUN, PSME/PHMA, PSME/VAGL and PSME/LIBO (PSME habitat types apply only to MT, not to ID).

Native Uncharacteristic Conditions

Scale Description

Scale can be in small patches of 50ac but generally is hundreds to thousands of acres (due to stand replacing fires requiring dry conditions or being wind driven).

Issues/Problems

Comments

Additional author was Ed Lieser (elieser@fs.fed.us). Dan Leavell and Cathy Steward provided additional post-workshop review of this model.

This model was originally conceived for the BpS "Northern Rocky Mountain Western Larch Woodland" and was revised slightly to be a split within the Dry-Mesic Mixed Conifer BpS (Pohl 11/18/2005).

Peer review of this model resulted in minor changes to the model description and the VDDT model. Reviewers agreed that mean fire return intervals should be more frequent (from 60yrs to 40yrs) with the inclusion of more frequent mixed severity fire. Two reviewers agreed that surface fire should be included at a low probability. The results of these changes was less class E, more class D and a more frequent MFI.

Based on the Rapid Assessment model R0WLLPDF, developed by Cathy Stewart (cstewart@fs.fed.us) and reviewed by Steve Barrett (sbarrett@mtdig.net).

For the Rapid Assessment, review comments incorporated on 3/16/2005. As a result of the peer-review process, this type was modified to increase the amount of mixed severity fire to 70% (from 60%) and the age ranges of late-development classes were adjusted to begin at 80yrs (from 65yrs). The end results were more late-development conditions (E) and more closed conditions (B and E).

Vegetation Classes

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 A 10%

Early Development 1 All Structures

Indicator Species* and Canopy Position

LAOC	Upper
PICO	Upper
PSME	Upper
ABLA	Lower

Upper Layer Lifeform

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

Fuel Model

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Young larch and lodgepole establish with some Douglas-fir. In some cases, lodgepole pine may dominate following stand replacement fire and may persist for 60-100yrs before western larch begins to dominate.

Recent observations of this succession stage in the White Mountain 1988 fire area in the Colville National Forest show Alnus sinuata, Salix scouleriana and western larch dominating upper layers at higher elevations; at lower elevations lodgepole pine and Salix scouleriana dominate. Abies lasiocarpa and Picea engelmannii are present at low cover values in the lower canopy at all elevations (Colville National Forest ecology data).

Class B 15%

Mid Development 1 Closed

Indicator Species* and Canopy Position

LAOC	Upper
PICO	Upper
PSME	Upper
ABLA	Middle

Upper Layer Lifeform

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

Fuel Model

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Larch, lodgepole and Douglas-fir (poles to medium trees) continue to dominate. Without disturbance, Douglas-fir can increase in understory. Subalpine fir may be present. Canopy cover rarely >60%.

Class C 25%

Mid Development 1 Open

Indicator Species* and Canopy Position

LAOC	Upper
PSME	Upper
PICO	Upper
ABLA	Middle

Upper Layer Lifeform

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

Fuel Model

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Larch, with some Douglas-fir, lodgepole and subalpine fir. Open condition is created by disturbance (fire, insect or disease), which opens up more closed conditions (ie, B or E).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 D 30 %

Late Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species* and Canopy Position

LAOC	Upper
PSME	Upper
PICO	Mid-Upper
ABLA	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Large larch and Douglas-fir, favored by disturbance. Subalpine fir, grand fir and lodgepole pine will be reduced or eliminated by fire, insect or disease.

Class E 20 %

Late Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species* and Canopy Position

ABLA	Upper
PSME	Upper
LAOC	Upper
ABGR	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Large diameter larch and Douglas-fir dominate overstory, subalpine fir and grand fir are present in the middle and understory. Lodgepole pine will be largely absent.

Canopy cover will rarely >60%.

Disturbances

Fire Regime Group:** III

Historical Fire Size (acres)

Avg
Min
Max

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	200	50	250	0.005	20
Mixed	65	20	140	0.01538	62
Surface	225			0.00444	18
All Fires	40			0.02483	

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

References

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington DC, 493 pp.

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**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.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Arno, S.F., H.Y. Smith and M.A. Krebs. 1997. Old growth ponderosa pine and western larch stand structures: influences of pre-1900 fires and fire exclusion. Res. Pap. INT-495. Ogden, UT: USDA Forest Service, Intermountain Research Station. 20 pp.

Arno, S.F., E.D. Reinhardt and J.H. Scott. 1993. Forest structure and landscape patterns in the subalpine lodgepole pine type: A procedure for quantifying past and present stand conditions. Gen. Tech. Rep. INT-294. Ogden, UT: USDA Forest Service, Intermountain Research Station. 17 pp.

Arno, S.F. 1980. Forest fire history in the northern Rockies. Journal of Forestry (78): 460-465.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Barrett, S.W. 1994. Fire regimes on andesitic mountain terrain in northeastern Yellowstone National Park. International Journal of Wildland Fire 4: 65-76.

Barrett, S.W. 1994. Fire regimes on the Caribou National Forest, Southeastern Idaho. Contract final report on file, Pocatello, ID: USDA Forest Service, Caribou National Forest, Fire Management Division. 25 pp.

Barrett, S.W. 2002. A Fire Regimes Classification for Northern Rocky Mountain Forests: Results from Three Decades of Fire History Research. Contract final report on file, Planning Division, USDA Forest Service Flathead National Forest, Kalispell MT. 61 pp.

Barrett, S.W., S.F. Arno and J.P. Menakis. 1997. Fire episodes in the inland Northwest (1540-1940) Based on Fire History Data. General Technical Report INT-370. USDA Forest Service, Intermountain Research Station.

Barrett, S.W., S.F. Arno and C.H. Key. 1991. Fire regimes of western larch-lodgepole pine forests in Glacier National Park, Montana. Canadian Journal of Forest Research 21: 1711-1720.

Brown, J.K. and J. Kapler-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.

Brown, J.K., S.F. Arno, S.W. Barrett and J.P. Menakis. 1994. Comparing the Prescribed Natural Fire Program with Presettlement Fires in the Selway-Bitterroot Wilderness. Int. J. Wildland Fire 4(3): 157-168.

Davis, K.M., B.D. Clayton and W.C. Fischer. 1980. Fire ecology of Lolo National Forest habitat types. Gen. Tech. Report INT-79. USDA Forest Service, Intermountain Forest and Range Experiment Station. 77 pp.

Eyre, F.H., ed. 1980. Forest cover types of the United States and Canada. Washington, DC: Society of American Foresters. 148 pp.

Fischer, W.F. and A.F. Bradley. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech.

Report INT-223. USDA Forest Service, Intermountain Forest and Range Experiment Station. 94 pp.

Hawkes, B.C. 1979. Fire history and fuel appraisal study of Kananaskis Provincial Park. Thesis, University of Alberta, Edmonton ALTA. 173 pp.

Hessburg, P.F., B.G. Smith, S.D. Kreiter, C.A. Miller, R.B. Salter, C.H. McNicoll and W.J. Hann. Historical and current forest and range landscapes in the Interior Columbia River Basin and portions of the Klamath and Great Basins. Part I: Linking vegetation patterns and landscape vulnerability to potential insect and pathogen disturbances. Gen. Tech. Rep. PNW-GTR-458. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 357 pp.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Keane, R.E., S.F. Arno and J.K. Brown. 1990. Simulating cumulative fire effects in ponderosa pine/Douglas-fir forests. Ecology 71(1): 189-203.

Leavell, D.M. 2000. Vegetation and process of the Kootenai National Forest. Dissertation abstracts, catalog #9970-793, vol 61-04B, page 1744, Ann Arbor, MI. 508 pp.

Lesica, P. 1996. Using fire history models to estimate proportions of old growth forest in Northwest Montana, USA. Biological Conservation 77: 33-39.

Loope, L.L. and G.E. Gruell, George. 1973. The ecological role of fire in the Jackson Hole area, northwestern Wyoming. Quaternary Research 3(3): 425-443.

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

Peet, R.K. 1988. Forests of the Rocky Mountains. Pages 64-102 in: M.G. Barbour and W.D. Billings, eds. Terrestrial vegetation of North America. Cambridge: Cambridge University Press.

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. Gen. Tech. Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Quigley, T.M. and S.J. Arbelbide, tech. eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: volume 1 of 4. Gen. Tech. Rep. PNW-GTR-405. Portland, OR: USDA Forest Service, Pacific Northwest Research Station.

Romme, W.H. 1982. Fire and landscape diversity in subalpine forests of Yellowstone National Park. Ecological Monographs 52(2): 199-221.

Romme, W.H. and D.H. Knight. 1981. Fire frequency and subalpine forest succession along a topographic gradient in Wyoming. Ecology 62: 319-326.

Schellhaas, R., A.E. Camp, D. Spurbeck and D. Keenum. 2000. Report to the Colville National Forest on the Results of the South Deep Watershed Fire History Research. USDA Forest Service, Pacific Northwest Research Station, Wenatchee Forestry Sciences Laboratory.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Steele, R., S.V. Cooper, D.M. Ondov, D.W. Roberts and R.D. Pfister. 1983. Forest habitat types of eastern Idaho and western Wyoming. Gen. Tech. Rep. INT-144. Ogden, UT: USDA Forest Service, Intermountain Mountain Research Station. 122 pp.

Tande, G.F. 1979. Fire history and vegetation pattern of coniferous forests in Jasper National Park, Alberta. Canadian Journal of Botany 57: 1912-1931.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [Accessed 5/22/03].

Wadleigh, L. and M.J. Jenkins. 1996. Fire frequency and the vegetative mosaic of a spruce-fir forest in northern Utah. Great Basin Naturalist 56: 28-37.

Williams, C.K., B.F. Kelley, B.G. Smith and T.R. Lillybridge. 1995. Forest plant associations of the Colville National Forest. Gen. Tech. Rep. PNW-GTR-360. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 375 pp.

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010453** **Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest - Grand Fir**

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models: This BpS is split into three types based on dominance: one dominated by ponderosa pine with Douglas-fir; one dominated by western larch; and one dominated by grand fir.*

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Vegetation Type

Forest and Woodland

Dominant Species*

PICO
PSME
LAOC
ABGR

General Model Sources

☐ Literature
☐ Local Data
☐ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

This BpS occurs mostly in ID, eastern WA , eastern OR and western MT. It is very important in Bailey's section M332.

Biophysical Site Description

Occurs above 4500ft elevation, just below the spruce-fir zone. Soils are underlain by granitics, metamorphics and minor volcanic rocks. Most have a volcanic ash influenced loess surface layer.

Vegetation Description

Stands range from relatively open to densely stocked, and are usually dominated by a mix of early to mid seral species, including lodgepole pine and western larch, with lesser amounts of grand fir, Englemann spruce and ponderosa pine. Grand fir increases markedly during mid to late successional stages, in the absence of fire and in response to pathogens that affect other species, like bark beetles. Stand understories range from moderately open to dense and include beargrass, mountain huckleberry, grouse whortleberry, serviceberry and snowberry.

Sources on historic composition are derived from Losensky (1993) and sub-basin assessments from the 1930s (USDA 1997-2003).

Disturbance Description

Fire regime group III, with stand replacing fires sometimes punctuated by mixed severity fires. Root disease and mountain pine beetle are very active in this BpS.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Adjacency or Identification Concerns

The mixed conifer zone in the Northern Rockies is broad, and represents a moisture gradient that affects fire regimes and species dominance. The Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland system was thus split into three BpS to represent differences in species dominance and fire regimes. 10451 represents the drier sites and is dominated by ponderosa pine and Douglas-fir with a very frequent, low severity fire regime. 10452 is dominated by western larch and represents slightly more mesic sites. The fire regime is dominated by moderately frequent, mixed severity fires. 10453 is dominated by grand fir and represents more mesic, cool sites with longer mixed severity fire regimes.

This BpS represents the warm/moderately moist grand fir habitat types (Pfister et al. 1977) including ABGR/VAGL, ABGR/ASCA and ABGR/XETE. This BpS grades into larch-dominated sites at lower elevations (10452) and western spruce-fir forest at higher elevations. This BpS typically supports more lodgepole pine than the adjacent (lower elevation) larch mixed-conifer type.

Native Uncharacteristic Conditions

Scale Description

Terrain is usually rolling hills, convex ridges and mountain slopes with little dissection, so fires spread easily. Large infrequent fires result in large patch sizes of 100s to 1000s of acres, and some occurrence of 10000s of acres.

Issues/Problems

Proportion of seral structural stages may fluctuate widely over time because large stand replacing fires can affect 100000ac at a time.

Comments

This model is identical to the Rapid Assessment model R0GFLP with minor modifications to the description.

Rapid Assessment review comments incorporated on 3/16/2005. As a result of the peer-review process, the mean fire return interval was increased to approximately 70yrs (from 55yrs) and the proportion of mixed fire to replacement fire was increased from 55:45 to approximately 70:30.

Vegetation Classes

Class A **15%**

Early Development 1 All Structures

Indicator Species* and Canopy Position

XETE	Lower
VAGL	Lower
PICO	Low-Mid
PSME	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Post stand-replacing fire, lasting about 30yrs. This class is initially dominated by resprouting forbs and shrubs, and transitions to seedling and sapling-dominated. Lodgepole pine is a frequent early seral dominant. Douglas fir and larch are common, while ponderosa pine and grand fir are less common. Residual, large western larch often survive all but the most severe fire to serve as seed sources.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 **15 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PICO	Upper
PSME	Upper
LAOC	Upper
ABGR	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Pole and immature forest (or mature lodgepole) of 30-100yrs. Tree canopy cover of 40% or more. Lodgepole pine is the most common dominant. Douglas-fir and western larch are secondary dominants. Larch may be reduced by grand fir competition, in the absence of fire.

Class C **25 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PICO	Upper
ABGR	Mid-Upper
PSME	Upper
LAOC	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Pole and immature forest (or mature lodgepole) of 30-100yrs. Tree canopy <40%. These are usually created by mixed fire, root disease activity or mountain pine beetle activity in mixed conifer stands.

Class D **20 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

LAOC	Upper
PSME	Upper
PIPO	Upper
PICO	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 10.1m	Tree 50m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Mature forest of 100yrs+. Tree canopy <40%. These are usually the result of mixed severity fire, leaving an overstory of larch, Douglas fir, with some residual grand fir or ponderosa pine and lodgepole. They may also occur as a result of insect or pathogen activity removing a Douglas-fir, lodgepole or grand fir understory.

Class E **25 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

LAOC	Upper
ABGR	Upper
PSME	Upper
PICO	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 10.1m	Tree 50m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Description

Mature forest of 100yrs or more. Tree canopy cover >40%. These are usually the result of uninterrupted succession in areas of low root disease occurrence or in areas of larch dominance.

Disturbances

Fire Regime Group:** III

Historical Fire Size (acres)

Avg
Min
Max

Sources of Fire Regime Data

- [x] Literature
- [x] Local Data
- [ ] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	220	50	250	0.00455	31
Mixed	100	35	150	0.01	69
Surface					
All Fires	69			0.01456	

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

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

References

Ager, A., D. Scott and C. Schmitt. 1995. UPEST: Insect and disease risk calculator for the forests of the Blue Mountains. File document. Pendelton, OR: USDA Forest Service, Pacific Northwest Region, Umatilla and Wallowa-Whiman National Forests. 25 pp.

Amman, G.D. 1977. The role of mountain pine beetle in lodgepole pine ecosystems: impact on succession. In: W.J. Mattson, ed. The role of arthropods in forest ecosystems. Springer-Verlag, New York, New York, USA.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Byler, J.W., M.A. Marsden and S.K. Hagle. 1992. The probability of root disease on the Lolo National Forest, Montana. Can. J. For. Res. 20:987-994.

Byler, J.W. and S.K. Hagle. 2000. Succession Functions of Pathogens and Insects. Ecoregion sections M332a and M333d in northern Idaho and western Montana. Summary. R1-FHP 00-09. USDA Forest Service, State and Private Forestry. 37 pp.

Filip, G.M. and D.J. Goheen. 1984. Root diseases cause severe mortality in white and grand fir stands of the Pacific Northwest. Forest Science 30: 138-142.

Furniss, M.M. R.L. Livingston and M.D. McGregor. 1981. Development of a stand susceptibility classification for Douglas-fir beetle (Dendroctonus pseudotsugae). Pages 115-128 in: R.L. Hedden, S.J. Barres and J.E. Coster, tech. coords. Hazard rating systems in forest insect pest management. Symposium proceedings; 1980 July 31- August 1; Athens, Georgia. Gen. Tech. Rep. WO-27. Washington, DC: USDA

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Forest Service.

Goheen, D.J. and E.M. Hansen. 1993. Effects of pathogens and bark beetles on forests. Pages 176-196 in: Beetle-pathogen interactions in conifer forests. Academic Press Ltd.

Hagle, S., J. Schwandt, T. Johnson, S. Kegley, C. Bell Randall, J. Taylor, I.B. Lockman, N. Sturdevant and M. Marsden. 2000. Successional functions of pathogens and insects; Ecoregion sections M332a and M333d in northern Idaho and western Montana. Volume 2: Results. R1-FHP 00-11. USDA Forest Service, State and Private Forestry, Northern Region. 262 pp. Appendices.

Hagle, S., T. Johnson, M. Marsden, L. Lewis, L. Stipe, J. Schwandt, J. Byler, S. Kegley, C. Bell Randall, J. Taylor, I.B. Lockman, N. Sturdevant and S. Williams. 2000. Successional functions of pathogens and insects; Ecoregion sections M332a and M333d in northern Idaho and western Montana. Volume 1: Methods. R1-FHP 00-10. USDA Forest Service, State and Private Forestry, Northern Region. 97 pp.

Hagle, S.K. and J.W. Byler. 1993. Root diseases and natural disease regimes in a forest of western U.S.A. Pages 606-627 in: M. Johansson and J. Stenlid, eds., Proceedings of the Eighth International Conference on Root and Butt Rots, 9-16 August 1993, Wik, Sweden and Haikko, Finland.

Hagle, S.K., J.W. Byler, S. Jeheber-Matthews, R. Barth, J. Stock, B. Hansen and C. Hubbard. 1994. Root disease in the Coeur d'Alene river basin: An assessment. Pages 335-344 in: Interior Cedar-Hemlock-White pine forests: Ecology and Management, 1993, 2-4 March 1993; Spokane, WA: Washington State University, Pullman, WA.

Haig, I.T., K.P. Davis and R.H. Weidman. 1941. Natural regeneration in the western white pine type. USDA Tech. Bull. 767. Washington, DC. 99 pp.

Holah, J.C., M.V. Wilson and E.M. Hansen. Impacts of a native root-rotting pathogen on successional development of old-growth Douglas-fir forests. Oecologia (1977) 111: 429-433.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Kurz, W.A., S.J. Beukema and D.C.E. Robinson. 1994. Assessment of the role of insect and pathogen disturbance in the Columbia River Basin: a working document. Prepared by ESSA Technologies, Ltd., Vancouver, B.C. USDA Forest Service, Coeur d'Alene, ID, 56 pp.

Leiberg, J.B. 1900. The Bitterroot Forest Preserve. Dept of Interior, US Geological survey. 19th Annual Report, Part V. Forest Reserves. Washington, D.C. 217-252.

Losensky, B.J. 1993. Historical vegetation in Region One by climatic section. USDA Forest Service, Northern Region. Draft report on file at Nez Perce National forest.

Morgan, P. and R. Parsons. 2001. Historical range of variability of forests of the Idaho southern batholith ecosystem. Final report to Boise Cascade Corporation, boise, ID. On file at Nez Perce Forest Headquarters. 34 pp.

Morgan, P., S.C. Bunting, A.E. Black, T. Merrill and S. Barrett. 1996. Fire regimes in the Interior Columbia River Basin: past and present. Final Report submitted to the Intermountain Fire Sciences Laboratory,

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Intermountain Research Station, Missoula, MT. 35 pp.

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Swetnam, T.W. and A. Lynch. 1989. A tree-ring reconstruction of western spruce budworm history in the southern Rocky Mountains. For. Sci. 35:962-986.

USDA. 1911. Extensive land survey. Nez Perce National Forest. On file at Forest headquarters.

USDA. 1914. Extensive land survey. Selway National Forest. On file at Forest headquarters.

USDA. 1938. Forest Statistics: Idaho County, Idaho. Forest Survey Release Number 15. A September progress Report. USDA Forest Service. Northern Rocky Mountain Forest and Range Experiment Station, Missoula MT. 31 pp.

USDA. 1954. Timber type map for the Nez Perce National Forest. On file at Forest headquarters.

USDA. 1997-2003. Subbasin Assessments: 1930s vegetation mapping

Veblen, T.T., K.S. Hadley, M.S.; Reid and A.J. Rebertus. 1991. The response of subalpine forests to spruce beetle outbreak in Colorado. Ecology 72(1): 213-231.

Williams, C.B., D.L. Azuma and G.T. Ferrell. 1992. Incidence and effects of endemic populations of forest pests in young mixed-conifer forest of the Sierra Nevada. Research Paper PSW-RP-212. USDA Forest Service, Pacific Southwest Research Station. 8 pp.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010460** **Northern Rocky Mountain Subalpine Woodland and Parkland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

PIAL
PIFL
ABLA
PIEN
LALY

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Western MT and northern and central ID. Limited distribution in northeastern OR and WA.

Biophysical Site Description

Upper subalpine zone (6000-9500ft) on moderate to steep terrain (eg, 40-70% slope). Landforms include ridgetops, mountain slopes, glacial trough walls and moraines, talus slopes, land and rock slides, and cirque headwalls and basins. Some sites have little snow accumulation because of high winds and sublimation, which increases summer drought.

Patchy distribution of this type may be controlled by edaphic conditions, including soil depth and susceptibility to summer drought.

Vegetation Description

Forest communities range from nearly homogeneous stands of five-needled pines on harshest, highest elevation sites to mixed species inclucing shade tolerant firs. Vegetation is stunted with short, dwarfed trees, including krumholz vegetation on the harshest sites. Historically, whitebark pine dominated on southerly aspects, while northerly aspects were dominated by alpine larch or subalpine fir and Engelmann spruce. Lodgepole pine may be present as an early succession species. Limber pine may be present in southeast and eastern ID, but in these mapping zones it is not typically a subalpine species (it favors lower treeline habitat). In this harsh windswept environment trees are often stunted and flagged from wind damage.

Whitebark pine is a keystone species in many of these forests. Mature whitebark pine trees ameliorate local

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conditions on harsh sites and facilitate the establishment of less hardy subalpine species. The seeds of whitebark pine provide an important food source for wildlife, particularly grizzly bears and Clark's nutcrackers. Whitebark pine also depends exclusively upon Clark's nutcrackers for seed dispersal and subsequent tree establishment.

Disturbance Description

Fire Regime Groups III and IV, primarily long-interval (eg, 100-200yrs+) mixed severity (25-75% top kill) and stand replacement fires. Ignitions are frequent due to lightning, though fires seldom carry due to lack of fuel from the slow-growing vegetation. Individual tree torching is more common. Nonlethal surface fires may dominate where continuous light fuel loading (ie, grasses) exists (Kapler-Smith and Fischer 1995), but would typically be small in extent and are not modeled here. Recent dendroecological data collected in whitebark pine forests near Missoula, in western Montana, found numerous small fires (MFIs <50yrs) punctuated by less frequent, larger fires (MFIs 75-100yrs) and implicated large-scale climate variability (eg, the Little Ice Age) as a driver of temporal changes in the fire regimes of these forest systems (Larson 2005).

The mountain pine beetle is an important disturbance agent in whitebark pine and lodgepole pine forests, and past outbreaks have caused widespread morality in these forest types throughout the region. Spruce budworm may be present on higher density spruce sites. Snow, wind and other weather events may cause damage and cause transitions between classes.

Adjacency or Identification Concerns

This BpS corresponds to cold upper subalpine and timberline habitat types (Pfister et al. 1977, Steele et al. 1983 and Cooper et al. 1991), including ABLA/LUHI, PIAL/ABLA, LALY/ABLA, PIAL/LALY and ABLA/XETE. Lower subalpine forests border at lower elevations, including lodgepole pine, Douglas-fir, Engelmann spruce and subalpine fir types. Successional trajectory towards more shade tolerant species in absence of fire.

Whitebark pine blister rust has decimated whitebark pine in moist ranges of this BpS (eg, near Glacier National Park). Mountain pine beetle is a natural agent of mortality affecting five-needle pines. Infestations occur periodically and are a natural agent of disturbance in these systems.

Early grazing, fire suppression and climate change may have altered natural fire frequency. Live and dead trees are potential dendro-climatic resources.

Native Uncharacteristic Conditions

Scale Description

Fires could range from individual trees to 100s of acres, though topography and continuity of fuel beds influence fire spread.

Issues/Problems

Empirical data for the upper subalpine forest is generally sparse; quantification of fire regimes, succession and other disturbances continues.

Comments

Additional reviewers included Steve Barrett (sbarrett@mtdig.net), Evan Larson (lars2859@umn.edu), Susan Miller (smiller03@fs.fed.us), Steve Rawlings (srawlings@fs.fed.us) and Cathy Stewart (cstewart@fs.fed.us).

Peer review resulted in changes to the description, but no changes to the model. Two reviewers disagreed about the fire frequency-- one suggesting it be changed to 150yrs MFI, another suggesting it be changed to

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~100yrs. No changes were made to the MFI.

Based on Rapid Assessment model R0WBLP by Steve Barrett and reviewed by Cathy Stewart. Adjustments for MZs 10 and 19 resulted in additions to the description and an increased fire frequency (from 155yrs to 133yrs MFI).

10/01/07: 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

Class A **20 %**

Early Development 1 All Structures

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIAL	Upper
LALY	Upper
PICO	Upper
PIFL	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

☑ Upper layer lifeform differs from dominant lifeform.

Higher elevation sites will be dominated by herbaceous species.

Description

Early succession after moderately-long to long interval replacement fires, and highly variable interval mixed severity fires. Whitebark pine, limber pine and subalpine larch will typically be early pioneers. Lodgepole pine may be present.

Wind, weather, insects, disease and replacement fire from all succession classes cause a transition to class A. This class will transition to class B after approximately 50yrs, although limited resources may cause this class to persist longer.

Class B **40 %**

Mid Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIAL	Upper
ABLA	Upper
PIEN	Mid-Upper
PICO	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	100 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Stands dominated by small-diameter with a mix of shade tolerant and intolerant species. High elevation or harsh sites may exhibit krummholz growth form. Whitebark pine and subalpine larch will typically be early pioneers on harsh sites.

This class succeeds to E at 130yrs.

---

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Class C 15%

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIAL	Upper
LALY	Upper
PICO	Upper
PIFL	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0%	30%
Height	Tree 5.1m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Stands dominated by small-diameter with a mix of shade tolerant and intolerant species. High elevation or harsh sites may exhibit krummholz growth form. Whitebark pine (especially on southerly aspects) and subalpine larch (especially on northerly aspects) will typically be early pioneers on harsh sites. Limber pine may also occur on these sites.

This class succeeds to D at 130yrs.

Class D 5%

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIAL	Upper
LALY	Upper
PICO	Upper
PIFL	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0%	40%
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Mid to large diameter mixed conifer species in small to moderate size patches generally on southerly aspects. Open canopy conditions occur on sites where soil is less developed or on wind-exposed, south-facing aspects. Whitebark pine (especially on southerly aspects) and subalpine larch (especially on northerly aspects) will typically dominate.

This class will persist until a disturbance causes a transition.

Class E 20%

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIAL	Upper
ABLA	Upper
PIEN	Upper
PIFL	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41%	100%
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Mid to larger diameter mixed conifer species in small to moderate size patches generally on southerly aspects. Subalpine fir is likely to be encroaching upon these sites. Closed canopy conditions occur on sites that are more protected (ie, northerly aspects) or have better soil development.

This class will persist until a disturbance causes a transition.

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Disturbances

Fire Regime Group: III**

Historical Fire Size (acres)

Avg 0
Min 10
Max 1000

Sources of Fire Regime Data

- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	400	100	1000	0.0025	40
Mixed	270			0.00370	60
Surface					
All Fires	161			0.00621	

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

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Island Press, Washington DC, 493 p.

Aplet, G.H., R.D. Laven and F.W. Smith. 1988. Patterns of community dynamics in Colorado Engelmann spruce and subalpine fir forests. Ecology 69: 312-319.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Barbour, M.G. and W.D. Billings. Eds. 2000. North American Terrestrial Vegetation. Cambridge University Press, Cambridge, UK. 708 pp.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Barrett, S.W. 1994. Fire regimes on andesitic mountain terrain in northeastern Yellowstone National Park. International Journal of Wildland Fire 4: 65-76.

Barrett, S.W. 1996. The historical role of fire in Waterton Lakes National Park, Alberta. Contract final report on file, Fire Management Division, Environment Canada, Canadian Parks Service Waterton Lakes National Park, Waterton Townsite, ALTA. 32 pp.

Barrett, S.W. 2002. A fire regimesclassification for northern Rocky Mountain forests: results from three decades of fire history research. Contract final report on file, Planning Division, USDA Forest Service Flathead National Forest, Kalispell MT. 61 pp.

Brown, J.K., S.F. Arno, S.W. Barrett and J.P. Menakis. 1994. Comparing the Prescribed Natural Fire Program with Presettlement Fires in the Selway-Bitterroot Wilderness. Int. J. Wildland Fire 4(3): 157-168.

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Clagg, H.B. 1975. Fire ecology in high-elevation forests in Colorado. M.S. Thesis, Colorado State University, Fort Collins, Colorado.

Cooper, S.V., K.E. Neiman and D.W. Roberts. 1991. Forest habitat types of northern Idaho: a second approximation. Gen. Tech. Rep. INT-236. Ogden, UT: USDA Forest Service, Intermountain Research Station. 143 pp.

Eyre, F.H., ed. 1980. Forest cover types of the United States and Canada. Washington, DC: Society of American Foresters. 148 pp.

Fule, P.Z., J.E. Crouse, T.A. Heinlein, M.M. Moore, W.W. Covington and G. Verkamp. 2003. Mixed-severity fire regime in a high-elevation forest: Grand Canyon, Arizona. Landscape Ecology (in press).

Hawkes, B.C. 1979. Fire history and fuel appraisal study of Kananaskis Provincial Park. Thesis, University of Alberta, Edmonton ALTA. 173 pp.

Hessburg, P.F., B.G. Smith, S.D. Kreiter, C.A. Miller, R.B. Salter, C.H. McNicoll and W.J. Hann. Historical and current forest and range landscapes in the Interior Columbia River Basin and portions of the Klamath and Great Basins. Part I: Linking vegetation patterns and landscape vulnerability to potential insect and pathogen disturbances. Gen. Tech. Rep. PNW-GTR-458. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 357 pp.

Keane, R.E., P. Morgan and J.P. Menakis. 1994. Landscape assessment of the decline of whitebark pine (Pinus albicaulis) in the Bob Marshall Wilderness Complex, Montana, USA. Northwest Science 68(3): 213-229.

Kipfmueller, K.F. and W.L. Baker. 2000. A fire history of a subalpine forest in southeastern Wyoming, USA. Journal of Biogeography 27: 71-85.

Larson, E.R. 2005. Spatiotemporal variations in the fire regimes of whitebark pine (Pinus albicaulis) forests, western Montana, USA, and their management implications. M.S. Thesis, University of Tennessee, Knoxville. 232 pp.

Loope, L.L. and G.E. Gruell. 1973. The ecological role of fire in the Jackson Hole area, northwestern Wyoming. Quaternary Research 3(3): 425-443.

Morgan, P. R. and Parsons. 2001, Historical range of variability of forests of the Idaho Southern Batholith ecosystem. Univerity of Idaho. Unpublished.

Morgan, P. and S.C. Bunting, Stephen C. 1990. Fire effects in whitebark pine forests. Pages 166-170 in: W.C. Schmidt and K.J. McDonald, compilers. Symposium on whitebark pine ecosystems: ecology and management of a high-mountain resource. Gen. Tech. Rep. INT-270. Ogden UT: USDA Forest Service, Intermountain Research Station.

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General

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Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Quigley, T.M. and S.J. Arbelbide, tech. eds. 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: Volume 1. Gen. Tech. Rep. PNW-GTR-405. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 4 vol. (Quigley, Thomas M., tech. ed.; The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment).

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Steele, R., S.V. Cooper, D.M. Ondov, D.W. Roberts and R.D. Pfister. 1983. Forest habitat types of eastern Idaho and western Wyoming. Gen. Tech. Rep. INT-144. Ogden, UT: USDA Forest Service, Intermountain Mountain Research Station. 122 pp.

Swetnam, T.W. and C.H. Baisan. 1996. Historical fire regime patterns in the Southwestern United States. Pages 11-32 in: C.D. Allen, ed. Fire effects in Southwestern Forests: Proceedings of the Second La Mesa Fire Symposium. 29-31 March 1994, Los Alamos NM; Gen. Tech. Rep. RM-GTR-286 Fort Collins CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Sherriff, R.; Veblen, T.T.; Sibold, J.S. 2001. Fire history in high elevation subalpine forests in the Colorado Front Range. Ecoscience 8:369-380.

Sibold, J. 2001. The forest fire regime of an upper montane and subalpine forest, Wild Basin, Rocky Mountain National Park. M.S. Thesis, University of Colorado, Boulder, CO.

Tande, G.F. 1979. Fire history and vegetation pattern of coniferous forests in Jasper National Park, Alberta. Canadian Journal of Botany 57: 1912-1931.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [Accessed 5/23/03].

Veblen, T.T., K.S.Hadley, E.M. Nel, T. Kitzberger, M.S. Reid and R. Villalba. 1994. Disturbance regime and disturbance interactions in a Rocky Mountain subalpine forest. Journal of Ecology 82: 125-135.

Veblen, T.T. and T. Kitzberger. 2002. Inter-hemispheric comparison of fire history: The Colorado Front Range, U.S.A. and the Northern Patagonian Andes, Argentina. Plant Ecology, in press.

Veblen, T.T. and D.C. Lorenz. 1991. The Colorado Front Range: a century of ecological change. University of Utah Press, Salt Lake City, Utah.

Whipple, S.A. and R.L. Dix. 1979. Age structure and successional dynamics of a Colorado subalpine forest. American Midland Naturalist 101: 142-158.

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LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010471** **Northern Rocky Mountain Mesic Montane Mixed Conifer Forest**

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models: Nearly pure cedar groves, with much longer fire return intervals, have been split from this system into BpS 10472.*

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Larry Kaiser	larry_kaiser@blm.gov	**Reviewer**	Steve Barrett	sbarrett@mtdig.net
Modeler 2	Katie Phillips	cgphillips@fs.fed.us	**Reviewer**	Pat Green	pgreen@fs.fed.us
Modeler 3	Randall Walker	rmwalker@fs.fed.us	**Reviewer**	Steve Rawlings	srawlings@fs.fed.us

Vegetation Type

Forest and Woodland

Dominant Species*

PIMO THPL
LAOC TSHE
PSME
ABGR

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

This BpS occupies maritime influenced sites in north-central to northern ID, northeastern WA and northwestern MT within the range of western red cedar.

Biophysical Site Description

This BpS occurs on low to mid-elevation slopes within the montane mesic forest, generally on northerly aspects. It can also occur on east-facing slopes and lower slopes of west or south-facing aspects in most maritime settings. This is primarily the Thpl/Asca, Tshe/Asca, Thpl/Clun and Tshe/Clun habitat types, in north Idaho Fire Group 8.

Vegetation Description

Vegetation composition will vary widely geographically, but is today dominated by Douglas-fir and grand fir with other mixed conifers. Western larch, western white pine, western hemlock and western red cedar may be present. Ponderosa pine (on warmest and driest sites, such as ridge-tops), Engelmann spruce and subalpine fir (on coldest sites) and pacific yew (on the most maritime sites) may be present. Today, the decline of white pine has led to the increase of grand fir and Douglas-fir in these forests, which have a high propensity to root rot.

In the northern extent of this system, this BpS was dominated by white pine and western larch with lesser components of Douglas-fir and grand fir. Today, white pine and western larch each comprise less than five percent of the relative canopy cover in the Idaho Panhandle National Forest (Art Zack, unpublished data). Historically, white pine may have occupied >30% of the relative canopy cover, and western larch may have occupied >10% (Art Zack, personal communication). On potassium limited soils, white pine was historically dominant (>60%). The removal of white pine and western larch is due to the non-native blister

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rust, logging and fire suppression (see also Adjacency/Identification concerns).

This system represents some of the most productive forests in this region. Forests are typically even-aged with scattered residuals (ie, 1-3 fire-regenerated age classes present in patches) with moderately dense to dense stands.

This type corresponds with warm/moderate, moist grand fir, western redcedar and western hemlock habitat types (Pfister et al. 1977). Daubenmire and Daubenmire (1968) characterized upland red cedar associates as "Paxistima myrsinites union".

Understory associates may include Linnaea borealis, Paxistima myrsinites, Alnus incana, Acer glabrum, Spiraea betulifolia, Rubus parviflorus, Taxus brevifolia, Gymnocarpium dryopteris and Vaccinium membranaceum.

Disturbance Description

Fire Regime Group III or IV. Fires are mostly mixed severity (50-150 year frequency) with the wetter sites experiencing longer fire return intervals and higher severity fires (~200yr frequency) (Zack and Morgan 1994). Mixed fire regimes, however, are very complex and occur "along a gradient that may not necessarily be stable in space or time" (Agee 2005). In the Idaho Panhandle National Forest, Zack and Morgan (1994) found replacement fire intervals at 200yrs and total fire interval at 65yrs for these systems.

Less productive sites may be susceptible to insects or disease. Douglas-fir bark beetle will affect Douglas-fir or grand fir. Root rot will affect Douglas-fir, grand fir and subalpine fir.

Adjacency or Identification Concerns

This type is distinguished from BpS 10472 (Northern Rocky Mountain Western Hemlock-Western Red Cedar Forest: Cedar Groves) because it has a more diverse mix of species, is more upland, and has a much shorter MFI.

Vegetation composition has changed significantly from the historic conditions. White pine is almost non-existent today due to blister rust. Fire suppression and logging have also significantly reduced the amount of larch. Larch is particularly dependent on mixed severity fires, which have been readily suppressed.

Forest structure has also changed significantly in this system. In the Idaho Panhandle National Forest, forests were historically dominated by late-development conditions (40-50%). Today, they are dominated by mid-development conditions (>50%).

Northern Rocky Mountain Conifer Swamp (1161) late successional forests and pure cedar groves (10472) will be present in bottomlands and toeslopes.

Native Uncharacteristic Conditions

Scale Description

Scales of fires tended to be highly variable and extensive (tens of thousands of acres) in area (Agee 1993, Graham and Jain 2005). Landscapes will typically be mosaics of single age-class patches resulting from stand-replacement fires, especially at mid-slopes. Broad ridges and riparian stringers may include more mixed-age stands due to mixed severity fire regime.

Issues/Problems

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Comments

Additional reviewer was Cathy Stewart (cstewart@fs.fed.us). Peer review resulted in modifications to the description and a slightly longer MFI (from 65yrs to 80yrs), but the change in MFI did not change the proportion in each class.

Based on the Rapid Assessment model ROMCCH by Kelly Pohl and reviewed by Steve Barrett and Pat Green. One reviewer suggested referencing the following historical document: John B. Leiberg. Nineteenth Annual Report of the United States Geological Survey to the Secretary of the Interior, 1987-98, Part V- Forest Reserves. However, due to time constraints recovery and incorporation of this document was not possible.

10/01/07: 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

Class A **15 %**

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 8

Indicator Species* and Canopy Position

CEVE	Upper
SASC	Upper
PIMO	Middle
LAOC	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Post-fire vegetation is shrub dominated with some seedling and sapling trees present. Establishment of western or paper birch, quaking aspen or black cottonwood is favored by fires that remove the duff layer (Williams et al. 1995). After 20yrs, this class succeeds to mid-development closed (class B).

Class B **30 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 8

Indicator Species* and Canopy Position

PIMO	Upper
LAOC	Upper
ABGR	Upper
PSME	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	61 %	100 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Pole and medium sized trees of mixed conifer species have overtopped the shrubs and dominate the site. Canopy cover is dense (will often be 100%). At 65yrs post-fire, this class succeeds to late-closed (class E). Western red cedar and western hemlock may be present in the understory. White pine, western larch, grand fir and Douglas-fir will be present in the overstory. Subalpine fir or Engelmann spruce may be important seral species on cooler sites (Williams et al. 1995).

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Class C 5 %

Mid Development 1 Open

Indicator Species* and Canopy Position

PIMO	Upper
LAOC	Upper
THPL	Low-Mid
ABGR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	60 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 8

Description

Open canopy conditions may be a result of topoedaphic conditions or disturbances. Mixed severity fires result in open, patchy stand conditions, and favor western larch and white pine. This condition will succeed to mid-development closed (B) after 20yrs, unless mixed severity fires maintain the open condition. Seedling/sapling western red cedar and western hemlock will be present in the understory.

Class D 10 %

Late Development 1 Open

Indicator Species* and Canopy Position

PIMO	Upper
LAOC	Upper
THPL	Upper
ABGR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	60 %
Height	Tree 25.1m	Tree >50.1m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 8

Description

Open canopy conditions are rare and may be a result of topoedaphic conditions or disturbances. Mixed severity fires result in open, patchy stand conditions. Western red cedar and western hemlock will be codominant with western white pine, western larch, and grand fir. Seedling/sapling western red cedar and grand fir will be present in the understory. After 30yrs, this condition succeeds to late-development closed (E).

Class E 40 %

Late Development 1 Closed

Indicator Species* and Canopy Position

THPL	Upper
TSHE	Upper
PSME	Upper
ABGR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	61 %	100 %
Height	Tree 25.1m	Tree >50.1m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 10

Description

Late-development closed conditions are multi-storied, dense canopies. Understories will tend to be depauperate due to dense overstory. Large woody debris is abundant caused by in-stand competition. Fuel loadings range from 18-40 tons/acre (Kapler-Smith and Fischer 1995). This class will shift to open conditions with mixed severity fire or disease. Root rot will affect Douglas-fir and grand fir in patches.

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Fire Regime Group: III**

Historical Fire Size (acres)

Avg 500
Min 5
Max 30000

Sources of Fire Regime Data

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	200	150	500	0.005	40
Mixed	133			0.00752	60
Surface					
All Fires	80			0.01253	

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

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

References

Agee, J.K. 2005. The complex nature of mixed severity fire regimes. Pages 1-10 in: L. Taylor, J. Zelnik, S. Cadwaller and B. Hughes, eds. Mixed severity fire regimes: ecology and management. symposium proceedings. 17-19 November 2004. Spokane, Washington: The Association for Fire Ecology and Washington State University.

Agee, J.K. 1993. Fire ecology of Pacific Northwest Forest. Island Press: Washington, DC. 493 pp.

Ager, A., D. Scott and C. Schmitt. 1995. UPEST: Insect and disease risk calculator for the forests of the Blue Mountains. File document. Pendelton, OR: USDA Forest Service, Pacific Northwest Region, Umatilla and Wallowa-Whiman National Forests. 25 pp.

Allen, R.B., R.K. Peet and W.L. Baker. 1991. Gradient analysis of latitudinal variation in southern Rocky Mountain forests. Journal of Biogeography 18: 123-139.

Amman, G.D. 1977. The role of mountain pine beetle in lodgepole pine ecosystems: impact on succession. In: W.J. Mattson, ed. The role of arthropods in forest ecosystems. Springer-Verlag, New York, New York, USA.

Anderson, L., C.E. Carlson and R.H. Wakimoto. 1987. Forest fire frequency and western spruce budworm outbreaks in western Montana. Forest Ecology and Management 22: 251-260.

Arno, S.F. 1980. Forest fire history in the northern Rockies. Journal of Forestry 78(8): 460-465.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Arno, SF., J.H. Scott and M. Hartwell. 1995. Age-class structure of old growth ponderosa pine/Douglas-fir stands and its relationship to fire history. Research Paper INT-RP-481. Ogden, UT: USDA Forest Service, Intermountain Research Station: 25 pp.

Baker, William L. and D. Ehle. 2001. Uncertainty in surface fire history: the case of ponderosa pine forests in

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

the western United States. Canadian Journal of Forest Research 31: 1205-1226.

Barrett, S.W. 1982. Fire's influence on ecosystems of the Clearwater National Forest: Cook Mountain fire history inventory. Unpublished final report on file at USDA Forest Service Clearwater National Forest, Orofino, ID. 42 pp.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Brown, J.K., S.F. Arno, S.W. Barrett and J.P. Menakis. 1994. Comparing the Prescribed Natural Fire Program with Presettlement Fires in the Selway-Bitterroot Wilderness. Int. J. Wildland Fire 4(3): 157-168.

Byler, J.W., M.A. Marsden and S.K. Hagle. 1992. The probability of root disease on the Lolo National Forest, Montana. Can. J. For. Res. 20: 987-994.

Byler, J.W. and S.K. Hagle. 2000. Succession functions of pathogens and insects. Ecoregion sections M332a and M333d in northern Idaho and western Montana. Summary. R1-FHP 00-09. USDA Forest Service, State and Private Forestry. 37 pp.

Cooper, S.V., K.E. Neiman and D.W. Roberts. 1991. Forest habitat types of northern Idaho: A second approximation. INT-GTR-236. Ogden, UT: USDA Forest Service, Intermountain Research Station. 144 pp.

Crane, M.F. 1982. Fire ecology of Rocky Mountain Region forest habitat types. Final Report to the USDA Forest Service, Region Two, 15 May 1982. Purchase order NO. 43-82X9-1-884.

Daubenmire, R.F. and J.B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Technical Bulletin 60. Pullman, WA: Washington State University, Agricultural Experiment Station. 104 pp.

Filip, G.M. and D.J. Goheen. 1984. Root diseases cause severe mortality in white and grand fir stands of the Pacific Northwest. Forest Science 30: 138-142.

Furniss, M.M., R.L. Livingston and M.D. McGregor. 1981. Development of a stand susceptibility classification for Douglas-fir beetle (Dendroctonus pseudotsugae). Pages 115-128 in: R.L Hedden, S.J. Barres and J.E. Coster, tech. coords. Hazard rating systems in forest insect pest management. Symposium proceedings; 1980 July 31- August 1; Athens, Georgia. Gen. Tech. Rep. WO-27. Washington, DC: USDA Forest Service.

Goheen, D.J. and E.M. Hansen. 1993. Effects of pathogens and bark beetles on forests. Pages 176-196 in: Beetle- pathogen interactions in conifer forests. Academic Press Ltd.

Graham, R.T. and T.B. Jain. 2005. Silvicultural tools applicable in forests burned by a mixed severity fire regime. Pages 45-58 in: L. Taylor, J. Zelnik, S. Cadwaller and B. Hughes, eds. Mixed severity fire regimes: ecology and management. symposium proceedings. 17-19 November 2004. Spokane, Washington: The Association for Fire Ecology and Washington State University.

Hagle, S., J. Schwandt, T. Johnson, S. Kegley, C. Bell Randall, J. Taylor, I.B. Lockman, N. Sturdevant and M. Marsden. 2000. Successional functions of pathogens and insects; Ecoregion sections M332a and M333d

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**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.

in northern Idaho and western Montana. Volume 2: Results. R1-FHP 00-11. USDA Forest Service, State and Private Forestry, Northern Region. 262 pp. Appendices.

Hagle, S., T. Johnson, M. Marsden, L. Lewis, L. Stipe, J. Schwandt, J. Byler, S. Kegley, C. Bell Randall, J. Taylor, I.B. Lockman, N. Sturdevant and S. Williams. 2000. Successional functions of pathogens and insects; Ecoregion sections M332a and M333d in northern Idaho and western Montana. Volume 1: Methods. R1-FHP 00-10. USDA Forest Service, State and Private Forestry, Northern Region. 97 pp.

Hagle, S.K. and J.W. Byler. 1993. Root diseases and natural disease regimes in a forest of western U.S.A. Pages 606-627 in: M. Johansson and J. Stenlid, eds., Proceedings of the Eighth International Conference on Root and Butt Rots, 9-16 August 1993, Wik, Sweden and Haikko, Finland.

Hagle, S.K., J.W. Byler, S. Jeheber-Matthews, R. Barth, J. Stock, B. Hansen and C. Hubbard. 1994. Root disease in the Coeur d'Alene river basin: An assessment. Pages 335-344 in: Interior Cedar-Hemlock-White pine forests: Ecology and Management, 1993, 2-4 March 1993; Spokane, WA: Washington State University, Pullman, WA.

Haig, I.T., K.P. Davis and R.H. Weidman. 1941. Natural regeneration in the western white pine type. USDA Tech. Bull. 767. Washington, DC. 99 pp.

Holah, J.C., M.V. Wilson and E.M. Hansen. Impacts of a native root-rotting pathogen on successional development of old-growth Douglas-fir forests. Oecologia (1977) 111: 429-433.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Kaufmann, M.R., C.M. Regan and P.M. Brown. 2000. Heterogeneity in ponderosa pine/Douglas-fir forests: age and size structure in unlogged and logged landscapes of central Colorado. Canadian Journal of Forest Research 30: 698-711.

Keane, R.E., S.F. Arno and J.K. Brown. 1990. Simulating cumulative fire effects in ponderosa pine/Douglas-fir forests. Ecology 71(1): 189-203.

Kurz, W.A., S.J. Beukema and D.C.E. Robinson. 1994. Assessment of the role of insect and pathogen disturbance in the Columbia River Basin: a working document. Prepared by ESSA Technologies, Ltd., Vancouver, B.C. USDA Forest Service, Coeur d'Alene, ID, 56 pp.

Laven, R.D., P.N. Omi, J.G. Wyant and A.S. Pinkerton. 1981. Interpretation of fire scar data from a ponderosa pine ecosystem in the central Rocky Mountains, Colorado. Pages 46-49 in M.A. Stokes and J.H. Dieterich, technical coordinators. Proceedings of the Fire History Workshop, 20-24 October 1980, Tucson, AZ. General Technical Report RM-81. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 142 pp.

Leiberg, J. 1900. The Bitterroot Forest Reserve. Dept. of Interior, US Geological Survey 20th Annual Report, Part V; Forest Reserves. Washington, DC. 317-410.

Morgan, P. and R. Parsons. 2001, Historical range of variability of forests of the Idaho Southern Batholith Ecosystem. Univerity of Idaho. Unpublished.

---

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Peet, R.K. 1988. Forests of the Rocky Mountains. Pages 64-102 in: M.G. Barbour and W. D. Billings, eds. Terrestrial Vegetation of North America. Cambridge: Cambridge University Press.

Peet, R.K. 1978. Latitudinal variation in southern Rocky Mountain forests. Journal of Biogeography 5: 275-289.

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Swetnam, T.W. and T.A. Lynch. 1989. A tree-ring reconstruction of western spruce budworm history in the southern Rocky Mountains. For. Sci. 35:962-986.

USDA Forest Service. 1938. Forest Statistics: Boundary County, Idaho. Forest Survey Release No. 6; A July 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 30 pp.

USDA Forest Service. 1938. Forest Statistics: Bonner County, Idaho. Forest Survey Release No. 7; An August 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 31 pp.

USDA Forest Service. 1938. Forest Statistics: Benewah County, Idaho. Forest Survey Release No.8; A September 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 30 pp.

USDA Forest Service. 1938. Forest Statistics: Kootenai County, Idaho. Forest Survey Release No. 9; A December 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 35 pp.

USDA Forest Service. 1938. Forest Statistics: Latah County, Idaho. Forest Survey Release No. 10; A January 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 32 pp.

USDA Forest Service. 1938. Forest Statistics: Shoshone County, Idaho. Forest Survey Release No. 11; A February 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 32 pp.

USDA Forest Service. 1938. Forest Statistics: Nez Perce County, Idaho. Forest Survey Release No. 12; A March 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 28 pp.

USDA Forest Service. 1938. Forest Statistics: Lewis County, Idaho. Forest Survey Release No. 13; A May

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 25 pp.

USDA Forest Service. 1938. Forest Statistics: Clearwater County, Idaho. Forest Survey Release No. 14; A June 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 35 pp.

USDA Forest Service. 1938. Forest Statistics: Idaho County, Idaho. Forest Survey Release No. 15; A September 1938 Progress Report. USDA Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Mt. 31 pp.

Veblen, T.T., K.S. Hadley, M.S. Reid and A.J. Rebertus. 1991. The response of subalpine forests to spruce beetle outbreak in Colorado. Ecology 72(1):213-231.

Williams, C.K., B.F. Kelley, B.G. Smith and T.R. Lillybridge. 1995. Forest plant associations of the Colville National Forest. Gen. Tech. Rep. PNW-GTR-360. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 375 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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LANDFIRE Biophysical Setting Model

Biophysical Setting: 1010472 **Northern Rocky Mountain Mesic Montane Mixed Conifer Forest - Cedar Groves**

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models: Nearly pure cedar groves, with much longer fire return intervals, have been split from the more common cedar-hemlock type (BpS 10471).*

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Steve Barrett	sbarrett@mtdig.net	**Reviewer**	
Modeler 2			**Reviewer**	
Modeler 3			**Reviewer**	

Vegetation Type

Forest and Woodland

Dominant Species*

THPL
ABGR
LAOC

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

Occurs in the maritime-influenced zone of northern ID and northwestern MT.

Biophysical Site Description

Wet canyon bottoms and toeslopes below 5000ft elevation; generally small to moderate size "stringer" groves dominated by Thuja plicata that often escape burning during fires on adjacent slopes.

Vegetation Description

Sheltered groves of nearly pure uneven aged Thuja plicata, with occasional minor associates Abies grandis, Tsuga heterophylla and Larix occidentalis. Understories are usually dominated by low growing forbs and ferns such as Asarum caudatum, Viola orbiculata, Clintonia uniflora, Tiarella trifoliata, Coptis occidentalis, Oplopanax horridum, Athyrium filix-femina and Adiantum pedatum.

Disturbance Description

Long-interval stand-replacement fire regime (200-500yrs) with occasional mixed severity fires (ie, burn margin effect from fires on adjacent drier slopes).

Adjacency or Identification Concerns

Type transitions to cedar/hemlock types (10471) with increasing slope steepness and elevation. This type is distinguished by the more mesic conditions (ie, riparian areas, draws and canyon bottoms) and composition of pure or nearly pure western red cedar.

Native Uncharacteristic Conditions

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Scale Description

Stand replacing disturbances tended to be extensive in the surrounding landscape, but smaller patches of mixed severity fire can occur during less-severe fire weather. This vegetation type represents relatively small imbedded "fire refugia," where Thuja plicata groves can persist for 500-1000yrs between stand-replacement fires.

Issues/Problems

Should seek reviewer advice about the roles of diseases; root rots and other fungi were important in stand successional patterns & pathways, but mostly for producing local gap-phase openings rather than stand replacement.

Comments

This model was adopted as-is from the Rapid Assessment model R0WERC with minor modifications to meet LANDFIRE standards.

10/01/07: 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

Class A 10 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

CLUN	Lower
ADPE	Lower
ATFI	Lower
THPL	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Herb 0m	Herb >1.1m
Tree Size Class	Sapling >4.5ft; <5"DBH	

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

Herbaceous layer will be up to 100% cover and may dominate prior to the development of cedar and hemlock saplings.

Description

Post-burn sites dominated by forbs, ferns and shrubs; tree regeneration generally consists of western redcedar and grand fir seedlings to saplings.

Class B 40 %

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

THPL	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Moderate to heavy regeneration of pole size western redcedar. Occasional grand fir, western larch and other species may be present.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 C 5 %

Mid Development 1 Open

Indicator Species* and Canopy Position

THPL Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Pole 5-9" DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Uncommon mid-open successional class resulting after mixed severity fire and blowdowns; dominated by western redcedar with occasional grand fir and western larch. The scale of open classes would be primarily local rather than landscape (ie, gap-phase openings within stands).

Class D 5 %

Late Development 1 Open

Indicator Species* and Canopy Position

THPL Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Uncommon mid-late open successional class resulting after mixed severity fire, blowdowns, disease; dominated by western redcedar with occasional grand fir and western larch. The scale of open classes would be primarily local rather than landscape (ie, gap-phase openings within stands).

Class E 40 %

Late Development 1 Closed

Indicator Species* and Canopy Position

THPL Upper
ABGR

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Moderately dense to densely stocked old growth groves dominated by western redcedar; generally depauperate understories as a result of heavy shading.

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Fire Regime Group:** V

Historical Fire Size (acres)

Avg
Min
Max

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	385	75	1000	0.0026	86
Mixed	2500			0.0004	13
Surface					
All Fires	334			0.00301	

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

Arno, S.F. and D.H. Davis. 1980. Fire history of western redcedar/hemlock forests in northern Idaho. Pages 21-26 in M.A. Stokes and J.H. Dieterich, technical coordinators. Proceedings of the Fire History Workshop, 20-24 October 1980, Tucson, AZ. General Technical Report RM-81. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station 142 pp.

Barrett, S.W. 1982. Fire's influence on ecosystems of the Clearwater National Forest: Cook Mountain fire history inventory. Unpub. final report. On file at USDA Forest Service, Clearwater National Forest, Orofino ID. 42 pp.

Barrett, S.W. 1985. Fire history of Units 26/30, Crooked Mink Timber Sale, Powell Ranger District, Clearwater National Forest. Unpub. report. On file at USDA Forest Service, Clearwater National Forest, Powell Ranger District, Lolo MT. 13 pp.

Barrett, S.W. 1986. Fire history reconnaisance for Point Source Ignition Project, Powell Ranger District, Clearwater National Forest. Unpub. Rept. On file at USDA Forest Service, Clearwater National Forest, Powell Ranger District, Lolo MT. 9 pp.

Barrett, S.W. 1994. Fire regimes on the Clearwater and Nez Perce National Forests, North central Idaho. Unpub. Rept. On file at USDA Forest Service, Clearwater National Forest, Orofino ID. 31 pp.

Barrett, S.W. 1995. Fire history assessment for the Lolo Trail, Powell Ranger District, Clearwater National Forest. Unpub. Rept. On file at USDA Forest Service, Clearwater National Forest, Powell, ID. 16 pp.

Barrett, S.W. 2004a. Fire Regimes in the Northern Rockies. Fire Mgt. Today 64(2): 32-38.

Barrett, S.W. 2004b. Altered fire intervals and fire cycles in the Northern Rockies. Fire Mgt. Today 64(3): 25-29.

Barrett, S.W. and S.F. Arno. 1991. Classifying fire regimes and defining their topographic controls in the Selway Bitterroot Wilderness. Pages 299-307 in: Proc. 11th Conf. Fire and For. Meterology, 16-19 April 1991, Missoula, MT.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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Brown, J.K., S.F. Arno, S.W. Barrett and J.P. Menakis. 1994. Comparing the Prescribed Natural Fire Program with Presettlement Fires in the Selway-Bitterroot Wilderness. Int. J. Wildland Fire 4(3): 157-168.

Cooper, S.V., K.E. Neiman and D.W. Roberts. 1991. Forest habitat types of northern Idaho: A second approximation. INT-GTR-236. Ogden, UT: USDA Forest Service, Intermountain Research Station. 144 pp.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Morgan, P., S. Bunting, A. Black, T. Merril, and S.W. Barrett. 1998. Fire regimes in the Interior Columbia River Basin: Past and Present. Pages 77-82 in: Proc. Fire mgt. under fire (adapting to change); 1994 Interior West Fire Council Meeting, Internatl. Assoc. Wildland Fire, Fairfield, WA.

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Zack, A.C. and P. Morgan. 1994. Fire history on the Idaho Panhandle National Forest. Unpub. report. On file at USDA Forest Service, Idaho Panhandle National Forest, Coeur d'Alene, ID, 44 pp.

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LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010490** **Rocky Mountain Foothill Limber Pine-Juniper Woodland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Mike Babler	mbabler@tnc.org	**Reviewer**	Dennis Knight	dhknight@wyo.edu
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Modeler 3			**Reviewer**	Paul Langowski	plangowksi@fs.fed.us

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

PIFL2	ARTR2
JUSC2	BOGR2
JUOS	LEKI2
ARNO4	POSE

General Model Sources

☑ Literature
☐ Local Data
☐ Expert Estimate

Geographic Range

Northern MT to central CO, on escarpments across WY into the Black Hills.

Biophysical Site Description

Occurs in foothill and lower montane zones into the western Great Plains. Elevation ranges from 1000-2400m (3300-7900ft). Occurs in shallow soils with high rock component, often gravelly and calcareous. Slopes are moderately steep to steep, typically on steep, rocky, well-drained, windswept, and nutrient-poor sites on exposed ridges and summits.

Vegetation Description

Open canopy dominated by Pinus flexilis. Commonly associated with Juniperus scopulorum, to a lesser extent Juniperus osteosperma. Often associated with Pinus ponderosa. Pinus edulis is not present. The shrubs layer is sparse to moderately dense. Shrubs may include Artemisia nova, Artemisia tridentata, Cercocarpus ledifolius, Cercocarpus montanus, Cornus sericea, Ericaneria nauseosa, Purshia tridentata, Rhus trilobata and Rosa woodsii. Herbaceous layers are sparse, often significantly different than surrounding community. These may include Bouteloua gracilis, Leucopoa kingii, Hesperostipa comata, Koeleria macrantha, Pipatherum micranthum, Poa secunda and Pseudoroegneria spicata. Limber pine at lower elevation appear to be short lived compared to those found at high elevation.

Disturbance Description

Limber pine bark at the base of older trees may be 2in (5cm) thick, therefore these trees can withstand stem scorch from low-severity fires. Terminal buds are somewhat protected from the heat associated with crown scorch by the tight clusters of needles around them. Wildfires are less frequent in limber pine communities than in other conifer habitats because of low fuel accumulation associated with poor soil development and limited grass and forb productivity. Locations where limber pine grows may have a much lower fire

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

frequency than surrounding communities. Surrounding community fire regime may have impact on limber pine.

Adjacency or Identification Concerns

Where limber pine grows in association with other trees, the fire regimes of those species are relevant and affect fire return interval.

Non-native white pine blister rust is a concern in WY and northern CO.

Native Uncharacteristic Conditions

Cover >70% can be considered uncharacteristic in this woodland community.

Scale Description

Tens to 100s of acres, generally smaller islands of trees.

Issues/Problems

Fire history is lacking with a wide range of estimates available. As a whole fire is rare in this BpS due to coarse, gravely soils and rock. Review raises concern about the percent of replacement fire.

Comments

This model was adopted as-is from MZ28 with minor modifications to the description. Original model developed for MZs 23 and 24 by Mike Babler, (mbabler@tnc.org), 4/10/2005. Reviewed by D Knight (dhknight@wyo.edu). Further modified for MZ28 4/19/2005. Was also reviewed in workshop by Chuck Kostecka (Colo State Forest Service, ret.).

Vegetation Classes

Class A 20 %

Early Development 1 All Structures

Indicator Species* and Canopy Position

PIFL Upper
JUSC2 Upper

Upper Layer Lifeform

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

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	70 %
Height	Tree 0m	Tree 5m
Tree Size Class	Seedling <4.5ft	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Seedling tend to establish in protected sites, shelter of rocks, little grass or herb competition. Trees <100yrs old.

Class B 30 %

Mid Development 1 Open

Indicator Species* and Canopy Position

PIFL Upper
JUSC2 Upper

Upper Layer Lifeform

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

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	40 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Trees are established. Grasses and herbs are sparse in gravelly rocky soils. Trees 100-200yrs old.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 C **50 %**

Late Development 1 Closed

Indicator Species* and Canopy Position

PIFL Upper
JUSC2 Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	70 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Medium 9-21"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 8

Description

Mature trees, little grass and herbs on ground. Trees >200yrs old. Often little grass or herb cover.

Class D **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Class E **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Disturbances

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 25
Min 1
Max 200

Sources of Fire Regime Data

☐ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	400			0.0025	99
Mixed					
Surface					
All Fires	400			0.00252	

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.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Additional Disturbances Modeled

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

References

Crane, M.F. and W.C. Fisher. 1986. Fire ecology of the forested habitat types of central Idaho. General Technical Report INT-218, USDA Forest Service. 86 pp.

Dreyfus, A. 2002. The Ecology of Pinus Flexilis stand on the Shortgrass steppe. MS thesis, Colorado State University, Ft Collins CO. 134p.

Fisher, R.F., M.J. Jenkens and W.F. Fisher. 1987. Fire and the prairie mosaic of Devils Tower National Monument. The American Midland Naturalist.117: 250-257.

Johnson, K. A. 2001. Pinus flexilis. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, March 17].

Johnston, B.C., 1987. Plant associations of region two, edition 4. USDA Forest Service R2-ECOL-87-2. 429 pp.

Knight, D.H. 1999. Ponderosa and limber pine woodlands. Pages 249-261 in R.C. Anderson, J.S. Fralish, and J.M. Baskin, editors. Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge University Press, Cambridge.

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

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. U.S.A. Data current as of November 4, 2004.

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

Schuster, W.S.F., J.B. Mitton, D.K. Yamaguchi and C.A Woodhouse. 1995. A comparison of limber (Pinus flexilis) ages at lower and upper treeline sites east of the Continental Divide in Colorado. The American Midland Naturalist. 133: 101-111.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010500** **Rocky Mountain Lodgepole Pine Forest**

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

General Information

Contributors (also see the Comments field) **Date** 5/20/2005

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Modeler 3			**Reviewer**		

Vegetation Type
Forest and Woodland

Map Zone
10

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

Dominant Species*
PICO ABLA
VASC
VAMYO
VASC

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Geographic Range

South-central WY, south in the Rocky Mountain Front and Interior Ranges, west to the White River Plateau and northern Gunnison Basin. Also occurs in the Northern Rockies, north of the Red Desert and Utah High Plateau. The occurrence of lodgepole pine is minimal and probably only mappable in the extreme northeast portion of MZ18.

Biophysical Site Description

Subalpine cold climate, relatively moist but usually comes in the winter months as snow. Soils are usually excessively well-drained, residual or glacial till and alluvium on valley floors where there is cold air accumulation, warm and droughty shallow soils over fractured quartzite bedrock, coarse fraction 20-30% in soil, shallow soil (effectively 1-2in) to broken rock or bedrock and shallow moisture-deficient soils with a significant component of volcanic ash. Soils are acidic, and rarely formed from calcareous parent materials. Precipitation 400-900mm/yr.

Vegetation Description

These forests are dominated by Pinus contorta with shrub, grass or barren understories. Sometimes there are intermingled mixed conifer/Populus tremuloides stands with the latter occurring with inclusions of deeper, typically fine-textured soils. The shrub stratum may be conspicuous to absent; common species include Arctostaphylos uva-ursi, Ceanothus velutinus, Mahonia repens, Purshia tridentata, Spiraea betulifolia, Spiraea douglasii, Shepherdia canadensis, Vaccinium caespitosum, Vaccinium spp, Symphoricarpos oreophilus, Ribes viscossissimum, Sambucus cerluea, Pachistima myrinsites, Salix scouleriama, Prunus virginianus and Penstomon fruiticolosa. Grasses include Elymus glauccus, Poa wheeleri, Carex geyeri and Carex hoodii. Dominant forbs are Arnica cordifolia and Hieracium alboflorum.

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**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.

Disturbance Description

These are subalpine forests where the dominance of Pinus contorta is related to fire history and topo-edaphic conditions. Following stand-replacing fires, Pinus contorta will rapidly colonize and develop into dense, even-aged stands. For the northeast corner of MZ18, the mean FRI is variable depending on elevation, precipitation and temperature (150-300yrs). Some Pinus contorta forests will persist on sites that are too extreme for other conifers to establish.

At approximately 100yrs of age, insect, disease and/or blow down create small openings in forest canopy maintaining class B.

Adjacency or Identification Concerns

Lodgepole pine stands may be too small to be mappable in the southern portion of MZ18.

Persistent lodgepole pine stands in the montane and lower subalpine zones on less well-drained soils are usually seral to mixed conifer or subalpine BpS, including species such as Douglas-fir, white fir, Engelmann spruce and subalpine fir.

Native Uncharacteristic Conditions

Scale Description

Isodiametric stands are mostly small (100s of acres) in the southern portion of MZ18 but reach into the 1000s of acres in the northeastern portion of the mapzone. Patches of this BpS usually correspond to patches of habitat (well-drained to excessively well-drained soils) in the subalpine zone. Although fire size could be large in other parts of the western US, in eastern CA, NV, south-central ID and western UT, patches of this type were small enough to keep fire size within 100ac. Fire in the northeast corner of MZ18 are larger in size (100-1000s of acres)

Issues/Problems

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.

Sarah Heide reviewed BpS 1050 on 5/20/05 and made modifications to MZs 12 and 17 databases (by Julia Richardson, jhrichardson@fs.fed.us, and Cheri Howell, chowell02@fs.fed.us). S. Heide's modifications included changes in species composition, geographic distribution (NE MZ18) and maximum fire size (100s to 1000s of acres). The VDDT model and cover breaks modeled in MZs 12 and17 were not changed. Fuel models were changed.

For MZs 12 and 17, model created for MZ16 by Doug Page (doug_page@blm.gov), Mark Loewen (mloewen@fs.fed.us) and Linda Chappell (lchapell@fs.fed.us) was adopted. Updated 2/23/05 for LANDFIRE BpS modeling by Pohl. Modeling errors were corrected, resulting in slightly different percentages in each class and slightly different probabilities of fire. Model revised by Pohl was further changed on 3/2/05 with class D deleted and fire dynamics simplified. Insect outbreaks were intensified, especially in older stands.

Vegetation Classes

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 A **20 %**

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 6

Indicator Species* and Canopy Position

VASC	Lower
RIVI	Lower
CAGE2	Lower
PICO	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	80 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Grasses, forbs, low shrubs and lodgepole seedlings-saplings. Succeeds to B after 20yrs because young lodgepole grows fast. If aspen is present, it grows faster and dominates lodgepole during this stage only. Cover of trees (seedlings-saplings) varies widely. Replacement fire occurs every 200yrs on average, setting back succession to age zero.

Class B **50 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 8

Indicator Species* and Canopy Position

PICO	Upper
VASC	Lower
CAGE2	Lower
ABLA	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	71 %	100 %
Height	Tree 0m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Moderate to dense pole-sized trees, sometimes very dense (dog-hair). Aspen usually not present.

Class will last until 80yrs and then succeed to C. Insects and disease (mean return interval of 75yrs) maintain class B. Replacement fire (mean FRI of 200yrs) returns vegetation to class A. Competition may maintain the dog-hair condition (prob/yr = 1/500).

Class C **30 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 10

Indicator Species* and Canopy Position

PICO	Upper
ABLA	Mid-Upper
VASC	Lower
CAGE2	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	70 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Many mature lodgepole pine, somewhat patchy, variety of lodgepole size classes and open canopies overall but patches of denser trees.

Class will self-maintain if no disturbances occur. Insects and disease (mean return interval of 75yrs) can cause a transition to class A. Replacement fire occurs every 100yrs on average; surface fires (mean FRI of 200yrs) maintain class C.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 D **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

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 100
Min 10
Max 1000

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	153	90	300	0.00654	81
Mixed					
Surface	667			0.0015	19
All Fires	124			0.00805	

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

Buechling, A. and W.L. Baker. 2004. A fire history of tree rings in a high-elevation forest of Rocky Mountain National Park. Canadian Journal of Forest Research 34: 1259-1273.

Bureau of Land Management. 2004. Fire, fuels, and related vegetation management direction plan amendment and environmental impact statement. Draft. Upper Snake River District. Idaho Falls, Idaho.

Johnston, B.C., L. Huckaby, T.J. Hughes and J. Pecor. 2001. Ecological types of the Upper Gunnison Basin: Vegetation-Soil-Landform-Geology-Climate-Water land classes for natural resource management. Technical Report R2-RR-2001-01. Lakewood, CO: USDA Forest Service, Rocky Mountain Region. 858 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Kaufmann, M. R. 1985. Annual transpiration in subalpine forests: large differences among four tree species. Forest Ecology and Management 13: 235-246.

Lotan, J.E.; J.K. Brown and L.F. Neuenschwanger. 1985. Role of fire in lodgepole pine forests. Pages 133-152 in: D.M. Baumgartner, R.G. Krebill, J.T. Arno and G.F. Weetman, compilers and editors. Lodgepole pine: the species and its management. Pullman, WA: Washington State University, Cooperative Extension.

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

Romme, W.H. 1982. Fire and landscape diversity in subalpine forests of Yellowstone National Park. Ecological Monographs 52(2): 199-221.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010530** **Northern Rocky Mountain Ponderosa Pine Woodland and Savanna**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 3	Kathy Geier-Hayes	kgeierhayes@fs.fed.us	**Reviewer**	Dana Perkins	dana_perkins@blm.gov

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

PIPO
FEID
PSSP6
PUTR2

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Throughout the northern and central Rocky Mountains in MT, central ID and northeastern WA. In ID, the distribution of this BpS is limited to lower slope positions in the Boise, Payette and Salmon River drainages. In northeastern WA, it is found on sites <4500ft, particularly along the Columbia and Kettle Rivers and in the Okanogan Highlands.

Biophysical Site Description

These stands typically occurred on hot, dry, south and west-facing slopes at lower elevations with well drained soils and gentle to moderately steep slopes.

Vegetation Description

Frequent fires promoted a grass-dominated understory with sparse shrubs and a ponderosa pine overstory. Douglas-fir and Rocky Mountain juniper may occur as incidental individuals, but overall Douglas-fir cover will be <10%.

Common snowberry, antelope bitterbrush and chokecherry are important shrubs, and mountain mahogany may also occur on rocky outcrops. Grasses may include Idaho and rough fescue (Fischer and Bradley 1987). More mesic shrubs may be present if it is a wetter habitat type that historically maintained an open stand via frequent fire.

Fischer and Bradley (1987), Fischer and Clayton (1983) and Kapler-Smith and Fischer (1997) would characterize this BpS as predominantly Fire Groups 2 and 4 for western MT and central ID, Fire Group 3

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**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.

for eastern MT and WY, and Fire Group 1 for northern ID. Also refer to Crane and Fischer (1986).

Disturbance Description

Frequent, non-lethal surface fires were the dominant disturbance factor, occurring every 3-30yrs (Arno and Petersen 1993, Arno 1976, Fischer and Bradley 1987). Three-year fire return intervals are likely very localized and associated with Native American burning. However, there is some disagreement as to the extent of Native burning. More median fire return intervals were likely about 15yrs. Mixed-severity fires likely occurred about every 50yrs; again, depending on the vegetative state. Stand-replacement fires likely occurred in stands and small patches on the order of a few hundred acres every 300-700yrs depending on the vegetative state. Some authors note that little information is available regarding the exact nature of stand replacement fire severity in this BpS.

Western pine beetle can attack large ponderosa pine in any canopy density.

Adjacency or Identification Concerns

Vegetation is characterized by Pfister et al. (1977) as the ponderosa pine series, by Steele et al. (1981) as the ponderosa pine series and by Williams et al. (1995) as Douglas-fir-ponderosa pine.

These sites typically formed the lower timberline in the area and were historically found adjacent to grasslands and shrublands that dominated valley bottoms. The early seral stages often resemble adjacent shrubland or grassland BpS.

In the 21st century, after missing several fire return intervals, these stands may support an overabundance of stagnant ponderosa pine pole thickets, heavy duff and litter layers and few grasses or shrubs. As a result it may be difficult to distinguish this BpS in its mid and late seral stages from BpS 1045.

Dense pockets of Douglas-fir may also occur. This BpS may be found on several different habitat types depending on the local fire regime; FRG I maintained these stands as ponderosa pine, but today they may be supporting Douglas-fir in some areas.

This vegetation type continues to be commercially logged. Site modifications include plantations and terracing.

Native Uncharacteristic Conditions

Cover >60% can be considered uncharacteristic in this woodland community.

Scale Description

Stands dominated by ponderosa pine with frequent fire return intervals commonly exhibit very small patch sizes even though fire events occurred over hundreds or thousands of acres (Agee 1998). Open, late-seral stands typically dominated the landscape with frequent fire, though even-aged stands were uncommon. In ID, this type was often found as a narrow band between grassland/shrublands at lower elevations and Douglas-fir types at higher elevations.

Issues/Problems

1) Fischer and Bradley (1987) show only a single pathway from the dense pole stage characterized by succession without a fire disturbance (Class A to Class B). However, it seems that under a frequent fire regime, these stands would typically bypass Class B and move directly to Class C--unless there is not enough fuel to carry fire at this stage (insufficient stand density and leaf litter). 2) Mixed-severity and stand-replacement fire return intervals are not well documented in the literature for this BpS. Some evidence suggests these fires indeed occurred, but there may be room to improve the assumptions used in this

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**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.

modeling effort. 3) There was some debate in the in-workshop peer review over the probability of mixed fire. Currently the model shows a fire interval of about 70yrs for mixed severity fire; some thought it should be more like 50yrs.

The southern portion of MZ10 may have supported a more frequent fire regime and thus more of class D. The BpS was not split for MZ10.

Comments

Additional reviewers were Steve Barrett (sbarrett@mtdig.net), Susan Miller (smiller03@fs.fed.us), Lyn Morelan (lmorelan@fs.fed.us), Catherine Phillips (cgphillips@fs.fed.us) and Cathy Stewart (cstewart@fs.fed.us). Peer review resulted in additions to the description.

This model was adapted from the Rapid Assessment model R0PIPOnr by Tonja Opperman and Lynnette Morelean and reviewed by Steve Barrett, Cathy Stewart and Jane Kapler-Smith.

Vegetation Classes

Class A 5%

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

FEID	Lower
PSSP6	Lower
PIPO	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	60 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

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

Grass species are the dominant lifeform in this class attaining maximum heights of three feet and being patchy in distribution (25-75% cover).

Description

Fire-maintained grass/forb and/or seedlings and saplings. Seedling/sapling size class would be less than five inches in diameter; no very large or old-growth trees would be present in patches of 10s to 100s of acres to be counted in this class. This is due to poor site conditions and abundance of rock outcroppings.

Dispersed large diameter fire remnant ponderosa pines with snag trees also present. These large diameter trees would have a density of less than one tree/acre.

Class B 10%

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIPO	Upper
FEID	Lower
PSSP6	Lower
PSME	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	60 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Closed PIPO pole and medium stand; may have Douglas-fir as incidentals. Larger, old-growth trees may be present in this class, the pole and medium diameter class (5-21in) occurring between these large trees is most abundant and characteristic of this class. May see large diameter snags, dead and down trees present. High

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density stunted pole stands are counted here; may see insect/disease here.

Class C **20%**

Mid Development 1 Open

Indicator Species* and Canopy Position

PIPO Upper
FEID Lower
PSSP6 Lower
PSME Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0%	40%
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Open PIPO pole and medium stand that may have Douglas-fir as incidentals. Larger, old-growth trees may be present in this class, the pole and medium (5-21in) diameter trees are what should be counted for this class. These patches have probably had recent fire or are drier therefore retaining a more open condition.

Class D **55%**

Late Development 1 Open

Indicator Species* and Canopy Position

PIPO Upper
FEID Lower
PSSP6 Lower
PSME Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0%	40%
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Fire-maintained open, park-like PIPO; nearly any fire maintains; Douglas-fir may be seen as incidentals or in patches, but not a major component of the overstory. The overstory is characterized by large and very large ponderosa pine and isolated Douglas-fir. Understory is dominated by grasses and is relatively open. Seedlings are very infrequent, with <10% cover usually occurring in patches.

Class E **10%**

Late Development 1 Closed

Indicator Species* and Canopy Position

PIPO All
PSME All

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41%	60%
Height	Tree 10.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 10

Description

High density, multi-storied PIPO stand; Douglas-fir regeneration on some sites. Thickets of various size classes distributed within the class and may be interspersed with large snags.

Disturbances

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**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.

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	360	50	1000	0.00278	4
Mixed	55	16	100	0.01818	24
Surface	18	12	20	0.05556	73
All Fires	13			0.07652	

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

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

References

Agee, J.K. 1988. The landscape ecology of western forest fire regimes. Northwest Science, Special Issue 72: 24-34.

Arno, S.F. 1980. Forest fire history in the northern Rockies. Journal of Forestry 78(8): 460-465.

Arno, S.A. and T.D. Petersen. 1983. Variation in estimates of fire intervals: a closer look at fire history on the Bitterroot National Forest. Res. Pap. INT-301, Ogden, UT: USDA, Forest Service, Intermountain Forest and Range Experiment Station, 8 pp.

Barrett, S.W. 1984. Fire history of the River of No Return Wilderness: River Breaks Zone. Final Report. Missoula, MT: Systems for Environmental Management. 40 pp. + appendices.

Barrett, S.W. 1993. Fire regimes on the Clearwater and Nez Perce National Forests north-central Idaho. Final Report: Order No. 43-0276-3-0112. Ogden, UT: USDA Forest Service, Intermountain Research Station, Fire Sciences Laboratory. 21 pp. Unpublished report on file with: USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Crane, M.F. and W.C. Fisher. 1986. Fire ecology of the forested habitat types of central Idaho. General Technical Report INT-218, USDA Forest Service. 86 pp.

Fischer, W.C. and B.D. Clayton. 1983. Fire ecology of Montana forest habitat types east of the Continental Divide. GTR-INT-141. Ogden UT: USDA Forest Service, Intermountain Research Station, 83 pp.

Fischer, W.C. and A.F. Bradley. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech. Rep. INT-223. Ogden, UT: USDA Forest Service, Intermountain Research Station. 95 pp.

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**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.

Habeck, J.R. and R.W. Mutch. 1973. Fire-dependent forest in the northern Rocky Mountains. Quarternary Research 3: 408-424.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Morgan, P. and R. Parsons. 2001. Historical range of variability of forests of the Idaho Southern Batholith Ecosystem. Univerity of Idaho. Unpublished.

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Steele, R., R.D. Pfister, R.A. Ryker and J.A. Kittams. 1981. Forest habitat types of central Idaho. Gen. Tech. Rep. INT-114. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 138 pp.

Williams, C.K., B.F. Kelley, B.G. Smith and T.R. Lillybridge. 1995. Forest plant associations of the Colville National Forest. Gen. Tech. Rep. PNW-GTR-360. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 375 pp.

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LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010550** **Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Katie Phillips	cgphillips@fs.fed.us	**Reviewer**	Rolan Becker	rolanb@cskt.org
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Modeler 3	Randall Walker	rmwalker@fs.fed.us	**Reviewer**	Ed Lieser	elieser@fs.fed.us

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

ABLA CARU
PIEN
PICO
CAGE

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Northeastern WA, northern and central ID and northwestern MT.

Biophysical Site Description

Subalpine zone, with lower extent at about 4500ft (in NE WA) or 6500ft (in MT and ID) and the upper extent at about 8500ft.

Vegetation Description

Lodgepole pine, subalpine fir and Engelmann spruce dominate. Lodgepole pine comprises a greater component on dryer sites and earlier successional stages, and can be a canopy dominant for over 250yrs in some stands (Kipfmueller and Kupfer 2005). Pockets of pure lodgepole pine are not uncommon. At high elevations and southerly aspects, whitebark pine may occur. Western larch and Douglas-fir may be early seral components at lower portions of this BpS. Aspen may be present, especially east of the Continental Divide and in the southern portions of MZs 10 and 19. Mountain hemlock may be present in the north and west portions of MZs 10 and 19.

Understory associates may include: Vaccinium scoparium, beargrass (Xerophyllum tenax), Rhododendron albiflorum, Linnaea borealis, Menziesia ferruginea and Alnus sinuata. Understory shrubs will be more prevalent on east and north-facing aspects.

Disturbance Description

Fire Regime Group IV or III, primarily moderately long-interval mixed and stand replacement fires. Lightning strikes are frequent, but will often result in small, patchy spot fires. Some recent data show more frequent MFIs (8-71yrs) in systems that may include this BpS (personal communication, Elaine Sutherland, USFS Rocky Mountain Research Station, August 2005). In southern and western portions of MZs 10 and 19

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this BpS may have more frequent fire regimes.

In some areas, spruce beetle and mountain pine beetle can influence successional stage, species composition and stand density. Spruce beetle and mountain pine beetle may act to accelerate succession by removing the lodgepole pine and promoting the more shade-tolerant species. Large scale insect infestations may create large patches of early seral conditions and/or create conditions that lead to large, stand-replacement fires.

Adjacency or Identification Concerns

This BpS corresponds to the following habitat types (Pfister et al. 1977): ABLA/CAGE, ABLA/VASC, TSME/XETE, TSME/MEFE, TSME/CLUN, PICEA/GART, PICEA/LIBO and PICEA/PHMA.

In northeastern WA and northern ID, this type may transition to mountain hemlock where it becomes more maritime.

Non-native insects and disease, including balsam wooly adelgid and whitebark pine blister rust, affect these forests today. Some local populations of whitebark pine have experienced >90% mortality from blister rust.

At lower elevations this type is adjacent to upper montane, including western hemlock, western redcedar, grand fir and Douglas-fir. At higher elevations, it is adjacent to Northern Rocky Mountain Subalpine Woodland and Parkland (1046).

Native Uncharacteristic Conditions

Scale Description

Fires could range widely in size from 1000s to 100000s of acres. Smith and Fischer (1997) suggest fires ranged from 500-1000ac. Spot fires are common (Williams et al. 1995). Variability of climate, topography and other site factors can result in a wide range of representation of successional stages on the landscape (Schoennagel et al. 2004). Equilibrium landscapes are not likely to develop in areas <500000ac.

Issues/Problems

Fire regimes in this system are strongly related to climatic cycles. Long-term changes in climate as well as interannual climate variability will affect the frequency of fire in this system and its distribution along an elevational gradient.

Moisture gradients control the fire regime of these systems relative to the lower elevation montane mixed conifer types (eg, BpS 1045). Disturbance regimes may operate on a similar gradient. Where this system is in close proximity to montane mixed conifer systems, fire regimes may be more similar to the mixed conifer system (ie, more frequent with more mixed severity fire).

Comments

Additional reviewers included: Steve Barrett (sbarrett@mtdig.net), Pat Green (pgreen@fs.fed.us), Susan Miller (smiller03@fs.fed.us), Cathy Stewart (cstewart@fs.fed.us) and Beverly A. Yelczyn (byelczyn@fs.fed.us). Peer review resulted in minor adjustments to the description. There was some debate among reviewers about the elevational range of this type and whether it should be split into lower (dominated by lodgepole pine with some Douglas-fir) and upper subalpine (dominated by spruce and fir) types. The single type was retained and improvements were made to the description after additional consultations with reviewers.

This type is lumped with BpS 1056, which is deemed to have a very similar fire regime.

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Based on Rapid Assessment model R0SPFI by Kathy Roche and reviewed by Bill Baker, Dennis Knight and Bill Romme.

Vegetation Classes

Class A 15%

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 8

Indicator Species* and Canopy Position

PICO	Upper
ABLA	Lower
PIEN	Lower
	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Early succession stage after long interval replacement fires. There can be extended periods (as long as 300yrs) of grass/seedling stage after fire replacement events.

Whitebark pine may be present in the central ID and southwestern MT. Western larch and Douglas-fir may be present in northern ID, eastern WA, and western MT.

Class B 45%

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PICO	Upper
ABLA	Low-Mid
PIEN	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 5.1m	Tree 50m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

High density lodgepole pine with spruce-fir in midstory. Tree heights of lodgepole pine will rarely exceed 25m.

Class C 15%

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PICO	Upper
ABLA	Low-Mid
PIEN	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 5.1m	Tree 50m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Low density pole to medium diameter trees. Primarily occurs after mixed severity fires, on droughty substrates or after insects or disease thin denser stands. Reburn events may also result in lack of seed source.

Douglas-fir and whitebark pine may be present in this class.

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Class D 5 %

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIEN	Upper
ABLA	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 10.1m	Tree 50m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Low density dominated by spruce-fir with declining lodgepole pine. Primarily occurs after mixed severity fires, on droughty substrates or after insects or disease thin denser stands. Reburn events may also result in lack of seed source.

Douglas-fir and whitebark pine may be present in this class.

Class E 20 %

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PIEN	Upper
ABLA	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 10.1m	Tree 50m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

High density dominated by spruce-fir with declining lodgepole pine. This type will occur in the more mesic portions of the BpS's range, with longer fire return intervals. Fires will tend to be more stand replacing in this type.

Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 100
Max 300000

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	200	100	600	0.005	67
Mixed	400			0.0025	33
Surface					
All Fires	133			0.00751	

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

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

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**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.

References

Agee, J.K. 2005. The complex nature of mixed severity fire regimes. Pages 1-10 in: L. Taylor, J. Zelnik, S. Cadwaller and B. Hughes, eds. Mixed severity fire regimes: ecology and management. symposium proceedings. 17-19 November 2004. Spokane, Washington: The Association for Fire Ecology and Washington State University.

Alexander R.R., G.R. Hoffman and J.M Wirsing. 1986. Forest vegetation of the Medicine Bow National Forest in southeastern Wyoming: a habitat type classification. Research Paper RM-271. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Alexander, R.R. 1986. Silvicultural systems and cutting methods for old-growth spruce-fir forests in the central and southern Rocky Mountains. General Technical Report RM-126. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Alexander, R.R. and O. Engelby. 1983. Engelmann spruce - subalpine fir. In: Silvicultural systems for the major forest types of the United States. Agriculture Handbook 445. Washington, DC: US Dept. of Agriculture.

Aplet, G.H., R.D. Laven and F.W. Smith. 1988. Patterns of community dynamics in Colorado Engelmann spruce and subalpine fir forests. Ecology 69: 312-319.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Baker, W.L. 2000. Measuring and analyzing forest fragmentation in the Rocky Mountains and western United States. Pages 55-94 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Baker, W.L. 1994. Landscape structure measurements for watersheds in the Medicine Bow National Forest using GIS analysis. Department of Geography and Recreation, Univ. of Wyoming. Prepared under agreement with the USDA Forest Service, Medicine Bow NF. On file at Medicine Bow-Routt NFs and Thunder Basin NG Supervisor's Office, Laramie, WY.

Baker, W.L. and K.F. Kipfmueller. 2001. Spatial ecology of pre-Euro-American fires in a Southern Rocky Mountain subalpine forest landscape. The Professional Geographer 53(2): 248-262.

Baker, W.L. and R. Knight. 2000. Roads and forest fragmentation in the Southern Rocky Mountains. Pages 97-122 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Baker, W.L. and T.T. Veblen. 1990. Spruce Beetles and Fires in the Nineteenth-Century Subalpine forests of Western Colorado, U.S.A. Arctic and Alpine Research, Vol 22, No 1, 1990, pages 65-80.

Barrett, S.W. 1994. Fire regimes on andesitic mountain terrain in northeastern Yellowstone National Park. International Journal of Wildland Fire 4: 65-76.

Buechling, A. and W.L. Baker. 2004. A fire history from tree rings in a high-elevation forest of Rocky Mountain National Park. Canadian Journal of Forest Research 34: 1259-1273.

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Buskirk, S.W., W.H. Romme, F.W. Smith and R. Knight. 2000. An overview of forest fragmentation in the Southern Rocky Mountains. Pages 3-14 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest Fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Clagg, H.B. 1975. Fire ecology in high-elevation forests in Colorado. M.S. Thesis, Colorado State University, Fort Collins, Colorado.

Coleman, M.D., T.M. Hinckley, G. McNaughton and B.A. Smit. 1992. Root cold hardiness and native distribution of subalpine conifers, Canadian Journal of Forest Research 22(7): 932-938.

Crane, M.F. 1982. Fire Ecology of Rocky Mountain Region Forest Habitat Types. Report prepared under contract to USDA FS Region 2.

Despain, D.G. 1973. Vegetation of the Big Horn Mountains in relation to substrate and climate. Ecological Monographs 43: 329-355.

Despain, D.G. and R.E. Sellers. 1977. Natural fire in Yellowstone National Park. Western Wildlands, summer.

Dillon, G. K., D. Knight and C. Meyer. 2003. Historic variability for upland vegetation in the Medicine Bow National Forest. Department of Botany, Univ. of Wyoming: prepared under agreement with the USDA Forest Service Medicine Bow NF 1102-0003-98-043.

Fischer, W.C. and A.F. Bradley. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech. Rep. INT-223. Ogden, UT: USDA Forest Service, Intermountain Research Station. 95 pp.

Graham, R.T. A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn and D.S. Page-Dumrose. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Research Paper INT-RP-477. Fort Collins, CO: USDA Forest Service, Intermountain Research Station.

Griggs, R.F. 1938. Timberlines in the Northern Rocky Mountains. Ecology 19(4): 548-564.

Griggs, R.F. 1946. The timberlines of Northern America and their interpretation. Ecology 27(4): 275-289.

Hinds, T.E., F.G. Hawksworth and R.W. Davidson. 1965. Beetle-killed Engelmann Spruce: Its deterioration in Colorado. J. For. 63(7): 536-542.

Jenkins, M.J., C.A. Dicus and E.G. Hebertson. 1998. Post-fire succession and disturbance interactions on an intermountain subalpine spruce-fir forest. Pages 219-229 in: T.L. Pruden and L.A. Brennan, eds. Proceedings, Symposium: Fire in Ecosystem Management: Shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahassee, FL.

Jones, G.P. and S M. Ogle. 2000. Characterization abstracts for vegetation types on the Bighorn, Medicine Bow, and Shoshone National Forests. Laramie. Prepared for USDA Forest Service, Region 2, by George Jones and Steve Ogle, WYNDD, UW, Laramie WY.

Kane, T.L., B.G. Brown and R. Sharman. 1999. A preliminary climatology of upper level turbulence reports. Preprints pages 363-367 in: 8th Conf. on Aviation, Range and Aerospace Meterology, 10-15 January. Dallas, TX: American Meteorology Society.

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Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

Kipfmueller, K.F. and W.L. Baker. 2000. A fire-history of a subalpine forest in south-eastern Wyoming, USA. Journal of Biogeography 27: 71-85.

Kipfmueller, K.F. 1997. A fire history of a subalpine forest in southeastern Wyoming. Thesis. University of Wyoming. Laramie, WY.

Kipfmueller, K.F. and W.L. Baker. 1998a. A comparison of three techniques to date stand-replacing fires in lodgepole pine forests. Forest Ecology and Management 104(1998) 171-177.

Kipfmueller, K.F. and W.L. Baker. 2000. A fire history of a subalpine forest in southeastern Wyoming, USA. Journal of Biogeography 27: 71-85.

Kipfmueller, K.F. and J.A. Kupfer. 2005. Complexity of successional pathways in subalpine forests of the Selway-Bitterroot Wilderness Area. Annals of the Association of American Geographers 95(3): 495-510.

Knight, D.H. 1987. Ecosystem studies in the subalpine coniferous forests of Wyoming. In: Management of subalpine forests: building on 50 years of research: Proceedings of a Technical Conference. General Technical Report RM-149. Fort Collins, CO: USDA Forest Service Rocky Mountain Forest and Range Experiment Station.

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

Knight, D.H. and W.A. Reiners. 2000. Natural patterns in southern Rocky Mountain landscapes and their relevance to forest management. Pages 15-30 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Knight, D.H., A.D. Anderson, G.T. Baxter, K.L. Diem, M. Parker, P.A. Rechard, P.C. Singleton, J.F. Thilenius, A.L. Ward and R.W. Weeks. 1975. Final report: the Medicine Bow ecology project: the potential sensitivity of various ecosystem components to winter precipitation management in the Medicine Bow Mountains, Wyoming. Prepared for the Division of Atmospheric Water Resources Management, Bureau of Reclamation, USDI, Denver, CO by the Rocky Mountain Forest and Range Experiment Station, USFS and the Wyoming Water Resource Research Institute.

Logan, J.A., J.M. Schmid and M.S. Mehl. 1980. A computer program to calculate susceptibilty of spruce-fir stands to spruce beetle outbreaks. USDA Forest Service Research Note RM-303. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Loope, L.L. and G.E. Gruell. 1973. The ecological role of fire in the Jackson Hole area, northwestern Wyoming. Quaternary Research 3(3): 425-443.

Mehl, M. 1992. Old-growth descriptions for the major forest cover types in the Rocky Mountain region. In: Old-growth forests in the Southwest and Rocky Mountain regions. Proceedings of a workshop. Gen. Tech. Report RM-213. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

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Merrill, E.H., T.W. Kohley, M.E. Herdendorf, W.A. Reiners, K.L. Driese, R.W. Marrs and S.A. Anderson. 1996. Wyoming GAP analysis project final report. University of Wyoming Department of Physiology and Department of Botany, Wyoming Cooperative Fish and Wildlife Research Unit and USGS Biological Resources Division. Available: http://www.sdvc.uwyo.edu/wbn/abstract.html.

Meyer, C.B. and D.H. Knight. 2001. Historic variability of upland vegetation in the Bighorn National Forest, Wyoming. Draft report, 30 November 2001.

Mielke, J.L. 1950. Rate of deterioration of beetle-killed Engelmann spruce. J. For. 48(12): 882-888.

Moir, W.H. 1992. Ecological concepts in old-growth forest definition. In: Old-growth forests in the Southwest and Rocky Mountain regions. Proceedings of a workshop. Gen. Tech. Report RM-213. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

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

Pennanen, J. 2002. Forest age distribution under mixed-severity fire regimes - A simulation-based analysis for middle boreal Fennoscandia. Silva Fennica: quarterly issues: 36(1): 213-231.

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Schmid, J.M. and R.H. Frye. 1977. Spruce beetle in the Rockies. General Technical Report RM 49. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 38 pp.

Schmid, J.M. and R.C. Beckwith. 1977. The spruce beetle. Pest Leaflet 127. USDA Forest Service. 7 pp.

Schmid, J.M. and R.H. Frye. 1976. Stand Ratings for Spruce Beetles. USDA Forest Service Research Note RM-309. Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.

Schmid, J.M. and S.A. Mata. 1996. Natural variability of specific forest insect populations and their associated effects in Colorado. General Technical Report RM-GTR-275. Fort, Collins, CO: USDA FS Rocky Mountain Forest and Range Experiment Station.

Schmid, J.M. and T.E. Hinds. 1974. Development of spruce-fir stands following spruce beetle outbreaks. Research Paper RM-131. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Schoennagel, T., T.T. Veblen, W.H. Romme. 2004. The interaction of fire, fuels and climate across Rocky Mountain forests. BioScience 54(7): 661-676.

Schrupp, D.L., W.A. Reiners, T.G. Thompson, L.E. O'Brien, J.A. Kindler, M.B. Wunder, J.F. Lowsky, J.C Buoy, L. Satcowitz, A.L. Cade, J.D. Stark, K.L. Driese, T.W. Owens, S.J. Russo and F. D'Erchia. 2000.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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Colorado Gap Analysis Program: A geographical approach to planning for biological diversity - final report. Denver, CO: USGS Biological Resource Division, Gap Analysis Program and Colorado Division of Wildlife.

Sherriff, R., T.T. Veblen and J.S. Sibold. 2001. Fire history in high elevation subalpine forests in the Colorado Front Range. Ecoscience 8: 369-380.

Sibold, J. 2001. The forest fire regime of an upper montane and subalpine forest, Wild Basin, Rocky Mountain National Park. M.S. Thesis, University of Colorado, Boulder, CO.

Stahelin, R. 1943. Factors influencing the natural restocking of high altitude burns by coniferous trees in the central Rocky Mountains. Ecology 24: 19-30.

Veblen, T.T., K.S. Hadley and M.S. Reid. 1991. Disturbance and stand development of a Colorado subalpine forest. Journal of Biogeography (1991)18: 707-716.

Veblen, T.T., K.S. Hadley, E.M. Nel, T. Kitzberger, M.S. Reid and R. Villalba. 1994. Disturbance regime and disturbance interactions in a Rocky Mountain subalpine forest. Journal of Ecology 82: 125-135.

Veblen, T.T., K.S. Hadley, M.S. Reid and A.J. Rebertus. 1989. Blowdown and stand development in a Colorado subalpine forest. Canadian Journal of Forest Resources. Vol 19: 1218-1225.

Veblen, T.T. and T. Kitzberger. 2002. Inter-hemispheric comparison of fire history: The Colorado Front Range, U.S.A. and the Northern Patagonian Andes, Argentina. Plant Ecology, in press.

Whipple, S.A. and R.L. Dix. 1979. Age structure and successional dynamics of a Colorado subalpine forest. American Midland Naturalist 101: 142-158.

Williams, C.K., B.F. Kelley, B.G. Smith and T.R. Lillybridge. 1995. Forest plant associations of the Colville National Forest. Gen. Tech. Rep. PNW-GTR-360. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 375 pp.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1010560 — **Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland**

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

General Information

Contributors (also see the Comments field) **Date** 4/14/2006

Modeler 1	Kathy Roche	kroche@fs.fed.us	**Reviewer**	Steve Barrett	sbarrett@mtdig.net
Modeler 2			**Reviewer**	Jeff Jones	jjones@fs.fed.us
Modeler 3			**Reviewer**	Brendan Ward	bward@fs.fed.us

Vegetation Type
Forest and Woodland

Map Zone
10

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

Dominant Species*
PIEN
ABLA
PICO

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Northern Rockies, including MT, ID and WY.

This specific model was refined to fit the mapped distribution of 10560 in the LANDFIRE BpS layer. This type occurs in western MT and ID north of the Salmon River.

Biophysical Site Description

Upper subalpine zone and mesic sites. Occurrences are typically found in locations with cold-air drainage or ponding, or where snowpacks linger late into the summer, such as north-facing slopes and high-elevation ravines. They can extend down in elevation below the subalpine zone in places where cold-air ponding occurs; northerly and easterly aspects predominate. These forests are found on gentle to very steep mountain slopes, high-elevation ridgetops and upper slopes, plateau-like surfaces, basins, alluvial terraces, well-drained benches and inactive stream terraces.

Vegetation Description

Engelmann spruce and subalpine fir dominate on most aspects with lodgepole pine comprising a greater component on dryer sites or earlier successional stages. Vaccinium scoparium is a common understory associate.

In the northern Rocky Mountains of northern ID and MT, Tsuga mertensiana occurs as small to large patches within the matrix of this mesic spruce-fir system and only in the most maritime of environments (the coldest and wettest of the more continental subalpine fir forests).

Mesic understory shrubs include Menziesia ferruginea, Vaccinium membranaceum, Rhododendron

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albiflorum, Amelanchier alnifolia, Rubus parviflorus, Ledum glandulosum, Phyllodoce empetriformis and Salix spp. Herbaceous species include Actaea rubra, Maianthemum stellatum, Cornus canadensis, Erigeron eximius, Gymnocarpium dryopteris, Rubus pedatus, Saxifraga bronchialis, Tiarella spp, Lupinus arcticus ssp. subalpinus, Valeriana sitchensis and graminoids Luzula glabrata var. hitchcockii or Calamagrostis canadensis.

Disturbance Description

Fire Regime Group V or IV; primarily long-interval stand replacement fires. In some areas, spruce beetle can influence successional stage, species composition and stand density. Spruce beetle may act to accelerate succession.

Adjacency or Identification Concerns

Adjacent to drier, lower subalpine forests (lodgepole-spruce-fir) and to krummholz and alpine vegetation. This system typically has more precipitation and longer winters than lower subalpine types.

Climate (severely dry conditions) is the primary driver of fire regimes in this system. Long-term changes in climate as well as interannual climate variability will affect the frequency of fire in this system.

This BpS corresponds to the following habitat types (Pfister et al. 1977): ABLA/ALSI, ABLA/CAGE, ABLA/VASC, TSME/XETE, TSME/MEFE, TSME/CLUN, PICEA/GART, PICEA/LIBO and PICEA/PHMA.

Native Uncharacteristic Conditions

Scale Description

Fires could range from 1000s-10000s of acres. Variability of climate, topography and other site factors can result in a wide range of representation of successional stages on the landscape. Equilibrium landscapes are not likely to develop in areas <500000ac.

Issues/Problems

Comments

This model was corrupted and had to be recreated months after it was delivered for MZs 10 and 19. Kathy Roche authored the model, but we were unable to get the model reviewed again prior to mapping. The comments from an earlier review that indicated the fire return interval should be around 175yrs were incorporated into this version of the model.

This model produced anomalous results in LANDSUM, and was revised on 7/28/06 by Brendan Ward with LANDFIRE at the Missoula Fire Sciences Lab. During revisions, it was discovered that this model was intended for extremely cold, long-return interval systems representing a more rare type of site within the distribution of spruce/fir, and was not representative of this system in the areas mapped to it in the LANDFIRE BpS layer. This current model was built from the previous version of the model delivered in January 2005 and was updated to reflect some of the characteristics of the revised model from April 2006. The disturbance and succession rates were further refined through dialogue with the modeler and the reviewer of a previous version. Notable changes include a fire frequency of around 175yrs, increased rates of insect disturbance, decreased durations in A, B and C, and the slight probability that some wind/weather/stress events will transition to B. This model was reviewed by the modeler (Kathy Roche), Steve Barrett and Jeff Jones on 7/28/06.

This model was adapted from the Rapid Assessment model R0SPFI, which was reviewed by Bill Baker

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(bakerwl@uwyo.edu), Dennis Knight (dhknight@uwyo.edu) and Bill Romme (romme@cnr.colostate.edu). Based on input for MZs 10 and 19 (Steve Barrett, sbarrett@mtdig.net; and Cathy Stewart, cstewart@fs.fed.us), minor modifications were made to the description and a reduction in the overall mean fire return interval (from 300yrs to 175yrs).

Vegetation Classes

Class A 15%

Early Development 1 All Structures

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIEN Upper
ABLA Mid-Upper
PICO Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Early succession stage after long interval replacement fires. There can be extended periods (as long as 300yrs) of grass/seedling stage after fire replacement events. This stage may occupy 3-50% of the landscape depending upon climatic conditions and variability of fire return intervals.

Sucession to B after 30yrs. Replacement fire every 200yrs resets this class to age zero.

Class B 30%

Mid Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIEN Upper
ABLA Upper
PICO Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

High density saplings to poles. May occupy 5-50% of the landscape.

Sucession to D after 70yrs. Replacement fire every 200yrs causes a transition to class A. Wind/weather/sress occurs every 1000yrs, resulting in a transition to A half of the time and C the remaining half. Insects and disease occur every 500yrs causing a transition to C. Competition/maintenance was modeled once every 500yrs with a transition to C to represent the stem-exclusion phase of more pure lodgepole pine stands.

Class C 10%

Mid Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIEN Upper
ABLA Upper
PICO Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 5.1m	Tree 50m
Tree Size Class	Pole 5-9" DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

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Low density saplings to poles. Primarily occurs after insects, disease or weather stress thins denser stands. This occupies 3-50% of landscape.

Sucession to D after 50yrs. Replacement fire every 200yrs causes a transition to class A. Wind/weather/sress occurs every 1000yrs, resulting in a transition to A half of the time and remaining in C the other half. Insects and disease occur every 1000yrs with no transition to other classes.

Class D **45 %**

Late Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species* and Canopy Position

PIEN	Upper
ABLA	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 10.1m	Tree 50m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Pole to larger diameter trees. This stage occupies 15-50% of the landscape.

Persistant state unless disturbance causes a transition. Replacement fire every 150yrs causes a transition to class A. Wind/weather/sress occurs every 1000yrs, resulting in a transition to A half of the time and C the remaining half. Insects and disease occur every 500yrs causing a transition to C.

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 2000
Min 100
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	172	100	600	0.00581	100
Mixed					
Surface					
All Fires	172			0.00583	

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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Additional Disturbances Modeled

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

References

Alexander R.R., G.R. Hoffman and J.M Wirsing. 1986. Forest vegetation of the Medicine Bow National Forest in southeastern Wyoming: a habitat type classification. Research Paper RM-271. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Alexander, R.R. 1986. Silvicultural systems and cutting methods for old-growth spruce-fir forests in the central and southern Rocky Mountains. General Technical Report RM-126. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Alexander, R.R. 1988. Forest vegetation on national forests in the Rocky Mountain and Intermountain regions: habitat types and community types. General Technical Report RM-162. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Alexander, R.R. and O. Engelby. 1983. Engelmann spruce - subalpine fir. In: Silvicultural systems for the major forest types of the United States. Agriculture Handbook 445. Washington, D.C: US Dept. of Agriculture.

Aplet, G.H., R.D. Laven and F.W. Smith. 1988. Patterns of community dynamics in Colorado Engelmann spruce and subalpine fir forests. Ecology 69: 312-319.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Baker, W.L. and R. Knight. 2000. Roads and forest fragmentation in the Southern Rocky Mountains. Pages 97-122 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Baker, W.L. 2000. Measuring and analyzing forest fragmentation in the Rocky Mountains and western United States. Pages 55-94 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Baker, W.L. and K.F. Kipfmueller. 2001. Spatial ecology of pre-Euro-American fires in a Southern Rocky Mountain subalpine forest landscape. The Professional Geographer 53(2): 248-262.

Baker, W.L. and T.T. Veblen. 1990. Spruce Beetles and Fires in the Nineteenth-Century Subalpine forests of Western Colorado, U.S.A. Arctic and Alpine Research 22(1): 65-80.

Baker, W.L. 1994. Landscape structure measurements for watersheds in the Medicine Bow National Forest using GIS analysis. Department of Geography and Recreation, Univ. of Wyoming. Prepared under agreement with the USDA Forest Service, Medicine Bow NF. On file at Medicine Bow-Routt NFs and Thunder Basin NG Supervisor's Office, Laramie, WY.

Barrett, S.W. 1994. Fire regimes on andesitic mountain terrain in northeastern Yellowstone National Park.

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International Journal of Wildland Fire 4: 65-76.

Buechling, A. and W.L. Baker. 2004. A fire history from tree rings in a high-elevation forest of Rocky Mountain National Park. Canadian Journal of Forest Research 34: 1259-1273.

Buskirk, S.W., W.H. Romme, F.W. Smith and R. Knight. 2000. An overview of forest fragmentation in the Southern Rocky Mountains. Pages 3-14 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest Fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Clagg, H.B. 1975. Fire ecology in high-elevation forests in Colorado. M.S. Thesis, Colorado State University, Fort Collins, Colorado.

Coleman, M.D., T.M. Hinckley, G. McNaughton and B.A. Smit. 1992. Root cold hardiness and native distribution of sub-alpine conifers. Canadian Journal of Forest Research 22(7): 932-938.

Crane, M.F. and W.C. Fisher. 1986. Fire ecology of the forested habitat types of central Idaho. General Technical Report INT-218, USDA Forest Service. 86 pp.

Despain, D.G. 1973. Vegetation of the Big Horn Mountains in relation to substrate and climate. Ecological Monographs 43:329-355.

Despain, D.G. and R.E. Sellers. 1977. Natural fire in Yellowstone National Park. Western Wildlands, summer.

Dillon, G. K., D. Knight and C. Meyer. 2003. Historic variability for upland vegetation in the Medicine Bow National Forest. Department of Botany, Univ. of Wyoming: prepared under agreement with the USDA Forest Service Medicine Bow NF 1102-0003-98-043.

Graham, R.T. A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn and D.S. Page-Dumrose. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Research Paper INT-RP-477. Fort Collins, CO: USDA Forest Service, Intermountain Research Station.

Griggs, R.F. 1938. Timberlines in the Northern Rocky Mountains. Ecology 19(4): 548-564.

Griggs, R.F. 1946. The timberlines of Northern America and their interpretation. Ecology 27(4): 275-289.

Hinds, T.E., F.G. Hawksworth and R.W. Davidson. 1965. Beetle-killed engelmann spruce: Its deterioration in Colorado. J. For. 63(7): 536-542.

Jenkins, M.J., C.A. Dicus and E.G. Hebertson. 1998. Post-fire succession and disturbance interactions on an intermountain subalpine spruce-fir forest. Pages 219-229 in: T.L. Pruden and L.A. Brennan, eds. Proceedings, Symposium: Fire in Ecosystem Management: Shifting the paradigm from suppression to prescription. Tall Timbers Fire Ecology Conference Proceedings, No. 20. Tall Timbers Research Station, Tallahassee, FL.

Jones, G.P., and S.M. Ogle. 2000. Characterization abstracts for vegetation types on the Bighorn, Medicine Bow, and Shoshone National Forests. Laramie. Prepared for USDA Forest Service, Region 2, by George Jones and Steve Ogle, WYNDD, UW, Laramie WY.

Kane, T.L., B.G. Brown and R. Sharman. 1999. A preliminary climatology of upper level turbulence reports. Preprints pages 363-367 in: 8th Conf. on Aviation, Range and Aerospace Meterology, 10-15 January. Dallas, TX: American Meteorology Society.

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Kipfmueller, K.F. 1997. A fire history of a subalpine forest in southeastern Wyoming. Thesis. University of Wyoming. Laramie, WY.

Kipfmueller, K.F. and W.L. Baker. 1998. A comparison of three techniques to date stand-replacing fires in lodgepole pine forests. Forest Ecology and Management 104: 171-177.

Kipfmueller, K.F. and W.L. Baker. 2000. A fire history of a subalpine forest in southeastern Wyoming, USA. Journal of Biogeography 27: 71-85.

Knight, D.H. 1987. Ecosystem Studies in the Subalpine Coniferous Forests of Wyoming. In: Management of Subalpine Forests: Building on 50 years of Research: Proceedings of a Technical Conference. General Technical Report RM-149. USDA Forest Service Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.

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

Knight, D.H. and W.A. Reiners. 2000. Natural patterns in southern Rocky Mountain landscapes and their relevance to forest management. Pages 15-30 in: R. Knight, F.W. Smith, W.H. Romme and W.L. Baker, eds. Forest fragmentation in the Southern Rocky Mountains. Boulder, Colorado: University Press of Colorado.

Knight, D.H., A.D. Anderson, G.T. Baxter, K.L. Diem, M. Parker, P.A. Rechard, P.C. Singleton, J.F. Thilenius, A.L. Ward and R.W. Weeks. 1975. Final report: the Medicine Bow ecology project: the potential sensitivity of various ecosystem components to winter precipitation management in the Medicine Bow Mountains, Wyoming. Prepared for the Division of Atmospheric Water Resources Management, Bureau of Reclamation, USDI, Denver, CO by the Rocky Mountain Forest and Range Experiment Station, USFS and the Wyoming Water Resource Research Institute.

Logan, J.A., J.M. Schmid and M.S. Mehl. 1980. A computer program to calculate susceptibilty of spruce-fir stands to spruce beetle outbreaks. USDA Forest Service Research Note RM-303. Fort Collins, CO: Rocky Mountain Forest and Range Experiment Station.

Loope, L.L. and G.E. Gruell. 1973. The ecological role of fire in the Jackson Hole area, northwestern Wyoming. Quaternary Research 3(3): 425-443.

Mehl, M. 1992. Old-growth descriptions for the major forest cover types in the Rocky Mountain region. In: Old-growth forests in the Southwest and Rocky Mountain regions. Proceedings of a workshop. Gen. Tech. Report RM-213. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Merrill, E.H., T.W. Kohley, M.E. Herdendorf, W.A. Reiners, K.L. Driese, R.W. Marrs and S.A. Anderson. 1996. Wyoming GAP analysis project final report. University of Wyoming Department of Physiology and Department of Botany, Wyoming Cooperative Fish and Wildlife Research Unit and USGS Biological Resources Division. Available: http://www.sdvc.uwyo.edu/wbn/abstract.html.

Meyer, C.B. and D.H. Knight. 2001. Historic variability of upland vegetation in the Bighorn National Forest, Wyoming. Draft report, 30 November 2001.

Mielke, J.L. 1950. Rate of deterioration of beetle-killed engelmann spruce. J. For. 48(12): 882-888.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
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Moir, W.H. 1992. Ecological concepts in old-growth forest definition. In: Old-growth forests in the Southwest and Rocky Mountain regions. Proceedings of a workshop. Gen. Tech. Report RM-213. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

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

Pennanen, J. 2002. Forest age distribution under mixed-severity fire regimes - A simulation-based analysis for middle boreal Fennoscandia. Silva Fennica: quarterly issues: 36(1): 213-231.

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Schmid, J.M. and R.H. Frye. 1977. Spruce beetle in the Rockies. General Technical Report RM 49. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 38 pp.

Schmid, J.M. and R.C. Beckwith. 1977. The spruce beetle. Pest Leaflet 127. USDA Forest Service. 7 pp.

Schmid, J.M. and R.H. Frye. 1976. Stand ratings for spruce beetles. Research Note RM-309. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Schmid, J.M. and S.A. Mata. 1996. Natural variability of specific forest insect populations and their associated effects in Colorado. General Technical Report RM-GTR-275. Fort, Collins, CO: USDA FS Rocky Mountain Forest and Range Experiment Station.

Schmid, J.M. and T.E. Hinds. 1974. Development of spruce-fir stands following spruce beetle outbreaks. Research Paper RM-131. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Schrupp, D.L., W.A. Reiners, T.G. Thompson, L.E. O'Brien, J.A. Kindler, M.B. Wunder, J.F. Lowsky, J.C Buoy, L. Satcowitz, A.L. Cade, J.D. Stark, K.L. Driese, T.W. Owens, S.J. Russo and F. D'Erchia. 2000. Colorado Gap Analysis Program: A geographical approach to planning for biological diversity - final report. Denver, CO: USGS Biological Resource Division, Gap Analysis Program and Colorado Division of Wildlife.

Sherriff, R., T.T. Veblen and J.S. Sibold. 2001. Fire history in high elevation subalpine forests in the Colorado Front Range. Ecoscience 8: 369-380.

Sibold, J. 2001. The forest fire regime of an upper montane and subalpine forest, Wild Basin, Rocky Mountain National Park. M.S. Thesis, University of Colorado, Boulder, CO.

Stahelin, R. 1943. Factors influencing the natural restocking of high altitude burns by coniferous trees in the central Rocky Mountains. Ecology 24: 19-30.

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**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.

Veblen, T.T. and T. Kitzberger. 2002. Inter-hemispheric comparison of fire history: The Colorado Front Range, U.S.A. and the Northern Patagonian Andes, Argentina. Plant Ecology, in press.

Veblen, T.T., K.S. Hadley and M.S. Reid. 1991. Disturbance and stand development of a Colorado subalpine forest. Journal of Biogeography (1991)18: 707-716.

Veblen, T.T., K.S. Hadley, E.M. Nel, T. Kitzberger, M.S. Reid and R. Villalba. 1994. Disturbance regime and disturbance interactions in a Rocky Mountain subalpine forest. Journal of Ecology 82: 125-135.

Veblen, T.T., K.S. Hadley, M.S. Reid and A.J. Rebertus. 1989. Blowdown and stand development in a Colorado subalpine forest. Canadian Journal of Forest Resources. Vol 19: 1218-1225.

Whipple, S.A. and R.L. Dix. 1979. Age structure and successional dynamics of a Colorado subalpine forest. American Midland Naturalist 101: 142-158.

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LANDFIRE Biophysical Setting Model

Biophysical Setting: 1010620 **Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland and Shrubland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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

Vegetation Type
Upland Shrubland

Map Zone
10

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

Dominant Species*
CELE3
ARTRV
PUTR2
SYMPH

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

The curlleaf mountain mahogany (Cercocarpus ledifolius var. intermontanus) community type occurs in the Sierra Nevada and Cascade Range, to the Rocky Mountains from MT to northern Arizona, and in Baja California and Mexico (Marshall 1995).

Biophysical Site Description

Curlleaf mountain mahogany (Cercocarpus ledifolius var. intermontanus) communities are usually found on upper slopes and ridges between 5000-10500ft. elevations (USDA-NRCS 2003), although northern stands may occur as low as 2000ft (Marshall 1995). In western NV and southern ID, curlleaf mountain mahogany may occur down to 5000ft or lower. Most stands occur on rocky shallow soils and outcrops, with mature stand cover between 10-55%. In the absence of fire, old stands may occur with more than 55% cover on somewhat productive sites with moderately deep soils or, at least, fractured below ground bedrock. In southern ID, curlleaf mountain mahogany is most often associated with a limestone bedrock.

Vegetation Description

Mountain big sagebrush is the most common codominant with curlleaf mountain mahogany. Curlleaf mountain mahogany is both a primary early succssesional colonizer rapidly invading bare mineral soils after disturbance and the dominant long-lived species. Where curlleaf mountain mahogany has reestablished quickly after fire, rabbitbrush (Chrysothamnus nauseosus) may co-dominate. Litter and shading by woody plants inhibits establishment of curlleaf mountain mahogany. Invasion of Utah and Rocky Mountain juniper or Douglas-fir can occur and will eventually shade-out the curlleaf mountain mahogany. Reproduction often appears dependent upon geographic variables (slope, aspect and elevation) more than biotic factors. Mountain big sagebrush, black sagebrush and antelope bitterbrush are often associated. Snowberry, Utah serviceberry and currant are present on cooler sites, with more moisture. Utah juniper, western juniper,

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Douglas-fir, red fir, white fir, Rocky Mountain juniper, jeffrey pine, singleleaf pinyon and limber pine may be present, in small (10% of total cover) to large (>30% total cover) amounts. In old, closed canopy stands, understory may consist largely of prickly phlox (Leptodactylon pungens).

Disturbance Description

Fire: Curlleaf mountain mahogany does not resprout, and is easily killed by fire (Marshall 1995). Curlleaf mountain mahogany is a primary early successional colonizer rapidly invading bare mineral soils after disturbance. Fires are not common in early seral stages, when there is little fuel, except in chaparral. Replacement fires (mean FRI of 150-500yrs) become more common in mid-seral stands, where herbs and smaller shrubs provide ladder fuel. By late succession, two classes and fire regimes are possible depending on the history of mixed severity and surface fires. In the presence of surface fire (FRI of 50yrs) and past mixed severity fires in younger classes, the stand will adopt a savanna-like woodland structure with a grassy understory, spiny phlox and currant. Trees can become very old and will rarely show fire scars. In late, closed stands, the absence of herbs and small forbs makes replacement fires uncommon (FRI of 500yrs), requiring extreme winds and drought. In such cases, thick duff provides fuel for more intense fires. Mixed severity fires (mean FRI of 50-200yrs) are present in all classes, except the late closed one, and more frequent in the mid-development classes.

Several fire regimes affect this community type. It is clear that being very sensitive to fire and very long-lived would suggest FRG V and development in fire-safe sites (Gruell et al. 1985). This is true of late development classes, but younger classes can resemble more the surrounding chaparral or sagebrush communities in their fire behavior and exhibit a FRG IV. Finally, on more productive sites in MZ18 or sites associated with ponderosa pine (FRI of 13-22 year; Arno and Wilson 1986), FRG I may be appropriate (very open and grassy stands), although this was not modeled. Experts had divergent opinions on this issue; some emphasized infrequent and only stand replacing fires whereas others suggested more frequent replacement fires, mixed severity fires and surface fires. The current model is a compromise reflecting more frequent fire in early development classes, surface fire in the late-open class and infrequent fire in the late-closed class.

Ungulate herbivory: Heavy browsing by native medium and large-sized mammals reduces mountain mahogany productivity and reproduction (USDA-NRCS 2003). This is an important disturbance in early, especially, and mid-seral stages, when mountain mahogany seedlings are becoming established. Browsing by small mammals has been documented (Marshall 1995), but is relatively unimportant and was incorporated as a minor component of native herbivory mortality.

Windthrow and snow creep on steep slopes are also sources of mortality.

Adjacency or Identification Concerns

Some existing curlleaf mountain mahogany stands may be in the big sagebrush (BpS 1125, Inter-Mountain Basins Big sagebrush Steppe and BpS 1126, Inter-Mountain Basins Montane Sagebrush Steppe), now uncharacteristic because of fire exclusion.

Native Uncharacteristic Conditions

Scale Description

Because these communities are restricted to rock outcrops and thin soils, stands usually occur on a small scale, and are spatially separated from each other by other communities that occur on different aspects or soil types. A few curlleaf mountain mahogany stands may be much larger than 100ac, especially in southern ID.

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Issues/Problems

Data about the setback in succession caused by native grazing are lacking, but consistently observed by experts; in the model, only class A exhibited a reversal of succession (mountain mahogany establishment) with native grazing, whereas no successional reversal was specified for classes B and C, which do not support many seedlings.

Comments

Additional comments added on 3/29/06 by K. Buford to reflect structure changes as a result of s-class rectification and further review from Sarah Heide.

This model is identical to the model from MZ18. 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.

Sarah Heide accepted as-is BpS 1062 for MZ18; the database record has minor modifications. Jon Bates (reviewer) suggested a few editorial changes and comments: 1) Western juniper was added to the list of conifers present in these stands. 2) Under biophysical setting, the occurrence of curlleaf mountain mahogany on more productive soils with deeper soils and fractured bedrock was described. 3) Under issues/problem, FRG I was introduced as a possibility for more productive sites in MZ18, which are sometimes associated with ponderosa pines or sagebrush. The model was not changed to reflect this case.

BpS 1062 for MZs 12 and 17 was developed by Chris Ross (c1ross@nv.blm.gov), Don Major (dmajor@tnc.org), Louis Provencher (lprovencher@tnc.org), Sandy Gregory (s50grego@nv.blm.gov), Julia Richardson (jhrichardson@fs.fed.us) and Cheri Howell (chowell@fs.fed.us). BpS 1062 is based on model modifications (and associated HRV) of BpS 1062 for MZ16 developed by Stanley Kitchen (skitchen@fs.fed.us) and Don Major (dmajor@tnc.org). Layout of VDDT model for BpS was corrected (switched class B and C). BpS 1062 for MZ16 was based on R2MTMA with moderate revisions to the original model. Current description is close to original. Original modelers were Michele Slaton (mslaton@fs.fed.us), Gary Medlyn (gmedlyn@nv.blm.gov) and Louis Provencher (lprovencher@tnc.org). Reviewers of R2MTMA were Stanley Kitchen (skitchen@fs.fed.us), Christopher Ross (c1ross@nv.blm.gov) and Peter Weisberg (pweisberg@cabnr.unr.edu).

Data from a thesis in NV and expert observations suggests some large mountain mahogany may survive less intense fires. Therefore, surface fires were added as a disturbance to late seral stages, but this is a more recent concept in curlleaf mountain mahogany ecology. Surface fires were assumed to occur on a very small scale, perhaps caused by lightning strikes.

10/01/07: As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for surface severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

Vegetation Classes

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Class A 10 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 5

Indicator Species* and Canopy Position

CELE3	Upper
ARTR2	Upper
CHRYS	Upper
SYMPH	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	20 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Curlleaf mountain mahogany rapidly invades bare mineral soils after fire. Litter and shading by woody plants may inhibit initial establishment but provide a favorable microhabitat for seedlings to become juveniles and adults when germination in these locations occur. Bunch grasses and disturbance-tolerant forbs and resprouting shrubs, such as snowberry, may be present. Rabbitbrush and sagebrush seedlings are present. Vegetation composition will affect fire behavior, especially if chaparral species are present. Replacement fire (average FRI of 500yrs), mixed severity (average FRI of 100yrs) and native herbivory of seedlings (two out of every 100 seedlings) all affect this class. Replacement fire and native herbivory will reset the ecological clock to zero. Mixed severity fire does not affect successional age. Succession to class C after 20yrs.

Class B 10 %

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 9

Indicator Species* and Canopy Position

CELE3	Upper
ARTR2	Mid-Upper
PUTR2	Mid-Upper
SYMPH	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	60 %
Height	Shrub 1.1m	Shrub >3.1m
Tree Size Class	None	

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

Various shrub species typically dominate. However, under mixed severity fire disturbance various grass species may dominate.

Description

Young curlleaf mountain mahogany are common, although shrub diversity is very high. One out of every 1000 mountain mahogany are taken by herbivores but this has no effect on model dynamics. Replacement fire (mean FRI of 150yrs) causes a transition to class A. Mixed severity fire can result in either maintenance (mean FRI of 80yrs) in the class or a transition to Class D (mean FRI of 200yrs). Succession to class E after 90yrs.

Class C 15 %

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 5

Indicator Species* and Canopy Position

CELE3	Upper
ARTR2	Low-Mid
CHRYS	Low-Mid
SYMPH	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	30 %
Height	Shrub 1.1m	Shrub 3.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Curlleaf mountain mahogany may co-dominate with mature sagebrush, bitterbrush, snowberry and rabbitbrush. Few mountain mahogany seedlings are present. Replacement fire (mean FRI is 150yrs) will cause a transition to class A, whereas mixed severity fire (mean FRI of 50yrs) will thin this class but not cause a transition to another class. Native herbivory of seedlings and young saplings occurs at a rate of 1/100 seedlings but does not

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cause an ecological setback or transition. Succession to class B after 40yrs.

Class D **20 %**

Late Development 1 Open

Indicator Species* and Canopy Position

CELE3 Upper
ARTR2 Low-Mid
PUTR2 Low-Mid

Upper Layer Lifeform

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

Fuel Model 9

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	30 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

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

Various shrub species typically dominate. However, under mixed severity fire disturbance various grass species may dominate.

Description

Moderate cover of mountain mahogany. This class represents a combined Mid2-Open and Late1-Open cover and structure combination resulting from mixed severity fire in class C (note: the combined class results in a slightly inflated representation in the landscape). Further, this class describes one of two late-successional endpoints for curlleaf mountain mahogany that is maintained by surface fire (mean FRI of 50yrs). Evidence of infrequent fire scars on older trees and presence of open savanna-like woodlands with herbaceous-dominated understory are evidence for this condition. Other shrub species may be abundant, but decadent. In the absence of fire for 150yrs (2-3 FRIs for mixed severity and surface fires), the stand will become closed (transition to class E) and not support much of a herbaceous understory. Stand replacement fire every 300yrs on average will cause a transition to class A. Class D maintains itself with infrequent surface fire and trees reach a very old age.

Class E **45 %**

Late Development 1 Closed

Indicator Species* and Canopy Position

CELE3 Upper

Upper Layer Lifeform

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

Fuel Model 6

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	60 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

High cover of large shrub or tree-like mountain mahogany. Very few other shrubs are present, and herb cover is low. Duff may be very deep. Scattered trees may occur in this class. This class describes one of two late-successional endpoints for curlleaf mountain mahogany. Replacement fire every 500yrs on average is the only disturbance and causes a transition to class A. Class will become old-growth with trees reported to reach 1000yrs+.

Disturbances

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Fire Regime Group:** III

Historical Fire Size (acres)

Avg 50
Min 1
Max 100

Sources of Fire Regime Data

☐ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	285	100	500	0.00351	24
Mixed	149	50	150	0.00671	47
Surface	238			0.00420	29
All Fires	69			0.01442	

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

Arno, S.F. and A.E. Wilson. 1986. Dating past fires in curlleaf mountain-mahogany communities. Journal of Range Management 39: 241-243.

Billings, W.D. 1994. Ecological impacts of cheatgrass and resultant fire on ecosystems in the western Great Basin. In: Proc. Ecology and management of annual rangelands. GTR-INT-313. USDA Forest Service.

Brown, J.K. and J. Kapler-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.

Davis, J.N. and J.D. Brotherson. 1991. Ecological relationships of curlleaf mountain mahogany (Cercocarpus ledifolius Nutt.) communities in Utah and implications for management. Great Basin Naturalist 51(2): 153-166.

Gruell, G., S. Bunting and L. Neuenschwander. 1985. Influence of fire on curlleaf mountain mahogany in the Intermountain West. Pages 58-72 in: J.K. Brown and J. Logan, eds. Fire's effects on wildlife habitat - Symposium Proceedings. USDA Forest Service Gen. Tech. Rep. INT-186.

Ibanez, I. and E.W. Schupp. 2002. Effects of litter, soil surface conditions, and microhabitat on Cercocarpus ledifolius Nutt. Seedling emergence and establishment. Journal of Arid Environments 52: 209-221.

Marshall, K.A. 1995. Cercocarpus ledifolius. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2004, November 16].

Monsen, S.B. and E.D. Mc Arthur. 1984. Factors influencing establishment of seeded broadleaf herbs and shrubs following fire. Pages 112-124 in: K. Sanders and J. Durham, eds. Proc. Symp.: Rangelands fire effects. Boise, Idaho: USDI Bureau of Land Management, Idaho Field Office.

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

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Peters, E.F. and S.C. Bunting. 1994. Fire conditions pre- and post-occurrence of annula grasses on the Snake River plain. In: Proc. Ecology and management of annual rangelands. GTR-INT-313. USDA Forest Service.

Ross, C. 1999. Population dynamics and changes in curlleaf mountain mahogany in two adjacent Sierran and Great Basin mountain ranges. Thesis. Reno, NV: University of Nevada, Reno. 111 pp.

Schultz, B.W., R.J. Tausch and P.T. Tueller. 1996. Spatial relationships amoung young Cercocarpus ledifolius (curlleaf mountain mahogany). Great Basin Naturalist 56: 261-266.

Schultz, B.W. 1987. Ecology of curlleaf mountain mahogany (Cercocarpus ledifolius) in western and central Nevada: population structure and dynamics. Thesis. Reno, NV: University of Nevada, Reno. 111 pp.

Tausch, R.J., P.E. Wigand and J.W. Burkhardt. 1993. Viewpoint: Plant community thresholds, multiple steady states, and multiple successional pathways: legacy of the Quaternary? Journal of Range Management 46: 439-447.

USDA-NRCS. 2003. Major land resource area 29. Southern Nevada Basin and Range. Ecological site descriptions. US Department of Agriculture. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake River plains: Ecological and management implications. In: Proc. Symp., Cheatgrass Invasion, shrub die-off, and other aspects of shrub biology and management. GTR-INT-276. Ogden, Utah: USDA Forest Service.

LANDFIRE Biophysical Setting Model

***Biophysical Setting:* 1010650 Columbia Plateau Scabland Shrubland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 3	Jack Sheffey	Jack_Sheffey@blm.gov	**Reviewer**		

Vegetation Type

Upland Shrubland

Map Zone

10

Model Zone

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

Dominant Species*

ARAR8
POSE
ACTH7
STST5
PYRRO
CHVI8

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This ecological system is found in the Columbia Plateau region and forms extensive low shrublands.

Biophysical Site Description

These semi-arid shrublands occur under relatively extreme soil-moisture conditions. Substrates are typically shallow lithic soils with limited water holding capacity over fractured basalt. Because of poor drainage through basalt, these soils are often saturated from fall to spring by winter precipitation but typically dry out completely to bedrock by midsummer.

Vegetation Description

Vegetation is characterized by an open dwarf-shrub canopy dominated by Artemisia arbuscula and/or Artemisia rigida along with other shrub and dwarf-shrub species, particularly Eriogonum spp. Low cover of Poa secunda or other perennial bunch grasses such as Danthonia unispicata, Elymus elymoides, Festuca idahoensis, as well as scattered forbs including species of Allium, Antennaria, Balsamorhiza, Lomatium, Phlox, goldenweed and Sedum, characterize these sites. Individual sites can be dominated by grasses and semi-woody forbs, such as Stenotus stenophyllus. Annuals may be seasonally abundant. Cover of moss and lichen is often high in undisturbed areas (1-60% cover).

Disturbance Description

Due to high rock coverage (up to 75%) and low stature of shrubs, fire does not spread in this ecological system. Therefore, fire may be due to spotting from adjacent sagebrush systems (mean FRI of 1000yrs for replacement fire after 80yrs of recovery). This type fits best into Fire Regime Group V.

Severe and prolonged drought every 200yrs on average contributed to both thinning of shrubs and small

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**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.

stand replacing events.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

Scale Description

Areas are generally small (<100ac).

Issues/Problems

Comments

This model is identical to the model from MZ18 with minor modifications to the description.

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.

BpS 1065 for MZ 18 was reviewed by Jon Bates (jon.bates@oregonstate.edu) and no changes were recommended. The reviewer does not consider himself an expert of this system, therefore was not recorded as a modeler.

BpS 1065 for MZ 12 and 17 was reviewed by Mike Zielenski (mike_zielenski@nv.blm.gov) and substantial changes were made to the description and model. Reviews resulted in increasing MFRI from 80 to 1000yrs and adding drought stress as the main disturbance. Also modified species composition following NRCS ecological site descriptions for scablands or very cobbly claypans.

Vegetation Classes

Class A 20 %

Early Development 1 All Structures

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model 1

Indicator Species* and Canopy Position

POSE	Mid-Upper
ACTH7	Mid-Upper
ARAR8	Upper
CHVI8	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☑ Upper layer lifeform differs from dominant lifeform.

Dominant vegetation is grasses with very scattered sagebrush.

Description

Early seral community dominated by herbaceous vegetation; less than five percent sagebrush canopy cover; up to 80yrs post-disturbance. Succession to B after 80yrs.

Class B 80 %

Late Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model 2

Indicator Species* and Canopy Position

ARAR8	Upper
CHVI8	Upper
ACTH7	Lower
POSE	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	20 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Late seral community with a mixture of herbaceous and shrub vegetation; greater than five percent sagebrush canopy cover present; 81yrs+ post-disturbance. Replacement fire occurs every 1000yrs on average. Wind/weather stress every 200yrs both thins the vegetation (50% of total probability maintains class B) and causes small stand replacing events (transition to class A 50% of times).

Class C **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Class D **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Class E **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 1
Min 1
Max 1

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [ ] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	1250	500	2000	0.0008	98
Mixed					
Surface					
All Fires	1247			0.00082	

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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Copeland, W.N. 1980a. The Lawrence Memorial Grassland Preserve, a biophysical inventory with management recommendations. June 1980. Unpublished report prepared by The Nature Conservancy Field Office, Portland, Oregon. 161 pp.

Daubenmire, R.F. 1970. Steppe vegetation of Washington. Washington State University Agricultural Experiment Station Technical Bulletin No. 62. 131 pp.

Ganskopp, D.C. 1979. Plant communities and habitat types of the Meadow Creek Experimental Watershed. Unpublished thesis, Oregon State University, Corvallis. 162 pp.

Hall, F.C. 1973. Plant communities of the Blue Mountains in eastern Oregon and southeastern Washington. USDA Forest Service, Pacific Northwest Region. R6 Area Guide 3-1. 62 pp.

Johnson, C.G. and S.A. Simon. 1985. Plant associations of the Wallowa Valley Ranger District, Part II: Steppe. USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. 258 pp.

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

Poulton, C.E. 1955. Ecology of the non-forested vegetation in Umatilla and Morrow counties, Oregon. Unpublished dissertation. State College of Washington, Pullman. 166 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1010700 Rocky Mountain Alpine Dwarf-Shrubland

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Louis Provencher	lprovencher@tnc.org	**Reviewer**	Vic Ecklund	vecklund@csu.org
Modeler 2			**Reviewer**	Chuck Kostecka	kostecka@webaccess.net
Modeler 3			**Reviewer**		

Vegetation Type

Upland Shrubland

Dominant Species*

CAME7 SARE2
DRIN4 PHEM
DROC VACCI
SAAR27 ERIGE2

General Model Sources

☐ Literature
☐ Local Data
☐ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

This widespread ecological system occurs above upper timberline throughout the Rocky Mountain cordillera, including alpine areas of ranges in CO, NM, AZ, UT, NV, ID, MT, WY and north into Canada.

Biophysical Site Description

Elevations are >3360m in the Colorado Rockies, but drop to <2250m in southeastern British Columbia. This system occurs in areas of level or concave glacial topography, with late-lying snow, and sub-irrigation from surrounding slopes. Soils have become relatively stabilized in these sites, are moist, but well drained, strongly acid and often have substantial peat layers.

Vegetation Description

This ecological system is characterized by a semi-continuous layer of ericaceous dwarf-shrubs, or dwarf willows which form a heath type ground cover <0.5m in height. Dense tuffs of graminoids and scattered forbs occur. Dryas octopetala or Dryas integrifolia communities are included here, although they occur on more wind-swept and drier sites than the heath communities. Within these communities Cassiope mertensiana, Dryas integrifolia, Dryas octopetala, Salix arctica, Salix reticulata or Phyllodoce empetriformis can be dominant shrubs. Vaccinium spp, Ledum glandulosum, Phyllodoce glanduliflora and Kalmia microphylla may also be shrub associates. The herbaceous layer is a mixture of forbs and graminoids, especially sedges, including, Erigeron spp, Luetkea pectinata, Antennaria lanata, Oreostemma alpigenum (=Aster alpigenus), Pedicularis spp, Castilleja spp, Deschampsia caespitosa, Caltha leptosepala, Erythronium spp, Juncus parryi, Luzula piperi, Carex spectabilis, Carex nigricans and Polygonum bistortoides. Fell-fields often intermingle with the alpine dwarf-shrubland.

Disturbance Description

Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost and a short growing

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season. Dry summers associated with major drought years (mean return interval of 100yrs) would favor grasses over forbs, whereas wet summers cause a more diverse mixture of forbs and graminoids.

Avalanches on stepper slopes where soil accumulated can cause infrequent soil-slips, which exposed bare ground.

Very small burns of a few square meters (replacement fire) caused by lightning strikes were included as a rare disturbance, although lighting storms are frequent in those elevations. The calculation of lightning strikes frequency was not based on fire return intervals, but on the number of strikes (in this case five) per 1000 possible locations per year, thus 0.005.

Native herbivores (Rocky Mountain bighorn sheep, mule deer and elk) were common in the alpine but probably did not greatly affect vegetation cover because animals move frequently as they reduce vegetation cover.

Adjacency or Identification Concerns

Adjacent to and inter-mixed with Rocky Mountain Dry Tundra.

Native Uncharacteristic Conditions

Scale Description

This ecological system can occupy large areas of the alpine. Patch size varies from a few acres to 100ac in mountain basins. Stand-replacement fires may be caused by lightning strikes that do not spread due to the sparse cover of fine fuel and extensive barren areas acting as fire breaks.

Issues/Problems

Scarce information on this system.

Comments

This is identical to the model for the same BpS in MZs 16, 23, 24 and 28. Input to the model was based on discussion with Kimball Harper (retired USFS scientist; UT), an alpine specialist of the Utah High Plateau. Due to the simplicity of this system, we used the same model as 1144 (Rocky Mountain Dry Tundra), but increased the duration of early development recovery of shrubs from three years to 10yrs.

Vegetation Classes

Class A 15%

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

CAREX	Upper
ERIGE2	Upper
DECA18	Upper
LUPE	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0%	10%
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Very exposed (barren) state following a lightning strike. Soil (not rock) may dominate the area. Grasses are more common than forbs or shrubs. Succession to class B after 10yrs.

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**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 **85%**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 6

Indicator Species* and Canopy Position

CAME7	Upper
DRIN4	Upper
DROC	Upper
SAAR27	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	50 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Alpine community is dominated by semi-continuous layer of ericaceous shrubs. Plant cover may vary from 10% on exposed sites to as much as 50% on mesic and more protected sites. Infrequent replacement fire in the form of lighting strikes (mean FRI of 500yrs), severe summer droughts (mean return interval of 100yrs) and rare avalanches on stepper slopes with soil (1/1000) cause a transition to class A.

Class C **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

Class D **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

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

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**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.

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 1
Min 1
Max 1

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	*Avg FI*	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	232			0.00431	100
Mixed					
Surface					
All Fires	232			0.00433	

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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [x] Other (optional 1) avalanches
- [ ] Other (optional 2)

References

Baker, W.L. 1980. Alpine vegetation of the Sangre De Cristo Mountains, New Mexico: Gradient analysis and classification. Unpublished thesis, University of North Carolina, Chapel Hill. 55 pp.

Bamberg, S.A. 1961. Plant ecology of alpine tundra area in Montana and adjacent Wyoming. Unpublished dissertation, University of Colorado, Boulder. 163 pp.

Bamberg, S.A. and J. Major. 1968. Ecology of the vegetation and soils associated with calcareous parent materials in three alpine regions of Montana. Ecological Monographs 38(2): 127-167.

Cooper, S.V., P. Lesica and D. Page-Dumroese. 1997. Plant community classification for alpine vegetation on Beaverhead National Forest, Montana. Report INT-GTR-362. Ogden, UT: USDA Forest Service, Intermountain Research Station. 61 pp.

Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation, University of Colorado, Boulder. 655 pp.

Komarkova, V. 1980. Classification and ordination in the Indian Peaks area, Colorado Rocky Mountains. Vegetation 42:149-163.

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

Schwan, H.E. and D.F. Costello. 1951. The Rocky Mountain alpine type: Range conditions, trends and land use (a preliminary report). Unpublished report prepared for USDA Forest Service, Rocky Mountain Region (R2), Denver, CO. 18 pp.

Thilenius, J.F. 1975. Alpine range management in the western United States-principles, practices, and problems: The status of our knowledge. Research Paper RM-157. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 32 pp.

Willard, B.E. 1963. Phytosociology of the alpine tundra of Trail Ridge, Rocky Mountain National Park,

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**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.

Colorado. Unpublished dissertation, University of Colorado, Boulder.

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010790** **Great Basin Xeric Mixed Sagebrush Shrubland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Crystal Kolden	ckolden@gmail.com	**Reviewer** Jon Bates	jon.bates@oregonstate.edu
Modeler 2	Gary Medlyn	gmedlyn@nv.blm.gov	**Reviewer**	
Modeler 3			**Reviewer**	

Vegetation Type

Upland Shrubland

Map Zone

10

Model Zone

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

Dominant Species*

ARNO4
ACHY
ACTH7
PSSP6

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Western Utah, eastern/central/northern NV and southern ID.

Biophysical Site Description

This type describes black sage and low sagebrush, mostly on convex slopes with Wyoming sagebrush and basin big sagebrush occurring in concave slopes and inset alluvial fans. Great Basin alluvial fans, piedmont, bajadas, rolling hills and mountain slopes. Can also be found on flats and plains. Other species include horsebrush, spiny hopsage and rubber rabbitbrush, although these are mostly associated with Wyoming and basin big sagebrush areas. Low/green rabbitbrush is associated with black sagebrush, as well as shadscale. Elevations range from 1500-2600m. Low sagebrush tends to grow where claypan layers exist in the soil profile and soils are often saturated during a portion of the year. Black sagebrush tends to grow where there is a root-limiting layer in the soil profile. Wyoming big sagebrush and basin big sagebrush generally occur on moderately deep to deep soils that are well-drained.

Vegetation Description

This type includes communities dominated by black sagebrush (Artemisia nova), low sagebrush (Artemisia arbuscula) and Wyoming big sagebrush (Artemisia tridentata ssp. wyomingensis) where there is a potential for pinyon (Pinus monophylla) and/or juniper (Juniperus osteosperma) establishment. Black sagebrush is the dominant shrub in this system with Wyoming big sagebrush and basin big sagebrush occurring in minor compositions, sometimes scattered but mostly continuous. Black sagebrush generally has relatively low fuel loads occurring with low growing and cushion forbs and scattered bunch grasses such as bluebunch wheatgrass (Pseudoroegneria spicata), needlegrasses (Achnatherum spp), Sandberg's bluegrass (Poa secunda) and Indian ricegrass (Achnatherum hymenoides). Forbs often include buckwheats (Eriogonum spp), fleabanes (Erigeron spp), phloxs (Phlox spp), paintbrushes (Castilleja spp), globemallows

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(Sphaeralcea spp) and lupines (Lupinus spp).

Disturbance Description

Black sagebrush generally supports more fire than other dwarf sagebrushes. This type generally burns with mixed severity (average FRI of 100-140yrs) due to relatively low fuel loads and herbaceous cover. Bare ground acts as a micro-barrier to fire between low stature shrubs. Stand-replacing fires (average FRI of 200-240yrs) can occur in this type when successive years of above average precipitation are followed by an average or dry year. Stand replacement fires dominate in the late successional class where the herbaceous component has diminished or where trees dominate. This type fits best into Fire Group III or IV.

Grazing by wild ungulates occurs in this type due to its high palatability (mostly for A. nova and A. arbuscula) compared to other browse. Native browsing tends to open up the canopy cover of shrubs but does not often change the successional stage. Native grazing was not included in the model.

Severe drought is a stress factor (average return interval of 200yrs) that causes two transitions: 50% of times drought thins the stand (same class transition), whereas 50% of other times severe thinning by drought causes a transition to the previous development class.

Burrowing animals and ants breaking through the root restrictive zone of low and black sagebrush types create mounds of mineral soil (seedbed) that is readily colonized by big sagebrush. Burrowing creates small patches (ie, generally <200 sq. ft) of big sagebrush in the low sagebrush types, which could affect fuel loads. This was not considered in the model.

Adjacency or Identification Concerns

In the transition area between the Great Basin and Columbia Plateau, BpS 1079 can be confused with Columbia Plateau Low Sagebrush Steppe (1124), which has a higher herbaceous cover.

The black and low sagebrush type tends to occur adjacent to either Wyoming big sagebrush or basin big sagebrush types. The Wyoming big sagebrush and basin big sagebrush types create a mosaic within the black and low sagebrush types. These big sagebrush types have a different fire regime that acts to carry the fire, with black and low sagebrush serving as fire breaks most of the time.

After mixed or low-severity fires, composition is primarily islands of black sagebrush with interspaces dominated by low rabbitbrush that resprouts, and with time, increases of shadscale and herbaceous composition.

Native Uncharacteristic Conditions

Scale Description

Black sagebrush can occupy extremely large areas (>100000ac) in eastern NV and western UT. Occurrences are typically smaller towards western and northern NV and southern ID. Disturbance patch size for this type is not well known but is estimated to be 10s to 100s of acres due to the relatively small proportion of the sagebrush matrix it occupies and the limited potential for fire spread. Where these sites exist in a more herbaceous state, fire expands readily where there is continuity of fine fuel and sufficient wind. It is usually a low intensity burn. Fire sizes up to 800ac possible in situations like this.

Issues/Problems

The effect of insect outbreaks (independent of drought) on mature pinyon and juniper in class D can cause a 50% reduction in class D (from 10% to 5%) if part or all of the outbreak sufficiently thins older trees (transition to class C). We assumed that 25% of outbreaks results in a transition to class C from D.

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**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 from MZ18 with minor modifications to the description.

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 revised BpS 1079 for MZ18 with no changes. Reviewer does not consider himself an expert of this system and, therefore, was not retained as a modeler.

Mike Zielenski (mike_zielenski@nv.blm.gov) reviewed BpS 1079 for MZs 12 and 17, which resulted in significant changes to the description. BpS 1079 was originally based on the Rapid Assessment model R2SBDW (dwarf sagebrush) developed by Gary Medlyn (gmedlyn@nv.blm.gov) and Sarah Heidi (sarah_heidi@blm.gov). Following expert review, choice of model was switched to R2SBDWwt (dwarf sagebrush with trees) developed by Gary Medlyn and Sarah Heidi because the NatureServe description includes pinyon and juniper encroachment and the appropriate elevation. Also, the reviewer indicated that black sagebrush is usually associated with juniper or pinyon in northcentral NV and recommended the version of the model with tree encroachment. Modifications were made to weather stress pathways and probabilities for R2SBDWwt. R2SBDW was reviewed by Paul Blackburn (paul.blackburn@usda.gov), Gary Back (gback@srk.com) and Paul Tueller (ptt@intercomm.com), whereas R2SBDWwt was reviewed by Paul Tueller.

Vegetation Classes

Class A 15 %

Early Development 1 All Structures

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model 1

Indicator Species* and Canopy Position

PSSP6	Middle
POSE	Low-Mid
ACHY	Middle
ACTH7	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☑ Upper layer lifeform differs from dominant lifeform.

Dominant life form is primarily herbaceous with some resprouting rabbitbrush. Canopy cover 4-10%, height 18-36cm (0.2-0.4m).

Description

Early seral community dominated by herbaceous vegetation; less than six percent sagebrush canopy cover; up to 24yrs post-disturbance. Fire-tolerant shrubs (green/low rabbitbrush) are first sprouters after stand-replacing, high-severity fire. Replacement fire (mean FRI of 250yrs) maintains vegetation in state A. Prolonged drought every 500yrs on average maintains vegetation in class A. Succession to B after 25yrs.

Class B 60 %

Mid Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model 1

Indicator Species* and Canopy Position

ARNO4	Upper
POSE	Lower
ACHY	Mid-Upper
PSSP6	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	20 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Mid-seral community with a mixture of herbaceous and shrub vegetation; 6-10% sagebrush (sagebrush/brush) canopy cover present; between 20-59yrs post-disturbance. Drought every 200yrs causes two transitions: 50% of times drought thins shrubs while maintaining vegetation in class B, whereas 50% of times drought causes a stand replacing event. Replacement fire (FRI of 250yrs) causes a transition to A, whereas mixed severity fire (FRI of 100yrs) maintains the site in its present condition. In the absence of fire for at least 120yrs, the site will follow an alternative successional path to C. Otherwise, succession and mixed severity fire keeps site in class B.

Class C **15 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

ARNO4	Upper
JUOS	Upper
PSSP6	Mid-Upper
ACHY	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	10 %
Height	Tree 0m	Tree 5m
Tree Size Class	Seedling <4.5ft	

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

Juniper, and maybe pinyon, overtopping shrubs. Tree cover less than six percent.

Description

Late seral community with a mixture of herbaceous and shrub vegetation; 10-25% sagebrush canopy cover present; and dispersed conifer seedlings and saplings established at less than six percent cover. Insects attack the vegetation in this state every 60yrs on average, but does not cause a transition to another state. Severe droughts (return interval of 200yrs) causes two thinning disturbances: to class B (50% of times) and within class C. Replacement fire is every 200yrs on average, whereas mixed severity fire is less frequent than in class B (FRI of 130yrs). Succession is to class D after 75yrs.

Class D **10 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

JUOS	Upper
PIMO	Upper
ARNO4	Middle
ACHY	Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	11 %	40 %
Height	Tree 0m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Late seral community with a closed canopy of conifer trees (6-40% cover). The degree of tree canopy closure differs depending on whether it is a low sagebrush (max 15%) or black sagebrush (max 40%) community. In low sagebrush communities a mixture of herbaceous and shrub vegetation with >10% sagebrush canopy cover would still be present. In black sagebrush communities the herbaceous and shrub component would be greatly reduced (less than one percent). When Ips beetle outbreaks occur the pinyon component is reduced (return interval of 60yrs): 75% of times thinning is not intense enough to cause a transition whereas in 25% of cases a transition to class C will occur. The only fire is replacement (FRI of 150yrs) and is driven by a greater amount of woody fuel than in previous states. Prolonged droughts have the same effect as before. Succession from class D to D without fire.

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**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 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:** III

Historical Fire Size (acres)

Avg 50
Min 1
Max 2000

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	227	100	250	0.00441	37
Mixed	133	75	140	0.00752	63
Surface					
All Fires	84			0.01193	

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

Blackburn, W.H. and P.T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in east-central Nevada. Ecology 51(5):841-848.

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

Ratzlaff, T.D. and J.E. Anderson. 1995. Vegetal recovery following wildfire in seeded and unseeded sagebrush steppe. Journal of Range Management 48: 386-391.

USDA-NRCS 2003. Ecological site descriptions for Nevada. Technical Guide Section IIE. MLRAs 28B, 28A, 29, 25, 24, 23. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

Young, J.A. and D.E. Palmquist. 1992. Plant age/size distributions in black sagebrush (Artemisa nova): effects on community structure. Great Basin Naturalist 52(4): 313-320.

Zamora, B. and P.T. Tueller. 1973. Artemisia arbuscula, A. longiloba, and A. nova habitat types in northern Nevada. Great Basin Naturalist 33: 225-242.

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**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.

LANDFIRE Biophysical Setting Model

***Biophysical Setting:* 1010800** **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** 11/18/2005

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Modeler 3	John DiBari	jdibari@email.wcu.edu	**Reviewer**	Robert Wooley	rwooley@fs.fed.us

Vegetation Type

Upland Shrubland

Map Zone

10

Model Zone

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

Dominant Species*

ARTRW HECO26
ARTRT ELTR7
ERNA10
PSSP6

General Model Sources

- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

Geographic Range

Sagebrush occurs throughout much of the west. For MZ19, Wyoming and Basin big sagebrush are found in southwest MT and east-central ID.

Biophysical Site Description

This type is found between 3000-7000ft elevation on deep, well drained, alluvial soils. Artemisia tridentata ssp. tridentata occurs in swales with deeper soils at lower elevations. Artemisia tridentata ssp. wyomingensis is the more common subspecies in MZ19 and occurs on toeslopes and alluvial fans at mid-elevations.

Vegetation Description

Wyoming and big basin sagebrush subspecies form a mosaic of patches throughout much of this BpS in MZs 10 and 19. Wyoming sagebrush (Atremisia tridentata ssp.wyomingensis) is the dominant species in valley bottoms and aluvial fans.

In deep soils Basin big sagebrush (Artemisia tridentata spp. tridentata) is the dominant subspecies, except on alkaline soils, where greasewood (Sarcobatus vermiculatus) and Rabbitbrush (Chrysothamnus spp.) may also be present.

Understory grasses include bluebunch wheatgrass (Pseudoroegneria spicata), Thurber needlegrass (Achnatherum thurberianum), needle and thread (Hesperostipa comata), basin wildrye (Leymus cinerius), squirreltail (Elymus elymoides), western wheatgrass (Pascopyrum smithii)). Forbs include hawksbeard (Crepis acuminata), bird's beak (Cordylanthus spp.) , blue bell (Mertensia spp.), Rocky mountain aster (Aster scopulorum), Phlox species, lupine (Lupinus spp.), and buckwheat (Eriogonum spp.).

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Disturbance Description

Fire regime group IV, but may also encompass III and IV. Fire return intervals are estimated to average approximately 60yrs, and range from 10-150yrs. However, questions have recently been raised about the frequency of fire as related to neighboring vegetation types (Baker 2004, in press). Fires were mostly stand replacing (Tirmenstein 1999). Mixed severity fire was probably present where fuel was discontinuous, though there is disagreement about the role of replacement versus mixed severity fire in this type. Ignition sources probably included burning by native Americans under reference conditions (Barrett and Arno 1982, 1999).

It has been hypothesized that prolonged drought has resulted in significant die off in this type.

Insects and disease may have resulted in replacement and mixed-severity disturbances in this type, but little information exists on the frequency of these disturbances under reference conditions. They are not modeled here.

Antelope, mule deer and pygmy rabbits are native herbivores that browse sagebrush.

Adjacency or Identification Concerns

Basin big sagebrush grows in association with Wyoming big sagebrush, mountain big sagebrush and desert shrub communities. Distribution is a result of local soil characteristics on a fine scale (1-500ac). Much of this type has been lost due to land clearing for agriculture or converted to a cheatgrass or greasewood type.

Native Uncharacteristic Conditions

Scale Description

Fuel may be continuous resulting in spread throughout patches. Disturbance size therefore probably resembles the patch size of the vegetation.

Disturbance patch sizes range from 10s-100s of hectares.

Issues/Problems

It is difficult to map and identify the subspecies of big sagebrushes (Artemesia tridentata) without the aid of field assessments.

Fire size, frequency and severity are variable.

Comments

This model is based on the Rapid Assessment model R0SBBB by Diane Abendroth (diane_abendroth@nps.gov) and reviewed by Bill Baker (bakerwl@uwyo.edu), Don Bedunah (bedunah@forestry.umt.edu), Shannon Downey (shannon_downey@blm.gov), Karen Clause (karen.clause@wy.usda.gov), Dennis Knight (dhknight@uwyo.edu), Thor Stephenson (thor_stephenson@blm.gov), Curt Yanish (curt_yanish@blm.gov), Gavin Lovell (gavin_lovell@blm.gov) and Eve Warren (eve_warren@blm.gov). Only descriptive changes were made to the model.

Peer review for the Rapid Assessment was incorporated 4/26/2005. There was considerable disagreement among reviewers about how to model this type. All comments were incorporated into the description. The following changes were made to the quantitative model based on peer review:
1.) Mixed severity fire was added to the model without changing the overall MFI. Several reviewers agreed that mixed fire should be included, though they disagreed at what proportion.
2.) Drought was added as a disturbance agent, causing both replacement type disturbances (once in 1000yrs)

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and mixed-severity disturbances (once every 50yrs).
3.) The proportion of fire was redistributed among the three classes so that class B had a higher likelihood of fire than class A or C.
These changes resulted in the following changed results in the model: class A changed from 30% to 20%; class B changed from 40% to 30%; class C changed from 30% to 50%.

The following items reviewers disagreed upon or did not have data to support and so were not included in the model, but were added to the description:
1.) The frequency and severity of insects, disease and native grazing disturbances.
2.) Whether or not two additional classes (mid-closed and late-open) should be added.
3.) The frequency of fire in this system. Estimates ranged from 40yrs to 150yrs. The model was left at an overall MFI of 60yrs, as several reviewers agreed upon this number.

Vegetation Classes

Class A 20 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

LECI4	Upper
ELTR7	Upper
HECO26	Upper
PSSP6	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	50 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Grass-dominated community following replacement disturbance. Sagebrush will begin to return within ~five years, but will remain relatively low canopy cover (<10%). This class lasts up to 20yrs post disturbance and succeeds to mid-development open (class B) unless drought or replacement fire cause stand-replacing disturbance.

Class B 30 %

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

ARTRT	Upper
ARTRW8	Upper
PSSP6	Lower
LECI4	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Sagebrush dominated (>10% canopy cover), open shrub community with abundant grasses. This class lasts approximately 20-50yrs post disturbance and succeeds to late-development closed (class B) unless replacement fire or drought cause a transition to class A. Mixed severity fire maintains this condition.

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Class C 50 %

Late Development 1 Closed

Indicator Species* and Canopy Position

ARTRT Upper
POSE Lower
ARTRW Upper
PSSP6 Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	80 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model

Description

Mature and overmature sagebrush with suppressed understory. Cover may range from 40-80%, but will rarely exceed 60%. This condition begins at age 50 and can perpetuate until disturbance causes a transition to another class. Replacement fire and drought may cause a transition to class A. Mixed severity fire will cause a transition to class C, but is relatively rare.

Class D 0 %

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Class E 0 %

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	80	10	150	0.0125	100
Mixed					
Surface					
All Fires	80			0.01252	

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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**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.

Additional Disturbances Modeled

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

References

Baker, W.L. and D.J. Shinneman. 2004. Fire and restoration of pinyon-juniper woodlands in the western United States: a review. Forest Ecology and Management 189: 1-21.

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

Barrett, S.W. and S.F. Arno. 1982. Indian fires as an ecological influence in the Northern Rockies. Journal of Forestry. 80(10): 647-651.

Barrett, S.W. and S.F. Arno. 1999. Indian fires in the Northern Rockies: Ethnohistory and ecology. Pages 50-64 in: R. Boyd, ed. Indians, fire, and the land in the Pacific Northwest. Corvallis, OR: Oregon State University.

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

Tirmenstein, D. 1999. Artemisia tridentata spp. tridentata. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2004, September 9].

Tirmenstein, D. Sarcobatus vermiculatus. 1987. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2004, September 10].

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.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1010810** **Inter-Mountain Basins Mixed Salt Desert Scrub**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 2	Crystal Kolden	ckolden@gmail.com	**Reviewer**		
Modeler 3	Don Major	dmajor@tnc.org	**Reviewer**		

Vegetation Type

Upland Shrubland

Map Zone

10

Model Zone

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

Dominant Species*

ATCO
PIDE4
KRLA2
ELEL5

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Geographic Range

Great Basin; OR, ID, UT, NV, CA and Colorado Plateau. This ecological system occupies sites west of the Wasatch Mountains, east of the Sierras, south of the Idaho batholith and north of the Mojave Desert.

Biophysical Site Description

This type occurs from lower slopes to valley bottoms ranging in elevation from 3800-6500ft. Soils are often alkaline or calcareous. Soil permeability ranges from high to low, with more impermeable soils occurring in valley bottoms. Water ponds on alkaline bottoms. Texture is variable becoming finer toward valley bottoms. Many soils are derived from alluvium. Average annual precipitation ranges from 3-10in, however, this system is in 5-8in of effective moisture within this broader range. Thus, other sites characteristics (eg, aspect, drainage and soil type) should be considered in identifying this ecotype. At the precipitation extremes, this system generally occurs as small patches and stringers. Summers are hot and dry with many days reaching 100F. Spring is the only dependable growing season with moisture both from winter and spring precipitation. Cool springs can delay the onset of plant growth and drought can curtail the length of active spring growth. Freezing temperatures are common from November through April.

This group generally lies above playas, lakes and greasewood communities. Both to the north and upslope it is bordered by low elevation big sagebrush groups, commonly ARTRWY, ARAR8 and ARNO4 communities. To the south, this group is bordered by Mojave Desert transition communities.

Vegetation Description

This ecological system includes low (less than thre feet) and medium-sized shrubs found widely scattered (often 20-30ft apart) to high density (3-5 plants per sq. m) shrubs interspersed with low to mid-height bunch

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grasses. Common shrubs are shadscale, winterfat, budsage, Nevada ephedra, horsebrush, low rabbitbrush, broom snakeweed and spiny hopsage. Shrub dominance is highly dependant on the site. Some of the above mentioned shrubs will be present. Common bunch grass species are Indian ricegrass, needle-and-thread, purple three-awn and bottlebrush squirreltail, and where monsoonal influences are present you will find common rhizomatous/sod forming grasses such as galleta grass, sand dropseed and blue grama. Globe mallows are the most common and widespread forbs. The understory grasses and forbs are salt-tolerant, not particularly drought tolerant, and are variably abundant. The relative abundance of species may vary in a patchwork pattern across the landscape in relation to subtle differences in soils (eg, sand sheets or other surface textural differences, biological crust coverage, etc.) and reflect variation in disturbance history. Total cover rarely exceeds 25% and annual precipitation is closely linked to prior 12 months precipitation. Stand replacing disturbances (insects, extended wet periods and drought) shift dominance between shrub and grass species. Following drought coupled with insect infestations, the system will tend more toward Class A.

Disturbance Description

Disturbance was unpredictable. But flooding, drought and insects may all occur in these systems. Fire may have been rare. For the model, extended wet periods occurred every 55yrs (30-80yrs), and drought periods occurred every 55yrs (30-80yrs).

Documented Mormon cricket/grasshopper outbreaks since settlement have corresponded with drought; outbreaks cause shifts in composition amongst dominant species, but do not typically cause shifts to different seral stages. During outbreaks Mormon crickets prefer open, low plant communities. Herbaceous communities and the herbaceous component of mixed communities were more susceptible to cricket grazing. Scale insects can have significant effects on shrub component (especially in combination with drought periods) thereby resulting in possible shifts in seral states (Sharp et al. 1990).

Fire was rare and limited to more mesic sites (and moist periods) with high grass productivity. Mixed severity fire with mean FRI of 1,000yrs (for the MODEL).

Extended wet periods tended to favor perennial grass development, while extended drought tended to favor shrub development. Shrubs, however, were always dominant.

Native American manipulation of salt desert shrub plant communities was minimal. Grass seed may have been one of the more important salt desert shrub crops. It is unlikely that native Americans manipulated the vegetation to encourage grass seed.

Adjacency or Identification Concerns

This ecological system contains the typical Great Basin salt desert shrub communities. Salt desert shrub communities are varied and the current model and description capture the most typical. Salt desert shrub is also common in the Wyoming big sagebrush community and there is some species overlap.

A wide range of salt desert shrubs can occur in this group. Two important types that were not included in the list of BpSs are winterfat (KRLA2) and Atriplex gardneri (Gardner's or sickle saltbush) (ATGA). Winterfat forms vast, homogeneous, and low-stature communities on silty soils resembling gray golf courses. Winterfat is critical to wildlife and livestock because it is more palatable than alfalfa and typically the only forage available during the winter. Gardner's saltbush resembles shadscale (thus BpS 1081) but form extensive and distinctive communities endemic to the Great Basin.

A drier site of mixed salt desert would include fourwing saltbush, which is usually not found within the

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**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.

shadscale community. The same model would apply with perhaps longer recovery times.

Indian ricegrass can dominate sites with sandy surface textures, however, the temporal nature of this condition is unknown.

Upland salt desert shrub communities are easily invaded and, in the short term at least, replaced by cheatgrass. Other nonnative problematic annuals include halogeton, Russian thistle and several mustards. Through central UT and east central NV this group is susceptible to invasion by squarrose knapweed. More mesic areas can be invaded by tall whitetop and hoary cress. All three are noxious weeds in Great Basin states.

Native Uncharacteristic Conditions

Scale Description

BpS 1081 forms vast communities easily >100000ac in valley bottoms. Disturbance scale was variable during presettlement. Droughts and extended wet periods could be region wide, or more local. A series of high water years or drought could affect whole basins.

Most fires were rare and less than one acre, but may exceed hundreds of acres with a good grass crop.

Issues/Problems

Comments

This model is identical to the model from MZ18 with minor modifications to the description.

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.

MZ 18 accepted BpS 1081 from MZs 12 and 17. The model was reviewed for MZ18 by Eric Limbach. D. Major reviewed model for MZ18 with significant revisions; including: 1) removal of budsage dominated class C, 2) addition of insect DRI's (this modified overall class percentages as follows: A from 5 to 15%; B 85% and 3) modified adjacency to reflect the Wyoming big sagebrush typical for this mapzone.

BpS 1081 for MZs 12 and 17 was modified from BpS 1081 for MZ16. 1) Pinyon-juniper steppe was removed as potential adjacent type in vegetation description. 2) The model was clearly defined following the dynamics of shadscale and bud sagebrush where mortality of shadscale in class B causes a transition to bud sagebrush dominant class C for a short period before abundant shadscale seed allow the return to class B. 3) In this revised model it is not possible to have an alternate succession from class A to C.

BpS 1081 for MZ16 was initially based on R2SDSH. Greasewood box was removed from R2SDSH by Jolie Pollet, Annie Brown and Stanley Kitchen to build BpS 1081 for MZ16. The model was greatly simplified at this time. Original descriptions by Bill Dragt were kept. Reviewers of R2SDSH were Stanley Kitchen (skitchen@fs.fed.us), Mike Zielinski (mike_zielinski@nv.blm.gov) and Jolie Pollet (jpollet@blm.gov).

Vegetation Classes

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 A 15 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

ACHY	Upper
ATCO	Upper
KRLA	Lower
ELEL5	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Dominated by scattered and young shrubs (shadscale). After five years, vegetation moves to Class B as the primary successional pathway. Extended wet period (every 55yrs) will have a stand replacing effect, with an ecological setback of five years. Insect outbreaks (grasshoppers, scale insects, etc.) can result in partial/complete setback (DRI 20yrs).

Class B 85 %

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

KRLA	Lower
ATCO	Upper
ELEL5	Lower
PIDE4	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	20 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Dominated by shadscale. Extended wet periods (every 55yrs on average) will cause a stand replacing transition to Class A. Extended severe drought periods or insect outbreaks (DRI 40yrs, respectively) will shift to Class A. Replacement fire is rare (mean FRI of 1000yrs).

Class C 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

Class D 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

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 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:** V

Historical Fire Size (acres)

Avg 1
Min 1
Max 1

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	1250			0.0008	98
Mixed					
Surface					
All Fires	1247			0.00082	

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

Blaisdell, J.P. and R.C. Holmgren. 1984. Managing intermountain rangelands-salt-desert shrub ranges. General Technical Report INT-163. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 52 pp.

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

Sharp, L.A., K. Sanders and N. Rimbey. 1990. Forty years of change in a shadscale stand in Idaho. Rangelands 12(6), pp. 313-328.

Tiedemann, A.R., E.D. McArthur, H.C. Stutz. R. Stevens and K.L. Johnson, compilers. 1984. Proceedings--symposium on the biology of Atriplex and related chenopods; 1983 May 2-6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment. 309 pp.

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.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

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.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011060** **Northern Rocky Mountain Montane-Foothill Deciduous Shrubland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Mike Babler	mbabler@tnc.org	**Reviewer**	Don Bedunah	bedunah@forestry.umt.edu
Modeler 2			**Reviewer**	C. R. Kyte	clayton_kyte@nps.gov
Modeler 3			**Reviewer**	anonymous	

Vegetation Type

Upland Shrubland

Dominant Species*

AMELA
PURSH
SYMPH
PRUNU

General Model Sources

☐ Literature
☐ Local Data
☐ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

Minor but relatively widespread. Occurs throughout the Intermountain West and Northern Rockies.

Biophysical Site Description

This BpS occupies draws and foothills (all aspects) in the transition zone between grasslands/shrublands and forests, including aspen and montane forests. Ranges widely in elevation (3000-9000ft) throughout its geographic range.

Vegetation Description

Various mixes of shrubs such as serviceberry, Prunus spp, snowberry, snowbrush, bigtooth maple and Rocky Mountain maple. (Society of Range Management Cover Types 317-319 and 418-421.)

Disturbance Description

Fire Regime Group IV, dominated by replacement fire (80%), but may have a small component of mixed severity fires (20%). The average fire return interval for this system may range from <60-100yrs+, and there is some debate about the role of mixed severity fire. Fire regimes of adjacent BpS will have significant impact on the frequency and severity of this BpS. This BpS will have significant variation in plant response to disturbance.

Drought, insects/disease and native grazing may all impact this BpS. However, little or no data exist to attribute these disturbances, and they were not included in this model.

Adjacency or Identification Concerns

The fire regime of adjacent BpS will dominate the fire regime here. This system is widespread and may be

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**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.

adjacent to many shrubland systems, mountain grassland systems and forested types including montane aspen, ponderosa pine and Douglas-fir forests.

Native Uncharacteristic Conditions

Scale Description

Variance in scale is a result of topography and localized moisture variability.

Issues/Problems

Extreme variability in fire regime, scale, and adjacency make this type difficult to model.

Comments

Additional reviewers were Susan Miller (smiller03@fs.fed.us), Lois Olsen (lolsen@fs.fed.us) and Robert Wooley (rwooley@fs.fed.us). Derived from the Rapid Assessment model R0MTSB (Mountain Shrub, non-sagebrushes). The model was taken as-is.

One reviewer felt that the overall MFI should be reduced to 10-60yrs, dominated by mixed severity fire. The other reviewers agreed with the fire frequency and severity in the model, and it was unchanged.

Peer review for the Rapid Assessment model incorporated on 4/11/2005. Additional reviewers included Thor Stephenson (thor_stephenson@blm.gov), Curt Yanish (curt_yanish@blm.gov) and Gavin Lovell (gavin_lovell@blm.gov). Peer review resulted in the addition of some mixed severity fire in classes B and C. There were disparate opinions about the frequency of fire in this type, ranging from an average fire return interval of 60-100yrs. Adjusting the MFI either direction resulted in only slight adjustments (+/-5%) in the resulting percent in each class. The model was left at an 80yr MFI.

Vegetation Classes

Class A **10%**

Early Development 1 All Structures

Indicator Species* and Canopy Position

AMELA Upper
SYMPH Upper

Upper Layer Lifeform

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

Fuel Model

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

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

Grasses and forbs will dominate, with scattered shrubs in overstory. Grass cover may reach 100%.

Description

Early succession, usually after frequent stand replacement fires. Dominated by grasses and forbs, with some shrubs sprouting. Grass/forb canopy cover will be high and variable (0-100%), but cover of shrubs will be <15%.

This class succeeds to B after ~10yrs.

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Class B **50 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

AMELA Upper
SYMPH Upper
LUPIN Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Shrub 0.6m	Shrub >3.1m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Greater than 40% shrub cover, with sprouting shrubs dominant in scattered openings.

This class succeeds to C after ~70yrs unless replacement fire occurs (causing a transition to class A). Mixed severity fires will not cause a transition to another class.

Class C **40 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

AMELA Upper
SYMPH Upper
LUPIN Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	60 %
Height	Shrub 0m	Shrub >3.1m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Greater than 40% shrub cover; all age classes present but dominated by overmature shrubs and sparse understory except in gaps.

This class persists indefinitely, unless a disturbance (replacement or mixed severity fire) cause a transition (to classes A and B, respectively).

Class D **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

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.

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**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.

Description

Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- ☑ Literature
- ☑ Local Data
- ☐ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	100	20	150	0.01	80
Mixed	400			0.0025	20
Surface					
All Fires	80			0.01251	

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

Arno, S.F. and G.E. Gruell. 1983. Fire history at the forest-grassland ecotone in southwestern Montana. Journal of Range Management 36: 332-336.

Arno, S.F. and G.E. Gruell. 1986. Douglas-fir encroachment into mountain grasslands in southwestern Montana. Journal of Range Management 39: 272-275.

Arno, S.F. and A.E. Wilson. 1986. Dating past fires in curlleaf mountain-mahogany communities. Journal of Range Management 39(3): 241- 243.

Barrett, S.W. 1994. Fire regimes on the Caribou National Forest, Southeastern Idaho. Contract final report on file, Pocatello, ID: USDA Forest Service, Caribou National Forest, Fire Management Division. 25 p.

Bunting, S.C., L.F. Neuenschwander and G.E. Gruell. 1985. Fire ecology of antelope bitterbrush in the Northern Rocky Mountains. Pages 48-57 in: J.E. Lotan and J.K. Brown, compilers. Fire's Effects on Wildlife Habitat— Symposium Proceedings. March 21, 1984, Missoula, Montana. Gen. Tech. Rep. INT-186. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Floyd, M.L., W.H. Romme, and D.D. Hanna. 2000. Fire history and vegetation pattern in Mesa Verde National Park, Colorado, USA. Ecological Applications 10: 1666-1680.

Gruell, G.E., S.C. Bunting and L.F. Neuenschwander. 1985. Influence of fire on curlleaf mountain-mahogany in the Intermountain West. Pages 58-71 in: J.E. Lotan and J.K. Brown, compilers. Fire's Effects on Wildlife Habitat— Symposium Proceedings. March 21, 1984, Missoula, Montana. Gen. Tech. Rep. INT-186. Ogden, UT: USDA Forest Service, Intermountain Research Station.

Martin, R.E. and C.H. Driver 1983. Factors affecting antelope bitterbrush reestablishment following fire. Pages 26-279 in: A.R. Tiedemann and K.L. Johnson, compilers. Research and management of bitterbrush and cliffrose in western North America. Gen. Tech. Rep. INT-152. Ogden, UT: USDA Forest Service,

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Intermountain Forest and Range Experiment Station.

Mueggler, W.F. and W.L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. Gen. Tech. Rep. INT-66. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station, 154 pp.

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

Paysen, T.E., J.R. Ansley, J.K. Brown, G.J. Gottfried, S.M. Haase, M.J. Harrington, M.G. Narog, S.S. Sackett and R.C. Wilson. Chapter 6: Fire in Western Shrubland, Woodland, and Grassland Ecosystems. Pages 121-160 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Rice, C.L. 1983. A literature review of the fire relationships of antelope bitterbrush. Pages 256-265 in: A.R. Tiedemann and K.L. Johnson, compilers. Research and management of bitterbrush and cliffrose in western North America. Gen. Tech. Rep. INT-152. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Shiflet, T.N., ed. 1994. Rangeland cover types of the United States. Denver, CO: Society for Range Management. 152 pp.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [Accessed 6/25/03].

Wright, H.A. 1971. Shrub response to fire. Pages 204-217 in: Wildland shrubs—their biology and utilization. Gen. Tech. Rep. INT-1. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011150 Inter-Mountain Basins Juniper Savanna

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

General Information

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

Modeler 1	Peter Weisberg	pweisberg@cabnr.unr.edu	**Reviewer**	Jon Bates	jon.bates@oregonstate.edu
Modeler 2	Crystal Kolden	ckolden@gmail.com	**Reviewer**	Don Major	dmajor@tnc.org
Modeler 3			**Reviewer**		

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

JUOS ELEL5
ARNO4 PLJA
HECO26
ACHY

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

In NV, western UT and southern ID.

Biophysical Site Description

This ecological system is typically found at lower elevations ranging from 1500-2300m. Occurrences are found on lower mountain slopes, hills, plateaus, basins and flats. The juniper savanna ecotype generally occurs in local, geologically confined, badland environments and is limited in its distribution. Occurs at the lower altitudinal limits for tree species, below the pinyon-juniper woodland type but at or above sagebrush semi-desert and salt desert shrubland in locations where soil moisture is limiting.

Vegetation Description

The vegetation is typically open savanna, although there may be inclusions of more dense juniper woodlands. This savanna is typically dominated by Juniperus osteosperma trees with sparse cover of black sagebrush and perennial bunch grasses and forbs, with Elymus elymoides, Achnatherum hymenoides (=Oryzopsis hymenoides), Hesperostipa comata and Pleuraphis jamesii (more southern locations) being most common. Pinyon trees are typically not present because sites are outside the ecological or geographic range of Pinus edulis and Pinus monophylla.

Disturbance Description

Uncertainty exists about the fire frequencies of this ecological system. It is likely that fires were very infrequent in this ecotype that has inherently low productivity. Fire occurrence was primarily determined by fire occurrence in the surrounding matrix vegetation. Lightning-ignited fires typically did not affect more than a few individual trees. Replacement fires were rare (average FRI of >300-1000yrs) and occurred primarily during extreme fire behavior conditions, particularly when preceded by wetter years associated with high herbaceous production. Fire regime primarily determined by adjacent communities, as fire rarely

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**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.

originated within the community. Mixed severity fire (average FRI of 200-500yrs) was characterized as a mosaic of replacement and surface fires distributed through the patch at a fine scale (<0.1ac). Surface fire could occur in stands where understory grass cover was high and provided adequate fuel. Surface fire was primarily responsible for producing fire scars on juniper trees in older stands (average FRI of 500yrs).

Adjacency or Identification Concerns

This system is generally found at lower elevations and more xeric sites than Great Basin Pinyon-Juniper Woodland (BpS 1019) or Colorado Plateau Pinyon-Juniper Woodland (BpS 1016).

In modern days, surrounding matrix vegetation has changed to young mid-aged woodlands that burn more intensely than the former sagebrush matrix that they encroached upon during the last century of fire exclusion or livestock grazing. Many lay-people confuse these younger juniper woodlands with true woodland sites dependent on naturally fire-protected features.

Also occurring under post-settlement management of woodlands (both fire exclusion and the reduction of grasses that would prevent woody establishment) is the uncharacteristic growth of younger trees amongst older trees. These canopy closures allow fires to crown and kill older trees (>200yrs) that would normally not experience these fires in unproductive soils.

Native Uncharacteristic Conditions

Scale Description

Juniper steppe was usually distributed across the landscape in patches that range from 10s to 100s of acres in size. In areas with very broken topography and/or mesa landforms this type may have occurred in patches of several hundred acres.

Issues/Problems

Uncertainty exists about the fire frequencies of this ecological system because juniper does not generally survive fire and most fire studies for pinyon and/or juniper are from other regions with fire scars recorded on conifers that experience more frequent fire.

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 reviewed BpS 1125 for MZ18 with no changes recommended. Reviewer does not consider himself an expert of this system, therefore he was not retained as a modeler. Louis Provencher (lprovencher@tnc.org) made editorial changes and adjusted to 15% cover the cutoff between mid-open and late-open to achieve mutually exclusive cover classes.

Note for MFSL by L. Provencher: classes D (100-400yrs) and E (400yrs+) cannot be distinguished by cover or height. The main difference between these classes is DBH and the shape of tree crowns: rounder crowns for older trees.

This is essentially the same model as R2PIJU developed by Steve Bunting (sbunting@uidaho.edu), Krista Waid-Gollnick (krista_waid@blm.gov) and Henry Bastian (henry_bastian@ios.doi.gov) for juniper and/or pinyon savanna. Mean FRIs are somewhat longer due to the more arid Great Basin context. Reviewers of R2PIJU were George Gruell (ggruell@charter.net), Jolie Pollet (jpollet@blm.gov) and Peter Weisberg (pweisberg@cabnr.unr.edu).

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**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.

10/01/07: As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for surface severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

Vegetation Classes

Class A 2%

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

HECO26	Upper
ELEL5	Upper
ACHY	Upper
CRYP	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Initial post-fire community dominated by annual forbs. Later stages of this class contain greater amounts of perennial grasses and forbs. Evidence of past fires (charcoal) can be observed. Duration 20yrs with succession to B, mid-development open. Replacement fire occurs every 300yrs on average. Infrequent mixed severity fire (average FRI of 200yrs) thins vegetation but has no effect on succession age.

Class B 2%

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

HECO26	Mid-Upper
ARNO4	Upper
ELEL5	Mid-Upper
ACHY	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Dominated by perennial forbs and grasses, with early shrub establishment. Total cover remains low due to shallow unproductive soil. Duration 20yrs with succession to C unless infrequent replacement fire (FRI of 300yrs) returns the vegetation to A. It is important to note that replacement fire at this stage does not eliminate perennial grasses, thus, in reality, succession age in A after this type of fire would be older than zero and <20yrs. Mixed severity fire (average FRI of 200yrs) thins the woody vegetation but does not change its succession age.

Class C 6%

Mid Development 2 Open

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

ARNO4	Middle
ELEL5	Low-Mid
JUOS	Upper
ACHY	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Tree 0m	Tree 5m
Tree Size Class	Seedling <4.5ft	

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

Juniper seedlings emerging from vegetation dominated by shrubs. Canopy cover of shrubs 10-20%. Height of shrubs 0.2-0.5m.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Shrub dominated community (10-25% cover) with young juniper seedlings becoming established. Duration 60yrs with succession to D unless replacement fire (average FRI of 300yrs) causes a transition to A. It is important to note that replacement fire at this stage does not eliminate perennial grasses, thus, in reality, succession age in A after this type of fire would be older than zero and <20yrs. Mixed severity fire as in B.

Class D **25 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

JUOS	Upper
ARNO4	Middle
ELEL5	Low-Mid
ACHY	Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	30 %
Height	Tree 0m	Tree 10m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Community dominated by young to mature juniper of mixed age structure. Juniper becoming competitive on site and beginning to affect understory composition. Duration 300yrs with succession to E unless replacement fire (average FRI of 1000yrs) causes a transition to A. Mixed severity and surface fire are less frequent than in previous states (500yrs).

Class E **65 %**

Late Development 2 Open

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

JUOS	Upper
ARNO4	Middle
ELEL5	Lower
ACHY	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	30 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Very Large >33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Site dominated by widely spaced old juniper. Grasses (eg, Hesperostipa comata) present on microsites sites with deeper soils (>20in) with restricting clay subsurface horizon. Shrubs present. Replacement fire is rare (average FRI of 1000yrs). Mixed and surface fire every 1000yrs on average will scar ancient trees. Duration 600yrs+.

Disturbances

Fire Regime Group:** III

Historical Fire Size (acres)

Avg 5
Min 1
Max 100

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	833	100	1000	0.00120	22
Mixed	417	100	1000	0.0024	44
Surface	555			0.00180	33
All Fires	185			0.00540	

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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**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.

Additional Disturbances Modeled

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

References

Alexander, R.R and F. Ronco, Jr. 1987. Classification of the forest vegetation on the National Forests of Arizona and New Mexico. Res. Note RM-469. Fort Collins, CO: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station. 10 pp.

Anderson, H.E. 1982. Aids to Determining Fuel Models For Estimating Fire Behavior. Gen. Tech. Rep. INT-122. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 22 pp.

Arno, S.F. 2000. Fire in western forest ecosystems. Pages 97-120 in: J.K. Brown and J. Kapler-Smith, eds. 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.

Baker, W.L. and D.J. Shinneman. 2004. Fire and restoration of pińon-juniper woodlands in the western United States. A review. Forest Ecology and Management 189: 1-21.

Blackburn, W.H., and P.T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in east-central Nevada. Ecology 51: 841-848.

Bradley, A.F., N.V. Noste and W.C. Fischer. 1992. Fire Ecology of Forests and Woodlands in Utah. Gen. Tech. Rep. GTR- INT-287. Ogden, UT: USDA Forest Service, Intermountain Research Station. 127 pp.

Brown, J. K. and J. Kapler-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.

Erdman, J.A. 1970. Pinyon-juniper succession after natural fires on residual soils of Mesa Verde, Colorado. Science Bulletin, Biological Series - -Volume XI, No. 2. Provo, UT: Brigham Young University. 26 pp.

Everett, R.L. and K. Ward. 1984. Early Plant Succession on Pinyon-Juniper Controlled Burns. Northwest Science 58: 57-68.

Eyre, F.H., ed. 1980. Forest cover types of the United States and Canada. Washington, DC: Society of American Foresters. 148 pp.

Goodrich, S. and B. Barber. 1999. Return Interval for Pinyon-Juniper Following Fire in the Green River Corridor, Near Dutch John, Utah. In: USDA Forest Service Proceedings RMRS-P-9.

Gruell, G. E. Historical and Modern Roles of Fire in Pinyon-Juniper. Pages 24-28 in: Proceedings, USDA Forest Service RMRS-P-9.

Gruell, G.E., L.E. Eddleman and R. Jaindl. 1994. Fire History of the Pinyon-Juniper Woodlands of Great Basin National Park. Technical Report NPS/PNROSU/NRTR-94/01. U.S. Department of Interior, National Park Service, Pacific Northwest Region. 27 pp.

Hardy, C.C., K.M. Schmidt, J.P. Menakis and R.N. Samson. 2001. Spatial data for national fire planning and

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fuel management. Int. J. Wildland Fire. 10(3&4): 353-372.

Hessburg, P.F., B.G. Smith, R.B. Salter R.D. Ottmar and E. Alvarado. 2000. Recent changes (1930s-1990s) in spatial patterns of interior northwest forests, USA. Forest Ecology and Management 136: 53-83.

Kilgore, B.M. 1981. Fire in ecosystem distribution and structure: western forests and scrublands. Pages 58-89 in: H.A. Mooney et al., technical coordinators. Proceedings: Conference on Fire Regimes and Ecosystem Properties, Honolulu, 1978. Gen. Tech. Rep. WO-GTR-26.

Kuchler, A.W. 1964. Potential Natural Vegetation of the Conterminous United States. American Geographic Society Special Publication No. 36. 116 pp.

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications. Terrestrial ecological systems of the Great Basin US: DRAFT legend for Landfire project. NatureServe Central Databases. Arlington, VA. Data current as of 4 November 2004.

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

Ogle, K. and V. DuMond. 1997. Historical Vegetation on National Forest Lands in the Intermountain Region. Ogden, UT: USDA Forest Service, Intermountain Region. 129 pp.

Ott, J.E., E.D. McArthur and S.C. Sanderson. 2001. Plant community dynamics of burned and unburned sagebrush and pinyon-juniper vegetation in west-central Utah. Pages 177-190 in: Proceedings, USDA Forest Service RMRS-P-9.

Romme, W.H., L. Floyd-Hanna and D. Hanna. 2002. Ancient Pinyon-Juniper forests of Mesa Verde and the West: A cautionary note for forest restoration programs. In: Conference Proceedings – Fire, Fuel Treatments, and Ecological Restoration: Proper Place, Appropriate Time, Fort Collins, CO, April 2002. 19 pp.

Schmidt, K.M., J.P. Menakis, C.C. Hardy, W.J. Hann and D.L. Bunnell. 2002. Development of coarse-scale spatial data for wildland fire and fuel management. Gen. Tech. Rep. RMRS-GTR-87. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 41 pp. + CD.

Soule', P.T. and P.A. Knapp. 1999. Western juniper expansion on adjacent disturbed and near-relict sites. Journal of Range Management 52: 525-533.

Soule', P.T. and P.A. Knapp. 2000. Juniperus occidentalis (western juniper) establishment history on two minimally disturbed research natural areas in central Oregon. Western North American Naturalist (60)1: 26-33.

Stein, S.J. 1988. Fire history of the Paunsaugunt Plateau in southern Utah. Great Basin Naturalist. 48: 58-63.

Tausch, R.J. and N.E. West. 1987. Differential establishment of pinyon and juniper following fire. The American Midland Naturalist 119(1): 174-184.

USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (2002, December). Fire Effects Information System, [Online]. Available: http://www.fs.fed.us/database/feis/ [Accessed: 11/15/04].

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**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.

Ward, K.V. 1977. Two-year vegetation response and successional trends for spring burns in the pinyon-juniper woodland. M.S. Thesis, University of Nevada, Reno. 54 pp.

Wright, H.A., L.F. Neuenschwander and C.M. Britton. 1979. The role and use of fire in sagebrush-grass and pinyon-juniper plant communities. Gen. Tech. Rep. INT-GTR-58. Ogden, UT: USDA Forest Service, Intermountain Research Station. 48 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: 501-505.

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011230 Columbia Plateau Steppe and Grassland

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Eric Limbach	eric_limbach@blm.gov	**Reviewer**	Jon Bates	jon.bates@oregonstate.edu
Modeler 2			**Reviewer**		
Modeler 3			**Reviewer**		

Vegetation Type

Upland Grassland/Herbaceous

Map Zone

10

Model Zone

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

Dominant Species*

LETR5
MURI
ARCAV2
ELTR7

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Geographic Range

ID, Nevada, and OR. This system occurs throughout much of the Columbia Plateau.

Biophysical Site Description

Elevations range from 5000-5500ft. This type is mostly found with basalt or rhyolite substrate. Soils range from relatively very deep, medium to fine textured, imperfectly drained, and non-saline often with a microphytic crust. BpS is often associated with large depressions that accumulate soil moistures. Temperature regime is usually frigid. Slopes are generally less than two percent.

Vegetation Description

These are grasslands within the sagebrush shrub-steppe ecological system and share the same species but in different proportions. This grassland is dominated by rhizomatous perennial grasses and forbs (>75% cover) sometimes with a sparse (<10% cover) shrub layer. Associated graminoids include creeping wildrye, mat muly and slender wheatgrass. Common forbs are poverty weed and dandelion. Grasslands are used abundantly by greater sage grouse, antelope and other native herbivores.

Disturbance Description

Wet cycles (mean 55yrs) or fire eliminated shrubs from the community. Fire frequency is presumed to be about 50yrs maintaining this system as a grassland. Fire interval was probably coupled to those of the surrounding sagebrush steppe.

Native herbivory is very likely in this system. During presettlement times antelope and, even, bison, if the species reached the southern Columbia Plateau, were likely herbivores.

Adjacency or Identification Concerns

Similar system on drier sites would be dominated by mountain silver sagebrush (>25% shrub cover).

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Sites are suitable for conversion via dryland pasture grass seeding.

Fine-textured soils are prone to compaction with heavy off-highway vehicle and grazing use.

With ground disturbance sites are prone to increase in tap-rooted and annual, weedy forbs, increase in shrubs and increase in less desirable forbs (poverty weeds).

Native Uncharacteristic Conditions

Scale Description

Stands vary from ten acres to 300ac in size on the southern Columbia Plateau. Grasslands are often associated with large depression areas within the sagebrush matrix.

Issues/Problems

Comments

This model is identical to the model from MZ18 with minor modifications to the description.

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.

BpS 1123 from MZs 12 and 17 was accepted by Eric Limbach (eric_limbach@blm.gov) for MZ18 with one important correction: Replacement fire is expected to have a MRI of 50yrs for both classes, but it was programmed to have a MRI of 100yrs for class B. Correcting this error changed the percentages from 80% to 70% for class A and from 20% to 30% for class B.

Jon Bates (jon.bates@oregonstate.edu) reviewed BpS 1065 for MZ18 and did not recommend changes. The reviewer does not consider himself an expert of this system.

BpS 1123 for MZs 12 and 17 was developed by Cheri Howell (chowell02@fs.fed.us) and substantially revised by Mize Zielinski (mike_zielinski@nv.blm.gov).

Original model and description of BpS 1123 was developed for a higher elevation grassland that may not be present on the Columbia Plateau. Reviewers recommend substantial changes to the original model and description by using NRCS ecological site descriptions for depression grasslands on the Columbia Plateau. Class C was removed from 3-box model, duration of class A was extended, wet cycles were introduced as a disturbance removing shrubs and the MFRI was extended from 20yrs to 50yrs. It is believed that elevation of the water table for a long period is more critical for shrub removal than fire.

Vegetation Classes

Class A **65 %**

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

LETR5	Upper
MURI	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	50 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

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**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.

Description

Grassland dominated by rhizomatous grasses from 30-50% cover. Succession to class B after 55yrs. Replacement fire occurs every 50yrs on average.

Class B **35 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

ARCAV2 Upper
LETR5 Upper
MURI Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	50 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

[x] Upper layer lifeform differs from dominant lifeform.

Dominant cover is herbaceous (generally <60%) with shrubs coverage from 30-50%.

Description

Grasslands with significant shrubs (mountain silver sagebrush) cover (30-50%). Wet cycles remove shrubs every 55yrs on average. Replacement fire occurs every 50yrs on average.

Class C **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

Class D **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

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

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**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.

Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 10
Min 1
Max 300

Sources of Fire Regime Data

- [x] Literature
- [x] Local Data
- [x] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	50	20	100	0.02	100
Mixed					
Surface					
All Fires	50			0.02002	

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
- [x] Wind/Weather/Stress
- [x] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Hironaka, M., M.A. Fosberg and A.H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Forest, Wildlife and Range Experiment Station, University of Idaho, Moscow, ID

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Systems of the United States. Natural Heritage Central Databases. NatureServe, Arlington, VA.

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

Peck, N.L. and M.E. Jensen. 1987. Sagebrush-grass community types of the Humboldt National Forest. Elko, NV

USDA-NRCS. 2005. The PLANTS Database (http://plants.usda.gov, 2005). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.

USDA-NRCS. 1992. Major Land Resource Area 25, Owyhee High Plateau Ecological Site Descriptions. Elko, NV. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011240 **Columbia Plateau Low Sagebrush Steppe**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Jon Bates	jon.bates@oregonstate.edu	**Reviewer**
Modeler 2			**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type
Upland Shrubland

Map Zone
10

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

Dominant Species*
ARAR8 FEID
ARARL CHVI8
ACTH7
PSSP6

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
Eastern OR, northern, central and western NV (at higher elevations) and southern ID. BpS will occur in large patches in eastern and central NV where similar substrates are found on higher elevation mountain tops and mesas.

Biophysical Site Description
This type describes low sagebrush on shallow soils where a clay pan produces a seasonally perched water table. Occurs on lowlands, erosional fan remnants, pediments of volcanic, granitic or quartzite base material, rock pediment remnants, side slopes and summits of mountains, and foothills. Subsoils swell on wetting and crack on drying, depth to a fine-textured subsoil ranges from 5-10in, and tend to have a high percentage of course fragments (gravels, cobbles, rocks or stones). Where soils are influenced by aeolian calcareous dust additions originating from local playas or another source, black sage can occur. Low sage tends to grow where claypan layers exist in the soil profile and soils are often saturated during a portion of the year. Elevations range from 1000m at higher latitudes to 3000m in lower latitudes. Where concave areas or drainages occur, Wyoming or basin big sagebrush (at lower elevations) and mountain big sagebrush (at higher elevations) will dominate. Precipitation is 10-16in.

Vegetation Description
This type includes communities dominated by low sagebrush (Artemisia arbuscula), low gray sagebrush (Artemisia arbuscula ssp. arbuscula), and in some cases, early sagebrush (Artemisia arbuscula subsp. longiloba) replaces low sagebrush. Although these types do not usually grow in combination, they do share similar fire regimes. Other shrubs growing on site may include antelope bitterbrush (Purshia tridentata) and/or Douglas rabbitbrush (Chrysothamnus viscidiflorous). Dwarf sagebrushes generally have relatively low fuel loads with low growing and cushion forbs and scattered bunch grasses such as bluebunch wheatgrass (Pseudoroegneria spicata), needlegrasses (Achnatherum spp), Sandberg's bluegrass (Poa

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secunda), Idaho fescue (Festuca idahoensis), Prairie junegrass (Koeleria macrantha), Thurber's needlegrass (Achnatherum thurberanium) and Indian ricegrass (Achnatherum hymenoides). The presence of Idaho fescue does not occur in more southerly and easterly dwarf-sage sites. Forbs often include buckwheats (Eriogonum spp), fleabanes (Erigeron spp), phloxs (Phlox spp), paintbrushes (Castilleja spp), goldenweeds (Haplopapus spp), hawksbeard (Crepis spp) and lupines (Lupinus spp).

Disturbance Description

Low sagebrush generally supports less fire than black sagebrush. This type generally burns more frequently with mixed severity (average FRI of 75-125yrs) because of the dominance of fine fuel on the site. Less bare ground than black sagebrush sites, allowing for more frequent mixed severity fire and less stand-replacing. Stand-replacing fires (average FRI of 230-250yrs) can occur in this type when successive years of above average precipitation are followed by a dry winter, dry spring and high winds are present with dry lightning (Miller and Rose 1999). Stand-driven replacing fires are primarily wind-driven and only cover small areas. This type fits best into Fire Group III.

Grazing by wild ungulates occurs in this type due to it's high palatability (mostly for A. nova and A. arbuscula) compared to other browse. Native browsing tends to open up the canopy cover of shrubs but does not often change the successional stage.

Low and early sagebrush types can be pockmarked by burrowing animals, especially ants, breaking through the root restrictive zone and creating a seedbed that is readily colonized by sagebrush. Burrowing creates small patches (ie, generally <200 sq. ft) of big sagebrush in the low sagebrush types, which could affect fuel loads. This was not considered in the model.

Adjacency or Identification Concerns

The low sagebrush type tends to occur over broad areas, with pockets of black sagebrush where there is a calcareous substrate, and Wyoming or mountain big sagebrush (in northern latitudes) in drainages or small concave pockets of deeper soils. In NV, where low sagebrush occurs at higher elevations, in rocky, open stands, pockets of curlleaf mountain mahogany with an understory of mountain sagebrush occur along the drainages.

Cheatgrass (Bromus tectorum) is likely to invade this site after disturbance, although not at higher elevations.

Native Uncharacteristic Conditions

Scale Description

Low sagebrush communities can occur in small to 10000ac areas on mountains ranges. Disturbance patch size for this type is not well known but is estimated to be 10s to 100s of acres due to the relatively small proportion of the sagebrush matrix it occupies and the limited potential for fire spread.

Issues/Problems

D. Major- "bare ground" needs to be defined in veg /class descriptions.

Comments

This model is identical to the model from MZ18 with minor modifications to the description.

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) accepted BpS 1124 from MZs 12 and 17 (developed by Crystal

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Golden, ckolden@gmail.com, and Gary Medlyn, gmedlyn@nv.blm.gov) with very few changes made to the description. Changes made by Jon Bates were: 1) Crepis spp was added to the species list. 2) Medusahead invasion into low sagebrush is cited as a potential problem (eg, Jordan Valley in OR and Owyhee uplands) after fire. 3) An error was corrected for class C under Upper Layer Lifeform not the dominant life form: Canopy cover 16-30% (not 10-15% as previously noted).

Reviewers of BpS 1124 for MZs 12 and 17 were Mike Zielenski (mike_zielinski@nv.blm.gov) and Terri Barton (terri_barton@nv.blm.gov), whose revisions changed appreciably the model and description.

BpS 1124 was based on R2SBDW developed by Gary Medlyn (gmedlyn@nv.blm.gov) and Sarah Heidi (sarah_heidi@blm.gov). Reviewers of R2SDDW were Mike Zielinski (mike_zielinski@nv.blm.gov), Gary Back (gback@srk.com) and Paul Tueller (ptt@intercomm.com). Modifications were made to BpS 1124 after reviews: 1) longer mean FRI for mixed severity fire in mid-development; 2) shorter mean FRI in late development; 3) longer mean FRI for replacement fire in late development; and 4) removal of short term drought effects throughout.

Suggested reviewers for BpS 1124 MZs 12 and 17: Mike Zielinski (mike_zielinski@nv.blm.gov) and Ed Horn (ed_horn@or.blm.gov).

10/01/07: 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

Class A 10%

Early Development 1 All Structures

Indicator Species* and Canopy Position

PSSP6	Middle
CHVI8	Upper
FEID	Middle
ACTH7	Middle

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☑ Upper layer lifeform differs from dominant lifeform.

Dominant life form is herbaceous (15-25% cover), however rabbitbrush will be the upper layer life form at less than six percent cover.

Description

Early seral community dominated by herbaceous vegetation; less than six percent sagebrush canopy cover; up to 24yrs post-disturbance. Replacement fire occurs every 250yrs on average. Succession to B after 24yrs.

Class B 70%

Late Development 1 Open

Indicator Species* and Canopy Position

ARAR8	Upper
CHVI8	Middle
PSSP6	Middle
ACTH7	Middle

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model 2

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	20 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☑ Upper layer lifeform differs from dominant lifeform.

Dominant life form is herbaceous with cover 15-25%. Height 0.2-0.4m.

Description

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**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.

Mid-seral community with a mixture of herbaceous and shrub vegetation; 6-15% sagebrush canopy cover present; between 20-59yrs post-disturbance. Drought every 3-4yrs reduces the herbaceous cover. Replacement fire (FRI of 250yrs) causes a transition to A, whereas mixed severity fire (FRI of 150yrs) maintains the site in its present condition. In the absence of fire for 120yrs, the site will follow an alternative successional path to C. Otherwise, succession and mixed severity fire keeps site in class B.

Class C **20 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

ARAR8	Upper
FEID	Middle
ARARL	Upper
PSSP6	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	30 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

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

Herbaceous component is co-subdominant with shrub cover. Canopy cover 16-30%. Height 0.2-0.4m.

Description

Late seral community with a mixture of herbaceous and shrub vegetation; >15% sagebrush canopy cover present; 75yrs+ post-disturbance. In class C, replacement fire is every 250yrs on average (transition to A), whereas mixed severity fire happens on average every 100yrs. Mixed severity fire causes a transition to B. Succession will keep the site in class C without fire.

Class D **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

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

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Fire Regime Group:** III

Historical Fire Size (acres)

Avg 90
Min 1
Max 2000

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	250	250	250	0.004	36
Mixed	143			0.00699	64
Surface					
All Fires	91			0.01100	

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

Blackburn, W.H. and P.T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in east-central Nevada. Ecology 51(5): 841-848.

Chambers, J.C. and J. Miller, editors. 2004. Great Basin riparian areas: ecology, management, and restoration. Society for Ecological Restoration International, Island Press. 24-48.

Miller, R.F. and J.A. Rose. 1999. Fire history and western juniper encroachment in sagebrush steppe. Journal of Range Management 52: 550-559.

Miller, R.F., T.J. Svejcar and J.A. Rose. 2000. Impacts of western juniper on plant community composition and structure. Journal of Range Management 53: 547-585.

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

USDA-NRCS 2003. Ecological site descriptions for Nevada. Technical Guide Section IIE. MLRAs 28B, 28A, 29, 25, 24, 23. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

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 sStand. Journal of Range Management 34: 501-505.

Young, J.A. and D.E. Palmquist. 1992. Plant age/size distributions in black sagebrush (Artemisa nova): effects on community structure. Great Basin Naturalist 52(4): 313-320.

Zamora, B. and P.T. Tueller. 1973. Artemisia arbuscula, A. longiloba, and A. nova habitat types in northern Nevada. Great Basin Naturalist 33: 225-242 .

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011250** **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** 11/18/2005

Modeler 1	Diane Abendroth	Diane_Abendroth@nps.gov	**Reviewer**	anonymous	
Modeler 2			**Reviewer**	Don Bedunah	bedunah@forestry.umt.edu
Modeler 3			**Reviewer**	Shannon Downey	shannon_downey@blm.gov

Vegetation Type
Upland Shrubland

Dominant Species*
ARTRT
ARTRW
HECO26
ELTR7

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Map Zone
10

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

Geographic Range

This widespread matrix-forming ecological system occurs throughout much of the Columbia Plateau, northern Great Basin, and plains of MT and WY.

Biophysical Site Description

This type is found between 3000-7000ft elevation. Soils are typically deep and non-saline, often with a microphytic crust.

Vegetation Description

A moderately dense canopy of basin big sagebrush (Artemisia tridentata spp. Tridentata) with Artemisia tridentata ssp wyomingensis, and/or Purshia tridentata codominating. Atriplex confertifolia, Chrysothamnus viscidiflorus, Ericameria nauseosa, or Tetradymia spp may be common especially in disturbed stands.

The herbaceous understory will have cover >25%. Understory grasses include slender wheatgrass (Pseudoroegneria spicata), Thurber needlegrass, (Achnatherum thurberianum), needle and thread (Hesperostipa comata), basin wildrye (Leymus cinerius), squirreltail (Elymus elymoides), western wheatgrass (Pascopyrum smithii), bluebunch wheatgrass (Pseudoroegneria spicata). Forbs are typically sparse, and include Phlox hoodii, Arenaria spp., Astragalus spp., hawskbeard (Crepis acuminata), bird's beak (Cordylanthus spp.), blue bell (Mertensia spp.), lupine (Lupinus spp.), and buckwheat (Eriogonum spp.).

Disturbance Description

Fire regime group IV, but may also encompass III and IV. Fire return intervals are estimated to average

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approximately 60yrs, and range from 10-150yrs. However, questions have recently been raised about the frequency of fire as related to neighboring vegetation types (Baker 2004, in press). Fires were mostly replacement severity (Tirmenstein 1999). Mixed severity fire was probably present where fuels were discontinuous, though there is disagreement about the role of replacement fire in this type. Ignition sources probably included native burning under reference conditions (Barrett and Arno 1982, 1999).

Drought may have caused replacement disturbances rarely (e.g., once every 1000yrs) and mixed-severity disturbance more frequently (e.g., once every 50yrs). Under current conditions, drought has recently cause approximately 20% mortality in some portions of Wyoming.

Insects and disease would have been replacement and mixed-severity disturbances in this type, but little information exists on the frequency of these disturbances under reference conditions. They are not modeled here.

Native grazing by large ungulates, including bison, elk, mule deer, and pronghorn would have maintained open conditions and caused rare, small degraded sites (i.e., wallows) that may have occupied <5% of the landscape. This disturbance is not modeled here.

Adjacency or Identification Concerns

Basin big sagebrush grows in association with Wyoming big sagebrush, mountain big sagebrush, and desert shrub communities. Distribution is a result of local soil characteristics on a fine scale (1-500 acres). Much of this type has been lost due to land clearing for agriculture or converted to a cheatgrass or greasewood type.

This BpS may be similar to the Rapid Assessment PNVG R2SBBB for the Great Basin model zone, but has some differences due to geographic variability.

Native Uncharacteristic Conditions

Scale Description

Fuels may be continuous resulting in spread throughout patches. Disturbance size therefore probably resembles the patch size of the vegetation.

Issues/Problems

It is difficult to map and identify the subspecies of big sagebrushes (Artemesia tridentata) without the aid of field assessments.

Comments

This model was adopted as-is, with only slight modifications to the description, from the Rapid Assessment model R0SBBB. Additional reviewers of the Rapid Assessment model were Karen Clause (karen.clause@wy.usda.gov), Dennis Knight (dhknight@uwyo.edu); Thor Stephenson (thor_stephenson@blm.gov), Curt Yanish (curt_yanish@blm.gov), and Gavin Lovell (gavin_lovell@blm.gov); and Eve Warren (eve_warren@blm.gov).

There was considerable disagreement among Rapid Assessment reviewers about how to model this type. All comments were incorporated into the description. The following changes were made to the quantitative model based on peer review:
-mixed severity fire was added to the model without changing the overall MFI. Several reviewers agreed that mixed fire should be included, though they disagreed at what proportion.
-drought was added as a disturbance agent, causing both replacement type disturbances (once in 1000yrs) and mixed-severity disturbances (once every 50yrs).

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-the proportion of fire was redistributed among the three classes so that class B had a higher likelihood of fire than class A or C.
These changes resulted in the following changed results in the model: class A changed from 30% to 20%; class B changed from 40% to 30%; class C changed from 30% to 50%.

The following items reviewers disagreed upon or did not have data to support and so were not included in the model, but were added to the description:
-the frequency and severity of insects, disease, and native grazing disturbances.
-whether or not two additional classes (mid-closed and late-open) should be added.
-the frequency of fire in this system. Estimates ranged from 40yrs to 150yrs. The model was left at an overall MFI of 60yrs, as several reviewers agreed upon this number.

Vegetation Classes

Class A 20 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

LECI4
ELTR7
HECO26
SAVE4

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	no data	

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

Vegetation is primarily herbaceous (>25% cover) with a few scattered shrubs (typically <5% cover).

Description

Grass-dominated community. If soils are alkaline, resprouting greasewood may also be present. This class lasts up to 20yrs post disturbance and succeeds to mid-development open (class C) unless drought or replacement fire cause stand-replacing disturbance.

Class B 30 %

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

ARTRT
ELTR7
HECO26
SAVE4

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	60 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	no data	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Mature and overmature sagebrush with suppressed understory. Cover will rarely exceed 40%. This condition begins at age 50 and can perpetuate until disturbance causes a transition to another class. Replacement fire and drought may cause a transition to class A. Mixed severity fire will cause a transition to class C, but is relatively rare.

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Class C 50 %

Mid Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model

Indicator Species* and Canopy Position

ARTRT
HECO26
SAVE4
LECI4

Structure Data (for upper layer lifeform)

	Min	Max
Cover	11 %	30 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	no data	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Sagebrush dominated open shrub community with abundant grasses. This class lasts approximately 20-50yrs post disturbance and succeeds to late-development closed (class B) unless replacement fire or drought cause a transition to class A. Mixed severity fire maintains this condition.

Class D 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

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:** III

Historical Fire Size (acres)

Avg
Min
Max

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	100	10	150	0.01	60
Mixed	150			0.00667	40
Surface					
All Fires	60			0.01668	

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.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Additional Disturbances Modeled

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

References

Baker, W.L. and D.J. Shinneman. 2004. Fire and restoration of pinyon-juniper woodlands in the western United States: a review. Forest Ecology and Management 189: 1-21.

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

Barrett, S.W. and S.F. Arno. 1982. Indian fires as an ecological influence in the Northern Rockies. Journal of Forestry. 80(10): 647-651.

Barrett, S.W. and S.F. Arno. 1999. Indian fires in the Northern Rockies: Ethnohistory and ecology. Pages 50-64 in: R. Boyd, ed. Indians, fire, and the land in the Pacific Northwest. Corvallis, OR: Oregon State University.

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

Tirmenstein, D. 1999. Artemisia tridentata spp. tridentata. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2004, September 9].

Tirmenstein, D. Sarcobatus vermiculatus. 1987. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2004, September 10].

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.

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011260** **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** 11/18/2005

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Modeler 2	Steve Rust	srust@idfg.idaho.gov	**Reviewer**	Carly Gibson	cgibson@fs.fed.us
Modeler 3	Susan Miller	smiller03@fs.fed.us	**Reviewer**	Mary Manning	mmanning@fs.fed.us

Vegetation Type

Upland Savannah/Shrub Steppe

Map Zone

10

Model Zone

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

Dominant Species*

ARTRV SYMPH
PSSP6 BASA
FEID
POSE

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Occurs throughout foothills and at higher, cooler elevations of the Boise, Salmon River, Seven Devils mountains, and throughout western MT and central ID.

Biophysical Site Description

This vegetation type is found on all aspects. Pure stands are found in areas with deeper soils and less topographic relief, but it is also common on slopes with a gradual shift to a mixed mountain shrub community on steeper slopes and in drainages. Elevation ranges from 4000-10000ft and precipitation from 12-20in/year. Soils are deep, well drained. Soil moistures are udic (not dry for as long as 90 cumulative days) and soil temperatures cryic (very cold soils of the Rocky Mountain Region).

Vegetation Description

Mountain sagebrush steppe dominated by mountain big sagebrush, mountain snowberry, and bitterbrush (specifically in MZ10) with a continuous grass and forb understory is believed to be a major presettlement vegetation type for within this map zone, although the exact composition of the community before settlement is unknown.

Dominant shrubs include mountain big sagebrush (Artemisia tridentata ssp. Vaseyana), antelope bitterbrush (Purshia tridentata, MZ10) and mountain snowberry (Symphoricarpos spp). Other common shrubs include serviceberry (Amelanchier alnifolia), wild cherry (two species), rose and currant. Other shrubs may be locally common.

Herbaceous cover is moderate to abundant ranging from 40-85%. Common grasses include: Festuca

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idahoensis, Agropyron spicata (now Pseudoroegneria spicata), Elymus elymoides, Elymus trachycaulus, Hesperostipa comata, Festuca campestris, Koeleria cristata and Poa secunda. Indicative forbs include Eriogonum umbellatum, Antennaria microphyla, Balsamorhiza sagittata, Lupinus spp, Delphinium spp, Castilleja spp and Geranium viscosissimum. Astragalus purshii may be present in the early growing season.

Low sagebrush and basin big sagebrush may be present, forming mosaics with mountain big sagebrush.

This vegetation type may be inclusions within forested types.

Disturbance Description

Fire is a major disturbance factor for mountain big sagebrush (Blaisdell et al 1984, Johnson 2000). Mountain big sagebrush has the fastest recovery rate of the three subspecies of big sagebrush (Johnson 2000; local data). Fire size for this type is larger than other big sagebrush species because of greater fine fuel load, but some unburned pockets remain after fires, often resulting in a patchy mosaic.

The fire return intervals reported in the literature for this type vary from 10-200yrs (Baker in press, Bunting et al 1987, Harniss and Murray 1973, Hironaka et al 1983, Miller and Rose 1999, Wright and Bailey 1982). However, estimating historic fire regimes for sagebrush ecosystems is tenuous at best and often based on fire scar and age structure data from adjacent forest types (eg, ponderosa pine and pinyon/juniper), shrub age structure and fuel characteristics. Fire regimes also vary considerably across the biogeographic range of mountain big sagebrush, based on factors like elevation, soil depth, slope, aspect, adjacent vegetation, frequency of lightning and climate.

Recent data from long term vegetation transects collected over a twenty year period in WY suggest that the recovery of mountain sagebrush steppe communities following fire requires at least 25yrs in northwestern WY and at least 40yrs in southern WY to reach a late seral state with >30% sagebrush cover (Grand Teton National Park/Bridger Teton National Forest Fire Effects Monitoring Data, Southern Wyoming Fire Zone BLM Fire Effects Monitoring Data). If recovery rates are correlated with composite fire return intervals, fire return intervals may lie somewhere between 40-60yrs. However, recent data show that fire return intervals may be twice or more as long as recovery periods, indicating a fire return interval of 70-200yrs (Baker in press). Reviewers of this type disagreed about the frequency of fire in mountain big sagebrush systems, and suggested MFIs ranged from 25yrs to 135yrs.

The severity of fire is also contested in this system. While the majority of fires were likely stand-replacing, some mixed severity fire may have occurred, though there is little data documenting mixed severity fires (Sapsis and Kaufmann 1991). Mixed severity fires were likely small in area, but ignitions may have occurred as frequently as 5-20yrs. There were probably also portions of this system that never carried fire because of sparse fuel (Bushey 1987). Historic fires likely occurred during the summer months and were wind-driven events. Lightning ignitions are variable and affect fire frequency on regional landscapes in the Northern Rockies. Fire may spread from adjacent forested communities.

Mountain big sagebrush does not resprout following fire and recolonization of burned areas must come from either a short-lived seed bank or seed dispersed by plants in unburned patches or adjacent stands (Johnson and Payne 1968, Bushey 1987). Sagebrush may also establish during recruitment pulses related to precipitation in single or successive growing seasons (Anderson and Inouye 2001).

Other disturbances, including drought stress, insects and native grazing, were present under presettlement conditions in this type. Most of these disturbances were mixed-severity, resulting in thinning of sagebrush. Native grazing by deer and elk in MZs 10 and 19 favors the increase of sagebrush cover.

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**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.

Adjacency or Identification Concerns

Differentiation of Mountain Big Sagebrush Steppe from Wyoming Big Sagebrush may be difficult at the ecotone due to physical similarities and hybridization zones (ie, species concepts become blurred). This is not a very big issue for MZs 10 and 19.

Adjacent plant associations on shallow clay soils are dominated by Wyoming sagebrush. Some of these communities may be small enough to occur as inclusions.

Conifer encroachment may occur on this vegetation type (especially Juniperus scopularum to the east and Juniperus occidentalis to the west).

Nearly all sagebrush communities today have been grazed and there are no refugia to use as reference conditions.

Native Uncharacteristic Conditions

Greater than 10% canopy cover by confers can be considered uncharacteristic. Potential causes of encroachment include lack of fire and livestock grazing.

Scale Description

Fires burn in patchy mosaics in this type, and scales ranged from small (tens of acres) to very large (possibly hundreds of thousands of acres). Landscape-scale assessments should probably be in the order of 10000ac for mountain sagebrush steppe communities because of the mosaic nature of vegetation communities, the moderate to long fire mean return intervals, and the extent of the vegetation community.

Issues/Problems

There is a limited amount of information available on fire regimes and reference conditions in sagebrush due to modern overgrazing (the herbaceous component is severely impacted and current information cannot exclude the effects of cattle). Nearly all sagebrush communities today have been grazed - there are few known refugia to use as reference conditions.

Comments

Additional reviewers were Lois Olsen (lolsen@fs.fed.us) and Robert Wooley (rwooley@fs.fed.us). Modifications were made to the structural data to adhere to LANDFIRE standards (Pohl 11/14/2005).

This BpS was adapted from the Rapid Assessment model R0SBMT (Mountain Sagebrush) by Mark Williams and reviewed by Bill Baker (bakerwl@uwyo.edu), Dennis Knight (dhknight@uwyo.edu), Ken Stinson (ken_stinston@blm.gov), Thor Stevenson (thor_stephenson@blm.gov), Gavin Lovell (gavin_lovell@blm.gov), Curt Yanish (curt_yanish@blm.gov) and Eve Warren (eve_warren@blm.gov).

For the Rapid Assessment, this model combined two additional Rapid Assessment models after peer-review: R0MTSBsb (workshop code MSHB2), modeled by Diane Abendroth (Diane_Abendroth@nps.gov) and reviewed by Dennis Knight (dhknight@uwyo.edu), Don Bedunah (bedunah@forestry.umt.edu), Shannon Downey (shannon_downey@blm.gov), Bill Baker (bakerwl@uwyo.edu), Ken Stinson (ken_stinson@blm.gov), Thor Stephenson (thor_stephenson@blm.gov), Curt Yanish (curt_yanish@blm.gov) and Gavin Lovell (gavin_lovell@blm.gov); and R0SBCL (workshop code CSAG1) modeled by George Soehn (george_soehn@blm.gov) and reviewed by Eldon Rash (erash@fs.fed.us) and Reggie Clark (rmclark@fs.fed.us).

Rapid Assessment peer review suggested lumping R0SBMT with R0MTSBsb as their disturbance regimes

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 vegetation composition were nearly identical. R0SBMT was very different from R0SBCL, in fire regime, but the other characteristics were the same. Based on the abundant peer review for R0SBMT, R0SBCL was combined here. Reviewers disagreed about the range of fire frequency for this vegetation type, suggesting MFIs ranging from 25-135yrs. The model was originally developed with an MFI of 50yrs; based on peer review it was increased to 70yrs. This resulted in the following changes in each vegetation class: class A was unchanged; class B changed from 35% to 45%; class C changed from 25% to 20%; class D changed from 35% to 30%.

10/01/07: 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

Class A **20%**

Early Development 1 All Structures

Indicator Species* and Canopy Position

FEID Lower
PSSP6 Lower
ARTRV Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	20 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

☑ Upper layer lifeform differs from dominant lifeform.

Grasses and forbs are the dominant lifeform in this class.

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model

Description

Shrub cover is low, and typically ranges from 0-20%. Herbaceous cover is variable, but is typically at least 30%. This class lasts approximately 10yrs, and then succeeds to mid-development open (class C).

Class B **15%**

Late Development 1 Closed

Indicator Species* and Canopy Position

ARTRV Upper
PSSP6 Lower
FEID Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	60 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model

Description

Sagebrush cover is >40% and rarely exceeds 60%. Understory vegetation has low cover in this class. Insects, drought stress and mixed severity fire cause transitions to class C by thinning sagebrush cover. If no disturbance occurs, this condition can persist.

In ID, Purshia tridentata may be present.

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**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 C 65 %

Mid Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model

Indicator Species* and Canopy Position

ARTRV Upper
FEID Lower
PSSP6 Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	40 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

(This class would also include shrubs >0.5m tall but <20% cover.)

Description

Shrub cover is ,40%. Insects, drought stress and replacement fire are replacement disturbances, causing transitions to class A. Mixed severity fire maintains this class in C. Herbaceous cover is variable in this class. Native grazing of herbaceous species by elk and deer cause succession to class B. In ID, Purshia tridentata may be present.

Class D 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

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- ☑ Literature
- ☑ Local Data
- ☑ Expert Estimate

Fire Intervals	*Avg FI*	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	100	100	166	0.01	26
Mixed	35			0.02857	74
Surface					
All Fires	26			0.03858	

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

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

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

Blaisdell, J.P., R.B. Murray and E. Durant. 1982. Managing Intermountain rangelands -- Sagebrush-grass ranges. GTR INT-134. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 41 pp.

Bunting, S.C., B.M. Kilgore and C.L. Bushey. 1987. Guidelines for Prescribed Burning Sagebrush-Grass Rangelands in the Northern Great Basin. USDA, USFS. Intermtn. Res. Stat. GTR-INT-231.

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

Dorn, R.D. 2001. Vascular Plants of Wyoming. Cheyenne, WY: Mountain West Publishing. 4120 pp.

Gates, D.H. 1964. Sagebrush infested by leaf defoliating moth. J. Range Management. 17: 209-210.

Harniss, R.O. and R.B. Murray. 1973. 30 years of vegetal changes following burning of sagebrush-grass range. Journal of Range Management 26: 322-325.

Hironaka, M., M.A. Fosberg and A.H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Bull.35. Univ. of Idaho, Forest, Wildl. And Range Exp. Statn. Moscow ID 44 pp.

Johnson, K.A. 2000. Artemisia tridentata spp. vaseyana. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2004, September 10].

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Johnson, J.R. and G.E. Payne. 1968. Sagebrush reinvasion as affected by some environmental influences. Journal of Range Management. 21: 209-213.

Miller, F.F. and J.A. Rose. 1999. Fire history and western juniper encroachment in sagebrush steppe. J. Range Management 52: 550-559.

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

Sapsis, D.B. and J.B. Kauffman. 1991. Fuel consumption and fire behavior associated with prescribed fires in sagebrush ecosystems. Northwest Science. 65(4): 173-179.

Tisdale, E.W. 1994. SRM 402: Mountain big sagebrush. Pages 41-42 in: T.N. Shiflet, ed. Rangeland cover types of the United States. Denver, CO: Society for Range Management.

Welch, B. and C. Criddle. 2003. Countering misinformation concerning big sagebrush. Research Paper RMRS-RP-40. Ogden, UT: Department of Agriculture, Forest Service, Rocky Mountain Research Station. 28 pp.

Wright, H. and A. Bailey. 1982. Fire Ecology: United States and Southern Canada. John Wiley and Sons, N.Y., N.Y.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

***Biophysical Setting:* 1011270** **Inter-Mountain Basins Semi-Desert Shrub-Steppe**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Don Major	dmajor@tnc.org	**Reviewer**	Mike Zielinski	mike_zielinski@nv.blm.gov
Modeler 2	Louis Provencher	lprovencher@tnc.org	**Reviewer**	Terri Barton	terri_barton@nv.blm.gov
Modeler 3			**Reviewer**		

Vegetation Type

Upland Savanna and Shrub-Steppe

Dominant Species*

GRSP
TETRA3
ARTRW
ATCO

General Model Sources

☐ Literature
☐ Local Data
☑ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

This ecological system occurs throughout the intermountain western US.

Biophysical Site Description

Found at elevations ranging from 4000-5000ft. The climate where this system occurs is generally hot in summers and cold in winters with low annual precipitation, ranging from 5-10in and high inter-annual variation. Much of the precipitation falls as snow, and growing-season drought is characteristic. Temperatures are continental with large annual and diurnal variation. Sites are generally alluvial fans and flats with moderate to deep soils. Substrates are generally calcareous derived from alluvium, medium to coarse-textured alluvial soils. Soils may be alkaline and typically moderately saline (West 1983).

This group generally lies above salt desert shrub and below sagebrush types. Both to the north and upslope it is bordered by low elevation big sagebrush groups, commonly ARTRWY, ARAR8 and ARNO4 communities. To the south this group is bordered by Mojave Desert transition communities.

Vegetation Description

The plant associations in this system are characterized by a somewhat sparse to moderately dense (10-70% cover) shrub layer of Grayia spinosa, Artemesia tridentata, Ephedra nevadensis, Ephedra viridis, Chrysothamnus viscidiflorus, Sarcobatus vermiculatus or Atriplex canescens. Shrub Tetradymia canescens may be occasionally present. The herbaceous layer is dominated by bunch grasses which occupy patches in the shrub matrix. The most widespread species are Heterostipa comata and Achnatherum hyminoides. Other locally dominant or important species include Leymus cinereus, Pascopyrum smithii, Pleuraphis jamesii, Elymus lanceolatus, Elymus elymoides, Koeleria macrantha, Hesperostipa comata and Poa secunda. Forbs

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**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.

are generally of low importance and are highly variable across the range, but may be diverse in some occurrences. Species that often occur are Astragalus, Oenothera, Eriogonum and Balsamorhiza. Mosses and lichens may be important ground cover.

Disturbance Description

Disturbance is unpredictable in these systems. However, drought, insects and fire may all occur here. Drought periods occurred approximately every 75yrs.

Documented Mormon cricket/grasshopper outbreaks since settlement have corresponded with drought; outbreaks cause shifts in composition amongst dominant species, but do not typically cause shifts to different seral stages. Therefore insect disturbance was not modeled. During outbreaks Mormon crickets prefer open, low plant communities. Herbaceous communities and the herbaceous component of mixed communities were more susceptible to cricket grazing.

Fire was infrequent and somewhat dependent on fire importation from the upper sagebrush zone. Replacement fire was the primary fire with mean FRI (200-300yrs) increasing with shrub development intermixed with grass.

Adjacency or Identification Concerns

This BpS is transitional between salt desert shrub (1081) and Inter-Mountain Basins Big Sagebrush Shrublands (1080) and is truly considered a higher elevation type of salt desert shrublands. Intermingling of both ecological systems on different lifeforms and aspects on alluvial fans creates this BpS.

This ecological system contains the typical Great Basin salt desert shrub communities. Salt desert shrub is also common in the Wyoming big sagebrush community and there is some species overlap. A wide range of salt desert shrubs can occur in this group.

Indian ricegrass can dominate sites with sand sheets, or surfaces, however, the temporal nature of this condition is unknown.

Upland shrub communities are easily invaded and, in the short term at least, replaced by cheatgrass. Other nonnative problematic annuals include halogeton, Russian thistle and several mustards. Through central UT and east central NV this group is susceptible to invasion by squarrose knapweed. More mesic areas can be invaded by tall whitetop and hoary cress. All three are noxious weeds in Great Basin states.

Native Uncharacteristic Conditions

Scale Description

Grayia spinosa communities occupy a narrow elevation band that can be extensive in many valleys (>10000ac). Disturbance scale was variable during presettlement. Droughts and extended wet periods could be region wide, or more local. A series of high water years or drought could affect whole basins.

Most fires were rare and less than one acre, but may have exceeded hundreds of acres with a good grass crop.

Issues/Problems

Comments

This model is identical to the model from MZ18 with minor modifications to the description.

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**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.

Originally, BpS 1127 for MZs 12 and 17 was based on the model results for BpS 1081 (salt desert shrub) developed by Gary Medlyn (gmedlyn@nv.blm.gov) and Don Major (dmajor@tnc.org) because 1127 and 1081 are both salt desert shrub systems. Reviewers recommended significant changes to the description and model to adapt this model to the spiny hopsage ecological site description. Spiny hopsage, a salt desert species, does not respond to drought and extended wet periods as does shadscale (BpS 1081). Moreover, spiny hopsage communities support a higher cover of Indian ricegrass than shadscale (little grass cover) and contain Wyoming and basin big sagebrushes. Therefore, class C was removed from the model, MFRIs shortened, and the explicit effect of wet extended periods removed from the model. Descriptions for 1127 are from NatureServe and modified according to the NRCS ecological site descriptions for spiny hopsage. Annie Brown (annie_brown@blm.gov), Jolie Pollet (jpollet@blm.gov) and Stanley Kitchen (skitchen@fs.fed.us) developed 1081 for MZ16, which was based on PNVG R2SDSH from the Great Basin Rapid Assessment. Greasewood box was removed from R2SDSH by Jolie Pollet, Annie Brown and Stanley Kitchen to build this model. Model was greatly simplified at that time. Original descriptions by Bill Dragt were kept. Reviewers of R2SDSH were Stanley Kitchen (skitchen@fs.fed.us), Mike Zielinski (mike_zielinski@nv.blm.gov) and Jolie Pollet (jpollet@blm.gov).

Vegetation Classes

Class A 30 %

Early Development 1 All Structures

Indicator Species* and Canopy Position

ACHY	Mid-Upper
HECO26	Upper
GRSP	Lower

Upper Layer Lifeform

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

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Dominated by continuous Indian ricegrass with widely scattered shrubs and relatively younger shrubs than in Class B. Over 20yrs, vegetation moves to Class B. Replacement fire occurs every 200yrs on average, and will set back succession to year zero. Climate (every 75yrs) will also have a stand replacing effect.

Class B 70 %

Mid Development 1 Open

Indicator Species* and Canopy Position

GRSP	Upper
ARTR2	Upper
ACHY	Lower

Upper Layer Lifeform

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

Fuel Model 2

Structure Data (for upper layer lifeform)

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

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Discontinuous grass patches, and higher shrub canopy cover than in Class A. Spiny hopsage dominates. Climate (every 75yrs) will shift vegetation back to Class A. Replacement fire is infrequent (mean FRI of 200yrs).

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Class C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

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.

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

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.

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

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.

Disturbances

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 10
Min 1
Max 1000

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	227	100	500	0.00441	100
Mixed					
Surface					
All Fires	227			0.00443	

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)

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

References

Blaisdell, J.P. and R.C. Holmgren. 1984. Managing intermountain rangelands-salt-desert shrub ranges. General Technical Report INT-163. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 52 pp.

Hironaka, M., M.A. Fosberg and A.H. Winward. 1983. Sagebrush-grass habitat types of southern Idaho. Forestry, Wildlife, and Range Experiment Station Bulletin No. 15, University of Idaho, Moscow. 44 pp.

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

Tiedemann, A.R., E.D. McArthur, H.C. Stutz. R. Stevens and K.L. Johnson, compilers. 1984. Proceedings--symposium on the biology of Atriplex and related chenopods; 1983 May 2-6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT. USDA Forest Service, Intermountain Forest and Range Experiment. 309 pp.

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.

West, N.E. 1983. Southeastern Utah galleta-threeawn shrub steppe. Pages 413-421 in: N.E. West, editor. Temperate deserts and semideserts. Ecosystems of the World, Volume 5. Elsevier Publishing Company, Amsterdam.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011340 **Columbia Basin Foothill and Canyon Dry Grassland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Rob Taylor	rtaylor@tnc.org	**Reviewer**	
Modeler 2			**Reviewer**	
Modeler 3			**Reviewer**	

Vegetation Type

Upland Grassland/Herbaceous

Map Zone

10

Model Zone

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

Dominant Species*

PSSP6 ARLO3
POSE ARRI2
SPCR CERE2
FEID

General Model Sources

☐ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

They occur in the canyons and valleys of the Columbia Basin, particularly along the Snake River canyon, the lower Salmon, lower Clearwater and lower Grande Ronde, in the lower foothill slopes of the Blue Mountains, and along the main stem of the Columbia River in eastern WA.

Biophysical Site Description

Occurrences are found on steep open slopes, from 90-1525m (300-5000ft) elevation. Annual precipitation is low, ranging from 4-10cm. Settings are primarily long, steep slopes of 100m to well over 400m, with soils derived from residuum and having patchy, thin, wind-blown surface deposits. Colluvial soil movement and slope failures are a common process.

Vegetation Description

These grasslands are similar floristically to Palouse Prairie Grassland (CES304.792) but are distinguished by landform, soil and process characteristics. Fire frequency is presumed to be less than 20yrs. The vegetation is dominated by graminoids on hill slopes with shrub dominated cover occuring in steep swales and toe slopes and at higher elevations. Pseudoroegneria spicata, Festuca idahoensis and Opuntia polyacantha are common species. Rhus glabra, Celtus reticulata and sub-shrub Aretmisia rigida are common elements in the shrubby swales and toe slopes. Deciduous shrubs Symphoricarpos spp, Physocarpus malvaceus, Holodiscus discolor and Ribes spp are infrequent native species that occur in areas protected from fire, and may increase with fire exclusion.

Disturbance Description

Fire return interval is 7-15yrs on average. Localized landslides occur throughout this system.

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**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.

Adjacency or Identification Concerns

This BpS abuts the Palouse Prairie in some parts of the range.

Native Uncharacteristic Conditions

Scale Description

This BpS occurs in very large patches of tens of thousands of hectares.

Issues/Problems

Comments

This model is identical to the model from MZ18. 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.

Vegetation Classes

Class A 30 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

PSSP6	Upper
POSE	Upper
SPCR	Upper
FEID	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	70 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

This early seral stage follows a replacement fire that removes the majority of the above-ground tissue of the grasses. The cover of the bunch grasses is reduced for 1-5 growing seasons. Forbs may be more abundant during this period.

Class B 70 %

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

PSSP6	Upper
POSE	Upper
SPCR	Upper
FEID	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	71 %	100 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Very little bare ground, with bunch grass cover and cover of litter 75%-100% in areas. Fires rarely cause changes in the distribution or abundance of dominant species, although there are records of minor changes in relative dominance among grass species.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 C **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

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.

Class D **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

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.

Class E **0 %**

[Not Used] [Not Used]

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

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.

Disturbances

Fire Regime Group:** II

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	14			0.07143	100
Mixed					
Surface					
All Fires	14			0.07145	

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)

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

References

Conrad, C.E. and C.E. Poulton. 1966. Effect of a wildfire on Idaho fescue and bluebunch wheatgrass. Journal of Range Management 19: 138-141

Daubenmire, R.F. 1968. Ecology of fire in grasslands. Advances in Ecological Research 5: 209-266

Daubenmire, R.F. 1972. Plant succession on abandoned fields and fire influences in a steppe area in southeast Washington. Northwest Science 49: 36-48

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

Tisdale, E.W. 1986. Canyon grasslands and associated shrublands of west-central Idaho and adjacent areas. Wildlife and Range Experiment Station, University of Idaho Moscow, ID Bulletin Number 40

Johansen, J.R. et al. 1993. Effects of rangefire on soil algal crusts in semiarid shrub-steppe of the lower Columbia Basin and their subsequent recovery. Great Basin Naturalist 5: 373-88

Johnson, C.G. Jr. 1998. Vegetation response after wildfires in National Forests of Northeastern Oregon. USDA Forest Service R6-NR-ECOL-TP-06-98

Ottmar, R.D. and D.V. Sandberg. 2001. Wildland fire in eastern Oregon and Washington. Northwest Science 75: 46-54

Robberect, R. and G.E. Defossé. 1995. The relative sensitivity of two bunchgrass species to fire. International Journal of Wildland Fire 5: 127-134

Uresk, D.W. et al. 1976. Impact of wildfire on three perennial grasses in south-central Washington. Journal of Range Management 29: 309-310

Uresk, D.W. et al. 1980. Perennial grasses and their response to a wildfire in south-central Washington. Journal of Range Management 33: 111-114

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011350** **Inter-Mountain Basins Semi-Desert Grassland**

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

General Information

Contributors (also see the Comments field) **Date** 3/30/2005

Modeler 1	Mike Zielenski	mike_zielinski@nv.blm.gov	**Reviewer**	Eric Limbach	eric_limbach@blm.gov
Modeler 2	Louis Provencher	lprovencher@tnc.org	**Reviewer**		
Modeler 3			**Reviewer**		

Vegetation Type

Upland Grassland/Herbaceous

Map Zone

10

Model Zone

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

Dominant Species*

ACHY
HECO26
LECI4
ARTR2
GRSP
ATCA2

General Model Sources

- ☑ Literature
- ☐ Local Data
- ☐ Expert Estimate

Geographic Range

Occurs throughout the Intermountain western US on sandsheets or stabilized dunes.

Biophysical Site Description

Ecological systems found at approximately 4200-5000ft of elevation in the Great Basin. These grasslands occur in lowland and upland areas and may occupy sandsheets, stabilized dunes, swales, playas, mesatops, plateau parks, alluvial flats, and plains, but sites are typically xeric. Substrates are often excessively to well-drained sandy or loamy-textured soils derived from sedimentary parent materials but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. These grasslands typically occur on aradic sites. When they occur near foothill grasslands they will be at lower elevations. These grasslands occur on a variety of aspects and slopes. Sites may range from flat to moderately steep. Annual precipitation is usually from 6-10 inches in the Great Basin.

Vegetation Description

Grasslands within this system are typically characterized by a sparse to moderately dense herbaceous layer dominated by medium-tall and short bunch grasses. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or co dominated by Achnatherum hymenoides, or Hesperostipa comata, and may include scattered shrubs and dwarf-shrubs of species of Artemisia tridentata, Atriplex canescens, Ephedra, or Krascheninnikovia lanata.

Disturbance Description

This system is maintained by frequent fires and sometimes associated with specific soils, often well-drained clay soils. Fire most often occurred in these sites, when adjacent shrublands (BpS 1080, 1125) burned. Therefore, the disturbance dynamics of this system are identical to those of BpS 1125: hence, it was

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**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.

assumed that dominant fires were stand replacement (mean FRIs of 75-94yrs) due to the continuity of fine fuels. Mixed severity fire played a minor role during late-development. Assuming a MFI of 75yrs (from the total fire probability), the mean FRI of mixed severity fire was 20% of fires, thus a mean FRI of 375yrs, during mid-development. Re-establishment following fire is from resprouting grasses with shrubs re-establishing from seed over time. 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).

Native American's likely used these sites for camping and vegetation collection (seeds of Indian ricegrass).

Adjacency or Identification Concerns

NatureServe description for BpS 1135 includes Muhlenbergia-dominated grasslands which flood temporarily. Muhlenbergia grasslands and flooding are not part of these sandy systems in Nevada.

Found adjacent to BpS 1125 and 1080, sagebrush steppe and semi-desert. Fires in sagebrush types spread to BpS 1135.

Many of these sites were impacted by introduced grazing animals post-European settlement and have been converted to shrub dominated systems.

Cheatgrass is present in these ecological systems but do not dominate due to the high sand content.

Native Uncharacteristic Conditions

Scale Description

Semi-desert grassland can be large (>10000ac) when associated with extensive sandsheet systems. Historic disturbance (fire) likely ranged from small (< 10 acres) to large (> 10,000 acres) depending on conditions, time since last ignition, and fuel loading. Assumed the average patch size of fire is 250 acres.

Issues/Problems

The scale of historic fire is unknown and numbers provided represent estimates. Native burning was presumably important to encourage seed production, but data are lacking.

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. In MZ18 this system is similar to that described for MZ12&17. The model was reviewed and accepted for MZ 18 by Eric Limbach
BpS 1135 for MZ 12 and 17 is completely different from BpS 1135 for MZ 16. BpS 1135 uses the model and disturbance regime of BpS 1125 (and 1080 without trees) for MZ 12 and 17 because the two systems are highly coupled, however BpS 1135 lacks class C because it is a grassland with shrub encroachment.

Vegetation Classes

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 A 20 %

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

ARTR2	Upper
HECO26	Upper
ACHY	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	40 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Perennial grasses and forbs dominate (25-40% cover) where woody shrub canopy has been top killed / removed by wildfire. Shrub cover < 5%. Replacement fire every 120yrs on average resets succession back to zero. Succession to class B after 20yrs.

Class B 80 %

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

ARTR2	Upper
HECO26	Low-Mid
ACHY	Lower

Structure Data (for upper layer lifeform)

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

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

Herbaceous layer is >25% cover whereas shrub cover is <25%.

Description

Shrubs are the upper layer life form (5-25% cover) with diverse perennial grass and forb understory dominant (20-60yrs). MFI is 75yrs with 80% replacement fire (mean FRI of 94yrs) and 20% mixed severity fire (mean FRI of 375yrs). Mixed severity fire, insect/disease (return interval of 75yrs), and weather related stress (return interval of 100yrs) maintains vegetation in class B.

Class C 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

Class D 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.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Description

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 250
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	98	30	120	0.01020	82
Mixed	454	120	500	0.00220	18
Surface					
All Fires	81			0.01242	

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)

References

Heyerdahl, E.K., D. Berry and J.K. Agee. 1994. Fire history database of the western United States. Final report. Interagency agreement: U.S. Environmental Protection Agency DW12934530; USDA Forest Service PNW-93-0300; University of Washington 61-2239. Seattle, WA: US Department of Agriculture, Pacific Northwest Research Station; University of Washington, College of Forest Resources. 28 pp. [+ Appendices]. Unpublished report on file with: USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory, Missoula, MT.

Howell, C., R. Hudson, B. Glover and K. Amy. 2004. Resource implementation protocol for rapid assessment matrices. USDA Forest Service, Humboldt-Toiyabe National Forest.

Kellogg, E.A. 1985. A biosystematic study of the Poa secunda complex. Journal of the Arnold Arboretum. 66: 201-242.

Martin, R.E. and J.D. Dell. 1978. Planning for prescribed burning in the Inland Northwest. Gen. Tech. Rep. PNW-76. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 67 pp.

McKell, C.M. 1956. Some characteristics contributing to the establishment of rabbitbrush, Chrysothamnus

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

spp. Corvallis, OR: Oregon State College. 130 pp. Dissertation.

NatureServe. 2004. International Ecological Classification Standard: Terrestrial Ecological Classifications. Terrestrial ecological systems of the Great Basin US: DRAFT legend for Landfire project. NatureServe Central Databases. Arlington, VA. Data current as of 4 November 2004.

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

Plummer, A.P., A.C. Hull, Jr., G. Stewart and J.H. Robertson. 1955. Seeding rangelands in Utah, Nevada, southern Idaho and western Wyoming. Agric. Handb. 71. Washington, DC: USDA Forest Service. 73 pp.

Range, P., P. Veisze, C. Beyer and G. Zschaechner. 1982. Great Basin rate-of-spread study: Fire behavior/fire effects. Reno, Nevada: US Department of the Interior, Bureau of Land Management, Nevada State Office, Branch of Protection. 56 pp.

USDA-NRCS 2003. Range Ecological Sites, Major Land Resource Area 24. Central Nevada. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

Young, R.P. 1983. Fire as a vegetation management tool in rangelands of the Intermountain Region. Pages 18-31 in: S.B. Monsen and N. Shaw, compilers. Managing Intermountain rangelands--improvement of range and wildlife habitats: Proceedings; 1981 September 15-17; Twin Falls, ID; 1982 June 22-24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station.

Zouhar, K.L. 2000. Achnatherum nelsonii. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2007, August 27].

Zschaechner, G.A. 1985. Studying rangeland fire effects: a case study in Nevada. Pages 66-84 in: K. Sanders and J. Durham, eds. Rangeland fire effects: Proceedings of the symposium; 1984 November 27-29; Boise, ID. Boise, ID: US Department of the Interior, Bureau of Land Management, Idaho State Office.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011390** **Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Katie Phillips	cgphillips@fs.fed.us	**Reviewer**	Lois Olsen	lolsen@fs.fed.us
Modeler 2	Randall Walker	rmwalker@fs.fed.us	**Reviewer**		
Modeler 3	Larry Kaiser	larry_kaiser@blm.gov	**Reviewer**		

Vegetation Type

Upland Grassland/Herbaceous

Map Zone

10

Model Zone

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

Dominant Species*

PSSP6
FEID
FESC
STCO

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Northern Rockies throughout MT, northern ID and northeastern WA (Okanogan Highlands). May occupy river valleys, including the Salmon, Snake and Clearwater Rivers. Drier portions of this type will resemble bluebunch wheatgrass communities in Columbia Basin.

Biophysical Site Description

This type occupies productive uplands below lower treeline or in small pockets where cold air drainage or shallow soils inhibit conifer growth, generally ranging from 1000-5000ft.

Vegetation Description

This type is dominated by bluebunch wheatgrass with Idaho fescue and rough fescue as dominant associates. Bluebunch wheatgrass is more prevalent in drier areas. Mueggler and Stewart (1980) have described these types as: Fredi/Agsp (now PSSP6) and Fesc/Agsp. Additional species include needle and thread, Sandberg's bluegrass and a variety of mesic forbs (eg, showy cinquefoil, sticky geranium, phlox, lupine and yarrow).

Disturbance Description

This type has frequent replacement fires (fire regime group II). Most species in this type are fire adapted and respond favorably to these fire types.

Where these systems occur within forested ecosystems, fire frequency will be strongly influenced by the surrounding forest's fire regime (eg, 10-20yrs). Where these systems occur below lower treeline, fire frequencies may be longer (eg, 20-30yrs).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Adjacency or Identification Concerns

Since this is a broad type, the dry bluebunch wheatgrass-needle and thread variant will probably have more bareground and a slightly higher MFI. Response to fire may differ slightly also.

Non-native species present today can include spotted knapweed, yellow starthistle and leafy spurge.

Native Uncharacteristic Conditions

Scale Description

This type can occupy broad expanses and also narrow bands below the lower montane forest. It may occur as small patches within forested ecosystems as a topoedaphic climax. In large valleys, fires may have been expansive historically, up to thousands of acres.

Issues/Problems

This is a highly variable type, which includes most of Mueggler and Stewart's habitat types. The literature in FEIS suggests a MFI of between 10-30yrs for this type. The Lewis and Clark range type classification needs to be incorporated into this model also.

Comments

Based on Rapid Assessment model R0MGRA by Mary Manning (mmanning@fs.fed.us) and reviewed by Eldon Rash (erash@fs.fed.us).

Vegetation Classes

Class A 5 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSSP6	Upper
KOCR	Upper
POSA	Upper
STCO	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	10 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Post fire, early seral community dominated by bunchgrasses and forbs. Herbs and forbs will generally have higher cover than pre-burn and may include astragalus, balsamroot, lupines, yarrow and prairie junegrass. Cover ranges from 0-10%. In the absence of fire or heavy animal impact, this condition succeeds to a mid-development condition (class B). Age ranges from 0-2yrs. Idaho fescue may be present, but will recover more slowly than the bluebunch wheatgrass after fire.

Class B 25 %

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSSP6	Upper
FEID	Upper
POSA	Upper
STCO	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	11 %	30 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Mid-development with moderate canopy closure dominated by bunchgrasses with forb cover generally higher than pre-burn. Typically lasts five years.

Class C 70 %

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSSP6	Upper
FEID	Upper
POSA	Upper
STCO	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	100 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Late-development, closed canopy of grasses and forbs. Bunchgrasses dominate with low densities of shrubs (<10%) in some areas, particularly where this BpS transitions to shrub or tree-dominated communities. Shrub species may include Artemisia tridentada, eriogonum (buckwheats), Ceanothus, bitterbrush and Symphorocarpus.

Class D 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

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Fire Regime Group:** II

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	17	2	30	0.05882	100
Mixed					
Surface					
All Fires	17			0.05884	

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

Agee, J.K. 1994. Fire and weather disturbances in terrestrial ecosystems of the eastern Cascades. From P. Hessburg, ed. Volume III: Assessment. Eastside Forest Ecosystem Health Assessment. General Technical Report PNW-GTR-320. USDA Forest Service, Pacific Northwest Research Station .

Daubenmire, R.F and J.B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Technical Bulletin 60. Pullman, WA: Washington State University, Agricultural Experiment Station. 104 pp.

Mueggler, W.F. and W.L. Stewart. 1980. Grassland and shrubland habitat types of western Montana. Gen. Tech. Rep. INT-66. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station, 154 pp.

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011400** **Northern Rocky Mountain Subalpine-Upper Montane Grassland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1 Katie Phillips	cgphillips@fs.fed.us	**Reviewer**	
Modeler 2 Randall Walker	rmwalker@fs.fed.us	**Reviewer**	
Modeler 3 Larry Kaiser	larry_kaiser@blm.gov	**Reviewer**	

Vegetation Type

Upland Grassland/Herbaceous

Map Zone

10

Model Zone

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

Dominant Species*

FEVI
FEID
ASTER
ERIOG

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Northern ID, western MT and eastern WA.

Biophysical Site Description

This is a high-elevation (>6000ft), lush grassland system dominated by perennial grasses and forbs, on dry sites particularly south-facing slopes. Subalpine grasslands are small meadows to large open parks surrounded by conifer trees but lack tree cover within them. In general soil textures are much finer, and soils are often deeper under grasslands than in the neighboring forests. Grasslands, although composed primarily of tussock-forming species, do exhibit a dense sod that makes root penetration difficult for tree species. Sites are often wind-swept, resulting in lack of snowpack and summer drought (Daubenmire 1981).

Vegetation Description

Typical dominant species include Festuca viridula, Festuca idahoensis, Aster spp, Eriogonum spp, Lupinus spp and Xerophyllum tenax.

Disturbance Description

Fire regimes are probably similar to adjacent forested vegetation, and will generally be long interval, stand replacement regimes (Fire Regime Group IV). Fires may finger into this system from adjacent forests. Conifer encroachment is not common due to the drought nature of these grasslands, but undoubtedly fire also plays some role in preventing conifer encroachment.

Adjacency or Identification Concerns

Historical sheep grazing may have occurred in these systems. The cumulative effects are unknown.

Native Uncharacteristic Conditions

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Scale Description

Patches are typically tens to hundreds of acres.

Issues/Problems

Comments

This model received no peer review.

Vegetation Classes

Class A 5 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

FEVI	Upper
FEID	Upper
PSSP6	Upper
BASA	Upper

Structure Data (for upper layer lifeform)

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

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Post-replacement disturbance conditions dominated by herbs and sprouting grasses including green fescue, Idaho fescue, bluebunch wheatgrass, Xerophyllum tenax or Epilobium spp.

Class B 95 %

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

FEVI	Upper
FEID	Upper
PSSP6	Upper
BASA	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	100 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Closed herbaceous cover dominated by green fescue, Idaho fescue, bluebunch wheatgrass and Xerophyllum tenax. Low shrubs may be present, particularly mountain big sagebrush, Erigonum spp and Phlox spp.

Class C 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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 D 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

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 20
Min 1
Max 100

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	150	50	500	0.00667	100
Mixed					
Surface					
All Fires	150			0.00669	

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

Daubenmire, R. 1981. Subalpine parks associated with snow transfer in the mountains of northern Idaho and eastern Washington. Northwest Science. 55(2): 124-135.

Daubenmire, R.F. and J.B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho. Technical Bulletin 60. Pullman, WA: Washington State University, Agricultural Experiment Station. 104 pp.

Franklin, J.F. and C.T. Dyrness. 1973. Natural vegetation of Oregon and Washington. Gen. Tech. Rep. PNW-8. Portland, OR: USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. 417 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011420 Columbia Basin Palouse Prairie

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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

Vegetation Type
Upland Grassland/Herbaceous

Map Zone
10

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

Dominant Species*
PSSP4 AMAL
FEID
HECO
ACSC

General Model Sources
☑ Literature
☐ Local Data
☐ Expert Estimate

Geographic Range
This once-extensive grassland system occurs in southern British Columbia, eastern WA and OR. This BpS likely occurs as remnant patches in the Owyhee Upland province Payette section of the Columbia Plateau.

Biophysical Site Description
This BpS is characterized by rolling topography composed of loess hills and plains over basalt plains. The climate of this region has warm-hot, dry summers and cool, wet winters. Remnant grasslands are now typically restricted to steep and rocky sites.

Vegetation Description
This BpS characterizes one of the most endangered ecosystems in the U.S with only one percent of the original habitat remaining; it is highly fragmented with most sites <10ac. The cool-season bunch grasses that dominate the vegetation are adapted to winter precipitation. Characteristic species are Pseudoroegneria spicata and Festuca idahoensis with Hesperostipa comata, Achnatherum scribneri, Leymus condensatus, Leymus cinereus, Koeleria macrantha, Pascopyrum smithii, or Poa secunda. Shrubs commonly found include Amelanchier alnifolia, Rosa spp, Eriogonum spp, Symphoricarpos albus and Crataegus douglasii.

Disturbance Description
Excessive grazing, past land use and invasion by introduced annual species have resulted in a massive conversion to agriculture or shrub-steppe and annual grasslands dominated by Artemisia spp and Bromus tectorum or Poa pratensis.

Adjacency or Identification Concerns

Native Uncharacteristic Conditions

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Scale Description

Large patch

Issues/Problems

Comments

This model is identical to the model from MZ18. This BpS is likely rare in MZ18. D. Major incorporated components of other dry grassland system models to describe this system.

Vegetation Classes

Class A 10%

Early Development 1 All Structures

Indicator Species* and Canopy Position

PSSP4 Upper
FEID Upper

Upper Layer Lifeform

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

Fuel Model 1

Structure Data (for upper layer lifeform)

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

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

This early seral community follows a topkill event in which cover of bunch grasses and perennial forbs has been reduced. Forb composition is relatively higher in this stage than at later stages. Replacement fire (mean FRI 25yrs)

Class B 90%

Mid Development 1 Closed

Indicator Species* and Canopy Position

PSSP4 Upper
FEID Upper

Upper Layer Lifeform

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

Fuel Model 1

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31%	80%
Height	Herb 0m	Herb >1.1m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

(Any amount of herbaceous cover >1.1m tall can be included in this class.)

Description

Very little bare ground, litter cover is high. Plants are vigorous and well established. Fires are rarely lethal, and the community responds quickly to fire. Cover values are high, ranging from 31-80%. Replacement fire (mean FRI 25yrs) returns to Class A. Surface fire (FRI 50yrs) maintains in Class B.

Class C 0%

[Not Used] [Not Used]

Indicator Species* and Canopy Position

Upper Layer Lifeform

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

Fuel Model

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 D 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

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:** II

Historical Fire Size (acres)

Avg 1000
Min 100
Max 10000

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [ ] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	35			0.02857	100
Mixed					
Surface					
All Fires	35			0.02859	

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

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow and J. Teague. 2003. Ecological Systems of the United States: A Working Classification of U.S. Terrestrial Systems. NatureServe, Arlington, Virginia. Available online at: http://www.natureserve.org/publications/usEcologicalsystems.jsp

Daubenmire, R. 1988. Steppe vegetation of Washington. Washington State University Cooperative Extension Service Publication EB1446. (Revised from and replaces Washington Agricultural Experiment Station Publication XT0062.) 131 pp.

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**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.

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

Tisdale, E.W. 1982. Grasslands of western North America: The Pacific Northwest bunchgrass. Pages 223-245 in: A.C. Nicholson, A. Mclean, and T.E. Baker, editors. Grassland Ecology and Classification Symposium, Kamloops, BC.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

***Biophysical Setting:* 1011430 Rocky Mountain Alpine Fell-Field**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Mike Babler	mbabler@tnc.org	**Reviewer**	
Modeler 2			**Reviewer**	
Modeler 3			**Reviewer**	

Vegetation Type
Upland Grassland/Herbaceous

Map Zone
10

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

Dominant Species*
SIAC CLME
TRNA2 DROCH
PHCO11
FEBR

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range
This ecological system is found discontinuously at alpine elevations throughout the Rocky Mountains.

Biophysical Site Description
These are wind-scoured fell-fields that are free of snow in the winter, such as ridgetops and exposed saddles, exposing the plants to severe environmental stress. Soils on these windy unproductive sites are shallow, stony, low in organic matter and poorly developed; wind deflation often results in a gravelly pavement. Fell is Gaelic for stone, and these are stone fields. Sites are stable for 100s-1000s of years as soils develop.

Vegetation Description
Most fell-field plants are cushioned or matted, frequently succulent, flat to the ground in rosettes and often densely haired and thickly cutinized. Plant cover is 15-50%, while exposed rocks make up the rest. Fell-fields are usually within or adjacent to alpine tundra dry meadows.

Disturbance Description
Vegetation in these areas is controlled by snow retention, wind desiccation, permafrost and a short growing season. Dry summers associated with major drought years (mean return interval of 100yrs) would favor grasses over forbs, whereas wet summers cause a more diverse mixture of forbs and graminoids.

Avalanches on steeper slopes where soil accumulated can cause infrequent soil-slips, which exposed bare ground.

Very small burns of a few square meters (replacement fire) caused by lightning strikes were included as a rare disturbance, although lighting storms are frequent in those elevations. The calculation of lightning strikes frequency was not based on fire return intervals, but on the number of strikes (in this case 5) per 1000

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possible locations per year, thus 0.005.

Alpine rodents (pikas, marmots, etc.) cause common, but generally small-scale disturbances in these systems. Native herbivores (Rocky Mountain bighorn sheep, mule deer and elk) were common in the alpine but probably did not greatly affect vegetation cover because animals move frequently as they reduce vegetation cover.

Adjacency or Identification Concerns

Several experts claim that over the next decades the alpine will be one of the more threatened community types by global climate change. Essentially, the treeline is moving up.

Native Uncharacteristic Conditions

Cover of vegetation >50% would indicate a system other than Rocky Mountain Alpine Fell Field, as rock cover will be 50% or more in this community.

Scale Description

This ecological system can occupy large areas of the alpine. Patch size varies from a few acres to 1000ac on mountain ridges and tops. Stand-replacement fires may be caused by lightning strikes that do not spread due to the sparse cover of fine fuel and extensive barren areas acting as fire breaks.

Issues/Problems

No data on fire or effects of lightning strikes. No data on recovery time after stand-replacing events. This model had no peer review. Species were derived from literature review. Uncertain if succession from A to B is 10yrs. Moss campion flowers at 10yrs.

Comments

This model is identical to the model from MZ28 with minor modifications to the description. This model is based on 1144 by Louis Provencher. Input to the 1144 model was based on discussion with Kimball Harper (retired USFS scientist; UT), an alpine specialist of the Utah High Plateau. Mike Babler modified species and geographic range to reflect fell field plants in MZ28.

Quality control resulted in slightly changed canopy cover values (A changed from 0-5% to 0-20%; B changed from 6-50% to 20-60%) to adhere to LANDFIRE mapping requirements.

Vegetation Classes

Class A **5%**

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

SIAC	Upper
TRNA2	Upper
FEBR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	20 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Very exposed (barren) state following disturbance. Rock may dominate the area. Forbs (cushion plants) are more common than grasses. Succession to class B after 10yrs.

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Class B 95 %

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

SIAC	Upper
TRNA2	Upper
FEBR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	50 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Alpine community is dominated by low growing perennials, some graminoids. Plant cover may vary from five percent to as much as 50%. Infrequent replacement fire in the form of lighting strikes (mean FRI of 500yrs), severe summer droughts (mean return interval of 500yrs) and animal disturbance (1/500) cause a transition to class A.

Class C 0 %

[Not Used] [Not Used]

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

Upper Layer Lifeform

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

Fuel Model

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Class D 0 %

[Not Used] [Not Used]

Indicator Species* and Canopy Position

Structure Data (for upper layer lifeform)

	Min	Max
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)

	Min	Max
Cover	%	%
Height		
Tree Size Class		

Upper Layer Lifeform

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

Fuel Model

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Disturbances

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**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.

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 1
Min 1
Max 1

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	525			0.00190	99
Mixed					
Surface					
All Fires	524			0.00192	

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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [x] Other (optional 1) Rodent disturbances
- [ ] Other (optional 2)

References

Baker, W.L. 1980a. Alpine vegetation of the Sangre De Cristo Mountains, New Mexico: Gradient analysis and classification. Unpublished thesis, University of North Carolina, Chapel Hill. 55 pp.

Bamberg, S.A. 1961. Plant ecology of alpine tundra area in Montana and adjacent Wyoming. Unpublished dissertation, University of Colorado, Boulder. 163 pp.

Bamberg, S.A. and J. Major. 1968. Ecology of the vegetation and soils associated with calcareous parent materials in three alpine regions of Montana. Ecological Monographs 38(2): 127-167.

Cooper, S.V., P. Lesica and D. Page-Dumroese. 1997. Plant community classification for alpine vegetation on Beaverhead National Forest, Montana. USDA Forest Service, Intermountain Research Station, Report INT-GTR-362. Ogden, UT. 61 pp.

Duft, J.F. and R.K. Mosely. 1989. Alpine wildflowers of the Rocky Mountains. Mountain Press Publishing Co. Missoula MT. 200 pp.

Komarkova, V. 1976. Alpine vegetation of the Indian Peaks Area, Front Range, Colorado Rocky Mountains. Unpublished dissertation, University of Colorado, Boulder. 655 pp.

Komarkova, V. 1980. Classification and ordination in the Indian Peaks area, Colorado Rocky Mountains. Vegetation 42:149-163.

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

Nelson, R.A. 1976. Plants of Rocky Mountain National Park. Rocky Mountain Nature Association. 168 pp.

Schwan, H.E. and D.F. Costello. 1951. The Rocky Mountain alpine type: Range conditions, trends and land use (a preliminary report). Unpublished report prepared for USDA Forest Service, Rocky Mountain Region (R2), Denver, CO. 18 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Thilenius, J.F. 1975. Alpine range management in the western United States--principles, practices, and problems: The status of our knowledge. USDA Forest Service Research Paper RM-157. Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO. 32 pp.

Weber, W.A. Rocky Mountain Flora. 1976. Colorado Associated University Press. Boulder, CO. 484 pp.

Willard, B.E. 1963. Phytosociology of the alpine tundra of Trail Ridge, Rocky Mountain National Park, Colorado. Unpublished dissertation, University of Colorado, Boulder.

Zwinger, A.H. and B.E. Willard.1972. Land above the trees; A guide to American Alpine Tundra. Harper and Row. New York. 487 pp.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011450 Rocky Mountain Subalpine-Montane Mesic Meadow

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Vegetation Type

Upland Grassland/Herbaceous

Map Zone

10

Model Zone

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

Dominant Species*

ERIGE2 LUPIN
MERTE SOLID
PENST DECA18
CAMPA KOELE

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Found in the Rocky Mountains, restricted to the subalpine zone typically above 3000m in the southern part and 1500m in the north.

Biophysical Site Description

Finely textured soils. Snow deposition, wind swept dry conditions limit tree establishment. On gentle to moderate gradient slopes. Soils seasonally moist in spring, drying out later in the growing season.

Vegetation Description

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Important taxa include Agastache urticifolia, Chamerion angustifolium, Erigeron spp, Senecio spp, Helianthella spp, Mertensia spp, Penstemon spp, Campanula spp, Hackelia spp, Lupinus spp, Solidago spp, Ligusticum spp, Osmorhiza spp, Thalictrum spp, Valeriana spp, Veratrum spp, Delphinium spp, Aconitum spp, Balsamorhiza sagitatta and Wyethia spp. Burrowing mammals can increase for density.

Disturbance Description

Fires are primarily replacement and occur about every 40yrs. Mixed severity fire (mean FRI of 75yrs) occurs in late development meadows and removes shrubs. The ignition source is generally not in this type and probably associated with native burning in the fall and spring, but spreads from adjacent shrub or tree dominated sites, such as mountain big sagebrush, ponderosa pine and aspen.

Adjacency or Identification Concerns

This BpS could be confused with low forb/alpine shrub communities. Often adjacent to aspen/tall forb

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

communities, mountain or big sagebrush/tall forb communities and upper montane/subalpine spruce-fir communities. In degraded sites this community may convert to silver sagebrush/tall forb.

Native Uncharacteristic Conditions

Scale Description

Range in size from less than ten acres to 300ac.

Issues/Problems

With heavy grazing these sites can convert to undesirable forbs and grasses such as Circium spp (thistle, any species), Galium spp (bedstraw), Rudbeckia occidentalis (coneflower), Helenium hoopesii (Orange sneezeweed), Polygonum spp. (knotweed), Rumex spp (sorrel or dock), Taraxacom officinale (dandelion), Wyethia amplexicaulis (mulesears), Madia glomerata (mountain tarweed), Descurainia spp (tansymustard), Nemophila brevifolia (basin blue eyes), Poa pratensis (Kentucky bluegrass), Agrostis exarata (bentgrass), Dactylis glomerata (orchardgrass), Bromus inermis (smooth brome), Bromus tectorum (cheatgrass), Poa bulbosa (bulbous bluegrass) and Vulpia octoflora (six-week fescue). Roads and trails can impact these sites.

There is not much information about this type. We estimated the fire frequency of 40 years based on adjacent aspen, herbaceous and sagebrush communities. Also, because fire was assumed to occur in the fall and spring when the summer's green and wet biomass would be dead and cured, replacement fire has little effect on annual tall forbs themselves. Fires would affect encroaching shrubs.

Comments

This is nearly identical to the model for the same BpS in MZs 16, 23, 24 and 28. The model was reviewed for MZs 10 and 19 by Mary Manning (mmanning@fs.fed.us). Minor edits were made to the description for MZs 10 and 19.

Vegetation Classes

Class A **5 %**

Early Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

ERIGE2	Upper
LUPIN	Upper
DECA18	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Succession to class B after three years. Replacement fire (mean FRI of 40yrs) presumably occurred during the fall and spring, therefore removing completely dead biomass, but, in these early development meadows, fire would not cause an ecological setback (ie, relative age = 0) because fire would simply remove dead annual forbs.

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Class B 45 %

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

ERIGE2 Upper
LUPIN Upper
DECA Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Herb 0.6m	Herb 1.0m
Tree Size Class	None	

[x] Upper layer lifeform differs from dominant lifeform.

Shrubs may be present, but will be less than five percent cover.

Description

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Some increase in shrub component, shrubs young and less than five percent cover. Succession to C after 20yrs. Replacement fire removes shrubs (mean FRI of 40yrs).

Class C 50 %

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model 1

Indicator Species* and Canopy Position

ASTER Middle
LUPIN Middle
ROWO Middle
RIBES Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	10 %
Height	Shrub 0m	Shrub >3.1m
Tree Size Class	Seedling <4.5ft	

[x] Upper layer lifeform differs from dominant lifeform.

Forbs dominate. Trees (Populus tremuloides) or shrubs (Artemisia cana, Artemisia tridentata, Rosa woodsii, Ribes spp and Amelanchier spp.) may be the upper layer lifeform, with low canopy cover (<10%).

Description

Vegetation is typically forb-rich, with forbs contributing more to overall herbaceous cover than graminoids. Five to 10% of cover in late seral may be woody species from adjacent plant communities such as Populus tremuloides, Artemisia cana, Artemisia tridentata, Rosa woodsii, Ribes spp and Amelanchier spp. Mixed severity fire (mean FRI of 75yrs) removes shrubs from overstory. Replacement fire (mean FRI of 40yrs) sets site back to class A.

Class D 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

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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:** II

Historical Fire Size (acres)

Avg 50
Min 1
Max 250

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	40			0.025	80
Mixed	161			0.00621	20
Surface					
All Fires	32			0.03122	

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

Barrett, S.W. 1984. Fire history of the River of No Return Wilderness: River Breaks Zone. Final Report. Missoula, MT: Systems for Environmental Management. 40 pp. + appendices.

Fischer, W.C. and A.F. Bradley. 1987. Fire ecology of western Montana forest habitat types. Gen. Tech. Rep. INT-223. Ogden, UT: USDA Forest Service, Intermountain Research Station. 95 pp.

Gregory, S. 1983. Subalpine forb community types of the Bridger-Teton National Forest, Wyoming. Final Report. USDA Forest Service Cooperative Education Agreement: Contract OM 40-8555-3-115. Ogden, UT: USDA Forest Service, Intermountain Region. 100 pp.

Lackschewitz, K. 1991. Vascular plants of west-central Montana--identification guidebook. Gen. Tech. Rep. INT-227. Ogden, UT: USDA Forest Service, Intermountain Research Station. 648 pp.

Lotan, J.E., M.E. Alexander, S.F. Arno [and others]. 1981. Effects of fire on flora: A state of-knowledge review. National fire effects workshop; 1978 April 10-14; Denver, CO. Gen. Tech. Rep. WO-16. Washington, DC: USDA Forest Service. 71 pp.

NatureServe. 2005. NatureServe Explorer: An online encyclopedia of life [web application]. Version 4.4. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: May 6, 2005).

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**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.

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

Young, R.P. 1986. Fire ecology and management in plant communities of Malheur National Wildlife Refuge. Portland, OR: Oregon State University. 169 pp. Thesis.

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011530 Inter-Mountain Basins Greasewood Flat

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 3	Jack Sheffey	Jack_Sheffey@blm.gov	**Reviewer**		

Vegetation Type

Upland Shrubland

Map Zone

10

Model Zone

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

Dominant Species*

SAVE4
DISTI
LECI4
ATCO

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Occurs throughout much of the western US in intermountain basins. Common in Southern ID, NV and UT.

Biophysical Site Description

This site occurs on alluvial flats or lake plains usually adjacent to playas. Sites typically have saline soils, shallow water table and flood intermittently, but remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations. Slope gradients of less than two percent are most typical. Elevations are between 3800-5800ft. Average annual precipitation is 5-8in, mean temperature is 45-50 degrees F, average growing season is 100-120 days. The surface layer will normally crust inhibiting water infiltration and seedling emergence.

Vegetation Description

This system sometimes occurs as a mosaic of multiple communities, with open to moderately-dense shrublands dominated or co-dominated by Sarcobatus vermiculatus (greasewood). Atriplex confertifolia (shadscale) may be present or co-dominant. Occurrences are often surrounded by mixed salt desert scrub. Herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of Sporobolus airoides (alkali sacaton) and Distichilis spicata (saltgrass). Vegetation on this site is normally restricted to coppice mound areas that are surrounded by playa-like depressions or nearly level, usually barren, inner spaces. Potential vegetative composition is about 15% grasses, 5% forbs and 80% shrubs. As ecological condition declines herbaceous understory is reduced or eliminated and the site becomes a community of halophytic shrub dominated by greasewood.

Disturbance Description

Historically, fire was extremely infrequent. May be killed by standing water that lasts >40 days based on

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observation of inundations of Lake Bonneville flats in 1983 (personal. observe., Gary Medlyn, Ely BLM) (mean return interval of 150yrs). Vigorous resprouter following low to moderate severity fires, although severe fires may result in some mortality. Some re-seeding may occur from nearby remnant plants.

Adjacency or Identification Concerns

Halogeton is likely to invade this site.

Native Uncharacteristic Conditions

Scale Description

Tens to 100000 of acres.

Issues/Problems

Comments

This model is identical to the model from MZ18 with minor modifications to the description.

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.

This model was reviewed for MZ 18 by Eric Limbach. It was accepted without changes.
Reviewers for MZs 12 and 17 recommended extending the MFRI from 200yrs to 1000yrs and adding extended flooding to 150yrs return interval. Duration of class A was extended to five years from two years.

Vegetation Classes

Class A 5%

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

ELEl4	Upper
LECI4	Lower
SPAI	Lower
SAVE4	Middle

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	20 %
Height	Herb 0m	Herb 0.5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Some grasses, with greasewood sprouts present. Some representation of other sprouting species may be present (rabbitbrush). Grass species varies geographically, but include the following for UT and NV: inland saltgrass, bottlebrush squirreltail and alkali sacaton. Succession to class B after five years.

Class B 95%

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 2

Indicator Species* and Canopy Position

SAVE4	Upper
DISTI	Lower
SPAI	Middle
LECI4	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	30 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

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Greasewood shrubs are mature. Rabbitbrush may be found with greasewood. May occur with various sagebrush species and salt desert shrub vegetation (shadscale, saltbushes and budsage). Greasewood communities stay in this class indefinitely. Replacement fire is rare (mean FRI of 1000yrs). Prolonged flooding events (>40 days) will cause a transition to class A (return interval of 150yrs).

Class C **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Class D **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Class E **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Disturbances

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**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.

Fire Regime Group:** V

Historical Fire Size (acres)

Avg 1
Min 1
Max 1

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	1000	500	2000	0.001	98
Mixed					
Surface					
All Fires	998			0.00102	

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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Anderson, M.D. 2004. Sarcobatus vermiculatus. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, December 2].

Blaisdell, J.P. and R.C. Holmgren. 1984. Managing intermountain rangelands-salt-desert shrub ranges. General Technical Report INT-163. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT. 52 pp.

Knight, D.H. 1994. Mountains and plains: Ecology of Wyoming landscapes. Yale University Press, New Haven, MA. 338 pp.

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

USDA-NRCS Ecological Site Description 29A & B, Sodic Dune and Flat. Available online: http://esis.sc.egov.usda.gov/Welcome/pgESDWelcome.aspx.

West, N.E. 1983. Intermountain salt desert shrublands. Pages 375-397 in: N.E. West, editor. Temperate deserts and semi-deserts. Ecosystems of the world, Volume 5. Elsevier Publishing Company, Amsterdam.

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**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011540** **Inter-Mountain Basins Montane Riparian Systems**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1 Louis Provencher lprovencher@tnc.org **Reviewer**
Modeler 2 **Reviewer**
Modeler 3 **Reviewer**

Vegetation Type

Wetlands/Riparian

Map Zone

10

Model Zone

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

Dominant Species*

POBAT	POTR5
SALIX	CELAR
ALRH2	CRDO2
BEOC2	PHLE4

General Model Sources

☐ Literature
☐ Local Data
☐ Expert Estimate

Geographic Range

Great Basin, eastern slopes of the northern Sierra Nevada of CA and Cascades of OR, Columbia Plateau, and western edge of northern Rockies.

Biophysical Site Description

This ecological system is found within a broad elevation range from about 750m (2460ft) in the central and northern part of MZ18 to over 2135m (7000 feet) in northern NV (eg, Little Humboldt River). Riparian systems are found in low-elevation canyons and draws, on floodplains, or in steep-sided canyons or narrow V-shaped valleys with rocky substrates. This low-elevation riparian system includes major tributaries of the Columbia River. Soils are typically alluvial deposits of sand, clays, silts and cobbles that are highly stratified with depth due to flood scour and deposition.

Vegetation Description

This ecological system occurs as a mosaic of multiple communities that are tree, shrub or herbaceous-dominated. Shrub and tree dominated patches were more common. In the Columbia Plateau section, important and diagnostic trees include Populus balsamifera ssp. trichocarpa, Alnus rhombifolia, Populus tremuloides, Celtis laevigata var. reticulata, Betula occidentalis or Pinus ponderosa. Important shrubs include Crataegus douglasii, Philadelphus lewisii, Cornus sericea, Salix lucida ssp. lasiandra, Salix eriocephala, Rosa nutkana, Rosa woodsii, Amelanchier alnifolia, Prunus virginiana and Symphoricarpos albus.

Disturbance Description

These are disturbance-driven systems that require flooding, scour and deposition for germination and maintenance. This system is dependent on a natural hydrologic regime, especially annual to episodic flooding with flooding of increasing magnitude causing more stand replacement events: seven-yr events for

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**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.

herbaceous and seedling cover; 20-yr events for shrubs and pole size trees; and 50-yr events for mature trees.

Beaver (Castor canadensis) crop younger cottonwoods (Populus spp) and willows (Salix spp), and frequently influence the hydrologic regime through construction of dams, etc. Beaver will move from areas where tree availability is depleted. Younger stands of cottonwood and willow will be affected by beaver every five years, whereas mid-development and late-development trees will be affected, respectively, every 20 years (50% stand replacing and 50% thinning) and 1000 years (strong thinning disturbance).

Fire disturbances occur, but are infrequent catastrophic events (FRI of 80yrs) that are caused by either fire importation from sagebrush steppe (BpS 181125) or set by Native Americans for hunting and first-year willow production for basketery. Ice scouring damages boles of larger trees and can cause mild thinning in older stands. The return interval of ice scouring was set at every seven years to match El Nino cycles.

Adjacency or Identification Concerns

Livestock grazing is a major influence in the alteration of structure, composition and function of the community. Livestock can result in the nearly complete removal of willow and cottonwood regeneration, and bank slumping in places where water is accessible.

Floodplains of the Columbia Plateau have mostly been converted to agriculture and urbanization.

Exotic trees of Elaeagnus angustifolia and Tamarix spp are common in some stands. Introduced forage species such as Agrostis stolonifera, Poa pratensis, Phleum pratense and the weedy annual Bromus tectorum are often present in disturbed stands.

Native Uncharacteristic Conditions

Scale Description

This system can exist as small to large linear features in the landscape (eg, Owyhee, Snake, Bruneau and Humboldt Rivers). In larger, low-elevation riverine systems, this system may exist as mid to large patches. Fire disturbance patch size varies from 1-100ac, but uncertainty exist about fire size and behavior in these riparian systems.

Issues/Problems

Uncertainty exists about the return intervals and effects for beaver activity, ice scouring and historic fire in these systems.

Comments

This model is identical to the model from MZ18. This model was originally developed for MZs 12 and 17 by Don Major (dmajor@tnc.org) and modified by Louis Provencher (lprovencher@tnc.org) by incorporating dynamics and parameter values from BpS 131154 into BpS 181154. Beaver and ice scour was added to the dynamics of 131154, the biophysical description was simplified and elevation considerably lowered for the more northern MZ18, and species composition was changed to the Columbia Plateau description from NatureServe. The fire return interval was slightly shortened (to 80yrs from 100yrs) to model importation from the dominant vegetation type surrounding rivers; BpS 181125 or sagebrush steppe. The flooding disturbance regime was refined compared to original values for MZs 12 and 17 by using expert-verified values of intensity for southern Rocky Mountains systems. No such expert input was provided in earlier versions of BpS 1154 for MZs 12 and 17. Finally, the duration of class B was shortened to 20yrs from 70yrs to reflect the rapid growth of cottonwood and willow after disturbance.

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This model attempts to combine the Columbia Basin Foothill and Lower Montane Riparian woodland and shrubland (CES304.768) and the northern part of the Great Basin Foothill and Lower Montane Riparian woodland and shrubland (CES304.045). This model is similar to BpS 181159 with only slight modifications to vegetation species composition because BpS 1154 and 1159 overlap in elevations and describe the lower part of meandering river systems of the Columbia Plateau.

10/01/07: As a result of final QC for LANDFIRE National by Kori Blankenship the user-defined min and max fire return intervals for replacement severity fire were deleted because they were not consistent with the modeled fire return interval for this fire severity type.

Vegetation Classes

Class A 50 %

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 3

Indicator Species* and Canopy Position

POPUL	Upper
SALIX	Upper
ALNUS	Upper
CAREX	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Immediate post-disturbance responses are dependent on pre-disturbance vegetation composition. Generally, this class is expected to occur 1-5yrs post-disturbance. Typically shrub dominated, but grass may co-dominate. Salix spp dominates after fire, whereas Populus spp and Salix spp co-dominate after flooding. Silt, gravel, cobble and woody debris may be common. Composition highly variable. Modeled disturbances include weather-related stress expressed as seven-yr annual flooding events and beavers returning every five years to young patches of trees and shrubs. Succession to class B after five years.

Class B 40 %

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 3

Indicator Species* and Canopy Position

POPUL	Upper
ALNUS	Upper
SALIX	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Highly dependent on the hydrologic regime. Vegetation composition includes tall shrubs and small trees (cottonwood, aspen and conifers). Modeled disturbances include: 1) weather-related stress expressed as five-yr annual flooding events, which maintains vegetation in class B, and 2) 20-yr flooding events (weather-related stress) causing stand replacement, 3) replacement fire every 80yrs on average, and 4) beaver (Castor canadensis) clear-cutting (Option1). Beaver clearcutting occurs every 20yrs on average with a total probability partitioned 50/50 causing, respectively, a transition back to Class A (mean return interval = 40yrs) and class B (mean return interval = 40yrs). Succession to class C after 20yrs.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 C **10 %**

Late Development 1 Closed

Indicator Species* and Canopy Position

POPUL	Upper
ALNUS	Mid-Upper
SALIX	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model 3

Description

This class represents the mature, large cottonwood, conifer, etc. woodlands. 50yr flooding events (weather-related stress) cause a transition to class A, whereas 20-yr flood events cause a transition to class B. Replacement fire occurs about every 80yrs on average and is caused by importation from surrounding systems. Beaver activity is infrequent and causes a thinning disturbance to class B. Ice scour occurs every seven years but rarely kills large patches of trees.

Class D **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Class E **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg 10
Min 1
Max 100

Sources of Fire Regime Data

- [ ] Literature
- [ ] Local Data
- [ ] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	175			0.00571	100
Mixed					
Surface					
All Fires	175			0.00573	

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
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [ ] Competition
- [x] Other (optional 1) Beaver
- [x] Other (optional 2) ice scour

References

Barbour, M.G. and W.D. Billings, editors. 1988. North American terrestrial vegetation. Cambridge University Press, New York. 434 pp.

Barbour, M.G. and J. Major, editors. 1977. Terrestrial vegetation of California. John Wiley and Sons, New York. 1002 pp.

Hall, E.R. 1946. Mammals of Nevada. University of Nevada Press. Reno, NV.

Johnson, C.G. and S.A. Simon. 1985. Plant associations of the Wallowa Valley Ranger District, Part II: Steppe. USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest. 258 pp.

Manning, M.E., and W.G. Padgett. 1995. Riparian community type classification for Humboldt and Toiyabe national forests, Nevada and eastern California. USDA Forest Service, Intermountain Region. 306 pp.

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

Sawyer, J.O., and T. Keeler-Wolf. 1995. A manual of California vegetation. California Native Plant Society, Sacramento. 471 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

***Biophysical Setting:* 1011590** **Rocky Mountain Montane Riparian Systems**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 2	Mary Manning	mmanning@fs.fed.us	**Reviewer**	Cathy Stewart	cstewart@fs.fed.us
Modeler 3			**Reviewer**	John DiBari	jndibari@yahoo.com

Vegetation Type

Wetlands/Riparian

Dominant Species*

POPUL CRAET
SALIX BEOC2
COSE16
CAREX

General Model Sources

☑ Literature
☐ Local Data
☐ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

This system is found throughout the Rocky Mountains and Colorado Plateau regions.

Biophysical Site Description

This system occurs within a broad elevation range from approximately 900 to 2800m within the flood zone of rivers, on islands, sand or cobble bars, and streambanks. Typically this system exists in large, wide occurrences on mid-channel islands in larger rivers or narrow linear bands on small, rocky canyon tributaries and well drained benches and hillslopes below seeps/springs. May also include overflow channels, backwater sloughs, floodplain swales, and irrigation ditches. Surface water is generally high for variable periods. Soils are typically alluvial deposits of sand, clays, silts and cobbles that are highly stratified with depth due to flood scour and deposition

Vegetation Description

This ecological system occurs as a mosaic of multiple communities that are tree dominated with a diverse shrub component. Deciduous woody trees dominate, including: Populus angustifolia, P. balsamifera, P. tremuloides, and Salix amygdaloides. Dominant shrubs include Acer glabrum, Alnus incana, Betula occidentalis, Cornus sericea, Crataegus rivularis, Prunus virginiana, and numerous tall willow species: Salix lutea, S. geyeriana, S. boothii, S. drummondiana, S. lasiandra, S. bebbiana and S. exigua. Generally the adjacent upland vegetation surrounding this riparian system includes grasslands to forests.

Disturbance Description

This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. Flood events of increasing magnitude will cause maintenance to stand replacing disturbances. Beaver (Castor canadensis) crop younger cottonwoods (Populus spp.) and willows (Salix spp.), and frequently influence the hydrologic regime through construction of dams. Beavers show considerable movement along rivers as available trees are felled.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Frequent fire maintains the deciduous shrub component, especially at the lower elevation range of this BpS. In the absence of fire, shade-tolerant conifers will encroach and shade out the deciduous shrubs. Fire intervals may have ranged from 35-150yrs, depending strongly on the fire regime's) of the surrounding upland vegetation (Olson and Agee 2005).

Adjacency or Identification Concerns

This BpS encompasses the mid- and lower-elevation riparian systems within the northern Rocky Mountains. Higher elevation riparian systems are covered in BpS 1160.

Absence of fire as a structuring agent, coupled with shade tolerant conifer establishment can lead to loss of shade intolerant deciduous woody species. In addition, grazing and trampling by domestic and wild ungulates can shift the composition toward weedy and/or nonriparian species. Associated bank damage, which results in headcutting and incision, can result when bank stabilizing vegetation is removed and/or damaged by ungulate activity. In addition, loss of beavers can, coupled with heavy ungulate use, shift dominance in these systems to herbaceous species.

Exotic trees of Elaeagnus angustifolia and Tamarix spp. are common in some stands. Herbaceous noxious weeds, including leafy spurge, tansy, spotted knapweed readily invade and persist in these systems today.

Native Uncharacteristic Conditions

Scale Description

These systems can exist as small to large linear features in the landscape. In larger, low elevation riverine systems, this system may exist as mid-large patches, as a function of valley bottom width and gradient.

Issues/Problems

Comments

Additional reviewer was Steve Barrett (sbarrett@mtdig.net). Peer review resulted in a more frequent MFI (from 370yrs to 50yrs) and the addition of mixed severity fire.

Adapted from a model for the same BpS in MZs 12 and 17. The VDDT model for this system was taken from BpS 1160 and modified to highlight the dominance of the hydrologic regime.

Vegetation Classes

Class A **30 %**

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 3

Indicator Species* and Canopy Position

POPUL	Upper
SALIX	Upper
ALNUS	Upper
CAREX	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 0m	Shrub 3.0m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Immediate post-disturbance responses are dependent on pre-burn vegetation composition. This class is dominated by sprouting shrubs that respond favorably to fire. Species composition is highly variable. Silt, gravel, cobble and woody debris may be common.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Generally, this class is expected to occur 1-5yrs post-disturbance. Replacement fire, mixed severity fire, beavers and flooding will maintain this class.

Class B **50 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model 3

Indicator Species* and Canopy Position

POPUL	Upper
SALIX	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 3.1m	Shrub >3.1m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Highly dependent on the hydrologic regime. Vegetation composition includes tall shrubs and small trees (cottonwood, aspen, conifers).

Generally, this class succeeds to C after approximately 50yrs, unless a replacement disturbance (beavers, flooding, replacement fire) cause a transition to class A. Mixed severity fire will maintain this class.

Class C **20 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 3

Indicator Species* and Canopy Position

POPUL	Upper
PINUS	Upper
SALIX	Mid-Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 50m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

This class represents the mature, large cottonwood, conifer, etc. woodlands.

Generally, this class persists until a replacement disturbance (beavers, flooding, replacement fire) cause a transition to class A. Mixed severity fire will maintain this class.

Class D **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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 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:** **III**

Historical Fire Size (acres)

Avg 100
Min 1
Max 1000

Sources of Fire Regime Data

☐ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	*Min FI*	*Max FI*	*Probability*	*Percent of All Fires*
Replacement	100	100	150	0.01	50
Mixed	100			0.01	50
Surface					
All Fires	50			0.02001	

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) Beaver
☐ Other (optional 2)

References

Baker, W.L. 1988. Size-class structure of contiguous riparian woodlands along a Rocky Mountain river. Physical Geography 9(1): 1-14.

Baker, W.L. 1989a. Macro- and micro-scale influences on riparian vegetation in western Colorado. Annals of the Association of American Geographers 79(1): 65-78.

Baker, W.L. 1989b. Classification of the riparian vegetation of the montane and subalpine zones in western Colorado. Great Basin Naturalist 49(2): 214-228.

Baker, W.L. 1990. Climatic and hydrologic effects on the regeneration of Populus angustifolia James along the Animas River, Colorado. Journal of Biogeography 17: 59-73.

Crowe, E.A., and R.R. Clausnitzer. 1997. Mid-montane wetland plant associations of the Malheur, Umatilla, and Wallowa-Whitman national forests. USDA Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-22-97.

Daubenmire, R. 1952. Forest vegetation of northern Idaho and adjacent Washington, and its bearing on concepts of vegetation classification. Ecological Monographs 22(4): 301-330.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Dwire, K.A., S.E. Ryan, L.J. Shirley, D. Lytjen and N. Otting. 2004. Recovery of riparian shrubs following wildfire: Influence of herbivory. In Riparian Ecoystems and Buffers: Multi-scale structure, function, and management. AWRA Summer Specialty Conference, Olympic Valley, California. 28-30 June 2004.

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, A. McMullen and J. Sanderson. 1999. A classification of riparian and wetland plant associations of Colorado: A user's guide to the classification project. Colorado Natural Heritage Program, Colorado State University, Fort Collins CO. 70 pp. plus appendices.

Kovalchik, B.L. 1992. Riparian zone associations on the national forests of eastern Washington. USDA Forest Service, Pacific Northwest Region. Draft. 203 pp.

Manning, M.E., and W.G. Padgett. 1995. Riparian community type classification for Humboldt and Toiyabe national forests, Nevada and eastern California. USDA Forest Service, Intermountain Region. 306 pp.

Muldavin, E., P. Durkin, M. Bradley, M. Stuever and P. Mehlhop. 2000. Handbook of wetland vegetation communities of New Mexico: Classification and community descriptions (volume 1). Final report to the New Mexico Environment Department and the Environmental Protection Agency prepared by the New Mexico Natural Heritage Program, University of New Mexico,
Albuquerque, NM.

Nachlinger, J., K. Sochi, P. Comer, G. Kittel and D. Dorfman. 2001. Great Basin: An ecoregion-based conservation blueprint. The Nature Conservancy, Reno, NV. 160 pp. plus appendices.

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

Neely, B., P. Comer, C. Moritz, M. Lammerts, R. Rondeau, C. Prague, G. Bell, H. Copeland, J. Jumke, S. Spakeman, T. Schulz, D. Theobald, and L. Valutis. 2001. Southern Rocky Mountains: An ecoregional assessment and conservation blueprint. Prepared by The Nature Conservancy with support form the USDA Forest Service, Rocky Mountain Region, Colorado Division of Wildlife and Bureau of Land Management.

Olson, D.L. and J.K. Agee. 2005. Historical fires in Douglas-fir dominated riparian forests of the south Cascades, Oregon. Fire Ecology 1(1): 54-74.

Padgett, W.G., A.P. Youngblood and A.H. Winward. 1989. Riparian community type classification of Utah and southeastern Idaho. USDA Forest Service, Intermountain Region. Report R4-ECOL-89-01. Ogden, UT. 191 pp.

Szaro, R.C. 1989. Riparian forest and scrubland community types of Arizona and New Mexico. Desert Plants Special Issue 9(3-4): 70-139.

Tuhy, J., P. Comer, D. Dorfman, M. Lammert, B. Neely, L. Whitham, S. Silbert, G. Bell, J. Humke, B. Baker and B. Cholvin. 2002. An ecoregional assessment of the Colorado Plateau. The Nature Conservancy, Moab Project Office. 112 pp. plus maps and appendices.

Walford, G.M. 1996. Statewide classification of riparian and wetland dominance types and plant communities - Bighorn Basin segment. Report submitted to the Wyoming Department of Environmental Quality, Land Quality Division by the Wyoming Natural Diversity Database. 185 pp.

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Walford, G., G. Jones, W. Fertig, S. Mellman-Brown and K. Houston. 2001. Riparian and wetland plant community types of the Shoshone National Forest. General Technical Report RMRS-GTR-85. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. 122 pp.

Walford, G., G. Jones, W. Fertig and K. Houston. 1997. Riparian and wetland plant community types of the Shoshone National Forest. Unpublished report. Wyoming Natural Diversity Database for The Nature Conservancy, and the USDA Forest Service. Wyoming Natural Diversity Database, Laramie. 227 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

***Biophysical Setting:* 1011600** **Rocky Mountain Subalpine/Upper Montane Riparian Systems**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 2	Mary Manning	mmanning@fs.fed.us	**Reviewer**	Cathy Stewart	cstewart@fs.fed.us
Modeler 3			**Reviewer**	John DiBari	jndibari@yahoo.com

Vegetation Type

Wetlands/Riparian

Map Zone

10

Model Zone

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

Dominant Species*

SALIX PICEA
POTR5
CAREX
ABLA

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Geographic Range

Higher elevations of the Great Basin, CA, northern Rockies and Pacific Northwest.

Biophysical Site Description

This ecological system represents the combination of numerous riparian types occurring in the upper montane/sub-alpine zones. It is found at 1500-3500m (4920-11500ft). This ecological system typically exists as relatively small linear stringers, but can occupy relatively wide and flat valleys.

Vegetation Description

This ecological system encompasses a broad array of riparian species. These systems are highly variable and generally consist of willows and other shrubs, sedges and other herbaceous vegetation or conifers (primarily spruce and subalpine fir). Shrubs include bog birch, bog blueberry and low willows (eg, Salix planifolia, S. wolfii, S. glauca, S. commutate and S. eastwoodia), among others. Graminoids include bluejoint reedgrass, Holm's sedge and water sedge, among others.

Unlike the lower elevation riparian types (1159, Rocky Mountain Subalpine Lower Montane Riparian Systems), this type does not typically include cottonwood species, but may include paper birch and aspen.

Disturbance Description

Flooding events and availability of water during drier periods are the major influences to this system, as a function of slope. Five-year flood events maintain vegetation but do not scour it, whereas 100-year events scour and reset succession to early development, depending on vegetation. Flat valley bottom systems store and release water slowly throughout the growing season, whereas narrow steep systems have little to no lateral floodplain development and water is transported downstream rapidly through step-pool channels. In the latter situation, larger materials (boulders, bedrock and large woody debris) typically armor the banks

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 maintain channel form, even in larger flooding events. Vegetation is less critical in these systems, however, it is the primary armoring agent in low gradient valley bottom systems.

The moisture associated with riparian areas promotes lower fire frequency compared with adjacent uplands, and rapid recovery from fire events. Wet meadow types seldom burn. In riparian systems the preburn herbaceous plant community is not permanently destroyed, and rapidly recovers. Recovery is possible within a single growing season. Woody species (ie, aspen, Salix spp and occasionally cottonwood species) can be topkilled, but generally resprout within a short period. In systems with conifers, post-fire establishment is from seed. Willows will regenerate from seed if bare wet mineral soil is present (ie, stream bars) but they also sprout vigorously after fire. Older vegetation experienced fire when replacement fires burned the uplands (MFRI of 100yrs). Surface fire (MFRI of 50yrs) affected the early development class through a combination of replacement fire from uplands and occasional native burning.

Adjacency or Identification Concerns

This BpS includes narrow to moderately wide meadows, shrublands and woodlands of conifers and aspen.

Over-grazing and irrigation use have had major impacts on some of these systems. This ecological system occurs at scales below 30-m resolution of LANDFIRE.

Native Uncharacteristic Conditions

Scale Description

These systems are small linear or relatively wide features in the landscape.

Issues/Problems

There is a paucity of fire information on this system and the very heterogeneous nature of the systems is challenging for model building. However, most of the shrubs and graminoids respond favorably to fire by resprouting from the root crown.

Comments

Additional reviewers was Steve Barrett (sbarrett@mtdig.net). Peer review resulted in changes to the fire regime (mixed severity fire was added, surface fire was eliminated and the overall MFI was lengthened) and overall proportions in classes A and B.

This model was adopted from MZs 12 and 17, which was adopted as-is from MZ16. The model for MZ16 was developed by Charles Kay (ckay@hass.usu.edu) and Don Major (dmajor@tnc.org).

Vegetation Classes

Class A 50 %

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☑ Shrub
- ☐ Tree

Fuel Model 3

Indicator Species* and Canopy Position

SALIX	Upper
CAREX	Upper
PICEA	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 0m	Shrub >3.1m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Immediate post-fire responses in this ecological system are dependent on pre-burn vegetation form. Post-burn condition sensitive to scouring and blow-out from floods. This class is shrub or grass dominated. Composition varies both within/among reaches. Generally, this class is expected to occur 1-3yrs post-disturbance. Re-establishment of conifers may require 50-100yrs.

Flooding disturbances (modeled as weather-related stress) include five-year events that do not scour and 100-yr events that resets the vegetation to age zero. Beaver (Option 1) reset succession every 10yrs on average by moving along the river with tree depletion. Replacement fire was typically rare and not included, whereas surface fire was more frequent (mean 50yrs FRI) and a combination of upland-driven fire and native burning. Succession to class B after 24yrs, however this is highly variable due to high moisture levels and high species variability.

Class B **50 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model 3

Indicator Species* and Canopy Position

SALIX	Upper
CAREX	Upper
PICEA	Upper
	Upper

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	100 %
Height	Tree 0m	Tree 50m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Highly dependent on the hydrologic regime. For example, could include any combination of the five vegetation forms described above. Composition of adjacent uplands is the determining factor for future fire events. Conifer establishment in these higher elevation areas causes a mean FRI of 100yrs.

Class C **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

Class D **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

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 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:** III

Historical Fire Size (acres)

Avg 10
Min 1
Max 100

Sources of Fire Regime Data

☐ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	200			0.005	40
Mixed	133			0.00752	60
Surface					
All Fires	80			0.01253	

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) Beaver
☑ Other (optional 2) 100-year flood events

References

Baker, W.L. 1988. Size-class structure of contiguous riparian woodlands along a Rocky Mountain river. Physical Geography 9(1): 1-14.

Baker, W.L. 1989a. Macro- and micro-scale influences on riparian vegetation in western Colorado. Annals of the Association of American Geographers 79(1): 65-78.

Baker, W.L. 1989b. Classification of the riparian vegetation of the montane and subalpine zones in western Colorado. Great Basin Naturalist 49(2): 214-228.

Baker, W.L. 1990. Climatic and hydrologic effects on the regeneration of Populus angustifolia James along the Animas River, Colorado. Journal of Biogeography 17: 59-73.

Crowe, E.A. and R.R. Clausnitzer. 1997. Mid-montane wetland plant associations of the Malheur, Umatilla, and Wallowa-Whitman national forests. USDA Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-22-97.

Dwire, K.A., S.E. Ryan, L.J. Shirley, D. Lytjen and N. Otting. 2004. Recovery of riparian shrubs following wildfire: Influence of herbivory. In: Riparian Ecoystems and Buffers: Multi-scale structure, function, and management. AWRA Summer Specialty Conference, Olympic Valley, California. 28-30 June 2004.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Kittel, G.M. 1994. Montane vegetation in relation to elevation and geomorphology along the Cache la Poudre River, Colorado. Unpublished thesis, University of Wyoming, Laramie.

Kittel, G., R. Rondeau, N. Lederer and D. Randolph. 1994. A classification of the riparian vegetation of the White and Colorado River basins, Colorado. Final report submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Colorado Natural Heritage Program, Boulder. 166 pp.

Kittel, G., R. Rondeau and A. McMullen. 1996. A classification of the riparian vegetation of the Lower South Platte and parts of the Upper Arkansas River basins, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency, Region VIII. Prepared by Colorado Natural Heritage Program, Fort Collins. 243 pp.

Kittel, G., R. Rondeau and S. Kettler. 1995. A classification of the riparian vegetation of the Gunnison River Basin, Colorado. Submitted to Colorado Department of Natural Resources and the Environmental Protection Agency. Prepared by Colorado Natural Heritage Program, Fort Collins. 114 pp.

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler and J. Sanderson. 1999a. A classification of the riparian plant associations of the Rio Grande and Closed Basin watersheds, Colorado. Unpublished report prepared by the Colorado Natural Heritage Program, Colorado State University, Fort Collins.

Kittel, G., E. Van Wie, M. Damm, R. Rondeau, S. Kettler, A. McMullen and J. Sanderson. 1999b. A classification of riparian and wetland plant associations of Colorado: A user's guide to the classification project. Colorado Natural Heritage Program, Colorado State University, Fort Collins CO. 70 pp. plus appendices.

Kovalchik, B.L. 1987. Riparian zone associations - Deschutes, Ochoco, Fremont, and Winema national forests. USDA Forest Service Technical Paper 279-87. Pacific Northwest Region, Portland, OR. 171 pp.

Kovalchik, B.L. 1993. Riparian plant associations on the national forests of eastern Washington - Draft version 1. USDA Forest Service, Colville National Forest, Colville, WA. 203 pp.

Kovalchik, B.L. 2001. Classification and management of aquatic, riparian and wetland sites on the national forests of eastern Washington. Part 1: The series descriptions. 429 pp. plus appendix. [http://www.reo.gov/col/wetland_classification/wetland_classification.pdf]

Manning, M.E., and W.G. Padgett. 1995. Riparian community type classification for Humboldt and Toiyabe national forests, Nevada and eastern California. USDA Forest Service, Intermountain Region. 306 pp.

Muldavin, E., P. Durkin, M. Bradley, M. Stuever and P. Mehlhop. 2000. Handbook of wetland vegetation communities of New Mexico: Classification and community descriptions (volume 1). Final report to the New Mexico Environment Department and the Environmental Protection Agency prepared by the New Mexico Natural Heritage Program, University of New Mexico, Albuquerque, NM.

Nachlinger, J., K. Sochi, P. Comer, G. Kittel and D. Dorfman. 2001. Great Basin: An ecoregion-based conservation blueprint. The Nature Conservancy, Reno, NV. 160 pp. plus appendices.

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

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Neely, B., P. Comer, C. Moritz, M. Lammerts, R. Rondeau, C. Prague, G. Bell, H. Copeland, J. Jumke, S. Spakeman, T. Schulz, D. Theobald and L. Valutis. 2001. Southern Rocky Mountains: An ecoregional assessment and conservation blueprint. Prepared by The Nature Conservancy with support form the USDA Forest Service, Rocky Mountain Region, Colorado Division of Wildlife and Bureau of Land Management.

Padgett, W.G. 1982. Ecology of riparian plant communities in southern Malheur National Forest. Unpublished thesis, Oregon State University, Corvallis. 143 pp.

Padgett, W.G., A.P. Youngblood and A.H. Winward. 1988a. Riparian community type classification of Utah and southeastern Idaho. Research Paper R4-ECOL-89-0. USDA Forest Service, Intermountain Region, Ogden, UT.

Padgett, W.G., A.P. Youngblood and A.H. Winward. 1988b. Riparian community type classification of Utah. USDA Forest Service, Intermountain Region Publication R4-ECOL-88-01. Ogden, UT.

Rondeau, R. 2001. Ecological system viability specifications for Southern Rocky Mountain ecoregion. First Edition. Colorado Natural Heritage Program, Colorado State University, Fort Collins, CO. 181 pp.

Szaro, R.C. 1989. Riparian forest and scrubland community types of Arizona and New Mexico. Desert Plants Special Issue 9(3-4): 70-139.

Tuhy, J., P. Comer, D. Dorfman, M. Lammert, B. Neely, L. Whitham, S. Silbert, G. Bell, J. Humke, B. Baker and B. Cholvin. 2002. An ecoregional assessment of the Colorado Plateau. The Nature Conservancy, Moab Project Office. 112 pp. plus maps and appendices.

Walford, G.M. 1996. Statewide classification of riparian and wetland dominance types and plant communities - Bighorn Basin segment. Report submitted to the Wyoming Department of Environmental Quality, Land Quality Division by the Wyoming Natural Diversity Database. 185 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011610 **Northern Rocky Mountain Conifer Swamp**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Katie Phillips	cgphillips@fs.fed.us	**Reviewer**	Steve Barrett	sbarrett@mtdig.net
Modeler 2	Randall Walker	rmwalker@fs.fed.us	**Reviewer**	Cathy Stewart	cstewart@fs.fed.us
Modeler 3	Larry Kaiser	larry_kaiser@blm.gov	**Reviewer**		

Vegetation Type

Wetlands/Riparian

Dominant Species*

PIEN
THPL

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Map Zone

10

Model Zone

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

Geographic Range

Northern Rocky Mountains from northwestern WY north into the Canadian Rockies and west into eastern OR and WA. Most common where the inland Pacific maritime influence is strongest. The biggest expanse of late-successional status currently is from Upper Priest Lake, ID to the Canadian border.

Biophysical Site Description

Poorly drained soils that are saturated a significant portion of the growing season may have seasonal flooding in the spring. Soils conditions may include exposed rock and gravel at the surface or, more rarely, organic matter. Stands generally occupy sites on benches, toeslopes or valley bottoms along mountain streams. May occupy upland sites (especially on northerly aspects) where high water table allows saturation part of the growing season.

Vegetation Description

Composition will vary geographically, but is generally dominated by large, old Picea engelmannii. Thuja plicata may be present on warm-wet lowland sites as well. Large downed logs are often common (50 tons/acre possible). Large old cedars tend to have heartrot.

Understory associates will vary widely geographically, but include Oplopanax horridum (devil's club), Athyrium filix-femina, Dryopteris spp, Lysichiton americanus, Gymnocarpium dryopteris, Equisetum arvense, Senecio triangularis, Mitella breweri (colder and wetter end of the range), Mitella pentandra, Streptopus amplexifolius and Calamagrostis canadensis (colder and wetter end of the range).

Disturbance Description

Fire regime group V with rare stand replacement fires (>200yrs+). Fire frequency is highly dependant on adjacent vegetation and relative patch size compared to the surrounding matrix. In the subalpine zone, these systems act as fuel breaks. However, frequency of fire is increased where drainage is oriented with

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**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.

prevailing wind. Fuel loading in adjacent vegetation may sometimes be important. Small patch fire events (individual lightning strikes) may occur within patches, but do not meet the threshold of mixed severity fire.

Openings the overstory canopy often results in windthrow (Williams et al. 1995).

Spruce beetle outbreaks may occur and be linked to subsequent fire events.

Adjacency or Identification Concerns

The wetland types are generally distinguishable from other upland forests and woodlands by shallow water tables and mesic or hydric undergrowth vegetation.

Native Uncharacteristic Conditions

Scale Description

Linear features and smaller patches. 10s-1000s of acres in size.

Issues/Problems

This is typically a small patch system and may be difficult to map.

This is a relatively stable ecosystem dominated by positive feedback mechanisms and so they were highly variable over space and time. Variability was dependent on patch size, native burning and adjacent vegetation.

Comments

Art Zack (azack@fs.fed.us) and Craig Glazier (cglazier@fs.fed.us) provided input to an earlier version of this model.

In general, modelers and reviewers had trouble with the NatureServe description of this type, as it combines two very different systems-- upland redcedar groves and lowland, seasonally flooded conifer (spruce) bogs. The upland redcedar type was split into a separate model for zones 10 and 19 (10472), and this "conifer swamp" type was modeled differently than the NatureServe description. As a result of peer review, mixed severity fire was removed from the model.

Peer review resulted in general concern that this system is too small in concept compared to other BpS and should not be included in LANDFIRE.

Vegetation Classes

Class A **10 %**

Early Development 1 All Structures

Indicator Species* and Canopy Position

PIEN Mid-Upper

Upper Layer Lifeform

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

Fuel Model

Description

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

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

Riparian sprouting species may be considered trees or shrubs. Nurse crops of white pine, lodgepole, or cottonwood may comprise this class, in which case tree heights would be very tall (>30m).

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Sprouting riparian shrubs and deciduous trees, such as black cottonwood, Douglas maple, willow and birch. Engelmann spruce and some other conifers may be regenerating.

The probability of fire is highest in this class and fires will often creep in from adjacent vegetation types.

Loss of large trees post-burn can alter the water table and reduce subsequent tree regeneration, causing this class to last many years.

Class B **20 %**

Mid Development 1 Closed

Indicator Species* and Canopy Position

PIEN Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Typically closed overstory of Engelmann spruce. Riparian deciduous species present but not dominant.

Class C **70 %**

Late Development 1 Closed

Indicator Species* and Canopy Position

PIEN Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 25.1m	Tree >50.1m
Tree Size Class	None	

☐ Upper layer lifeform differs from dominant lifeform.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Description

Typically closed, old Engelmann spruce trees. Canopy closure tends to be >60%.

Class D **0 %**

[Not Used] [Not Used]

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.

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☐ Tree

Fuel Model

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 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:** V

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	400	250	750	0.0025	99
Mixed					
Surface					
All Fires	400			0.00252	

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

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-GTR-363. Ogden, UT: USDA Forest Service, Intermountain Research Station. 142 pp.

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

Olson, D.L. and J.K. Agee. 2005. Historical fires in Douglas-fir dominated riparian forests of the southern Cascades, Oregon. Fire Ecology 1(1): 51-74.

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Stevens, I. 1860. Narrative and Final Report of Explorations for a Route for a Pacific Railraod, 1855. In: Reports of Explorations and Surveys to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean. 36th Congress, House of Representatives. Executive Document No. 56. Volume XII. Book I. Washington, DC.

Williams, C.K., B.F. Kelley, B.G. Smith and T.R. Lillybridge. 1995. Forest plant associations of the Colville

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

National Forest. Gen. Tech. Rep. PNW-GTR-360. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 375 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011650** **Northern Rocky Mountain Foothill Conifer Wooded Steppe**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Jeff Jones	jjones@fs.fed.us	**Reviewer**	Mary Manning	mmanning@fs.fed.us
Modeler 2			**Reviewer**	Cathy Stewart	cstewart@fs.fed.us
Modeler 3			**Reviewer**	Carly Gibson	cgibson@fs.fed.us

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

PSME	JUCO
PIPO	JUSC
PIFL	PSSP6
ARTRV	FEID

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

Primarily found east of the Continental Divide in northern MT, eastern ID and WY, but west of Billings, MT.

Biophysical Site Description

These savannas occur at the lower treeline/ecotone between grassland or shrubland and more mesic coniferous forests typically in warm, dry, exposed sites. Elevations range from <500m British Columbia to 1600m the central ID mountains. Occurrences are found on all slopes and aspects; however, moderately steep to very steep slopes or ridgetops are most common. This ecological system generally occurs on glacial till, glacio-fluvial sand and gravel, dune, basaltic rubble, colluvium, to deep loess or volcanic ash-derived soils, with characteristic features of good aeration and drainage, coarse textures, circumneutral to slightly acid pH, an abundance of mineral material, rockiness and periods of drought during the growing season. These savannas in the eastern Cascades, Okanagan and northern Rockies regions receive winter and spring rains, and thus have a greater spring "green-up" than the drier woodlands and savannas in the central Rockies.

Vegetation Description

Generally dominated by Douglas-fir with incidental ponderosa pine and/or limber pine. Understory of bunchgrasses and sparse shrubs. Stands are typically open and dominated by moderate to large diameter Douglas-fir.

Disturbance Description

Fire regime is predominantly (70%) frequent, low severity fires with a MFI of approximately 30yrs. Mixed-severity fires occur with a typical frequency of 30-50yrs primarily in dense stands (classes B and E). Native American burning may have occurred in many of these low-elevation forests.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Limber pine may be affected by blister rust.

Adjacency or Identification Concerns

This BpS corresponds with cool, dry Douglas-fir and limber pine habitat types (Pfister et al. 1977), including PSME/ARUV, PSME/AGSP, PIFL/AGSP, PIFL/FEID/FESC, PIFL/AGSP and PIFL/FEID. Ecotone with mountain grasslands/sagebrush.

Native Uncharacteristic Conditions

Scale Description

Since this type is dominated by surface fires and because this type represents an ecotone, patches tended to be smaller in size. Consequently, fire sizes were also relatively small. Analysis areas of several thousand acres would probably be adequate.

Issues/Problems

Comments

Additional reviewers were John DiBari (jndibari@yahoo.com), Steve Barrett (sbarrett@mtdig.net) and Lee Clark (lwclark@fs.fed.us).

Based on the Rapid Assessment model R0PSMEdy, by Jeff Jones and reviewed by Cathy Stewart (cstewart@fs.fed.us) and Steve Barrett (sbarrett@mtdig.net).

Rapid Assessment peer review comments incorporated on 3/16/2005, resulting in clarification in description and slightly more surface fires and higher MFI overall.

10/01/07: 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

Class A **10 %**

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME	Upper
FEID	Lower
ARTRV	Lower
PIFL	Upper

Structure Data (for upper layer lifeform)

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

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Dominated by bunchgrasses and mountain sagebrush, and seed/sapling sized Douglas-fir. Limber pine and ponderosa pine may be present in varying amounts.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 **2 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME Upper
PIFL Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	31 %	100 %
Height	Tree 0m	Tree 50m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Relatively dense pole and/or large sized Douglas-fir. Limber pine and ponderosa pine may be present in varying amounts. Sagebrush has largely dropped out of the stand. Mixed severity fire may open up the canopy.

Class C **8 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME Upper
FEID Lower
ARTRV Lower
PIFL Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	30 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Open poles of Douglas-fir with bunchgrass and sagebrush understory. Limber pine and ponderosa pine may be present in varying amounts. Surface fires maintain the open condition.

Class D **80 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME Upper
FEID Lower
ARTRV Lower
PIFL Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	30 %
Height	Tree 10.1m	Tree 50m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Widely spaced, open canopy of medium to large diameter Douglas-fir with bunchgrass and sagebrush understory. Canopy fuel is discontinuous. Limber pine and ponderosa pine may be present in varying amounts. Surface fires maintain the open condition.

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

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*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Disturbances

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	200	100	300	0.005	10
Mixed	145			0.0069	13
Surface	25	15	40	0.04	77
All Fires	19			0.0519	

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

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

References

Barrett, S.W. 2004. Personal communication and fire history database. June 17, 2004.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Fischer, W.C. and B.D. Clayton. 1983. Fire ecology of Montana forest habitat types east of the Continental Divide. Gen. Tech. Rep. INT-141. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 83 pp.

Heyerdahl, E.K. and R.F. Miller. 2004. Fire and forest history in a high-elevation mosaic of Douglas-fir forest and sagebrush-grass, Fleecer Mountains, Montana: A pilot study. Final report ot BLM, Butte Field Office, 15 December 2004. 38 pp. On file at the USFS Region 1, Regional Office, Fire, Air, and Aviation Unit.

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011660** **Middle Rocky Mountain Montane Douglas-fir Forest and Woodland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Steve Rust	srust@idfg.idaho.gov	**Reviewer**	Rolan Becker	rolanb@cskt.org
Modeler 2	Kathy Geier-Hayes	kgeierhayes@fs.fed.us	**Reviewer**	Ed Lieser	elieser@fs.fed.us
Modeler 3	Susan Miller	smiller03@fs.fed.us	**Reviewer**	Cathy Stewart	cstewart@fs.fed.us

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

PSME CAGE
PICO BERE
PIFL PHMA5
CARU

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Geographic Range

This BpS occurs in the southeast and eastern portions of MZs 10 and 19 (eastern Salmon River mountains, Pioneer mountains and Soldier mountains, Helena NF).

Biophysical Site Description

The xeric Douglas-fir type primarily exists on lower foothills immediately above grasslands/shrublands in elevation. Upper elevations border on dry subalpine fir. Slopes range from gentle to steep.

Vegetation Description

Generally dominated by Douglas-fir with an understory of graminoides and sparse shrubs. Stands are typically open and dominated by moderate to large diameter Douglas-fir. Limber pine may be present. Lodgepole pine can co-dominate in cooler portions of the mapping zones.

Disturbance Description

Fire regime is predominantly mixed with a MFI of approximately 35-50yrs (Crane and Fischer 1986, Bradley et al. 1992) . Mixed-severity fires occur with a typical frequency of 30-50yrs primarily in dense stands (classes B and E).

Adjacency or Identification Concerns

This BpS corresponds with cool, dry Douglas-fir and limber pine habitat types (Pfister et al. 1977, Steele et al. 1981), including PSME/CAGE, PSME/FEID, PSME/SYOR, PSME/ARCO, PSME/JUCO, PIFL/FEID/FEID phase and PIFL/JUCO.

This type often forms an ecotone with mountain grasslands/sagebrush. Class A in this model is equivalent with a Class A in neighboring grassland/shrubland types. Higher elevations of this type border dry subalpine

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

fir systems and persistent lodgepole pine in frost pockets and cooler areas of the map zone.

Douglas-fir increases in canopy density in the absence of fire disturbance. Much of this landscape today has canopy cover denser than the historic range of variability.

Native Uncharacteristic Conditions

Canopy closure of >90% in this BpS is considered uncharacteristic.

Scale Description

Since this type is dominated by mixed fires, patches tend to be smaller in size due to limited fuels. Fire sizes are generally variable. Analysis areas of several thousand acres would probably be adequate.

Issues/Problems

Comments

Additional reviewer was Susan Miller (smiller03@fs.fed.us).

This BpS was adapted from Rapid Assessment model R0PSMEdy, by Jeff Jones and reviewed by Steve Barrett and Cathy Stewart.

Review comments incorporated on 3/16/2005, resulting in clarification in description and slightly more surface fires and higher MFI overall.

Vegetation Classes

Class A 20%

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME	Upper
PICO	Upper
PIFL	Upper
CARU	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	90 %
Height	Tree 0m	Tree 5m
Tree Size Class	Sapling >4.5ft; <5"DBH	

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

Graminoids are the dominant lifeform in this class.

Description

Dominated by graminoids and seedling and sapling sized Douglas-fir, lodgepole pine and/or limber pine. Understory may be dominated by Calamagrostis rubescens and Carex geophila.

Class B 15%

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME	Upper
PICO	Upper
PIFL	Lower
CARU	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	90 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Relatively dense pole and medium sized Douglas-fir or lodgepole pine. The understory is open and relatively depauperate. Mixed severity fire may open up the canopy. Understory may be dominated by Calamagrostis rubescens and Carex geophila.

Class C **30 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME	Upper
PICO	Upper
PIFL	Upper
CARU	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	40 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Open poles and medium sized Douglas-fir, lodgepole pine or limber pine with patchy graminoid cover and dispersed shrubs. Understory may be dominated by Calamagrostis rubescens and Carex geophila.

Class D **20 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME	Upper
PICO	Upper
PIFL	Upper
CARU	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	21 %	40 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Very Large >33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Open canopy of medium-large sized lodgepole pine and/or limber pine and large to very large Douglas-fir and/or limber pine with a graminoid and sparse shrub understory. Understory may be dominated by Calamagrostis rubescens and Carex geophila.

Class E **15 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PSME	Upper
PICO	Upper
PIFL	Upper
CARU	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	90 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Very Large >33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Multi-storied Douglas-fir, sometimes with lodegpole pine and limber pine present. Mixed severity fire may open up the canopy. Sparse understory dominated by Calamagrostis rubescens and Carex geophila.

Disturbances

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [x] Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	75	20	130	0.01333	42
Mixed	55	50	700	0.01818	57
Surface	2500			0.0004	1
All Fires	31			0.03192	

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

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

References

Barrett, S.W. 2004. Fire history database. June 17, 2004.

Barrett, S.W. 2004. Fire Regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Bradley, A.F., W.C. Fischer and N.V. Noste. 1992. Fire ecology of the forest habitat types of eastern Idaho and western Wyoming. Gen. Tech. Rep. INT-290. Ogden, UT: USDA Forest Service, Intermountain Research Station. 92 pp.

Crane, M.F. and W.C. Fisher. 1986. Fire ecology of the forested habitat types of central Idaho. General Technical Report INT-218, USDA Forest Service. 86 pp.

Fischer, W.C. and B.D. Clayton. 1983. Fire ecology of Montana forest habitat types east of the Continental Divide. Gen. Tech. Rep. INT-141. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 83 pp.

Heyerdahl, E.K. and R.F. Miller. 2004. Fire and forest history in a high-elevation mosaic of Douglas-fir forest and sagebrush-grass, Fleecer Mountains, Montana: A pilot study. Final report ot BLM, Butte Field Office, 15 December 2004. 38 pp. On file at the USFS Region 1, Regional Office, Fire, Air, and Aviation Unit.

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Steele, R., R.D. Pfister, R.A. Ryker and J.A. Kittams. 1981. Forest habitat types of central Idaho. Gen. Tech. Rep. INT-114. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 138

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

pp.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: 1011670 Rocky Mountain Poor-Site Lodgepole Pine Forest

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

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Modeler 3	John DiBari	Jdibari@email.wsu.edu	**Reviewer**	Roy Renkin	roy_renkin@nps.gov

Vegetation Type

Forest and Woodland

Map Zone

10

Model Zone

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

Dominant Species*

PICO CARO5
CAGE2
VASC
CARU

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Geographic Range

Northern Rockies, south western MT and central ID.

Biophysical Site Description

This type occurs on coarse, nutrient poor soils derived largely from silicic rocks, (rhyolite, granite and some sterile sandstone). This type may be considered an edaphic climax that occurs on rocky soils in cold air pockets. These are subalpine forests where the dominance of Pinus contorta is related to topo-edaphic conditions and nutrient-poor soils. These include excessively well-drained pumice deposits, glacial till and alluvium on valley floors where there is cold air accumulation, warm and droughty shallow soils over fractured quartzite bedrock, and shallow moisture-deficient soils with a significant component of volcanic ash. Soils on these sites are typically well-drained, gravelly, coarse-textured, acidic, and rarely formed from calcareous parent materials. Annual precipitation averages 25-35in. with fairly even distribution across the months with slightly more in the spring and less during the summer.

Vegetation Description

Following stand-replacing fires, Pinus contorta will rapidly colonize and develop into dense, even-aged stands and then persist on these sites that are too extreme for other conifers to establish. Mature to overmature stands are dominated by slow growing lodgepole pine (Pinus contorta Dougl.). Lodgepole pine occurs in nearly pure stands throughout all successional stages (ie, lodgepole pine plays early-seral and quasi-climax roles in this system). These stands can be dense (80-100 basal area (ft sq)).

Understory will typically be sparse except in gaps. Species may include: Geyer's sedge, Ross' sedge, Vaccinium spp, pine grass, twin flower and kinnikinnick. Early succession stands can be dense with lodgepole pine seedlings and saplings that thin over time to widely spaced trees with a multi-aged structure.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Disturbance Description

Fire is infrequent and often quite patchy due to lack of surface fuel. Winds carry crown fire for stand replacing events. Mountain pine beetles kill trees in endemic and epidemic disturbance events. Large diameter trees (>8in DBH) are preferred by mountain pine beetles but in epidemics, 5in DBH class trees have been known to be killed. Generally younger trees are not host trees. Patches of mortality provide gaps for regeneration. Mortality of trees from mountain pine beetles produces fuel for large stand replacing fires. The interrelationships between fire and insects are the principle drivers in this system.

Mistletoe may cause mortality in older trees, a profusion of induced branches and partial crown mortality, which may predispose them to intense torching that may lead to crown fire.

Adjacency or Identification Concerns

May be confused with dense stands of lodgeople dominated seral stages of more moist subalpine forested environments. Seral lodegpole pine stands can be distinguished because they have a more continuous cover of herbaceous growth and will have the occasional presence of spruce or fir seedlings. This BpS cannot support any coniferous species other than lodgepole pine.

This type corresponds to cool habitat types dominated by lodgepole pine (Pfister et al. 1977) but may not contain subalpine firs and spruce.

Native Uncharacteristic Conditions

Scale Description

Patch size ranges from a few tens of acres to a few hundred on sandstone outcrops to areas of thousands to tens of thousand on rhyolite and granitic substrates.

Issues/Problems

Comments

Additional reviewer was Ward McCaughey (wmccaughey@fs.fed.us). Peer review resulted in a longer overall MFI (from 175yrs to 300yrs) and a significant reduction in the amount of mixed severity fire (from ~40% to ~10%). There was some debate among reviewers about the exact nature of this BpS compared to subalpine, seral lodgepole pine. Additional adjustments were made in the model description to clarify these differences.

Based on the Rapid Assessment model R0PICO by Don Despain (don_despain@usgs.gov) and reviewed by Steve Barrett (sbarrett@mtdig.net) and Cathy Stewart (cstewart@fs.fed.us).

Vegetation Classes

Class A **15 %**

Early Development 1 All Structures

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Description

Indicator Species* and Canopy Position

PICO	Upper
CAGE2	Low-Mid
CARO5	Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Tree 0m	Tree 5m
Tree Size Class	Seedling <4.5ft	

☐ Upper layer lifeform differs from dominant lifeform.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Sparse to dense lodgepole pine seedlings to young pole-sized trees. Sparse herbaceous ground cover mostly of Carex geyeri and C. rossii. Lodgepole are slow growing, and succession to class B occurs after 40yrs.

Class B **25 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PICO
CAGE2
CARO5

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Pole sized lodgepole pine and a sparse herbaceous layer dominated by Carex geyeri. Disturbance caused gaps may cause a transition to class C. Competition in the doghair condition may delay succession and prolong stay in this class. Self thinning would cause a transition to C. Otherwise the class succeeds to class D after 150yrs.

Class C **15 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PICO
CAGE2
CARO5
VASC

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	40 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Pole sized lodgepole pine with a Carex spp dominated understory. At 150yrs, this class succeeds to class D.

Class D **45 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

PICO
CAGE2
CARO5
VASC

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Large 21-33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Nearly homogenous even aged or uneven aged lodgepole pine stands with limited recruitment in gaps. Understory herbaceous cover is sparse and limited to where there is sunlight. Mountain pine beetle infestations at epidemic levels may cause transition of class A. Blowdowns and endemic population levels of beetles result in opening and the transition to class C.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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 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:** V

Historical Fire Size (acres)

Avg 0
Min 0
Max 0

Sources of Fire Regime Data

☑ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	350	300	600	0.00286	87
Mixed	2500			0.0004	12
Surface					
All Fires	307			0.00327	

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

Barrett, S.W. 2004. Altered fire intervals and fire cycles in the Northern Rockies. Fire Management Today 64(3): 25-29.

Barrett, S.W. 2004. Fire regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Bradley, A.F. 1992. Fire ecology of the forest habitat types of eastern Idaho and western Wyoming. GTR INT-290. Ogden, UT: USDA Forest Service. 92 pp.

Despain, D.G. 1990. Vegetation of Yellowstone National Park: Consequences of history and environment. Boulder, CO: Roberts Reinhart Publishers. 239 pp.

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Romme, W.H. 1982. Fire and landscape diversity in subalpine forests of Yellowstone National Park.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Ecological Monographs: 52(2): 199-221

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011680** **Northern Rocky Mountain Avalanche Chute Shrubland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Kelly Pohl	kpohl@tnc.org	**Reviewer**	Mary Manning	mmanning@fs.fed.us
Modeler 2			**Reviewer**		
Modeler 3			**Reviewer**		

Vegetation Type
Wetlands/Riparian

Map Zone
10

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

Dominant Species*
ABLA ALIN2
ACGL POBAT
ALVI5 PIEN
POTR5 SASC

General Model Sources
☐ Literature
☐ Local Data
☐ Expert Estimate

Geographic Range
This ecological system occurs in the mountains throughout the northern Rockies, from WY north and west into British Columbia and Alberta.

Biophysical Site Description
This system is found on steep, frequently disturbed slopes in the subalpine and upper montane zones. Occurrences are found on the lower portions and runout zones of avalanche tracks, and slopes are generally steep, ranging from 15-60%. Aspects vary, but are more common where unstable or heavy snowpack conditions frequently occur. Sites are often mesic to wet because avalanche paths are often in stream gullies, and snow deposition can be heavy in the run-out zones.

Vegetation Description
This BpS is composed of a diverse mix of deciduous shrubs or trees and conifers. The vegetation consists of moderately dense, woody canopy characterized by dwarfed and damaged conifers and small, deciduous trees/shrubs. Characteristic species include Abies lasiocarpa, Picea engelmanni, Acer glabrum, Alnus viridis ssp. sinuata or Alnus incana, Populus balsamifera ssp. trichocarpa, Populus tremuloides, Salix scouleriana or Cornus sericea. Other common woody plants include Paxistima myrsinites, Sorbus scopulina and Sorbus sitchensis. The ground cover is moderately dense to dense forb-rich, with Senecio triangularis, Castilleja spp., Athyrium filix-femina, Thalictrum occidentale, Urtica dioica, Erythronium grandiflorum, Myosotis asiatica (=Myosotis alpestris), Veratrum viride, Heracleum maximum (=Heracleum lanatum) and Xerophyllum tenax. Mosses and ferns are often present.

Vegetation patterns in avalanche chutes are unique. Typically, smaller statured shrubs and mesic forbs dominate at the higher portions of the chute, while taller shrubs and trees are more common in the lower portions.

*Dominant Species are from the NRCS PLANTS database. To check a species code, please visit http://plants.usda.gov.
**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.

Due to frequent avalanching, large amounts of woody debris are likely present.

Disturbance Description

Avalanches are the dominant disturbance agent, keeping vegetation dwarfed and typically damaging trees and shrubs with diameters >10cm (Knight 1994). Larger avalanche chutes may experience infrequent, but large slides (50-100yrs), whereas smaller chutes may experience frequent, smaller events (1-5yrs). In Glacier National Park, vegetation in avalanche chutes indicated annual slides (Butler 1979). Frequent snow slides may increase cover of trees and shrubs, but decrease height (Patten and Knight 1994). Avalanches are modeled here at 100yr return intervals (causing a replacement disturbance) and five year return intervals (maintaining mid-development open conditions).

Avalanche chutes can act as fire breaks for the surrounding vegetation matrix, although they will occasionally burn. However, most shrub species resprout vigorously after fire. Mean fire return intervals are dependent upon the surrounding vegetation matrix.

Adjacency or Identification Concerns

In-filling of avalanche chutes by matrix coniferous forests has occurred in Glacier National Park in the twentieth century because of changes in the magnitude and frequency of avalanches. Whether decreases in snowfall, milder temperatures or other factors are the cause is unknown (Butler and DeChano 2001).

Native Uncharacteristic Conditions

Scale Description

Typically narrow, linear patches within coniferous forest vegetation matrix.

Issues/Problems

Comments

Peer review resulted in minor descriptive changes to the model.

Vegetation Classes

Class A **10 %**

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

ACGL	Upper
POTR5	Upper
ALVI5	Upper
POBAT	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 0m	Shrub 0.5m
Tree Size Class	None	

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

Dominant lifeform may be herbaceous at any cover level. Although upper layer species are tree lifeform, they may appear as shrubs in remotely sensed imagery due to their dwarfed nature.

Description

Forbs, shrubs and deciduous trees resprouting immediately following disturbance. Scattered, severely damaged conifers may be present. This class typically lasts a short amount of time (5-20yrs) and succeeds to class B.

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Class B **70%**

Mid Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

ACGL	Upper
POTR5	Upper
ALVI5	Upper
POBAT	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 0.6m	Shrub >3.1m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Although upper layer species may be tree lifeform, they may appear as shrubs in remotely sensed imagery due to their dwarfed nature.

Description

Mid-height shrubs and trees. This class may persist for long periods of time if frequent, smaller avalanches keep conifers and larger diameter trees from developing (ie, succeeding to class C).

Class C **20%**

Late Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model

Indicator Species* and Canopy Position

ABLA	Upper
POTR	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	80 %
Height	Tree 0m	Tree 5m
Tree Size Class	None	

- [ ] Upper layer lifeform differs from dominant lifeform.

Although most upper layer species are tree lifeform, they may appear as shrubs in remotely sensed imagery due to their dwarfed nature.

Description

Taller shrubs and trees. This class will typically be returned to succession classes A and B during avalanche events because trees will be damaged by slides.

Class D **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

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.

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**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.

Description

Disturbances

Fire Regime Group:** V

Historical Fire Size (acres)

Avg
Min
Max

Sources of Fire Regime Data

☐ Literature
☐ Local Data
☑ Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	500	50	500	0.002	99
Mixed					
Surface					
All Fires	500			0.00202	

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) Avalanches (large, infrequent)
☐ Wind/Weather/Stress ☐ Competition ☑ Other (optional 2) Avalanches (small, frequent)

References

Butler, D.R. 1979. Snow avalanche path terrain and vegetation, Glacier National Park, Montana. Arctic and Alpine Research 11: 17-32.

Butler, D.R. 1985. Vegetation and geomorphic change on snow avalanche paths, Glacier National Park, Montana, USA. Great Basin Naturalist 45(2): 313-317.

Butler, D.R. and L.M. DeChano. 2001. Environmental change in Glacier National Park, Montana: An assessment through repeat photography from fire lookouts. Physical Geography 22(4): 291-304.

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

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

Patten, R.S. and D.H. Knight. 1994. Snow avalanches and vegetation patterns in Cascade Canyon, Grand Teton National Park, Wyoming, USA. Arctic and Alpine Research 26(1): 35-41.

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LANDFIRE Biophysical Setting Model

Biophysical Setting: **1011690** **Northern Rocky Mountain Subalpine Deciduous Shrubland**

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

General Information

Contributors (also see the Comments field) **Date** 11/18/2005

Modeler 1	Kelly Pohl	kpohl@tnc.org	**Reviewer**	Steve Barrett	sbarrett@mtdig.net
Modeler 2			**Reviewer**	Mary Manning	mmanning@fs.fed.us
Modeler 3			**Reviewer**		

Vegetation Type

Upland Shrubland

Map Zone

10

Model Zone

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

Dominant Species*

ACGL	RUPA
MEFE	ALVI5
RHAL	VAME
RILA	SASC

General Model Sources

☑ Literature
☐ Local Data
☐ Expert Estimate

Geographic Range

This shrubland ecological system is found in the upper montane and subalpine zones in the northern Rocky Mountains.

Biophysical Site Description

This BpS occurs within the continuous forest zone in the upper montane and lower subalpine. This BpS is maintained by recurring disturbances, including fire and downslope movement of soil, water, snow and rock. It can occur on all aspects and soils, but is generally found on well-drained sites.

Vegetation Description

Persistent shrubfields dominated by Acer glabrum, Menziesia ferruginea, Rhamnus alnifolia, Ribes lacustre, Rubus parviflorus, Alnus viridis, Salix scouleriana, Holidiscus discolor, Sorbus spp, Prunus emarginata, Sampucus spp and/or Vaccinium membranaceum. Xerophyllum tenax, Chamerion angustifolium and Pteridium aquilinum are important forbs, reflecting the mesic nature of many of these shrublands.

Disturbance Description

This BpS is typically initiated and maintained by fires and will persist on sites for long periods because of repeated burns and vigorous stump sprouting. Fire frequencies in these shrubfields are generally the result of anomalous reburns with relatively short fire return intervals as compared to the surrounding vegetation types with longer fire return intervals. Most of the shrub species resprout vigorously following fire, often within the first growing season. Severe fires may delay resprouting and/or reduce survival, depending on species and microsite characteristics. Fire frequencies will be highly dependent on surrounding vegetation, but typically range from 50-75yrs (Barrett 1982, Barrett 2004).

Mass movement of snow, rock and soil, especially on steeper slopes in the lower subalpine zone, can cause

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occasional, but generally small disturbances in this BpS, typically causing resprouting of the shrub species (though these disturbances are not modeled here).

The shrub species in this BpS are important browsing and cover species for wildlife (although this disturbance is not modeled here).

Adjacency or Identification Concerns

Conifer systems may re-establish in these shrublands with fire exclusion, but these shrub communities are typically aggressive competitors. In climatic climax classifications (sensu Daubenmire and Daubenmire 1968), these persistent shrubfield BpSs would be considered forested habitat types.

Many of these shrub species are common understory and/or early seral associates in conifer BpS. The persistent shrubfields represented by this BpS may be distinguished by the lack of tree cover and coniferous seedlings.

Avalanche chutes may have some similar species present, but are distinguished by their relatively narrow, linear nature across steep elevation gradients. Avalanche chute systems correspond to BpS 1168 (Northern Rocky Mountain Avalanche Chute).

Native Uncharacteristic Conditions

Scale Description

Issues/Problems

This system represents geographic and biophysical outliers within the subalpine and upper montane zone and exist because of anomalous reburn events. This may not actually be a result of environmental or biophysical site potential, but rather of fire regimes.

Comments

Peer review of this model resulted in slight modifications to the description and a slight change in the proportion of mixed severity fire to replacement fire.

Vegetation Classes

Class A **10%**

Early Development 1 All Structures

Upper Layer Lifeform

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

Fuel Model 0

Indicator Species* and Canopy Position

ACGL	Upper
MEFE	Upper
RHAL	Upper
RILA	Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 0m	Shrub 1.0m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Resprouting mixture of shrubs immediately following disturbance. This class lasts for only a few years (less than six years), as shrubs typically resprout vigorously following disturbance. However, following rare severe replacement fires, resprouting may be delayed (modeled as "competition/maintenance"). Mixed severity fires may cause very small patchy openings in this class, but not complete top-kill.

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Class B 90%

Mid Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☑ Shrub
☐ Tree

Fuel Model 0

Indicator Species* and Canopy Position

ACGL Upper
MEFE Upper
RHAL Upper
RILA Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 1.1m	Shrub >3.1m
Tree Size Class	Medium 9-21"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Mid and late-development shrubs of typically dense canopy cover and tall heights. Rocky Mountain maple can reach heights of three meters within 10yrs post-disturbance, and will typically reach maximum heights (>10m) by 20-40yrs post-disturbance (Anderson 2001).

Fires cause top-kill of shrubs and transition to class A. Mixed severity fires may cause very small, patchy openings in this class, but not complete top-kill.

Class C 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

Class D 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

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

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Disturbances

Fire Regime Group:** IV

Historical Fire Size (acres)

Avg
Min
Max

Sources of Fire Regime Data

- [x] Literature
- [ ] Local Data
- [ ] Expert Estimate

Fire Intervals	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	55	50	75	0.01818	90
Mixed	500	35	1000	0.002	10
Surface					
All Fires	50			0.02019	

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
- [x] Competition
- [ ] Other (optional 1)
- [ ] Other (optional 2)

References

Anderson, M.D. 2001. Acer glabrum. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, November 11].

Barrett, S.W. 1982. Fire's influence on ecosystems of the Clearwater National Forest: Cook Mountain fire history inventory. Unpublished report on file, Fire Management, USDA Forest Service, Clearwater National Forest, Orofino, ID.

Barrett, S.W. 2004. Fire regimes in the Northern Rockies. Fire Management Today 64(2): 32-38.

Cooper, S.V., P. Lesica and D. Page-Dumroese. 1997. Plant community classification for alpine vegetation on the Beaverhead National Forest, Montana.

Daubenmire, R.F. and J.B. Daubenmire. 1968. Forest vegetation of eastern Washington and northern Idaho.

Habeck, R. . 1992. Menziesia ferruginea. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, November 11].

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

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977. Forest habitat types of Montana. General Technical Report INT-34. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 174 pp.

Simonin, K.A. 2000. Vaccinium membranaceum. In: Fire Effects Information System, [Online]. USDA Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2005, November 11].

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