LANDFIRE Biophysical Setting Model

Biophysical Setting **0910470** **Northern Rocky Mountain Mesic Montane Mixed Conifer Forest**

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

General Information

Contributors (also see the Comments field) **Date** 10/5/2005

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Vegetation Type
Forest and Woodland

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species
ABGR
PSME
PIPO
LAOC

Map Zone
9

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

Geographic Range

This type is modal in MZ10. It also occurs on stream and river canyons in the foothills of the Blues and of the Northern Rockies. If this type occurs in MZ08, it would occur in the foothills of Yakima and Klickitat county, especially on stream slopes.

Biophysical Site Description

This type occurs above 25in precipitation zone in the Blue Mtns, and on a wide range of elevation. Soils are commonly deep ash (2-3ft) with high moisture content.

Vegetation Description

Includes ABGR, ABCO and PSME with various amounts of LAOC, PIPO, CADE3, PIEN, TABR or PICO. ABCO hybridizes with ABGR throughout the Blue Mtns. Important understory associates are ASCA3, CLUN, LIBO2, VAME, ACGL and TRCA3.

Disturbance Description

Fire regime is mixed (III). Average fire return intervals range from approximately 45yrs at the warm dry end of this PNVG to approximately 100yrs at the transition to ABLA2 or TSME in the Wallowas and ABLA2 in the Blue Mountains. Insect and disease interactions are important in the mid and late closed conditions. Important insect and diseases include fir engraver, Douglas-fir beetle, armillaria and other root diseases, stem decay caused by indian paint fungus and defoliating insects (western spruce budworm, Douglas-fir tussock moth and larch casebearer). Root diseases occur in smaller patches (<100ha) and attack all age classes, while bark beetles cause mid-sized patches (<1000ha), especially older trees. Defoliators can cause patches in the same size range as the replacement fires, primarily effecting younger trees.

Adjacency or Identification Concerns

This BpS occurs below subalpine fir and above dry mixed conifer (pine dominated) in the Blue Mtns. Management in the '60s and '70s planted more ponderosa pines than were originally present. These pines

**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 now showing extensive snow and ice damage. There was likely more larch in the past than presently occurs, due either to high-grading, or to preferential removal for domestic uses. Also, blister rust has removed much of the white pine.

Native Uncharacteristic Conditions

Scale Description

Stand replacement fire occurs in large events covering 1000-10000ac patches.

Issues/Problems

This MCON type occurs on the cool moist sites, while (Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest (1045) occurs on warm dry sites.

Comments

This model was derived from the R#MCONms. Review of an initial model (with Dave Swanson) resulted in the conversion of the deterministic succession from class D to E, into a time-since-disturbance transition.

Vegetation Classes

Class A **15 %**

Early Development 1 All Structure

Upper Layer Lifeform

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

Fuel Model

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Indicator Species and Canopy Position

CEVE
Upper
ACGL
Upper
SASC
Upper
PHMA5
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	100 %
Height	Shrub 0.6m	Shrub 3.0m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Shrub communities usually dominate following stand replacement disturbance. Important species vary by ecoregion. ACGL, CEVE and PHMA are important in the Blue Mountains. Succession to class B after 30yrs. Replacement fire MFRI 500yrs. Some sites are limited, or shrub dominated (due to a reburn) and succeed to class C. These shrub fields (CEVE, SASC) may recycle in A for extended periods of time. R. Haugo (01/08/2013) expanded to include max height up to 5m inorder for continuous mapping criteria.

Class B **40 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

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Indicator Species and Canopy Position

PSME
Upper
ABGR
Upper
PIPO
Upper
LAOC
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	51 %	100 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

This class is the primary direction of succession from class A. Class B is pole to small in size (5-20in). These sites have prolific reproduction and quickly close. Class B is dominated by various mixtures of shade tolerant and intolerant conifers. Species vary by ecoregion. PSME and/or ABGR have higher cover than LAOC, PIPO, PIMO or PICO.

**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.

Succession to E after 70yrs in this class. Replacement fire MFRI 250yrs. Mixed fire opens it up to class C (MFRI 250yrs). Other disturbances (insect/disease,such as defoliators, and wind/stress) also open up the stands class C.

Class C **10 %**

Mid Development 1 Open

Indicator Species and Canopy Position

PIPO
Upper
LAOC
Upper
PSME
Mid-Upper
ABGR
Mid-Upper

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model
9

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	50 %
Height	Tree 5.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Small amounts of this BpS do not immediately close or are created by mixed fire and insect/disease in class B. Class C is pole-small in size (5-20") with Shade intolerant species are dominant. PIPO and LAOC are more important components than PSME and ABGR or ABCO in this class. Succession to class D after 50yrs in this class. Replacement fire MFRI 100yrs. Surface (MFRI 50yrs) and mixed (MFRI 60-70yrs) fires maintain the patch in class C. If there has been no fire for 40yrs, the patch will transition to class B.

Class D **10 %**

Late Development 1 Open

Indicator Species and Canopy Position

PSME
Upper
PIPO
Upper
LAOC
Upper
ABGR
Mid-Upper

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model
9

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	50 %
Height	Tree 25.1m	Tree >50.1m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Class D is created by mixed fire and insect/disease in class E or development of class C. Size of this class is large (over 20in DBH) but canopy closure is low and sites may be single or multiple canopied. PSME, PIPO and LAOC are more important than ABGR or ABCO in this class. Maintains in this with disturbance. Replacement fire MFRI 350yrs. Mixed fire MFRI 100yrs maintains in class D. Insect/disease, including bark beetles, (probability/yr 0.008) attacks the older trees and transitions the stand to class C. Surface fire is rare, and maintains in class D. There is occasional wind/snow damage that maintains in class D. After 40yrs without fire, the stand will close in to class E.

Class E **25 %**

Late Development 1 Closed

Indicator Species and Canopy Position

ABGR
Upper
PSME
Upper
PIPO
Upper
LAOC

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model
10

Structure Data (for upper layer lifeform)

	Min	Max
Cover	51 %	100 %
Height	Tree 25.1m	Tree >50.1m
Tree Size Class	Very Large >33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

**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 Upper

Large trees dominate class E. Stands typically have multiple canopies. Species composition may be mixed shade tolerant species or include minor amounts of shade intolerant pines or larch. Replacement fire MFRI 150yrs. Mixed fire (MFRI 100yrs) opens up the stand and transitions it to class D. Insects, including bark beetles, usually removes the older trees and opens the stand up to class C, though sometimes merely opens to class D.

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	200			0.005	35
Mixed	150			0.00667	47
Surface	400			0.0025	18
All Fires	71			0.01417	

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

Burleson, W. 1981 (unpublished report) North Slope Fire Frequency -- Western Ochoco Mountains.

Camp, A., C. Oliver, P. Hessburg and R. Everett. Predicting late-successional fire refugia pre-dating European settlement in the Wenatchee Mountains. For. Ecol. Manage. 95: 63-77.

Hessburg, P.F., R.G. Mitchell, and G.M. Filip. 1994. Historical and Current Roles of Insects and Pathogens in Eastern Oregon and Washington Forested Landscapes. PNW-GTR-327. Portland, OR, USDA Forest Service, Pacific Northwest Research Station, 72 pp.

Hessl A.E., D. McKenzie and R. Schellhaus. 2004. Drought and pacific decadal oscillation linked to fire occurrence in the inland Pacific Northwest. Ecological Applications, 14(2): 425-442.

Hummel, S. and J.K. Agee. 2003. Western spruce budworm defoliation effects on forest structure and potential fire behavior. Northwest Science. 77(2): 159-169.

Johnson, C.G. and R.R. Clausnitzer. 1992. Plant associations of the Blue and Ochoco Mountains. P6-ERW-TP-036-92. Portland, OR: USDA Forest Service, Pacific Northwest Reigion. 164 pp. + appendices.

Johnson, C.G. and S.A. Simon. 1986. Plant associations of the Wallowa-Snake province. R6-ECOL-TP-255b-86. Portland, OR: USDA Forest Service, Pacific Northwest Reigion. 272 pp. + appendices.

Lehmkuhl, J.F., P.F Hessburg, R.L. Evertt, M.H. Huff and R.D. Ottmar. 1994. Historical and Current Forest Landscapes of Eastern Oregon and Washington. Part 1: Vegetation Pattern and Insect and Disease Hazards, PNW-GTR-328. Portland, OR, USDA Forest Service, Pacific Northwest Research Station, 88 pp.

**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.

Simon, S.A. 1991. Fire history in the Jefferson Wilderness Area east of the Cascade Crest. Final report to the Deschutes National Forest Fire Staff. 29 pp.

Volland, L. 1982. Plant Associations of the Central Oregon Pumice Zone. R6-ECOL-104-1982

Volland, L. Ecology Plot Data Unpublished Data Collected Mid 1960's to Mid 1970's

Wickman, B.E., R.R. Mason and T.W. Swetnam 1994. Searching for long-term patterns of forest insect outbreaks. Pages 251-261 in: S.R. Leather, K.F.A. Walters, N.J. Mills and A.D. Watt, eds., Individuals, Populations and Patterns in Ecology, Intercept Press, Andover, United Kingdom.

Wright, C.S. and J.K. Agee. 2004. Fire and vegetation history in the eastern cascade mountains, Washington. Ecological Applications, 14(2): 443-459.

**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 0910532 Northern Rocky Mountain Ponderosa Pine Woodland and Savanna - Xeric

☐ *This BPS is lumped with:*

☑ *This BPS is split into multiple models: Suggest splitting into a mesic and xeric. This model is the xeric and more commonly found in MZ09. Represented by longer mfri than mesic in areas with <17in precipitation.*

General Information

Contributors (also see the Comments field) **Date** 10/4/2005

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Modeler 3	James Dickinson	jddickinson@fs.fed.us	**Reviewer**		

Vegetation Type

Forest and Woodland

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species

PIPO
ARTR
CELE
JUOC

Map Zone

9

Model Zone

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

Geographic Range

This BpS occurs in the forest shrub steppe interface along the east side of the Fremont and Deschutes National Forests and along the southern fringe of the Blue Mountains to the ID border.

Biophysical Site Description

This BpS occurs in precipitation zones between 15-17in. This precipitation band reaches from the east side of the Fremont NF north along the east side of the Deschutes NF to the south edge of the Blues, and east along the Ochocos and Malheur NF. This type may occur in Idaho opposite the Snake River.

Vegetation Description

Tree species common in this type are PIPO and JUOC. Minor amounts of PSME may occur. Understory vegetation is dominated by ARTR, ARAR, CELE and PUTR2. Important herbaceous species include FEID, AGSP (now PSSP6), SIHY, POSA and various Stipa species.

Disturbance Description

Mixed and stand replacement fires dominate this type. Large wind driven events originating in the shrub steppe or juniper woodland vegetation zones heavily influence this BpS. Fire return intervals in this type are more like adjacent shrub steppe or juniper woodland communities than typical low intensity frequent fire PIPO communities.

Adjacency or Identification Concerns

Typically this vegetation type occurs between JUOC/ARTR, JUOC/ARAR, JUOC/PUTR, ARTR or PUTR and PIPO or dry mixed conifer sites with frequent fire return intervals. These communities have higher shrub components and longer fire return intervals with more of a mixed severity fire regime.

This type is distinct from ponderosa pine mesic (RA: R#PIPOm; LANDFIRE: 091053mesic) in that it

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typically occurs in regions with <45cm/year precipitation. This model is designed to address the mappable pockets of PIPO that exist on low productivity, low moisture and high stress sites resulting in lower reproductive rates and slower growth.

Native Uncharacteristic Conditions

Scale Description

Stand replacement events can be tens of thousands of acres in size.

Issues/Problems

This model attempts to capture the forest-shrub steppe interface areas where lack of fuel continuity increases the fire return intervals and significant dry shrub communities increase the occurrence of stand replacement and mixed fires.

Comments

Oct. 4 Update: Amy Waltz (awaltz@tnc.org) and Kori Buford (kbuford@tnc.org) also helped with the model. The RA model (R#PIPOxe) was adapted for Landfire without modification to the model but we enhanced the descriptions and addressed reviewer comments (below) in Adjacency box.
Reviewers requested greater clarification between this model and R#PIPOm. Furthermore, it was suggested that the replacement fire may occur too frequently resulting in too much mid-seral (classes B and C). A run with reduced replacement fire (0.003 for open classes C and D; 0.01 for classes A, B and E) moved 15% of the landscape from class A and C into class D, and nearly doubled the MFRI of replacement fires.

Vegetation Classes

Class A **25 %**

Early Development 1 All Structure

Upper Layer Lifeform

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

Fuel Model

Indicator Species and Canopy Position

ARTR Upper
CHVI8 Middle
PSSP6 Lower
ELEL5 Lower

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	0 %	50 %
Height	Tree 0m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Class A is a grass/forb/shrub and seedling sapling and pole stage (age 0-49 yrs). Initial establishment of grass and herbaceous species (and CHVI if present in the pre-disturbance community) gives way to shrubs at 15-30yrs. JUOC and PIPO are often established after the shrub community is in place. Re-establishment of the trees may be delayed by the large disturbance size and removal of nearby seed sources.

Class B **5 %**

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species and Canopy Position

PIPO Upper
JUOC Mid-Upper
FEID Lower
ARTR Middle

Structure Data (for upper layer lifeform)

	Min	*Max*
Cover	25 %	70 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

**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 represents pole to small tree (5-20in DBH, age 50-149, succession to class E) dominated sites with significant competition between trees even though canopy cover does not exceed 70%. Shrub and herbaceous species are often depauperate or declining in this stage due to the competition from overstory trees. This stage is susceptible to mountain pine beetle attack which cycles this stage to class C. R. Haugo (01/08/2013), modified to min canopy closure 30% and max canopy closure 80%.

Class C **25 %**

Mid Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species and Canopy Position

PIPO
Upper
ARTR
Middle
PUTR2
Middle
PSSP6
Lower

Structure Data (for upper layer lifeform)

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

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Class C represents pole to small tree (5-20in DBH, age 50-149yrs) dominated sites with open canopies. Understories are more vigorous than class B and have similar species composition to class A. If two or three fire cycles are missed this stand would convert to class E. R. Haugo (01/08/2013), modified to max canopy closure 30%.

Class D **40 %**

Late Development 1 Open

Upper Layer Lifeform

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

Fuel Model

Indicator Species and Canopy Position

PIPO
Upper
ARTR
Middle
CELE3
Middle
ELEL5
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	25 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Class D represents large trees (20in+, age 150yrs+) and open canopy conditions. Often this gives a savanna-like appearance. Shrub and herbaceous communities are similar to class A. If two or three fire cycles are missed this stand would convert to class E. R. Haugo (01/08/2013), modified to max canopy closure 30%.

Class E **5 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species and Canopy Position

PIPO
Upper
CELE3
Middle
JUOC
Mid-Upper
FEID
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	25 %	70 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Class E (age 150yrs+) occurs when class D misses 2-3 fire intervals. This stage is susceptible to western pine beetle events which cycle this stage to class C. R. Haugo (01/08/2013), modified to min canopy closure 30%

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and max canopy closure 80%.

Disturbances

Fire Regime Group:** III

Historical Fire Size (acres)

Avg
Min
Max

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	130			0.00769	37
Mixed	100			0.01	48
Surface	300			0.00333	16
All Fires	48			0.02103	

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

References

Baker, W.L. and D.J. Shinneman, 2003. Fire and restoration of pinon-juniper woodland in the western United States: a review. Forest Ecology and Management 189(1-21).

Hall, F.C. 1973. Plant communities of the Blue Mountains in eastern Oregon and southeastern Washington. USDA Forest Service R6 Area Guide 3-1. Pacific Northwest Region, Portland, Oregon. 71 pp.

Hopkins, W.E. 1979a. Plant associations of the Fremont National Forest. USDA Forest Service R6 Ecol 79-004. Pacific Northwest Region, Portland Oergon. 106 pp. + illus.

Hopkins, W.E. 1979b. Plant associations of the south Chiloquin and Klamath Ranger Districts, Winema National Forest. USDA Forest ServiceR6 Ecol 79-005. Pacific Northwest Region, Portland, Oregon. 96 p. + illus.

Johnson, C.G., Jr., and R.R. Clausnitzer. 1992. Plant associations of the Blue and Ochoco Mountains. USDA Forest Service R6 ERW-TP-036-92. Pacific Northwest Region, Portland, Oregon. 207 pp.

Johnson, C.G., Jr., and S.A. Simon. 1987. Plant associations of the Wallowa-Snake Province. USDA Forest Service R6 Ecol TP 255a-86. Pacific Northwest Region, Portland, Oregon. 472 pp.

Johnson, Charles Grier Jr., and David K. Swanson, (review draft Sept 2004) Bunchgrass Plant Communities of the Blue and Ochoco Mountains. A Guide for Managers.

Miller, R. and J. Rose, 1999. Fire History and western juniper encroachment in sagebrush steppe. J. Range Manage. 52: 550-559.

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

Volland, L.A. 1985. Plant associations of the central Oregon Pumice zone. USDA Forest Service R6 Ecol 104-1985. Pacific Northwest Region, Portland, Oregon. 138 pp.

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Volland, L. Ecology Plot Data Unpublished Data Collected Mid 1960's to Mid 1970's.

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LANDFIRE Biophysical Setting Model

Biophysical Setting **0910610** **Inter-Mountain Basins Aspen-Mixed Conifer Forest and Woodland**

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

General Information

Contributors (also see the Comments field) **Date** 3/16/2005

Modeler 1	Julia H. Richardson	jhrichardson@fs.fed.us	**Reviewer**
Modeler 2	Louis Provencher	lprovencher@tnc.org	**Reviewer**
Modeler 3			**Reviewer**

Vegetation Type
Forest and Woodland

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species
POTR
ABCO
ABLA
PIFL2

Map Zone
9

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

Geographic Range

This ecological system occurs on montane slopes and plateaus in UT, western CO, northern AZ, eastern NV, southern ID and western WY. Elevations range from 1700-2800m (5600-9200ft.).

Biophysical Site Description

Occurrences are typically on gentle to steep slopes on any aspect but are often found on clay-rich soils in intermontane valleys. Soils are derived from alluvium, colluvium and residuum from a variety of parent materials, but most typically occur on sedimentary rocks.

Vegetation Description

The tree canopy is composed of a mix of deciduous and coniferous species, codominated by Populus tremuloides and conifers, including Abies concolor, Abies lasiocarpa, Picea engelmannii, Pinus flexilis and Pinus ponderosa. As the occurrences age, Populus tremuloides is slowly reduced until the conifer species become dominant. Common shrubs include Amelanchier alnifolia, Prunus virginiana, Symphoricarpos oreophilus, Juniperus communis, Paxistima myrsinites, Rosa woodsii, Spiraea betulifolia, Symphoricarpos albus or Mahonia repens. Herbaceous species include Bromus carinatus, Calamagrostis rubescens, Carex geyeri, Elymus glaucus, Poa spp, Achnatherum, Hesperostipa, Nassella and/or Piptochaetium spp (=Stipa spp.), Achillea millefolium, Arnica cordifolia, Asteraceae spp, Erigeron spp, Galium boreale, Geranium viscosissimum, Lathyrus spp., Lupinus argenteus, Mertensia arizonica, Mertensia lanceolata, Maianthemum stellatum, Osmorhiza berteroi (= Osmorhiza chilensis) and Thalictrum fendleri.

Disturbance Description

This is a strongly fire adapted community, more so than BpS 1011 (Rocky Mountain Aspen Forest and Woodland), with FRIs varying for mixed severity fire with the encroachment of conifers. It is important to

**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.

understand that aspen is considered a fire-proof vegetation type that does not burn during the normal lightning season, yet evidence of fire scars and historical studies show that native burning was the only source of fire that occurred predominantly during the spring and fall. BpS 1061 has elements of Fire Regime Groups II, III and IV. Mean FRI for replacement fire is every 60yrs on average in all development classes, except during early development where no fire is present (as for stable aspen, BpS 1011). The FRI of mixed severity fire increases from 40yrs in stands <80yrs to 20yrs in stand >80yrs with conifer encroachment.

Under presettlement conditions, disease and insect mortality did not appear to have major impacts, 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 1000 yrs), whereas 80% of outbreaks would thin older trees >40 yrs (average return interval 250 yrs). Older conifers (>100yrs) would experience insect/disease outbreaks every 300yrs on average.

Some sites are prone to snowslides, mudslides and rotational slumping. Flooding may also operate in these systems.

Adjacency or Identification Concerns

If conifers are not present in the landscape or represent <25% relative cover, the stable aspen model (BpS 1011; Rocky Mountain Aspen Forest and Woodland) should be considered, especially in western and central NV.

This type is more highly threatened by conifer replacement than stable aspen. Most occurrences at present represent a late-seral stage of aspen changing to a pure conifer occurrence. Nearly a hundred years of fire suppression and livestock grazing have converted much of the pure aspen occurrences to the present-day aspen-conifer forest and woodland ecological system.

Under current conditions, herbivory can significantly effect stand succession. Kay (1997, 2001a, b and 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.

Native Uncharacteristic Conditions

Scale Description

This type occurs in a landscape mosaic from moderate (10ac) to large sized patches (1000ac).

Issues/Problems

East of the Great Basin, Baker (1925) studied closely the presettlement period for aspen and noted fire scars on older trees. Bartos and Campbell (1998) support these findings. Results from Baker (1925) and Bartos and Campbell (1998) would apply to eastern NV and BpS 1061. We interpreted ground fires that scarred trees, probably started by Native Americans, as mixed severity fire that also promoted abundant suckering. In the presence of conifer fuel, these would be killed and aspen suckering promoted.

In previous models from the Rapid Assessment (e.g., R2ASMClw), experts and modelers expressed different views about the frequency of all fires, citing FRIs longer than those noted by Baker (1925). The FRIs used here were a compromise between longer FRIs proposed by reviewers and the maximum FRI of Baker (1925).

Comments

Model for MZ09 was imported from MZ12 without modification. BpS 1061 for MZs 12 and 17 is a compromise among the Rapid Assessment model R2ASMClw (aspen-mixed conifers low-mid elevation),

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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.

BpS 1011 for MZs 12 and 17, and BpS 1061 for MZ 16. BpS 1061 for MZs 12 and 17 is approximately split into the age classes of R2ASMClw. The FRIs of replacement fire from BpS 1011 were used (60yrs). For mixed severity fire, the mean FRIs followed closely BpS 1061 for MZ16, except that 20yrs was used instead of 13yrs during periods of conifer encroachment. R2ASMClw was developed by Linda Chappell (lchappell@fs.fed.us), Bob Campbell (rbcampbell@fs.fed.us) and Cheri Howell (chowell02@fs.fed.us), and reviewed by Krista Gollnick-Wade/Sarah Heidi (Krista_Waid@blm.gov), Charles E. Kay (ckay@hass.usu.edu) and Wayne D. Shepperd (wshepperd@fs.fed.us). BpS 1061 for MZ16 was developed by Linda Chappell, Robert Campbell, Stanley Kitchen (skitchen@fs.fed.us), Beth Corbin (ecorbin@fs.fed.us) and Charles Kay.

As this type has a fairly short fire return interval compared to other aspen types, it should be noted that aspen can act as a tall shrub. Bradley, et al. (1992) state that Loope & Gruell estimated a fire frequency of 25-100yrs for a Douglas-fir forest with seral aspen in Grand Teton National Park (p39). They later state that fire frequencies of 100-300yrs appear to be appropriate for maintaining most seral aspen stands. In the Fontenelle Creek, WY draininage, the mean fire-free interval was estimated to be 40yrs. Fires in this area burned in a mosaic pattern of severities, from stand-replacement to low fires that scarred but did not kill the relatively thin-barked lodgepole pine on the site (p46).

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 during initial encroachment. While not dependent upon disturbance to regenerate, aspen is adapted to a diverse array of disturbances.

Vegetation Classes

Class A 14 %

Early Development 1 All Structure

Upper Layer Lifeform

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

Fuel Model

8

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	Seedling <4.5ft	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Grass/forb and aspen suckers less than six feet tall. Generally, this is expected to occur 1-3yrs post-disturbance. Fire is absent and succession occurs to class B after 10yrs.

Class B 40 %

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

8

Indicator Species and Canopy Position

POTR
Upper
SYOR2
Low-Mid
RIBES
Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	100 %
Height	Tree 5.1m	Tree 10m
Tree Size Class	Sapling >4.5ft; <5"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Aspen saplings over six feet tall dominate. Canopy cover is highly variable. Replacement fire occurs every 60yrs on average. Mixed severity fire (average FRI of 40yrs) does not change the successional age of these stands, although this fire consumes litter and woody debris and may stimulate suckering. Succession to class

**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.

C after 30yrs.

Class C **35 %**

Mid Development 2 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model
8

Indicator Species and Canopy Position

POTR
Upper
SYOR2
Middle
RIBES
Middle

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

Aspen trees 5-16in DBH. Canopy cover is highly variable. Conifer seedlings and saplings may be present. Replacement fire occurs every 60yrs on average. Mixed severity fire (mean FRI of 40yrs), while thinning some trees, promotes suckering and maintains vegetation in this class. Insect/disease outbreaks occur every 200yrs on average causing stand thinning (transition to class B) 80% of the time and causing stand replacement (transition to class A) 20% of the time. Conifer encroachment causes a succession to class D after 40yrs.

Class D **10 %**

Late Development 1 Open

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model
8

Indicator Species and Canopy Position

POTR
Upper
ABCO
Mid-Upper
ABLA
Mid-Upper
PIFL2
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.

Description

Aspen dominate, making up ~80% of the overstory. Conifers which escape fire, or are the more fire resistant species, are present in the understory and will likely cause the progressive suppression of aspen. Mixed severity fire (20yr MFI) keeps this stand open, kills young conifers and maintains aspen (max FRI from Baker 1925). Replacement fire occurs every 60yrs on average. In the absence of any fire for at least 100yrs, the stand will become closed and dominated by conifers (transition to class E).

Class E **1 %**

Late Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model
10

Indicator Species and Canopy Position

ABLA
Upper
ABCO
Upper
POTR
Mid-Upper
PIFL2
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	80 %
Height	Tree 5.1m	Tree 50m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

Conifers dominate at 100yrs+. Aspen over 16in DBH, uneven sizes of mixed conifer and main overstory is conifers (>50% of overstory). FRI for replacement fire is every 60yrs. Mixed severity fire (mean FRI of 20yrs)

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

causes a transition to class D. Insect/disease outbreaks will thin older conifers (transition to class D) every 300yrs on average.

Disturbances

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 10
Min 1
Max 100

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	68	50	300	0.01471	36
Mixed	39	10	50	0.02564	64
Surface					
All Fires	25			0.04036	

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
- [ ] 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 Wypoming. 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 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

**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.

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, L. Floyd-Hanna, D. D. Hanna and E. Bartlett. 2001. Aspen's ecological role in the west. Pages 243-259 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.

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 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.

Shepperd, W.D., 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.

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.

**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.

Print Services, Brigham Young University, Provo, UT. 912 pp.

**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 **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

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species

PIPO
PSME
PICO
CARU
CAGE
PHMA5
ABGR
LAOC

Map Zone

10

Model Zone

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

Geographic Range

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

**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

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).

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).

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

This 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 Structure

Upper Layer Lifeform

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

- [x] 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.

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

**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

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

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.

**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.

Lower

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
- [x] 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). R. Haugo (01/08/2013) - included pixels with forest height 25 to 50 meters and canopy cover 80 to 100% so they will be accounted in Landfire Active Treatment Analysis, rather than lumping with UN.

Disturbances

Fire Regime Group:** I

Historical Fire Size (acres)

Avg 1000
Min 100
Max 30000

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	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

- [x] Insects/Disease
- [x] 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.

**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

**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 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.

Holah, J.C., M.V. Wilson and E.M. Hansen. Impacts of a native root-rotting pathogen on successional

**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.

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 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-

**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.

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.

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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

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species

LAOC
PICO
PSME
ABLA

Map Zone

10

Model Zone

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

Geographic Range

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

**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.

fires.

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

**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 Structure

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species and Canopy Position

LAOC
Upper
PICO
Upper
PSME
Upper
ABLA
Lower

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

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species and Canopy Position

LAOC
Upper
PICO
Upper
PSME
Upper
ABLA
Middle

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

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species and Canopy Position

LAOC
Upper
PSME
Upper
PICO
Upper
ABLA
Middle

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).

**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
- [x] 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
- [x] 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

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	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.

Additional Disturbances Modeled

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

References

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

**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.

**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.

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.

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.

**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.

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.

**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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Modeler 2	Jason Cole	jcole@fs.fed.us	**Reviewer**	Steve Barrett	sbarrett@mtdig.ne
Modeler 3	Sue Hagle	shagle@fs.fed.us	**Reviewer**		

Vegetation Type

Forest and Woodland

General Model Sources

☐ Literature
☐ Local Data
☐ Expert Estimate

Dominant Species

PICO
PSME
LAOC
ABGR

Map Zone

10

Model Zone

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

Geographic Range

This 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.

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

**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.

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 Structure

Upper Layer Lifeform

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

Fuel Model

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.

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.

**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
☑ 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
☑ 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
☑ 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.

**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 **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.

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

**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.

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 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.

**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.

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, 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.

**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 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

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
PIAL
ABLA
PIEN
LALY
PIFL

Map Zone
10

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

Geographic Range

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 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.

**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 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 ~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).

**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 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 Structure

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

[x] 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
- [x] 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.

**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 **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. R. Haugo (01/08/2013), extend to maximum height of 50m to avoid UN classification.

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

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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.

more protected (ie, northerly aspects) or have better soil development.

This class will persist until a disturbance causes a transition. R. Haugo (01/08/2013), extend to maximum height of 50m to avoid UN classification.

Disturbances

Fire Regime Group:** III

Historical Fire Size (acres)

Avg 0
Min 10
Max 1000

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.

Sources of Fire Regime Data

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

Additional Disturbances Modeled

- [x] Insects/Disease
- [x] Wind/Weather/Stress
- [ ] Native Grazing
- [x] 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.

**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.

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.

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

**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.

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.

**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 **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
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Modeler 3	Randall Walker	rmwalker@fs.fed.us	**Reviewer**	Steve Rawlings	srawlings@fs.fed.us

Vegetation Type

Forest and Woodland

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species

PIMO
LAOC
PSME
ABGR
THPL
TSHE

Map Zone

10

Model Zone

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

Geographic Range

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

**Fire Regime Groups are: I: 0-35 year frequency, surface severity; II: 0-35 year frequency, replacement severity; III: 35-100+ year frequency, mixed severity; IV: 35-100+ year frequency, replacement severity; V: 200+ year frequency, replacement severity.

This 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

PIMO is able to persist for 200 yrs+ following stand replacing disturbance (T. Jain, personal communication). PIMO should be considered a dominant species in S-Class E. R. Haugo, 01/03/2013

Comments

Additional reviewer was Cathy Stewart (cstewart@fs.fed.us). Peer review resulted in modifications to 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.

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 Structure

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).

**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

Upper Layer Lifeform

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

Fuel Model

8

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.

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

Upper Layer Lifeform

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

Fuel Model

8

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.

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

Upper Layer Lifeform

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

Fuel Model

10

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.

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. R. Haugo Notes: Follow review with Terrie Jain (Dec. 2012), note that western white pine will continue to be a dominant component of these stands for 200+ years in the absence of white pine blister rust. As such, western white pine should also be noted as a characteristic species of Class E.

**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:** 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

**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 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 in northern Idaho and western Montana. Volume 2: Results. R1-FHP 00-11. USDA Forest Service, State

**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 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.

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

**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.

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 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

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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.

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.

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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

General Model Sources

☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species

THPL
ABGR
LAOC

Map Zone

10

Model Zone

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

Geographic Range

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

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

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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 Structure

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. R. Haugo (01/08/213), increased maximum height to 10m to maintain S-Class continunity.

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.

**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

**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

- [x] Literature
- [x] Local Data
- [x] 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

- [x] 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.

Brown, J.K., S.F. Arno, S.W. Barrett and J.P. Menakis. 1994. Comparing the Prescribed Natural Fire

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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* 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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Vegetation Type
Forest and Woodland

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
PIPO
FEID
PSSP6
PUTR2

Map Zone
10

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

Geographic Range
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 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

**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 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 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.

**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

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
- ☑ 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	

☑ 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. R. Haugo (01/08/2013), increased max canopy closure to 100% to maintain S-Class continuity.

Class B 10 %

Mid Development 1 Closed

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ 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 density stunted pole stands are counted here; may see insect/disease here. R. Haugo (01/08/2013), increased max canopy closure to 100% to maintain S-Class continuity.

**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 **20 %**

Mid Development 1 Open

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

- [ ] Upper layer lifeform differs from dominant lifeform.

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

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

- [ ] Upper layer lifeform differs from dominant lifeform.

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

Upper Layer Lifeform

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

Fuel Model

10

Indicator Species and Canopy Position

PIPO
All
PSME
All

Structure Data (for upper layer lifeform)

	Min	Max
Cover	41 %	60 %
Height	Tree 25.1m	Tree 50m
Tree Size Class	Very Large >33"DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

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. R. Haugo (01/07/2013) changed the minimum canopy height from 10.1m to 25.1m to maintain mutually exclusive structural characteristics between S-Classes. Assumed min height of 10.1m was an error. R. Haugo (01/08/2013), increased max canopy closure to 100% to maintain S-Class continuity.

Disturbances

**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.

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

**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.

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.

**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 **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

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
ABLA
PIEN
PICO
CAGE
CARU

Map Zone
10

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

Geographic Range

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 this BpS may have more frequent fire regimes.

**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 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.

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

**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.

Vegetation Classes

Class A **15 %**

Early Development 1 All Structure

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 10m
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. R. Haugo (01/07/2013), adjust maximum height to 10m, assume 50m was error.

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 10m
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. R. Haugo (01/07/2013), adjust maximum height to 10m, assume 50m was error.

**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 **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)

**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.

Buskirk, S.W., W.H. Romme, F.W. Smith and R. Knight. 2000. An overview of forest fragmentation in the

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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.

Kapler-Smith, J. and W.C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. INT-

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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.

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

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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. 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.

**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.

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.

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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

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species
PIEN
ABLA
PICO

Map Zone
10

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

Geographic Range

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 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,

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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 (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).

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Vegetation Classes

Class A 15 %

Early Development 1 All Structure

Upper Layer Lifeform

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

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

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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

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.

Additional Disturbances Modeled

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

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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. 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.

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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.

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,

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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.

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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.

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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.

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.

**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.

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.

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.

**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., 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.

**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

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Modeler 3	Larry Kaiser	larry_kaiser@blm.gov	**Reviewer**		

Vegetation Type
Wetlands/Riparian

Dominant Species
PIEN
THPL

Map Zone
10

General Model Sources
☑ Literature
☐ Local Data
☑ Expert Estimate

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

Geographic Range

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 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 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.

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 Structure

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species and Canopy Position

PIEN
Mid-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.

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).

Description

Sprouting riparian shrubs and deciduous trees, such as black cottonwood, Douglas maple, willow and birch. Engelmann spruce and some other conifers may be regenerating.

**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 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

Upper Layer Lifeform

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

Fuel Model

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.

Description

Typically closed overstory of Engelmann spruce. Riparian deciduous species present but not dominant.

Class C **70 %**

Late Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

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.

Description

Typically closed, old Engelmann spruce trees. Canopy closure tends to be >60%.

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

**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 National Forest. Gen. Tech. Rep. PNW-GTR-360. Portland, OR: USDA Forest Service, Pacific

**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.

Northwest Research Station. 375 pp.

**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

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Modeler 3	Susan Miller	smiller03@fs.fed.us	**Reviewer**	Cathy Stewart	cstewart@fs.fed.us

Vegetation Type

Forest and Woodland

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species

PSME
PICO
PIFL
CARU
CAGE
BERE
PHMA5

Map Zone

10

Model Zone

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

Geographic Range

This 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 fir systems and persistent lodgepole pine in frost pockets and cooler areas of the map zone.

**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.

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 Structure

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

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.

**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 **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. R. Haugo (01/09/2013), extend min canopy closure to 10% to maintain continuity of S-Class mapping criteria.

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. R. Haugo (01/09/2013), extend min canopy closure to 10% and max height to 50m to maintain continuity of S-Class mapping criteria.

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. R. Haugo (01/09/2013), extend max canopy closure to 100% and max height to 50m to maintain continuity of S-Class mapping criteria.

Disturbances

**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 pp.

**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

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Vegetation Type
Forest and Woodland

General Model Sources
☑ Literature
☑ Local Data
☑ Expert Estimate

Dominant Species
PICO
CAGE2
VASC
CARU
CARO5

Map Zone
10

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

Geographic Range

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.

**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 Structure

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

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.

Description

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.

**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 **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. R. Haugo (01/09/2013), extend max height to 50m to maintain continuity of S-Class mapping criteria.

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. R. Haugo (01/09/2013), extend max height to 50m to maintain continuity of S-Class mapping criteria.

**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. Ecological Monographs: 52(2): 199-221

**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.