LANDFIRE Biophysical Setting Model

Biophysical Setting 2911792 Northwestern Great Plains-Black Hills Ponderosa Pine Woodland and Savanna - Savanna

☑ *This BPS is lumped with: 1013*

☑ *This BPS is split into multiple models:* *Bur Oak is being lumped into several systems as an inclusion within the system, because it occurs in a variety of settings/communities - 1054, 1117, 1385, riparian, and transitioning from aspen in north in ND. It's in transition zones in MZs 29 amd 30. Therefore, we can tell you where to map it (Dakotas), but it won't have its own model, because each model would encompass pieces of the aforementioned models.*

Querceus macrocarpal/Prunus virginiana habitat type forms relatively extensive communities on backslopes of intermittent streams and drainageways. This habitat type was limited to glaciated areas. The Populus tremuloides/QUMA2 community type occupied erosive slopes. Once these areas become stabiliized, the QUMA2/PRVI habitat type will probably result because QUMA2 reproduces in the understory. The QUMA2/Corylus species habitat type is found in the Killdeer Mountains and adjacent areas. This habitat type is on gentle slopes and the soils are more leached than many of the other types. The Betula papyrifera Corylus Cornuta community type occupies similar sites and is seral to QUMA2/Corylus species habitat type (Girard et al. 1989).

This system is split into Low Elevation PIPO, and PIPO Savanna.

General Information

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Vegetation Type

Forest and Woodland

General Model Sources

☑ Literature
☐ Local Data
☑ Expert Estimate

Dominant Species

PIPO
JUSC2
RHAR4
PSSP6
PASM
CAREX
SCSC
QUMA2

Map Zone

29

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 is located in the lower elevations of the Black Hills, western ND and SD, eastern MT, the Missouri River Breaks of northern MT and from the High Plains of eastern WY (including the Rochelle Hills of the Thunder Basin National Grassland) eastward to western NE (in NE, the Pine Ridge escarpment would be included in this, but not the Sandhills. The Pine Ridge escarpment reaches to the

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edge of the Sandhills, but not really into them). This might describe areas in MZ29, 30, 20 and 31. In MZ29, it could occur generally east of the Bighorn and Laramie Ranges (including sections 331G, 331K and 331F; subsections M334Aa, 331Mi and 331Md).

This is the PIPO Savanna that is not in the mountains of the Rockies.

Biophysical Site Description

The geology is typically sedimentary in origin. Often found on buttes, hogbacks, rocky outcrops and steep, rocky slopes. Elevations range from 3200-4400ft, but in the southern Black Hills may be found up to 5700ft on southern aspects. In eastern MT and northeast WY, it is also found on southern aspects.

Vegetation Description

This type is dominated by interior ponderosa pine and is often the only tree present. Understory composition varies but Rocky Mountain juniper, skunkbush sumac, mountain mahogany (in southern Black Hills and the eastern Pine Ridge), snowberry, and yucca are common woody species (one reviewer noted that under the historic fire regime, the occurrence of yucca would have been a bit lower than at present). Bur oak might occur in this system as well. Currant and chokecherry are found in the Montana portion of the BpS's range. These also occur on the Pine Ridge, but neither is significant except in draws. Poison ivy is also common in the Pine Ridge.

Regional lead asked about Rocky Mountain juniper (JUSC2) as an indicator for the Black Hills: JUSC2 really is a component and indicator of many of the ponderosa pine savanna areas. The species generally becomes more prominent in the pine savanna as the soils become more skeletal, or the soil profile and surface contain more rock fragments. There may be some sites where it is a very limited component. JUSC2 can also be considered an indicator for Thunder Basin. In the Pine Ridge in NE, JUSC2 is never hard to find in the PIPO areas, but you sometimes have to actively look for it - so it might not be an indicator on the Pine Ridge; this may be one of the differences between this side of the range and the NW side of the range. Rocky Mountain juniper is listed as present in late successional communities for ponderosa pine/Idaho fescue, ponderosa pine/sun sedge, and ponderosa pine/bluebunch wheatgrass habitat types by Hanson and Hoffman (1988) for southeastern MT. But it's not mentioned as present in the other ponderosa pine habitat types (ponderosa pine/common juniper, ponderosa pine/chokecherry). RM Juniper is not an indicator for ponderosa pine habitat types in southeastern MT or western ND.

Herbaceous species include needlegrasses, grama grasses, little bluestem, western wheatgrass, sedges and bluebunch wheatgrass. There is Idaho fescue as far east as Ashland, MT.

Disturbance Description

Generally frequent fires of low severity (Fire Regime Group I). Mixed severity fire occurs in the closed canopy conditions, and stand replacement fire is very infrequent (300yrs+). Low-severity fires are frequent and range from <10yrs to more than 20yrs (Brown and Sieg 1999, Fisher et al. 1987), but probably not more than 40yrs at the high end (3-70yrs range). The MFRI is approximately 12-15yrs for low severity fires.

There is considerable debate over the role of mixed severity and surface fires in the historical range of variability in this and other ponderosa pine forests in the northern and central Rockies (Baker and Ehle 2001, 2003; Barrett 2004; Veblen et al. 2000). However, Brown (2006) argues that surface fire was the dominant mode of fire disturbance and that the role of mixed-severity fires is overstated.

The surgeon’s log at Fort Robinson in 1893 states that the White River face has steep asclivities that are

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black with the pines that have given their name to the ridge. The forest growth is limited by the creek and beyond are grass-grown prairies whose annual fires have destroyed the seedling pines. A drive of twelve miles would take us to the summit and bring to view a rolling fertile land that sinks by gentle slopes to the level of the Niobrara on Running Waters. Things would have changed some by 1893, but this area didn't settle heavily until at least two decades after that. Additionally, a form he had to fill out stated that the trees were mostly up on the ridges. So – this documents a very high frequency fire regime, at least at that time (the last armed conflict with Native Americans was in 1890, so Native American influences on the fire regime were already tremendously affected – probably shorter. Higgens suggested that with the coming of the railroads, fire frequencies increased significantly (Lata, pers comm).

In the Rapid Assessment (RA) workshop, review indicated more mixed fire should occur in the early stage and surface fire should be modeled in all structural stages. Peer review comments during the RA disagreed on the role of mixed and surface fire in this type. The majority of review agreed with the original model's parameters for mixed fire, but thought surface fire could be slightly less frequent. One review contended that there is no evidence of mixed severity fire in this type at all, and that the overall MFRI should be around 25yrs.

For MZs 29 and 30, it was suggested that mixed fire be removed from this model; reviewers agreed, and therefore mixed fire is not in the model.

Variation in precipitation and temperature interacting with fire, tip moths and ungulate grazing affects pine regeneration. Windthrow, storm damage and mountain pine beetles were minor disturbances in this type unless stands reach high densities. The interactions among drought, insects and disease are not well understood.

Ips spp of bark beetles can cause significant mortality among pole-sized and larger diameter pines, especially those weakened by drought, fire injury and the hail-related native disease diplodia. This serves to maintain the late-development open stage (class D) and move the late-development closed stage (class E) to the late-development open stage (class D).

In ponderosa pine, bur oak occurs with fire adapted species. When a stand replacing fire occurs, system will get big patches of bur oak that will persist until the pine comes in. It's shade intolerant.

In the northern Black Hills, there is a separate bur oak type with a long FRI.

Ponderosa pine - Juniperus scopulorum savanna in the southern Black Hills has lots of rock exposure or sparsely grassed soils, which probably protected some of the juniper seed trees from being wiped out by fire.

Adjacency or Identification Concerns

This type is either surrounded by Northern Plains grasslands and shrublands or is a transition between Northern Plains grasslands and shrublands and higher-elevation coniferous forests. Ponderosa pine in this BpS has encroached into the Northern Plains grassland and shrubland types in many areas due to fire suppression and grazing.

As this system model and description is a copy of 1117, this system will be difficult to distinguish from that one, and is only distinguished by geography.

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Invasive species in this system include cheatgrass, Japanese brome, crested wheatgrass, Kentucky bluegrass and intermediate wheatgrass. Crested wheatgrass and cheatgrass are at lower elevations mostly. Cheatgrass has altered the fire frequency and extent (although not on the Pine Ridge).

Currently, there have probably been at least 5-10 fire cycles that have been missed due to suppression, grazing, etc. Therefore, the system today would look much more like the late closed stage with approximately 50-80% canopy closure - uncharacteristic. Also- encroachment into prairies by pine and juniper is an issue today (Juniper becomes more of an issue further east; it's primarily ponderosa pine that is encroaching in the NE area), although JUSC2 is an indicator at least in the Black Hills. Generally. the juniper that is an issue with the prairies east of the Black Hills is the eastern redcedar. As it continues to be incorporated into windbreaks, it is continuing to increase into new areas.

Hardwoods exist in drainages, which encompasses a separate BpS. In NE, there is green ash, chokecherry, hackberry and American elm, which get crowded out by the ponderosa pine.

Currently expanding into grasslands and shrublands because of fire suppression, grazing and natural expansion from Holocene rebound (Norris 2006).

Native Uncharacteristic Conditions

Currently, there have probably been at least 5-10 fire cycles that have been missed due to suppression, grazing, etc. Therefore, the system today would look much more like the late closed stage with approximately 50-80% canopy closure - uncharacteristic. Some areas have been thinned to "even spacing," rather than the "clumpier" arrangement that is shown in early photos.

Scale Description

Disturbance patch size probably ranged from 10s-10000s of acres. On the Pine Ridge in NE, fires could have at least been 75-100000ac, as evidenced by current fires that have burned there (approx 60K acres), that would have continued to burn if they weren't suppressed.

System would be a patchy mosaic of 10s-1000 acres. It could be a range of patches, such as in Missouri Breaks where it could be up to 10000ac patches.

Issues/Problems

Comments

This BpS was originally modeled as MZ29 and MZ30 BpS 1117 which included the Black Hills. However, post-model-review-and-delivery, the new Northwestern Great Plains-Black Hills Ponderosa Pine BpS was created by NatureServe. Therefore, this model is a copy of MZs 29 and 30 1117, only different from the current 1117 by defined geography.

The 1117 model for MZ29 and 30 was adapted from the Rapid Assessment model R0PIPOnp developed by Breck Hudson and reviewed by Bill Baker, Dennis Knight, and Brad Sauer. Other modelers for MZs 29 and 30 were Paul Mock, David Overcast and Kim Reid. Other reviewers for MZs 29 and 30 were Carolyn Sieg and Mary Lata.

RA Workshop code was PPIN11.

Additional authors for the RA include Deanna Reyher, Carolyn Sieg, Breck Hudson, Cody Wienk, Peter

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Brown and Blaine Cook. This type was modeled based on earlier work done by an expert panel (Morgan and Parsons 2001). Collapsing of stages were necessary to fit the five-box model used for this process.

Vegetation Classes

Class A 5 %

Early Development 1 All Structure

Upper Layer Lifeform

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

Fuel Model

1

Indicator Species and Canopy Position

NAVI4
Mid-Upper
PASM
Mid-Upper
PSSP6
Mid-Upper
CAREX
Low-Mid

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	90 %
Height	Herb 0m	Herb 1.0m
Tree Size Class	Seedling <4.5ft	

- [ ] Upper layer lifeform differs from dominant lifeform.

Shrubs are the upper layer, perhaps, but cover is <20%.

Description

This community is dominated by herbaceous and woody species, including the graminoids needlegrasses, western wheatgrass, bluebunch wheatgrass, sedges, Idaho fescue and little bluestem in moister areas, and various shrubs including skunkbush and snowberry. Ponderosa pine seedlings are scattered and found in small clumps.

Little bluestem will also be indicator species.

Number of years in this class is variable depending on climatic patterns and fire disturbances. This class typically ends at 30yrs in this model. Without fire for 25yrs, this class can move to a mid-closed stage.

Needlegrasses can be tall up to one meter, but other graminoids are typically less than 0.5 meters.

Low severity surface fires occur every 30yrs. Replacement fires (since this is mostly grassland in this class) occur every 50yrs.

Class B 2 %

Mid Development 1 Closed

Upper Layer Lifeform

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

Fuel Model

Indicator Species and Canopy Position

PIPO
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	51 %	100 %
Height	Tree 0m	Tree 10m
Tree Size Class	Pole 5-9" DBH	

- [ ] Upper layer lifeform differs from dominant lifeform.

Description

Multi-story stand of small and medium trees with saplings and seedlings coming in as clumps. Understory is sparse. Some juniper might be present - could be an outlier. Grasses and shrubs are shaded out.

This class lasts approximately 70yrs, then moves to a late closed stage.

Low severity surface fires occur every 15yrs and move this stage to a mid open stage. Replacement fires occur infrequently approximately every 300yrs.

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

Insect/disease was modeled at approximately occurring every 50yrs, not causing a transition.

Class C **8 %**

Mid Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species and Canopy Position

PIPO
Upper
NAVI4
Lower
PASM
Lower
PSSP6
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.

Graminoids could have up to 60-80% cover (Hansen and Hoffmann 1988). Grasses co-dominate.

Description

Predominantly single-story stands with a few pockets of regeneration. Low shrubs such as snowberry and skunkbush and poison ivy are dominant as well as grass and forbs. Graminoids could have up to 70-80% cover. Rocky Mountain juniper present in patches (Rocky Mountain juniper is not common on the Pine Ridge in NE).

Carex spp and little bluestem will also be indicator species.

This class lasts approximately 50yrs then goes to a late open stage. Without fire for 40yrs, this could transition back to a mid closed stage.

Low severity surface fires occur every 15yrs, maintaining this class. Replacement fires occur very infrequently (modeled at 0.0015 probability).

Class D **80 %**

Late Development 1 Open

Upper Layer Lifeform

- ☐ Herbaceous
- ☐ Shrub
- ☑ Tree

Fuel Model

Indicator Species and Canopy Position

PIPO
Upper
NAVI4
Lower
PASM
Lower
PSSP6
Lower

Structure Data (for upper layer lifeform)

	Min	Max
Cover	0 %	50 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Large 21-33"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Graminoids could have up to 60-80% cover. Grasses co-dominate.

Description

Predominantly single-story stands of large ponderosa pine with pockets of smaller size classes (replacement). Snowberry, skunkbush and patches of Rocky Mountain juniper. Understory is dominated by shrub species and grasses and poison ivy. Graminoids could have up to 70-80% cover.

Carex spp and little bluestem will also be indicator species.

It is thought that class D, the late open stage, should occupy approximately 80% of the historical landscape.

Low severity fires occur every 15yrs and maintain this stage. Replacement fires occur very infrequently

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(0.0015 probability). If no fire occurs after 40yrs, this class could transition to the late closed stage.

Insect/disease occurs every 50yrs and maintains this stage.

Class E **5 %**

Late Development 1 Closed

Upper Layer Lifeform

☐ Herbaceous
☐ Shrub
☑ Tree

Fuel Model

Indicator Species and Canopy Position

PIPO
Upper

Structure Data (for upper layer lifeform)

	Min	Max
Cover	51 %	100 %
Height	Tree 10.1m	Tree 25m
Tree Size Class	Medium 9-21"DBH	

☐ Upper layer lifeform differs from dominant lifeform.

Description

This is a somewhat uniform late-development stage, multi-story stands of large, medium, small and seedling ponderosa pine. Shrubs and grasses are sparse. This type generally exceeds 70% canopy cover. DBH is less in this class than late-open.

Low severity surface fires occur every 15yrs and cause a transition back to the late open stage. Replacment fires occur every 300yrs.

Insect/disease occurs every 250yrs, causing a transition back to the late open stage. Drought can also occur - every 500yrs, causing a transition to the late open stage.

Disturbances

Fire Regime Group:** I

Historical Fire Size (acres)

Avg
Min 1
Max 50000

Sources of Fire Regime Data

☑ Literature
☑ Local Data
☑ Expert Estimate

Fire Intervals

	Avg FI	Min FI	Max FI	Probability	Percent of All Fires
Replacement	380			0.00263	4
Mixed					
Surface	15	3	70	0.06667	96
All Fires	14			0.06931	

Fire Intervals (FI):

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is central tendency modeled. Minimum and maximum show the relative range of fire intervals, if known. Probability is the inverse of fire interval in years and is used in reference condition modeling. Percent of all fires is the percent of all fires in that severity class.

Additional Disturbances Modeled

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

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