

10460

Northern Rocky Mountain Subalpine Woodland and Parkland

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Forest and Woodland

Map Zones

21

Geographic Range

The geographic range for MZ21 includes southwest MT, southeast ID and northwest WY.

Biophysical Site Description

Upper subalpine zone (7,000-11,000ft) on moderate to steep terrain (e.g., 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

This is a subalpine parkland setting with tree clumps or discontinuous forest mixed with meadow. Forest communities range from nearly homogeneous stands of whitebark pine on harshest, highest elevation sites to mixed species including shade tolerant subalpine fir or Engelmann spruce. Vegetation can be stunted with short, dwarfed trees, including krummholz vegetation on the harshest sites. Historically, whitebark pine dominated on southerly aspects, while northerly aspects were dominated by subalpine fir and Engelmann spruce. Rarely, limber pine may be present in 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.

Undergrowth on these sites is usually sparse and at timberline is highly variable. Shrubs that may occur include *Vaccinium* spp., *Juniperus communis*, *Shepherdia canadensis*, and *Paxistima myrsinites*. *Ledum glandulosum* may also be present. Grasses include *Carex geyeri*, *Carex rossii*, *Festuca idahoensis*, *Bromus carinatus*, *Elymus trachycaulus*, and *Trisetum spicatum*. Herbs include yarrow, prairie smoke, mountain dandelion and *Ribes montigenum*. These understory species listed apply to MZ21 (Fischer and Clayton 1983, Bradley et al 1992, USDA, Targhee National Forest Subsections and Landtype Associations 1998). Other common forbs include *Arnica cordifolia*, *Claytonia lanceolata*, *Lupinus argenteus*, and *Erythronium grandiflorum*.

This type is a mixture of whitebark pine dominated clumps and stringers mixed with the Idaho fescue-bearded wheatgrass habitat type in Yellowstone.

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 grizzly bears and Clark's nutcrackers. Whitebark pine also depends exclusively upon Clark's nutcrackers for seed dispersal and subsequent tree establishment. The Clark's nutcracker may distribute seeds eight kilometers from the source tree. Reproduction following disturbance is slow; trees may not produce cones until they are 50yrs or older.

BpS Dominant and Indicator Species

Symbol	Scientific Name	Common Name
PIAL	<i>Pinus albicaulis</i>	Whitebark pine
ABLA	<i>Abies lasiocarpa</i>	Subalpine fir
PIEN	<i>Picea engelmannii</i>	Engelmann spruce

Species names are from the NRCS PLANTS database. Check species codes at <http://plants.usda.gov>.

Disturbance Description

Fire Regime Groups III and IV, primarily long-interval (e.g., 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 and cool, moist conditions. Tree clumps may burn out without carrying through intervening meadow, or spot from one clump to the next. Individual tree torching is common. Non-lethal surface fires may dominate where continuous light fuel loading (i.e., grasses) exists (Kapler-Smith and Fischer 1997), but would typically be small in extent and are not modeled here. Recent dendroecological data collected in whitebark pine forests near Missoula, in western MT, found numerous small fires (MFIs <50yrs) punctuated by less frequent, larger fires (MFIs 75-100yrs) and implicated large-scale climate variability (e.g., the Little Ice Age) as a driver of temporal changes in the fire regimes of these forest systems (Larson 2005). While this may be more common in the northern Rockies, there has been little evidence of frequent fires in this forest type in MZ21 (Walsh 2005).

Fire frequency is largely controlled by climate in this system (Romme, personal correspondence, Veblen et al. 1994) and there is a relatively long MFI in the Greater Yellowstone Ecosystem, maybe longer than elsewhere (Walsh 2005).

The mountain pine beetle is an important disturbance agent in whitebark pine and lodgepole pine forests, and past outbreaks have caused widespread mortality 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.

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. The mountain pine beetle has become increasingly more important (versus historically) in the last five years due to warm temperatures.

Fire Frequency

Severity	Avg FI	Percent of All Fires	Min FI	Max FI
Replacement	517	39	100	1000
Moderate (Mixed)	325	61	55	1000
Low (Surface)				
All Fires	200	100		

Fire interval is expressed in years for each fire severity class and for all types of fire combined (All Fires). Average FI is the central tendency modeled. Percent of all fires is the percent of all fires modeled in that severity class. Minimum and Maximum FIs show the relative range of fire intervals as estimated by model contributors, if known.

Scale Description

Fire sizes range from individual trees, tree clumps and groups. Occasionally, larger patches of fire occur, as in Yellowstone National Park in 1988. Insects and whitepine blister rust may affect whole drainages.

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 and ABLA/XETE. Lower subalpine forests border at lower elevations, including lodgepole pine, Douglas-fir, Engelmann spruce and subalpine fir types. There is a successional trajectory towards more shade tolerant species in absence of fire in many locations.

Whitebark pine blister rust has affected whitebark pine in moist ranges of this BpS, but blister rust mortality is not as severe in MZ21 as in MZ19. Whitepine blister rust might preferentially affect older trees, possibly retarding succession to older series; however, that is unconfirmed, as others state that it does not preferentially attack older individuals and that the rust will actually kill younger and smaller trees faster than the larger, older ones.

The Shoshone Forest and Yellowstone NP have some climax stands of whitebark pine with no or little evidence of blister rust present. Blister rust is, however, becoming more prominent in the Teton Range, Mount Leidy Highlands, and there is a high mortality from a variety of insects and diseases on all conifer species on the Bridger-Teton.

Reviewers for MZ21 felt that this BpS could be a solution to BpS 1070 Alpine Mountain Dwarf-Shrubland not encompassing krummholz features.

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

On Mount Washburn in Yellowstone National Park, one of the whitebark pine plots that burned in a crown fire is regenerating entirely to Engelmann spruce. However, this is an occurrence that might be happening on a small scale and is not necessarily happening everywhere.

Issues or Problems

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

Native Uncharacteristic Conditions

On Mount Washburn in Yellowstone National Park, an anomaly is occurring in that one of our whitebark pine plots that burned in a crown fire is regenerating entirely to Engelmann spruce. However, this is an occurrence that might be happening on a small scale and is not necessarily happening everywhere.

Comments

Additional reviewers for the MZ21 were Sarah Canham (scanham@fs.fed.us) and one anonymous reviewer.

Succession Classes

Mapping Rules

Upper Layer Lifeform	Height (m)	Canopy Cover (%)									
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
Herb	0-0.5	A	A	A	A	A	A	A	A	A	A
Herb	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Herb	>1.0	A	A	A	A	A	A	A	A	A	A
Shrub	0-0.5	A	A	A	A	A	A	A	A	A	A
Shrub	0.5-1.0	A	A	A	A	A	A	A	A	A	A
Shrub	1.0-3.0	A	A	A	A	A	A	A	A	A	A
Shrub	>3.0	A	A	A	A	A	A	A	A	A	A
Tree	0-5	A	A	A	A	A	A	A	A	A	A
Tree	5-10	C	C	C	B	B	B	B	B	B	B
Tree	10-25	D	D	D	D	E	E	E	E	E	E
Tree	25-50	D	D	D	D	E	E	E	E	E	E
Tree	>50	D	D	D	D	E	E	E	E	E	E

Succession class letters A-E are described in the Succession Class Description section. Some classes use a leafform distinction where a qualifier is added to the class letter: Brdl (broadleaf), Con (conifer), or Mix (mixed conifer and broadleaf). UN refers to uncharacteristic native or a combination of height and cover that would not be expected under the reference condition. NP refers to not possible or a combination of height and cover which is not physiologically possible for the species in the BpS.

Description

Class A 21 Early Development 1 - All Structures

Indicator Species

Symbol	Scientific Name	Common Name	Canopy Position
PIAL	<i>Pinus albicaulis</i>	Whitebark pine	Upper
PICO	<i>Pinus contorta</i>	Lodgepole pine	Upper
PIEN	<i>Picea engelmannii</i>	Engelmann spruce	Upper
PIFL2	<i>Pinus flexilis</i>	Limber pine	Upper

Description

Description

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. Subalpine larch is uncommon in the Greater Yellowstone Ecosystem. And although limber pine is rare, some PIFL2 individuals were found intermixed in a nearly pure PIAL forest in the Wind River Range, but that has not been seen often in the Greater Yellowstone Ecosystem.

Pole 5-9" DBH

Class D	5	Late Development 1 - Open
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Symbol	Scientific Name	Common Name	Canopy Position
PIAL	<i>Pinus albicaulis</i>	Whitebark pine	Upper
PICO	<i>Pinus contorta</i>	Lodgepole pine	Upper
PIFL2	<i>Pinus flexilis</i>	Limber pine	Upper

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, subalpine fir, Engelmann spruce and lodgepole pine will typically dominate.

Medium 9-21"DBH

Class E	27	Late Development 1 - Closed
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Symbol	Scientific Name	Common Name	Canopy Position
PIAL	<i>Pinus albicaulis</i>	Whitebark pine	Upper
ABLA	<i>Abies lasiocarpa</i>	Subalpine fir	Upper
PIEN	<i>Picea engelmannii</i>	Engelmann spruce	Upper
PIFL2	<i>Pinus flexilis</i>	Limber pine	Upper

Mid to larger diameter mixed conifer species in small to moderate size patches generally on southerly aspects. Subalpine fir is likely to be initiating in the understory on these sites. Closed canopy conditions occur on sites that are more protected (i.e., northerly aspects) or have better soil development. This class will persist until a disturbance causes a transition.

Maximum Tree Size Class
Medium 9-21"DBH

Model Parameters

Deterministic Transitions

From Class	Begins at (yr)	Succeeds to	After (years)
Early1:ALL	0	Mid1:CLS	49
Mid1:OPN	50	Late1:OPN	129
Mid1:CLS	50	Late1:CLS	129
Late1:OPN	130	Late1:OPN	999
Late1:CLS	130	Late1:CLS	999

Probabilistic Transitions

Disturbance Type	Disturbance occurs In	Moves vegetation to	Disturbance Probability	Return Interval (yrs)	Reset Age to New Class Start Age After Disturbance?	Years Since Last Disturbance
Replacement Fire	Early1:ALL	Early1:ALL	0.001	1000	Yes	0
Wind or Weather or Stress	Early1:ALL	Early1:ALL	0.005	200	Yes	0
Insects or Disease	Early1:ALL	Early1:ALL	0.005	200	Yes	0
Competition or Maintenance	Early1:ALL	Early1:ALL	0.005	200	Yes	0
Alternative Succession	Early1:ALL	Mid1:OPN	0.01	100	Yes	0
Insects or Disease	Mid1:OPN	Mid1:OPN	0.002	500	No	0
Insects or Disease	Mid1:OPN	Early1:ALL	0.002	500	Yes	0
Wind or Weather or Stress	Mid1:OPN	Early1:ALL	0.003	333	Yes	0
Replacement Fire	Mid1:OPN	Early1:ALL	0.003	333	Yes	0
Mixed Fire	Mid1:OPN	Mid1:OPN	0.007	143	No	0
Alternative Succession	Mid1:OPN	Mid1:CLS	0.05	20	Yes	0
Competition or Maintenance	Mid1:CLS	Mid1:CLS	0.002	500	No	0
Replacement Fire	Mid1:CLS	Early1:ALL	0.002	500	Yes	0
Insects or Disease	Mid1:CLS	Mid1:OPN	0.003	333	Yes	0
Insects or Disease	Mid1:CLS	Early1:ALL	0.003	333	Yes	0
Mixed Fire	Mid1:CLS	Mid1:OPN	0.004	250	Yes	0
Wind or Weather or Stress	Mid1:CLS	Mid1:OPN	0.005	200	Yes	0

Insects or Disease	Late1:OPN	Mid1:OPN	0.001	1000	Yes	0
Insects or Disease	Late1:OPN	Late1:OPN	0.002	500	No	0
Insects or Disease	Late1:OPN	Early1:ALL	0.002	500	Yes	0
Replacement Fire	Late1:OPN	Early1:ALL	0.003	333	Yes	0
Wind or Weather or Stress	Late1:OPN	Late1:OPN	0.007	143	No	0
Mixed Fire	Late1:OPN	Late1:OPN	0.007	143	No	0
Alternative Succession	Late1:OPN	Late1:CLS	0.05	20	Yes	0
Insects or Disease	Late1:CLS	Mid1:OPN	0.002	500	Yes	0
Mixed Fire	Late1:CLS	Late1:OPN	0.002	500	Yes	0
Insects or Disease	Late1:CLS	Late1:OPN	0.002	500	Yes	0
Replacement Fire	Late1:CLS	Early1:ALL	0.002	500	Yes	0
Insects or Disease	Late1:CLS	Early1:ALL	0.003	333	Yes	0
Wind or Weather or Stress	Late1:CLS	Late1:OPN	0.006	167	Yes	0

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