10612

Inter-Mountain Basins Aspen-Mixed-Conifer Forest and Woodland—High Elevation

BpS Model/Description Version: Aug. 2020

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| --- | --- | --- | --- |
| **Modelers** |  | **Reviewers** |  |
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| None | None | None | None |

Vegetation Type

Forest and Woodland

Map Zones

16, 23

Model Splits or Lumps

This biophysical setting (BpS) is split into multiple models. 10611 represents lower elevation (<~8,500ft) aspen and mixed-conifer forests, where ponderosa pine, lodgepole pine, and Douglas-fir are associated conifers. 10612 represents higher elevation (>~8,500ft) aspen and mixed-conifer forests, where Engelmann spruce and subalpine fir are the associated conifers.

Geographic Range

This is typically found in Nevada, Utah, California, Arizona, New Mexico, Colorado, Idaho, Wyoming, Montana, and eastern Oregon.

Biophysical Site Description

This type typically occurs on flat to steep terrain (<80%) on all aspects. Elevation generally ranges from 8,000-11,000ft. Within the Utah High Plateaus (map zone [MZ] 16), elevations range from 8,000-10,000ft north of US Highway 6; south of US Highway 6, elevations typically range from 9,000-11,000ft. Soils are highly variable, but generally cool to frigid. This type occurs at the same elevation as the subalpine spruce-fir zone.

Vegetation Description

This highly variable ecological system is comprised of pure aspen or primarily aspen with few to several conifer species at higher elevations throughout Nevada, Utah, southern Idaho, western Colorado, and Wyoming. These conifers include mostly *Abies lasiocarpa* and *Picea engelmannii*, with *Abies concolor*, *Pinus contorta*,and *Pinus flexilis*. Without regular fire and with high levels of herbivory, conifers may replace the aspen community wherever aspen is present. The presence of even a single aspen tree in a stand provides strong evidence that the area historically supported aspen clones.

As a species, aspen is adapted to a much broader range of environments than most plants found associated with it. Aspen exist in single-story or multi-story stands. The understory structure may be complex, with multiple shrub and herbaceous layers, or simple, with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by graminoids or forbs.

Common shrubs include *Acer glabrum*, *Amelanchier alnifolia*, *Artemisia tridentata*, *Juniperus communis*, *Prunus virginiana*, *Rosa woodsii*, *Shepherdia canadensis*, *Symphoricarpos oreophilus*, and the dwarf-shrubs *Mahonia repens* and *Vaccinium* spp.

The herbaceous layers may be lush and diverse. Common graminoids may include *Bromus carinatus*, *Calamagrostis rubescens*, *Carex siccata* (=*Carex foenea*), *Carex geyeri*, *Carex rossii*, *Elymus glaucus*, *Elymus trachycaulus*, *Festuca thurberi*,and *Hesperostipa comata*. Associated forbs may include *Achillea millefolium*, *Eucephalus engelmannii* (=*Aster engelmannii*), *Delphinium* spp., *Geranium viscosissimum*, *Heracleum sphondylium*, *Ligusticum filicinum*, *Lupinus argenteus*, *Osmorhiza berteroi* (=*Osmorhiza chilensis*), *Pteridium aquilinum*, *Rudbeckia occidentalis*, *Thalictrum fendleri*, *Valeriana occidentalis*, *Wyethia amplexicaulis*, and many others.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| POTR5 | *Populus tremuloides* | Quaking aspen |
| ABLA | *Abies lasiocarpa* | Subalpine fir |
| PIEN | *Picea engelmannii* | Engelmann spruce |
| PICO | *Pinus contorta* | Lodgepole pine |
| ABCO | *Abies concolor* | White fir |
| PIFL2 | *Pinus flexilis* | Limber pine |

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

Disturbance Description

This BpS shares fire characteristics of stable aspen (1011) before conifer dominance, but behaves like dry-mesic subalpine spruce fir with conifer dominance. For the aspen phase, replacement fire and ground fire were common in stable aspen, and both depended heavily on native burning. It is important to understand that aspen is considered a fire-proof vegetation type that does not burn during the normal lightening season, yet evidence of fire scars and historical studies demonstrate that native burning was the primary source of fire and occurred mostly during the spring and fall. For the conifer-dominant phase, fire regime group (FRG) V (infrequent, stand-replacing fire) best described the system.

This BpS has elements of FRGs III, II, and IV. Replacement fire occurs. With the dominance of conifers following extended periods of fire exclusion, mixed-severity fire becomes nonexistent. Under pre-settlement conditions, disease and insect mortality did not appear to have major effects; however, older aspen stands would be susceptible to outbreaks. We assumed that 20% of outbreaks resulted in heavy insect/disease stand-replacing events, whereas 80% of outbreaks would thin older trees. Disturbance effects would also have varied from clone to clone. Many aspen clones situated on steep slopes are prone to disturbance caused by avalanches and mud-/rockslides. Riparian aspen is prone to flooding and beaver clearcutting. Under conifer dominance, replacement fire and severe insect/disease outbreaks cause stand-replacing events. Subalpine conifer-dominant stands will also be more susceptible to weather-related stress than aspen stands.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 71 | 46 |  |  |
| Moderate (Mixed) | 61 | 54 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 33 | 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

Patch sizes vary but are mostly in the tens and hundreds of acres.

Adjacency or Identification Concerns

Mapping: If any aspen is present with subalpine conifers common (>25% relative cover), this is probably the correct BpS (or 1011 at higher elevations if <25% relative cover of conifers).

This type is significantly altered today and is very difficult to identify because of conifer encroachment and fire exclusion, but less so than the lower elevation aspen and mixed conifer (BpS 10611).

BpS 10612 is higher elevation and exhibits less fire than 10611, but overlaps in elevation and shares closer fire regimes with aspen forest and woodland (1011). With extended fire exclusion, BpS 10612 will be very similar to subalpine spruce-fir forest and woodland types (BpSs 1055 and 1056). Mesic montane mixed-conifer forests (BpS 1052) are adjacent to BpS 10612 along the riparian systems.

Under current conditions, herbivory can significantly affect stand succession. Kay (1997, 2001a-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 impact of ungulates was low. Herbivory was therefore not included in the model.

Issues or Problems

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

There is uncertainty about the role of mixed-severity fire. We assumed that native burning in aspen stands invaded by young conifers resulted in mixed-severity fire, whereas the same source of fire would cause low-severity fire (surface fire) in the same-age stands that were more open. Experts and modelers expressed different views about the frequency of all fires, citing fire return intervals (FRIs) longer than those noted by Baker (1925), who actually studied the historical condition. The FRIs used here are a compromise. The longer FRIs were used for the oldest development states and the maximum FRI of Baker (1925) was used for stands that were being encroached by lower elevation conifers.

Native Uncharacteristic Conditions

Comments

MZs 16 and 23 were combined during 2015 BpS Review.

The split for BpS 1061 into low elevation (10611) and high elevation (10612) was at the request of the Missoula Fire Sciences Laboratory based on plot data for MZ16.

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 | C | C | C | C | A | A | A | A | A | A |
| Tree | 5-10 | C | C | C | C | B | B | B | B | B | B |
| Tree | 10-25 | C | C | C | C | D | D | D | D | D | D |
| Tree | 25-50 | C | C | C | C | D | D | D | D | D | D |
| Tree | >50 | C | C | C | C | D | D | D | D | D | D |

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 13 Early Development 1 - Closed

Upper Layer Lifeform: Tree

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POTR5 | Populus tremuloides | Quaking aspen | Upper |
| SYOR2 | Symphoricarpos oreophilus | Mountain snowberry | Middle |
| RIBES | Ribes | Currant | Middle |

Description

Aspen suckers. Grass and forbs present. No fire at this stage.

Class B 39 Mid Development 1 - Closed

Upper Layer Lifeform: Tree

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POTR5 | Populus tremuloides | Quaking aspen | Upper |
| SYOR2 | Symphoricarpos oreophilus | Mountain snowberry | Lower |
| RIBES | Ribes | Currant | Lower |

Description

Aspen dominate. Canopy cover highly variable.

Class C 44 Late Development 1 - Closed

Upper Layer Lifeform: Tree

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POTR5 | Populus tremuloides | Quaking aspen | Upper |
| PIEN | Picea engelmannii | Engelmann spruce | Middle |
| ABLA | Abies lasiocarpa | Subalpine fir | Mid-Upper |
| ABCO | Abies concolor | White fir | Mid-Upper |

Description

Aspen trees with conifer understory up to co-dominance. Canopy cover is highly variable, with conifers starting to suppress aspen. A lack of fire will eventually allow conifer dominance.

Class D 4 Late Development 1 - Open

Upper Layer Lifeform: Tree

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POTR5 | Populus tremuloides | Quaking aspen | Mid-Upper |
| PIEN | Picea engelmannii | Engelmann spruce | Mid-Upper |
| ABLA | Abies lasiocarpa | Subalpine fir | Upper |
| ABCO | Abies concolor | White fir | Upper |

Description

Subalpine conifers dominate with aspen present. Pole-size and larger diameter moderately to shade-tolerant conifer species will occur in moderate to large patches on all aspects. Fir dominates; pine is intermediate or suppressed/dying.

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:CLS | 0 | Mid1:CLS | 9 |
| Mid1:CLS | 10 | Late1:CLS | 39 |
| Late1:CLS | 40 | Late1:CLS | 999 |
| Late1:OPN | 130 | Late1:OPN | 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 | Mid1:CLS | Early1:CLS | 0.017 | 59 | Yes | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.02 | 50 | No | 0 |
| Wind or Weather or Stress | Late1:OPN | Late1:OPN | 0.001 | 1000 | No | 0 |
| Replacement Fire | Late1:OPN | Early1:CLS | 0.004 | 250 | Yes | 0 |
| Insects or Disease | Late1:OPN | Early1:CLS | 0.004 | 250 | Yes | 0 |
| Alternative Succession | Late1:CLS | Late1:OPN | 1 | 1 | Yes | 130 |
| Insects or Disease | Late1:CLS | Early1:CLS | 0.001 | 1000 | Yes | 0 |
| Insects or Disease | Late1:CLS | Mid1:CLS | 0.004 | 250 | Yes | 0 |
| Replacement Fire | Late1:CLS | Early1:CLS | 0.017 | 59 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.02 | 50 | No | 0 |

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