11600

Rocky Mountain Subalpine/Upper Montane Riparian Systems

BpS Model/Description Version: Aug. 2020

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

Vegetation Type

Woody Wetland

Map Zones

20, 29

Geographic Range

Higher elevations in the zone down to valley river bottoms. In map zone (MZ) 20, this Biophysical Setting (BpS) is very limited in extent.

For MZ29, this type would occur only in section M331B (Cleland et al. 2007).

Biophysical Site Description

This ecological system represents the combination of numerous riparian types occurring in the upper montane/subalpine zones. Found at 900-3,000m (3,000-10,000ft), but range is probably more like 6,000-8,000ft in MZ20. This ecological system typically exists as relatively small linear stringers but can occupy relatively wide and flat valleys. This is a widely dispersed type generally adjacent to live water.

Although reviewers recommended that the descriptions be made less broad so as to adhere more to high elevation, it was decided that this type includes montane and subalpine elevations, and therefore descriptions were kept broad.

These wetlands typically are in small upper-elevation watersheds that periodically experience high rainfall in short periods from late-season snowmelt and convective thunderstorms.

In MZ29, it probably occurs at 6,000-11,000ft in the Bighorn Mountains.

Vegetation Description

These systems are highly variable and generally consist of one or more of the following five basic vegetation forms: 1) cottonwoods (might not occur in this type in Bighorns in MZ29); 2) willows and other shrubs; 3) sedges and other herbaceous vegetation; 4) aspen; and 5) conifers (primarily spruce and subalpine fir).

This BpS encompasses a broad array of riparian species. It is composed of seasonally flooded forests, woodlands, and shrublands found at montane to subalpine elevations.

For MZ29, trees include aspens and coniferous forests -- *Picea engelmannii*, *Vaccinium*, *Ledum*, *Phyllodoce*, and *Calamagrostis canadensis*. Dominant and indicator species would be *Picea engelmannii*, *Ledum*, *Salix*, *Alnus*, *Carex*, and *Deschampsia*.

Shrubs include bog birch and willows (e.g., *Salix planifolia*, *S. wolfii*, *S. drummondii*, *S. geyeriana*, and *S. bebbiana*), among others. Shrubs for MZ29 include *Salix boothii*, *S. geyeriana*, *S. bebbiana*, *S. planifolia*, *S. drummondiana*, *Alnus viridis*, and *S. wolfii*.

Graminoids include tufted hairgrass, bluejoint reedgrass, beaked sedge (*Carex utriculata*), and water sedge (*Carex aquatilis*), among others. Sedges and grasses for MZ29 include *Deschampsia cespitosa*, *Carex aquatilis*, *Carex utriculata*, *Carex lenticularis*, *Juncus balticus*, and *Calamagrostis canadensis*.

Other *Salix* species for MZ20 may include *Salix candida*, *S. lutea*, *S. planifolia*, *S. serissima*, *S. barclayi*, *S. exigua*, *S. lasiandra*, *S. psudomonticola*, *S. commutata*, and *S. tweedyi*.

At lower elevations in MZ20, some of this riparian type (e.g., the *S. exigua* community type) typically includes cottonwood species. At higher elevations, *S. geyeriana* communities often include aspen. At the highest elevations, *S. planifolia* sometimes has a spruce-fir-lodgepole component. In MZ20, high-elevation meadows have the spruce-fir component interspersed in the wetlands along with the addition of lodgepole pine. These occupy low-gradient alluvial settings.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| SALIX | *Salix* | Willow |
| CAREX | *Carex* | Sedge |
| PSEUD7 | *Pseudotsuga* | Douglas-fir |
| PICO | *Pinus contorta* | Lodgepole pine |
| ABLA | *Abies lasiocarpa* | Subalpine fir |
| PIEN | *Picea engelmannii* | Engelmann spruce |
| POPUL | *Populus* | Cottonwood |
| PICEA | *Picea* | Spruce |

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

Disturbance Description

Flooding events and availability of water during drier periods are the major influences to this system, as a function of slope. Frequent flood events maintain vegetation but do not scour it, whereas larger, infrequent flood events scour and deposit sediments, resetting succession to early development, depending on vegetation. The importance of flooding as a disturbance depends on the degree of slope. Meandering, low-gradient streams are probably little changed by flood events outside of some deposition. However, high-gradient streams can be scoured by flood events, although these kinds of streams usually have narrow floodplains.

Reviewers felt that this BpS 1160 is more consistently wet with deep root systems, deep fens, springs, and small streams; flooding events aren't the major influence. Short growing season, temperature, radiation, avalanches, snow events, ice and scouring, herbivory, and possibly long-interval fire regimes are major disturbances, but more data are still needed (Ozenberger personal communication).

These wetlands are in small upper-elevation watersheds that periodically experience high rainfall in short periods from convective thunderstorms, leading to rapid runoff and mobilization of the fine alluvium in willow-dominated areas and even some of the rocks in conifer-dominated riparian on steeper gradients. Floods in willow-dominated alluvium may not show up as rushing streams scouring banks but more as a rising bathtub type of flood. Alluvium does get moved and willows get topkilled by inundation or by deposition or removal of alluvium (anonymous contributor, personal correspondence). In MZ20, at least, these watersheds are also common at lower elevations, too.

Sites are probably fairly lush, so fires may skip over them. This would be a patchy replacement fire, topkilling all the vegetation. Most of the species are fire-adapted and would respond favorably (Dwire et al. 2004). Fire would probably only have a significant, long-term impact only on the conifer- and aspen-dominated riparian zones.

Beaver (*Castor canadensis*) crop cottonwoods (*Populus* spp.) and willows (*Salix* spp.) and frequently influence the hydrologic regime through construction of dams (ponding water and slow release). Beavers show movement along rivers as available trees are felled. Beavers were the main agent of disturbance in pre-settlement times. Beaver dams impounded large, low-gradient valleys, allowing wetland and meadow vegetation to dominate in what might have been forest or steppe.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 299 | 50 | 100 | 500 |
| Moderate (Mixed) | 296 | 50 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 149 | 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

These systems are small linear or relatively wide features in the landscape.

Per NatureServe, stands are variable, occurring as narrow bands of trees and/or shrubs lining streambanks and alluvial terraces in narrow to wide, low-gradient valley bottoms and floodplains with sinuous stream channels to larger floodplains or terraces of rivers and streams, in V-shaped, narrow valleys and canyons.

When into the upper montane and subalpine zones, the streams are too small to be thought of as rivers. These are more headwaters streams.

Adjacency or Identification Concerns

This BpS includes narrow to moderately wide meadows, shrublands, and woodlands of conifers and aspen. It is adjacent to conifer/deciduous forest.

Over-grazing and irrigation use have had major impacts on some of these systems. Exotics in this setting are primarily Kentucky bluegrass, smooth brome, quackgrass, redtop, timothy, orchardgrass, and dandelion.

Domestic sheep may be an issue in the Wyoming and Wind River ranges. Global warming and acid rain may affect vegetation.

Many low-gradient, middle- to high-elevation streams have suffered from livestock grazing in the past 120yrs. Cattle and sheep destroy or weaken the streamside vegetation, allowing the stream to downcut its banks, which in turn causes drying of the riparian area. Plus the loss of beavers in many of these systems means that natural downcutting and drying are not reversed by the trapping of sediment in beaver impoundments. The result is that many montane riparian areas are narrower with smaller or more decadent shrubs.

Many moist to wet meadows have high canopy cover of *Juncus balticus* and unpalatable forbs instead of *Deschampsia cespitosa* as a result of livestock grazing.

Issues or Problems

Native Uncharacteristic Conditions

Many moist to wet meadows have high canopy cover of *Juncus balticus* and unpalatable forbs instead of *Deschampsia cespitosa* as a result of livestock grazing.

Comments

This model for MZ29 was adopted as is from the same model from MZ20 created by Linda Vance and Steve Barrett and reviewed by Mary Manning.

This model for MZ20 was adapted from the same BpS in MZ21 created by Tim Klukas (tim\_klukas@nps.gov), John Simons (john\_simons@blm.gov), and an anonymous contributor and reviewed by Jim Ozenberger (jozenberger@fs.fed.us), Andy Norman (anorman@fs.fed.us), Sarah Canham (scanham@fs.fed.us), and Brenda Fiddick (bfiddick@fs.fed.us). Descriptive and quantitative changes were made to better reflect MZ20 and to have the fire return interval (FRI) resemble other MZs and other adjacent systems more closely. Descriptive and other quantitative changes were made upon further review to more closely match the models from MZ10, MZ19, MZ12, and MZ17.

The model for MZ21 was adapted from the LANDFIRE models for the same BpS 1160 from MZ10, MZ19, MZ12, MZ17, and MZ16; models from MZ10 and MZ19 were created by Don Major (dmajor@tnc.org) and Mary Manning (mmanning@fs.fed.us) and reviewed by Carly Gibson (cgibson@fs.fed.us), Cathy Stewart (cstewart@fs.fed.us), John DiBari (jndibari@yahoo.com), and Steve Barrett (sbarrett@mtdig.net). For MZ21, descriptions were modified, and fire intervals were changed/increased (less fire).

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 | B | B | B | B | B | B | B | B | B | B |
| Tree | 5-10 | B | B | B | B | B | B | B | B | B | B |
| Tree | 10-25 | B | B | B | B | B | B | B | B | B | B |
| Tree | 25-50 | B | B | B | B | B | B | B | B | B | B |
| Tree | >50 | B | B | B | B | B | B | B | B | B | B |

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 54 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | Salix | Willow | Upper |
| CAREX | Carex | Sedge | Upper |
| PSEUD7 | Pseudotsuga | Douglas-fir | Middle |
| POPUL | Populus | Cottonwood | Middle |

Description

Immediate post-fire responses in this ecological system are dependent on pre-burn vegetation form. Post-burn condition sensitive to scouring and blowout from floods. This class is shrub- or grass-dominated. Composition varies both within/among reaches. Succession is highly variable due to high moisture levels and high species variability.

This class could contain seedlings of Douglas-fir, lodgepole pine, cottonwood, aspen, spruce, and subalpine fir.

This class could be thought of as the shrub-dominated version of this system. There would be little effect of fire after a couple of years, because nothing is killed and everything sprouts right back. This class could also be thought of as a tree-dominated (aspen or spruce) version of the system where fire has killed or set the trees back to this class, and then aspen or spruce (over different time spans) return to a tree-dominated stage.

Flooding disturbances (modeled as weather-related stress) include events that do not scour every 2yrs and events that reset the vegetation.

Beaver reset succession by moving along the river with tree depletion.

Replacement and mixed fire were modeled with an overall FRI split 50/50.

Native grazing occurs very infrequently.

*Maximum Tree Size Class*  
None

Class B 46 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | Salix | Willow | Middle |
| CAREX | Carex | Sedge | Middle |
| PSEUD7 | Pseudotsuga | Douglas-fir | Upper |
| POPUL | Populus | Cottonwood | Upper |

Description

Highly dependent on the hydrologic regime. For example, could include any combination of the five vegetation forms described above in "Vegetation Description." Composition of adjacent uplands is the determining factor for future fire events.

This class contains grasses, shrubs, and maturing trees of Douglas-fir, lodgepole pine, cottonwood, aspen, spruce, and subalpine fir.

Replacement and mixed fire were modeled with an overall FRI, split 50/50.

Large flood events reset vegetation to early class. Beavers and non-scouring flooding occur but have no effect on succession classes.

Beavers would be most active in aspen-dominated systems and least active in spruce-dominated systems. Given a long enough time, aspen would be invaded and overrun by spruce.

*Maximum Tree Size Class*  
Pole 5-9" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:CLS | 20 |
| Mid1:CLS | 21 | Mid1: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** |
| Native Grazing | Early1:ALL | Early1:ALL | 0.001 | 1000 | No | 0 |
| Replacement Fire | Early1:ALL | Early1:ALL | 0.0033 | 303 | Yes | 0 |
| Mixed Fire | Early1:ALL | Early1:ALL | 0.0033 | 303 | No | 0 |
| Optional 2 | Early1:ALL | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Optional 1 | Early1:ALL | Early1:ALL | 0.1 | 10 | Yes | 0 |
| Wind or Weather or Stress | Early1:ALL | Early1:ALL | 0.5 | 2 | No | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.0033 | 303 | No | 0 |
| Replacement Fire | Mid1:CLS | Early1:ALL | 0.0033 | 303 | Yes | 0 |
| Optional 2 | Mid1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Optional 1 | Mid1:CLS | Mid1:CLS | 0.03 | 33 | No | 0 |
| Wind or Weather or Stress | Mid1:CLS | Mid1:CLS | 0.1 | 10 | No | 0 |

Optional Disturbances

Optional 1: Beaver

Optional 2: 100-year flood events

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