11620

Western Great Plains Floodplain Systems

BpS Model/Description Version: Aug. 2020

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Vegetation Type

Mixed Upland and Wetland

Map Zone

22

Geographic Range

This system in map zone (MZ) 22 occurs east of the Continental Divide and merges at higher elevations with the Rocky Mountain lower montane riparian woodland and shrubland, which is an aggregate of Rocky Mountain montane riparian systems. It occurs along portions of the major rivers in the Bighorn Basin and along the Platte River and portions of the Wind River.

Biophysical Site Description

This system occurs along portions of the floodplain of both meandering and braided rivers on alluvial soils.

Vegetation Description

A broadleaf deciduous forest dominated by cottonwood (primarily *Populus deltoides*, but at upper elevation *P. angustifolia* and *P. acumumenata* are present), boxelder, peachleaf willow, sandbar willow, and coyote willow may be present. Early seral-stage phreatophytic vegetation becomes established on low-elevation flood deposits. Long-term survival of this vegetation type is possible only on bare, moist sites with a slightly higher elevation (1-3m above lower limit of perennial vegetation)

Other species found in the floodplain riparian zone include sandbar and coyote willow, box elder, peachleaf, hackberry, and green ash, typically associated with late seral stages. Other river systems are dominated by lanceleaf cottonwood (*Populus angustifolia James*) and a stabilized hybrid of plains and lanceleaf cottonwood (*Populus acuminata Rydb*. [pro spp.] [*angustifolia* × *deltoides*]). Understory species in these later seral stages may include skunkbush sumac, silver buffaloberry, silver sagebrush, and basin big sagebrush. The herbaceous component may include western wheatgrass, basin wildrye, blue wildrye, and other wildryes. Kentucky bluegrass, rubber rabbitbrush, and snowberry occur. The taller shrubs such as willow and sumac form discrete patches as overstory cottonwood die.

In the Bighorn River system, plains cottonwood (*Populus deltoides Bartr. ex Marsh* ssp. *monilifera* [*Ait*.] *Eckenwalder*) is the more common taxa. Common herbaceous taxa in mature Bighorn River systems include smooth brome, western and slender wheatgrasses, basin wildrye, western white clematis, and smooth Solomon’s seal. Shrub components of the Bighorn River system are silver buffaloberry, basin big sagebrush, coyote willow, skunkbush sumac, wild rose, and rabbitbrush. Depending upon the floodplain location and soil type, greasewood and basin big sagebrush can become the late-seral-system dominants.

Lanceleaf cottonwood and the stabilized hybrid of plains and lanceleaf cottonwood can resprout from roots and branches even though sprouting ability decreases with stem age.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| PODE3 | *Populus deltoides* | Eastern cottonwood |
| SAEX | *Salix exigua* | Narrowleaf willow |
| RHTR | *Rhus trilobata* | Skunkbush sumac |
| ERNA10 | *Ericameria nauseosa* | Rubber rabbitbrush |
| SALIX | *Salix* | Willow |

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

Disturbance Description

The development and maintenance of this system is dependent on fluvial geomorphic processes such as channel meandering, sedimentation, erosion, channel avulsion, and barform accretion driven by hydrologic variability. This variability incorporates the features of timing, duration, frequency, magnitude, and intensity. Regeneration of the dominant species (cottonwood and willow) is dependent on flooding and movement of river channels, which create bare, moist soil needed for seedling establishment, as well as limit reproduction from sprouting. Oxbow and slough development also influence the floodplain system and create variability in plant community composition. Upper terraces have infrequent flooding and scouring events whereas the lower terraces nearest the river flood frequently. Early-seral-stage development stands are produced on point bars via channel meandering, which occurs most often during moderately frequent high flows.

This community is most affected by fluvial geomorphic processes such as flooding, avulsion and deposition, and channel movement. Flood frequency for a class is based on location on the floodplain, with higher terraces subjected to longer flood cycles (up to 500yrs).

Scouring caused by ice jams during the winter, channel meandering, oxbows, and slough development greatly influence this system.

Changes in hydrology due to the activities of beaver are also an important ecological process in this system. Beaver impoundments kill trees (sometimes over large areas) and may create open water habitat and willow stands or contribute to channel meandering.

Fire was a significant disturbance component in this system when it occurred, although ignition was most likely limiting in this system. Despite being a riparian system, fuel can be very dry.

Wildland and prescription fire kill seedlings and saplings of lanceleaf cottonwood and the stabilized hybrid of plains and lanceleaf cottonwood, but pole-size and larger stems can survive. Plains cottonwood is also a poor root-crown “resprouter” and is fire-killed during both wildland and prescription fires.

Traveling ungulate herds and Native American activities locally impacted seral stage development. However, not enough is known about such disturbances to attempt modeling.

The original fire replacement interval (FRI) for MZ22 (200yrs) differed greatly from that in MZ20 (FRI, 50yrs). Therefore, upon further review, a few changes were made. Other disturbance differences are geographic differences and are explained further in the “Issues” section.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 574 | 18 |  |  |
| Moderate (Mixed) | 126 | 82 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 103 | 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

This is a linear system in this zone that occupies an area of tens to hundreds of acres.

Adjacency or Identification Concerns

This type merges at higher elevations with the Rocky Mountain lower montane riparian woodland and shrubland, which is an aggregate of Rocky Mountain montane riparian systems. In Wyoming, this system currently contains numerous exotics, including tamarisk, Russian olive, Russian knapweed, whitetop, perennial pepperweed, and houndstongue.

Plains cottonwood has a 90-yr life expectancy of mature stems. With decreased opportunities for seed germination and establishment, recruitment of seedlings into the cottonwood population is seen less and less.

Lanceleaf cottonwood and the stabilized hybrid of plains and lanceleaf cottonwood have a 100- to 200-yr life span of mature stems. They are similar to plains cottonwood in having diminished opportunities for seedling recruitment.

The natural disturbance regime for most of this system has been highly altered from historic conditions. Invasion of exotics might lead to increased flammability in this system. Russian olive and tamarisk have added to a shift in overall community composition and differing successional stages and successional pathways.

Issues or Problems

This system may contain occasionally a successional pathway to herbaceous meadow systems that was not modeled from box A. Class D -- then Class E -- could eventually move potentially to meadow, which wasn’t modeled.

Probability of fluvial disturbance in Class C and Class D is uncertain. Beaver-induced flood damage in Class E is an uncertain probability.

The FRI for MZ22 for this Biophysical Setting (BpS) differs from the FRI for MZ20 for this same BpS. Reviewers for MZ22 agreed a bit more with MZ20 FRIs; therefore, FRIs for MZ20 were altered somewhat. Likewise, the models and structural stages differ somewhat. An MZ22 modeler states the following issues in consistency: descriptions and classes and disturbance frequencies for MZ22 are based in part on data from a stretch of the Bighorn River, given in Akashi’s thesis. There are several pathways in the MZ20 model that are more complex but do not necessarily add to the model, such as the 50-yr flooding from Class C to Class D, and 50-100yr from Class D to Class A, and flooding 20yr from Class A to Class B. A modeler for MZ22 also states the MZ20 400-yr meander interval seems long. Otherwise, the classes for MZ20 versus MZ22 are similar and are along the same lines of thinking, but are just defined with different breakpoints.

Another MZ22 reviewer stated that the descriptions for MZ22 better fit MZ22 and not MZ20, and that differences were geographic and the MZ22 model was more specific for Wyoming and Bighorn Basin. Beaver had more influence in this BpS in MZ20 than MZ22. Scourings from ice jams in the Bighorn system also have a more dependable cycle and influence in MZ22 than MZ20. Also, cottonwoods do not resprout in Class C in MZ22 as stated in MZ20.

Native Uncharacteristic Conditions

Comments

This model for MZ22 was adapted from the Rapid Assessment (RA) model R4NOFP created by George Cunningham and reviewed by John Ortmann. Descriptive and quantitative changes were made.

For the RA, one anonymous reviewer provided feedback that was incorporated into the document.

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 | E | E | E | E | E | E | E | E | E | E |
| Shrub | 0.5-1.0 | E | E | E | E | E | E | E | E | E | E |
| Shrub | 1.0-3.0 | E | E | E | E | E | E | E | E | E | E |
| Shrub | >3.0 | E | E | E | E | E | E | E | E | E | E |
| Tree | 0-5 | A | A | B | B | B | B | B | B | B | B |
| Tree | 5-10 | B | B | B | B | B | B | B | B | B | B |
| Tree | 10-25 | D | D | C | C | C | C | C | C | C | C |
| Tree | 25-50 | D | D | C | C | C | C | C | C | C | C |
| Tree | >50 | D | D | C | C | C | C | C | C | C | C |

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 4 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PODE3 | Populus deltoides | Eastern cottonwood | Upper |
| SAEX | Salix exigua | Narrowleaf willow | Upper |

Description

Created by deposition, stream meander changes, point bar formation, and scouring. Pioneer tree and shrub species of cottonwood and willow. Herbaceous understory of sedges in wet areas. In this early stage, most of the area is bare sand. Most of area is seasonally flooded.

*Maximum Tree Size Class*  
Seedling <4.5ft

Class B 11 Early Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PODE3 | Populus deltoides | Eastern cottonwood | Upper |
| SAEX | Salix exigua | Narrowleaf willow | Middle |

Description

Dominated by young canopy of tree saplings and shrubs. The understory is highly variable and consists of bare sand, annuals, or perennial hydrophytes. Species include various grass, sedges, and rushes. (Tree structure originally started at 5m; however, after review, and to align more with MZ20, it was changed to 0m.) In reality, this class has trees shorter than the minimum 5m height -- from about 2m and larger.

Mixed fire occurs. Beaver are a disturbance.

*Maximum Tree Size Class*  
Sapling >4.5ft; <5" DBH

Class C 18 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PODE3 | Populus deltoides | Eastern cottonwood | Upper |

Description

This stage develops as the stand starts to mature. This community tends to be partially open, with scattered cottonwood and willow. The shrubs consist of silver buffaloberry, snowberry, skunkbush sumac, rabbitbrush, and wild rose. The understory vegetation is highly variable, with wild rye, western wheatgrass, and wild licorice.

Mixed fire occurs. Fluvial disturbance occurs.

*Maximum Tree Size Class*  
Medium 9-21" DBH

Class D 49 Late Development 1 - Open

Upper Layer Lifeform Is Not the Dominant Lifeform

Shrubland is dominant, with canopy cover of 30-90%, and height from 1-9 m.

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PODE3 | Populus deltoides | Eastern cottonwood | Upper |
| RHTR | Rhus trilobata | Skunkbush sumac | Low-Mid |
| ROSA | Rorippa sarmentosa | Longrunner | Low-Mid |
| ERNA10 | Ericameria nauseosa | Rubber rabbitbrush | Low-Mid |

Description

Shrubland with dying and dead cottonwood. Shrub layer typically consists of skunkbush sumac, wild rose, silver buffaloberry, rabbitbrush, and basin big sagebrush. Mixed fire was originally modeled and maintains this class. Reviewers agreed more with FRIs of MZ20. Fluvial disturbance occurs.

*Maximum Tree Size Class*  
Very Large >33" DBH

Class E 18 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | Salix | Willow | Middle |

Description

Willow shrubland composed mainly of an assortment of willow species with mix of herbaceous species such as Kentucky bluegrass and sedge. This occurs after cottonwood die out. (*Artemisia cana* is the shrub species present in this class for the model for MZ20. It is thought that *Artemisia cana* also might occur in MZ22 in this class.) Mixed fire occurs. Beaver and fluvial disturbances occur.

Replacement fire was added to this class per MZ20 and because reviewers agreed more with FRIs of MZ20 for this BpS. Because this is a shrub stage, it is reasonable to expect replacement fires.

*Maximum Tree Size Class*  
None

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Early1:CLS | 4 |
| Early1:CLS | 5 | Mid1:CLS | 29 |
| Late1:CLS | 5 | Late1:CLS | 999 |
| Mid1:CLS | 30 | Late1:OPN | 80 |
| Late1:OPN | 81 | 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** |
| Alternative Succession | Early1:ALL | Late1:CLS | 0.3 | 3 | Yes | 0 |
| Mixed Fire | Early1:CLS | Early1:CLS | 0.01 | 100 | No | 0 |
| Optional 1 | Early1:CLS | Early1:CLS | 0.1 | 10 | No | 0 |
| Mixed Fire | Mid1:CLS | Mid1:CLS | 0.001 | 1000 | No | 0 |
| Optional 2 | Mid1:CLS | Early1:ALL | 0.007 | 143 | Yes | 0 |
| Optional 2 | Late1:OPN | Early1:ALL | 0.006 | 167 | Yes | 0 |
| Mixed Fire | Late1:OPN | Late1:OPN | 0.01 | 100 | No | 0 |
| Optional 2 | Late1:CLS | Early1:ALL | 0.006 | 167 | Yes | 0 |
| Replacement Fire | Late1:CLS | Late1:CLS | 0.01 | 100 | No | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.01 | 100 | No | 0 |
| Optional 1 | Late1:CLS | Early1:ALL | 0.07 | 14 | Yes | 0 |

Optional Disturbances

Optional 1: Beaver Damage

Optional 2: Fluvial Disturbance

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