11590

Rocky Mountain Montane Riparian Systems

BpS Model/Description Version: Aug. 2020

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

Vegetation Type

Woody Wetland

Map Zone

29

Geographic Range

For map zone (MZ) 29, the Rocky Mountain riparian systems occur in the mountains (Bighorns, Black Hills, and perhaps Bear Lodge, Ferris, or the Laramie ranges), whereas Great Plains riparian and floodplain are at lower elevations in the plains matrix and are better covered by 1162. The exception to this is the strings of narrow-leaf cottonwood (*Populus angustifolia*) found along the Laramie River and other rivers in the Wyoming portions of MZ29, which are Rocky Mountain in character. It might occur in M331B, 331N, and M334A.

See Adjacency or Identification Concerns box regarding smaller second- and third-order prairie streams and where they occur or what they are classified as. Also see Adjacency or Identification Concerns box for how to distinguish from floodplain.

This system is found throughout the Rocky Mountains and Colorado Plateau regions. In MZ21, it occurs throughout the zone and is more common than biophysical setting (BpS) 1154 (black cottonwood) on rivers. It is associated with the isolated mountain ranges in MZ20.

Biophysical Site Description

This system occurs within a broad elevation range -- from approximately 900m-2,800m (3,000ft-9,200ft) within the flood zone of rivers and on islands, sand or cobble bars, and streambanks. The upper limit for MZ20 is probably approximately 2,050m (6,725ft). Typically, this system exists in large, wide occurrences on mid-channel islands in larger rivers or narrow, linear bands on small, rocky canyon tributaries and well-drained benches and hillslopes below seeps/springs. May also include overflow channels, backwater sloughs, cutoff meanders, floodplain swales, and irrigation ditches. Surface water is generally high for variable periods. Soils are typically alluvial deposits of sand, clay, silt, and cobble that are highly stratified with depth due to flood scour and deposition.

For MZs 29 and 30, the Rocky Mountain riparian systems occur in the mountains in higher elevation areas -- the intermountain parks -- at possibly 4,000ft-8,000ft.

Vegetation Description

This ecological system occurs as a mosaic of multiple communities that are tree dominated with a diverse shrub understory. Deciduous woody trees dominate, including *Populus deltoides* (not in Montana montane systems because they do not occur much over 4,000ft in Montana; instead *P. deltoides* and *Fraxinus pennsylvanica* should be in Great Plains riparian/floodplain systems), *Populus angustifolia* (east of the Continental Divide), and the tree willow *Salix amyglioides*. *Fraxinus pennsylvannicus* is found at lower elevations. *Fraxinus pennsylvanicus* is not in Montana montane systems; it does not occur much over 4,000ft in Montana. It does become dominant in MZ30 riparian areas, where it comes in after *P. deltoides*. It grows much more slowly, but persists after *P. deltoides* because it can recruit into shaded, relatively undisturbed sites. Riparian trees for MZ29 is limited to *Populus angustifolia* and/or *P. balsamifera* var. *trichocarpa*.

Dominant shrubs include *Acer negundo*, *Alnus incana*, *Cornus sericea*, *Crataegus rivularis*, *Prunus virginiana*, *Sheperdia argentea*, and numerous tall willow species (*Salix lutea*, *S. geyeriana*, *S. boothii*, *S. drummondiana*, *S. lasiandra*, *S. bebbiana*, and *S. exigua*). *Acer glabrum* exists in MZ20, but it is not a dominant shrub. *Acer negundo* is more common. *Alnus incana* and *Betula occidentalis* are minor components of MZ20. For MZ29, *Alnus incana* or *A. viridis*, *Salix exigua*, *S. bebbiana*, *S. drummondiana*, *S. boothii*, *Cornus sericea*, *Betula occidentalis*, and *Acer glabrum* are common shrubs. *Juniperus occidentalis* is often seen along montane rivers. This cottonwood-dominated vegetation probably does not extend higher than 6,000ft in elevation and is found in gentle terrain, perhaps along major tributaries of the Tongue and Powder rivers.

Matrix vegetation is steppe, grassland, or coniferous forest.

It is not clear whether this system is meant to include all streamside vegetation in the mountains or if that is 1160. If it is 1159, it should be remembered that a lot of canyons, even at fairly low elevations, have spruce, alder, dogwood, and a few willow along streams, especially if the matrix vegetation is coniferous forest and the channel is constrained by geology, usually in steeper terrain. Perhaps this type of riparian vegetation could be mapped with the adjacent coniferous forest.

Gentle terrain at elevations >6,000ft most likely has willow-dominated riparian vegetation: *Salix geyeriana*, *S. boothii*, *S. bebbiana*, *S. planifolia*, and so on. Matrix vegetation is steppe or grasslands, as well as coniferous forest.

Forbs and graminoids include *Carex* spp., especially *Carex utriculata* and *Carex aaquatilis*, which occur in nearly homogeneous stands, and numerous mesic forbs (e.g., *Geum macrophyllum*, *Mertensia ciliatus*, *Equisetum arvense*, and *Senecio hydrophilus*).

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| POPUL | *Populus* | Cottonwood |
| SALIX | *Salix* | Willow |
| COSE16 | *Cornus sericea* | Redosier dogwood |
| CAREX | *Carex* | Sedge |
| CRRI | *Crataegus rivularis* | River hawthorn |
| EQAR | *Equisetum arvense* | Field horsetail |
| POBAT | *Populus balsamifera ssp. trichocarpa* | Black cottonwood |
| BEOC2 | *Betula occidentalis* | Water birch |

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

Disturbance Description

This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. Flood events of increasing magnitude maintain stand-replacing disturbances.

Beaver (*Castor canadensis*) crop younger cottonwood (*Populus* spp.) and willow (*Salix* spp.), and frequently influence the hydrologic regime through construction of dams (pooling off water and slow release). Beaver show considerable movement along rivers as available trees are felled. However, they usually do not build dams on larger streams or rivers, but rather build dens in the banks.

Fire occurs mostly as a result of spread from surrounding uplands. Many of these vegetative species, especially shrubs, respond favorably to fire. They are vigorous sprouters and are also shade intolerant. The absence of fire and shading by conifer cause a decrease in these communities. Most fires ignite and move through upland fuel until they reach a riparian zone, then either go out because of high fuel moisture, continue spreading into dry riparian fuel, or leap across damp streams and continue up the hill on the other side. Streams could be a barrier to low-/moderate-intensity fires, but would hardly slow down a high intensity crown fire (Michael Harrington, pers comm, observations on the Bitterroot 2000). It is thought that the lower elevation forests (ponderosa pine dominated) were capable of burning during a large portion of the summer and fall because of the rapid drying of the types of fine fuel present, whereas intersecting riparian area fuel had a longer seasonal exposure to soil moisture and high humidity. So, this indicates a period, especially in early summer, when it seems upland were more easily burned and riparian zones were less so. These two zones generally become more similar as summer deepens (Harrington, pers. comm.).

Olson (2000) found that riparian Weibull median probability fire return intervals for riparian forests (in Oregon, however), ranged from 10-40yrs. Forest type and slope aspect played a larger role than proximity to a stream when it came to differentiating fire regimes in the study area. Stream channels also did not act as fire barriers during the more extensive fire years (Olson 2000).

It is doubtful that ice scour is important in these systems the way it is in the larger, low-gradient river systems. The water is moving with too much force to get massive ice buildup; there is not much evidence of large-scale ice scour in the mountains east of the Divide. This environmental component was therefore removed from the model for MZ29.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement | 100 | 54 | 75 | 275 |
| Moderate (Mixed) | 118 | 46 |  |  |
| Low (Surface) |  |  |  |  |
| All Fires | 54 | 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 can exist as small to large linear features in the landscape. In larger, low-elevation riverine systems, this system may exist in mid to large patches, as a function of valley bottom width and gradient.

Adjacency or Identification Concerns

This BpS encompasses the mid- and lower elevation riparian systems within the northern Rocky Mountains. Higher elevation riparian systems are covered in BpS 1160.

The absence of recurrent floods and fire as structuring agents, coupled with shade-tolerant conifer establishment (less-frequent fires due to fire suppression or less-frequent flooding due to impoundment, which result in conifer encroachment into these deciduous-dominated, early-seral communities) can lead to loss of shade-intolerant deciduous woody species.

Grazing and trampling by domestic and wild ungulates can shift the composition toward weedy and/or non-riparian species. Associated bank damage, which results in head cutting and incision, can result when bank-stabilizing vegetation is removed and/or damaged by ungulate activity. Livestock grazing, however, results in downcutting only along smaller streams. Browsing of cottonwood and willow by cattle and/or native ungulates and beavers could retard the development of this type in favor of herbaceous vegetation. Loss of beaver, coupled with heavy ungulate use, can shift dominance in these systems to herbaceous species.

Exotic trees of Russian olive (*Elaeagnus angustifolia*), especially in lower elevation, wide-valley bottom systems, are common in some stands. Herbaceous noxious weeds, including leafy spurge, tansy, and spotted knapweed, readily invade and persist in these systems today. Tamarisk is becoming a concern. Perennial pepperweed may be an issue as well. Russian olive and tamarisk, however, are unlikely to be seen at elevations >5,000ft -- in MZ29, at least.

Trapping of beaver affects beaver presence, thus the storage of groundwater and the recharging of the local aquifer.

This system is to be distinguished from 1162 floodplains systems by geographic range/ecoregions. The Great Plains floodplain systems are in the Northwestern Glaciated Plains and the Northern Great Plains; the Rocky Mountain Montane Riparian systems are in the lower elevations (i.e., not alpine) of the Northern and Middle Rockies, some of which occur as isolated mountain ranges in the Great Plains. Broadly generalized, the Great Plains floodplain systems typically have broader floodplains and more terrace development.

For MZ29, the Rocky Mountain riparian systems occur in the mountains, whereas Great Plains riparian and floodplain are at lower elevations in the plains matrix and are better covered by 1162. The exception to this is the strings of narrow-leaf cottonwood (*P. angustifolia*) found along the Laramie River and other rivers in the Wyoming portions of MZ29, which are Rocky Mountain in character despite being surrounded by grasslands and sage steppe. These riparian zones in the middle of sage steppe are really Rocky Mountain systems, not Great Plains. So Rocky Mountain riparian is in higher elevation areas -- the intermountain parks rather than the eastern Wyoming and eastern Montana plains grasslands.

Montane riparian systems of central Montana and probably the Black Hills have steeper gradients, narrower floodplains, and are dominated by *Populus angustifolia* or *P. balsamifera*, as opposed to *P. deltoides* for Great Plains floodplains. Rivers like the Powder, Tongue, and probably the Little Missouri start as montane rivers and become Great Plains rivers.

There might be some difficulty distinguishing the floodplain systems from the riparian from the wooded draw/ravines, and determining where to assign smaller second- and third-order prairie streams. The second- and third-order prairie streams can sometimes have cottonwood and are like small rivers (riparian, floodplain). Sometimes they are dominated by other woody species, such as water birch, boxelder, green ash (wooded draw/ravine), and willows, depending on how far east you go. Sometimes they have very few woody plants other than silver sagebrush. Streams in the eastern half of Montana (east of the Big Snowies) could probably be modeled as either a cottonwood successional sequence or a woody draw successional sequence, depending on the size of the drainage basin. If the basin is big enough there, eventually will be a flood big enough to result in cottonwood regeneration. This may not happen very often naturally, so these types of drainages would be in silver sagebrush a lot of the time. This is especially true now that we have all the impoundments in the headwaters of these prairie streams. Drainages that just do not have the area to get a serious flood probably were some sort of woody draw, dominated by green ash in the eastern third of the state or other woody species like hawthorn or chokecherry in the more western part of the Great Plains. Whether to assign the drainage to one or the other type of system depends on basin size.

It is not clear whether this system is meant to include all streamside vegetation in the mountains, or perhaps that is covered by 1160. If it is in 1159, it should be remembered that a lot of canyons, even at fairly low elevations, have spruce, alder, dogwood, and a few willow along the streams, especially if the matrix vegetation is coniferous forest and the channel is constrained by geology, usually in steeper terrain. Perhaps this type of riparian vegetation would be mapped with the adjacent coniferous forest.

Fire suppression and impoundment (unsure of how often dams are a problem in these montane systems in MZ29) result in more late-seral vegetation on the landscape -- in other words, more conifer such as spruce and juniper (maybe pine) in with the cottonwood. However, the paucity of beaver probably means there are more mature cottonwood and willow now than there might have been in pre-settlement times. So, perhaps pre-European settlement, there was probably more early-seral vegetation due to floods, fire, and beaver.

Issues or Problems

Native Uncharacteristic Conditions

Fire suppression and impoundment (unsure of how often dams are a problem in these montane systems in MZ29) result in more late-seral vegetation on the landscape -- in other words, more conifer such as spruce and juniper (maybe pine) with the cottonwood. However, the paucity of beaver probably means there are more mature cottonwood and willow now than there might have been in pre-settlement times. So, perhaps pre-European settlement, there was more early-seral vegetation due to floods, fire, and beaver.

Comments

This model for MZ29 was adopted from MZ20 created by Linda Vance and Steve Barrett, and reviewed by Mary Manning. Descriptive and quantitative changes were made to represent MZ29, but also to better represent a picture of disturbance reality in general.

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 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | 0.5-1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| Herb | >1.0 | UN | UN | UN | UN | UN | UN | UN | UN | UN | UN |
| 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 | B | B | B | B | B | B | B | B | B | B |
| Tree | 0-5 | C | C | C | C | C | C | C | C | C | C |
| Tree | 5-10 | C | C | C | C | C | C | C | C | C | C |
| Tree | 10-25 | C | C | C | C | C | C | C | C | C | C |
| Tree | 25-50 | C | C | C | C | C | C | C | C | C | C |
| Tree | >50 | C | C | 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 15 Early Development 1 - All Structures

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POPUL | Populus | Cottonwood | Upper |
| SALIX | Salix | Willow | Upper |
| COSE16 | Cornus sericea | Redosier dogwood | Middle |
| CAREX | Carex | Sedge | Lower |

Description

Immediate post-disturbance responses are dependent on pre-burn vegetation composition. This class is dominated by sprouting shrubs that respond favorably to fire. Species composition is highly variable. Silt, gravel, cobble, and woody debris may be common.

In general, this class is expected to occur a few years post-disturbance. Replacement fire sets this class back to the beginning. Flooding maintains this class.

Beaver were originally modeled as a disturbance; however, for MZ29, it is questionable whether beaver would be interested in small shrubs and trees. Therefore, they were removed from this early class.

*Maximum Tree Size Class*  
None

Class B 58 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POPUL | Populus | Cottonwood | Upper |
| SALIX | Salix | Willow | Mid-Upper |
| COSE16 | Cornus sericea | Redosier dogwood | Middle |

Description

Highly dependent on the hydrologic regime. Vegetation composition includes tall shrubs and small trees (cottonwood, aspen, and conifer). This class persists for approximately a couple of decades.

Modeled disturbances include weather-related stress expressed as annual flooding events that maintain vegetation and periodic flooding events (weather-related stress) that cause stand replacement, replacement and mixed-severity fire causing no transition, and beaver (*Castor canadensis*) herbivory.

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

Class C 27 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| POPUL | Populus | Cottonwood | Upper |
| PINUS | Pinus | Pine | Upper |
| SALIX | Salix | Willow | Mid-Upper |
| JUSC2 | Juniperus scopulorum | Rocky Mountain juniper | Mid-Upper |

Description

This class represents the mature, large cottonwood, conifer, etc., woodlands. In Montana, these closed late systems can also be dominated by Rocky Mountain juniper, or spruce at higher elevations and green ash at lower elevations. Ponderosa pine is only one possible dominant. Redosier dogwood is an indicator in all of these, with a range of 10-60% cover, depending on overstory species. Other dominant and indicator species are interior Douglas-fir in the upland areas and PICEA, FRAPEN, and COSE16. For MZ29, spruce may have been just as common as pine in this class; green ash is questionable.

In general, this class persists until a replacement disturbance (beaver, flooding, replacement fire) causes a transition. Some flooding events (weather-related stress) cause a transition, whereas other flood events occur but just maintain the class. Replacement fire is caused by importation from surrounding systems. Replacement and mixed fire occur overall (mixed causing no transition).

Beaver activity infrequently causes a thinning disturbance. However, some beaver activity is frequent and maintains this class; some is a replacement disturbance, causing a transition. Beaver were modeled as a replacement disturbance in MZ29 because they probably had a major impact on pre-settlement montane riparian forests. Many were “trapped out” before settlers arrived. Where beaver are common, there are few large cottonwoods within 50m of the water, and most montane riparian zones would not have been too much more than 100yds wide. This is opinion based on the Marias River (north-central Montana) and the fact that the Beaverhead River (southwest Montana) had no cottonwood when Lewis and Clark came through (Lesica, pers. comm.). Therefore, replacement disturbance beaver impact was modeled as occurring, which reduced the percentage of this class.

Ice scour was originally modeled. However, it was removed from MZ29 because there is little likelihood it occurred east of the Continental Divide.

*Maximum Tree Size Class*  
Large 21-33" DBH

Model Parameters

Deterministic Transitions

|  |  |  |  |
| --- | --- | --- | --- |
| **From Class** | **Begins at (yr)** | **Succeeds to** | **After (years)** |
| Early1:ALL | 0 | Mid1:OPN | 4 |
| Mid1:OPN | 5 | Late1:CLS | 29 |
| Late1:CLS | 30 | 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 | 0.01 | 100 | Yes | 0 |
| Wind or Weather or Stress | Early1:ALL | Early1:ALL | 0.05 | 20 | No | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.01 | 100 | No | 0 |
| Wind or Weather or Stress | Mid1:OPN | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Replacement Fire | Mid1:OPN | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Optional 1 | Mid1:OPN | Mid1:OPN | 0.025 | 40 | No | 0 |
| Optional 1 | Mid1:OPN | Early1:ALL | 0.025 | 40 | Yes | 0 |
| Wind or Weather or Stress | Mid1:OPN | Mid1:OPN | 0.2 | 5 | No | 0 |
| Optional 1 | Late1:CLS | Mid1:OPN | 0.001 | 1000 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Mid1:OPN | 0.005 | 200 | Yes | 0 |
| Wind or Weather or Stress | Late1:CLS | Early1:ALL | 0.005 | 200 | Yes | 0 |
| Mixed Fire | Late1:CLS | Late1:CLS | 0.01 | 100 | No | 0 |
| Replacement Fire | Late1:CLS | Early1:ALL | 0.01 | 100 | Yes | 0 |
| Optional 1 | Late1:CLS | Early1:ALL | 0.025 | 40 | Yes | 0 |
| Optional 1 | Late1:CLS | Late1:CLS | 0.1 | 10 | No | 0 |
| Wind or Weather or Stress | Late1:CLS | Late1:CLS | 0.2 | 5 | No | 0 |

Optional Disturbances

Optional 1: Beaver

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