14710

Central Interior and Appalachian Floodplain Systems

BpS Model/Description Version: Aug. 2020

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| None | None | None | None |

Vegetation Type

Mixed Upland and Wetland

Map Zones

41, 50

Geographic Range

This system is found along medium and large river floodplains throughout the glaciated Midwest ranging from eastern Kansas and western Missouri to western Ohio and north along the Red River basin in Minnesota. This system is found in all of Section (Cleland et al. 2007) 222 in Minnesota, Wisconsin, and Michigan and in Section 251 in Minnesota.

Biophysical Site Description

River valleys are linear depressions that contain a river channel and its floodplain, often embedded within a series of higher terraces. River valleys, formed by the meltwater of glaciers, occur in glacial outwash channels. The river floodplain is the low-lying area adjacent to the river that was formed under the present drainage system and is subject to periodic flooding and cycles of erosion and deposition. In contrast, terraces are former floodplain surfaces at higher elevations than the floodplain that were abandoned when the river channel incised lower into the valley floor. Within the broader landscape, river valleys represent an unusually diverse mosaic of landforms, physical environmental factors, species and biological communities because of their abrupt environmental gradients and complex ecological processes (Brinson 1990, Gregory et al. 1991, Naiman et al. 1993). Floodplain forests occur along streams or rivers that are third order or greater (Strahler 1952).

Vegetation Description

The variety of soil properties associated with this system can create a mixture of vegetation. *Acer saccharinum* occurs on the wetter soils of floodplains in the eastern portion of this system, with *Populus deltoides* and willows, especially *Salix nigra*, occurring more in the western range of this system. *Fraxinus pennsylvanica, Ulmus americana*, and *Quercus macrocarpa* occur in more well-drained areas. Understory species can vary across the range of this system but can include shrubs such as *Cornus drummondii* and *Asimina triloba*, and sedge and grass species. Oxbows within this system may have species such as *Nelumbo lutea* and *Typha latifolia*.

BpS Dominant and Indicator Species

|  |  |  |
| --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** |
| ACSA2 | *Acer saccharinum* | Silver maple |
| SANI | *Salix nigra* | Black willow |
| CELTI | *Celtis* | Hackberry |
| ULAM | *Ulmus americana* | American elm |
| ACNEI2 | *Acer negundo var. interius* | Boxelder |
| FRPE | *Fraxinus pennsylvanica* | Green ash |
| PODE3 | *Populus deltoides* | Eastern cottonwood |
| PLOC | *Platanus occidentalis* | American sycamore |

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

Disturbance Description

Floodplain systems are produced and maintained by active hydrologic and geomorphic processes such as channel meandering, sedimentation and erosion (Gregory, et al. 1991, Hughes 1994) caused by natural hydrological variation (Richter and Richter 2000). Regeneration of the early successional dominant species (cottonwood maple and willow) is dependent on flooding and movement of river channels, which creates bare, moist soil needed for seedling establishment (Noble 1979, Johnson et al. 1976, Scott et al. 1997). Oxbow and slough development also influence the floodplain system and create variability in plant community composition. Deposits of sand and other sediments can create low ridges that influence vegetation establishment (Weaver 1960). The flood frequency in a given area is dependent upon its location on the floodplain, with upper terraces having infrequent flooding and scouring events, while the lower terraces nearest the river flood frequently. Scouring caused by ice jams during the winter, channel meandering, and oxbow and slough development greatly influence this system.

Fire Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Severity** | **Avg FI** | **Percent of All Fires** | **Min FI** | **Max FI** |
| Replacement |  |  |  |  |
| Moderate (Mixed) | 431 | 14 |  |  |
| Low (Surface) | 67 | 86 |  |  |
| All Fires | 58 | 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 Considerations

Patches must be adequate in size to contain natural variation in vegetation and disturbance regime. This system is often widespread on medium or larger rivers and should be at least 0.5 miles long and 100m wide.

Adjacency or Identification Concerns

Today, bank stabilization, dams and water diversion have significantly altered these floodplains.

Pollution and heavy metals may be an issue in this Biophysical Setting (BpS) due modern waste water issues and the flooding nature of this system.

Issues or Problems

Assumptions: This system is most affected by flooding, scouring and channel movement. We modeled the floodplain valley including forested and non-forested areas. The model does include wetlands, sloughs or oxbows. We used two flooding regimes in the model: Option 1 – minor flooding/scouring; and Option 2 – major flooding/scouring. Flood frequency for a class is based on location on the floodplain, with higher terraces being subject to longer flood cycles. We modeled attributes such as channel migration, oxbow and slough development, and sedimentation. Fire activity had a minor impact, due to low intensity, infrequent intervals, small size and low fuel loads.

Current Conditions

Comments

This model adapted from Rapid Assessment (RA) model R6FPFOgl Great Lakes Floodplain Forest by Robert Mayer (rmayer@fs.fed.us) and Rick Miller (rick.miller@dnr.state.oh.us) on 09/30/2005. Material from the Michigan Natural Features Inventory community abstract for Floodplains (Tepley et al. 2004) is also incorporated.

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

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** |
| PODE3 | Populus deltoides | Eastern cottonwood | Upper |
| SALIX | Salix | Willow | Upper |

Description

Early successional stage created by scouring and deposition following seasonal flooding and stream meander changes (Optional 1 in model). A mix of pioneer tree seedlings, shrubs (often willows), and herbaceous primary succession. Rare surface fires.

Minor flooding/scouring, modeled as optional 1 replaces the systems. Surface fire would maintain the system.

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

Class B 23 Mid Development 1 - Open

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| SALIX | Salix | Willow | Mid-Upper |
| PLOC | Platanus occidentalis | American sycamore | Upper |
| PODE3 | Populus deltoides | Eastern cottonwood | Upper |

Description

This stage develops as the stand starts to mature. Low diversity stands. Dominant species are cottonwood, willow (sandbar, peach-leaved, black), and sycamore.

Minor flooding/scouring, modeled as optional 1 would maintain the system in this class. Mixed fire would also maintain the system in this class. Major flooding would replace the system.

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

Class C 45 Mid Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| PLOC | Platanus occidentalis | American sycamore | Upper |
| PODE3 | Populus deltoides | Eastern cottonwood | Upper |
| ACNE2 | Acer negundo | Boxelder | Upper |
| ACSA2 | Acer saccharinum | Silver maple | Upper |

Description

Mixed canopy. Overstory is dominated by a mix of cottonwood, American elm, silver maple, box elder, red maple and sycamore. Vines and poison ivy are abundant in the understory.

Minor flooding/scouring, modeled as optional 1 would maintain the system in this class. Major flooding would replace the system. Surface fire would also maintain the system.

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

Class D 17 Late Development 1 - Closed

Indicator Species

|  |  |  |  |
| --- | --- | --- | --- |
| **Symbol** | **Scientific Name** | **Common Name** | **Canopy Position** |
| ACSA2 | Acer saccharinum | Silver maple | Upper |
| JUNI | Juglans nigra | Black walnut | Upper |
| FRPE | Fraxinus pennsylvanica | Green ash | Upper |
| QUPA2 | Quercus palustris | Pin oak | Upper |

Description

Found along upper terraces or areas protected from frequent flooding. Species diversity increases towards the south and east within the region. Overstory species include hackberry, American elm, ash (green and black), sycamore, black walnut, shagbark hickory, oak (bur, swamp, white), basswood, tulip poplar and maple (red and silver). Understory cover is often higher than in other classes in this model. Shrubs and small trees such as *Lindera benzoin, Carpinus caroliniana, Cercis canadensis, Cornus* spp. and *Prunus virginiana* are typical.

Major flooding, modeled as optional 2 moves the system back but not replacement. Surface fire would maintain the class.

*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 | 9 |
| Mid1:OPN | 10 | Mid1:CLS | 29 |
| Mid1:CLS | 30 | Late1:CLS | 149 |
| Late1:CLS | 150 | 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** |
| Surface Fire | Early1:ALL | Early1:ALL | 0.01 | 100 | No | 0 |
| Optional 1 | Early1:ALL | Early1:ALL | 0.2 | 5 | Yes | 0 |
| Mixed Fire | Mid1:OPN | Mid1:OPN | 0.01 | 100 | No | 0 |
| Optional 2 | Mid1:OPN | Early1:ALL | 0.02 | 50 | Yes | 0 |
| Optional 1 | Mid1:OPN | Mid1:OPN | 0.25 | 4 | No | 0 |
| Optional 2 | Mid1:CLS | Mid1:OPN | 0.02 | 50 | Yes | 0 |
| Surface Fire | Mid1:CLS | Mid1:CLS | 0.022 | 45 | No | 0 |
| Optional 1 | Mid1:CLS | Mid1:CLS | 0.25 | 4 | No | 0 |
| Optional 2 | Late1:CLS | Mid1:OPN | 0.005 | 200 | Yes | 0 |
| Surface Fire | Late1:CLS | Late1:CLS | 0.02 | 50 | No | 0 |

Optional Disturbances

Optional 1: Minor Flooding

Optional 2: Minor Flooding

References

Brinson, M.M. 1990. Riverine forests. Pages 87-141 in: D. Goodall, A. Lugo, M. Brinson, and S. Brown (eds.), Ecosystems of the World, Forested Wetlands, Vol. 15.

Elsevier, New York. 527 pp.

Cleland, D.T.; Freeouf, J.A.; Keys, J.E.; Nowacki, G.J.; Carpenter, C.A.; and McNab, W.H. 2007. Ecological Subregions: Sections and Subsections for the conterminous United States. Gen. Tech. Report WO-76D [Map on CD-ROM] (A.M. Sloan, cartographer). Washington, DC: U.S. Department of Agriculture, Forest Service, presentation scale 1:3,500,000; colored

Forest Cover Types of the United States and Canada, SAF 1980, F.H. Eyre, Editor. 148 pp.

Gregory, S.V., F.J. Swanson, W.A. McKee and K.W. Cummins. 1991. An ecosystem perspective of riparian zones. Bioscience 41: 540-551.

Hughes, F.M.R. 1994. Environmental change, disturbance and regeneration in semi-arid floodplain forests. Pages 321–345 in: A.C. Millington and K. Pye, Editors, Environmental Change in Drylands: Biogeographical and Geomorphological Perspectives, John Wiley & Sons, Chichester, UK.

Johnson, W.C., R.L. Burgess and W.R. Keammerer. 1976. Forest overstory vegetation and environment on the Missouri River floodplain in North Dakota. Ecological Monographs 46: 59-84.

Naiman, R.J., Decamps, H. and Pollock, M. 1993. The role of riparian corridors in maintaining regional biodiversity. Ecological Applications 3: 209–212.

NatureServe. 2007. International Ecological Classification Standard: Terrestrial Ecological Classifications. NatureServe Central Databases. Arlington, VA. Data current as of 10 February 2007.

Noble, M.G. 1979. The origin of Populus deltoides and Salix interior zones on point bars along the Minnesota River. American Midland Naturalist 102(1): 59-67.

Richter, B.D. and H.E. Richter. 2000. Prescribing flood regimes to sustain riparian ecosystems along meandering rivers. Conservation Biology 14: 1467-1478.

Scott, M. L., G. T. Auble and J. M. Friedman. 1997. Flood dependency of cottonwood establishment along the Missouri River, Montana, USA. Ecological Applications 7: 677–690.

Strahler, A.N. 1952. Dynamic Basis of Geomorphology. Geological Society of America Bulletin 63: 923-938.

Tepley, A.J., J.G. Cohen and L. Huberty. 2004. Natural community abstract for southern floodplain forest. Michigan Natural Features Inventory, Lansing, MI. 14 pp.

Weaver, J.E. 1960. Flood plain vegetation of the central Missouri Valley and contacts of woodland with prairie. Ecological Monographs. 30(1): 37-64.