USDA Natural Resources Conservation Service

Ecological site F089XY004WI
Loamy Floodplains

Last updated: 9/27/2023
Accessed: 11/04/2024

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 089X–Wisconsin Central Sands

The Wisconsin Central Sands (MLRA 89) corresponds closely to Central Sand Plains Ecological Landscape published by the Wisconsin Department of Natural Resources (WDNR, 2015). Much of the following brief overview of this MLRA is borrowed from that publication.

The Wisconsin Central Sands MLRA is entirely in Wisconsin. The total land area is 2,187,100 acres (3,420 square miles, 8858 square kilometers). It is bordered to the east by Johnstown-Hancock end moraines, which were pushed to their extent by the west side of the Green Bay Lobe (Clayton & Attig, 1999). It is bordered to the southwest by highly eroded, unglaciated valleys and ridges. The dominant feature of this MLRA is the remarkably flat, sandy plain, composed of lacustrine deposits and outwash sand, that was once the main basin of Glacial Lake Wisconsin. It also features extensive pine and oak barrens and wetland complexes.

Glacial Lake Wisconsin was fed primarily by glacial meltwater from the north and east. The lake deposited silt overlain by tens of meters of sand (Clayton & Attig, 1989). The silty layers are closer to the surface in some areas, where they impede drainage and contribute to the formation of extensive wetland complexes. It is believed that Glacial Lake Wisconsin drained within several days after a breach in the ice dam that supported it. The catastrophic flood that followed flowed to the south and carved the scattered buttes and mesas protruding from the sandy plain in the southern portion of this MLRA. Before vegetation established after glacial recession, strong winds formed aeolian sand dunes that now support xeric pine and oak stands within the Wisconsin Central Sands.

The surface of the northwestern portion is mostly undulating. The sandy surface sediment was mostly deposited by meltwater during the Wisconsin glaciation. Gentle hills are a result of underlying bedrock topography. Valleys and floodplains are formed by stream action. The underlying bedrock controls the water table elevation and contributes to the formation of numerous wetlands.

Historically, the Wisconsin Central Sands were dominated by large wetland complexes, sand prairies, and oak forests, savannas, and barrens. Some pine and hemlock forests were found in the northwest portion. The Wisconsin Central Sands was subject to frequent fires, leading to today’s need for prescribed burns to maintain the area.

Classification relationships

Major Land Resource Area (MLRA): Wisconsin Central Sands (89)

USFS Subregions: Neillsville Sandstone Plateau (222Rb) and Central Wisconsin Sand Plain (222Ra)

Relationship to Established Framework and Classification Systems:
Habitat Types of S. Wisconsin (Kotar, 1996): This sites in this ES keyed out to three habitat types: Acer-Quercus/Viburnum, Geranium variant (AQVb-Gr); Acer-Tilia/Caulophyllum (ATiCa); Acer-Tilia-Fraxinus/Circaea

(ATiFrCi)

Biophysical Settings (Landfire, 2014): This ES is mapped as North-Central Interior Dry Oak Forest and Woodland, Laurentian-Acadian Northern Hardwoods Forest, and Eastern Cool Temperate Row Crop.

WDNR Natural Communities (WDNR, 2015): This ES is most similar to the Mesic Floodplain Terrace.

Ecological site concept

The Loamy Floodplains ecological site is located along rivers and streams along the northern and southwest borders of MLRA 89. These sites are characterized by very deep, poorly or somewhat poorly drained soils that formed in loamy alluvium. The loamy alluvium is comprised of loamy materials from the Wisconsin and Minnesotan Thin Loess plain to the north, and from the Driftless region to the southwest. These sites are frequently subject to flooding during the spring and fall. Some sites are subject to frequent ponding. The water source is primarily stream overflow, but precipitation, runoff from adjacent uplands, and groundwater discharge also contribute as significant waters sources. These sites range from very strongly acid to moderately acid. Some sites are wetlands.

Vegetation clearly reflects the spatial and temporal variations in hydrologic regimes leading to great diversity of community types on the landscape. Most plant communities are woodlands and they typically contain some of the following tree species: Silver maple (*Acer saccharinum*), hackberry (*Celtis occidentalis*), red maple (*Acer rubrum*), black ash (Fraxinus nigra), White ash (F. Americana), green ash (F. pennsylvanica), swamp white oak (*Quercus bicolor*), white oak (*Q. alba*), northern pin oak (Q. ellipsoidalis), and some times also basswood (*Tilia americana*). On sandier inclusions within this ES, white pine (*Pinus strobus*) and red maple dominate and red pine (*P. resinosa*) is often present.

This ecological site differs from Sandy Floodplains based on loamy parent materials and family particle size class. Loamy materials often result in a higher pH and available water capacity than sandy materials. The higher pH and available water capacity may support more vegetative growth on these sites.

Associated sites

F089XY003WI	**Sandy Floodplains** Many ecological sites are found adjacent to Loamy Floodplains. Other floodplain sites may be associated. Many upland sites that are adjacent to a river can be associated with this site.

Similar sites

F089XY014WI	**Moist Loamy Uplands** Moist Loamy Uplands consist of deep loamy alluvium over sandy alluvium or clayey lacustrine deposits. They are somewhat poorly drained and are not subject to flooding. Despite this, the vegetative communities these sites support are very similar to those of Loamy Floodplains.
F089XY008WI	**Wet Loamy Lowlands** Wet Loamy Lowlands form in a loamy or silty mantle 9.8 tp 39.3 inches (25 to 100 cm) thick overlying sandy residuum weathered from sandstone and shale. Bedrock contact may occur as high at 26 inches (66 cm). These soils are poorly drained, remain saturated for much the growing season, and are sometimes subject to ponding. They are exclusive to the northern third of the Wisconsin Central Sands MLRA, which was covered in loamy glacial deposits prior to the most recent glacial advance. The vegetative communities found on these sites are similar to those of Loamy Floodplains.
F089XY009WI	**Wet Clayey Lowlands** Wet Clayey Lowlands form in deep clayey lacustrine deposits overlain by a silty mantle. These soils are poorly drained, remain saturated for much of the growing season, and are sometimes subject to ponding. These sites are found in the southwestern portion of the Wisconsin Central Sands MLRA. The vegetative communities that occur on these sites may be similar to those of Loamy Floodplains.

F089XY003WI	**Sandy Floodplains** Sandy Floodplains sites are found exclusively on floodplains in sandy alluvium. Most sites are somewhat poorly to poorly drained and are subject to flooding. These sites occur primarily along the Wisconsin, Lemonweir, Yellow, and Black Rivers and some of their tributaries. The vegetative communities associated with Sandy Floodplains prefer a similar soil moisture regime as those of Loamy Floodplains but have lower nutrient requirements.

Table 1. Dominant plant species

Tree	(1) *Celtis occidentalis* (2) *Tilia americana*
Shrub	Not specified
Herbaceous	(1) *Matteuccia struthiopteris* (2) *Hydrophyllum virginianum*

Physiographic features

These sites occur in depressions and flats on floodplains of rivers downstream of loamy deposits. Slopes range from 0 to 3 percent. Sites are in toeslope or no hillslope position. Elevation ranges from 656 to 1969 feet (200 to 600 meters) above sea level.

Some sites are subject to ponding and the frequency ranges from rare to frequent. Ponding duration is brief (2 to 7 days) to long (7 to 30 days), at depths of 0 to 11.8 inches (0 to 30 cm) above the soil surface. All sites are subject to very rare to frequent flooding. The duration of flooding ranges from brief to long. Sites have a seasonally high water table at the soil surface. The water table can drop to greater than 59 inches (150 cm) during dry conditions. Surface runoff is negligible to low.

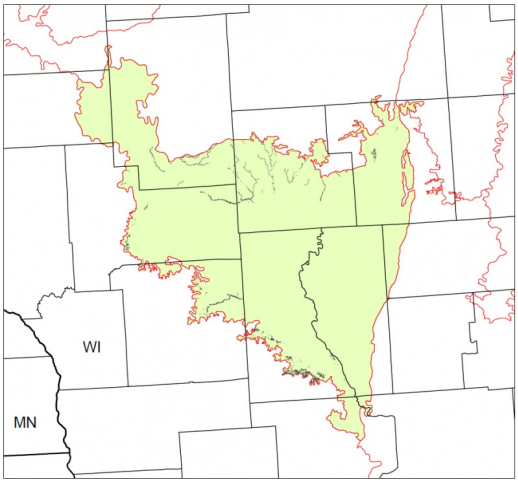


Figure 1. Distribution of Loamy Floodplains in the Wisconsin Central Sands MLRA (89)

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Depression (2) Alluvial plain > Alluvial flat
Runoff class	Negligible to low
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Very rare to frequent
Ponding duration	Brief (2 to 7 days) to long (7 to 30 days)
Ponding frequency	None to frequent
Elevation	656–1,968 ft
Slope	0–3%

Ponding depth	0–12 in
Water table depth	0–48 in
Aspect	Aspect is not a significant factor

Climatic features

The continental climate of the Wisconsin Central Sands is typical of the southern half of the state – cold winters and warm summers. Precipitation is well-distributed throughout the year with a slight peak in the summer months. Snowfall covers the ground from late fall to early spring. The soil moisture regime of MLRA 89 is udic (humid climate). The soil temperature regime is mostly frigid, with a small portion of mesic in the southern tip. Neither precipitation nor temperature vary greatly across this MLRA. More so than latitude, local topography seems to be an important predictor of growing season length, with fewer growing degree days in lower-lying areas.

This site occurs on landscape depressions and its local topography is expected to influence its growing season length. The freeze-free and frost-free periods may be shorter than what is represented here.

The average annual precipitation for this ecological site is 34 inches. The average annual snowfall is 46 inches. The annual average maximum and minimum temperatures are 55°F and 34°F, respectively.

Table 3. Representative climatic features

Frost-free period (characteristic range)	94-125 days
Freeze-free period (characteristic range)	114-148 days
Precipitation total (characteristic range)	33-34 in
Frost-free period (actual range)	78-125 days
Freeze-free period (actual range)	99-149 days
Precipitation total (actual range)	33-34 in
Frost-free period (average)	108 days
Freeze-free period (average)	129 days
Precipitation total (average)	33 in

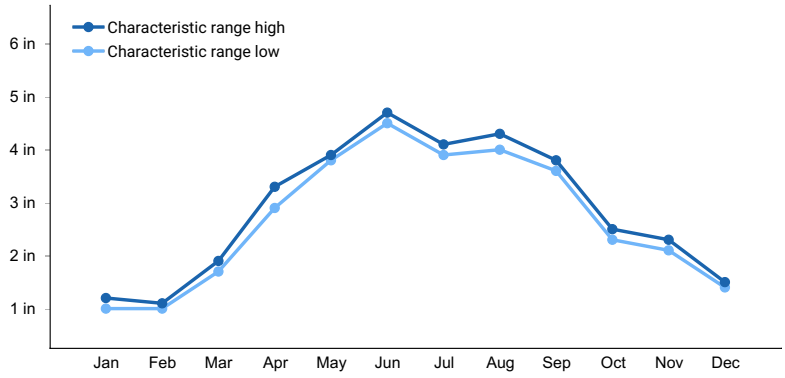


Figure 2. Monthly precipitation range

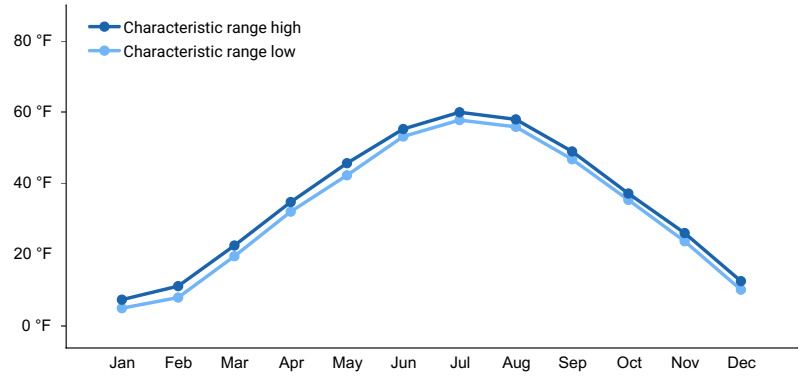


Figure 3. Monthly minimum temperature range

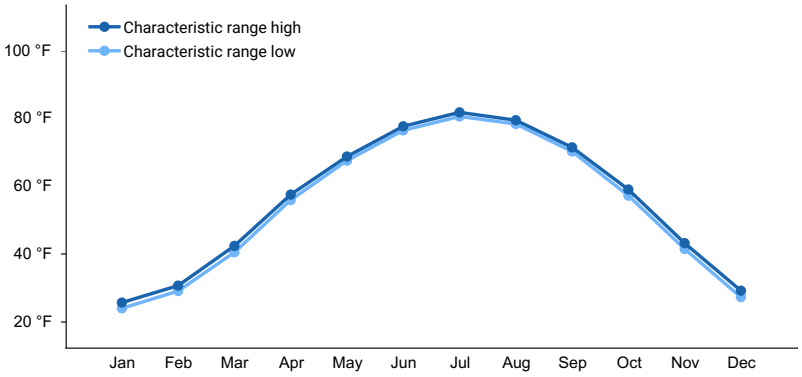


Figure 4. Monthly maximum temperature range

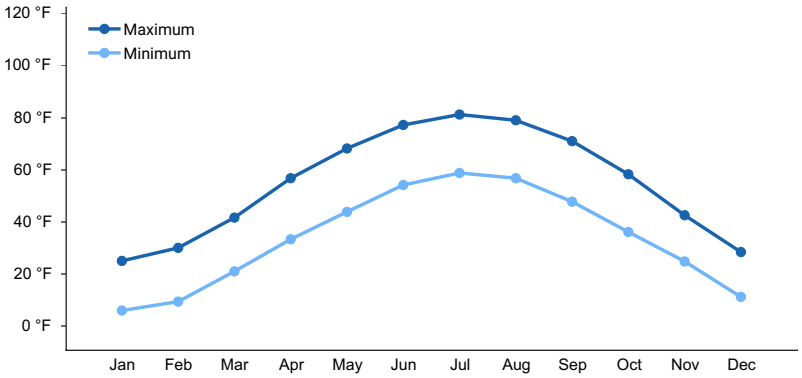


Figure 5. Monthly average minimum and maximum temperature

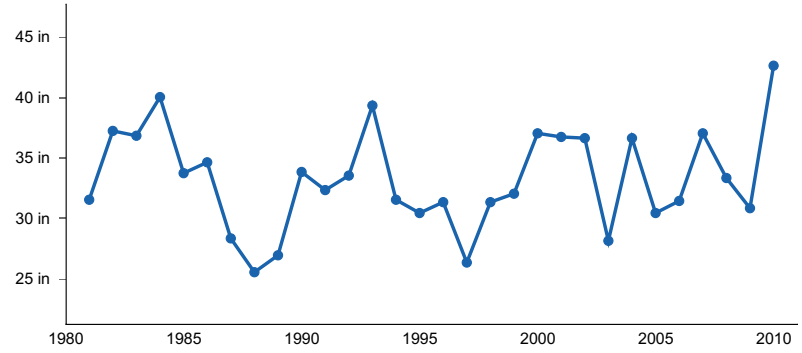


Figure 6. Annual precipitation pattern

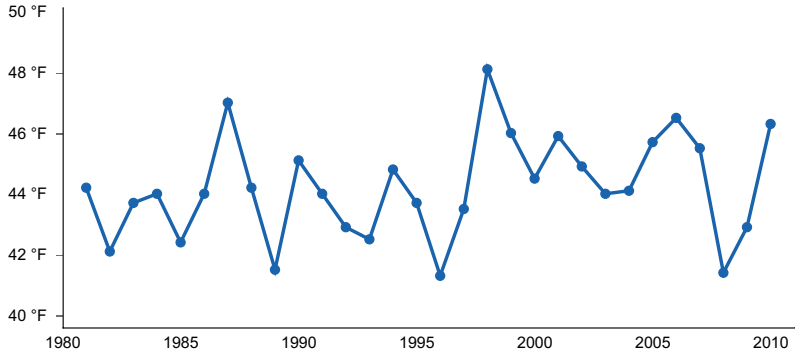


Figure 7. Annual average temperature pattern

Climate stations used

- (1) HATFIELD [USC00473471], Merrillan, WI
- (2) MAUSTON 1 SE [USC00475178], Mauston, WI
- (3) STEVENS POINT [USC00478171], Stevens Point, WI

Influencing water features

Water is received through precipitation, runoff from adjacent uplands, stream inflow, and groundwater discharge. Water levels are greatly influenced by precipitation rates and runoff from upland sites. Water leaves from the site primarily through stream outflow, subsurface outflow, evapotranspiration, and groundwater recharge. These sites are wetlands.

Frequent flooding from stream inflow is a significant factor in the ecological development of Loamy Floodplain sites. The vegetation must be tolerant of inundation for up to a month.
Under the Cowardin System of Wetland Classification, or National Wetlands Inventory (NWI), the wetlands can be classified as:

1) Palustrine, forested, broad-leaved deciduous, saturated, or
2) Palustrine, scrub-shrub, broad-leaved deciduous, saturated, or
3) Palustrine emergent, persistent, saturated

Under the Hydrogeomorphic Classification System (HGM), the wetlands can be classified as:

1) Depressional, acid, forested/organic, or
2) Depressional, acid, scrub-shrub/organic

Permeability of the soils is moderately slow. The hydrologic group of these sites is A or A/D.

Soil features

These sites are represented by the Fordum, Northbend, Sturgeon, and Vancecreek soil series. Fordum is classified as a Mollic Fluvaquent; Northbend is a Fluvaquentic Dystrudept; Sturgeon is and Aquic Udifluvent; and Vancecreek is a Fluvaquentic Endoaquoll.
These soils formed in loamy alluvium over sandy alluvium. Soils are very deep and are poorly or somewhat poorly drained. These sites meet hydric soil requirements.

The surface texture of these sites is primarily silt loam but also includes fine sandy loam. Subsurface textures include silt loam, loamy fine sand, fine sandy loam, very fine sandy loam, and sand. Soil pH ranges from extremely acid to moderately acid with values of 4.2 to 5.6. Surface fragments are absent. Subsurface fragments less than 3 inches can be present up to 3 percent volume, but fragments greater than 3 inches are absent. Carbonates are absent.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Sandy loam
Drainage class	Somewhat poorly drained to poorly drained
Permeability class	Moderately slow
Soil depth	78 in
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0%
Available water capacity (0-60in)	6.85–9.78 in
Calcium carbonate equivalent (0-40in)	0%
Soil reaction (1:1 water) (0-40in)	4.2–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–3%
Subsurface fragment volume >3" (Depth not specified)	0%

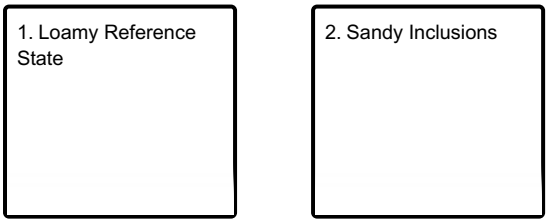
Ecological dynamics

Because this Ecological Site is subject to seasonal, yearly and long-term variation in hydrological conditions, it is not possible to speak of any directional, community-driven plant succession, as is typical of more environmentally-stable upland plant communities. Instead, individual hydrologic events create conditions temporarily favorable to a given species, or groups of species, and unfavorable to other species or groups. Species differ greatly in their ability to tolerate frequency of flooding and duration of ponding. Silver maple (*Acer saccharinum*) is best adapted species to colonize freshly deposited sediment. It is a prolific seed producer and germinates immediately upon maturing, without the need of undergoing a cold period. Once established, seedlings, as well as mature trees, tolerate repeated flooding and prolonged ponding. Similarly, well-adapted species is hackberry (*Celtis occidentalis*). Established trees can withstand the entire season of ponding (USDA, 1990). Other species that also become established in periods without major flooding, or ponding are swamp white oak (*Quercus bicolor*), white oak (*Q. alba*) and even basswood (*Tilia americana*). It appears that very long period without ponding leads this site type to develop into ATiCa (Acer-Tilia/Caulophyllum) Forest Habitat Type (Kotar and Burger, 1996), although presence of basswood and sugar maple also heavily depends on existence of local seed sources. These sources are rare throughout southern Wisconsin, presumably due to prevalence of wildfires in pre- European settlement time. Seed sources of fire-sensitive species have been preserved almost exclusively on landscape positions protected from advancing fires by water bodies and wetlands (Finley, 1976).

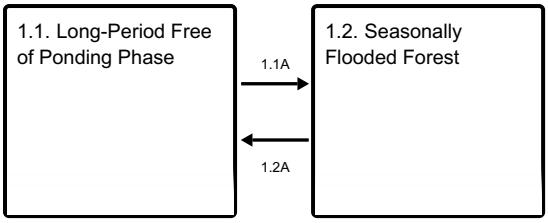
On sandier inclusions within this site type, plant communities tend to be dominated by white pine (*Pinus strobus*) and red maple (*Acer rubrum*), while common associates include red pine (*Pinus resinosa*), northern pin oak and swamp white oak. Prolonged ponding may eliminate or reduce the presence of these species and trigger another developmental cycle, beginning with colonization of the site by silver maple.

State and transition model

Ecosystem states



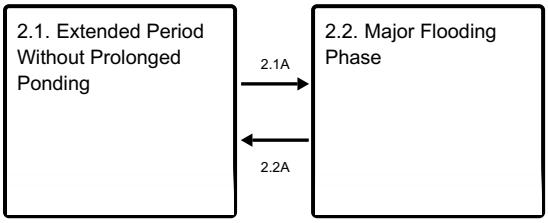
State 1 submodel, plant communities



1.1A - Small-scale canopy disturbance, e.g. snow/ice breakage, individual tree mortality, increasing light on forest floor, stimulating regeneration of canopy trees.

1.2A - Major flooding event depositing new sediment.

State 2 submodel, plant communities



2.1A - Major flooding event depositing new sediment

State 1
Loamy Reference State

Because of the dynamic nature of hydrological events affecting this Ecological Site, many different plant communities can be found at any given time. We chose two distinct community phases to represent the Reference state: 1, a long-period free of extended ponding community phase and 2, frequently flooded and ponded community phase.

Dominant plant species

- common hackberry (*Celtis occidentalis*), tree
- American basswood (*Tilia americana*), tree

Community 1.1
Long-Period Free of Ponding Phase

Periods of several decades, or longer, without prolonged ponding allow for the development of forest communities closely resembling the upland mesic or wet-mesic communities. Such forests are characterized by strong presence, or dominance of any of the following species: White ash (*Fraxinus americana*), hackberry, white oak, basswood, yellow birch (*Betula alleghaniensis*) and, in some cases, even sugar maple (*A. saccharum*), a species known for its intolerance of prolonged root zone saturation. Characteristic understory plants include elderberry (Sambucus spp.), ostrich fern (Matteuccia strutiopteris), cinnamon fern (*Osmunda cinnamomea*), touch-me-not, or jewelweed (*Impatiens capensis*), sensitive fern (Onoclea sensibillis) and Virginia waterleaf (Hydrophillum virginianum). Small scale canopy disturbances, e.g., snow/ice breakage and individual tree mortality, increase light on forest floor and stimulate regeneration of canopy species. Through this process the relative importance of different species varies, but the basic mesic community is perpetuated.

Dominant plant species

- white ash (*Fraxinus americana*), tree
- hackberry (*Celtis*), tree
- white oak (*Quercus alba*), tree
- basswood (*Tilia*), tree
- yellow birch (*Betula alleghaniensis*), tree
- elderberry (*Sambucus*), other herbaceous

- ostrich fern (*Matteuccia*), other herbaceous
- cinnamon fern (*Osmunda cinnamomea*), other herbaceous
- touch-me-not (*Impatiens*), other herbaceous
- jewelweed (*Impatiens capensis*), other herbaceous

Community 1.2
Seasonally Flooded Forest

Silver maple is a well-adapted species to frequently flooded conditions. On such sites it typically occurs in pure stands, or with only sporadic association of other species that become established on micro-sites with less frequent, or shorter duration ponding. Such associates are red maple, swamp white oak, elms (Ulmus spp.) and occasionally yellow birch. Understory vegetation is sparse, consisting mostly of sedges (Carex spp.) and false nettle (*Laportea canadensis*). This site can have fresh sediment deposition due to seasonal flooding.

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- swamp white oak (*Quercus bicolor*), tree
- elm (*Ulmus*), tree
- yellow birch (*Betula alleghaniensis*), tree
- sedge (*Abildgaardia*), other herbaceous
- false nettle (*Boehmeria*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Small scale canopy disturbances, e.g., snow/ice breakage and individual tree mortality, increase light on forest floor and stimulate regeneration of canopy species. Through this process the relative importance of different species varies, but the basic mesic community is perpetuated.

Pathway 1.2A
Community 1.2 to 1.1

Major flooding event deposits new sediment, causes mortality of some of the canopy trees and provides germination and seedling establishment conditions for some species, most frequently silver maple.

State 2
Sandy Inclusions

This ecological site includes small areas of sandier soils, where ecological conditions, and therefore vegetation, differ appreciably from that of the reference state but do not correspond closely enough to conditions described in the Sandy Floodplains site. In order to better facilitate management decision making, the sites are treated here as a separate states with two community phases.

Dominant plant species

- pine (*Pinus*), tree
- red maple (*Acer rubrum*), tree
- oak (*Quercus*), tree

Community 2.1
Extended Period Without Prolonged Ponding

Periods of several decades, or longer, without prolonged ponding allow for the development of forest communities closely resembling the upland dry-mesic forest communities. Such communities are characterized by strong presence, or dominance, of any of the following species: White pine, red pine, red maple, swamp white oak and pin oak. Some characteristic, although not necessarily dominant, understory species include blueberries, (Vaccinium spp.), goldthread (Coptis groenlandica) and cinnamon fern (*Osmunda cinnamomea*). Small scale canopy

disturbances, e.g., snow/ice breakage and individual tree mortality, increase light on forest floor and stimulate regeneration of canopy species. Through this process the relative importance of different species varies, but the basic mesic community is perpetuated.

Dominant plant species

- eastern white pine (*Pinus strobus*), tree
- red pine (*Pinus resinosa*), tree
- red maple (*Acer rubrum*), tree
- swamp white oak (*Quercus bicolor*), tree
- pin oak (*Quercus palustris*), tree
- blueberry (*Vaccinium*), other herbaceous
- goldthread (*Coptis*), other herbaceous
- cinnamon fern (*Osmunda cinnamomea*), other herbaceous

Community 2.2
Major Flooding Phase

Depending on the degree of mortality in the canopy layer and on differential survival among the species, the resulting community will be composed of some surviving individuals of the canopy species and some newly established regeneration that will include colonizers, particularly silver maple and red maple.

Dominant plant species

- silver maple (*Acer saccharinum*), tree
- red maple (*Acer rubrum*), tree

Pathway 2.1A
Community 2.1 to 2.2

Major flooding events deposit new sediment and may cause light to severe mortality of canopy trees. Both events create understory condition suitable for colonization of other species, particularly silver maple.

Pathway 2.2A
Community 2.2 to 2.1

Prolonged period of major flooding leads to re-establishment of Community Phase 2.1.

Additional community tables

Inventory data references

A review of the scientific literature and professional experience were used to approximate the plant communities for this provisional ecological site. Information for the state-and-transition model was obtained from the same sources. All community phases are considered provisional based on these plots and the sources identified in ecological site description.

Other references

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Approval

Suzanne Mayne-Kinney, 9/27/2023

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	09/27/2023

Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
