USDA Natural Resources Conservation Service

Ecological site F147XY010PA
Coarse Mixed Floodplain

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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): 147X–Northern Appalachian Ridges and Valleys

Major Land Resource Area 147 is in the Middle section of the Valley and Ridge Province of the Appalachian Highlands. Characteristic features include folded and faulted parallel ridges and valleys that are carved out of anticlines, synclines, and thrust blocks. The variability of weathering of the underlying bedrock has resulted in resistant sandstone and shale ridges separated by less resistant limestone and shale narrow to moderately broad valleys. The ridges are strongly sloping to extremely steep and have narrow, rolling crests, and the valleys are mainly level to strongly sloping. The Great Valley is a salient feature of the eastern portion and runs the entire length of the MLRA where it is called the Shenandoah Valley in the south. The western side of the MLRA is dominantly hilly to very steep and is rougher and much steeper than the rolling hills to the east. Parts of the northernmost section of the MLRA were subjected to pre-Illinoian glaciation (>770,000 years ago). Anthracite coal underlies some areas in the north and has been mined since the 1700's.

Elevation in MLRA 147 generally ranges from 330 to 985 feet (100 to 300 meters) in the valleys and from 1,310 to 2,625 feet (400 to 800 meters) on the ridges and mountains. It is as high as 2,955 feet (900 meters) on some mountain crests and is nearly 4,430 feet (1,350 meters) on a few isolated, linear mountain ridges. Local relief in the valleys is about 15 to 165 feet (5 to 50 meters). The ridges rise about 660 feet (200 meters) above the adjoining valleys. (USDA, 2006).

Classification relationships

This ecological site is found in Major Land Resource Area 147- Northern Appalachian Ridges and Valleys, 148. MLRA 147 is located within Land Resource Region S - Northern Atlantic Slope Diversified Farming Region (USDA 2006), and in United States Forest Service ecoregion M221 – Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province (Bailey, 1995). In addition, MLRA 147 falls within area #67 of EPA Ecoregion Level III – the Ridge and Valley (US EPA 2013). The Coarse Mixed Floodplain ecological site occurs primarily within 67b, and 67da of EPA Ecoregion IV - Northern Shale Valleys, and Northern Dissected Ridges and Knobs respectively (Woods et. al. 1996).

Ecological site concept

The Coarse Mixed Floodplain ecological site is found on floodplains predominantly in small to medium stream and river valleys that drain the shale and sandstone uplands in MLRA 147, Northern Appalachian Ridges and Valleys. It occupies first bottoms of rivers and streams and natural levees. The soil and landscape characteristics are the result of high water velocity movement that favors the deposition of coarser, sandier and gravelly sediments relative to the silt loams, silty clay loams, and fine sandy loam textures of the Loamy Mixed Floodplain Ecological site. The underlying soil material formed in recent coarse alluvium derived from mixed sedimentary geology including sandstones, shales, siltstones, and limestone. They are well drained with moderate to rapid permeability. Soil textures range from sandy loams to coarse sands and gravels. These areas are subject to frequent flooding as

classified by the National Soil Survey Handbook (USDA 2016). This is defined as more than a 50 percent chance of flooding in any year.

Much of this ecological site has been cleared for hay and pasture. Where forest exists, and flooding is frequent they are dominated by *Betula nigra* (River birch) and *Platanus occidentalis* (American sycamore) with associates including *Acer negundo* (Boxelder) and occasionally *Acer saccharinum* (Silver maple) and *Fraxinus pennsylvanica* (Green ash). In areas where flooding and ice-scouring is relatively more powerful, an early-successional woodland community may predominate that is characterized by stunted, usually battered and flood-trained trees of *Platanus occidentalis* and *Betula nigra*, with Salix species (willow) in the shrub layer.

Table 1. Dominant plant species

Tree	(1) *Betula nigra* (2) *Platanus occidentalis*
Shrub	Not specified
Herbaceous	(1) *Impatiens capensis*

Physiographic features

This ecological site is found on floodplains in stream and river valleys in MLRA 147, Northern Appalachian Ridges and Valleys. This ecological site may also be found on toe slopes and stream terraces. This ecological site occupies first bottoms of rivers and streams and may form natural levees. These areas are the result of high water velocity movement that favors the deposition of coarser, sandier and gravelly sediments relative to the silt loams, silty clay loams, and fine sandy loam textures of the Loamy Mixed Floodplain Ecological site. The parent material is recent coarse textured alluvium from mixed sedimentary geology of sandstone, siltstone, shale, and limestone. Slope is less than 5 percent. This ecological site is subject to very brief (4 to 48 hours) flooding, but in some instances flooding can be longer than 7 days. Most areas are well drained, permeability is moderately rapid to rapid, and bedrock is greater than 60 inches (152 cm) deep. These sites are in forests, pasture, and hayland.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace (3) Natural levee
Flooding duration	Very brief (4 to 48 hours) to long (7 to 30 days)
Flooding frequency	None to frequent
Elevation	30–671 m
Slope	0–5%
Water table depth	152 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate of this region is temperate and humid. The Ridge and Valley Province is not rugged enough for a true mountain type of climate but it does have many of the characteristics of such a climate (Daily 1971). The influence of the high and low topography on air movement causes somewhat greater temperature extremes than are experienced in the Piedmont region to the east. The differences in elevation also affect the length of the frost free season on the ridges verses that in the valleys. The cooler temperatures and the shorter freeze-free periods occur at the higher elevations and in the more northern latitudes. The maximum precipitation occurs from early spring through mid-summer, and the minimum occurs in January and February. The average annual snowfall ranges from 16 to more than 51 inches (40 to 130 centimeters). The average annual temperature is 44 to 57 degrees F (7 to 14 degrees C). A portion of this region that extends from Maryland southward through most of the Shenandoah Valley in Virginia falls within a rain shadow cast by the Appalachian Mountains to the west and the Blue Ridge Mountains to the east. The mountains on either side block moist flowing air from either the east or the west causing the valleys to be drier. Average annual precipitation in this shadow area can average 34 to 36 in/year (86 to 91cm) compared

to 40 to 42 in/year (102 - 107 cm) for the rest of the region (PRISM 2013).

Data for mean annual precipitation, frost-free and freeze-free periods and monthly precipitation for this ecological site are shown below. The original data used in developing the tables was obtained from the USDA-NRCS National Water & Climate Center (2015) climate information database for 3 weather stations throughout MLRA 147 in proximity to this ecological site. All climate station monthly averages for maximum and minimum temperature and precipitation were then added together and averaged to make this table.

Table 3. Representative climatic features

Frost-free period (average)	138 days
Freeze-free period (average)	154 days
Precipitation total (average)	1,041 mm

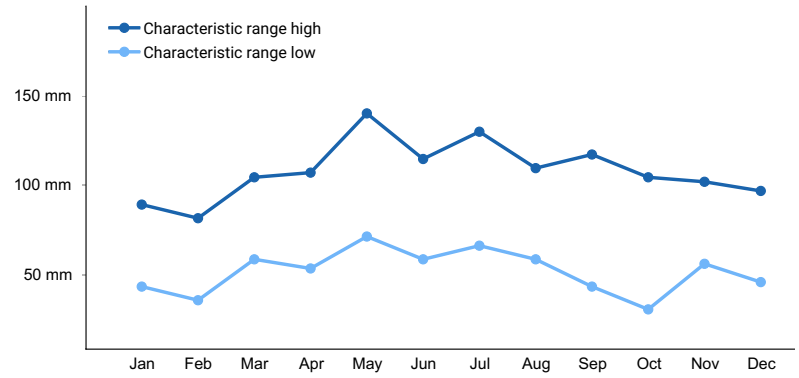


Figure 1. Monthly precipitation range

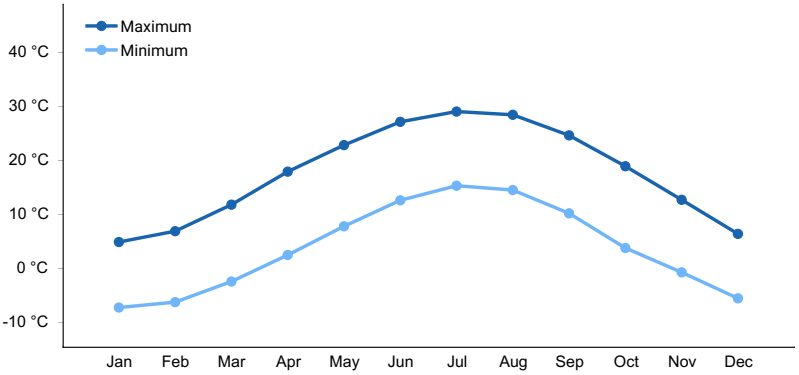


Figure 2. Monthly average minimum and maximum temperature

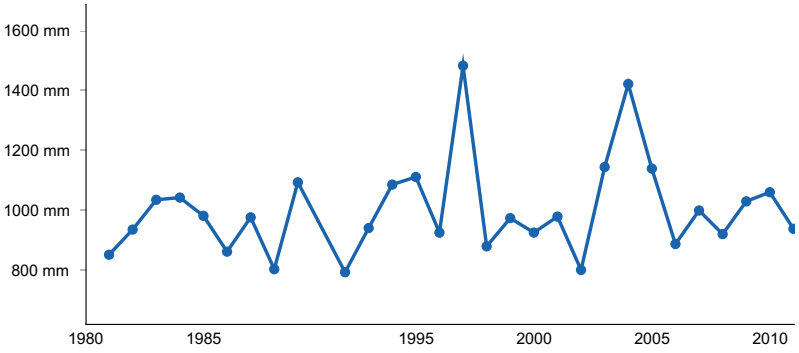


Figure 3. Annual precipitation pattern

Climate stations used

- (1) HANCOCK [USC00184030], Hancock, MD

- (2) MILLGAP [USC00445595], Monterey, VA
- (3) WARDENSVILLE RM FARM [USC00469281], Wardensville, WV

Influencing water features

This ecological site is not influenced by wetland riparian water features.

Soil features

The soil series associated with this site are: Potomac, Nelse, Millrock, and Craigsville. These soils formed in recent coarse alluvium derived from mixed sedimentary geology including sandstones, shales, siltstones, and limestone. They are well drained with moderate to rapid permeability. Surface textures are predominantly sandy loams but also include fine sandy loam, loamy fine sand, loamy sand, and loams. Subsoil is sandy and loamy. Depth to bedrock is over 60 inches (152 cm). These soils are on floodplains that are subject to rare to frequent flooding that usually lasts just a few hours. Lower horizons are composed of stratified sands and sometimes gravels. Soils data was obtained from the Natural Resources and Conservation Service (NRCS) National Soils Information System database (USDA 2015).

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone
Surface texture	(1) Very cobbly sandy loam (2) Fine sandy loam (3) Gravelly loamy sand
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	231 cm
Surface fragment cover <=3"	0–2%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	5.59–11.43 cm
Soil reaction (1:1 water) (0-101.6cm)	4.8–6.7
Subsurface fragment volume <=3" (Depth not specified)	1–40%
Subsurface fragment volume >3" (Depth not specified)	0–55%

Ecological dynamics

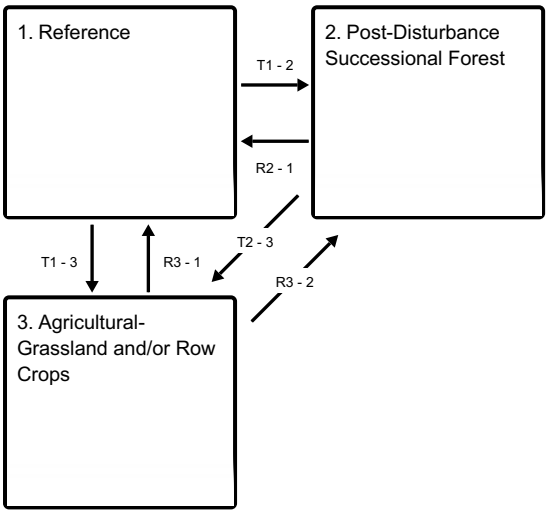
The vegetation groupings described in this section are based on the terrestrial ecological system classification and vegetation associations developed by NatureServe (Comer 2003) and the Natural Heritage Programs of Pennsylvania (Zimmerman et al. 2012), Virginia (Fleming et al. 2013), West Virginia (WVDNR 2014), and Maryland (Harrison 2004). Terrestrial ecological systems are specifically defined as a group of plant community types (associations) that tend to co-occur within landscapes with similar ecological processes, substrates, and/or environmental gradients. They are intended to provide a classification unit that is readily mappable, often from remote imagery, and readily identifiable by conservation and resource managers in the field. A given system will typically manifest itself in a landscape at intermediate geographic scales of tens to thousands of hectares and will persist for 50 or more years. A vegetation association is a plant community that is much more specific to a given soil, geology, landform, climate, hydrology, and disturbance history. It is the basic unit for vegetation classification. Each association will be named by the dominant species that occupy the different strata (tree, sapling, shrub, and herb). Within the NatureServe database, individual vegetation associations are assigned an identification number called a Community Element Global Code (CEGL).

The Coarse Mixed Floodplain Ecological Site is located in the Ridge and Valley region of the Appalachian Highlands, an area that has undergone extensive human disturbance since pre and post-European settlement times (Braun, 1950). The reference forest community is part of the Central Appalachian River Floodplain system (CES202.608) (Nature Serve 2009). Much of this ecological site has been cleared for hay and pasture. Where forests exists, and flooding is frequent, *Betula nigra* (River birch) and *Platanus occidentalis* (American sycamore) dominate with associates including *Acer negundo* (Boxelder) and occasionally *Acer saccharinum* (Silver maple) and *Fraxinus pennsylvanica* (Green ash). In areas where flooding and ice-scouring is relatively more powerful, an early-successional woodland community may predominate that is characterized by stunted, usually battered and flood-trained trees of *Platanus occidentalis* and *Betula nigra*, with Salix species (willow) in the shrub layer.

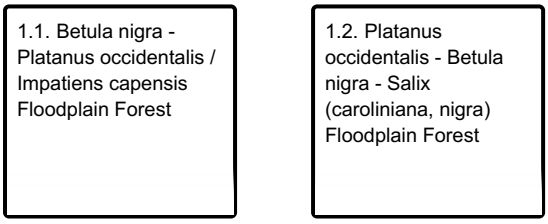
Much of the Coarse Mixed Floodplain ecological site has been cleared for hayland and pasture. Successional forests that recolonize former agricultural fields or other disturbed areas are often dominated by *Juglans nigra* (Black walnut) but can also contain *Liriodendron tulipifera* (Tuliptree), *Robinia pseudoacacia* (Black locust), Fraxinus Americana (White ash), Ulmus Americana (American elm), *Platanus occidentalis* (American sycamore), and *Acer saccharum* (Sugar maple). The subcanopy may include *Carya cordiformis* (Bitternut hickory), *Celtis occidentalis* (Common hackberry), *Sassafras albidum* (Sassafras), and *Carpinus caroliniana* (American hornbeam). The shrub layer may include *Asimina triloba* (Pawpaw), *Viburnum prunifolium* (Blackhaw), *Lindera benzoin* (Spicebush), and a host of exotic invasive species including *Rosa multiflora* (Multiflora rose), *Microstegium vimineum* (Nepalese browntop), Alliaria petiolate (Garlic mustard), and Persicaria longiseta (Smartweed).

State and transition model

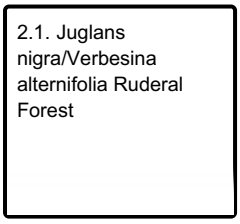
Ecosystem states



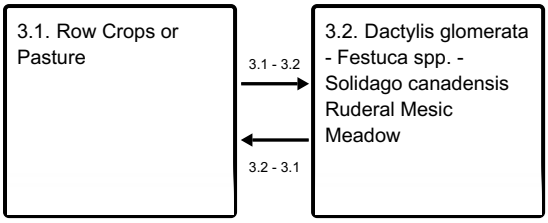
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

The reference state is a combination of several vegetation associations of the Central Appalachian River Floodplain Forest System (CES202.608) (NatureServe 2009). As a result of the long history of human activity, the associations listed below may in reality reflect the current naturalized, minimally managed state rather than the historic, pre-European settlement condition. Due to the heterogeneity and the broadness of this provisional ecological unit, the vegetation associations listed are not intended to cover every situation nor the full range of conditions and species. There are no transition pathways designated between the communities in the reference state because the differences in vegetation are more controlled by landscape position or inherent soil properties than management or disturbance. Agriculture is the dominant land use for the Coarse Mixed Floodplain Ecological Site except for areas which are subject to relatively frequent and powerful ice-scouring and flooding.

Community 1.1
Betula nigra - Platanus occidentalis / Impatiens capensis Floodplain Forest

The River Birch - American Sycamore / Jewelweed Floodplain Forest, also known as the River Birch Low Floodplain Forest (CEGL006184; NatureServe 2015), occurs throughout the Mid-Atlantic. It is a floodplain forest of large and moderately large rivers and occurs on sandy, gravelly, well-drained soils of levees, gravel bars, braided channels and other areas of frequent flooding. The tree canopy is well-developed and dominated by *Betula nigra* (River birch) and *Platanus occidentalis* (American sycamore), with associates including *Acer negundo* (Boxelder) and occasionally *Acer saccharinum* (Silver maple) and *Fraxinus pennsylvanica* (Green ash). The shrub layer can include *Cornus amomum* (Silky dogwood), *Cornus sericea* (Redosier dogwood), and *Lindera benzoin* (Spicebush). The vine and herb layers are lush and diverse and may include *Boehmeria cylindrica* (Smallspike false nettle) , *Elymus hystrix* (Eastern bottlebrush grass), *Stellaria pubera* (Star chickweed), *Impatiens capensis* (Jewelweed), *Impatiens pallida* (Pale touch-me-not), Laportea Canadensis (Canadian woodnettle), *Pilea pumila* (Canadian clearweed), *Toxicodendron radicans* (Poison ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis rotundifolia* (Muscadine) or *Vitis riparia* (Riverbank grape), *Chasmanthium latifolium* (Indian woodoats), *Podophyllum peltatum* (Mayapple), *Polygonum virginianum* (Jumpseed), *Apocynum cannabinum* (Indianhemp), and Urtica sp. (Nettle). Exotic species are typical and may include Lysimachia sp. (Loosestrife), *Microstegium vimineum* (Nepalese browntop), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Polygonum cuspidatum* (Japanese knotweed), *Phalaris arundinacea* (Reed canarygrass), and *Alliaria petiolata* (Garlic mustard).

Community 1.2
Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra) Floodplain Forest

The American Sycamore - River Birch - (Coastal Plain Willow, Black Willow) Floodplain Forest, also known as the Piedmont-Central Appalachian Sycamore - River Birch Floodplain Forest (CEGL003896; NatureServe 2015), is an early-successional woodland community of coarse-textured (cobbly / bouldery) to fine-textured (silty or muddy) depositional bars and islands. The vegetation association occurs along rivers and large streams in the High Allegheny Plateau, Central Appalachians, and Lower New England ecoregions. It is subject to relatively frequent and powerful flooding and ice-scouring and is highly variable. It is dominated by stunted, usually battered and flood-trained trees of *Platanus occidentalis* (American sycamore) and *Betula nigra* (River birch). Tree heights may vary from <5 to >10 m tall (<16 to >33 ft.). *Salix caroliniana* (Coastal Plain willow) and *Salix nigra* (Black willow) are dominant or codominant in a minority of stands. Other floodplain trees, particularly *Acer saccharinum* (Silver maple) and *Fraxinus pennsylvanica* (Green ash), may occur as minor associates. Shrub associates include *Cornus amomum* (Silky dogwood), *Salix sericea* (Silky willow), *Alnus serrulata* (Hazel alder), and sometimes *Cephalanthus occidentalis* (Common buttonbush) or *Physocarpus opulifolius* (Common ninebark). The herbaceous layer ranges

from sparse to moderately dense. Characteristic herbs include *Apocynum cannabinum* (Indianhemp), *Polygonum virginianum* (Jumpseed), *Polygonum hydropiper* (Marshpepper knotweed), *Polygonum pensylvanicum* (Pennsylvania smartweed), *Polygonum hydropiper*oides (Swamp smartweed), *Polygonum sagittatum* (Arrowleaf tearthumb), *Eupatorium serotinum* (Lateflowering thoroughwort), Asclepias incarnate (Swamp milkweed), *Pilea pumila* (Canadian Clearweed), Hypericum spp. (St. Johnswort), Bidens spp. (Beggarticks), *Phalaris arundinacea* (Reed canarygrass), *Dichanthelium clandestinum* (Deertongue), *Leersia virginica* (Whitegrass), *Panicum virgatum* (Switchgrass), and Justicia Americana (American water-willow). Vines such as *Vitis riparia* (Riverbank grape) and *Toxicodendron radicans* (Poison ivy) are often found throughout this association. Exotics such as *Lythrum salicaria* (Purple loosestrife), *Microstegium vimineum* (Nepalese browntop), *Polygonum cuspidatum* (Japanese knotweed), Coronilla varia (Crownvetch), and *Rosa multiflora* (Multiflora rose) are frequent invaders.

State 2
Post-Disturbance Successional Forest

Community 2.1
Juglans nigra/Verbesina alternifolia Ruderal Forest

The Black Walnut/Wingstem Ruderal Forest also known as the Successional Black Walnut Forest (CEGL007879) (NatureServe2009) occurs in a variety of habitats from ridgetops to floodplains. Associated trees are *Liriodendron tulipifera* (Tuliptree), *Juglans cinerea* (Butternut), *Robinia pseudoacacia* (Black locust), Fraxinus Americana (White ash), Ulmus Americana (American elm), *Platanus occidentalis* (American sycamore), *Acer saccharum* (Sugar maple), *Acer nigrum* (Black maple), *Morus rubra* (Red mulberry), and *Aesculus flava* (Yellow buckeye). Additional tree species in the subcanopy can include *Carya cordiformis* (Bitternut hickory) and *Celtis occidentalis* (Common hackberry). *Sassafras albidum* (Sassafras) and/or *Carpinus caroliniana* (American hornbeam) may be present as small trees. The shrub layer may or may not be well-developed; common species include *Asimina triloba* (Pawpaw), *Viburnum prunifolium* (Blackhaw), *Lindera benzoin* (Spicebush), Corylus Americana (American hazelnut), and the exotic invasive *Rosa multiflora* (Multiflora rose). The herb layer is variable, often with one or a few species providing most of the cover. *Verbesina alternifolia* (Wingstem) and *Ageratina altissima* (White snakeroot) are characteristic and may be dominant; other herbs include *Ambrosia trifida* (Great ragwood), *Amphicarpaea bracteata* (American hogpeanut), *Agrimonia pubescens* (Soft agrimony), Apios Americana (Groundnut), Cryptotaenia Canadensis (Canadian honewort), *Galium triflorum* (Fragrant bedstraw), *Osmorhiza longistylis* (Longstyle sweetroot), *Dichanthelium clandestinum* (Deertongue), *Packera aurea* (Golden ragwort), *Polygonum virginianum* (Jumpseed), *Rudbeckia laciniata* (Cutleaf coneflower), *Podophyllum peltatum* (Mayapple), *Impatiens capensis* (Jewelweed), *Circaea lutetiana* (Broadleaf enchanter's nightshade), *Viola striata* (Striped cream violet), and *Ambrosia trifida* (Great ragweed). The invasive exotics *Microstegium vimineum* (Nepalese browntop), *Alliaria petiolata* (Garlic mustard), *Rosa multiflora* (Multiflora rosa), and Polygonum caespitosum (Oriental lady's thumb) can be common in this community.

State 3
Agricultural-Grassland and/or Row Crops

Community 3.1
Row Crops or Pasture

This is the dominant state that exists either in row crops like corn and soybeans, or in managed pastures planted with non-native forages. Non-native grasses may include cool season species such as *Schedonorus arundinaceus* (Tall fescue), Phleum pretense (Timothy) and *Dactylis glomerata* (Orchardgrass). Other species included *Sorghum halepense* (Johnsongrass), Setaria spp. (Foxtails), Panicum spp. (Panic grass), Amaranthus spp. (Amaranth), *Taraxacum officinale* (Common dandelion), and *Cirsium arvense* (Canada thistle). Frequent flooding, surface fragments, low organic matter content and soil acidity make agriculture harder to maintain in a healthy, productive state on this ecological site.

Community 3.2
Dactylis glomerata - Festuca spp. - Solidago canadensis Ruderal Mesic Meadow

The Orchardgrass - Fescue species - Canada Goldenrod Ruderal Mesic Meadow Alliance (A1190, NatureServe 2017) is a broadly defined community which includes mesic abandoned pastures and agricultural fields and is

largely composed of non-native cool-season grasses and herbs (generally of European origin) in the early stages of succession. Species composition varies from site to site, depending on land-use history and perhaps soil type, but in general this vegetation is quite wide-ranging in northeastern and midwestern states. Dominant grasses vary from site to site but generally include the exotic grasses *Agrostis stolonifera* (Creeping bentgrass), *Agrostis hyemalis* (Winter bentgrass), *Anthoxanthum odoratum*, (Sweet vernalgrass), *Bromus inermis* (Smooth Bromegrass), *Bromus tectorum* (Cheatgrass), *Dactylis glomerata* (Orchardgrass), Schedonorus arundinaceum (Tall fescue), *Lolium perenne* (Perennial ryegrass), Phleum pretense (Timothy) as well as weedy natives such as *Elymus repens* (Quackgrass), *Poa pratensis* (Kentucky bluegrass), and, less commonly, *Schizachyrium scoparium* (Little bluestem) and *Tridens flavus* (Purpletop). Herbaceous species may be minor or dominant and include various Solidago spp. (goldenrods), Sympyotrichum spp. (Asters), and other native and non-native species. *Juniperus virginiana* (eastern redcedar), is a woody species that has been observed in old fields of this ecological site. In wetter areas, *Phalaris arundinacea* (Reed canarygrass) is common.

Pathway 3.1 - 3.2
Community 3.1 to 3.2

Cessation of cropping or active pasture management; occasional mowing to prevent establishment of trees and shrubs.

Pathway 3.2 - 3.1
Community 3.2 to 3.1

Tillage, follow a conservation plan, plant row crops.

Transition T1 - 2
State 1 to 2

Historically logged and cleared; possibly plowed, pastured, and grazed. Long term succession; no longer grazed.

Transition T1 - 3
State 1 to 3

Clearcutting; tillage; conversion to agricultural land; fertilizer and lime application; active management.

Restoration pathway R2 - 1
State 2 to 1

Return to the reference or post logged minimally managed state may require a very long term series of costly management options and stages. Many species may need to be planted or seeded to restore the system. Herbivory can be a problem as well as competition from faster growing species. Depending on the existing seed bank and the proximity of a mature forest from which to recruit seeds, ruderal forests may regain a mixed forest stand. Nevertheless, sites that have been cleared and tilled have significant soil disturbance which may include compaction, erosion, loss of native soil structure, loss of soil organic matter, disruption of soil microorganisms, all which affect the soil's nutrient availability and water holding capacity (Duiker and Myers, 2005). These characteristics favor recolonization by plant species that have wind dispersed seeds (verses those that propagate through underground roots called rhizomes, or which have heavy seeds that stay near the parent tree), are shade intolerant, have rapid to moderate growth rates, and drought tolerance (Dyer, 2010). Aggressive control of nonnative and invasive species will be ongoing. The following conservation practices from the Natural Resources Conservation Service Field Office Technical Guide can be used for restoration efforts (FOTG-USDA): Brush Management-314; Critical Area Planting-342; Early Successional Habitat Development-647; Fence-382; Forest Stand Improvement-666; Herbaceous Weed Control-315; Tree/Shrub site Preparation-490; Upland Wildlife habitat management-645; Riparian Forest Buffer-39.

Conservation practices

Brush Management
Critical Area Planting

Fence
Riparian Forest Buffer
Tree/Shrub Site Preparation
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Forest Stand Improvement
Herbaceous Weed Control

Transition T2 - 3
State 2 to 3

Logging, clearing, tillage and then establishment of agricultural practices. Wet areas may benefit from installation of drainage ditches.

Restoration pathway R3 - 1
State 3 to 1

Return to the reference or post logged minimally managed state may require a very long term series of costly management options and stages. Many species may need to be planted or seeded to restore the system. Herbivory can be a problem as well as competition from faster growing species. Depending on the existing seed bank and the proximity of a mature forest from which to recruit seeds, ruderal forests may regain a mixed forest stand. Nevertheless, sites that have been cleared and tilled have significant soil disturbance which may include compaction, erosion, loss of native soil structure, loss of soil organic matter, disruption of soil microorganisms, all which affect the soil's nutrient availability and water holding capacity (Duiker and Myers, 2005). The following conservation practices from the Natural Resources Conservation Service Field Office Technical Guide can be used for restoration efforts (FOTG-USDA): Brush Management-314; Critical Area Planting-342; Early Successional Habitat Development-647; Fence-382; Forest Stand Improvement-666; Herbaceous Weed Control-315; Tree/Shrub site Preparation-490; Upland Wildlife habitat management-645; Riparian Forest Buffer-39.

Conservation practices

Brush Management
Fence
Riparian Forest Buffer
Tree/Shrub Site Preparation
Upland Wildlife Habitat Management
Early Successional Habitat Development/Management
Forest Stand Improvement
Herbaceous Weed Control

Restoration pathway R3 - 2
State 3 to 2

Abandonment of pasture or old field. Discontinue mowing and do not allow grazing. Allow natural regeneration.

Additional community tables

Other references

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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	
Approved by	
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:

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

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

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

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:**
