USDA Natural Resources Conservation Service

Ecological site NX119X01Y012
Drainageway

Last updated: 9/22/2023
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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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 119X–Ouachita Mountains

Major Land Resource Area 119, the Ouachita Mountains, is in Arkansas and Oklahoma. This MLRA is about 11,885 square miles (30,800 square kilometers). Hot Springs National Park and the Ouachita National Forest reside in this MLRA.

This MLRA is located in the Ouachita Mountains section of the Ouachita Province of the Interior Highlands. The steep mountains are underlain by folded and faulted sedimentary and metamorphic rocks. Most of the valleys are narrow and have steep gradients while wide terraces and flood plains border the Ouachita River. Elevation ranges from 130 feet (40 meters) in the bottomlands to 2,670 feet (810 meters) on the mountain peaks.

These steep mountains are underlain by folded and faulted formations, dominantly of shale and sandstone. Ordovician-age shale and sandstone are included in the Collier Shale, Crystal Mountain Sandstone, and Womble Shale. Mississippian-age shale, sandstone, novaculite, and chert are included in the Arkansas Novaculite and the Stanley Shale. Pennsylvanian-age shale, slate, quartzite, and sandstone are included in the Jackfork Sandstone, Johns Valley Shale, and upper Atoka Formations. Alluvial deposits of silt, sand, and gravel are on the wide terraces and flood plains that border the Ouachita River.

The dominant soil orders in this MLRA are Ultisols and Inceptisols. The soils in this MLRA have a thermic soil

temperature regime, a udic soil moisture regime, and mixed or siliceous mineralogy.

Ecological site concept

The Drainageway ecological site is in river valleys along flood plains. The soils associated with this site are very deep and formed in alluvium derived from sandstone and shale. This site has slopes between 0 and 3 percent with elevations ranging from 300 to 1,240 feet (91 to 380 meters). Important abiotic characteristics associated with this site are a greater than 18 percent clay in the particle size control section, an irregular decrease in organic matter throughout the soil profile, and occasional to frequent flooding for very brief to brief periods.

Associated sites

NX119X01Y019	**Rarely Flooded Terrace** This ecological site is differentiated from the Drainageway Ecological Site by landscape position.

Similar sites

NX119X01Y018	**Poorly Drained Flood Plain** This ecological site is differentiated from the Drainageway Ecological Site by very poor drainage characteristics.

Table 1. Dominant plant species

Tree	(1) *Liquidambar* (2) *Platanus*
Shrub	(1) *Hamamelis* (2) *Alnus*
Herbaceous	(1) *Panicum virgatum* (2) *Andropogon gerardii*

Legacy ID

F119XY012AR

Physiographic features

This ecological site is in river valleys along flood plains. This site has slopes between 0 and 3 percent. Elevations range from 300 to 1,240 feet (91 to 380 meters). Runoff class varies from negligible to low, with no ponding. Occasional to frequent flooding occurs for very brief to brief periods.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain
Runoff class	Negligible to low
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	91–378 m
Slope	0–3%
Water table depth	15–152 cm
Aspect	Aspect is not a significant factor

Climatic features

This ecological site is characterized by hot summers, cool winters, and mild spring and fall temperatures. Mean annual precipitation is 54 inches. The average frost-free period is 182 days, and the average freeze-free period is 207 days. The highest precipitation occurs in May (6.4 inches), and the lowest occurs in August (3.4 inches). Precipitation varies greatly across this ecological site, with increasing precipitation from west to east. The warmest month of the year is August (93°F average high), and the coolest is January (26°F average low).

Thunderstorms and heat waves are common and occur frequently during summer months. Catastrophic storm events, such as tornados, ice-storms, floods, and hail-storms are also known to occasionally occur within this ecological site. According to the Oklahoma Water Resource Board, drought occurs on 5 to 10 year cycles. The Environmental Protection Agency (EPA) predicts that droughts will become more severe throughout Arkansas due to longer periods without rain and an increase in very hot days (EPA, 2016).

Data was provided by the Alum Fork, Battiest, Wilburton, Murfreesboro, Waldron, and Hot Springs climate stations. Site specific data should be obtained by accessing the database provided by the National Centers for Environmental Information (https://www.ncdc.noaa.gov/cdo-web/search).

Table 3. Representative climatic features

Frost-free period (characteristic range)	176-194 days
Freeze-free period (characteristic range)	206-217 days
Precipitation total (characteristic range)	1,295-1,422 mm
Frost-free period (actual range)	173-198 days
Freeze-free period (actual range)	198-228 days
Precipitation total (actual range)	1,245-1,422 mm
Frost-free period (average)	186 days
Freeze-free period (average)	212 days
Precipitation total (average)	1,346 mm

Climate stations used

- (1) TUSKAHOMA [USC00349023], Tuskahoma, OK
- (2) MCGEE CREEK DAM [USC00345713], Atoka, OK
- (3) MOUNT IDA ASOS [USW00053921], Mount Ida, AR
- (4) BLAKELY MTN DAM [USC00030764], Mountain Pine, AR
- (5) NIMROD DAM [USC00035200], Perryville, AR

Influencing water features

This ecological site has rare to frequent flooding (1 to 5 times in 100 years to more than 50 times in 100 years) for very brief periods (4 to 48 hours).

Wetland description

This ecological site is not significantly influenced by wetlands.

Soil features

The soils associated with this ecological site are formed in alluvium derived from sandstone and shale. These soils are very deep, moderately well to well drained, and have a moderate permeability class. A loam or silt surface texture is common. Important abiotic characteristics associated with this site are a greater than 18 percent clay in the particle size control section and an irregular decrease in organic matter throughout the soil profile.

The soil series associated with this site are Ceda, Dela, Kenn, Neff, Rexor, and Avilla.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Loam (2) Silt
Drainage class	Moderately well drained to well drained
Permeability class	Moderate
Soil depth	152–203 cm
Surface fragment cover <=3"	1–20%
Surface fragment cover >3"	0–3%
Available water capacity (Depth not specified)	5.84–19.3 cm
Soil reaction (1:1 water) (Depth not specified)	4.5–6.5
Subsurface fragment volume <=3" (Depth not specified)	1–33%
Subsurface fragment volume >3" (Depth not specified)	0–8%

Ecological dynamics

The Drainageway reference state consists of a bottomland hardwood forest that is periodically flooded throughout the year. The common trees species for this state are sweetgum, sycamore, hickory, oak, hackberry, elm, and loblolly pine (Eldredge, 1937).

Flooding is a major ecosystem disturbance on this ecological site. Ecosystems are affected differently by flooding depending on the duration, time of year, and water stagnation. Species diversity has been shown to decrease with increased flooding duration. Nutrients and seeds are transported and distributed throughout the landscape during flooding events (Smith and Callahan, 1983). Flooding during the dormant season does not have negative effects on species diversity and growth (Bedinger, 1979).

Fire has some influence on this ecological site during dry years. High precipitation throughout the year will decrease fire behavior due to proximity with riparian areas. The historical average fire return interval was likely between 3 and 25 years (Guyette and Spetich, 2003; Hallgren, DeSantic, and Burton, 2012). These wildfires would occur naturally through lightning strikes, but the majority were probably ignited by anthropogenic sources (DeSantis, Hallgren, and Stahle, 2010).

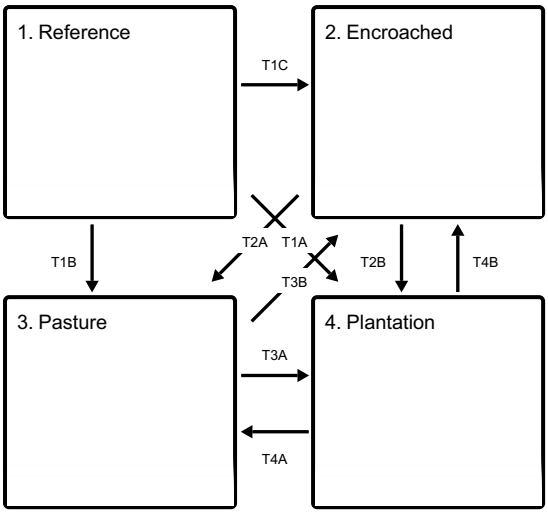
Climate related events, such as hail-storms, tornados, thunderstorms, and extreme precipitation, occur on these sites. Hail-storms can reduce canopy size, increase litter deposition, and increase tree bark removal. When paired with other disturbances, such as fire, the effects on tree species were much greater than in areas not affected by hail-storms (Gower et al., 2015). Tornados have been shown to change plant community compositions in savanna ecosystems, favoring hardwoods and eliminating softwoods (Liu et al., 1997). Thunderstorms greatly effect ecosystem dynamics. Thunderstorms generally occur during summer months but can occur during every season. If a fire is started by a lightning strike, there will be different effects in the ecosystem depending on the season (Hiers, Wyatt, and Mitchell, 2000).

Grazing and farming can occur on this ecological site. Changes to the ecological dynamics are proportional to the intensity of livestock grazing and can be accelerated by overgrazing (Angerer, Fox, and Wolfe, 2013; Kohl, 2016). For example, desirable grasses and forbs are repeatedly grazed by livestock, weakening, and potentially killing or replacing these species with less desirable species (Smith, 1940).

A state and transition model has been created to explain this Ecological Site. However, sparse data availability only allowed basic principles to be explored and a small number of species to be recorded. More data will be collected to provide a greater understanding of the ecological dynamics, as well as the resources consumption and distribution.

State and transition model

Ecosystem states



T1C - Absence of fire or alternative brush management, woody species encroachment.

T1B - Tree removal, mechanical and chemical woody vegetation suppression, tillage, introduce annual or perennial forage species.

T1A - Tree removal, brush management, plantation tree establishment and management.

T2A - Tree removal, mechanical and chemical woody vegetation suppression, tillage, introduce annual or perennial forage species.

T2B - Woody species removal, plantation tree planting, prescribed fire.

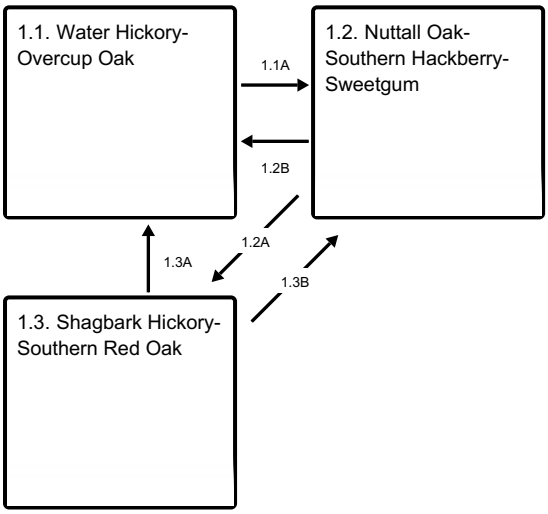
T3B - Lack of management or abandonment.

T3A - Forage species suppression, brush management, plantation tree establishment and management.

T4B - Lack of management or abandonment.

T4A - Woody species removal, prescribed fire, seeding, and grazing.

State 1 submodel, plant communities



1.1A - Less water, decreased flooding

1.2B - More water, increased flooding

1.2A - Less water, decreased flooding

1.3A - More water, increased flooding

1.3B - More water, increased flooding

State 1
Reference

The Reference State is representative of the natural range of variability without major anthropogenic influences. Drivers: Flooding duration and frequency, climate (decadal scale), insect and disease presence or establishment,

wildlife grazing or browsing, and fire frequency. Feedbacks: Water tolerant tree species dominate this ecological site. Flooding events limit what species can grow and survive inundation.

Characteristics and indicators. The reference state consists of a bottomland hardwood forest that is periodically flooded throughout the year.

Dominant plant species

- oak (*Quercus*), tree
- hybrid hickory (*Carya*), tree
- hackberry (*Celtis*), tree
- sycamore (*Platanus*), tree
- pine (*Pinus*), tree
- sweetgum (*Liquidambar*), tree
- switchgrass (*Panicum virgatum*), grass

Community 1.1
Water Hickory-Overcup Oak

Water Hickory and Overcup Oak.

Community 1.2
Nuttall Oak- Southern Hackberry- Sweetgum

Nuttall Oak, Southern Hackberry, and Sweetgum.

Community 1.3
Shagbark Hickory- Southern Red Oak

Shagbark Hickory and Southern Red Oak.

Pathway 1.1A
Community 1.1 to 1.2

This pathway is characterized by periods of lower precipitation and decreased flooding.

Pathway 1.2B
Community 1.2 to 1.1

This pathway is characterized by periods of higher precipitation and increased flooding.

Pathway 1.2A
Community 1.2 to 1.3

This pathway is characterized by periods of lower precipitation and decreased flooding.

Pathway 1.3A
Community 1.3 to 1.1

This pathway is characterized by periods of higher precipitation and increased flooding.

Pathway 1.3B
Community 1.3 to 1.2

This pathway is characterized by periods of higher precipitation and increased flooding.

State 2

Encroached

The encroached state is dominated by woody species. Driver: Absence of fire, seed dispersal by wildlife, climate (decadal scale), and canopy density. Feedbacks: Woody species dominate the ecological site, shading herbaceous species. As herbaceous species are outcompeted for resources, fire frequency decreases. Nutrient and water cycling are controlled by woody species.

Characteristics and indicators. The Encroached State consists of many woody species, especially eastern redcedar, where there is significant canopy closure. Time and fire frequency determine the community phases and species abundance and variation. As the woody canopy increases the hydrology of the site is altered. The increased canopy intercepts most of the precipitation. Understory species have less available water for growth and must compete with an extensive overstory root system.

Dominant plant species

- eastern redcedar (*Juniperus virginiana*), tree
- oak (*Quercus*), tree
- hybrid hickory (*Carya*), tree
- beech (*Fagus*), tree

State 3
Pasture

The Pasture State is characterized by the dominance of improved forage species. The quality and quantity of forb, grass, and legume species within this state will depend on the level of management inputs including seeding, weed management, and land uses. Species of both warm-season and cool-season grasses are feasible for these sites. Drivers: Mechanical soil disturbance and seed planting, climate (decadal scale), seed dispersal, and wildlife or livestock grazing or browsing. Feedbacks: Land managers use mechanical and chemical equipment to increase forage. Inputs of fertilizer and brush management are required to maintain high productivity. Wildlife and livestock grazing and browsing decrease the amount of available forage.

Characteristics and indicators. The Pasture State consists of species that are grown for specific management goals, mainly livestock grazing. Common pasture species include buffalograss, western wheatgrass, little bluestem, sideoats grama, Bermudagrass, and bahiagrass. Quality and quantity of forb, grass, and legume species within this state depend on the level of management inputs (seeding, weed management, and land uses). Species of both warm-season and cool-season grasses are feasible for these sites.

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass
- red clover (*Trifolium pratense*), grass

State 4
Plantation

The plantation state is characterized by the planting of merchantable trees species. The most common species for a plantation is loblolly pine. Community phases differ by tree type (softwood or hardwood) and the harvesting process. Drivers: Prescribed fires, pest management, vegetation management, canopy density. Feedbacks: Timber harvesting. Planted tree species dominate this ecological site, shading out other vegetation. Anthropogenic management decreases competition with other species and assists in growth.

Characteristics and indicators. A plantation state consists of tree species that are planted and managed to maximize the production of merchantable timber. The most common plantation species is loblolly pine, followed by hardwood trees. Community phases differ by tree type (softwood or hardwood), timber harvest method, management, and reforesting practices.

Dominant plant species

- loblolly pine (*Pinus taeda*), tree
- oak (*Quercus*), tree

Transition T1C
State 1 to 2

Trigger: The absence of wildfire allows woody species to increase and outcompete herbaceous species for nutrients, water, and sunlight. Slow variables: Increased competition for sunlight, nutrients, and moisture resources. Increased overstory competition results in decreased vigor and reproductive capacity of herbaceous understory species. Thresholds: Nutrient cycles shift from grass-and-leaf dominance to leaf-and-needle dominance. Increased woody canopy cover alters hydrologic cycles, potentially increasing runoff, decreasing infiltration, and increasing precipitation interception to woody species.

Transition T1B
State 1 to 3

Trigger: Mechanical and chemical woody vegetation suppression, tillage, and annual forage species introduction. Slow Variables: Increase production and management of forage species. Thresholds: Changes in soil properties, such as structure, organic matter, and nutrient cycling, as well as changes in type and frequency of disturbance.

Transition T1A
State 1 to 4

Trigger: Native tree removal, mechanical and chemical woody vegetation suppression, introduce plantation tree species. Slow Variables: Increased production and management of plantation species. Thresholds: Changes in soil properties such as structure, organic matter, and nutrient cycling as well as changes in type and frequency of disturbance.

Transition T2A
State 2 to 3

Trigger: Mechanical and chemical woody vegetation treatment, tillage, and forage species introduction. Slow Variables: Increase production and management of forage species. Thresholds: Changes in soil properties, such as structure, organic matter, and nutrient cycling, as well as changes in type and frequency of disturbance.

Transition T2B
State 2 to 4

Trigger: Native tree removal, mechanical and chemical woody vegetation suppression, introduce plantation tree species. Slow Variables: Increased production and management of plantation species. Thresholds: Changes in soil properties such as structure, organic matter, and nutrient cycling as well as changes in type and frequency of disturbance.

Transition T3B
State 3 to 2

Triggers: Lack of management or abandonment. Slow Variables: Increase in the establishment and size of woody species. Thresholds: Woody species dominate ecological processes. This reduces vigor and reproduction of understory species due to shading and increased competition for soil moisture, nutrients, and sunlight.

Transition T3A
State 3 to 4

Trigger: Forage species removal and suppression, mechanical and chemical woody vegetation suppression, introduce and manage plantation tree species. Slow Variables: Increased production and management of plantation species. Thresholds: Changes in soil properties such as structure, organic matter, and nutrient cycling as well as changes in kind and frequency of disturbance.

Transition T4B

State 4 to 2

Triggers: Lack of management or abandonment. Slow Variables: Increase in the establishment and size of woody species. Thresholds: Woody species dominant ecological processes resulting in reduced vigor and reproduction of herbaceous species in the understory due to shading and increased competition for soil moisture, nutrients, and sunlight.

Transition T4A
State 4 to 3

Trigger: Tree removal, mechanical and chemical woody vegetation suppression, tillage, introduce annual or perennial forage species. Slow Variables: Increase production and management of forage species. Thresholds: Changes in soil properties such as structure, organic matter, and nutrient cycling as well as changes in type and frequency of disturbance.

Additional community tables

Animal community

Common wildlife species in this area include coyote, whitetail deer, bobcat, beaver, raccoon, otter, skunk, opossum, muskrat, mink, cottontail, armadillo, gray squirrel, and turkey. The species of fish in the area include largemouth bass, bluegill, redear sunfish, channel catfish, spotted bass, white bass, crappie, flathead catfish, sucker, bullhead, bowfin, and gar.

Hydrological functions

Following are the estimated withdrawals of freshwater by use in this MLRA:

Public supply— surface-water, 26.5%; ground-water, 0.3%
Livestock— surface-water, 9.6%; ground-water, 0.3%
Irrigation— surface-water, 0.6%; ground-water, 0.0%
Other— surface-water, 62.6%; ground-water, 0.0%

The total withdrawals average 155 million gallons per day (585 million liters per day). About 1 percent is from ground-water sources, and 99 percent is from surface-water sources. The high precipitation, perennial streams, and reservoirs provide abundant water. Several large reservoirs are used for water storage, flood control, and recreation. In the valleys, small ponds and springs are the main sources of water for domestic use and for livestock. The surface-water is typically of very good quality in this mountainous area.

In the valleys, shallow wells in alluvium are the main sources of water for domestic use and for livestock. None of the bedrock aquifers in Arkansas or Oklahoma occur in this area. The quality of the shallow ground-water is very similar to the quality of the water in the streams and rivers. The ground-water is suitable for drinking.

Recreational uses

Mountain biking, camping, fishing, hiking, horseback riding, hunting, mineral prospecting, nature viewing, off-highway vehicle riding, and water activities can all be enjoyed throughout this MLRA on public land where permitted and on private land where allowed. The Ouachita National Forest is throughout this MLRA, encompassing nearly 1.8 million acres of public land.

Wood products

Public and private timberland comprise large areas throughout this MLRA. Loblolly pine is the most popular species to harvest and produces products such as lumber, pulpwood, posts, and poles. Hardwood species are also harvested and used to produce lumber, flooring, and pulpwood.

Other products

Poultry production is a major industry throughout the MLRA. Small grains, soybeans, and hay are major crops.

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The Nature Conservancy
US Fish and Wildlife Service
Encyclopedia of Arkansas
United States Forest Service Southern Research Station
NatureServe
Oklahoma Water Resource Board
National Centers For Environmental Information
University of Arkansas
Oklahoma State University
Arkansas Department of Forestry
Oklahoma Department of Forestry

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Approval

Bryan Christensen, 9/22/2023

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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	05/19/2024
Approved by	Bryan Christensen
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):

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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:**
