USDA Natural Resources Conservation Service

Ecological site PX135B01Y015
Well Drained Flood Plain

Last updated: 9/22/2023
Accessed: 05/11/2025

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): 135B–Cretaceous Western Coastal Plain

Major Land Resource Area 135B, Cretaceous Western Coastal Plain, is in Arkansas and Oklahoma. This MLRA is about 3,970 square miles (10,290 square kilometers).

This area is mostly in the West Gulf Coastal Plain Section of the Coastal Plain Province of the Atlantic Plain. It consists of nearly level to moderately sloping uplands, terraces, and flood plains. Valley floors, side slopes, and ridgetops are underlain by clay, marl, and chalk. These parent materials are highly erodible, causing gullies to form. Elevations generally range from 260 to 570 feet (80 to 170 meters), with lower and higher elevations found on valley floors and ridgetops.

Cretaceous marine sediments underlie most of this MLRA. Geologic members of the Lower Cretaceous include a basal member of gravel and conglomerate rocks. Members of the Upper Cretaceous consist of clay marls, thin limestones, sandy marls, and fine grained sands. Other formations consist of crystalline limestone, chalk, and marly chalk, some of which contain fossils.

The dominant soil orders in this MLRA are Inceptisols and Alfisols, with Entisols and Vertisols present to a lesser extent. The soils in the area have a thermic soil temperature regime, an ustic soil moisture regime, and smectitic or mixed mineralogy.

Ecological site concept

The Well Drained Flood Plain Ecological Site is on coastal plains along flood plains. This site has slopes between 0 and 3 percent and elevations ranging from 90 to 830 feet (27 to 250 meters). Soils are formed in alluvium, are deep to very deep, well drained, and have a moderately rapid permeability class. This site is characterized by a clay content of 18 to 35 percent in the particle size control section, evidence of redox reactions below 24 inches (60 cm). Flooding during the winter and spring seasons occur on an occasional to frequent basis (5 to 50 times in 100 years to more than 50 times in 100 years) with durations of very brief to brief (4 to 48 hours or 2 to 7 days).

Associated sites

PX135B01Y012	**Terrace** Found on coastal plains along terraces. This ecological site is differentiated from the Well Drained Floodplain Ecological Site by landscape position and no flooding events.

Similar sites

PX135B01Y014	**Poorly Drained Flood Plain** Found on coastal plains along flood plains. This ecological site is differentiated from the Well Drained Floodplain Ecological Site by a higher percentage of clay soil throughout the particle size control section and increased flooding duration.

Table 1. Dominant plant species

Tree	(1) *Quercus* (2) *Liquidambar*
Shrub	(1) *Rhus* (2) *Cornus*
Herbaceous	(1) *Panicum virgatum* (2) *Tripsacum dactyloides*

Legacy ID

F135BY015AR

Physiographic features

This ecological site is found on coastal plains and occurs along flood plains. This site has slopes between 0 and 3 percent. Elevations range from 90 to 830 feet (27 to 250 meters). Runoff class varies from low to high, with no ponding.

Table 2. Representative physiographic features

Landforms	(1) Coastal plain > Flood plain
Runoff class	Low to high
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Occasional to frequent
Ponding frequency	None
Elevation	90–830 ft
Slope	0–3%
Water table depth	18–60 in
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 51 inches. The average frost-free period is 193 days, and the average freeze-free period is 217 days. The highest precipitation occurs in May (6.2 inches), and the lowest occurs in August (2.8 inches). Precipitation varies across the MLRA, with decreasing precipitation from east to west. The warmest month of the year is August (94°F average high), and the coolest is January (29°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 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 Antlers, Hugo, Idabel, DeQueen, Nashville, and Arkadelphia 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)	187-200 days
Freeze-free period (characteristic range)	211-223 days
Precipitation total (characteristic range)	48-54 in
Frost-free period (actual range)	184-202 days
Freeze-free period (actual range)	204-226 days
Precipitation total (actual range)	47-55 in
Frost-free period (average)	193 days
Freeze-free period (average)	217 days
Precipitation total (average)	51 in

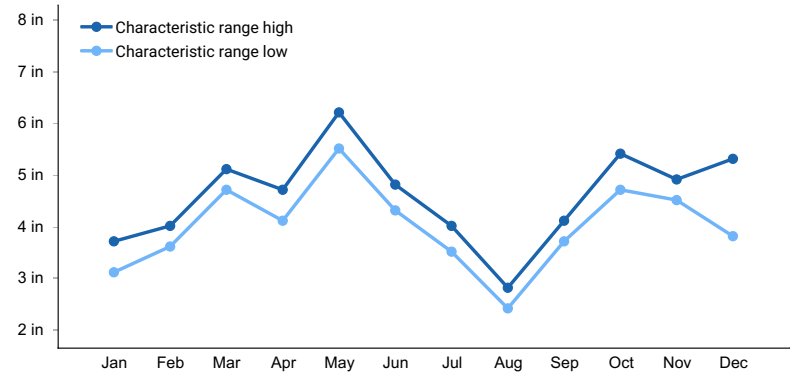


Figure 1. Monthly precipitation range

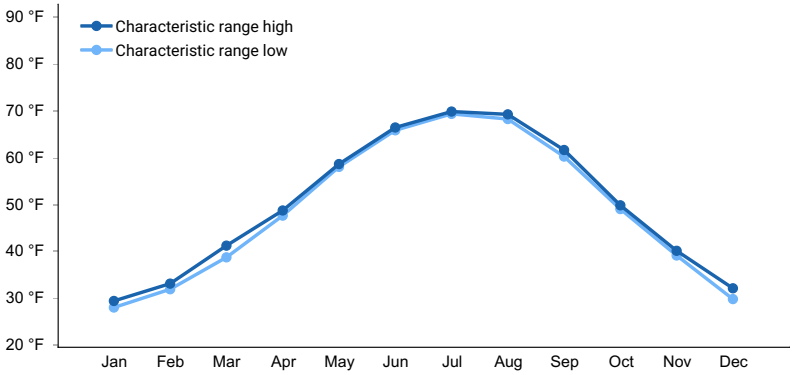


Figure 2. Monthly minimum temperature range

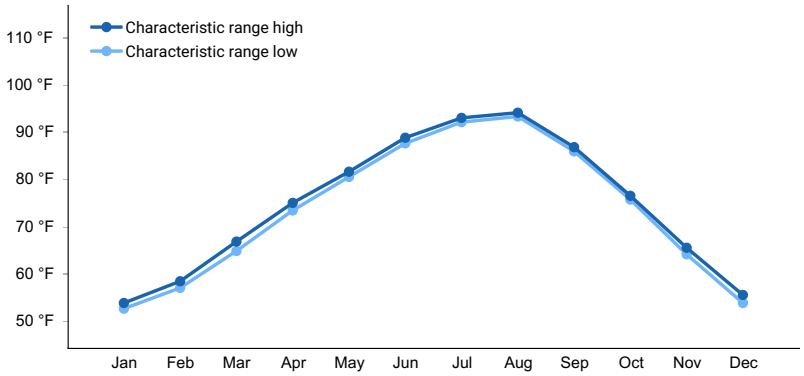


Figure 3. Monthly maximum temperature range

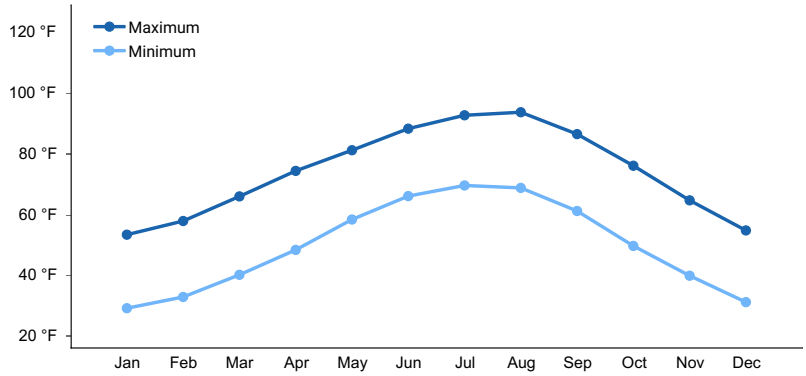


Figure 4. Monthly average minimum and maximum temperature

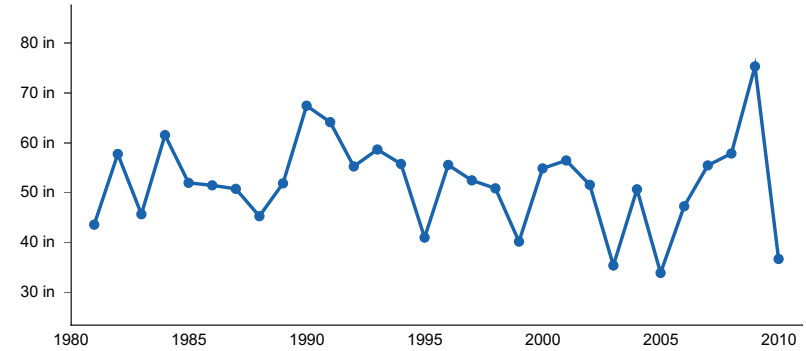


Figure 5. Annual precipitation pattern

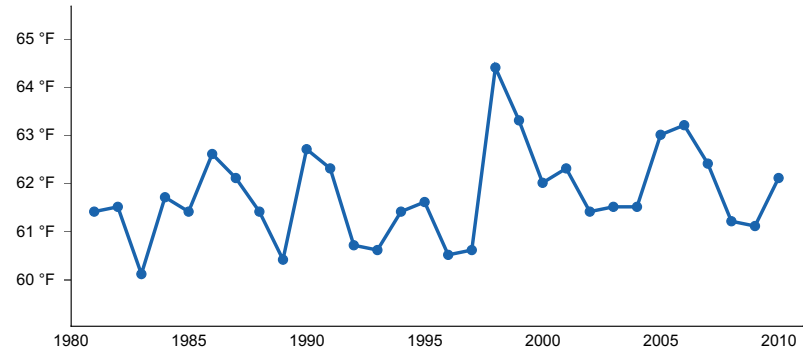


Figure 6. Annual average temperature pattern

Climate stations used

- (1) ANTLERS [USC00340256], Antlers, OK
- (2) HUGO [USC00344384], Hugo, OK
- (3) IDABEL [USC00344451], Broken Bow, OK
- (4) DEQUEEN [USC00031948], De Queen, AR
- (5) NASHVILLE [USC00035112], Nashville, AR
- (6) ARKADELPHIA 2 N [USC00030220], Arkadelphia, AR

Influencing water features

This ecological site is influenced by occasional to frequent flooding (more than 5 to 50 times in 100 years to more than 50 times in 100 years) of various durations.

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 loamy material. These soils are deep to very deep, somewhat poorly to well drained, and have a very slow to moderately rapid permeability class. A fine sandy loam surface texture is common. Important abiotic characteristics associated with this site are a clay content of 18 to 35 percent in the particle size control section and evidence of redox reactions below 24 inches (60 cm).

The soil series associated with this site are Ouachita and Rexor.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Fine sandy loam (2) Gravelly silt loam
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained to well drained
Permeability class	Very slow to moderately rapid
Soil depth	60–80 in
Surface fragment cover <=3"	0–4%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	3.8–7.7 in
Soil reaction (1:1 water) (Depth not specified)	4.5–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–7%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

The Well Drained Flood Plain reference state consists of a bottomland hardwood forest that is periodically flooded throughout the year. The common trees species for this state are 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

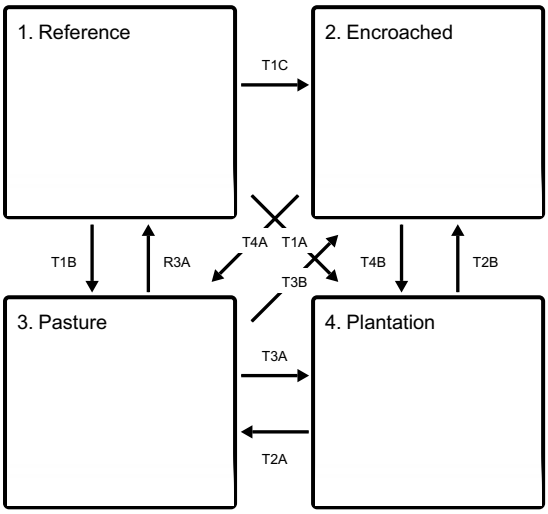
a fire is started by a lightning strike, there will be different effects in the ecosystem depending on the season (Hiers, Wyatt, and Mitchell, 2000).

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.

T4A - Tree removal, mechanical and chemical woody vegetation suppression, tillage, introduce annual or perennial forage species.

T4B - Woody species removal, plantation tree planting, prescribed fire.

R3A - Remove pasture species and allow natural regeneration and disturbance regimes.

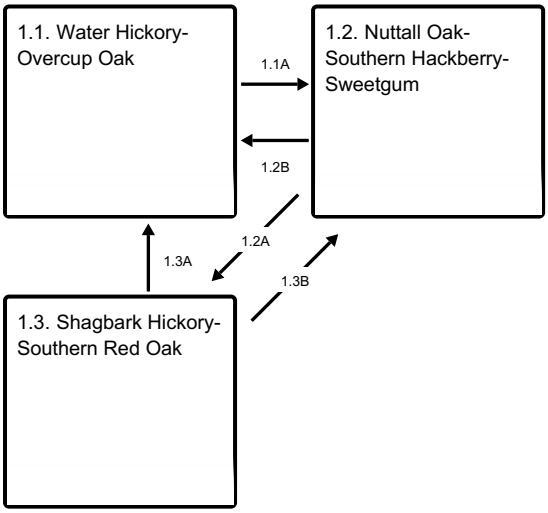
T3B - Lack of management or abandonment.

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

T2B - Lack of management or abandonment.

T2A - Woody species removal, prescribed fire, seeding, and grazing.

State 1 submodel, plant communities



1.1A - Lower precipitation, decreased flooding.

1.2B - Higher precipitation, increased flooding.

1.2A - Lower precipitation, decreased flooding.

1.3A - Higher precipitation, increased flooding.

1.3B - Higher precipitation, 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 wildfire frequency. Feedbacks- Water tolerant tree species dominate this ecological site. Flooding events limit what species can grow and survive inundation.

Dominant plant species

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

Community 1.1
Water Hickory-Overcup Oak

Community 1.2
Nuttall Oak- Southern Hackberry- Sweetgum

Community 1.3
Shagbark Hickory- 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 wildfire, 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 T4A
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 T4B
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.

Restoration pathway R3A
State 3 to 1

Remove all pasture species to the extent possible and stop vegetation suppression activities on desirable species. Allow natural flooding events to occur, this should provide seeds and nutrients.

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 T2B
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 T2A
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

Major wildlife species include whitetail deer, coyote, armadillo, bobcat, beaver, raccoon, skunk, mink, cottontail rabbit, turkey, and mourning dove. Fish species include channel catfish, flathead catfish, white bass, largemouth bass, black bass, and bluegill.

Hydrological functions

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

Public supply—surface-water, 11.6%; ground-water, 6.6%
Livestock—surface-water, 1.9%; ground-water, 2.4%
Irrigation—surface-water, 0.0%; ground-water, 1.2%
Other—surface-water, 70.3%; ground-water, 6.1%

Total withdrawals average 82 million gallons per day (310 million liters per day). About 16 percent is from ground-water sources with the remaining 84 percent from surface-water sources. Precipitation and perennial streams are important sources of water in this area. Ponds provide water for livestock and are used locally for recreation. A few large reservoirs are available for recreational uses. Surface-water is used for industrial production and for cooling thermoelectric power plants, as well as by some communities for their public water supply.

The principal sources of ground-water in this area are bedrock aquifers, including the Antlers aquifer in Oklahoma and the Nacatoch aquifer in Arkansas. The ground-water in this area is used primarily for public supply. Most rural landowners also rely on the bedrock aquifers for domestic water. The ground-water is soft to hard in Arkansas and very hard in Oklahoma.

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.

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. Sand, gravel, clay, bauxite, gypsum, and petroleum are found in industrially significant quantities.

References

Angerer, J., W. Fox, and J. Wolfe. 2016. Land Degradation in Rangeland Ecosystems. Biological and Environmental hazards, Risks, and Disasters. Academic Press.

Bedinger. 1979. Forests and Flooding with Special Reference to the White River and Ouachita River Basins, Arkansas. US Geological Survey.

Cannon, J.B. and J.S. Brewer. 2013. Effects of Tornado Damage, Prescribed Fire, and Salvage Logging on Natural Oak Regeneration in a Xeric Southern USA Coastal Plain Oak and Pine Forest.

Carey, J. 1992. Quercus stellata, Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Fire Sciences Laboratory.

Clark, J.A. and K.R. Covey. 2012. Tree species richness and the logging of natural forests: A meta analysis. Forest Ecology and Management. Elsevier, Yale School of Forestry and Environmental Studies. 146–153.

DeSantis, R.D., S.W. Hallgreen, and D.W. Stahle. 2010. Historic Fire Regime of an Upland Oak Forest in South Central North America. Fire Ecology. USDA Forest Service, Northern Research Station, Saint Paul, Minnesota.

Eldredge, I. 1937. Forest Resources of Southern Arkansas. Southern Forest Experiment Station. US Forest Service.

Engle, D. and T. Bidwell. 2001. The response of central North American prairies to seasonal fire. Range Management 54:2–10.

Engle, D.M. 2017. Fire in North American Tallgrass Prairies. Weed Technology 5:247–248.

Gower, K., J. Fontaine, C. Birnbaum, and N. Enright. 2015. Sequential Disturbance Effects of Hailstorms and Fire on Vegetation in a Mediterranean-Type Ecosystem. Ecosystems 18:1121–1134.

Guldin, J.M. and M.W. Fitzpatrick. 1991. Comparison of Log Quality from Even-Aged and Uneven-Aged Loblolly Pine Stands in South Arkansas. Southern Journal of Applied Forestry 15:10–17.

Guyette, R.P. and M. A. Spetich. 2003. Fire History of Oak-Pine Forests in the Lower Boston Mountains, Arkansas, USA. Forest Ecology and Management. Elsevier. 463–474.

Guyette, R.P., M.A. Spetich, and M.C. Stambaugh. 2006. Historic fire regime dynamics and forcing factors in the Boston Mountains, Arkansas, USA. Forest Ecology and Management 234:293–304.

Hallgren, S.W., DeSantis. R. D., and J.A. Burton. 2012. Fire and vegetation Dynamics in the Cross Timbers Forests of South-Central North America. Proceedings of the 4th Fire in Eastern Oak Forests Conference. USDA Forest Service General Techincal Report NRS-P-102, Springfield, Missouri. 52–66.

Heikens, A. 2007. Glade Communities of the Ozark Plateaus Province. Pages 220–230 in Savannas, Barrens, and Rock Outcrop Plant Communities of North America.

Hiers, K., R. Wyatt, and R. Mitchell. 2000. The effects of fire regime on legume reproduction in longleaf pine savannas: is a season selective?. Oecologia 125:521–530.

Jenks, J.A., Leslie, R.L. Lochmiller, M.A. Melchiors, and McCollum. 1996. Competition in sympatric white-tailed deer and cattle populations in southern pine forests of Oklahoma and Arkansas, USA. Acta Theriologica 41:287–306.

Klos, R.J. and G.G. Wang. 2009. Drought impact on forest growth and mortality in the southeast USA: an analysis using Forest Health and Monitoring data. Ecological Applications 19:699–708.

Kohl, M., P. Krausman, K. Kunkel, and D. Williams. 2013. Bison Versus Cattle: Are They Ecologically Synonymous. Rangeland Ecology and Management 66:721–731.

Linzon, S.N. 1962. Hail Damage to White Pine and Other Trees. The Forestry Chronicle. Canadian Institute of Forestry.

Liu, C., J. Glitzenstein, P. Harcombe, and R. Knox. 1997. Tornado and fire effects on tree species composition in a savanna in the Big Thicket National Preserve, southeast Texas, USA. Forest Ecology and Management 91:279–289.

Owens, D. 2005. First report of a geological reconnaissance of the northern counties of Arkansas, made during the years 1857 and 1858. Arkansas Geological Survey.

Siemann, E., J.A. Carrillo, C.A. Gabler, R. Zipp, and W.E. Rogers. 2009. Experimental test of the impacts of feral hogs on forest dynamics and processes in the southeastern US. Forest Ecology and Management. Elsevier. 546–553.

Smith, C. 1940. The Effects of Overgrazing and Erosion Upon the Biota of the Mixed-Grass Prairie of Oklahoma. Ecology. Wiley. 381–397.

Smith, E. and R. Callahan. 1983. Bottom Land Hardwoods for Wildlife and Timber. The Yearbook of Agriculture 244–251.

Spetich, M. and H. He. 2008. Oak decline in the Boston Mountains, Arkansas, USA: Spatial and temporal patterns under two fire regimes. Forest Ecology and Management 254:454–462.

Varner, J.M., D.R. Gordon, F.E. Putz, and J.K. Hiers. 2005. Restoring Fire to Long-Unburned Pinus palustris Ecosystems: Novel Fire Effects and Consequences for Long-Unburned Ecosystems. Restoration Ecology 13:536–544.

Warrillow, M. and P. Mou. 1999. Ice Storm Damage to Forest Tree Species in the Ridge and Valley Region of Southwestern Virginia. The Journal of the Torrey Botanical Society. Torrey Botanical Society. 147–158.

Zou, C., D. Twidwell, and C. Bielski. 2018. Impact of Eastern Redcedar Proliferation on Water Resources in the Great Plains USA- Current State of Knowledge.

Other references

Arkansas Soil Survey
Ouachita National Forest
Arkansas State Parks
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

Contributors

Trevor Crandall, Ecological Site Specialist

Approval

Bryan Christensen, 9/22/2023

Acknowledgments

Larry Gray
Elizabeth Gray
Erin Hourihan

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	05/11/2025

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):**

---

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:**

---

17. **Perennial plant reproductive capability:**
