USDA Natural Resources Conservation Service

Ecological site NX117X01Y033
Loamy Upland

Last updated: 9/22/2023
Accessed: 05/13/2025

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): 117X–Boston Mountains

This MLRA is about 6,850 square miles (17,775 square kilometers) and is in Arkansas (82 percent) and Oklahoma (18 percent). The Ozark National Forest makes up a significant portion of the MLRA.

This area is predominantly in the Boston Mountains Section of the Ozark Plateaus Province of the Interior Highlands. This MLRA marks the southern extent of the Ozarks, a deeply eroded plateau. Ridges of the MLRA are narrow and rolling, and valley sides are steep. Elevation ranges from 570 feet (170 meters) to 1,860 feet (560 meters). Some lower and higher areas are on valley floors and crests of ridges, respectively.

Level to slightly tilted shale, sandstone, and siltstone strata of geologic formations from the Pennsylvanian Subperiod underlie most of the MLRA. These formations include the Atoka Formation, the Bloyd Shale, and the Cane Hill and Prairie Grove Members of the Hale Formation. The Pitkin Limestone, Fayetteville Shale, and Batesville Sandstone Formations from the Mississippian Subperiod underlie parts of the northern edge of the MLRA. Alluvial deposits are in river valleys and consist of an unconsolidated mixture of clay, silt, sand, and gravel.

The MLRA has a thermic soil temperature regime and a udic soil moisture regime. The dominant soil orders are Ultisols and Inceptisols. The soils are loamy and have mixed or siliceous mineralogy. They are shallow to very deep and are well drained. Hapludults and Dystrudepts formed in residuum on hills, plateaus, and mountains. Paleudults, on terraces and hills, formed in old alluvium over residuum or colluvium over residuum.

Ecological site concept

The Loamy Upland Ecological Site is on mountains and hills, specifically on mountain slopes and hillslopes. Slope ranges from 3 to 40 percent, and elevation ranges from 370 to 2,490 feet. The soils associated with this site are greater than 20 inches (50 cm) deep, are well drained, and formed in residuum and colluvium from soft sandstone or interbedded sandstone and shale. The soils have a particle-size control section with less than 35 percent clay and a Bt horizon within 20 inches (50 cm) of the surface.

Associated sites

NX117X01Y034	**Shallow Upland** This site is on hillsides and mountainsides. The soils are less than 20 inches to a restrictive layer. This site may be confused with shallower areas within the Loamy Upland Ecological Site.

Similar sites

NX117X01Y035	**Seasonally Wet Loamy Upland** This site is on hillslopes of hills and has deep or very deep soils. There is a perched water table 24 to 36 inches below the soil surface in late winter and spring.

Table 1. Dominant plant species

Tree	(1) *Quercus* (2) *Cornus*
Shrub	(1) *Hamamelis* (2) *Acer rubrum*
Herbaceous	(1) *Andropogon gerardii* (2) *Sorghastrum nutans*

Legacy ID

F117XY033AR

Physiographic features

This ecological site is on hills and mountains, specifically on hillslopes and mountain slopes. Slope ranges from 3 to 40 percent, and elevation range from 370 to 2,490 feet (112 to 760 meters). Runoff class is high or very high. The site is not subject to ponding or flooding.

Table 2. Representative physiographic features

Landforms	(1) Hills > Hillslope (2) Mountains > Mountain slope
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	113–759 m
Slope	3–40%
Aspect	Aspect is not a significant factor

Climatic features

Hot summers, cool winters, and mild spring and fall temperatures are typical for the ecological site. The mean annual precipitation is 51 inches. The average frost-free period is 165 days, and the average freeze-free period is 191 days. The highest precipitation occurs in May (6.2 inches), and the lowest occurs in January (3.0 inches). The warmest month of the year is August (91°F average high), and the coolest is January (25°F average low). Thunderstorms and heat waves are common and occur frequently during the summer months.

Occasionally, catastrophic storm events, such as tornados, ice storms, floods, and hailstorms, will occur. According to the Oklahoma Water Resource Board, drought occurs every 5 to 10 years (Oklahoma Water Resources Board, 2022). The EPA predicts droughts will become more severe throughout Arkansas due to longer periods without rain and an increase in very hot days (EPA, 2016).

For detailed information visit the Natural Resources Conservation Service National Water and Climate Center athttp://www.wcc.nrcs.usda.gov/. The Deer, Fayetteville, Huntsville, Mountainburg, and Mountain View climate stations provided general climate data. Site-specific climate data is available through the National Weather Service.

Table 3. Representative climatic features

Frost-free period (characteristic range)	160-179 days
Freeze-free period (characteristic range)	191-204 days
Precipitation total (characteristic range)	1,219-1,346 mm
Frost-free period (actual range)	159-182 days

Freeze-free period (actual range)	186-207 days
Precipitation total (actual range)	1,194-1,397 mm
Frost-free period (average)	171 days
Freeze-free period (average)	197 days
Precipitation total (average)	1,295 mm

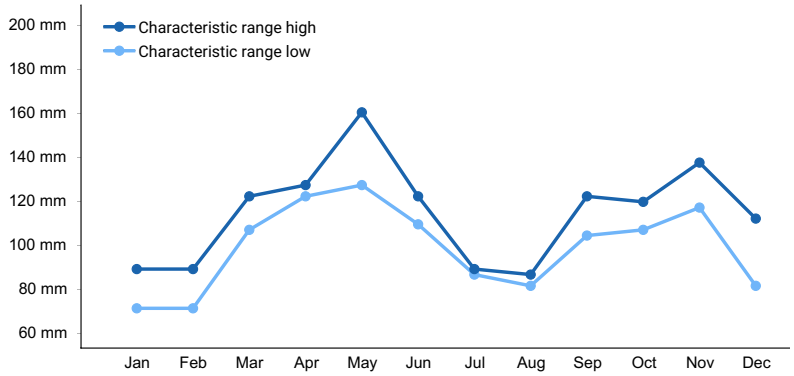


Figure 1. Monthly precipitation range

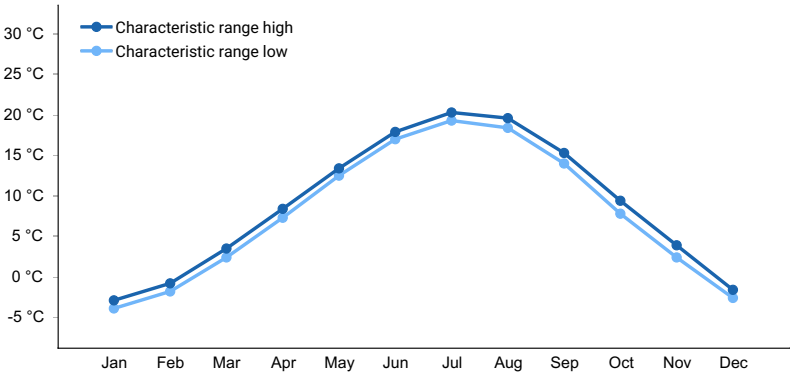


Figure 2. Monthly minimum temperature range

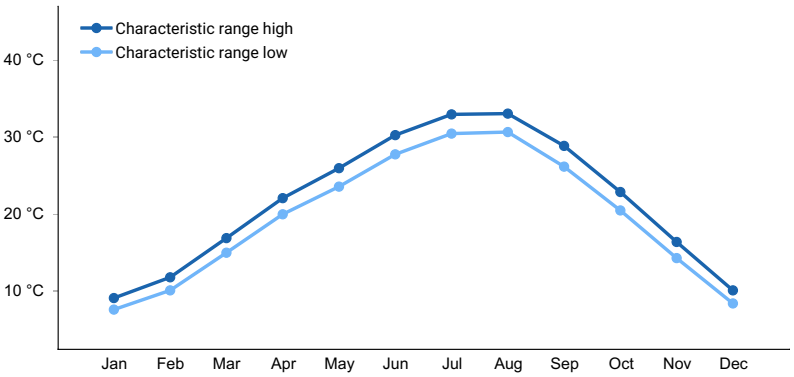


Figure 3. Monthly maximum temperature range

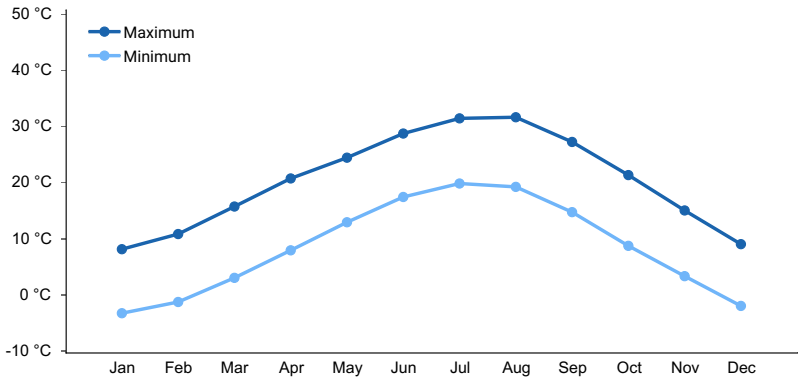


Figure 4. Monthly average minimum and maximum temperature

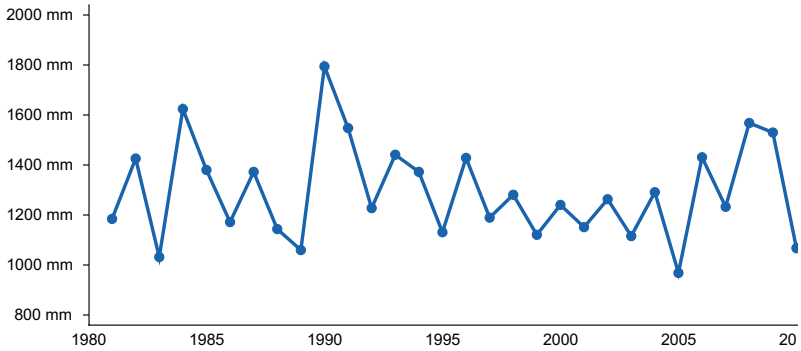


Figure 5. Annual precipitation pattern

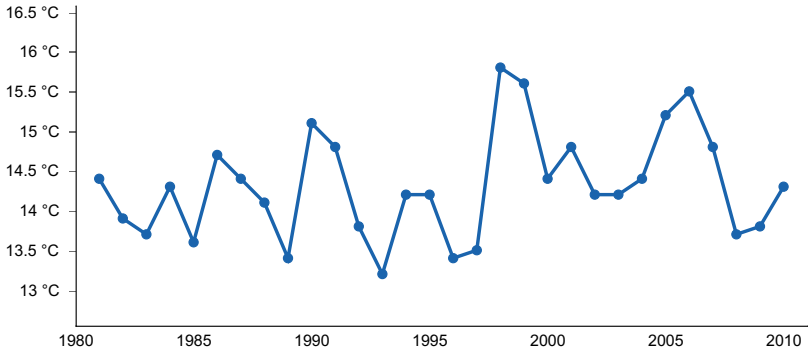


Figure 6. Annual average temperature pattern

Climate stations used

- (1) MTN VIEW [USC00035046], Mountain View, AR
- (2) DEER [USC00031900], Deer, AR
- (3) HUNTSVILLE 1 SSW [USC00033544], Huntsville, AR
- (4) FAYETTEVILLE DRAKE FLD [USW00093993], Fayetteville, AR
- (5) MOUNTAINBURG 2 NE [USC00035018], Mountainburg, AR

Influencing water features

Water features do not significantly influence this ecological site.

Wetland description

Wetlands do not significantly influence this ecological site.

Soil features

The soils associated with this ecological site formed in colluvium from sandstone and shale. The soils are

moderately deep to very deep, are well drained, and have a moderate permeability class. The surface texture is commonly cobbly, gravelly, or stony fine sandy loam. The soils have a particle-size control section with less than 35 percent clay and a Bt horizon within 20 inches (50 cm) of the surface.

The soil series associated with this site are the Fayetteville, Nella, Hartsells, Linker, and Nauvoo Series.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale
Surface texture	(1) Cobbly, gravelly, stony fine sandy loam
Drainage class	Moderately well drained to well drained
Permeability class	Moderate
Soil depth	102–203 cm
Surface fragment cover <=3"	1–7%
Surface fragment cover >3"	1–8%
Available water capacity (Depth not specified)	7.62–15.24 cm
Soil reaction (1:1 water) (Depth not specified)	4.6–5.6
Subsurface fragment volume <=3" (Depth not specified)	1–21%
Subsurface fragment volume >3" (Depth not specified)	1–26%

Ecological dynamics

The Reference State for this ecological site consists of a hardwood forest characterized by mixed hardwood species and a vegetative ground cover. The characteristic tree species for this state are hardwoods such as oak, beech, and hickory (Foti, 2004). Native grass species such as big bluestem, switchgrass, little bluestem, and Indiangrass grow in canopy openings and throughout the understory (Owen, 1858).

Fire significantly influences this ecological site. Historically, the average fire-return interval was likely between 3 and 25 years (Guyette and Spetich, 2003; Hallgren et al., 2012). Some of these wildfires occurred naturally through lightning strikes, but human activities probably caused most of these fires (DeSantis et al., 2010). Native species evolved with and responded well to fire (Spetich and He, 2008; Engle and Bidwell, 2001). Fires on similar upland ecological sites today are likely of moderate to low severity due to forested conditions and lower amounts of ground vegetation (Carey, 1992).

Climate-related events, such as hailstorms, tornados, thunderstorms, and extreme precipitation, occur on this site. Hailstorms 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 the hailstorm (Gower et al., 2015). Tornados can change plant community compositions in savanna ecosystems, favoring hardwoods and eliminating softwoods (Liu et al., 1997). Lightning storms greatly affect ecosystems. Lightning storms generally occur during summer months but can occur during any season. If a fire starts with a lightning strike, the effects on the ecosystem vary depending on the season (Hiers et al., 2000).

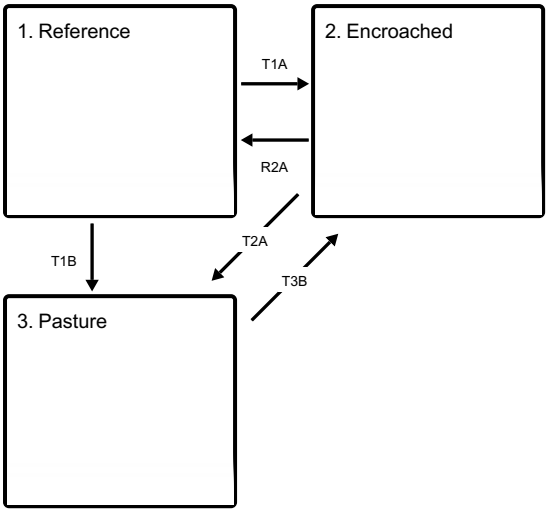
Grazing and farming are feasible for this ecological site. Changes to the ecological dynamics are proportional to the intensity of livestock grazing and can accelerate through overgrazing (Angerer et al., 2016). For example, desirable grasses and forbs repeatedly grazed by livestock become weak and can die, and less desirable species may replace preferable ones (Smith, 1940).

The state-and-transition model for the Loamy Upland Ecological Site consists of three identified states: Reference, Encroached, and Pasture. Because of sparse data availability, the model only explored basic principles and included only a small number of species. Further data collection from this ecological site would provide a greater

understanding of ecological form and function and of resource consumption and distribution.

State and transition model

Ecosystem states



T1A - Woody species encroachment

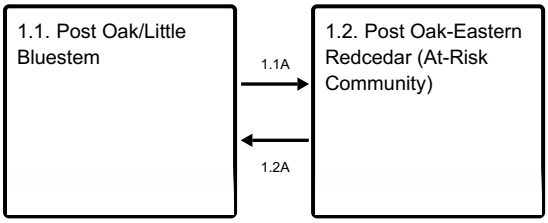
T1B - Tree removal Mechanical and chemical suppression of woody vegetation Tillage Introduction of annual or perennial forage species

R2A - Natural regeneration and disturbance regimes

T2A - Tree removal Mechanical and chemical suppression of woody vegetation Tillage Introduction of annual or perennial forage species

T3B - Lack of management Abandonment

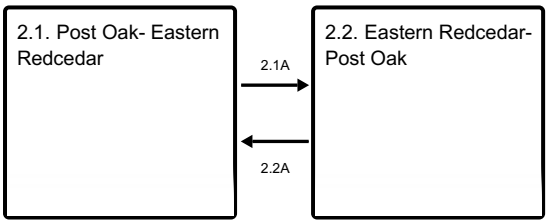
State 1 submodel, plant communities



1.1A - Absence of fire Woody species growth Excessive grazing pressure

1.2A - Wildfire or other disturbance that reduces woody canopy

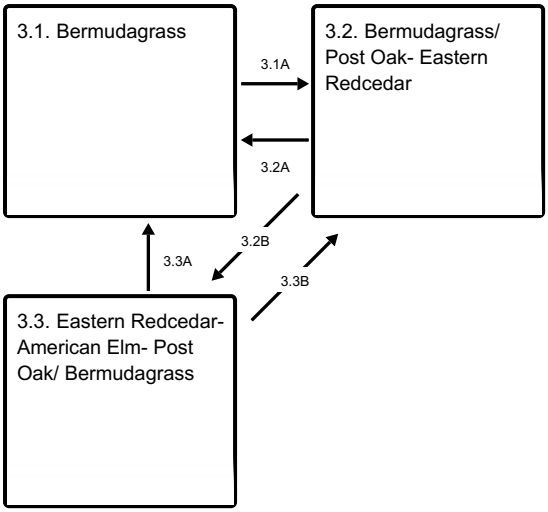
State 2 submodel, plant communities



2.1A - Fire suppression

2.2A - Excessive fire Mechanical tree removal.

State 3 submodel, plant communities



3.1A - Fire suppression

3.2A - Tree removal Brush management

3.2B - Fire suppression

3.3A - Tree removal Brush management

3.3B - Tree removal Brush management

State 1
Reference

The Reference State represents the natural range of variability for the ecological site without major human influences. The main drivers for community pathways within the Reference State are fire frequency intervals between 3 and 25 years (Guyette and Spetich, 2003; Hallgren et al., 2012), climate effects (decadal scale), insect or disease presence or establishment, and wildlife grazing or browsing. Fire is the main feedback mechanism within this state, and fire-tolerant species dominate the ecological site. Fire intervals suppress vegetation growth; wildlife grazing or browsing reduces the amount of grass available. Reduced grass availability lessens fire intensity and causes wildlife migration.

Characteristics and indicators. The Reference State consists of a hardwood forest characterized by mixed hardwoods and sporadic gaps where other vegetation grows. Hardwood species include oak, beech, and hickory (Foti, 2004). Native grass species, such as big bluestem, switchgrass, little bluestem, and Indiangrass, grow in canopy openings and throughout the understory (Arkansas Geological Survey, 2005).

Dominant plant species

- oak (*Quercus*), tree
- beech (*Fagus*), tree
- hybrid hickory (*Carya*), tree
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium*), grass
- Indiangrass (*Sorghastrum*), grass
- switchgrass (*Panicum virgatum*), grass

Community 1.1
Post Oak/Little Bluestem

Oak trees and warm-season, perennial tallgrasses dominate this community phase. Dominant grasses are little bluestem, big bluestem, Indiangrass, and switchgrass. Common trees include post oak, blackjack oak, white oak, and red oak.

Community 1.2

Post Oak-Eastern Redcedar (At-Risk Community)

This community phase has a moderately closed canopy and an understory of tallgrasses and midgrasses. The absence of fire allows post oak, blackjack oak, and eastern redcedar densities to increase. Competition from the denser canopy leads to a reduction in the herbaceous understory.

Pathway 1.1A
Community 1.1 to 1.2

The main drivers for this community pathway are the absence of fire and the growth of woody species. Excessive grazing pressure may also accompany this transition.

Pathway 1.2A
Community 1.2 to 1.1

The main drivers for this community pathway are periodic wildfires that reduce the amount of woody vegetation. Drought and outbreaks of insects, diseases, or both may also result in a reduced woody canopy.

Conservation practices

Prescribed Burning
Prescribed Grazing

State 2
Encroached

The main drivers for community pathways within the Encroached State are the absence of wildfire, seed dispersal by wildlife, climate effects (decadal scale), and canopy density. The main feedback mechanism for community pathways in this state is the dominance of woody species. Woody species shade and outcompete herbaceous species. Fire intensity diminishes, and woody species take control of nutrient and water cycling.

Characteristics and indicators. The Encroached State consists of many woody species (especially eastern redcedar) and significant canopy closure. Time and fire intensity determine the community phases and species abundance and variation. As the woody canopy increases and the Encroached State develops, the hydrology of the ecological site alters. The denser canopy intercepts most precipitation and changes hydrological patterns to favor woody species over herbaceous species. Understory species, therefore, have less available water for growth and must compete with an extensive overstory root system (Zou et al., 2018).

Dominant plant species

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

Community 2.1
Post Oak- Eastern Redcedar

This community phase consists of oak, hickory, beech, and eastern redcedar. The canopy cover increases, thereby causing a reduction in the herbaceous ground cover. Eastern redcedar increases in size and quantity.

Community 2.2
Eastern Redcedar- Post Oak

Eastern redcedar dominates this community phase. Oak, hickory, and beech trees may be present. Oak, hickory, and beech trees experience reduced vigor and reproductive capacity due to shading and competition from eastern redcedar.

Pathway 2.1A
Community 2.1 to 2.2

The absence of wildfire is the main driver for this community pathway and contributes to natural regeneration and increased woody vegetation growth.

Pathway 2.2A
Community 2.2 to 2.1

The main driver for this community pathway is a reduction in canopy cover. As canopy cover decreases, more sunlight reaches the ground, and herbaceous vegetation increases. Increased herbaceous vegetation can lead to fires that reduce woody vegetation. Excessive fire and the mechanical removal of trees contribute to reduced canopy cover.

State 3
Pasture

The Pasture State consists of introduced herbaceous species planted to maximize livestock forage production. The main drivers for community pathways within the Pasture State are the mechanical disturbance of the soil and seed planting, climate effects (decadal scale), seed dispersal, and wildlife and livestock grazing or browsing. The main feedback mechanism for community pathways in this state is the use of mechanical equipment and chemicals to increase forage. Fertilizer inputs and brush management are essential for maintaining high productivity. Wildlife or livestock grazing or browsing reduces the amount of available forage.

Characteristics and indicators. The Pasture State consists of species grown for specific management goals, mainly livestock grazing. Common pasture species include buffalograss, western wheatgrass, little bluestem, sideoats grama, Bermudagrass, and bahiagrass. The quality and quantity of forbs, grasses, and legume species within this state depend on the level of management inputs (seeding, weed management, and land use). Both warm-season and cool-season grasses are suitable for this ecological site.

Dominant plant species

- Bermudagrass (*Cynodon*), grass
- sideoats grama (*Bouteloua curtipendula*), grass
- bahiagrass (*Paspalum notatum*), grass

Community 3.1
Bermudagrass

This community phase consists of herbaceous species planted to maximize forage production for grazing livestock.

Community 3.2
Bermudagrass/ Post Oak- Eastern Redcedar

This community phase consists of herbaceous species planted to maximize forage production for grazing livestock. Improper pasture management allows for the growth of woody species, such as eastern redcedar and oaks.

Community 3.3
Eastern Redcedar- American Elm- Post Oak/ Bermudagrass

This community phase consists of herbaceous species planted to maximize forage production for grazing livestock. Improper pasture management over time allows the growth of woody species, such as eastern redcedar, oaks, and American elm. Woody species encroach on the pasture and dominate resources previously used by forage species.

Pathway 3.1A
Community 3.1 to 3.2

The main drivers for this community pathway are the absence of fire, improper management, and natural

regeneration.

Pathway 3.2A
Community 3.2 to 3.1

The main driver for this community pathway is the removal or reduction of woody species.

Pathway 3.2B
Community 3.2 to 3.3

The main drivers for this community pathway are the absence of fire, improper management, and natural regeneration.

Pathway 3.3A
Community 3.3 to 3.1

The main driver for this community pathway is the removal or reduction of woody species.

Pathway 3.3B
Community 3.3 to 3.2

The main driver for this community pathway is the removal or reduction of woody species.

Transition T1A
State 1 to 2

The main trigger for this transition is the absence of wildfire, which allows woody species to grow and compete for nutrients, water, and sunlight. The main slow variable for this transition is the increased competition for sunlight, nutrients, and moisture resources. Increased overstory competition reduces the vigor and reproductive capacity of the herbaceous understory. The main threshold for this transition is a shift in nutrient cycling (from grass and leaf dominance to leaf and needle dominance). Increased woody canopy cover alters hydrologic cycles, potentially reducing runoff and infiltration and increasing precipitation interception by woody species.

Transition T1B
State 1 to 3

The main triggers for this transition are tree removal, mechanical and chemical suppression of woody vegetation, tillage, and the introduction of annual or perennial forage species. The main slow variables for this transition are increased production and management of forage species. The main thresholds for this transition are changes in soil properties, such as structure, organic matter, and nutrient cycling, and changes in type and frequency of disturbance.

Conservation practices

Brush Management
Prescribed Burning
Land Clearing
Prescribed Grazing

Restoration pathway R2A
State 2 to 1

Restoration efforts for this pathway begin with mechanical and chemical treatment of undesirable woody vegetation and seeding native species. A grazing management plan and the reintroduction of historical disturbance regimes must accompany these initial treatments. Returning to a historical fire interval through prescribed burning helps to suppress woody vegetation and manage invasive species.

Conservation practices

Brush Management
Prescribed Burning

Transition T2A
State 2 to 3

The main triggers for this transition are tree removal, mechanical and chemical suppression of woody vegetation, tillage, and the introduction of annual or perennial forage species. The main slow variables for this transition are increased production and management of forage species. The main thresholds for this transition are changes in soil properties, such as structure, organic matter, and nutrient cycling, and changes in type and frequency of disturbance.

Conservation practices

Brush Management
Prescribed Burning
Land Clearing
Prescribed Grazing

Transition T3B
State 3 to 2

The main trigger for this transition is the lack of management or abandonment. The main slow variables for this transition are increased establishment and increased size of woody species. The main threshold for this transition is woody species dominance. Woody species dominate ecological processes, causing shading and increased competition for soil moisture, nutrients, and sunlight. Woody species dominance reduces the vigor and reproductive capacity of herbaceous species in the understory.

Additional community tables

Animal community

Common wildlife species in this MLRA include whitetail deer, coyote, red fox, gray fox, bobcat, beaver, raccoon, opossum, skunk, muskrat, mink, cottontail, fox squirrel, gray squirrel, bobwhite quail, and mourning dove.

Hydrological functions

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

Public supply—surface water, 24.4%; ground water, 5.1%
Livestock—surface water, 8.1%; ground water, 0.6%
Irrigation—surface water, 0.0%; ground water, 0.0%
Other—surface water, 61.8%; ground water, 0.0%

Total withdrawals average 95 million gallons per day (360 million liters per day). About 6 percent is from groundwater sources, and 94 percent is from surface-water sources. The moderately high precipitation is adequate for crops and pasture. Large reservoirs on a few major streams supply water for municipal purposes, aid in flood control, and provide recreation opportunities. The surface-water quality is generally good, and the water is suitable for most uses. Shallow wells are the principal sources of water for domestic use. Deep wells are necessary for obtaining moderate to large quantities of ground water. Water from the Ozark aquifer system in the northern half of this MLRA is suitable for drinking.

Recreational uses

In this MLRA, mountain biking, camping, fishing, hiking, horseback riding, hunting, mineral prospecting, nature viewing, off-highway vehicle riding, and water activities are available where permitted on public land, and where allowed on private land. The Ozark National Forest makes up a significant portion of this MLRA.

Wood products

Public and private timberland cover large areas throughout this MLRA. Loblolly pine is the most popular species to harvest and provides timber for lumber, pulpwood, posts, and poles. Hardwood species provide timber for 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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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	05/13/2025
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:**