USDA Natural Resources
Conservation Service

Ecological site R077EY056OK
Loamy Upland 16-24" PZ

Last updated: 9/12/2023
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.

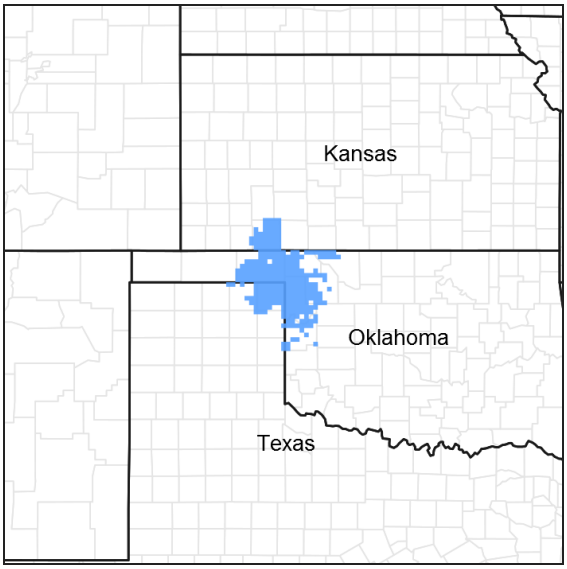


Figure 1. Mapped extent

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): 077E–Southern High Plains, Breaks

MLRA 77E occurs along moderately sloping breaks and steep escarpments associated with dissecting river systems and erosional margins of the Southern High Plains. Soil temperature regime is thermic and soil moisture regime is ustic bordering on aridic. Loamy and sandy soils are generally well drained, range from shallow to deep, and developed in Ogallala Formation sediments.

Classification relationships

This ecological site is correlated to soil components at the Major Land Resource Area (MLRA) level which is further described in USDA Ag Handbook 296.

Ecological site concept

These sites occur on loam and clay loam soils on uplands. Reference vegetation consists of native mid and tallgrass species with forbs and very few woody species. This plant community evolved under periodic fire, grazing, and drought. Abusive grazing may lead to a decline in the more palatable tallgrasses and exclusion of fire can allow woody species to increase across the site. These sites occur predominately in the northeastern portions of the MLRA. In the southern portions, similar soils are correlated to the Clay Loam ecosite.

Associated sites

R077EY061TX	**Mixedland Slopes 16-24" PZ** Very gently to moderately steeply sloping, very deep coarse-loamy soils on higher hillslopes. Tallgrasses and midgrasses dominate with forbs, and few shrub species.
R077EY057TX	**Limy Upland 16-24" PZ** Gently sloping to moderately sloping loamy soils with highly calcareous subsoils on higher hillslopes. Short and mid-grass dominate and with few tall grasses, perennial and annual forbs, and few woody species present.

Similar sites

R077AY015KS	**Loamy Upland 16-22" PZ** A similar site in MLRA 77A with soils formed from fine-silty and fine-loamy eolian deposits in a slightly cooler mesic soil temperature regime.
R077EY051TX	**Clay Loam 16-24" PZ** Similar soils in the warmer and dryer southwestern portions of the MLRA, with dominantly shortgrass species of buffalograss and blue grama.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Andropogon hallii*

Physiographic features

These sites are on nearly level to sloping stream terraces, remnant stream terraces, paleoterraces, and aggraded hillslopes in the Southern High Plains Breaks (MLRA-77E). Slopes range from 0 to 8 percent.

Table 2. Representative physiographic features

Geomorphic position, terraces	(1) Tread
Landforms	(1) Plains > Stream terrace (2) Plains > Paleoterrace (3) Plains > Hillslope (4) Plains > Stream terrace
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	610–914 m
Slope	0–8%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None
Elevation	610–914 m
Slope	0–8%

Climatic features

Climate is a cold semi-arid steppe (Koppen-Geiger classification BSk). Summers are hot and winters are cold. Temperature extremes are common. Humidity is generally low, evaporation is high, and short-term droughts are common. Average annual wind speed is 12 mph with highest winds in early spring. The prevailing wind direction is south. Summertime brings strong high pressure systems that build into heat domes with highs in the upper 90 to mid-100 degree F range. Evaporation in summer is high and open pan evaporation exceeds 6 feet per year. Early autumn temperatures are mild, with Canadian and Pacific cold fronts bringing cold air in mid-autumn throughout winter. Arctic air can settle in and dominate for several weeks during winter with very cold air in place for 2 to 3 weeks at a time.

Most of the precipitation comes in the form of rain from May through September. Rainfall events often occur as intense showers of relatively short duration. Snowfall average is about 17 inches but is also variable from 8 to 36 inches annually. Long term droughts are likely to occur every 15 to 20 years and may last 4 to 5 years. Mean precipitation is around 21 inches but varies significantly from year to year. Rainfall amounts over the last 100 years have varied from as little as 9 inches to as much as 37 inches. The probability is about 70% that precipitation will fall between 14 to 24 inches. Growing season averages 190 days. Average first frost is around October 22, and the last freeze of the season occurs around April 15.

Table 4. Representative climatic features

Frost-free period (characteristic range)	144-156 days
Freeze-free period (characteristic range)	181-194 days
Precipitation total (characteristic range)	559-635 mm
Frost-free period (actual range)	144-163 days
Freeze-free period (actual range)	179-196 days
Precipitation total (actual range)	559-660 mm
Frost-free period (average)	150 days
Freeze-free period (average)	187 days
Precipitation total (average)	584 mm

Climate stations used

- (1) GATE [USC00343489], Gate, OK
- (2) FOLLETT [USC00413225], Follett, TX
- (3) MEADE [USC00145171], Meade, KS
- (4) BEAVER [USC00340593], Beaver, OK
- (5) COLDWATER [USC00141704], Coldwater, KS
- (6) REYDON 2SSE [USC00347579], Reydon, OK
- (7) LIPSCOMB [USC00415247], Booker, TX
- (8) CANADIAN [USC00411412], Canadian, TX

Influencing water features

Well drained soils with negligible to high runoff. No influencing water features.

Wetland description

Soils in this ecological site are not part of wetland ecosystems.

Soil features

Soils are mapped for each county within the MLRA. Mapunits are representations of the major soil series component(s) and named accordingly. Each Mapunit is spatially represented on a digital soils map as polygons of

different shapes and sizes. Within these Mapunits, there are often minor soil series components included. These minor components are soils that occur within a Mapunit polygon but are of small extent (15% or less of the Mapunit area). However, it is difficult to separate these minor soils spatially due to the scale of soil mapping.

Ecological sites are correlated at the component level of the soil survey. Therefore, a single Mapunit may contain multiple Ecological Sites just as it may contain multiple soil components. This is important to understand when investigating soils and Ecological Sites. A soil survey Mapunit may be correlated to a single Ecological Site based on the major component; however, there may be inclusions of areas of additional Ecological Sites which are correlated to the minor components of that particular soil Mapunit.

This group of soils consists of very deep, well drained, and moderately permeable soils that formed in loamy, calcareous, alluvium of Holocene or late Pleistocene age. These soils occur on stream terraces or stream terrace remnants. They commonly have loam or silt loam surface textures, fine-silty or fine-loamy argillic horizons, and a calcic horizon in the subsoil. Slopes range from 0 to 8 percent. Runoff is negligible to medium dependent upon the slope.

Representative soil components for this site include: Abbie, Chiquita, Irene, and Kroeker.

Table 5. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loam (2) Silt loam
Family particle size	(1) Fine-loamy (2) Fine-silty
Drainage class	Well drained
Permeability class	Moderate
Soil depth	203 cm
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	11.43–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	0–45%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–3
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.4
Subsurface fragment volume <=3" (0-101.6cm)	0–7%
Subsurface fragment volume >3" (0-101.6cm)	0%

Ecological dynamics

The information contained in the State and Transition Diagram (STD) and the Ecological Site Description was developed using archeological and historical data, professional experience, and scientific studies. The information presented is representative of a very complex set of plant communities. Not all scenarios or plants are included. Key indicator plants, animals and ecological processes are described to inform land management decisions.

Like many ecosites throughout the great plains, the Loamy Upland site evolved under periodic fire and grazing

events. The deep loamy soils support the growth of palatable vegetation for grazing and browsing animals. In the reference condition this vegetation is also capable of carrying fires across the landscape which, historically, has limited the encroachment of woody species. The deep rooted tallgrass species and good ground cover facilitated capture and infiltration of precipitation.

However, these productive soils were often overutilized by cattlemen or plowed up by the farmsteaders in the early 1900s. This lead to widespread erosion in some areas and depletion of the soil resources. While farming has ceased on many of these upland sites, abusive grazing practices still persist. Most acres that were farmed have been planted back to introduced species such as irrigated Bermudagrass, old world bluestems, or in some cases native species. While the monocultures of introduced species can address the soil erosion on these sites, they do little to restore the hydrologic or ecological function.

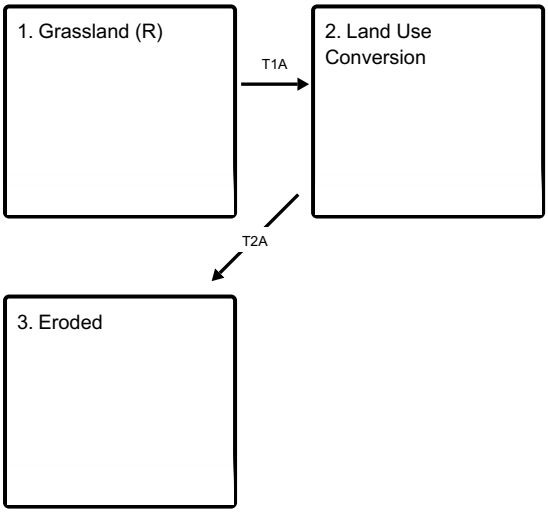
In the absence of prescribed fire or alternative brush management, woody species are likely to increase in abundance and stature. While these woody species may not increase enough to dominate ecological functions on the site, their presence can impact grazing access and wildlife habitat needs. It is important to note that mesquite is not found in abundance on these sites like it is on similar soils further south in the MLRA.

State and Transition Diagram:
A State and Transition Diagram for the Loamy Upland (R077EY056OK) site is depicted below. Thorough descriptions of each state, transition, and pathway follow the model. Experts base this model on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.
Plant communities will differ across the MLRA because of the natural variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal; other vegetative states may be desired plant communities as long as the Range Health assessments are in the moderate and above category. The biological processes on this site are complex. Therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site. Composition by dry weight and percent canopy cover are provided to describing the functional groups. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs).

The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances. It does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and transition model

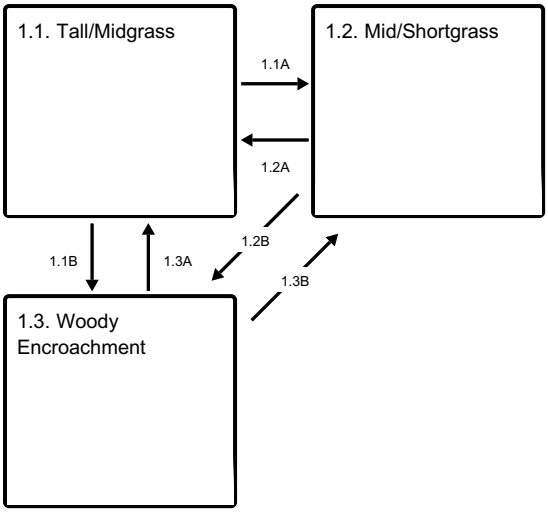
Ecosystem states



T1A - Extensive soil disturbance and introduction of improved forage species

T2A - Extensive soil disturbance and active soil erosion

State 1 submodel, plant communities



State 1
Grassland (R)

This is the reference or diagnostic community for the site. The description is based on early range site descriptions, clipping data, professional consensus of experienced range specialists, and analysis of field work.

Dominant plant species

- little bluestem (*Schizachyrium scoparium*), grass
- sand bluestem (*Andropogon hallii*), grass

Community 1.1
Tall/Midgrass

Figure 8. Reference community 1.1 Meade County KS

This is the reference community for the Loamy Upland site. The vegetation is dominated by mixed tallgrasses and midgrasses, mainly sand and little Bluestem. Sideoats grama may be abundant along with many perennial forbs and legumes. Minor amounts of woody species may occur including skunkbush, hackberry, or sandplum. Total annual production for this community is estimated to range from 1500 to 3500 pounds per acre.

Community 1.2
Mid/Shortgrass

This plant community is dominated by mid and shortgrasses such as sideoats grama and blue grama. Other species may include dropseed species, silver bluestem and some remnant little bluestem. There has been an increase in annual forbs and bare ground. With the absence of tallgrasses, the forage base for grazing livestock has been diminished and infiltration rate may have declined also.

Community 1.3
Woody Encroachment

This community phase has been encroached upon by woody species such as eastern Redcedar, Siberian elm, or others. While the woody species may not take expand enough to dominate the hydrologic or energy flow across the site, this is still an important community shift to identify. Particularly from a wildlife habitat standpoint.

Pathway 1.1A
Community 1.1 to 1.2

Abusive grazing practices that include stocking above carry capacity without adequate rest may push this community towards community 1.2 as the more palatable species are damaged. Additionally, long periods of drought may hinder the vigor of some of the tallgrasses and favor the more drought tolerant mid and short grasses.

Pathway 1.1B
Community 1.1 to 1.3

In the absence of fire or alternative brush management, woody species may encroach on the site pushing it to community 1.3.

Pathway 1.2A
Community 1.2 to 1.1

Through adequate rest from grazing and favorable growing season precipitation, this community may be shifted back to the reference community.

Pathway 1.2B
Community 1.2 to 1.3

In the absence of fire or alternative brush management, woody species may encroach on the site pushing it to community 1.3.

Pathway 1.3A
Community 1.3 to 1.1

Through the implementation of a prescribed fire or brush management program, couple with prescribed grazing, this community may be shifted back to the reference community.

Pathway 1.3B
Community 1.3 to 1.2

Through the implementation of a prescribed fire or brush management program without prescribed grazing, this community may be shifted to community phase 1.2.

State 2
Land Use Conversion

This is an alternative state from the reference. Hydrologic and ecological functions have been altered. The site is in current crop production or has been tilled and seeded to an introduced forage. The hydrology has been altered and requires different management. See Soil Survey or Extension publications for yield data.

State 3
Eroded

This is an alternative state from the reference. Hydrologic and ecological functions have been altered. This state is the result of water erosion over bare soil. Most of the "A" horizon of the soil profile has been displaced. The remaining subsoil is very low in fertility. Some native grasses and forbs will persist in this state, however, production

is greatly reduced.

Transition T1A
State 1 to 2

Through tillage and seeding this site will transition to state 2.

Transition T2A
State 2 to 3

Cultivation of these sites has often lead to severe water and wind erosion.

Additional community tables

Inventory data references

Old range site descriptions, condition class worksheets, and soil survey manuscripts were used in the development of this provisional ESD.

Other references

USDA-NRCS (Formerly Soil Conservation Service) Range Site Descriptions (1960s)
USDA-NRCS (Formerly Soil Conservation Service) Ag Handbook 296 (2006)

Contributors

Colin Walden Range Specialist Stillwater OK
Steven McGowen, MLRA Office Leader, NRCS, Woodward, OK

Approval

Bryan Christensen, 9/12/2023

Acknowledgments

Site Development and Testing Plan
Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.
Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

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:**
