Ecological site R080AY010OK
Claypan Upland (North)

Last updated: 9/19/2023
Accessed: 06/21/2026

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): 080A–Central Rolling Red Prairies

MLRA 80A is characterized by dark red Permian sandstones or shales that are exposed on gently sloping plains. The dominant soil order in this MLRA is Mollisols. The soils in the area dominantly have a thermic soil temperature regime, an ustic soil moisture regime, and mixed, siliceous, or smectitic mineralogy. They generally are shallow to very deep, are well drained, and generally are loamy or clayey. These plains are dissected by rivers that flow from northwest to southeast. Major rivers of this MLRA include the Chickaskia and Bluff rivers in KS, the Salt Fork, Cimarron, North and South Canadian, Washita, Cache, Red River in OK, and branches of the Wichita River in TX.

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 upland topography over deep soils weathered from shales or clays. The representative soils are mollisols, however, this site differs from the Loamy Upland site due to the dense clay subsoils (Claypan) that can limit plant available water and lead to lower productivity. The reference grassland state is a mixture of tallgrasses, midgrasses, forbs , and occasional shrubs.

Associated sites

R080AY056OK	**Loamy Upland** Adjacent upland site. Loamy surface, lacks abrupt textural change.

Similar sites

R080AY011OK	**Claypan Upland (South)** R080AY011OK lays south of R080AY010OK beginning at Interstate 40. The sites are very similar for several miles north and south of the interstate.
R080AY056OK	**Loamy Upland** Adjacent upland site. Loamy surface, lacks abrupt textural change.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Amorpha canescens*
Herbaceous	(1) *Schizachyrium scoparium* (2) *Silphium laciniatum*

Physiographic features

This site is an upland site on hills and paleoterraces. Slopes vary from 1 to 5 percent. The site may receive some run-on water from uphill sites and also shed water via run-off to sites downslope.

Figure 1. Claypan Prairie

Table 2. Representative physiographic features

Landforms	(1) Plains > Hill (2) Plains > Paleoterrace
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	210 – 460 m
Slope	0 – 10 %
Ponding depth	0 cm
Water table depth	200 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by moist, cool, springs; hot, often dry summers; mild autumns; and mild to cold winters. Variation in timing and amounts of precipition from year to year is quite common. Drought cycles range from three to five years duration with occasionally longer periods occurring at unpredictable intervals. Above normal rainfall cycles are usually just as random, but shorter in duration.

Table 3 Representative climatic features

Frost-free period (characteristic range)	180-190 days
Freeze-free period (characteristic range)	200-220 days
Precipitation total (characteristic range)	810-990 mm
Frost-free period (actual range)	170-190 days
Freeze-free period (actual range)	200-230 days
Precipitation total (actual range)	790-1,020 mm
Frost-free period (average)	190 days
Freeze-free period (average)	210 days
Precipitation total (average)	890 mm

- (1) CUSHING [USC00342318], Cushing, OK
- (2) GEARY [USC00343497], Calumet, OK
- (3) MEEKER 5 W [USC00345779], Meeker, OK
- (4) NORMAN 3SSE [USC00346386], Norman, OK
- (5) OKEENE [USC00346629], Okeene, OK
- (6) PONCA CITY MUNI AP [USW00013969], Ponca City, OK
- (7) CHEROKEE 4W [USC00341724], Cherokee, OK
- (8) CHICKASHA EXP STATION [USC00341750], Chickasha, OK
- (9) ANTHONY [USW00013980], Anthony, KS

Influencing water features

This site's dense clayey subsoils slow moisture infiltration. Surface soils may become saturated and remain extremely wet for extended periods of time following heavy rainfall events. Subsoils have the ability to store water, but this water is tightly held by clay particles, so, during periods of below normal precipitation, plants stress quickly.

Wetland description

NA

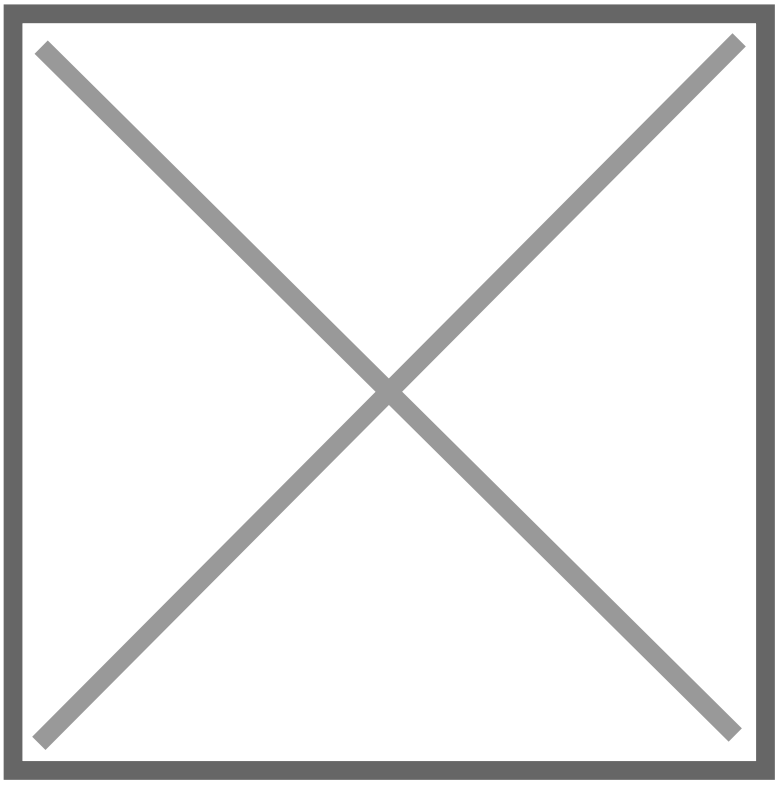

Figure 8.

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 inclusional areas of additional Ecological Sites which are correlated to the minor components of that particular soil Mapunit.

Representative soil components for this site include:
Agra, Kirkland, & Renfrow

These are silt loam to clay loam surface textured soils, eight to twelve inches deep, with compact blocky clay subsoils.

Table 4. Representative soil features

Parent material	(1) Residuum – clayey shale
Surface texture	(1) Silt loam (2) Clay loam (3) Silty clay loam
Drainage class	Moderately well drained to well drained

Permeability class	Very slow to slow
Soil depth	70 – 250 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	5.08 – 20.32 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	5.6 – 8.4
Subsurface fragment volume <=3" (Depth not specified)	0 – 40 %
Subsurface fragment volume >3" (Depth not specified)	0 – 30 %

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Soil depth	Not specified

Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	Not specified
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

Like many sites across the Great Plains, this Claypan Upland site evolved under periodic disturbances by fire, drought, and grazing (Frost 1998, Fuhlendorf 2009). The soils are well suited for herbaceous plant growth but are somewhat limited by their dense clay subsoil. The potential of the clay subsoil to restrict plant available water makes the site more susceptible to influence by drought the the loamy upland sites. However, the reference state of this site is very resilient to natural disturbances. Alternative land uses include cropland and pastureland. Alternative states within the rangeland land use include a woody encroached state, a reseeded state and an eroded state.

The reference state for this site is dominated by warm-season perennial grasses. The composition consists of fluctuating tallgrasses and midgrasses interspersed with numerous perennial warm-season forbs. A small component of cool-season grasses and forbs occurs on this site. The dominant grasses and forbs have evolved under extreme conditions of excessive moisture and extended drought. Grazing by large herbivores and fire were both common during the development of this reference state.

The soils typically have dense clayey subsoils that greatly influence plant growth. Clayey subsoils slow moisture infiltration. Surface soils may become saturated and remain extremely wet for extended periods of time following heavy rainfall events. Subsoils may store large amounts of water, but usually this moisture is tightly held (bonded) so, during periods of below normal precipitation, plants stress quickly.

The absence of fire or alternative brush management can lead to the increase of woody species on the site. The woody species begin to dominate ecological processes (hydrology, energy flow, etc.) and transition the site to the woody state (Scholtz, 2018).

Historically, the focus of conservation efforts has been on proper stocking rates and restoration of the woody encroached sites across the Great Plains. However, new research suggests that a more effective strategy involves addressing woody plants in the seed dispersal stage prior to the change in ecological states. Preserving intact prairie for both agricultural production and ecosystem services must become a priority for land managers and conservationist alike.

Additionally, the site is well suited for crop production and a large portion of the site remains in the cultivated state of the cropland land use.

This site has the potential to be converted to a variety of introduced monocultures. This requires cultivation, seeding or sprigging, and fertilization. There are eroded soils mapped in Claypan Upland ESD, so an eroded state has been added to the State and Transition Model. This state is usually a result of cultivation and water erosion.

State and Transition Diagram:
A State and Transition Diagram for the Claypan Upland (R080AY010OK) is depicted below. Descriptions of each state, transition, and pathway follow the model. Experts based 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.

State and transition model

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1				1341-2309	
	big bluestem	ANGE	*Andropogon gerardii*	912-1569	–
	switchgrass	PAVI2	*Panicum virgatum*	269-466	–
	Indiangrass	SORGH	*Sorghastrum*	130-233	–
	eastern gamagrass	TRDA3	*Tripsacum dactyloides*	40-72	–
2				942-1632	
	little bluestem	SCSC	*Schizachyrium scoparium*	1177-2040	–
3				471-807	
	dropseed	SPORO	*Sporobolus*	176-303	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	98-168	–
	blue grama	BOGR2	*Bouteloua gracilis*	65-112	–
	thin paspalum	PASE5	*Paspalum setaceum*	65-112	–
	marsh bristlegrass	SEPA10	*Setaria parviflora*	31-56	–
	Florida paspalum	PAFL4	*Paspalum floridanum*	31-56	–
	silver bluestem	BOSA	*Bothriochloa saccharoides*	31-56	–
	fall witchgrass	DICO6	*Digitaria cognata*	26-45	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	26-45	–
	white tridens	TRAL2	*Tridens albescens*	20-34	–
	purpletop tridens	TRFL2	*Tridens flavus*	20-34	–
4				202-350	
	Canada wildrye	ELCA4	*Elymus canadensis*	131-224	–
	Virginia wildrye	ELVI3	*Elymus virginicus*	65-112	–
	western wheatgrass	PASM	*Pascopyrum smithii*	65-112	–

	sedge	CAREX	*Carex*	52-90	–
	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	46-78	–
	winter bentgrass	AGHY	*Agrostis hyemalis*	26-45	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	13-22	–
	prairie wedgescale	SPOB	*Sphenopholis obtusata*	13-22	–
Forb					
5				128-233	
	compassplant	SILA3	*Silphium laciniatum*	98-168	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	98-168	–
	white heath aster	SYER	*Symphyotrichum ericoides*	46-78	–
	greenthread	THELE	*Thelesperma*	33-56	–
	ashy sunflower	HEMO2	*Helianthus mollis*	33-56	–
	dotted blazing star	LIPU	*Liatris punctata*	33-56	–
	whitest evening primrose	OEAL	*Oenothera albicaulis*	33-56	–
	cobaea beardtongue	PECO4	*Penstemon cobaea*	33-56	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	33-56	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	33-56	–
	false boneset	BREU	*Brickellia eupatorioides*	33-56	–
	pale purple coneflower	ECPA	*Echinacea pallida*	33-56	–
	prairie fleabane	ERST3	*Erigeron strigosus*	33-56	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	28-56	–
	Canada goldenrod	SOCA6	*Solidago canadensis*	33-56	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	33-56	–
	azure blue sage	SAAZ	*Salvia azurea*	33-56	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	26-45	–
	Texas goldentop	EUGY	*Euthamia gymnospermoides*	20-34	–
	fringeleaf wild petunia	RUHU	*Ruellia humilis*	20-34	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	20-34	–
	hoary verbena	VEST	*Verbena stricta*	13-22	–
	stiffstem flax	LIRI	*Linum rigidum*	13-22	–
	Carolina larkspur	DECA3	*Delphinium carolinianum*	13-22	–
	rainlily	COOPE	*Cooperia*	7-11	–
6				99-175	
	Illinois bundleflower	DEIL	*Desmanthus illinoensis*	46-78	–
	littleleaf sensitive-briar	MIMI22	*Mimosa microphylla*	46-78	–
	slimflower scurfpea	PSTE5	*Psoralidium tenuiflorum*	33-56	–
	lespedeza	LESPE	*Lespedeza*	33-56	–
	groundplum milkvetch	ASCR2	*Astragalus crassicarpus*	20-34	–
	smallflowered milkvetch	ASNU4	*Astragalus nuttallianus*	20-34	–
	white prairie clover	DACA7	*Dalea candida*	20-34	–
	prairie clover	DALEA	*Dalea*	20-34	–
Shrub/Vine					
7				0-58	
	leadplant	AMCA6	*Amorpha canescens*	0-58	–
	ceanothus	CEANO	*Ceanothus*	0-58	–
	smooth sumac	RHGL	*Rhus glabra*	0-58	–

	coralberry	SYOR	*Symphoricarpos orbiculatus*	0-58	–

Table 7. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 5.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 7.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

This site is suited for grazing cattle. Quail utilize the site for food, nesting, and occasional cover. Coyote, badger, skunk, cottontail rabbit and ground squirrels are common. There is some site use by whitetail deer. Hawks, including the red-tailed hawk, Coopers' hawk, Rough-legged hawk, sparrow hawk and marsh hawk utilize this site for hunting prey.

Hydrological functions

These upland site may shed some water via runoff during heavy rain events. The presence of good ground cover and deep rooted grasses can help facilitate infiltration and reduce sediment loss. As residue height decreases, run off during storm events may increase.

Recreational uses

N/A

Wood products

N/A

Other products

N/A

Other information

N/A

Inventory data references

Information presented has been derived from NRCS clipping data, research from Oklahoma State University, field observations and measurements by trained range personnel. Most of the clipping data was gathered by a team consisting of a range conservationist and a soil scientist and was site/soil specific. Yields were taken at the end of the growing season and, as near as possible, were obtained from areas that were un-grazed that year. Clipping data repository is in the NRCS State Office in Stillwater, OK. Data from NRI collections and field sampling was also used in the development of this ESD.

Type locality

Location 1: Payne County, OK	
Township/Range/Section	T18N R1E SNW3

General legal description	OSU CTER NW3-T18N-R1E

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Contributors

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Approval

Bryan Christensen, 9/19/2023

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)	Mark Moseley, Harry Fritzler, Steve Glasgow, Jack Eckroat
Contact for lead author	100 USDA Suite 206 Stillwater, OK 74074
Date	04/01/2005
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** **There are few, if any, rills and there is no active headcutting and sides are covered with vegetation.**

2. **Presence of water flow patterns:** **There is some evidence of soil deposition or erosion, particularly after significant rain events, but water generally flows evenly over the entire landscape.**

3. **Number and height of erosional pedestals or terracettes:** **There should not be any evidence of erosional pedestals or terracettes on this site.**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** **There is ~5% bare ground on this site. Bare areas are small and not connected.**

5. **Number of gullies and erosion associated with gullies:** **None, drainages are represented as natural stable channels; vegetation is common with no signs of erosion.**

6. **Extent of wind scoured, blowouts and/or depositional areas:** **None.**

7. **Amount of litter movement (describe size and distance expected to travel):** Uniform distribution of litter. Litter rarely moves >6 inches on flatter slopes and may be as much as doubled on steeper slopes, then only during high intensity storms.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Surface soil is stabilized (Stability Score 5 – 6). Stability scores based on a minimum of 6 samples tested.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A horizon: 0 to 13 inches; silt loam, clay loam, medium granular structure. Btssl horizon: 13 to 25 inches; reddish brown clay, moderate medium blocky structure. Refer to specific description for component sampled.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration and runoff are not affected by any changes in plant community composition and distribution. (Tallgrass dominated). Any changes in infiltration and runoff can be attributed to other factors (e.g. compaction).

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** There is usually no compaction layer. Naturally dense subsoil may be mistaken for a compaction layer.

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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: Tallgrasses

    Sub-dominant: Midgrasses, Shortgrasses

    Other: Forbs, Cool-Season Perennial Grasses, Shrubs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** There is some plant mortality and decadence on the perennial grasses, especially in the absence of fire and herbivory, but usually <5%.

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14. **Average percent litter cover (%) and depth (in):** Litter should cover 50-75% of the area between plants with accumulations of .25-1 inch deep.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Normal production is 2838-4964 pounds per acre.

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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: No invasive species. Invasives might include: eastern redcedar, bois d'arc, mesquite, annuals and non-natives.**

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17. **Perennial plant reproductive capability: All plants capable of reproducing at least every 2 years. Seed stalks, stalk length, and seedheads are numerous and what would be expected. Overall health of plants is what would be expected.**
