USDA Natural Resources Conservation Service

Ecological site R085BY002OK
Clay Upland 38-42 PZ

Last updated: 9/21/2023
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 085B–Arbuckle Uplift

The Grand Prairie MLRA is characterized by predominately loam and clay loam soils underlain by limestone and shale. Topography transitions from steeper ridges and summits of the Lampasas Cut Plain on the southern end to the more rolling hills of the Fort Worth Prairie to the north. The Arbuckle Mountain area in Oklahoma is also within this MLRA. In the structurally complex Arbuckle Mountains of southern Oklahoma, outcropping rocks are primarily limestone, sandstone, dolomite, quartzite, and chert. These units are exposed as alternating beds of Paleozoic rocks that have been faulted, tilted, and deformed to form a tombstone-like topography. This area has significant exposures of granite, rhyolite, and gabbro of Precambrian age.

Classification relationships

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

Ecological site concept

These sites occur on clay and clay loam soils on uplands. The reference vegetation includes tallgrasses and a variety of forbs and legumes. Few woody species occur when in reference condition. However, in the absence of fire or other brush management woody species will increase across the site. The soils associated with these sites can be quite productive but may be more susceptible to drought conditions than loamy sites. Many of these sites were farmed during early settlement and some are still in crop production.

Associated sites

R085BY056OK	**Loamy Upland 38-42 PZ** Loamy soils on uplands
R085BY076OK	**Savannah 38-42 PZ** Similar soils in the southern portion of Grand Prairie

Similar sites

R085AY177TX	**Blackland 30-38" PZ** Similar soils in the southern portion of Grand Prairie

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Andropogon gerardii* (2) *Sorghastrum nutans*

Physiographic features

This site occurs on treads of paleoterraces or stream terraces and on base slopes, side slopes, and interfluves of hillslopes in the Arbuckle Uplift. Slopes are typically less than 3 percent.

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Stream terrace (2) Alluvial plain > Paleoterrace (3) Hills > Hillslope
Runoff class	High to very high
Elevation	198–396 m
Slope	0–3%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Climatic features

The climate is moist subhumid with average annual rainfall from 37 to 42 inches per year. The highest percentages in rainfall occur during April, May and June. More years of below average rainfall can be expected than those above average. Winters are characterized by mild temperatures with occasional “Northers” which can produce severe cold for short periods of time. Average wind velocities can be high in the Southern Great Plains during February, March and April causing erosion on unprotected surfaces.

Table 3. Representative climatic features

Frost-free period (characteristic range)	187-200 days
Freeze-free period (characteristic range)	204-224 days
Precipitation total (characteristic range)	991-1,067 mm
Frost-free period (actual range)	184-207 days
Freeze-free period (actual range)	201-225 days
Precipitation total (actual range)	965-1,067 mm
Frost-free period (average)	194 days
Freeze-free period (average)	212 days
Precipitation total (average)	1,041 mm

Climate stations used

- (1) CHICKASAW NRA [USC00341745], Sulphur, OK
- (2) ARDMORE [USC00340292], Ardmore, OK
- (3) ADA [USC00340017], Ada, OK
- (4) PAULS VALLEY 4 WSW [USC00346926], Pauls Valley, OK
- (5) MADILL [USC00345468], Madill, OK

Influencing water features

Dense clay soils can restrict or slow water infiltration. However, the presence of deep rooted tallgrass can help facilitate infiltration into the soil profile.

Wetland description

NA

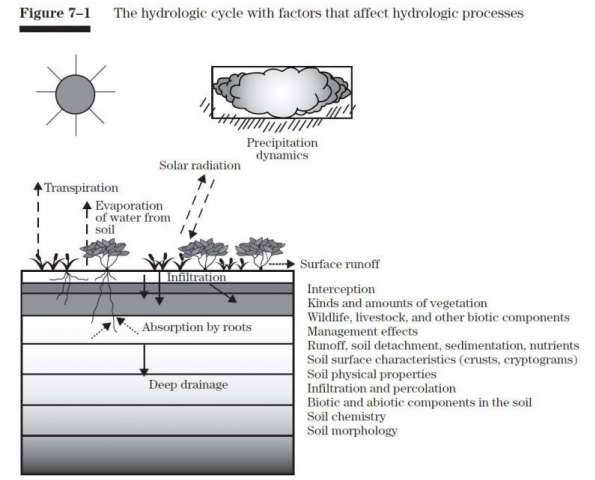


Figure 8.

Soil features

Representative soil components for this ecological site include: Burleson, Clarita, Ferris, Heiden, Tussy

The site is characterized by clayey, very slowly permeable soils.

Table 4. Representative soil features

Parent material	(1) Alluvium–conglomerate (2) Alluvium–shale (3) Residuum–conglomerate (4) Residuum–shale
Surface texture	(1) Clay (2) Silty clay
Drainage class	Moderately well drained to well drained
Permeability class	Very slow
Soil depth	102 cm
Surface fragment cover <=3"	0–1%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	15.24–25.4 cm
Calcium carbonate equivalent (0-101.6cm)	0–40%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–8.4

Subsurface fragment volume <=3" (0-101.6cm)	0–15%
Subsurface fragment volume >3" (0-101.6cm)	0–5%

Ecological dynamics

Like many sites across the Great Plains, changes in disturbance initiated by permanent settlements has had a profound impact on the ecological dynamics of these sites. Historically, the site was influenced by periodic fires during all seasons of growth. These fires were often the result of dry lightning strikes and/or anthropogenic fires set by Native Americans. The fire frequency during the period prior to settlement is estimated between 2-5 years for the southern Great Plains. These frequent fires were often followed by grazing of migratory bison herds attracted to the new growth of grass. This led to a shifting mosaic between burned/grazed and unburned and ungrazed landscapes.

With the removal of fire and the introduction of conventional livestock fencing, the landscape began to change to more homogenous vegetation patterns and altered plant communities. Gently sloping sites like the Clay Upland site were often broken out for crop production also. This led to a highly fragmented, highly disturbed landscape we see today across much of the area.

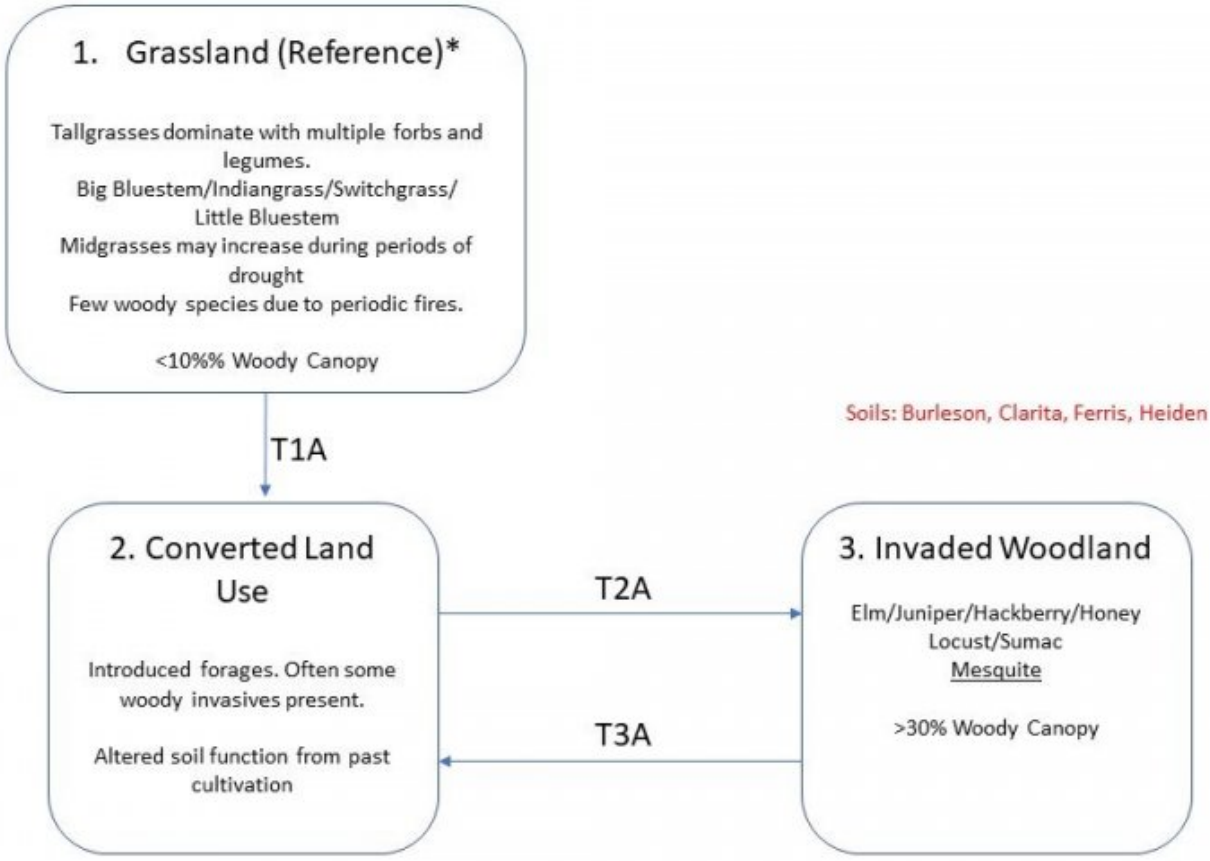
Less fire tolerant woody species are more prevalent in many areas due to fire suppression and/or the use of strictly dormant season fires. Abusive grazing can shift the plant community to less palatable grass species and lead to an increase in opportunistic forbs. Heavy grazing can also reduce fine fuel load and limit the ability to conduct a prescribed fire.

State and Transitional Pathways:
The following diagram suggests some pathways that vegetation on the site might take in response to various treatments or natural stimuli over time. There may be other states that are not shown on this diagram. This information identifies the changes in plant communities that do occur due to management practices and natural factors. The plant communities described here are commonly observed on this ecological site. The local NRCS field office has information available to assist with planning and development of the plant community for specific purposes.

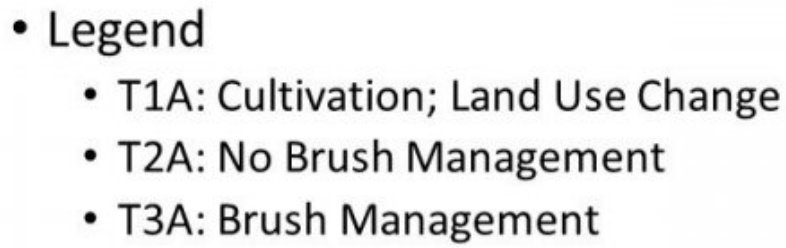
Changes in plant community makeup may be due to many factors. Change may occur slowly or in some cases, fairly rapidly. As vegetative changes occur, certain thresholds are crossed. A threshold means that once a certain point is reached during the transition of one community to another, a return to the previous state may not be possible without the input of some form of energy. This often means intervention with practices that are not part of natural processes. An example might be the application of herbicide to control some woody species to reduce their population and encourage more grass and forbs growth. Merely adjusting grazing practices would probably not accomplish any significant change in a plant community once certain thresholds are crossed. The amount of energy required to effect change in community would depend on the present vegetative state and the desired change.

State and transition model

Clay Upland R085XY002OK



*Note: The majority of these soils have been converted to cropland or introduced pasture species



State 1
Grassland

This is the reference state for the Clay Upland ecological site. It represents the historic range of variability in the plant communities with the periodic disturbance of fire and grazing. It is dominated by herbaceous plants with few woody species. The dominant grasses are big bluestem, Indiangrass, switchgrass and little bluestem. Other grasses include Texas cupgrass, sideoats grama, dropseeds, silver bluestem and Scribner's panicum. Dominant forbs include compassplant, Engelmann daisy, sunflowers, western ragweed, heath aster, poppymallows and pitcher sage. Legumes include wild indigo, leadplant, Illinois bundleflower, scurfpea, and native lespedezas. Few woody species persist in reference condition but may include sumacs, sand plum, coralberry, persimmon and blackberry. The Clay Upland site is estimated to produce between 3,500 – 7,000 pounds of vegetative production per year in reference condition. Tallgrasses Midgrasses Forbs Shrubs and Trees are a minor component of these sites.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass

Community 1.1

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	3335	4764	6669
Forb	392	560	785
Shrub/Vine	157	224	314
Tree	39	56	78
Total	**3923**	**5604**	**7846**

State 2
Converted Land Use

Figure 10. Burlseson soils. Carter County, OK

This state represents a change in land use from rangeland to pastureland. The soil structure and biology has been altered and the site is dominated by introduced species. Management of introduced forages requires more inputs than native grasses. Careful consideration should be taken prior to planting to ensure the result meets the desired use. Ratings for forage yields can be found under the non-irrigated crop yield section in web soil survey. As with any fertility management program, current soil tests should be taken before planting and subsequent fertilization of introduced pastures. The most common forage species on these sites include Bermudagrass and Old World Bluestems(eg. KR Bluestem). Without brush management, woody species such as mesquites, junipers, elms, or honey locust may invade these sites. There may be opportunities to plant native grass species on these sites to restore the reference plant communities. The success of this type of restoration is highly variable and depends on the remaining soil resources and past management. This type of endeavor often requires site specific planning and evaluation. However, the species described in the reference state are a good resource for initial planning of any restoration project.

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass

State 3
Invaded Woodland

This state describes the invaded, woody dominated plant community of the Clay Upland site. The ecological processes are dominated by woody species including mesquite, honey locust, elm, and juniper species. Some herbaceous plants persist under the woody canopy or in interspaces. Usually, shade tolerant species like Texas wintergrass are prominent herbaceous components in this community. There may also be an increase in prickly pear in this state.

Dominant plant species

- Texas wintergrass (*Nassella leucotricha*), grass

Transition T1A
State 1 to 2

Most of these sites were cultivated for crop production during the settlement of the area. Many of them have been planted to monocultures of introduced forage grasses in recent years. When these sites are cultivated, the soil properties are significantly altered from the reference state. Soil structure, hydrology and biology have been impacted and the site is transitioned to the Converted state.

Transition T2A
State 2 to 3

These sites are prone to invasion by juniper, mesquite and honey locust. Without brush management, brush invasion may increase to the point where the site transitions to the Invaded Woodland state. At this point it will take significant inputs to remove woody species and restore the grass dominated pasture.

Transition T3A
State 3 to 2

At this point it will take significant inputs to remove woody species and restore the grass dominated pasture. However, it may be achieved through brush management and a prescribed grazing plan which allows ample rest for the re-establishment of grasses.

Additional community tables

Animal community

Domestic livestock and white-tail deer are the dominant grazers and browsers of the site. Various songbirds and small mammals may also find use of these areas. As the site changes towards the woody dominated community, the quality of the habitat may improve for some species and decline for others. Management must be applied to maintain a vegetative state in optimum habitat quality for the desired animal species.

Hydrological functions

These sites occur on upland and shed water to adjacent sites lower on the landscape. Some sites may also receive some run-on water. However, the clay subsoils slow infiltration and permeability. The presence of deep rooted tallgrasses can help facilitate percolation of water into the soil profile. While these sites can be a productive site, it may become quite droughty during dry periods as the clay subsoils tend to hold available water where it is not available for plant growth.

Recreational uses

NA

Wood products

NA

Other products

NA

Other information

NA

Inventory data references

Soil Survey Manuscripts Murray, Carter, Johnston counties in Oklahoma.

Type locality

Location 1: Murray County, OK	
General legal description	NA

References

Frost, C.C. 1998. Presettlement Fire Frequency Regimes of the United States: A First Approximation. Plant Conservation Program. North Carolina Department of Agriculture and Consumer Services, Raleigh, NC.

Other references

These site descriptions were developed as part a Provisional ESD project using historic soil survey manuscripts, available range site descriptions, and low intensity field traverse sampling.

Contributors

Colin Walden, Soil Survey Region 9

Approval

Bryan Christensen, 9/21/2023

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, and 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)	Harry Fritzler, Steve Glasgow
Contact for lead author	
Date	07/01/2005
Approved by	Bryan Christensen
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.

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.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A1 horizon: 0 to 11 inches; black or very dark gray clay, fine to medium granular structure. AC horizon: 11 to 30 inches; olive clay to dark brown or grayish brown silty clay, weak coarse blocky structure.

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/ Midgrass dominated). Any changes in infiltration and runoff can be attributed to other factors (e.g. compaction).

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. Calcareous, clayey soil layers may be mistaken for a compaction layer.

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, Midgrasses

    Sub-dominant: Shortgrasses, Forbs

    Other: Shrubs, Annuals

    Additional:

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%.

14. **Average percent litter cover (%) and depth (in):** Litter should cover >95% of the area between plants with accumulations of ~1 1/2 inches deep.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Normal production is 3500 – 7000 pounds per year.

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, annuals and non-natives.

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