USDA Natural Resources Conservation Service

Ecological site R087BY002TX
Claypan Savannah

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): 087B–Texas Claypan Area, Northern Part

This area is in northeastern Texas (79 percent) and southeastern Oklahoma (21 percent). It makes up about 4,480 square miles (11,610 square kilometers). The towns of Greenville, Sulphur Springs, Paris, Mount Vernon, Canton, and Athens, Texas, and Durant, Oklahoma, are in this MLRA. Interstates 30 and 20 and Highways 69, 70, 80, and 82 cross the area. The Caddo National Grasslands is in the north end of the area.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 87B

Ecological site concept

The Claypan Savannah ecological site is characterized by a fine sandy loam or loam surface soil underlain by a dense clay subsoil. This is also the typifying site to which the MLRA derived it's name. The clay subsoil impacts water movement through the soil, which often perches water.

Associated sites

R087BY004TX	**Sandy**
R087BY005TX	**Deep Sand**
R087BY007TX	**Loamy Bottomland**
R087BY001TX	**Depression**
R087BY003TX	**Sandy Loam**
R087BY002TX	**Claypan Savannah**

Similar sites

R087AY003TX	**Claypan Savannah**

Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Quercus marilandica*
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Sorghastrum nutans*

Physiographic features

This site occurs as nearly level to sloping uplands. Slopes range from 0 to 20 percent, but are generally 1 to 8 percent. The soils are underlain by a dense clay subsoil and during large precipitation events, the sites can briefly pond water. This is more common if the sites are associated with depression and flood plain areas. Some sites will have a high water table, which is generally highest in late winter and early spring.

Table 2. Representative physiographic features

Landforms	(1) Plains > Interfluve (2) Plains > Ridge
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	76–229 m
Slope	1–8%
Water table depth	203 cm
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible to very high
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–20%
Water table depth	Not specified

Climatic features

The average annual precipitation is 47 inches in most of this area, but it can be higher or lower depending on the exact location. Most of the rainfall occurs in spring and winter. The average annual temperature is 62 to 66 degrees F. The freeze-free period averages 235 days and frost-free period averages 210 days.

Table 4. Representative climatic features

Frost-free period (average)	210 days
Freeze-free period (average)	235 days
Precipitation total (average)	1,194 mm

Climate stations used

- (1) BOSWELL 1 S [USC00340980], Boswell, OK
- (2) CLARKSVILLE 2NE [USC00411772], Clarksville, TX
- (3) EMORY [USC00412902], Emory, TX
- (4) DURANT [USC00342678], Durant, OK
- (5) MT PLEASANT [USC00416108], Mount Pleasant, TX
- (6) MT VERNON [USC00416119], Mount Vernon, TX
- (7) LAKE FORK RSVR [USC00414976], Quitman, TX
- (8) PARIS [USC00416794], Paris, TX
- (9) BONHAM 3NNE [USC00410923], Bonham, TX
- (10) DENISON DAM [USC00412394], Cartwright, TX

Influencing water features

The site can have a high water table. Water tables are most common in the late winter and early spring, or anytime the soil is saturated from large precipitation events.

Wetland description

A stream or wetland does not influence the plant community of this site.

Soil features

The soils are deep to very deep and have fine sandy loam or loamy surfaces over dense clay subsoils. The topsoil ranges from 6 to 15 inches deep but averages less than 10 inches. The surface soil takes in water readily but the clay subsoil is very slowly permeable and restricts air movement and root growth. The very slow permeability and shallow topsoil cause the site to be wet in the winter, slow to warm in the spring, and droughty during the growing season. Low to moderate fertility somewhat limits production on this site. Under good management where herbaceous cover and litter are maintained, rills, gullies, pedestals, and soil compaction layers are not present on the site. Soils correlated to this site include: Annona, Bazette, Boxville, Bryarly, Crockett, Karma, Raino, Whakana, and Woodtell.

Table 5. Representative soil features

Parent material	(1) Residuum–shale
Surface texture	(1) Loam (2) Fine sandy loam
Family particle size	(1) Clayey
Drainage class	Moderately well drained to well drained
Permeability class	Very rapid
Soil depth	114–203 cm
Surface fragment cover <=3"	0%

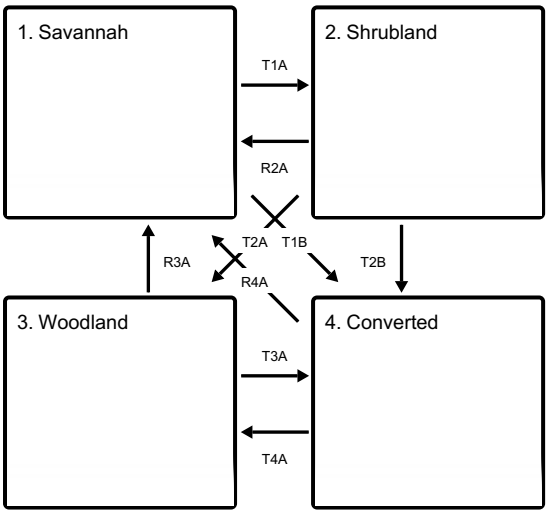
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	4.5–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–6%
Subsurface fragment volume >3" (Depth not specified)	0–2%

Ecological dynamics

The Claypan Savannah ecological site evolved and was maintained by the grazing and herding effects of native wild large ungulates, periodic fires, and climatic fluctuations. Conversion of this site to cropland and the subsequent abandonment of cropping removed the natural native vegetation, organic matter, fertility, and allowed woody species to invade the site. Continuous grazing by domestic livestock and the suppression of fire on non-cropland sites removes little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), Engelmann's daisy (*Engelmannia peristenia*), yellow neptunia (*Neptunia lutea*), and gayfeather (*Liatris elegans*). Less productive perennial and annual grasses, forbs, vines, and shrubs will replace these plants. With continued continuous grazing, no brush management, and the absence of periodic fires, a community dominated by winged elm (*Ulmus alata*), eastern persimmon (*Diospyros virginiana*), mesquite (*Prosopis glandulosa*), yaupon (*Ilex vomitoria*), post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*), and eastern red cedar (*Juniperus virginiana*) will replace the savannah.

State and transition model

Ecosystem states



T1A - Heavy continuous grazing, no brush management, abandonment

T1B - Brush management, crop cultivation, pasture planting

R2A - Brush management, prescribed grazing, prescribed burning

T2A - Heavy continuous grazing, no brush management, abandonment

T2B - Brush management, crop cultivation, pasture planting

R3A - Brush management, range planting, prescribed grazing

T3A - Brush management, crop cultivation, pasture planting

R4A - Range planting, prescribed grazing, prescribed burning

T4A - Heavy continuous grazing, no brush management, abandonment

State 1 submodel, plant communities

1.1. Tallgrass/Oak Savannah

State 2 submodel, plant communities

2.1. Oak Scrub/Shrubland

State 3 submodel, plant communities

3.1. Post Oak/Elm Woodland

State 4 submodel, plant communities

4.1. Converted Land

State 1
Savannah

One community exists in the Savannah State, the 1.1 Tallgrass/Oak Savannah Community. The State is dominated by warm season perennial grasses and the overstory canopy cover is less than 20 percent.

Community 1.1
Tallgrass/Oak Savannah

The interpretive plant community of this site is the reference plant community. This site is a fire-climax savannah of post oak and blackjack oak trees that shade 15 to 20 percent of the ground. The herbaceous component is tall and midgrasses dominated by little bluestem, Indiangrass, and brownseed paspalum (*Paspalum plicatulum*), which usually make up 50 to 75 percent of the total annual yield. Purpletop tridens (*Tridens flavus*), Florida paspalum (*Paspalum floridanum*), switchgrass, tall dropseed (*Sporobolus compositus*), and thin paspalum (*Paspalum setaceum*) also occur. Cool-season forage plants occurring on this site include Canada wildrye (*Elymus canadensis*), Engelmann's daisy, and sedges (Carex spp.). A variety of shrubs, vines, and forbs occur in this community. Grazing prescriptions that permit acceptable grazing periods and allow adequate rest periods with prescribed fire every three to five years are important in the maintenance of the herbaceous plant community and the savannah landscape structure. Continuous overgrazing or over rest and the absence of fire tend to allow a vegetative shift towards woody species such as eastern persimmon, eastern red cedar, and winged elm. Without corrective measures, this shift will continue to the Shrubland State.

State 2
Shrubland

One community exists in the Shrubland State, the 2.1 Oak Scrub/Shrubland Community. The herbaceous production is not as great compared to the Savannah State, and overstory canopy has increased between 20 and 50 percent.

Community 2.1
Oak Scrub/Shrubland

This plant community is a transitional community between the Savannah and Woodland State. It develops in the absence of fire or mechanical or chemical treatments. It is usually the result of abandonment following cropping or yearly continuous grazing. Trees and shrubs begin to replace the grassland component of the savannah community. In addition to the naturally occurring post oak and blackjack oak, winged elm, water oak (*Quercus nigra*), mesquite, eastern persimmon, bumelia (*Sideroxylon lanuginosum*), eastern red cedar, yaupon, and greenbriar (Smilax spp.) increase in density and canopy coverage (20 to 50 percent). Species whose seeds are windblown (elm) or animal dispersed (persimmon, mesquite, eastern red cedar, bumelia) are the first to colonize and dominate the site. Remnants of little bluestem and Indiangrass may still occur but the herbaceous component of the community becomes dominated by lesser producing grasses and forbs. Silver bluestem (*Bothriochloa laguroides*), tall dropseed, arrowfeather threeawn (*Aristida purpurascens*), Scribner's dichanthelium (*Dichanthelium oligosanthes*), thin paspalum, Hall's panicum (*Panicum hallii*), western ragweed (*Ambrosia psilostachya*), croton (Croton spp.), and narrowleaf sumpweed (*Iva angustifolia*) commonly occur. If the woody shrub canopy has not exceeded 50 percent, prescribed burning on a three to five year interval in conjunction with prescribed grazing is a viable option for returning this community to a Savannah State that may resemble the reference plant community. If the woody canopy exceeds 50 percent, chemical or mechanical brush control must also be applied to move this transitional community back towards the reference plant community.

State 3
Woodland

One community exists in the Woodland State, the Post Oak/Elm Woodland Community. The site is characterized by little herbaceous production. The overstory canopy is over 50 percent and shrubs also limit light to the surface.

Community 3.1
Post Oak/Elm Woodland

This plant community is a closed overstory (50 to 80 percent) woodland dominated by post oak, winged elm, blackjack oak, black hickory (*Carya texana*), eastern red cedar, and water oak. Understory shrubs and sub-shrubs include yaupon, farkleberry (*Vaccinium arboreum*), possumhaw (*Ilex decidua*), and American beautyberry (*Callicarpa americana*). Woody vines also occur and include Alabama supplejack (*Berchemia scandens*), poison ivy (Toxicondendron radicans), grape (Vitis spp.), greenbriar, trumpet creeper (*Campsis radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and peppervine (Ampelopsis arborea). A herbaceous understory is almost nonexistent but shade tolerant species including longleaf woodoats (*Chasmanthium sessiliflorum*), broadleaf woodoats (*Chasmanthium latifolium*), cedar sedge (*Carex planostachys*), ironweed (Veronia baldwinii), and goldenrod (Solidago spp.) may occur in small amounts. Prescribed fire may be used to convert this site back to the Tallgrass/Oak Savannah but may take many consecutive years of burning due to light fine fuel loads. Chemical brush control on a large scale is usually not a treatment option on this site due to the herbicide resistance of yaupon. Individual plant treatment with herbicides on small acreage may be a viable option. Mechanical treatment of this site, along with seeding, is the most viable option for reversion back to a Tallgrass/Oak Savannah, but the economic viability of this option is questionable.

State 4
Converted

The Converted Land State contains one community, the 4.1 Converted Land Community. The state is characterized by the land manager farming crops or planted grasses.

Community 4.1
Converted Land

Conversion of this site to cropland occurred from the middle 1800's to the early 1900's. Some remains in cropland today, typically cotton (Gossypium spp.), corn (*Zea mays*), sorghum (Sorghum spp.), and soybeans (*Glycine max*). Ditching, land leveling, and levee construction has significantly changed the topography and hydrology on many acres of this site. While restoration of this site to a semblance of the reference plant community is possible with seeding and prescribed grazing, complete restoration of the reference community in a reasonable time is very unlikely. Following crop production, this site is often planted to native or introduced grasses and legumes for livestock grazing or hay production. Typical species planted include improved Bermudagrass varieties, bahiagrass, switchgrass, dallisgrass, kleingrass (*Panicum coloratum*), old world bluestems (Bothriochloa spp.) annual ryegrass (Lolium multiflorum), and white clover. Many of the introduced species (bahiagrass, Bermudagrass, and dallisgrass) are invasive-moving by wind, water, and animals. Once established, they are extremely difficult to remove and will hinder the reestablishment of native species. The establishment and maintenance of these species requires cultivation, fertilization, weed control, and prescribed grazing management.

Transition T1A
State 1 to 2

The Savannah State will transition to the Shrubland State when continued heavy grazing pressure, no brush management, and/or field abandonment continues. The transition is evident when woody species canopy cover exceeds 20 percent and grasses shift composition to more shade-tolerant species.

Transition T1B
State 1 to 4

The transition to the Converted State occurs when the site is plowed for planting crops or pasture. The driver for the transition is the land manager's decision to farm the site.

Restoration pathway R2A
State 2 to 1

Restoration back to the Savannah State requires brush management, prescribed grazing and/or prescribed fire. Mechanical or chemical controls can be used to remove the woody overstory species and shrubs. Prescribed grazing may require destocking and/or deferment.

Transition T2A
State 2 to 3

The Shrubland State will transition to the Woodland State when continued heavy grazing pressure, no brush management, and/or field abandonment continues. The transition is evident when woody species canopy cover exceeds 50 percent and grasses shift composition to more shade-tolerant species.

Transition T2B
State 2 to 4

The transition to the Converted State occurs when the site is plowed for planting crops or pasture. The driver for the transition is the land manager's decision to farm the site.

Restoration pathway R3A
State 3 to 1

Restoration back to the Savannah State requires substantial energy inputs. Brush management and prescribed grazing will be needed to shift the community back to the reference state. Mechanical or chemical controls can be used to remove the woody overstory species back below 20 percent. Prescribed grazing may require destocking and/or deferment to manage the understory grasses back to those found in the reference community. Fire may be an option, but only if adequate amounts of fine fuel exist in the understory.

Transition T3A
State 3 to 4

The transition to the Converted State occurs when the site is plowed for planting crops or pasture. The driver for the transition is the land manager's decision to farm the site.

Restoration pathway R4A
State 4 to 1

The restoration to State 1 can occur when the land manager ceases agronomic practices. Range planting of native species found in the reference community will be required to bring back a similar community as the State 1 plant composition. The extent of previous soil disturbances will determine how much seedbed preparation will be needed, as well as the ability to be restored. Proper grazing and brush management will be required to ensure success.

Transition T4A
State 4 to 3

The Converted Land State will transition to the Woodland State when continued heavy grazing pressure, no brush management, and/or field abandonment continues. The transition is evident when woody species canopy cover exceeds 50 percent and grasses shift composition to more shade-tolerant species.

Additional community tables

Animal community

The historic savannah provided habitat to bison, deer, turkey, migratory birds and large predators such as wolves, coyotes, mountain lions, and black bear. White-tailed deer, turkey, coyotes, bobcats, and resident and migratory birds find suitable habitat in these savannahs today. Domestic livestock and exotic ungulates are the dominant grazers and browsers of this site. As the savannah transitions through the various vegetative states towards the woodlands, 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

Peak rainfall periods occur in May and June from frontal passage thunderstorms and in September and October from tropical systems as well as frontal passages . Rainfall amounts may be high (three to five inches per event) and events may become intense. The site is subject to erosion where adequate herbaceous cover is not maintained and on heavy use areas such as roads and livestock trails. Gullies feeding into streams and drains are common on this site where adequate herbaceous cover has not been maintained. Extended periods (60 days) of little to no rainfall during the growing season are common. The hydrology of this site may be manipulated through management to yield higher runoff volumes or greater infiltration to groundwater. Management for less herbaceous cover will favor higher surface runoff while dense herbaceous cover will favor ground water recharge. Potential pollution from sediment, pesticides, and both organic and inorganic fertilizers should always be considered when managing for higher volumes of surface runoff.

Recreational uses

Hunting, camping, bird watching, equestrian, and photography are common activities.

Wood products

Oaks are used for firewood. Hickory and mesquite are used for barbecue wood. Yaupon is used for landscaping.

Other products

Fruit from dewberries, grapes, and plums are harvested.

Inventory data references

These site descriptions were developed as part a Provisional Ecological Site project using historic soil survey manuscripts, available site descriptions, and low intensity field traverse sampling. Future work to validate the information is needed. This will include field activities to collect low, medium, and high-intensity sampling, soil correlations, and analysis of that data. A final field review, peer review, quality control, and quality assurance review of the will be needed to produce the final document.

Other references

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Contributors

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Approval

Bryan Christensen, 9/21/2023

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	05/13/2024
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):

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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:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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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:**

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17. **Perennial plant reproductive capability:**
