

## Ecological site R087AY007TX Deep Sand

Last updated: 9/21/2023  
Accessed: 05/18/2024

### 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.

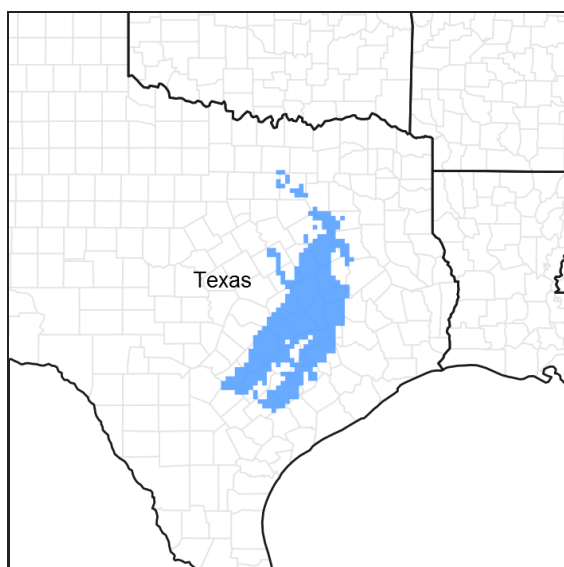


Figure 1. Mapped extent

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): 087A–Texas Claypan Area, Southern Part

This area is entirely in south-central Texas. It makes up about 10,535 square miles (27,295 square kilometers). The towns of Bastrop, Bryan, Centerville, College Station, Ennis, Fairfield, Franklin, Giddings, Gonzales, Groesbeck, La Grange, Madisonville, and Rockdale are in this MLRA. Interstate 45 crosses the northern part of the area, and Interstate 10 crosses the southern part. A number of State Parks are located throughout this area. The parks are commonly associated with reservoirs.

### Classification relationships

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

### Ecological site concept

The site is characterized by very deep soils with a sand layer that extends at least 40 inches into the subsoil before any noticeable clay accumulations. This causes the site to be droughty, but more productive than the Very Deep Sand ecological site.

## Associated sites

R087AY004TX	<b>Deep Redland</b> Deep Redland
R087AY006TX	<b>Sandy</b> Sandy
R087AY008TX	<b>Very Deep Sand</b> Very Deep Sand

## Similar sites

R087AY006TX	<b>Sandy</b> Sandy
R087AY008TX	<b>Very Deep Sand</b> Very Deep Sand
R087BY005TX	<b>Deep Sand</b> Different MLRA.

**Table 1. Dominant plant species**

Tree	(1) <i>Quercus incana</i> (2) <i>Quercus marilandica</i>
Shrub	(1) <i>Ilex vomitoria</i> (2) <i>Callicarpa americana</i>
Herbaceous	(1) <i>Schizachyrium scoparium</i> (2) <i>Sorghastrum nutans</i>

## Physiographic features

This site occupies gently sloping to sloping ridges. The slope ranges from 0 to 15 percent, but is typically 1 to 8 percent.

**Table 2. Representative physiographic features**

Landforms	(1) Plains > Ridge
Runoff class	Negligible to very low
Flooding frequency	None
Ponding frequency	None
Elevation	61–229 m
Slope	1–8%
Aspect	Aspect is not a significant factor

**Table 3. Representative physiographic features (actual ranges)**

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	Not specified
Slope	0–15%

## Climatic features

The climate for MLRA 87A is humid subtropical and is characterized by hot summers, especially in July and August,

and relatively mild winters. The summer months have little variation in day-to-day weather except for occasional thunderstorms that dissipate the afternoon heat. The moderate temperatures in spring and fall are characterized by long periods of mild days and cool nights. The average annual precipitation in this area is 41 inches. Most of the rainfall occurs in spring and fall. The freeze-free period averages about 276 days and the frost-free period 241 days.

**Table 4. Representative climatic features**

Frost-free period (average)	241 days
Freeze-free period (average)	276 days
Precipitation total (average)	1,041 mm

## Climate stations used

- (1) COLLEGE STN [USW00003904], College Station, TX
- (2) BELLVILLE 6NNE [USC00410655], Bellville, TX
- (3) LA GRANGE [USC00414903], La Grange, TX
- (4) MADISONVILLE [USC00415477], Madisonville, TX
- (5) SMITHVILLE [USC00418415], Smithville, TX
- (6) CROCKETT [USC00412114], Crockett, TX
- (7) FAIRFIELD 3W [USC00413047], Fairfield, TX
- (8) GONZALES 1N [USC00413622], Gonzales, TX
- (9) SOMERVILLE DAM [USC00418446], Somerville, TX
- (10) BARDWELL DAM [USC00410518], Ennis, TX
- (11) ELGIN [USC00412820], Elgin, TX
- (12) FRANKLIN [USC00413321], Franklin, TX

## Influencing water features

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

## Wetland description

Wetlands are not associated with this site.

## Soil features

The soils of this site are very deep, rapidly permeable, neutral to slightly acid fine sands. Most are classified as grossarenic, meaning the sand continues to a depth of 40 inches until a noticable amount of clay increases in the subsoil. Moisture enters the soil rapidly, and quickly passes through and out of the root zone. Moisture holding capacity and inherent fertility is low. Water erosion is generally not a hazard but the site is susceptible to wind erosion when the soil is exposed. The site is subject to erosion where adequate herbaceous cover is not maintained and on heavy use areas such as roads and livestock trails. Soils correlated to this site include: Arenosa, Catilla, Desan, Eufaula, Faula, Joiner, Navasan, Padina, Patilo, Tadina, and Tonkavar.

**Table 5. Representative soil features**

Parent material	(1) Alluvium—sandstone and shale (2) Residuum—sandstone
Surface texture	(1) Loamy fine sand (2) Fine sand
Family particle size	(1) Sandy
Drainage class	Moderately well drained to somewhat excessively drained
Permeability class	Rapid to very rapid
Soil depth	183–203 cm

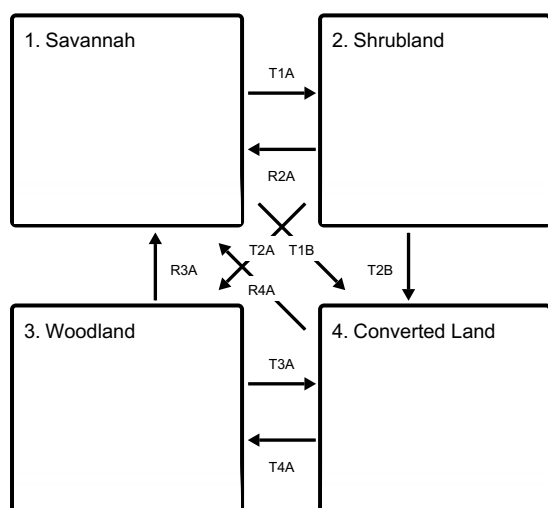
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	5.08–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–3%
Subsurface fragment volume >3" (Depth not specified)	0–2%

## Ecological dynamics

The Deep Sand 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 (watermelons, peanuts, etc.) and the subsequent abandonment of cropping removed the natural native vegetation, organic matter and fertility, and allowed woody species to dominate the site. Continuous grazing by confined domestic livestock and the suppression of fire on non-cropland sites removes little bluestem (*Schizachyrium scoparium*), Indiangrass (*Sorghastrum* spp.), and preferred forbs like tephrosia (*Tephrosia* spp.) and prairie clover (*Dalea* spp.). Less productive perennial and annual grasses and forbs will replace these plants. Years of continuous grazing generally lead to periods of prolonged rest for recovery of the perennial herbaceous plant component. These prolonged rest periods with no fire or brush management lead toward a community dominated by woody species such as winged elm (*Ulmus alata*), yaupon (*Ilex vomitoria*), post oak (*Quercus stellata*), and blackjack oak (*Quercus marilandica*).

## 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  
Community

**State 3 submodel, plant communities**

3.1. Post Oak/Yaupon  
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 25 percent.

**Community 1.1  
Tallgrass/Oak Savannah**



The characteristic plant community of this site is the reference plant community. This site is an open savannah of bluejack oak (*Quercus incana*), blackjack oak (*Quercus marilandica*), and post oak (*Quercus stellata*) trees that shade up to 25 percent of the ground. The dominant understory shrubs include yaupon (*Ilex vomitoria*), hawthorn (*Crataegus* spp.), and American beautyberry (*Callicarpa americana*). The herbaceous plant community of tall and midgrasses is dominated by little bluestem (*Schizachyrium scoparium*) which makes up 50 to 65 percent of the total annual production. Sand lovegrass (*Eragrostis trichodes*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and purpletop tridens (*Tridens flavus*) occur less frequently and in smaller amounts. Grazing prescriptions that permit acceptable grazing periods and allow adequate rest periods along with prescribed fire every five to seven years are important in the maintenance of the reference plant community and the savannah landscape structure. Continuous overgrazing or over rest and the absence of fire tend to allow a vegetative composition shift towards woody species. Without corrective measures, this shift will continue to the Shrubland State.

**Table 6. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	2242	2690	3138
Tree	280	336	392
Shrub/Vine	140	168	196
Forb	140	168	196
<b>Total</b>	<b>2802</b>	<b>3362</b>	<b>3922</b>

## 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 25 and 50 percent.

### Community 2.1 Oak Scrub/Shrubland Community



This plant community is a transitional community between the Savannah and Woodland States. It develops in the absence of fire or mechanical or chemical brush management treatments. It is usually the result of abandonment following either cropping or yearly continuous grazing. Trees and shrubs begin to encroach onto introduced pastureland or replace the grassland component of the savannah community. In addition to the naturally occurring oaks, other woody species such as eastern persimmon (*Diospyros virginiana*), winged elm, and eastern red cedar (*Juniperus virginiana*) increase in density and canopy coverage (25 to 50 percent). Remnants of little bluestem and Indiangrass may still occur but the herbaceous component of the community becomes dominated by lesser producing grasses and forbs. Initially, species such as brownseed paspalum (*Paspalum plicatulum*), tall dropseed (*Sporobolus compositus*), and fall witchgrass (*Digitaria cognata*) replace the taller grasses. As the site continues to transition, the plants which increase or invade on the site include sandbur (*Cenchrus* spp.), red lovegrass (*Eragrostis secundiflora*), Yankeeweed (*Eupatorium compositifolium*), bullnettle (*Cnidoscolus texanus*), croton (*Croton* spp.), snake cotton (*Froelichia* spp.), prickly pear (*Opuntia* spp.), queen's delight (*Stillingia texana*), beebalm (*Monarda* spp.), and baccharis (*Baccharis* spp.). Prescribed burning on a three to five year interval in conjunction with prescribed grazing may be a viable option for returning this community to the Savannah State provided the woody canopy cover is less than 50 percent and adequate herbaceous fine fuel still exists. When this threshold is exceeded, mechanical or chemical brush control becomes necessary to move back towards the reference community.

**Table 7. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1261	1513	1765
Tree	841	1009	1177
Shrub/Vine	560	673	785
Forb	140	168	196
<b>Total</b>	<b>2802</b>	<b>3363</b>	<b>3923</b>

### State 3 Woodland

One community exists in the Woodland State, the Post Oak/Yaupon 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/Yaupon Woodland



This plant community is a closed overstory (50 to 80 percent) woodland dominated by bluejack oak ( *Quercus incana*), blackjack oak ( *Quercus marilandica*), and post oak ( *Quercus stellata*). Yaupon is the dominant understory shrub. Woody vines also occur and include greenbrier ( *Smilax* spp.) and grape ( *Vitis* spp.). A herbaceous understory is almost nonexistent but shade tolerant species such as longleaf woodoats ( *Chasmanthium sessiliflorum*) and cedar sedge ( *Carex planostachys*) may occur in small amounts. Prescribed burning in conjunction with prescribed grazing may be used to convert this site back to the Savannah State but generally takes many consecutive years of burning due to light fine fuel loads comprised mainly of hardwood tree leaves. Chemical brush control on a large scale is usually not a treatment option on this site due to the resistance of yaupon to broadcast herbicide applications. Individual plant treatment with herbicides on small acreage is a viable option. Mechanical treatments for reducing woody plant canopies and densities is an option, but the low water holding capacity and low fertility of this site makes re-establishment of herbaceous species by seeding very difficult.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	1261	1513	1765
Shrub/Vine	981	1177	1373
Grass/Grasslike	420	504	588
Forb	140	168	196
<b>Total</b>	<b>2802</b>	<b>3362</b>	<b>3922</b>

## State 4 Converted Land

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*). Specifically, this site is used for watermelons, peas, sweet potatoes, and peanuts. 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, eastern gamagrass, 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 25 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 need to shift the community back to the reference state. Mechanical or chemical controls can be used to remove the woody overstory species back below 25 percent. Prescribed grazing may require destocking and/or deferment to manage the understory grasses back to those found in the reference community.

## 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. 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

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Tallgrasses</b>			1401–1961	
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	560–1345	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	560–1345	–
2	<b>Tall/Midgrasses</b>			448–588	
	sand lovegrass	ERTR3	<i>Eragrostis trichodes</i>	84–224	–
	switchgrass	PAVI2	<i>Panicum virgatum</i>	84–224	–
	slender Indiangrass	SOEL3	<i>Sorghastrum elliottii</i>	84–224	–
	purpletop tridens	TRFL2	<i>Tridens flavus</i>	84–224	–
3	<b>Shortgrasses</b>			258–392	
	Hall's panicgrass	PAHA	<i>Panicum hallii</i>	112–280	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	112–280	–
4	<b>Midgrasses</b>			135–196	
	splitbeard bluestem	ANTE2	<i>Andropogon ternarius</i>	28–140	–
	woollysheath threeawn	ARLA6	<i>Aristida lanosa</i>	28–140	–
	purple lovegrass	ERSP	<i>Eragrostis spectabilis</i>	28–140	–
<b>Forb</b>					

5	<b>Forbs</b>			112–140	
	partridge pea	CHFA2	<i>Chamaecrista fasciculata</i>	0–45	–
	Virginia dayflower	COVI3	<i>Commelina virginica</i>	0–45	–
	ticktrefoil	DESMO	<i>Desmodium</i>	0–45	–
	lespedeza	LESPE	<i>Lespedeza</i>	0–45	–
	prairie snoutbean	RHLA5	<i>Rhynchosia latifolia</i>	0–45	–
	fuzzybean	STROP	<i>Strophostyles</i>	0–45	–
	Virginia tephrosia	TEVI	<i>Tephrosia virginiana</i>	0–45	–
	prairie spiderwort	TROC	<i>Tradescantia occidentalis</i>	0–45	–
6	<b>Forbs</b>			28–56	
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	0–22	–
	Texas bullnettle	CNTE	<i>Cnidoscolus texanus</i>	0–22	–
	croton	CROTO	<i>Croton</i>	0–22	–
	yankeeweed	EUCO7	<i>Eupatorium compositifolium</i>	0–22	–
	plains snakecotton	FRFL	<i>Froelichia floridana</i>	0–22	–
<b>Shrub/Vine</b>					
7	<b>Shrubs/Vines</b>			140–196	
	American beautyberry	CAAM2	<i>Callicarpa americana</i>	0–45	–
	parsley hawthorn	CRMA5	<i>Crataegus marshallii</i>	0–45	–
	yaupon	ILVO	<i>Ilex vomitoria</i>	0–45	–
	Oklahoma plum	PRGR	<i>Prunus gracilis</i>	0–45	–
	southern dewberry	RUTR	<i>Rubus trivialis</i>	0–45	–
	cat greenbrier	SMGL	<i>Smilax glauca</i>	0–45	–
	muscadine	VIRO3	<i>Vitis rotundifolia</i>	0–45	–
<b>Tree</b>					
8	<b>Trees</b>			280–392	
	bluejack oak	QUIN	<i>Quercus incana</i>	84–224	–
	blackjack oak	QUMA3	<i>Quercus marilandica</i>	84–224	–
	post oak	QUST	<i>Quercus stellata</i>	84–224	–

## 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 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 be 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 following livestock trails to water are common on this site where continuous grazing is practiced and adequate herbaceous cover is not 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 and litter 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 are common activities.

## **Wood products**

Post oak and blackjack oak are used for firewood. 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**

1. Archer, S. 1994. Woody plant encroachment into southwestern grasslands and savannas: rates, patterns and proximate causes. In: Ecological implications of livestock herbivory in the West, pp. 13-68. Edited by M. Vavra, W. Laycock, R. Pieper. Society for Range Management Publication, Denver, CO.
2. Archer, S. and F.E. Smeins. 1991. Ecosystem-level Processes. Chapter 5 in: Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.
3. Bestelmeyer, B.T., J.R. Brown, K.M. Havstad, R. Alexander, G. Chavez, and J.E. Herrick. 2003. Development and use of state-and-transition models for rangelands. *J. Range Manage.* 56(2): 114-126.
4. Brown, J.R. and S. Archer. 1999. Shrub invasion of grassland: recruitment is continuous and not regulated by herbaceous biomass or density. *Ecology* 80(7): 2385-2396.
5. Foster, J.H. 1917. Pre-settlement fire frequency regions of the United States: a first approximation. Tall Timbers Fire Ecology Conference Proceedings No. 20.
6. Gould, F.W. 1975. The Grasses of Texas. Texas A&M University Press, College Station, TX. 653p.
7. Hamilton, W. and D. Ueckert. 2005. Rangeland Woody Plant Control: Past, Present, and Future. Chapter 1 in: Brush Management: Past, Present, and Future. pp. 3-16. Texas A&M University Press.
8. Scifres, C.J. and W.T. Hamilton. 1993. Prescribed Burning for Brush Management: The South Texas Example. Texas A&M University Press, College Station, TX. 245 p.
9. Smeins, F., S. Fuhlendorf, and C. Taylor, Jr. 1997. Environmental and Land Use Changes: A Long Term Perspective. Chapter 1 in: Juniper Symposium 1997, pp. 1-21. Texas Agricultural Experiment Station.
10. Stringham, T.K., W.C. Krueger, and P.L. Shaver. 2001. State and transition modeling: and ecological process approach. *J. Range Manage.* 56(2):106-113.
11. Texas Agriculture Experiment Station. 2007. Benny Simpson's Texas Native Trees (<http://aggie-horticulture.tamu.edu/ornamentals/natives/>).
12. Texas A&M Research and Extension Center. 2000. Native Plants of South Texas (<http://uvalde.tamu.edu/herbarium/index.html>).
13. Thurow, T.L. 1991. Hydrology and Erosion. Chapter 6 in: Grazing Management: An Ecological Perspective. Edited by R.K. Heitschmidt and J.W. Stuth. Timber Press, Portland, OR.
14. USDA/NRCS Soil Survey Manuals counties within MLRA 87A.
15. USDA, NRCS. 1997. National Range and Pasture Handbook.
16. USDA, NRCS. 2007. The PLANTS Database (<http://plants.usda.gov>). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
17. Vines, R.A. 1984. Trees of Central Texas. University of Texas Press, Austin, TX.
18. Vines, R.A. 1977. Trees of Eastern Texas. University of Texas Press, Austin, TX. 538 p.

Contributors

Mike Stellbaur  
Tyson Hart

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)	Mike Stellbauer, David Polk, Bill Deauman
Contact for lead author	Mike Stellbauer, Zone RMS, NRCS, Bryan, Texas
Date	06/08/2004
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None.
- 
2. **Presence of water flow patterns:** Water flow patterns are uncommon for this site.
- 
3. **Number and height of erosional pedestals or terracettes:** Pedestals or terracettes are uncommon for this site when occupied by the reference community.
- 
4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect no more than 30 percent bare ground distributed in small patches.
- 
5. **Number of gullies and erosion associated with gullies:** No gullies should be present.
- 
6. **Extent of wind scoured, blowouts and/or depositional areas:** None.
- 
7. **Amount of litter movement (describe size and distance expected to travel):** This site has highly permeable soils

with high infiltration rates. Only small sized litter will move short distances with intense storms.

---

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is resistant to erosion. Stability class range is expected to be 2 to 3.
- 
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 0 to 60 inches thick with colors from pale brown fine sand to dark brown loamy fine sand and generally single grain loose structures. SOM is approximately 0.5 to 1.0 percent.
- 
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The savannah of trees, shrubs, vines, grasses, and forbs, along with adequate litter and little bare ground, provides for maximum infiltration and little runoff under normal rainfall events.
- 
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None.
- 
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: Warm-season tallgrasses >>
- Sub-dominant: Warm-season midgrasses >
- Other: Trees > Shrubs/Vines > Forbs
- Additional:
- 
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** There should be little mortality or decadence for any functional group.
- 
14. **Average percent litter cover (%) and depth ( in):** Litter is primarily herbaceous.
- 
15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 2,500 pounds per acre for below average moisture years to 3,500 pounds per acre for above average moisture years.
- 
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:** Potential invasive species include bahiagrass, common Bermudagrass, post oak, yaupon, and elm.

---

17. **Perennial plant reproductive capability:** All perennial plants should be capable of reproducing, except for periods of prolonged drought conditions, heavy natural herbivory or intense wildfires.
-