Ecological site R080BY148TX
Deep Redland
26-33" PZ

Last updated: 9/19/2023
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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.

MLRA notes

Major Land Resource Area (MLRA): 080B–Texas North-Central Prairies

MLRA 80B consists of gently rolling, dissected plains with very steep hillsides and sideslopes and narrow flood plains associated with small streams. Loamy and clayey soils range from very shallow to deep and developed in sandstones, shales, and limestones of Pennsylvanian 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 Ag Handbook 296.

Ecological site concept

These sites occur over moderately deep non-calcareous loam and clay loam soils on uplands. The reference vegetation includes native perennial tallgrasses with abundant forbs and scattered oaks. Without fire or other brush management, woody species may increase and dominate the site. In reference condition, woody canopy coverage is less than thirty percent.

Associated sites

R080BY155TX	**Redland 26-33" PZ** Shallower soils than Deep Redland site.

Similar sites

R080BY146TX	**Clay Loam 26-33" PZ** Similar landforms and surface texture but higher in carbonates.

Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Quercus marilandica*
Shrub	Not specified

Herbaceous	(1) *Andropogon gerardii* (2) *Schizachyrium scoparium*

Physiographic features

This site occurs on linear to convex interfluves and crests of ridges and dip slopes in the Texas North-Central Prairies. This site is characteristically a water distributing site. Slopes are typically less than 3 percent.

Table 2. Representative physiographic features

Landforms	(1) Hills > Ridge (2) Hills > Dip slope
Runoff class	High
Elevation	230 – 730 m
Slope	0 %
Aspect	Aspect is not a significant factor

Climatic features

The climate is subtropical subhumid and is characterized by hot humid summers and relatively mild winters. Tropical maritime air controls the climate during spring, summer and fall. In winter and early spring, frequent surges of polar Canadian air cause sudden drops in temperatures and add considerable variety to the daily weather. The average first frost generally occurs about November 5 and the last freeze of the season usually occurs about March 19. The average frost free period ranges from 215 days in the northern counties, to 240 days in the south.

The average relative humidity in mid-afternoon is about 60 percent in the summer months. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time possible during the summer and 50 percent in winter. The prevailing wind direction is from the southwest and highest windspeeds occur during the spring months.

Approximately 75% of annual rainfall occurs between April 1 and October 31. Rainfall during the months of April through September typically occurs during thunderstorms which tend to be intense and brief, resulting in large amounts of rain in a short time. The wettest months of the year are May, June, September, and October. The driest months during the growing season are July and August. The winter months of November, December, January, and February are the driest months overall.

Average annual precipitation for the entire MLRA is approximately 28 inches. There is a noticeable difference in the average annual precipitation in the northern counties in comparison to the southern and western counties of this Major Land Resource Area. Jack, Clay, Young, and Palo Pinto Counties all have an average annual precipitation of more than 31 inches. Stephens, Eastland, McCulloch, and San Saba Counties all have an average annual precipitation of less than 28 inches.

Winters tend to be mild, with occasional periods of very cold temperatures which can be accompanied by strong northerly winds and freezing precipitation. Snow is infrequent and significant accumulations are rare. These periods of very cold weather are generally short-lived. Summers tend to be hot and dry. Drought conditions are common during most summers. Air temperatures of more than 95oF are common from mid-June through September. In the northern counties nearest to the Red River, temperatures are generally slightly cooler during winter months and slightly warmer during summer months than in the other counties in the North Central Prairie.

Table 3 Representative climatic features

Frost-free period (characteristic range)	180-200 days

Freeze-free period (characteristic range)	210-230 days
Precipitation total (characteristic range)	760-810 mm
Frost-free period (actual range)	180-200 days
Freeze-free period (actual range)	210-230 days
Precipitation total (actual range)	740-840 mm
Frost-free period (average)	190 days
Freeze-free period (average)	220 days
Precipitation total (average)	790 mm

- (1) SAN SABA 7NW [USC00417994], Richland Springs, TX
- (2) BROWNWOOD 2ENE [USC00411138], Early, TX
- (3) EASTLAND [USC00412715], Eastland, TX
- (4) MINERAL WELLS AP [USW00093985], Millsap, TX
- (5) BRECKENRIDGE [USC00411042], Breckenridge, TX
- (6) GRAHAM [USC00413668], Graham, TX
- (7) JACKSBORO [USC00414517], Jacksboro, TX

Influencing water features

This being an upland site, it is not influenced by water from a wetland or stream.

The site sheds water to adjacent areas downslope. However, the presence of deep rooted tallgrasses help to facilitate water infiltration into the soil.

Wetland description

NA

Soil features

Representative soil components for this ecological site include: Lindy

The site is characterized by moderately deep to very deep, non-calcareous loamy, well drained soils.

Table 4. Representative soil features

Parent material	(1) Residuum – limestone

Surface texture	(1) Stony loam (2) Clay loam (3) Silt loam
Drainage class	Well drained
Permeability class	Slow
Soil depth	50 – 100 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	10.16 – 12.7 cm
Calcium carbonate equivalent (Depth not specified)	0 – 10 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.1 – 7.8
Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The plant communities that can occur on this site range from a Tallgrass/Midgrass dominant, live oak (Quercus fusiformis) and post oak (Quercus stellata) Savannah to a Midgrass Savannah, to an Ashe juniper (Juniperus ashei) and Mesquite (Prosopis glandulosa var. glandulosa) dominated mixed grass and/or shortgrass range, to a thick canopy Ashe juniper/mesquite/shrub short and annual grasses and forb complex community. This wide diversity of plant communities occurring on this site is in direct response to type of grazing management, the inherent selection of this site by all kinds of grazing animals due to its fertility in relation to other neighboring sites, reaction to fire regimes, extermination of the prairie dogs, and the impacts of droughts on the different hydrology's associated with each of the steady states.

The reference plant community is a Tall/Midgrass Savannah Community of live oak and post oak that have a woody canopy of approximately ten percent. The major tallgrass species are big bluestem (Andropogon gerardii), little bluestem (Schizachyrium scoprium ssp. scoparium), Indiangrass (Sorghastrum nutans), and switchgrass (Panicum virgatum). These grasses dominate the site with a number of midgrasses such as sideoats grama (Bouteloua curtipendula var. curtipendula), tall dropseed (Sporobolus compositus var. compositus), cane bluestem (Bothriochloa barbinoidis var. barbinoidis), silver bluestem (Bothriochloa laguroides ssp. torreyana), vine-mesquite (Panicum obtusum), and cool-season grasses such as Canada wildrye (Elymus canadensis var. canadensis), Texas bluegrass (Poa arachnifera), and Texas wintergrass (Nassella leucotricha). There are numerous perennial forbs that share the landscape. Such forbs include Maximilian sunflower (Helianthus maximiliani), bush sunflower (Simsia calva), Englemann's daisy (Engelmannia peristenia), dotted gayfeather (Liatris punctata var. punctata), blacksamson (Liatris punctata var. punctata), bundleflowers (Desmanthus sp.), heath aster (Chaetopappa ericoides), western ragweed (Ambrosia psilostachya), and legumes such as prairie clover (Dalea sp.), trailing wildbean (Strophostyles helvula), least snoutbean (Rhynchosia minima), tickclover (Desmodium sp.), and scurfpea (Pediomelum sp.). Besides the live oak and post oak, there are numerous other woody plants such as Texas oak (Quercus buckleyi), bigelow oak (Quercus sinuata var. breviloba), blackjack oak (Quercus marilandica), elm (Ulmus sp.), hackberry (Celtis laevigata), redbud (Cercus canadensis var. texensis) , bumelia (Sideroxylon lanuginosum), sumacs (Rhus sp.), elbowbush (Froestiera pubescens), agarito (Mahonia trifiolata), greenbriar (Smilax sp.), vine ephedra (Ephedra antisyphilitica), and bush honeysuckle (Lonicera albiflora).

In the reference plant community, tall and midgrasses dominated the shortgrasses due to their ability to capture sunlight and shade them. The tall and midgrasses also had deeper root systems that allowed them to capture the deep moisture while the shortgrasses had shorter root systems and could capture only the more shallow moisture. Many of the deep-rooted grasses also have more root hairs that allow them to be more efficient at extracting moisture from very dry soil. Due to these differences, the tall and midgrasses maintained their dominance over the shortgrasses as they could produce much more food and maintain a high state of health and vigor even in times of drought.

When European settlers arrived, the area was inhabited by bison, white-tailed deer, turkey, quail, dove, many song birds, rabbits, squirrel, prairie dogs, lizards and snakes. Fire was a major factor in maintaining the site in the reference state. Lightning fires, and fires set by Native Americans would burn for days with out stopping. Hundreds of thousands of acres would burn as there was nothing but wide spread rivers or a change in weather to stop them. This repeated burning kept the range in a savannah state, with only the large tall trees being spared a top kill. The re-sprouting shrubs, the fresh lush green growth of the grass and forbs made this range a sea of lush growth that attracted the grazing and browsing animals and provided them highly nutritious forage.

There were no fences. The bison were free to roam and migrate from south to north in the summer and north to south as the winter season was nearing. This area provided the winter grazing for the bison herds that had ventured north for the summer. They came by the thousands and grazed the range as they moved around. Antelope were on the range, and grazed and roamed at their desire, seeking the best nutrition they could find in the forbs and grasses. Prairie dogs lived in groups on the site. They kept the woody shrubs cut down as a means of protection from hawks, eagles, coyotes, bobcats, and cougars. Recent research has shown that they would not let a mesquite stand overnight that was planted in or around their town.

European settlers started settling this area in the early 1800's with a major thrust just before and after the civil war. The first settlers moved about from ranch to ranch as no one owned land. After the grass was grazed to a point of "being gone", they would move to another place where the grass was good and start another ranch. When the grass "came back" on the ranch they had left, a new rancher would move in and take over that ranch.

In 1880, barbed wire was introduced into this area. The land had also come under private ownership. The fencing stopped the open range, where livestock had wondered to be guided only by the line riders. Now the forces of contained livestock grazing started to have its toll on the plant communities. The wildfires that once systematically burned over the land were either put out or burned with less intensity due to reduced fine fuel due to the heavier and continuous grazing.

Depending on how the rancher managed, the plant communities started to change. If the rancher allowed fire to continue to control the Ashe juniper and mesquite seedlings, they could manage their rangeland to be classified as Tall/Midgrass Savannah Community. If fire was not allowed to maintain the invading brush species, the Ashe juniper and mesquite would encroach over the range as the many other shrubs natural to the site expanded in canopy. If it was burned prior to achieving approximately 6 feet in height, fire could be used to reclaim the land. If the brush was allowed to exceed 6 feet, then fire could no longer control the brush species and the range entered a new steady state that would require more than fire to reclaim it. The manager would have to use machinery or herbicides to manage the brush to a desired canopy.

Also, the manager would have to apply a well thought out prescribed grazing plan to maintain the vigor and health of the grasses and forbs that they desired on the range. As the stocking rates exceeded the carrying capacity of the land and the natural graze-rest cycles

were broken by continuous grazing, the palatable and highly selected tallgrasses were grazed to the point that they could no longer produce sufficient food in their leaves to maintain their health and vigor. Records of stocking rates show that on much of the land, there was a cow to 2 acres. When the tallgrasses were grazed to the point that they had little leaf area left, they stopped supplying the root system with food, as all available food produced was going to grow more leaf area to enhance the food manufacturing process. If the overgrazing continued, the root system of the overgrazed plants continued to be used up and shrink, as respiration continued in the root system that required energy. In time, with continued close grazing, the tallgrasses would become not a deep rooted, healthy plant, but a very shallow rooted, small leaf area, weak plant that was set up for doom during the next drought. This process was intensified due to the natural droughts that occur in the area. These tallgrass plants were not now in a dominant position to the midgrasses, but in a position of being dominated by the midgrasses on the site. This then lead to the demise of the tallgrasses and an increase of mid and shortgrasses on the site. These midgrasses were sideoats grama, cane bluestem, silver bluestem and vine-mesquite. At the same time this was occurring with the grasses, the palatable forbs were being overgrazed and killed out of the plant community.

If the new steady state of cedar and mesquite and mixed grasses was overgrazed and no brush was controlled, the site would evolve to a canopy of 30 to 50 percent, with mainly buffalograss, Texas wintergrass and other short grasses in the understory. If this management was allowed to continue, the site would change to a dense canopy of juniper and mesquite, shortgrasses and invading forbs and annual cool-season grasses.

Since the soils of this site are very productive and fertile, much of this site has been plowed and put into cropland. In many instances, this land has either been reseeded to native grasses, introduced grasses or just turned out to let come back what could. Many times this turned out land, also known as Abandoned or Go Back land, was planted to native or introduced grasses when it was found that it was not very productive growing the annual grasses and forbs.

After the land was planted to native or introduced grasses and forbs, management of the land to control the invasion of Ashe juniper and mesquite from neighboring lands was a must if the manager desired to keep the open land. This could be accomplished with prescribed burning or other means of brush management. Also, to maintain the stand of native or introduced grasses planted, a prescribed grazing plan must be designed and applied that meets the needs of the plants, the animals and the managers objectives.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			1009-2018	
	big bluestem	ANGE	*Andropogon gerardii*	0-560	–
	switchgrass	PAVI2	*Panicum virgatum*	0-560	–
	little bluestem	SCSC	*Schizachyrium scoparium*	0-560	–
	Indiangrass	SONU2	*Sorghastrum nutans*	0-560	–
2	**Midgrasses**			975-1950	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	0-488	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	0-488	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	0-488	–
	vine mesquite	PAOB	*Panicum obtusum*	0-488	–
	composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	0-488	–
3	**Cool-season Grasses**			504-1009	
	Canada wildrye	ELCA4	*Elymus canadensis*	0-336	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	0-336	–
	Texas bluegrass	POAR	*Poa arachnifera*	0-336	–
4	**Shortgrasses**			336-673	
	purple threeawn	ARPUP6	*Aristida purpurea var. purpurea*	0-168	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	0-168	–
	buffalograss	BODA2	*Bouteloua dactyloides*	0-168	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	0-168	–
	fall witchgrass	DICO6	*Digitaria cognata*	0-168	–

	Scribner's rosette grass	DIOLS	*Dichanthelium oligosanthes var. scribnerianum*	0-168	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	0-168	–
	Texas cupgrass	ERSE5	*Eriochloa sericea*	0-168	–
	curly-mesquite	HIBE	*Hilaria belangeri*	0-168	–
	white tridens	TRAL2	*Tridens albescens*	0-168	–
5	**Grass/Grasslike**			34-67	
	sedge	CAREX	*Carex*	0-67	–
	purpletop tridens	TRFL2	*Tridens flavus*	0-67	–
Forb					
6	**Forbs**			168-336	
	Texas Indian mallow	ABFR3	*Abutilon fruticosum*	0-84	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	0-84	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0-84	–
	aster	ASTER	*Aster*	0-84	–
	Berlandier's sundrops	CABEB2	*Calylophus berlandieri ssp. berlandieri*	0-84	–
	prairie clover	DALEA	*Dalea*	0-84	–
	bundleflower	DESMA	*Desmanthus*	0-84	–
	ticktrefoil	DESMO	*Desmodium*	0-84	–
	blacksamson echinacea	ECANA	*Echinacea angustifolia var. angustifolia*	0-84	–
	Engelmann's daisy	ENGEL	*Engelmannia*	0-84	–
	beeblossom	GAURA	*Gaura*	0-84	–
	Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0-84	–
	coastal indigo	INMI	*Indigofera miniata*	0-84	–
	dotted blazing star	LIPU	*Liatris punctata*	0-84	–
	Indian breadroot	PEDIO2	*Pediomelum*	0-84	–
	smartweed leaf-flower	PHPO3	*Phyllanthus polygonoides*	0-84	–
	least snoutbean	RHMI4	*Rhynchosia minima*	0-84	–
	wild petunia	RUELL	*Ruellia*	0-84	–
	pitcher sage	SAAZG	*Salvia azurea var. grandiflora*	0-84	–
	awnless bushsunflower	SICA7	*Simsia calva*	0-84	–
	amberique-bean	STHE9	*Strophostyles helvola*	0-84	–
Shrub/Vine					
7	**Shrubs**			235-471	
	eastern redbud	CECA4	*Cercis canadensis*	0-118	–
	Texas redbud	CECAT	*Cercis canadensis var. texensis*	0-118	–
	clapweed	EPAN	*Ephedra antisyphilitica*	0-118	–
	stretchberry	FOPU2	*Forestiera pubescens*	0-118	–
	western white honeysuckle	LOAL	*Lonicera albiflora*	0-118	–
	algerita	MATR3	*Mahonia trifoliolata*	0-118	–
	Texas red oak	QUBU2	*Quercus buckleyi*	0-118	–
	bastard oak	QUSIB	*Quercus sinuata var. breviloba*	0-118	–
	sumac	RHUS	*Rhus*	0-118	–
	gum bully	SILAO	*Sideroxylon lanuginosum ssp. oblongifolium*	0-118	–
	greenbrier	SMILA2	*Smilax*	0-118	–
Tree					
8	**Trees**			101-202	

	hackberry	CELTI	*Celtis*	0-50	–
	Texas live oak	QUFU	*Quercus fusiformis*	0-50	–
	blackjack oak	QUMA3	*Quercus marilandica*	0-50	–
	post oak	QUST	*Quercus stellata*	0-50	–
	elm	ULMUS	*Ulmus*	0-50	–

Table 6. Community 1.2 plant community composition

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

Table 7. Community 1.3 plant community composition

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

Table 8. Community 2.1 plant community composition

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

Table 9. Community 2.2 plant community composition

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

Table 10. Community 2.3 plant community composition

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

Table 11. Community 3.1 plant community composition

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

Table 12. Community 3.2 plant community composition

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

Table 13. Community 4.1 plant community composition

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

Animal community

Bison and prairie dog were inhabitants of this site when the area was settled by European man. They have been removed from the site as explained in the Ecological Dynamics portion of this site description. This site is used for the production of domestic livestock and to provide habitat for native wildlife. Cow-calf and stocker operations are the primary livestock enterprises. Sheep and goat operations have been used in the past, but currently are very few. Sustainable stocking rates have declined over the years due to a change in the plant community. As the tall and midgrasses have been removed by continuous overgrazing and the invasion of Ashe juniper, mesquite, and lotebush, the production of plants desired by cattle have been drastically reduced in some situations. As the plant community changes, the stocking rate for one animal species may decrease while the amount of desired forage for other animals may increase. For instance, as grass production decreases, and the forbs and shrub/vine production increases, the production for food and cover for quail and white-tailed deer are increasing. Therefore, the early stages of (2.1) Juniper/Mesquite with Midgrasses, 30 % Canopy steady state may be outstanding for quail and deer. In the manager’s scheme, he or she may desire to maintain all or part of their land in this steady state to meet their overall wildlife and domestic livestock plan. Smaller mammals on the site include rodents, jackrabbit, cottontail rabbit, raccoon skunks, opossum, and armadillo. Mammalian predators include coyote, red fox, gray fox, and bobcat. Species of snakes and lizards are native to the site. Many species of birds are found on this site including game birds, song birds and birds of prey. Major game birds that are economically important are Rio Grande turkey, bobwhite quail, and mourning dove. Turkey prefers plant communities with substantial amounts of shrubs and trees interspersed with grassland. Quail prefer plant communities with a combination of low shrubs, bunch grass, bare ground and low successional forbs. The different song birds vary in their habitat preferences. In general, habitat that provides a large variety of grasses, forbs, shrubs, vines and trees and a complex of grassland, savannah, shrubland, and woodland will support a good variety and abundance of songbirds. Birds of prey are important to keep the numbers of rodents, rabbits and snakes in balance. The different plant communities of the site will sustain different species of raptors. Feral hogs are present on this site in many instances. They can cause much damage to the site as they up root the desirable plants. They can be controlled by trapping and hunting.

Hydrological functions

The landform is a plain that ranges in elevation from 751 to 2251 feet above sea level. The hydrologic group is C and the runoff class is high. The drainage class is well drained. Permeability class is very slow. The soil is underlain by fractured limestone at approximately 28 to 40 inches. There is no water table within 6 feet of the surface. Site does not pond water and the area does not flood. The Tallgrass/Midgrass Savannah, 10% Canopy had a very favorable influence on the infiltration and deep percolation of rainfall. As the site is overgrazed there is a reduction in the tallgrasses and midgrasses. As this change occurs, organic matter in the soil is reduced. This has a negative impact on infiltration and water holding capacity of the soil. More runoff is generated from rainfall, and erosion becomes more evident. When the soil is dry, it cracks. This allows rapid infiltration at first, but as the cracks close, infiltration is greatly reduced. Light showers tend to be ineffective on this site. As the site is invaded by Ashe juniper and mesquite, the water cycle is further altered. Interception of rainfall by tree canopies is increased which reduces the amount of rainfall reaching the surface. Stem flow is increased due to the funneling effect of the canopy, which increases soil moisture at the base of the tree. Increased transpiration, especially when evergreen species such as live oak and juniper dominate, provides less chance for deep percolation into aquifers. As woody species increase, grass cover decreases, which causes some of the same effects as overgrazing. Brush management combined with good grazing management can help restore the natural hydrology of the site.

Recreational uses

This site has the appeal of the wide open spaces. The abundant tall and midgrasses with the scattered live oak and post oak and shrubs provides excellent fall color variations. This site produces excellent wildlife foods, there fore is a choice for bird watching, viewing deer, turkey, and quail, as well as hunting.

Wood products

Honey mesquite, oaks, and ashe juniper can be used for firewood and the specialty wood industry.

Other products

None.

Other information

None.

Inventory data references

1. 417 data collected on the site with emphasis form 1979 until 1985.

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Other references

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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)	Colin Walden, Soil Survey Region 9
Contact for lead author	colin.walden@ok.usda.gov
Date	02/14/2018
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** **Minimal evidence of current or past rill formation.**

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2. **Presence of water flow patterns:** **Few water flow patterns on steep areas. Short and stable, not incising.**

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3. **Number and height of erosional pedestals or terracettes:** No pedestals or terracettes present.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground less than 10 percent. Bare areas small and not connected.

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5. **Number of gullies and erosion associated with gullies:** No gullies present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** No wind scoured areas.

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7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement less than 3 feet. Vegetative cover should restrict litter movement over long distances. Only herbaceous litter less than .25 inches expected to move.

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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):** Soil stability scores of 5 or greater expected.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Lindy series: Ap--0 to 4 inches; dark brown (7.5YR 4/3) loam, dark brown (7.5YR 3/3) moist; weak medium granular structure, thin platy in surface inch; very hard, friable See official description for specific soil component.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Presence of native tallgrasses and midgrasses allow for good infiltration across landscape.

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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):** No compaction under reference conditions. Beware texture change of Bt horizon not product of compaction.

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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 (group 1) Midgrasses (2)

    Sub-dominant: Cool season & shortgrasses (3&4)

    Other: All other groups.

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Possible mortality only during prolonged drought. Less than 5%.

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14. **Average percent litter cover (%) and depth (in):** Litter expected to be at 75% cover at average .25 inch depth.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production 4,500 lb/ac. Ranging from 3,000 to 6,000 lbs.

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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:** Mesquite and Juniper(ashe juniper/eastern redcedar) most common invaders.

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17. **Perennial plant reproductive capability:** Plants should be capable of reproducing every year with exception of prolonged growing season drought.
