USDA Natural Resources Conservation Service

Ecological site R078CY014OK
Rolling Sands

Last updated: 9/15/2023
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.

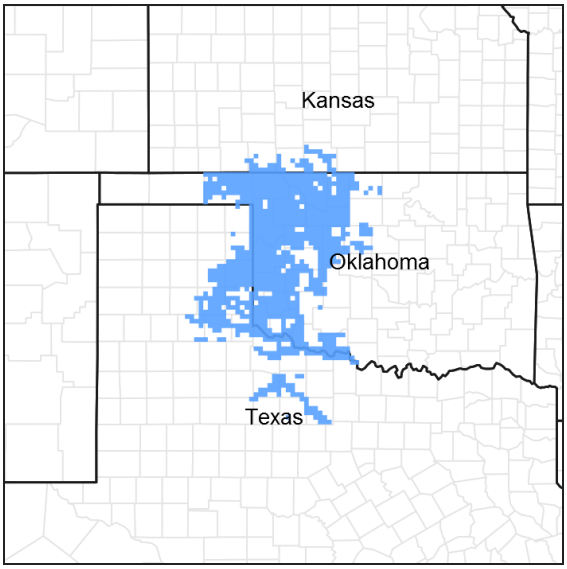


Figure 1. Mapped extent

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): 078C–Central Rolling Red Plains, Eastern Part

MLRA 78C is characterized by moderately dissected, rolling plains with prominent ridges and valleys and numerous terraces adjacent to dissecting streams. Loamy and clayey soils are generally deep, well drained, and developed in calcareous and gypsiferous sediments of Permian age.

LRU notes

NA

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

This site consists of deep sandy soils with relatively low water holding capacity and rolling to hummocky relief. The reference plant community is dominated by warm season perennial mid and tall grasses with subdominant perennial

forbs and legume species. Woody species canopy cover is generally the least in the reference plant community and generally increases as “time since fire” increases. Productivity on this site may vary greatly from year to year depending on precipitation patterns. In the absence of fire and proper grazing management, this plant community can quickly transition to an alternative plant community.

Associated sites

R078CY017OK	**Deep Sand Shrubland** Similar landscape as the Rolling Sands. Older, more acidic soils with argillic horizons. Support Shinnery Oak Growth.

Similar sites

R080AY014OK	**Deep Sand** Correlated to the Eda soil component mapped in MLRA 80A.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia filifolia* (2) *Prunus angustifolia*
Herbaceous	(1) *Andropogon hallii* (2) *Tephrosia virginiana*

Physiographic features

These sites are located on nearly level to rolling, hummocky, low dune topography.

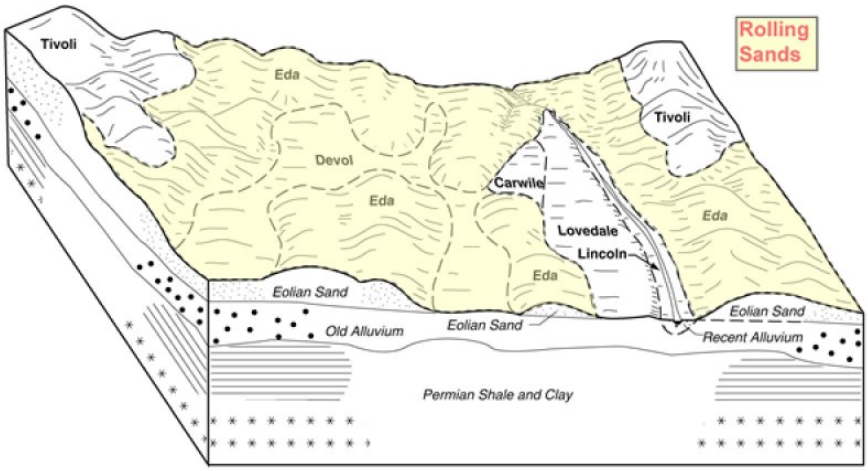


Figure 2. Rolling Sand

Table 2. Representative physiographic features

Landforms	(1) Alluvial plain > Dune (2) Alluvial plain > Sand sheet
Runoff class	Negligible to very low
Flooding frequency	None
Ponding frequency	None
Elevation	305–762 m
Slope	0–12%
Ponding depth	0 cm

Aspect	Aspect is not a significant factor

Climatic features

MLRA 78C lies within the subtropical sub-humid climate regime. This regime is characterized by rapid changes in temperature; marked extremes, both daily and annual; and rather erratic rainfall. The weather is alternately influenced by cold dry air from the Arctic Circle, and warm moist air from the Gulf of Mexico.

Seasonal changes are gradual. Spring is a season of variable weather and relatively high precipitation with prevailing winds from the southwest. Summers are generally hot with low humidity. Fall has long periods of pleasant weather interspersed with moderate to heavy rains. Winter is open and moderate to cold with winds from the north and infrequent snows.

Wind speeds average more than eleven miles an hour with prevailing southern winds. Rather strong winds can occur in all months of the year. While strong gusty winds occur, severe dust storms are rare.

Approximately 75 percent of the rainfall occurs during the warm season, and much of it comes in storms of high intensity and short duration in May and June. These rains can be particularly erosive on sites where vegetation is sparse. Occasional droughts are to be expected. Lack of rainfall and hot, dry winds often curtail forage production during July and August.

Table 3. Representative climatic features

Frost-free period (characteristic range)	157-201 days
Freeze-free period (characteristic range)	191-223 days
Precipitation total (characteristic range)	660-686 mm
Frost-free period (actual range)	150-205 days
Freeze-free period (actual range)	186-230 days
Precipitation total (actual range)	660-711 mm
Frost-free period (average)	181 days
Freeze-free period (average)	207 days
Precipitation total (average)	686 mm

Climate stations used

- (1) COLDWATER [USC00141704], Coldwater, KS
- (2) TALOGA [USC00348708], Taloga, OK
- (3) CLINTON SHERMAN AP [USW00003932], Dill City, OK
- (4) LAKE KEMP [USC00414982], Seymour, TX
- (5) ANSON 3ESE [USC00410268], Anson, TX

Influencing water features

According to definitions outlined in the ESIS manual, there are no influencing water features on this site.

Wetland description

NA

Soil features

Soils are generally mapped for each county at the Mapunit level. Mapunits are representations of the major soil series component(s) and named accordingly. Each Mapunit is spatially represented on a soils map as polygons of different shapes and sizes. Within these Mapunits, there are often minor soil series components included. These

minor components are soils that occur within a Mapunit polygon but are of small extent (15% or less of the Mapunit area). However, it is difficult to separate these minor soils spatially due to the scale of soil mapping.
Ecological sites are correlated at the component level of the soil survey. Therefore, a single Mapunit may contain multiple Ecological Sites just as it may contain multiple soil components. This is important to understand when investigating soils and Ecological Sites. A soil survey Mapunit may be correlated to a single Ecological Site based on the major component; however, there may be inclusional areas of additional Ecological Sites which are correlated to the minor components of that particular soil Mapunit.

The soils of this site are sands with sandy loam subsoils. These soils are very deep and coarse. Infiltration of moisture is rapid. Permeation is rapid and deep. There is very little runoff. Water storage capacity is low, but moisture that is present is usually readily available to plants. Available moisture, coupled with the soil's deep sandy profile, encourages deep rooted grasses and various species of woody vegetation.

Representative soils for this site include:

Eda and Devol (LFS)

Note: There may be minor components adjacent to these major components that because of mapping scale are not divided out. These may include some Dunal areas of the Tivoli or Jester series (Sand Hills 078CY107TX) or depressional areas of the Carwile series (Depressional Upland 078CY098OK).

Table 4. Representative soil features

Parent material	(1) Eolian sands
Surface texture	(1) Fine sand (2) Loamy fine sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to well drained
Permeability class	Moderately rapid to rapid
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	2.03–13.97 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)	5.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This plant community evolved during large herbivore grazing and occasional fires. This interaction referred to as pyric herbivory, (Fuhlendorf et al 2008) shaped the grasslands of the Great Plains into a shifting mosaic landscape. Native Americans used fire to alter the landscape and create conditions that large herbivores would have been attracted to. Fire tended to suppress the growth of woody plants and reset the natural advance of these plants on

this site. Fires would lead to more open landscapes that would allow for improvement to grazing accessibility and the quality of the herbaceous component of the plant community. Based on historical accounts large herds of herbivores typically Bison, numbering in the hundreds of thousands or possibly millions would have been attracted to areas with an abundance of grasses and moved through consuming a large portion of the plants in their path. This would set back the natural succession of the plants creating a patchy landscape of plant communities that would have been shifting due to the grazing and fire interaction.

In the absence of fire, shrub species generally increase, and may eventually dominate the site up to a stable level. On Rolling sands a scattering of annual plants are common, but usually only increase as the site deteriorates due to overgrazing. Annual plants may also appear on-site because of disturbances by rodents and other small digging mammals, or when normal rainfall patterns return after an extended periods of drought. With the introduction of cool season annual plants during the last hundred years, degraded plant communities have a larger portion of annual plants due to the invasive nature of these plants and their ability to fill a niche in the warm season plant community.

Within the plant community the tallgrass plants are strongly rhizomatous and often form colonies four to six feet across when given the opportunity and dominate the production of the site when given the opportunity. Production can be highly variable from year to year depending on rainfall and/or temperature. Precipitation regimes (precipitation belts of varying widths running north and south through the MLRA) vary considerably in total annual precipitation from west to east. Due to the nature of the soils this site is relatively droughty when rainfall is below normal and can lead to very low production when overgrazed. Heavy grazing can impact the stability of the site and usually results in a gradual decrease of the tallgrass species. The tallgrasses lost to overgrazing are replaced by perennial mid and shortgrasses and varying amounts and species of annuals, both forbs and grasses. When this happens the shallower rooted species do not have access to deep soil moisture during these dry periods and during prolonged periods of drought herbage production will be reduced. When overgrazing occurs during years of below average rainfall over consecutive years the productivity of this site falls quickly and can be difficult to recover especially if constant over stocking continues. When overgrazed, the site will exhibit a midgrass and sagebrush dominated landscapes and typically only a few tallgrass species will be seen, specifically in areas where animals are deterred from grazing. Conversely, deep rooted tallgrasses respond well and vegetative production can be quite high during periods of normal or above normal precipitation. Sand sagebrush is almost always found on the Rolling Sands and should be considered an integral part of the plant community. Typically sand sagebrush stands will not increase in density more than 30% canopy cover overall on the landscape and can be managed with the use of fire to reduce the canopy and stimulate grass growth. Small pockets of higher canopies may be found on the landscape that exceed 30 percent but would be considered atypical.

The general aspect of this site is open shrubland with mid and tallgrasses on nearly level to rolling, hummocky topography. As the site deteriorates from overgrazing, absence of fire, or both, other plant communities result. These communities include a midgrass/shortgrass community and eventually a shrub dominated annual grass community.

State and Transition Model

A State and Transition Model for the Rolling Sands Ecological Site (078CY014) is depicted in Figure 1. Thorough descriptions of each state, transition, plant community, and pathway follow the model. Experts base this model on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.

Plant communities will differ across the MLRA because of the naturally occurring variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal; other vegetative states may be desired plant communities as long as the Range Health assessments are in the moderate and above category. The biological processes on this site are complex. Therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

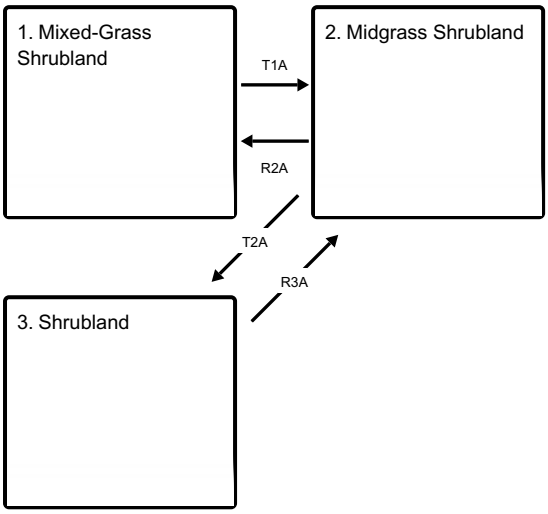
Both percent species composition by weight and percent canopy cover are described as are other metrics. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs). Canopy cover can drive the transitions between communities and states because of the influence of shade and interception of

rainfall. Species composition by dry weight is used for describing the herbaceous community and the community as a whole. Woody species are included in species composition for the site. Calculating similarity index requires use of species composition by dry weight.

The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown on the diagram. This information is intended to show what might happen in a given set of circumstances. It does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and transition model

Ecosystem states



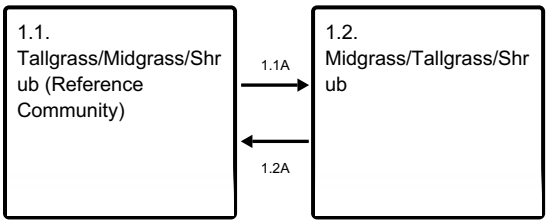
T1A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

R2A - Adequate rest from defoliation, followed by reintroduction of historic disturbance regimes

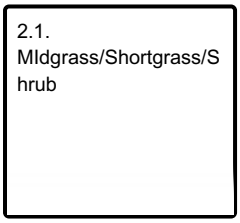
T2A - Absence of disturbance and natural regeneration over time, may be coupled with excessive grazing pressure

R3A - Removal of woody canopy and adequate rest from defoliation

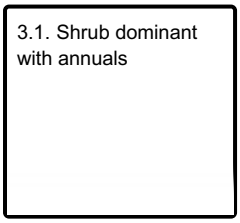
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Mixed-Grass Shrubland

This ecological state is dominated by warm season native species and is dominated by little bluestem as well as sand bluestem. Shrubs and annual forbs are subdominant although fluctuations naturally occur between the plant communities within this state depending on weather patterns and time since fire. These changes may also be induced by changes in management and use.

Community 1.1
Tallgrass/Midgrass/Shrub (Reference Community)

Figure 9. Tallgrass/Midgrass/Shrub plant community on Eda soils. Woodward County, OK

Figure 10. Tallgrass/Midgrass/Shrub plant community on Eda soils. Woodward County, OK

This is the reference or interpretive community for the site. The description is based on early range site descriptions, historical documents, clipping data, professional consensus of experienced range specialists, and analysis of field work. The Mixed-grass dominated community is the reference plant community for this site. In reference condition, this site is a fire/herbivory dependent; Mixed-grass dominated community with about 10 percent woody canopy cover. Plant communities are dynamic in nature and fluctuations in the landscape would have been continuous based on natural and anthropogenic disturbance patterns. This plant community is dominated by warm season, perennial tall and midgrasses and has a shrub component that could be considered an essential part of the plant community. The dominance of grasses can vary widely across the site based on clay content in the soil, depth of sand and landscape location. These variations within the site are factors that can make this site sensitive to grazing especially during below average precipitation. This plant community is dominated by tall, warm season grasses. These include Sand Bluestem (*Andropogon hallii*), Switchgrass (*Panicum virgatum*), Indiangrass(*Sorghastrum nutans*), Little Bluestem(*Schizachyrium scoparium*) and occasionally Giant Sandreed(*Calamovilfa gigantea*) . Midgrasses typically found on the site are Sand Dropseed(*Sporobolus cryptandrus*), Sideoats Grama(*Bouteloua curtipendula*), Thin Paspalum(*Paspalum setaceum*), and Sand Lovegrass(*Eragrostis trichodes*. Some cool-season grasses include Texas Bluegrass(*Poa arachnifera*), Western Wheatgrass(*Pascopyrum smithii*), Scribner’s

Panicum(*Dichanthelium oligosanthes*) and Canada Wildrye(*Elymus canadensis*). Scattered throughout this site is small amounts of shortgrasses, consisting primarily of Blue Grama(*Bouteloua gracilis*), and Hairy Grama(*Bouteloua hirsuta*). Forbs in this community include Pitcher's Sage(*Salvia azurea*), Erect Dayflower(*Commelina erecta*), Scarlet Guara(*Gaura coccinea*),Queen's Delight(*Stillingia sylvatica*), Ground Cherry(Physalis spp.), Globemallow(Spaeralcea spp.), and many others. Legumes include Indian Rushpea(*Hoffmannseggia glauca*), Goat's Rue(*Tephrosia virginiana*), Roundhead Lespedeza(*Lespedeza capitata*), and Showy Partridge Pea(*Chamaecrista fasciculata*)Typically, a few shrubs such as Sand Sagebrush(*Artemisia filifolia*), Fragrant Sumac(*Rhus aromatica*), and Sand Plum(*Prunus angustifolia*) occur on the site with Sand Sagebrush being the dominant shrub component. Annuals that commonly occur following rodent disturbances and drought include Fourpoint Evening-primrose(*Oenothera rhombipetala*), Annual Buckwheat(*Eriogonum annuum*), Cheatgrass(*Bromus tectorum*), and Camphorweed(*Heterotheca subaxillaris*). This plant community is relatively stable and can withstand short term droughts although production can fluctuate accordingly. If the site is abused by overgrazing, a reduction of the more palatable tall and mid grasses, forbs, and legumes will occur. When this happens the overall productivity of the site can decrease because of the loss of deep rooted highly productive tall grass species. The cool season plants will also be more prominent when abundant fall rains occur. Fire on a 2 to 5 year frequency will help suppress shrubs and enhance the cycling of minerals and nutrients. Once fire return intervals exceed this frequency additional management like grazing deferment may need to be used to increase fine fuels to carry a fire through the plant community. Grazing has a dual effect in maintaining this grassland. Grazing assists in nutrient cycling by digesting coarse grasses and depositing the digested plants through manure back to the soil surface. However, overgrazing can shift the plants within this community, create bare ground, and remove any opportunity for burning for that season. Typically these sites when well managed would show very little signs of erosion and the use of fire would not accelerate this process because of the below ground biomass produced when perennial grasses and shrubs are present to protect the soil.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1177	2354	3531
Forb	336	673	1009
Shrub/Vine	151	303	454
Tree	17	34	50
Total	**1681**	**3364**	**5044**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	0%
Forb foliar cover	0%
Non-vascular plants	0%
Biological crusts	0%
Litter	60-80%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0-10%

Figure 12. Plant community growth curve (percent production by month). OK0009, Native Warm-Season Grasses. The growing season for warm season(C4) grasses in this region runs from last frost to first frost with peak production from mid April through mid July. The curve listed below is intended to be a representative of normal growing conditions. The monthly

production pecentages can vary from year to year deopending upon temperature and rainfall variatioins..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	9	25	28	15	5	10	5	0	0

Community 1.2
Midgrass/Tallgrass/Shrub

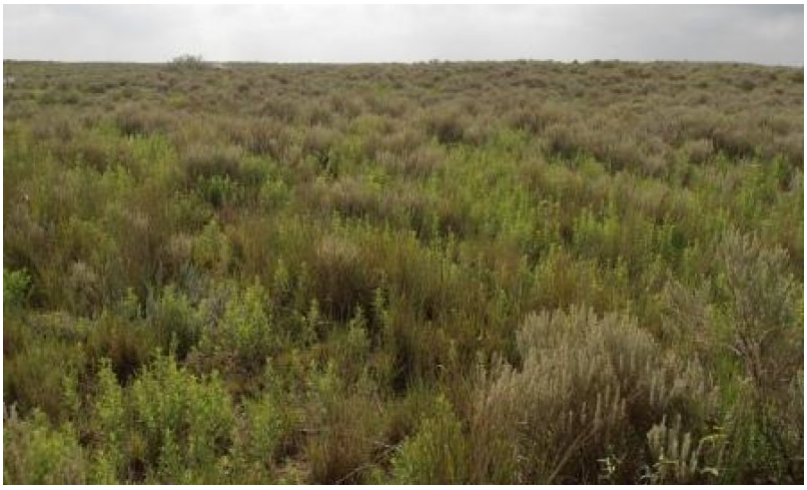


Figure 13. Midgrass/Tallgrass/Shrub plant community in foreground. Transitioning to plant community 2.1 in the background.

This plant community is still dominated by warm season mid and tallgrasses. However, there is reduced vigor among the tallgrasses and there may be an increase in both brush canopy and annual forbs depending on time since fire and vigor of perennial grasses. In many instances Sand Sagebrush has become “visually dominant” due to the reduced vigor and structure of the perennial grass component. This community is considered “at risk” of crossing a threshold to a Midgrass Shrubland Sate 2. Special consideration should be taken to ensure the health and vigor of the tallgrass species if the objective is to manage the site as the reference state.

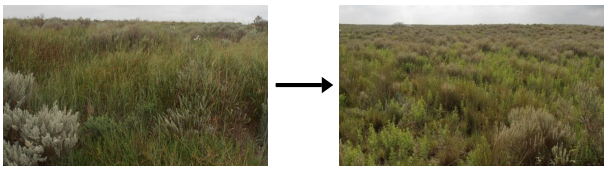
Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1093	2186	3278
Forb	370	740	1110
Shrub/Vine	202	404	605
Tree	17	34	50
Total	**1682**	**3364**	**5043**

Figure 15. Plant community growth curve (percent production by month). OK0009, Native Warm-Season Grasses. The growing season for warm season(C4) grasses in this region runs from last frost to first frost with peak production from mid April through mid July. The curve listed below is intended to be a representative of normal growing conditions. The monthly production pecentages can vary from year to year deopending upon temperature and rainfall variatioins..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	9	25	28	15	5	10	5	0	0

Pathway 1.1A
Community 1.1 to 1.2

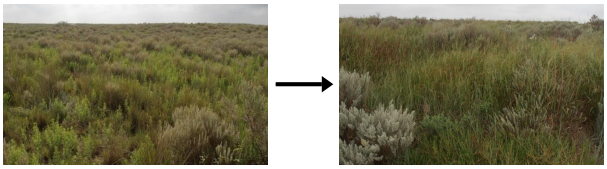


Tallgrass/Midgrass/Shrub
(Reference Community)

Midgrass/Tallgrass/Shrub

When grazing pressure exceeds the carrying capacity for the site; the plant community may shift to community 1.2. Excessive grazing pressure shifts the grass and forb component between the two plant communities while sagebrush percentage typically is not affected by grazing. This shift could also be the result of long term drought and/or the exclusion of fire. The lack of fire allows individual sagebrush plants to grow increasing canopy percentages. Within these communities, fine fuel continuity is typically sufficient to conduct a prescribed burn. This pathway would be seen as consistent within the historical fire return interval.

Pathway 1.2A
Community 1.2 to 1.1



Midgrass/Tallgrass/Shrub

Tallgrass/Midgrass/Shrub
(Reference Community)

With proper grazing management, prescribed burning, periodic rest, and favorable precipitation, this community may shift back to the reference community 1.1. Grazing disturbance typically does not affect the sagebrush canopy and only provides for an increase in the number and amount of tall and midgrass species within the community. Decrease in sagebrush canopy must be accomplished by another disturbance such as fire or mechanical methods that provide for a short term removal of canopy that typically does not alter the number of plants per acre. Fire can also stimulate the growth of fire tolerant grass species like Sand Bluestem for a period of time post burn. This pathway would be consistent within historical fire return intervals.

State 2
Midgrass Shrubland

This ecological state is the result of a transition across a threshold from the reference state (1). It is dominated by midgrass species with subdominant annual forbs and grasses. Shrub species are still subdominant, but have exceeded the threshold of 20% canopy cover. This state is less resilient to disturbances than the reference state (1). Transition to this state may decrease species diversity and above ground herbaceous biomass production.

Community 2.1
MIdgrass/Shortgrass/Shrub

Figure 16. Community 2.1 Midgrass/Shortgrass/Shrub plant community on Eda soils.

This plant community is dominated by midgrasses including, Sand Dropseed (*Sporobolus cryptandrus*), Sand Paspalum (*Paspalum setaceum*), and Lovegrass species (Eragrostis spp.). Texas Bluegrass (*Poa arachnifera*) may be abundant depending on season of use by grazing animals. Many perennial forbs and tallgrasses have been replaced by opportunistic annual forbs and annual cool-season grasses. These forbs include Camphorweed (*Heterotheca subaxillaris*), Sand Sunflower (*Helianthus petiolaris*), Annual Buckwheat (*Eriogonum annuum*), and Dozedaisy (*Aphanostephus skirrhobasis*). Cool-season annual grasses include Brome species (Bromus spp.), Little Barley (*Hordeum pusillum*), and Six-weeks Fescue (*Vulpia octoflora*). Sand sagebrush (*Artemisia filifolia*), Fragrant Sumac (*Rhus aromatica*), and Sand Plum (*Prunus angustifolia*) have exceeded 20% canopy cover. This site is susceptible to invasion by Eastern Red Cedar due to the lack of fire.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Forb	588	1059	1569
Grass/Grasslike	572	1029	1524
Shrub/Vine	504	908	1345
Tree	17	30	45
Total	**1681**	**3026**	**4483**

Figure 18. Plant community growth curve (percent production by month). OK0004, Warm season midgrass/shrub.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	3	15	25	22	10	8	10	4	1	1

State 3
Shrubland

This ecological state is the result of a transition across a threshold from the Midgrass Shrubland State (2). It is dominated by woody species with an understory of annual grasses, forbs, and an abundant amount of bare ground. Very few remnant tallgrasses or midgrasses will be found in this plant community.

Community 3.1
Shrub dominant with annuals

Figure 19. Shrub dominated plant community

This plant community is dominated by Sand Sagebrush(*Artemisia filifolia*), along with Sand Plum(*Prunus angustifolia*), and Fragrant Sumac(*Rhus aromatica*). The dominant herbaceous components are annual grasses and forbs including Annual Buckwheat (Eriogonum Annuum) and Camphorweed (*Heterotheca subaxillaris*). Annual grass including Sand Bur, (Cenchrus sp.), Brome (Bromus spp.) and Little Barley (*Hordeum pusillum*) thrive in the interspaces and areas of bare ground. Few traces of tall and midgrass species persist within this plant community

and are typically found in areas where grazing is inaccessible. Typically this site has been invaded by Eastern Red Cedar and accounts for a portion of the canopy cover.

Table 9. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	757	1261	1765
Forb	488	813	1138
Grass/Grasslike	420	701	981
Tree	17	28	39
Total	**1682**	**2803**	**3923**

Figure 21. Plant community growth curve (percent production by month). OK0010, Shrub dominant with annuals and few perennials.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	1	5	22	30	24	6	4	4	2	1	1

Transition T1A
State 1 to 2

Lack of disturbance such as fire within the historic fire return interval has allowed sagebrush canopy to increase to a steady level that typically does not exceed 30% on the average within management units. Small inclusions of sagebrush that exceeds 30% may be present but typically is not normal on a landscape basis. Grazing has continued to impact the palatable grasses and forbs while an increase in annual forbs and the lack of most tallgrasses in any measurable amount is typical.

Restoration pathway R2A
State 2 to 1

With the implementation of both Prescribed Grazing (seasonal deferment) and disturbance like Prescribed Burning conservation practices, the Midgrass Shrubland State may be restored back to the Mixed-grass Shrubland State. Prescribed grazing to decrease the pressure on palatable species will improve the grass and forb component. This will also increase the amount of fine fuel needed to effectively implement prescribed fire to reduce the canopy cover of sand sagebrush and promote fire tolerant grass species. This restoration timeframe is dependent upon the degree of degradation, available moisture during rest periods, fire return intervals, and the management strategies.

Transition T2A
State 2 to 3

With continuous abusive grazing, no disturbance such as fire or brush management, the Midgrass Shrubland State will transition into the Shrubland State. This transition is due to the loss of or lack of any harvestable production of perennial grass species. Sand Sagebrush canopy is consistent as it is not typically affected by overgrazing by herbivores but other brush species have increased in response to the lack of a disturbance like fire. (Ex - Eastern Red Cedar) Most production is made up of a few perennial grass and forb species along with a surge in annual grass and forb production.

Restoration pathway R3A
State 3 to 2

Restoration of this severely degraded state requires long term planning. Depending on the remaining grass species, it may take years (decades) of season long grazing deferment as well as suitable weather conditions to recover. Implementation of a prescribed fire program is also key to the restoration of this state. Burning will return sagebrush cover to a lower canopy percent and provide control of Eastern Redcedar, but may not recover the perennial grass component rapidly. Over time, with the implementation of proper stocking rates and prescribed burning program, this state may be restored to a Midgrass Shrubland State (2).

Additional community tables

Table 10. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			764–2295	
	sand bluestem	ANHA	*Andropogon hallii*	224–785	–
	little bluestem	SCSC	*Schizachyrium scoparium*	269–673	–
	switchgrass	PAVI2	*Panicum virgatum*	78–224	–
	giant sandreed	CAGI3	*Calamovilfa gigantea*	34–112	–
	Indiangrass	SONU2	*Sorghastrum nutans*	34–112	–
	purpletop tridens	TRFL2	*Tridens flavus*	34–112	–
	Grass, perennial	2GP	*Grass, perennial*	34–112	–
	big bluestem	ANGE	*Andropogon gerardii*	45–112	–
2	**Midgrass/Shortgrass**			235–706	
	thin paspalum	PASE5	*Paspalum setaceum*	39–112	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	39–112	–
	sideoats grama	BOCU	*Bouteloua curtipendula*	34–90	–
	witchgrass	PACA6	*Panicum capillare*	22–67	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	22–67	–
	Grass, perennial	2GP	*Grass, perennial*	11–34	–
	red lovegrass	ERSE	*Eragrostis secundiflora*	11–34	–
	composite dropseed	SPCO16	*Sporobolus compositus*	11–34	–
	fall witchgrass	DICO6	*Digitaria cognata*	11–34	–
	gummy lovegrass	ERCU	*Eragrostis curtipedicellata*	7–22	–
	purple lovegrass	ERSP	*Eragrostis spectabilis*	7–22	–
	blue grama	BOGR2	*Bouteloua gracilis*	6–17	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	6–17	–
	silver beardgrass	BOLA2	*Bothriochloa laguroides*	0–7	–
	tumble windmill grass	CHVE2	*Chloris verticillata*	0–7	–
	tumblegrass	SCPA	*Schedonnardus paniculatus*	0–7	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–7	–
3	**Cool-Season Perennial Grasses**			165–494	
	Heller's rosette grass	DIOL	*Dichanthelium oligosanthes*	45–112	–
	Canada wildrye	ELCA4	*Elymus canadensis*	45–112	–
	sedge	CAREX	*Carex*	34–90	–
	Texas bluegrass	POAR	*Poa arachnifera*	34–90	–
	western wheatgrass	PASM	*Pascopyrum smithii*	11–45	–
4	**Annual Grasses**			11–36	
	sandbur	CENCH	*Cenchrus*	0–17	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–17	–
	little barley	HOPU	*Hordeum pusillum*	0–4	–
	threeawn	ARIST	*Aristida*	0–2	–

Forb					
5	**Annual Forbs**			34–101	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	6–11	–
	sunflower	HELIA3	*Helianthus*	3–11	–
	tenpetal blazingstar	MEDE2	*Mentzelia decapetala*	3–11	–
	evening primrose	OENOT	*Oenothera*	3–11	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	–
	smooth jewelflower	STHY	*Streptanthus hyacinthoides*	0–6	–
	cutleaf geranium	GEDI	*Geranium dissectum*	0–6	–
	Spanish gold	GRPA8	*Grindelia papposa*	0–6	–
	camphorweed	HESU3	*Heterotheca subaxillaris*	0–6	–
	hogwort	CRCA6	*Croton capitatus*	0–6	–
	vente conmigo	CRGL2	*Croton glandulosus*	0–6	–
	Texas croton	CRTE4	*Croton texensis*	0–6	–
	Palmer's spectaclepod	DICA31	*Dimorphocarpa candicans*	0–6	–
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–6	–
	Indian blanket	GAPU	*Gaillardia pulchella*	0–3	–
	lemon beebalm	MOCI	*Monarda citriodora*	0–3	–
	prairie broomweed	AMDR	*Amphiachyris dracunculoides*	0–2	–
	scratchdaisy	CROPT	*Croptilon*	0–2	–
	Gordon's bladderpod	LEGO	*Lesquerella gordonii*	0–2	–
	pepperweed	LEPID	*Lepidium*	0–2	–
	spurge	EUPHO	*Euphorbia*	0–2	–
	plains snakecotton	FRFL	*Froelichia floridana*	0–2	–
	Arkansas dozedaisy	APSK	*Aphanostephus skirrhobasis*	0–2	–
	crested pricklypoppy	ARPO2	*Argemone polyanthemos*	0–2	–
	lambsquarters	CHAL7	*Chenopodium album*	0–2	–
	soft goldenaster	CHPI8	*Chrysopsis pilosa*	0–2	–
	golden tickseed	COTI3	*Coreopsis tinctoria*	0–2	–
6	**Perennial Forbs**			235–706	
	queen's-delight	STSY	*Stillingia sylvatica*	22–67	–
	dayflower	COMME	*Commelina*	22–67	–
	mat sandbur	CELO3	*Cenchrus longispinus*	24–40	–
	little barley	HOPU	*Hordeum pusillum*	24–40	–
	globemallow	SPHAE	*Sphaeralcea*	11–34	–
	soapweed yucca	YUGL	*Yucca glauca*	11–34	–
	clammy groundcherry	PHHE5	*Physalis heterophylla*	11–34	–
	prairie groundcherry	PHHI8	*Physalis hispida*	11–34	–
	azure blue sage	SAAZ	*Salvia azurea*	11–34	–
	beeblossom	GAURA	*Gaura*	11–34	–
	hoary false goldenaster	HECA8	*Heterotheca canescens*	11–34	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	11–34	–
	bush morning-glory	IPLE	*Ipomoea leptophylla*	11–34	–
	Forb, perennial	2FP	*Forb, perennial*	11–34	–

	Forb, perennial	2FP	*Forb, perennial*	11–34	
	white sagebrush	ARLU	*Artemisia ludoviciana*	7–20	–
	milkweed	ASCLE	*Asclepias*	4–13	–
	aster	ASTER	*Aster*	4–13	–
	tarragon	ARDR4	*Artemisia dracunculus*	4–13	–
	soft greeneyes	BEPU2	*Berlandiera pumila*	0–7	–
	purple poppymallow	CAIN2	*Callirhoe involucrata*	0–7	–
	yellow sundrops	CASE12	*Calylophus serrulatus*	0–7	–
	yellowspine thistle	CIOC2	*Cirsium ochrocentrum*	0–7	–
	wavyleaf thistle	CIUN	*Cirsium undulatum*	0–7	–
	Texas bullnettle	CNTE	*Cnidoscolus texanus*	0–7	–
	dotted blazing star	LIPU	*Liatris punctata*	0–7	–
	rush skeletonplant	LYJU	*Lygodesmia juncea*	0–7	–
	lacy tansyaster	MAPI	*Machaeranthera pinnatifida*	0–7	–
	narrowleaf four o'clock	MILI3	*Mirabilis linearis*	0–7	–
	common yellow oxalis	OXST	*Oxalis stricta*	0–7	–
	yellow nailwort	PAVI4	*Paronychia virginica*	0–7	–
	skullcap	SCUTE	*Scutellaria*	0–7	–
	Carolina horsenettle	SOCA3	*Solanum carolinense*	0–7	–
	silverleaf nightshade	SOEL	*Solanum elaeagnifolium*	0–7	–
	white heath aster	SYER	*Symphyotrichum ericoides*	0–7	–
	late purple aster	SYPA11	*Symphyotrichum patens*	0–7	–
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–7	–
	nettleleaf noseburn	TRUR2	*Tragia urticifolia*	0–7	–
	Missouri gourd	CUFO	*Cucurbita foetidissima*	0–7	–
	shaggy dwarf morning-glory	EVNU	*Evolvulus nuttallianus*	0–7	–
7	**Legumes**			67–202	
	Virginia tephrosia	TEVI	*Tephrosia virginiana*	11–45	–
	roundhead lespedeza	LECA8	*Lespedeza capitata*	11–28	–
	slender lespedeza	LEVI7	*Lespedeza virginica*	4–13	–
	leadplant	AMCA6	*Amorpha canescens*	4–13	–
	sessileleaf ticktrefoil	DESE	*Desmodium sessilifolium*	4–13	–
	Indian rushpea	HOGL2	*Hoffmannseggia glauca*	4–13	–
	coastal indigo	INMI	*Indigofera miniata*	4–13	–
	prairie clover	DALEA	*Dalea*	0–11	–
	Forb, perennial	2FP	*Forb, perennial*	0–11	–
	fourvalve mimosa	MIQU2	*Mimosa quadrivalvis*	0–11	–
	sidebeak pencilflower	STBI2	*Stylosanthes biflora*	0–6	–
Shrub/Vine					
8	**Shrubs**			151–454	
	sand sagebrush	ARFI2	*Artemisia filifolia*	78–224	–
	Chickasaw plum	PRAN3	*Prunus angustifolia*	45–135	–
	fragrant sumac	RHAR4	*Rhus aromatica*	22–56	–
	smooth sumac	RHGL	*Rhus glabra*	7–22	–

	smooth sumac	RHGL	*Rhus glabra*	1–22	
	Havard oak	QUHA3	*Quercus havardii*	0–11	–
	twistspine pricklypear	OPMA2	*Opuntia macrorhiza*	0–6	–
Tree					
9	**Trees**			17–50	
	netleaf hackberry	CELAR	*Celtis laevigata var. reticulata*	9–28	–
	blackjack oak	QUMA3	*Quercus marilandica*	0–11	–
	post oak	QUST	*Quercus stellata*	0–11	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	0–6	–

Table 11. Community 1.2 plant community composition

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

Table 12. Community 2.1 plant community composition

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

Table 13. Community 3.1 plant community composition

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

Animal community

This plant community has good value for grazing by domestic animals. It also has good value as food and cover for numerous species of wildlife. It provides excellent habitat for northern bobwhite quail as well as Lesser Prairie chicken where they are found. White-tailed deer and wild turkey frequent the site. A great variety of song birds utilize this site for summer habitat. This community is particularly important for Cassin’s sparrow when shrub cover is high. For more specific guidance, refer to Wildlife Habitat Appraisal Guides that are species specific.

Hydrological functions

The soils of this site are rapidly permiable and excessively drained. Most available moisture permiates through the soil profile rather quickly. This should be taken into consideration before applying any soil ammendments or herbicides. Many of these sites have inclusional areas of Carwile soils(Depressional Upland) which may pond water from time to time.

Recreational uses

This site is well known in Oklahoma for its quail hunting. A multitude of mammals and birds frequent this site, so it is a great area to observe and study Oklahoma animal and plant life. This site is used for many common recreational activities such as hiking, camping, bird watching, hunting and horseback riding.

Wood products

None

Other products

There is potential for recreational harvesting of sand plums where they occur throughout the site.

Inventory data references

Inventory Data References:
Information presented has been derived from NRCS clipping data, research from Oklahoma State University, field observations and measurements by trained range personnel. Most of the clipping data was gathered by a team

consisting of a range conservationist and a soil scientist and was site/soil specific. Yields were taken at the end of the growing season and, as near as possible, were obtained from areas that were un-grazed that year. Clipping data repository is in the NRCS State Office in Stillwater, OK.

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It is important to remember that ESDs always ramain as draft documents and as more information is collected, they are updated accordingly through update projects. The concepts within this report were developed using the current information available at the time.

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Approval

Bryan Christensen, 9/15/2023

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 (Edited original version by Mark Moseley & Jack Eckroat 2004)
Contact for lead author	colin.walden@ok.usda.gov
Date	08/01/2013
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** There should be no rills due to the rapidly permeable soils

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2. **Presence of water flow patterns:** No water flow patterns should be present

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3. **Number and height of erosional pedestals or terracettes:** Rare occurence of pedestals <1inch on areas of steeper slopes

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Some variability from year to year with precipitation patterns. No more than 15%

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

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

7. **Amount of litter movement (describe size and distance expected to travel):** Very little litter movement due to rapidly permeable soils

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 and 6 for canopy and interspaces

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0 to 16 inches; brown (7.5YR 5/4) crushed loamy fine sand, brown (7.5YR 4/4) crushed moist; weak medium subangular blocky structure parting to structureless, single grained; loose, very friable, non sticky, non plastic

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Very little runoff due to rapidly permeable soils regardless of functional group proportions

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No 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: Warm-Season Midgrasses & Tallgrasses codominant

    Sub-dominant: Perennial Forbs>Shrubs>Cool-Season Grasses>Annuals

    Other:

    Additional: Some of the soil series associated with the Rolling Sands Ecological Site sustain populations of plants that would refer to a different ecological site. Refer to 078CY017 or 080AY018 based on the dominant overstory of shrub or other woody species.

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Some mortality from year to year < 10%

14. **Average percent litter cover (%) and depth (in):** Litter cover should average 75% at a depth of 1/2 inch

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1500 - 4500 lb/ac

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 invases: Eastern Redcedar, Brome, Sericea Lespedeza(uncommon).

17. **Perennial plant reproductive capability:** All plants should be capable of reproducing every 2-3 years