USDA Natural Resources Conservation Service

Ecological site R077AY004OK
Parna Dune 16-22" PZ

Last updated: 9/11/2023
Accessed: 05/20/2025

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.

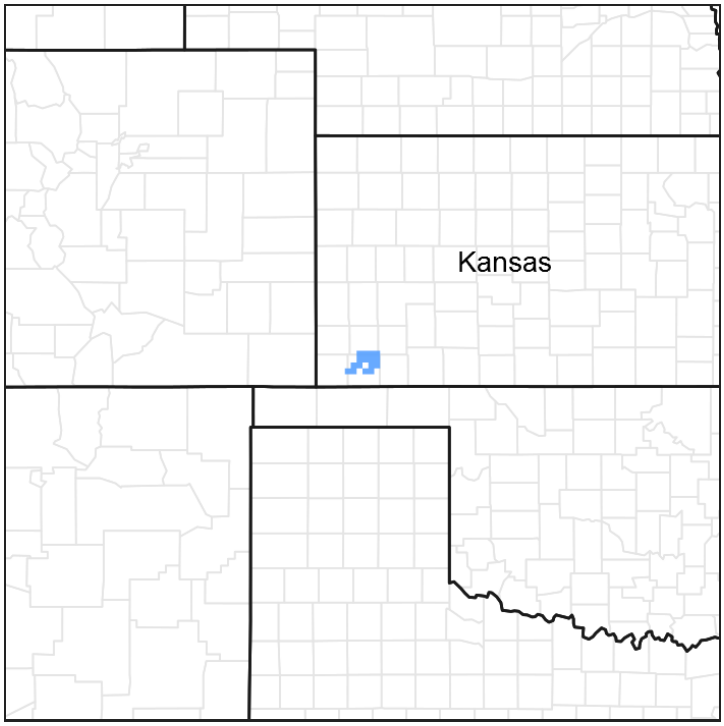

Figure 1. Mapped extent

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): 077A–Southern High Plains, Northern Part

MLRA 77A is characterized by nearly level plains with playa depressions and sloping breaks along rivers and creeks. Soils are generally deep, fine-textured, and occur in a

mesic soil temperature regime.

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 occurs over loamy calcareous loess deposits that have been shaped into dunelike topography. The reference vegetation consists of native mid and shortgrasses and forbs with very few woody species. With abusive grazing practices, the plant community may shift towards a shortgrass dominated community.

Associated sites

R077AY002TX	**Draw 16-22" PZ** Gently sloping loamy soils on lower positions that receive water run-on from adjacent sites. Due to increased water availability this site has higher production potential with tall and mid grasses.
R077AY005TX	**Playa 16-22" PZ** Nearly level clayey soils with high shrink-swell potential on lower closed depression playa positions that intermittently pond water. Vegetation is variable and includes hydrophytes.
R077AY006TX	**Limy Upland 16-22" PZ** Gently sloping to moderately sloping loamy soils with highly calcareous subsoils on lower side slopes. Short and mid-grass dominate and with few tall grasses, perennial and annual forbs, and few woody species present.
R077AY015KS	**Loamy Upland 16-22" PZ** Nearly level to gently sloping soils on adjacent positions formed in mixed loamy and silty eolian deposits with subsoils of fine-loamy or fine-silty argillic horizons. These soils do not have a calcic horizon above 100 cm (40 in). Mixture of tall and mid grass species dominate with a few woody species present.
R077AY001TX	**Deep Hardland 16-22" PZ** Nearly level to gently sloping fine-textured soils on lower positions that formed in calcareous loess. Dominated by short and mid-grass species with few woody species.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Bouteloua curtipendula* (2) *Bouteloua gracilis*

Physiographic features

This site is classified as an upland and consists nearly level to moderately sloping dunes formed in calcareous parna (windblown calcareous aggregates of coarse silt and sand-sized particles) and located on the High Plains. Slopes range from 0 to 8 percent.

Table 2. Representative physiographic features

Geomorphic position, flats	(1) Rise
Landforms	(1) Plains > Parna dune
Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,500–4,500 ft
Slope	0–8%

Table 3. Representative physiographic features (actual ranges)

Runoff class	Negligible to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,300–4,990 ft
Slope	0–8%

Climatic features

Climate is a cold semi-arid steppe (Koppen-Geiger classification BSk). Summers are hot and winters are cold. Temperature extremes are common. Humidity is generally low, and short-term droughts are common. Humidity is generally low and evaporation high. Average annual wind speed is 12 mph with highest winds in early spring. The prevailing wind direction is south. Summertime brings strong high pressure systems that build into heat domes with highs in the upper 90 to mid-100 degree F range. Evaporation in summer is high and open pan evaporation exceeds 6 feet per year. Early autumn temperatures are mild, with Canadian and Pacific cold fronts bringing cold air in mid-autumn throughout winter. Arctic air can settle in and dominate for several weeks during winter with very cold air in place for 2 to 3 weeks at a time.

Most of the precipitation comes in the form of rain from May through September. Rainfall

events often occur as intense showers of relatively short duration. Snowfall average is about 15 inches but is also variable from 8 to 36 inches annually. Long term droughts are likely to occur every 15 to 20 years and may last 4 to 5 years. Mean precipitation is around 19 inches but varies significantly from year to year. Rainfall amounts over the last 100 years have varied from as little as 9 inches to as much as 37 inches. The probability is about 70% that precipitation will fall between 14 inches and 23 inches. Growing season averages 180 days. Average first frost is around October 17, and the last freeze of the season occurs around April 21.

Table 4. Representative climatic features

Frost-free period (characteristic range)	143-156 days
Freeze-free period (characteristic range)	175-190 days
Precipitation total (characteristic range)	18-21 in
Frost-free period (actual range)	138-163 days
Freeze-free period (actual range)	169-194 days
Precipitation total (actual range)	18-22 in
Frost-free period (average)	150 days
Freeze-free period (average)	182 days
Precipitation total (average)	19 in

Climate stations used

- (1) ELKHART [USC00142432], Elkhart, KS
- (2) STRATFORD [USC00418692], Stratford, TX
- (3) GOODWELL 2 E [USW00003055], Goodwell, OK
- (4) SPEARMAN [USC00418523], Spearman, TX
- (5) DUMAS [USC00412617], Dumas, TX
- (6) HUGOTON [USC00143855], Hugoton, KS
- (7) LIBERAL [USC00144695], Liberal, KS
- (8) PERRYTON [USC00416950], Perryton, TX
- (9) BOISE CITY 2 E [USC00340908], Boise City, OK

Influencing water features

Well drained soils with negligible to medium runoff. No influencing water features.

Wetland description

Soils in this ecological site are not part of wetland ecosystems.

Soil features

Soils are mapped for each county within the MLRA. Mapunits are representations of the major soil series component(s) and named accordingly. Each Mapunit is spatially represented on a digital 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.

This group of soils consists of very deep, well drained, and moderately permeable soils that formed in loamy, calcareous, eolian parna and loess deposits of Holocene age. These soils occur on parna dunes or loess plains. They have loam or silt loam surface textures, fine-silty argillic horizons, and a calcic horizon above 100 cm (40 in) of the soil surface. These soils are calcareous throughout the entire soil profile. Slopes range from 0 to 8 percent. Runoff is negligible to medium dependent upon the slope.

Representative soil components for this site include: Canina

Table 5. Representative soil features

Parent material	(1) Parna (2) Loess
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Fine-silty
Drainage class	Well drained
Permeability class	Moderate
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5.5–8.5 in
Calcium carbonate equivalent (0-40in)	5–30%

Electrical conductivity (0-40in)	1 mmhos/cm
Sodium adsorption ratio (0-40in)	0–1
Soil reaction (1:1 water) (0-40in)	7.7–8.2
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

The information contained in the State and Transition Diagram (STD) and the Ecological Site Description was developed using archeological and historical data, professional experience, and scientific studies. Not all scenarios or plants are included. Key indicator plants, animals and ecological processes are described to inform land management decisions.

Like many ecosites throughout the great plains, this site evolved under periodic fire and grazing events. The deep soils support the growth of palatable vegetation for grazing and browsing animals. In the reference condition this vegetation is also capable of carrying fires across the landscape which, historically, has limited the encroachment of woody species. However, these productive soils were often overutilized by cattlemen or plowed up by the farmsteaders in the early 1900s. This lead to widespread erosion in some areas and depletion of the soil resources. While farming has ceased on many of these upland sites, abusive grazing practices still persist. Most acres that were farmed have been planted back to introduced species such as Bermudagrass, old world bluestems, or in some cases native species. While the monocultures of introduced species can address the soil erosion on these sites, they do little to restore the hydrologic or ecological function. In the absence of prescribed fire or alternative brush management, woody species are likely to increase in abundance and stature. While these woody species may not increase enough to dominate ecological functions on the site, their presence can impact grazing access and wildlife habitat needs. It is important to note that mesquite is not found in abundance on these sites like it is on sites further south in the MLRA.

A State and Transition Diagram for the Parna Dune (R077EY004OK) site is depicted below. Thorough descriptions of each state, transition, 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 natural 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.

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

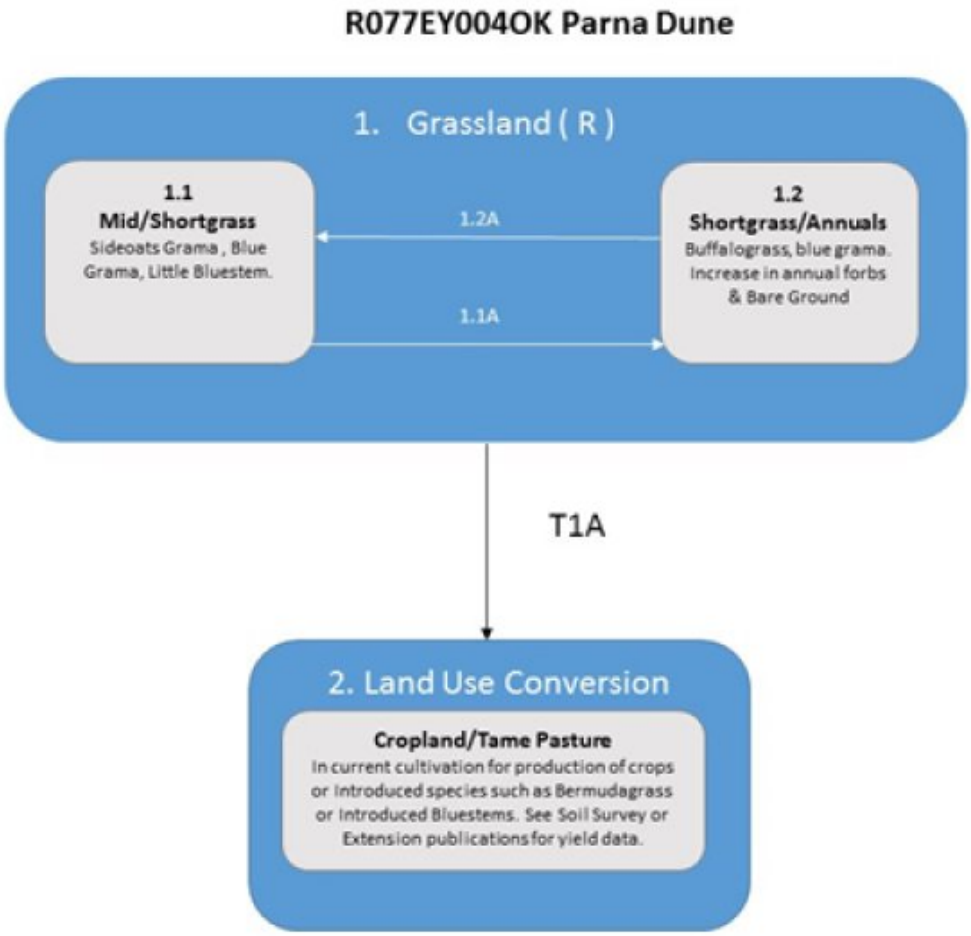

Figure 8. R077AY004OK

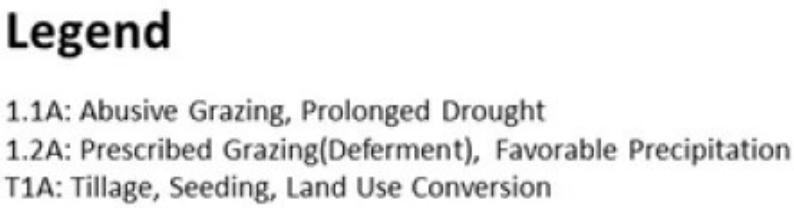

Figure 9. R077AY004OK

State 1
Grassland

This is the reference or diagnostic community for the site. The description is based on early range site descriptions, clipping data, professional consensus of experienced range specialists, and analysis of field work.

Dominant plant species

- sideoats grama (*Bouteloua curtipendula*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 1.1
Mid/Shortgrass

This is the reference community for the Parna Dune site. The vegetation is dominated by mixed midgrasses and shortgrasses, mainly sideoats grama, blue grama and little bluestem. Some tallgrasses may occur in minor amounts such as switchgrass or sand bluestem. Many perennial forbs and legumes also occur on these sites. Minor amounts of woody species may occur including skunkbush, hackberry, yucca, or sandplum. Total

annual production for this community is estimated to range from 500 to 2500 pounds per acre.

Community 1.2
Shortgrass/Annuals

This plant community is dominated by shortgrasses such as buffalograss and blue grama. Other species may include silver bluestem and some remnant sideoats. There has been an increase in annual forbs and bare ground. With the absence of midgrass species, the forage base for grazing livestock has been diminished and infiltration rate may have declined also.

Pathway 1.1A
Community 1.1 to 1.2

Abusive grazing practices that include stocking above carrying capacity without adequate rest may push this community towards community 1.2 as the more palatable species are damaged. Additionally, long periods of drought may hinder the vigor of some of the mid and tallgrasses and favor the more drought tolerant short grasses.

Pathway 1.2A
Community 1.2 to 1.1

Through adequate rest from grazing and favorable growing season precipitation, this community may be shifted back to the reference community.

State 2
Land Use Conversion

This is an alternative state from the reference. Hydrologic and ecological functions have been altered.

Community 2.1
Cropland/Tame Pasture

This community phase is in current crop production or has been tilled and seeded to an introduced forage. The hydrology has been altered and requires different management. See Soil Survey or Extension publications for yield data.

Transition T1A
State 1 to 2

Through tillage and seeding this site will transition to state 2.

Additional community tables

Animal community

Plains grassland birds and mammals frequent this site. Scaled quail, coyotes, various raptors, song birds such as meadow lark, Texas horned lizard, jackrabbit, and other species that prefer an open plains grassland habitat are found on this site.

Hydrological functions

This site is an upland position and sheds runoff to adjacent sites. Increases in shortgrasses and bare ground can limit infiltration and increase runoff.

Other references

USDA-NRCS (Formerly Soil Conservation Service) Range Site Descriptions (1960s)
USDA-NRCS (Formerly Soil Conservation Service) Ag Handbook 296 (2006)
Soil Survey Manuscripts Beaver County, OK

Contributors

Colin Walden Range Management Specialist Stillwater OK
Steven McGowen, MLRA Office Leader, NRCS, Woodward, OK

Approval

Bryan Christensen, 9/11/2023

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)	
Contact for lead author	
Date	05/20/2025
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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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):

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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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):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
