



NEON Site-Level Plot Summary

Caddo-LBJ National Grasslands (CLBJ)

Document Information

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Site Background

The Caddo-LBJ National Grasslands (CLBJ) site is near Decatur, Texas in the LBJ National Grasslands. The site is in Major Land Resource Area (MLRA) 84B – West Cross Timbers, but also includes a minor extent of MLRA 85 – Grand Prairie. The site consists of 19,962 acres and occurs on the moderately dissected, very low hills of the eastern Osage Plain. The elevation at the site ranges from approximately 244 to 356 m (800 to 1,168 ft) above sea level.

Site Information

The parent material at the CLBJ site consists predominantly of residuum derived from interbedded sandstone and siltstone of the Antlers Sand Formation; of minor extent are residuum and colluvium derived from calcareous limestone of the Walnut Clay Formation and local alluvium. Land use is about 50 percent rangeland grassland and savanna and 43 percent forest land, with the remaining land use consisting of developed land and open water.

Grasslands are dominated by mid to tall warm season grasses, primarily little bluestem (*Schizachyrium scoparium* (Michx.) Nash), indianguass (*Sorghastrum nutans* (L.) Nash), and purpletop (*Tridens flavus* (L.) Hitchc.). Cool-season grasses such as Scribner's panicum (*Dichanthelium oligosanthes* (Schult.) Gould var. *scribnerianum* (Nash) Gould) and Texas Wintergrass (*Nasella leucotricha* (Trin. & Rupr.) Pohl) are also present. Little bluestem is dominant on many areas that were disturbed by farming in the past. Forest land is dominated by post oak (*Quercus stellata* Wangenh.), blackjack oak (*Quercus marilandica* Münchh.), and greenbrier (*Smilax rotundifolia* L.). Savannas consist of post oak and blackjack oak with a tall and midgrass understory.

Major soil series on the site include Duffau, Keeter, Weatherford, Windthorst, and Wise. Landforms that these soils typically occur on are narrow crests and hillslopes. To a lesser extent, footslopes, stream beds, open depressions, active and stabilized gullies are also represented.

Analysis of Plots for Sampling

Soil map unit and landform were the two major features employed for selecting plots to sample. Each plot was chosen based on best representation of the landform and potential to sample the

most representative pedon for a soil series located within the site. The Soil Survey of the site consisted of 39 different map units, however, the pre-selected sampling plots occurred in only 11 of the map units. The analysis resulted in 11 plots being selected for field description, sampling, and lab characterization. The 23 plots not sampled either occurred in non-typical settings or were duplicates of one of the 11 chosen plots.

Sampled soil map units represent approximately 78 percent of the CLBJ site:

Map unit symbol	Map Unit Name	% Total site area
ByE	Brackett-Aledo complex, 5 to 20 percent slopes	1.9
DuB	Duffau fine sandy loam, 1 to 3 percent slopes	4.6
DvC4	Duffau-Gullied land complex, 3 to 8 percent slopes, severely eroded	12.2
KtC	Keeter very fine sandy loam, 1 to 6 percent slopes	11.9
KtC3	Keeter very fine sandy loam, 2 to 6 percent slopes, eroded	9.5
VeC	Venus loam, 3 to 8 percent slopes	5.7
WeC	Weatherford-Duffau complex, 3 to 8 percent slopes	16.1
WeC3	Weatherford-Duffau complex, 3 to 8 percent slopes, severely eroded	16.5
	Total	78.4

Of the 22 percent of the CLBJ site area soil map units not sampled, only 5 percent is represented by 3 individual NEON distributed plots. These soils are of minor extent within CLBJ and are listed:

Map unit symbol	Map Unit Name	% Total site area
DfC	Duffau loamy fine sand, 1 to 5 percent slopes	1.9
PhC	Patilo-Heaton fine sands, 3 to 12 percent slopes	1.0
SoC	Somervell-Aledo complex, 1 to 8 percent slopes	2.0
	Total	4.9

Plot Findings

The selected plots based on field observations are representative of the range of variation that is expected within the parent material, landforms and map units in which they occur. Fifty-five percent of the plots sampled (6 plots) occur in soils similar to the major soil components listed within the soil map unit descriptions. The remaining 5 sampled plots are soils that occur as minor soil components within the stated map unit. The occurrence of minor soil components is within the expected range in soil variation that exists at the CLBJ site.

The 11 pedons sampled represent nine of the most extensive soil map units on the site. The major soil components sampled are Duffau, Keeter, Weatherford, Windthorst, Pidcoke, and Wise.

Landforms—NEON Plot CLBJ_048 is on a convex crest. Plot CLBJ_044 is on a broad concave headslope. Plots CLBJ_049, 050, 051, 052, 054, 058, and 059 are located on linear backslopes of side slopes. Plot CLBJ_039 is located on a narrow linear footslope. Plot CLBJ_034 is located on a linear shoulder of a limestone interfluvium.

Parent Material—The CLBJ site is dominated by residuum derived from two sources: noncalcareous interbedded sandstone-siltstone and calcareous fossiliferous limestone. Also present are slope alluvium and colluvium derived from the same source rocks. Slope alluvium and colluvium are more prevalent in lower positions adjacent to the higher limestone interfluviums because the steep scarps and longer slopes allow for sediment deposition through gravity (colluvium) and slope wash (slope alluvium) processes. In most of the CLBJ site, the relatively erodible interbedded sandstone and siltstone provides an environment where gully and stream down cutting limit accumulation of alluvial sediments except in the broad alluvial valleys. In this landscape, small-scale variability within the interbedded sandstone and siltstone influences the soil forming processes and resultant soil properties.

Areas dominated by sandstone weather to Duffau and Weatherford soils, whereas dominantly siltstone areas weather to the Keeter and Windthorst soils. Residuum weathered from sandstone and siltstone (8 plots) is the dominant parent material, followed by slope alluvium (1 plot), colluvium (1 plot), and residuum weathered from fossiliferous limestone (1 plot). Plots CLBJ_044, 048, 049, 050, 051, 052, 054, and 058 formed from residuum weathered from sandstone and siltstone. Plot CLBJ_039 formed from slope alluvium. Plot CLBJ_059 formed from colluvium over residuum. Plot CLBJ_034 formed from residuum weathered from fossiliferous limestone.

Summary of Soils

The main goal at the site was to sample the following soil series: Duffau, Weatherford, Keeter, Pidcoke, and Wise. Also sampled were areas of Windthorst soils, which at the CLBJ site are transitional between the Keeter and Duffau soils. The most common soils were the Duffau (4 plots: CLBJ_049, 058, 044, 051) and Windthorst (3 plots: CLBJ_039, 050, 052). Also sampled were the Weatherford (1 plot: CLBJ_054), Keeter (1 plot: CLBJ_048), Pidcoke (1 plot, CLBJ_034), and Wise (1 plot: CLBJ_059). The following paragraphs describe in more detail the soil field characteristics and occurrence at the plots.

The Duffau, Weatherford, Keeter, and Windthorst soils have an ochric epipedon and a significant clay increase to a well-developed argillic horizon. These four soils are differentiated by the sand and clay content of the upper part of the argillic horizon, the depth of pedogenesis (solum depth), and the depth to a root limiting layer. The Pidcoke soils have a mollic epipedon and an abundance of calcium carbonate in the lower part of the soil above the lithic contact with fossiliferous limestone. The Wise soils have an ochric epipedon, and a subsoil that is marginally developed (cambic horizon). These soils have a solum depth of less than 100 cm and are underlain by stratified noncemented sandstone and siltstone.

The Duffau soils formed from residuum weathered from sandstone. The soils were sampled from two distinct landforms (linear backslopes and broad concave head slopes) and one distinct microfeature (the stabilized bench of a gully on a side slope). CLBJ_049 and CLBJ_058 were sampled as the Duffau series and are located on the more typical landform for the series linear backslopes on side slopes. CLBJ_044 was sampled as a taxadjunct to the Duffau series - this soil

has the typical morphology and parent material of the Duffau series, but has formed in a water receiving concave position. Based on field observations, this soil may have a perched water table at a depth of 84 cm during wet periods in the spring and fall of the year. CLBJ_051 was sampled as a taxadjunct to the Duffau series. This soil component has not been typified in the past. In current surveys these stabilized and vegetated areas are included with the actively eroding Gullied land miscellaneous areas. Future surveys may identify a soil component for these stabilized remnants of former active gullies. CLBJ_051 is also located adjacent to a seasonal open depression. This proximity, coupled with the less permeable bulk density of this young soil, may allow water to perch at a depth of 43 cm during wet periods in the spring and fall of most years. It is also possible that the aquic features in this soil formed prior to the down cutting and placement of the current open depression that is nearby. The relatively impermeable nature of the Bt2 horizon described at 43 cm is evident by the contrast in rooting abundance in the Bt1 versus the Bt2. Of the four pedons sampled as Duffau, all were sampled from a map unit with Duffau listed as a major component (Duffau fine sandy loam, 1 to 3 percent slopes, Duffau-Gullied land complex, 3 to 8 percent slopes, severely eroded, and Weatherford-Duffau complex, 3 to 8 percent slopes).

The Windthorst soils were sampled from two parent materials, residuum weathered from sandstone and siltstone, as well as slope alluvium. These soils are located on two distinct landforms (linear backslopes and footslopes) which relate to the processes of formation. CLBJ_050 and CLBJ_052 are located on the more typical landform for the series - linear backslopes on side slopes. CLBJ_050 is considered similar to the Windthorst series, but the redox features expressed in the upper part of this pedon are not considered typical of the series. Given the current topography and lack of iron manganese concentrations in this pedon, the redox depletions present today may have formed prior to the down cutting of the nearby streambed and gullies. CLBJ_052 is in a transitional area between the Duffau and Keeter series: this soil has a solum depth deeper than is typical of the Keeter series, and a higher clay content and lower sand content than is typical of the Duffau series. Due to the very deep solum depth and clayey texture, this soil is considered most similar to the Windthorst series. CLBJ_039 is located on a footslope position and appears to have a complex depositional history. The gravelly 2Bk and 2BCK horizons may have been deposited by colluvial processes (prior to the back weathering of the nearby limestone interfluvium), this may have been followed by local slope wash processes, wherein sediments derived from sandstone and siltstone were deposited over the former colluvial surface. This soil is designated as Windthorst because of the lack of a mollic epipedon and sandy loam surface texture. While it is similar to Windthorst with respect to morphology, consideration was given to designate this soil as a taxadjunct of the Blanket soil series given the depositional processes involved in the formation of this soil. The three pedons of Windthorst are from minor components in map units of Weatherford-Duffau complex, 3 to 8 percent slopes, severely eroded, Keeter very fine sandy loam, 2 to 6 percent slopes, eroded, and Keeter very fine sandy loam, 1 to 6 percent slopes.

The Weatherford soils formed from residuum weathered from sandstone. One pedon (CLBJ_054) was sampled from the typical landform for these soils (linear backslopes). The sampled soil has the typical morphology for the Weatherford soil series, and represents the dominant major component for the Weatherford-Duffau complex, 3 to 8 percent slopes map unit.

The Keeter soils formed from residuum weathered from very-fine grained sandstone and siltstone. One pedon (CLBJ_048) was sampled from the typical landform for these soils (convex

crests). The sampled soil has the typical morphology for the Keeter series, but has a higher clay content than is typical of the Keeter series. The Keeter series in prior surveys to Wise County, Texas was mapped as a moderately deep phase of the Windthorst series. Given the solum depth and depth to stratified noncemented sandstone, CLBJ_048 is considered a taxadjunct to the Keeter series.

The Pidcoke soils formed from residuum weathered from fossiliferous limestone. One pedon (CLBJ_034) was sampled from a shoulder position of a limestone interfluvium. These soils have been included with the Aledo soils in many soil surveys (including Wise County). Pidcoke soils differ from the Aledo soils in that the Pidcoke soils typically have a surface horizon with less than 25 percent limestone fragments. Pidcoke soils formed in fossiliferous limestone of the Walnut Clay formation, whereas Aledo soils most often form in nodular limestone of the Comanche Peak or Goodland Limestone formations. The sampled pedon does not fit the Pidcoke series due to the thickness of the layer of high calcium carbonate. This layer does not meet the minimum thickness requirement for a calcic horizon. This pedon also has a higher limestone fragment content in the lower part than is typical of the Pidcoke series, but is considered within the range of variation expected in mapped areas.

The Wise soils formed from colluvium derived from limestone and sandstone over residuum weathered from sandstone. One pedon (CLBJ_059) was sampled from a linear backslope below a limestone interfluvium, which is a typical landform for the Wise soils. These young soils form in interbedded sandstone and siltstone of the Antlers or Paluxy formations, but also must have a calcareous influence from the overlying Walnut Clay formation. Due to this colluvial position, the range of variation for the particle size class is greater than in most soils. The sampled soil was described as much coarser than is typical of the Wise series (or the Venus series). Mapped areas include areas of fine-loamy alongside the typified fine-silty particle-size control section. This area is mapped as Venus loam, 3 to 8 percent slopes. The Venus soils have a mollic epipedon and a solum of more than 100 cm. Given the position of many of the Venus loam, 3 to 8 percent slopes map units at the CLBJ site, this sampled minor component of Wise soils is expected to have representation across the CLBJ site in many areas delineated as Venus soils.