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# NEON Site Level Plot Summary University of Kansas Field Station (UKFS)

## Document Information

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## Site Background
The University of Kansas Field Station (UKFS) site is near Lawrence, Kansas. The site is in Major Land Resource Area (MLRA) 106 – Nebraska and Kansas Loess-Drift Hills. The site consists of 1535 acres. The University of Kansas Field Station is situated within the tallgrass prairie/eastern deciduous forest transition zone.

## Site Information
Elevation ranges from approximately 850 feet to 1050 feet above sea level.

The parent materials at the UKFS site are residuum, till, colluvium, and local alluvium.

Land use is about 66 percent covered by forest land, with the rest of the areas cleared for grass land, conservation reserve program land, or other agricultural or general use.

Forest land plant communities are dominated by oak-hickory forest. Grass land plant communities are dominated by tallgrass prairie including big bluestem, indiangrass, and switchgrass.

Major soil series on the site include Grundy, Martin, Oska, Pawnee, Rosendale, and Bendena.

Landform positons that these soils occur on are residual summits, shoulder slopes, back slopes; colluvial foot slopes and toeslopes; and alluvial drainageways.

Soil mapping consisted of 17 different map units. This included 4 miscellaneous area map units (Earthen dam, Made land, Miscellaneous water, and Water).

## Analysis of Plots for Sampling

Soil map unit, geology, landform, and major vegetative communities were four features identified for each plot during the pre-analysis. Each unique combination of these four features was labeled as a landform setting. The landforms identified on the UKFS site were residual or till hillslopes with summits, shoulders, back slopes; colluvial hillslopes with footslopes and toeslopes; and alluvial drainageways. The pre-selected sampling plots occurred in only 6 of the map units (out of the total 17). The analysis resulted in 17 plots (out of a total of 34) being selected for field description, field sampling, and lab characterization. The 17 plots not sampled either occurred in non-typical settings or were duplicates of one of the 17 chosen plots.
There was one soil sample site added for a study that the University of Kansas was conducting in conjunction with the NEON study. This sample site was not in any NEON sample plot.

Approximately 90 percent of the NEON site area at UKFS site consisted of map units that were sampled. These include:

| Map Unit Symbol | Map Unit Name | % Total Site Area |
|---|---|---|
| 7252 | Grundy silty clay loam, 1 to 3 percent slopes | 3.03 |
| 7302 | Martin silty clay loam, 3 to 7 percent slopes | 8.37 |
| 7305 | Martin silty clay loam, 7 to 12 percent slopes, eroded | 5.39 |
| 7461 | Oska silty clay loam, 3 to 8 percent slopes, eroded | 14.65 |
| 7501 | Pawnee clay loam, 4 to 8 percent slopes, eroded | 19.38 |
| 7550 | Rosendale-Bendena silty clay loams, 3 to 40 percent slopes | 38.99 |
| | **Total** | **89.82** |

Approximately 10 percent of the NEON site area at UKFS site consisted of map units that were not sampled. These include:

| Map Unit Symbol | Map Unit Name | % Total Site Area |
|---|---|---|
| 7051 | Kennebec silt loam, frequently flooded | 0.45 |
| 7090 | Wabash silty clay loam, occasionally flooded | 0.13 |
| 7254 | Grundy silty clay loam, 3 to 7 percent slopes, eroded | 2.57 |
| 7303 | Martin silty clay loam, 3 to 7 percent slopes, eroded | 0.09 |
| 7530 | Sharpsburg silt loam, 1 to 4 percent slopes | 0.36 |
| 7603 | Sibleyville loam, 3 to 7 percent slopes | 0.26 |

| | | |
|---|---|---|
| 7604 | Sibleyville loam, 3 to 7 percent slopes, eroded | 2.61 |
| 9971 | Arents, earthen dam | 0.46 |
| 9984 | Made land | 2.03 |
| 9986 | Miscellaneous water | 0.75 |
| 9999 | Water | 0.48 |
| | **Total** | **10.18** |

The selected sample plots are representative of the map units in which they occur. Some of these map units cover multiple landform positions, because the individual landform positions were too small to map out into separate polygons. With the selection process, we tried to make sure the different major landform positions within a map unit were sampled. In 6 of the 17 sampled plots, we described minor components that occurred in the map units because of all the different landform positions. These minor components were the typical soils for the plot they were in and represent the complexity of the UKFS site. They usually fell within the Range in Characteristics (RIC) of the named series with the exception of a few outliers (noted below). The random plot selection method missed some landform positions within map units. Although these areas are of minor extent to the overall site, they might be important for establishing the variability of the soils at the UKFS location.

## Plot Findings

The 17 pedons sampled represent 6 soil map units. The components sampled were Grundy, Martin, Oska, Pawnee, Rosendale, Bendena, Wamego, Muscotah, and Wymore. Most of the plots sampled were forested (75%). Secondary land use was grassland (25%).

**Parent Material** – The UKFS site area has many different kinds of parent material that includes: till, localized loess caps, interbedded limestone and shale bedrock, colluvium, and alluvium. Plots UKFS_001, 004, and 011 consisted of soils formed in residuum of shale or limestone. Plots UKFS_008, 019, and 022 consisted of soils formed in colluvium. Plots UKFS_007 consisted of soils formed in alluvium. Plots UKFS_012 and 020 consisted of soils formed in colluvium over residuum. Plots UKFS_017 and 018 consisted of soils formed in till. Plots UKFS_030 formed in loess. Plots UKFS_025 consisted of soils formed in loess over residuum.

## Summary of Soils

We did not describe any O horizons at any of the sites we sampled. In the forested sample sites there would be a thin layer of litter, but we did not feel that it was thick enough to be an O horizon. Overall we felt there was a good representation of soils sampled at the UKFS site.

Of the 17 plots sampled, Martin was the most sampled series with four pedons (UKFS_008, 019, 022, 023). For plot UKFS_023, this was the dominant soil type for that plot, but is a minor component in the Rosendale-Bendena silty clay loams, 3 to 40 percent slopes map unit. All the

Martin soils occurred on footslopes and toeslopes and were developed in colluvium. All the Martin samples were within the range of characteristics of the Martin Series. These soils all had a mollic epipedon over 50 centimeters thick. These soils also have an increase in clay content in the subsoil (i.e. an argillic horizon) and are fine, with a subsoil field estimated clay content ranging from about 39 to 47 percent. In the Rosendale-Bendena silty clay loams, 3 to 40 percent slopes map unit, the Tully soils occur in the footslopes below the Rosendale and Bendena soils. The Rosendale and Bendena soils are on the backslope, shoulders and summits. Bendena soils have limestone bedrock occurring within 50 centimeters. Rosendale soils have shale bedrock occurring between 100 centimeters and 150 centimeters, and Rosendale soils do not have thick dark surface (mollic epipedon) that Martin has. The added soil sample site for the University Kansas study was a Martin soil too.

The second most common soil sampled was Oska in three plots (UKFS_004, 011, and 015). For plot UKFS_015, this was the dominant soil type for that plot, but is a minor component in the Rosendale-Bendena silty clay loams, 3 to 40 percent slopes map unit. All the Oska soils were on summits and shoulders and were developed in residuum. UKFS_004 and 015 had bedrock occurring between 50 to 100 centimeters which is within the range of characteristics for Oska. UKFS_011 was greater than 100 centimeters to bedrock and outside the range of characteristics because of this. This does not affect the use and management of the soil. These soils have an increase in clay content in the subsoil (i.e. an argillic horizon) and are fine, with a subsoil field estimated clay content ranging from about 38 to 48 percent. In the Rosendale-Bendena silty clay loams, 3 to 40 percent slopes map unit, the Oska soils occur in the summits and shoulders in higher elevation to the Rosendale and Bendena soils. The Rosendale occur on backslopes and Bendena soils are also occur on shoulders and summits. Bendena soils have limestone bedrock occurring within 50 centimeters. Whereas Oska soils have limestone occurring between 50 and 100 centimeters. Rosendale soils have shale bedrock occurring between 100 centimeters and 150 centimeters, and Rosendale soils do not have thick dark surface (mollic epipedon) that Oska has. Oska is usually mapped next to the Rosendale-Bendena silty clay loams, 3 to 40 percent slopes map unit.

There were 2 Pawnee soils sampled (UKFS_017 and 018). These soils are on backslopes and developed in till. These plots were in an eroded Pawnee map unit. Plot UKFS_018 had indications that that area used to be farmed and had been planted back to tallgrass plant species. Plot UKFS_017 did meet the range in characteristics for a Pawnee soil. For plot UKFS_018, the surface had eroded off enough that it did not meet the required thickness for a mollic epipedon. Since this is a previously farmed area, that variation in surface is expected. These soils have an increase in clay content in the subsoil (i.e. an argillic horizon) and are fine, with a subsoil field estimated clay content ranging from about 40 to 48 percent.

There were 2 Rosendale soils sampled (UKFS_012 and 020). These soils are on backslopes and developed in colluvium over residuum. Both of these plots are taxadjuncts to the Rosendale series. Both plots had a thicker dark surface than is normal for a Rosendale soil. Rosendale normally has a surface less than 25 centimeters thick. These plots had a surfaces with 38 to 53 centimeters in thickness. Plot UKFS_020 had a higher amount of rock fragments in the subsoil

than usually in Rosendale soils. This plot had 50% to 70% rock fragments in the subsoil. Rosendale soils usually have less than 25% rock fragments. These differences do not affect the use and management of the soil. We do believe there is a lot of variation that occurs in the soils on these backslope positions in the Rosendale-Bendena silty clay loams, 3 to 40 percent slopes map unit. These soil samples are probably as typical as any other soils found in these backslopes. The subsoil field estimated clay content ranged from about 32 to 42 percent.

There were 2 Wamego soils sampled (UKFS_011 and 028). For both of these plots, this was the dominant soil type, but these soils are minor components in the Oska silty clay loam, 3 to 8 percent slopes, eroded map unit. These soils developed in residuum. Plot UKFS_011 occurs on a backslope and meets the range of characteristics of the Wamego series. The Wamego series has bedrock occurring between 50 and 100 centimeters, and this plot has bedrock occurring at 76 centimeters. This soil has an increase in clay content in the subsoil (i.e. an argillic horizon) and is fine, with a subsoil field estimated clay content ranging from about 35 to 42 percent. Plot UKFS_028 is a taxadjunct to the Wamego series. This soil is on a shoulder position. This plot shows indications that it used to be farmed and then was replanted back to tallgrass plants. The surface on this plot has been eroded down and does not meet the thickness requirement for a mollic epipedon which Wamego soils should have. The surface was described going to 18 centimeters whereas the series requires a surface thickness between 25 to 50 centimeters. Also the depth to bedrock at this plot was deeper than 1 meter which is outside the range of characteristics for the Wamego series. These differences do not affect the use and management of the soil. The difference between Wamego soils and Oska soils is Wamego soils have shale bedrock occurring between 50 and 100 centimeters. Oska soils have limestone bedrock occurring between 50 and 100 centimeters. In the UKFS site, the geology has interbedded layers of limestone and shale.

There was a Bendena soil sampled (UKFS_001). This soil occurs on a shoulder and was developed in residuum. The Bendena series has limestone bedrock occurring within 50 centimeters. Usually this limestone bedrock is greater than 50 centimeters thick overlaying shale. At this soil sample site, the limestone did occur at 25 centimeters, but it was only 11 centimeters thick. We were able to break through the limestone and sample the shale below it. Since the limestone was this thin, plants, roots, and water are able to go between the bedrock cracks into the shale. This difference does not affect the use and management of the soil.

There was a Muscotah soil sampled (UKFS_007). For this plot, this was the dominant soil type, but this soil is a minor component in the Martin silty clay loam, 3 to 7 percent slopes map unit. This soil occurs on an upland drainageway and was formed in alluvium. This sample does fit in the range of characteristics of the Muscotah series. This soil had a mollic epipedon over 50 centimeters thick. This soil also had a fine textured subsoil, with a subsoil field estimated clay content ranging from about 43 to 50 percent. This sample should be similar to other drainageway areas within the UKFS site. In the Martin silty clay loam, 3 to 7 percent slopes map unit, Muscotah soils occur in the alluvial drainageways below the footslopes and toeslopes that Martin occurs on. Muscotah soils do not have the clay increase in the subsoil (argillic horizon) that occurs in martin soils.

There was a Wymore soil sampled (UKFS_030). For this plot, this was the dominant soil type, but this soil is a minor component in the Pawnee clay loam, 4 to 8 percent slopes, eroded map unit. This soil is on a shoulder and formed in loess. Sometimes there are localized loess caps occurring above the till in MLRA 106. This is indicated by the lack of rocks, silty textures, and no bedrock occurring within 2 meters. This sample does fit in the range of characteristics of the Wymore series. These soils have an increase in clay content in the subsoil (i.e. an argillic horizon) and are fine, with a subsoil field estimated clay content ranging from about 40 to 45 percent.

There was a Grundy soil sampled (UKFS_025). This soil is on a shoulder and formed in loess over residuum. This sample is outside the range of characteristics of the Grundy series, because it has a lithologic discontinuity at 77 centimeters. Otherwise this soil is similar to the Grundy series. This difference does not affect the use and management of the soil. These soils have an increase in clay content in the subsoil (i.e. an argillic horizon) and are fine, with a subsoil field estimated clay content ranging from about 42 to 45 percent.