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NEON Site Level Plot Summary
Dakota Coteau Field School (DCFS)

Document Information

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Site Background

The Dakota Coteau Field School (DCFS) site is on 4 tracts of state-owned land near Pingree, North Dakota. This site is an area with moderate relief, distinct landforms, fairly uniform geology, and relatively detailed soil mapping. The DCFS site is in MLRAs 53B (Central Dark Brown Glaciated Plains) and 55B (Central Black Glaciated Plains) and consists of 1,930 acres. MLRA 53B in landform context is characterized as dead-ice moraine and MLRA 55B is a low-lying glacial drift (ground moraine) prairie. The boundary between these two MLRAs is a steep escarpment.

Site Information

- The parent materials at the DCFS site are principally Wisconsin age fine-loamy glacial till and local alluvium derived from the till. The northeast part of the site contains sandy and gravelly glacial outwash in addition to the till.
- The dominant land use is rangeland for grazing livestock. Closed depressions on the site also provide ideal waterfowl habitat.
- Plant communities are dominated by perennial grasses and forbs. The site has a long history of agricultural use, so most of the current grasses are introduced species. Native forbs and some native grass species, however do occur throughout the site.
- Soils on the site are all Mollisols. Diagnostic features present in the soils are a mollic epipedon; argillic, calcic, and cambic horizons; and aquic (redox features) conditions.
- Most of the soils are fine-loamy in the particle size control section. Some pedons, however, have fine textured, sandy, or sandy skeletal control sections.

Plot Analysis for Sampling

The number of plots sampled per map unit was based on the relative percentage of the map unit within the NEON site. Map units that encompassed a larger area had more plots sampled. The DCFS was split into 4 separate sampling areas. Each of these sampling areas had at least 1 plot selected for sampling. Landscape position and slope were considered during location selection with each hillslope profile position being targeted for sampling.

Soil mapping for the DCFS site consisted of 17 unique map units. Six of these map units contained at least one pre-selected plot. Fourteen of the 34 pre-selected plots were selected for characterization and analysis.

Plots sampled represented approximately 88% of the DCFS site's total map unit acres. Map units covering 12% of the site's total area were not sampled: these areas did not have a NEON plot available for sampling. At least one plot was selected in each map unit that contained a plot.

Soil map units sampled at DCFS were:

Map Unit Symbol	Map Unit Name	Acres	Percent Site Area
C132C	Williams-Zahl-Zahill complex, 6 to 9 percent slopes	117	6%
C156F	Zahl-Max-Bowbells loams, 6 to 35 percent slopes	1148	59%
C165F	Zahl-Max-Parnell complex, 0 to 35 percent slopes	316	16%
G143C	Barnes-Buse-Langhei loams, 6 to 9 percent slopes	39	2%
G273A	Sioux-Arvilla complex, 0 to 2 percent slopes	14	1%
G273B	Sioux-Arvilla complex, 2 to 6 percent slopes	69	4%
	Total	**1,703**	**89%**

Soil map units not sampled at the DCFS site were:

Map Unit Symbol	Map Unit Name	Acres	Percent Site Area
C3A	Parnell silty clay loam, 0 to 1 percent slopes	27	1%
C5A	Southam silty clay loam, 0 to 1 percent slopes	103	5%
C135D	Zahl-Williams loams, 9 to 15 percent slopes	3	0%
C210B	Williams-Bowbells loams, 3 to 6 percent slopes	23	1%

C275A	Hamerly-Bowbells loams, 0 to 3 percent slopes	5	0%
C996	Water	27	1%
G143B	Barnes-Svea loams, 3 to 6 percent slopes	10	1%
G143F	Buse-Barnes loams, 15 to 35 percent slopes	10	1%
G250A	Divide loam, 0 to 2 percent slopes	3	0%
G269A	Fordville-Renshaw loams, 0 to 2 percent slopes	10	1%
G269B	Fordville-Renshaw loams, 2 to 6 percent slopes	6	0%
	Total	**227**	**11%**

Most of the selected sample plots are representative of one of the major or minor components or are a similar soil to one of the components in the map units in which they occur. They fall within the Range in Characteristics (RIC) of the individual component and typically occur on the landform position associated with that component in the map unit. One of the selected sample plots (DCFS_029) contained a buried A horizon, and was not representative of the Grail soil series in MLRA 53B.

Plot Findings

The 14 pedons sampled represent 6 soil map units and a variety of glacial till soils, alluvial soils derived from till, and outwash parent materials. Soil series found were Aastad, Arnegard, Badger, Bowbells, Grail, Parnell, Renshaw, Sioux, Williams, and Zahl. All of the plots sampled were in rangeland for grazing and dominated by plant communities of grasses and forbs.

Landforms and Parent Materials

Plots DCFS_004 and DCFS_030 are soils formed in outwash sediments. All other plots formed in glacial till.

Summary of Soils

All of the soils sampled at the DCFS site were prairie grassland Mollisols with dark mollic surface horizons ranging from 18 to 87 cm thick. The sampled soils generally follow the soil-landscape relationships based on the soil forming factors, and are typical of soils and their corresponding landform positions in MLRA's 53B and 55B. Soils with mollic epipedons less than 20 centimeters were found on convex shoulder slopes. On linear backslopes, soils with slightly thicker mollic epipedons and argillic horizons were found. Concave footslopes contained

soils with deep mollic epipedons as well as argillic and cambic horizons. One sampling location (DCFS_063) was near a wetland and met the criteria for a hydric soil.

Aastad was identified in one plot (DCFS_020). Aastad is a fine-loamy moderately well drained soil found on till plains. The soil is characterized by a thick (> 50 cm) mollic epipedon and an argillic horizon. Aastad has a similar profile to the Bowbells that was found on other plots. However Bowbells and Aastad are separated from each other by moisture regime. Aastad has a udic moisture regime and Bowbells has a ustic moisture regime. Aastad will be slightly moister than Bowbells. The Aastad was found in a Barnes-Buse-Langhei loams, 6 to 9 percent slopes map unit. It is not a major or minor component in the map unit. It is similar to the Svea minor component in the map unit. The primary difference between Aastad and Svea is the presence of an argillic horizon in Aastad and a cambic horizon in Svea. Other than the argillic and cambic horizon differences these soils are similar. Both are moderately well drained, fine loamy soil formed in glacial till and occur on similar landscape positions. This site was in an unexpected position for the series. It was located on a summit on the till plain, where typically Aastad is fount on footslopes. This plot was also cobbly which is not typical of the Aastad series.

One plot (DCFS_014) was identified as the Arnegard soil series. The point was located on a foot slope in a Zahl-Max-Bowbells loams, 6 to 35 percent slopes map unit. Arnegard was not identified as a named major or minor soil component, but is similar to the Bowbells major component. Arnegard is a fine-loamy moderately well drained soil that formed in alluvium. The soil is characterized by a thick surface horizon and cambic horizon. The primary difference between Arnegard and Bowbells is the presence of an argillic horizon in Bowbells and a cambic horizon in Arnegard. Other than the horizon differences these soils are similar. Both are moderately well drained, fine loamy soil formed in alluvium and occur on similar landscape positions. This location is not typical of the series, Arnegard is typically found in residual areas and not usually associated with glacial till.

One plot (DCFS_022) was identified as the Badger soil series. Badger is a fine, somewhat poorly drained soil found on till plains. The soil is characterized by a thick surface horizon, argillic horizon, and aquic conditions. This sites was located in a swale within a Zahl-Max-Parnell complex, 0 to 35 percent slopes map unit. Badger was not identified as a named major or minor soil component. Badger occupies a landscape position between the minor component Vallers and Bowbells in the map unit. Badger has been found throughout MLRA 53B, but not extensively enough to have been correlated in the area.

Three plots (DCFS_011, DCFS_016 and DCFS_027) were identified as the Bowbells soil series. Bowbells is a fine loamy, moderately well drained soil and occurs on swales on till plains. The distinctive features are a thick surface horizon and an argillic horizon. Two of these pedons were located within a Zahl-Max-Bowbells loams, 6 to 35 percent slopes map unit and the other pedon was in a Williams-Zahl-Zahill complex, 6 to 9 percent slopes map unit. Bowbells is a major component in both of these map units. Sites DCFS_011 and DCFS_027 were found on the lower portions of a backslope in the map units and site DCFS_016 was located on a footslope in the map unit.

Two plots (DCFS_010 and DCFS_029) were identified as the Grail soil series. Grail is a fine, well-drained soil that formed in alluvium. These pedons were located on a footslope within a Zahl-Max-Bowbells loams, 6 to 35 percent slopes map unit and on a footslope within a Zahl-Max-Parnell complex, 0 to 35 percent slopes map unit. Grail was not identified as a named major or minor soil component. It is similar to the Bowbells component in the map units. The primary difference between Grail and Bowbells is the texture of the argillic horizon. Grail has a fine textured argillic horizon and Bowbells has a fine-loamy texture. Both soils occur on similar landscape positions. This location is not typical of the series, Grail is typically found in residual areas and not usually associated with glacial till. The Grail found at plot DCFS_029 contained a buried A horizon. Typically, a Grail does not contain any buried horizons, but due to the diagnostic features found in the soil profile and landscape position it was classified as Grail. Formation of the buried A horizon is assumed to be due to fire. The fire would have destabilized the plant cover permitting an erosional event depositing material from upslope, burying the original soil surface.

One plot (DCFS_063) was identified as the Parnell soil series. Parnell is a fine, very poorly drained soil and occurs on closed depression on till plains. The distinctive features of it is a thick surface horizon, argillic horizon, and aquic conditions. The sample point was located in a closed depression within a Zahl-Max-Parnell complex, 0 to 35 percent slopes map unit. Parnell is a major soil component in this map unit.

One plot (DCFS_030) was identified as the Renshaw soil series. Renshaw is a somewhat excessively drained soil that has a loamy cap overlying sandy and gravelly sediments and is found on outwash plains. This plot was located on a backslope within a Sioux-Arvilla complex, 0 to 2 percent slopes. Renshaw was not identified as a major or minor soil component. It is similar to the Arvilla major component. These soils are separated by the loamy cap that is present in Renshaw where Arvilla will have a sandy texture throughout the soil profile. With the exception of the surface horizon these series are similar and are found in the same landscape positions.

One plot (DCFS_004) was identified as the Sioux soil series. Sioux is a sandy and gravelly, excessively drained soil on outwash plains. The distinctive features of it are a thin mollic epipedon and gravels throughout the soil profile. The site was located on the upper portions of a back slope in within a Sioux-Arvilla complex, 2 to 6 percent slopes map unit. Sioux is a major component in this map units.

Two plots (DCFS_007 and DCFS_023) were identified as the Williams soil series. Williams is a well-drained, fine loamy soil formed in glacial till. Both of the sites were located within a Zahl-Max-Bowbells loams, 6 to 35 percent slopes map unit. Williams was not identified as a named major or minor soil component. In both delineations the Williams was found on backslopes with slopes near 10 percent. Williams is similar to the Max major component in the map unit. The primary difference between Williams and Max is the presence of an argillic horizon in Williams and a cambic horizon in Max. The argillic horizon found in Williams is a subsurface horizon that has an accumulation of translocated clay. The cambic horizon in Max is a layer that has

experienced some soil formation. Other than the horizon differences these soils are similar and occur on comparable landscape positions.

One plot (DCFS_001) was identified as the Zahl soil series. Zahl is a fine-loamy, well-drained soil on till plains. The distinctive features of it is are a thin mollic epipedon and a calcic horizon. The site was located on a shoulder within a Zahl-Max-Bowbells loams, 6 to 35 percent slopes. Zahl is a major component in this map unit.