NEON Site-Level Plot Summary
Woodworth (WOOD)

Document Information

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Site Background

The Woodworth (WOOD) NEON site is located within the Chase Lake National Wildlife Refuge which in Stutsman County, North Dakota. The site itself is an approximately 2,626-acre subset of the larger refuge that encompasses the refuge headquarters. The portion of the refuge that coincides with the WOOD site contains approximately 13 lakes in addition to > 25 areas of seasonal wetness that contribute to the Chase Lake NWRs utilization for waterfowl habitat. Elevation of the site ranges between 1864 ft (568 m) and 2021 ft (616 m). The site is in Major Land Resource Area (MLRA) 53B Central Dark Brown Glaciated Plains.

This area is entirely in the Western Lake Section in the Central Lowland Province of the Interior Plains. This area is underlain by the Pierre Formation below the Missouri Coteau, which causes a significant local topographic rise and influence on drainage of Stutsman Co., ND. Parent materials at the WOOD site consist of late Wisconsin glacial deposits and outwash. The area in and surrounding the site is best characterized as a ground moraine with numerous areas of stagnant-ice features that include lakes, closed depressions, and collapsed glacial topography, which results in an undulating-rolling relief pattern. In addition, some glaciofluvial features such as eskers and kames exist on the site. Eskers mark former on-ice rivers, ice tunnels, and/or infilled cracks that existed in the ice. Kames that now occur as asymmetric topographic highs originally formed as sediment filled depressions within the glacial ice. The supporting ice subsequently melted with the glacial sediment now forming a hill (topographic high).

Plant communities at the site are dominated by mixed grass prairie with smaller proportions of wooded draws and emergent marshes.

Soil at this site dominantly have particle size control section textures of Fine-Loamy with lesser proportions of Fine, Fine-Loamy over Sandy, Sandy-Skeletal, and Sandy textures. Soil minerology at this site is dominantly Mixed with lesser proportions of soils with Smectitic minerology. Soils at this site dominantly classify as Mollisols with lesser proportions classifying within the Inceptisols Order. Various other diagnostic features present or absent in each individual soil determine its eventual taxonomic classification and are noted within the soil descriptions for this project; relevant ones for this site are: endosaturation, calcic horizon, argillic horizon, aquic conditions, and lack of readily defined and categorized diagnostic features other than those used to determine Soil Order and climatic factors.

Analysis of Plots for Sampling

Plots for the WOOD site were selected to maximize the characterization coverage of the site and return the most complete site representation within the pre-selected plot locations. Also considered were: plot locations within the mapunit delineation, sampling timeframe, and personnel. Plots were given more consideration in the analysis for map units that were more extensive within the plot, and had limited or no existing data that could be extrapolated in the geographic area for the mapunits components. In addition, we emphasized sampling of plots that could provide a similar soil on both a distributed plot and a tower plot. Field observations from a distribute plot (where excavation is permitted) aided in the soil description at the tower plot, where observation was limited to an auger borehole. Soil map units on the WOOD site differ by slope, surface texture, and map unit type (complex or consociation). The map units, however, have similar components by named soil series; this was also weighed in plot selection.

The existing soil survey, which includes the WOOD site shows 23 uniquely named soil mapunits within the site boundary. The pre-selected plots existed within with 16 of these mapunits. However, two of the mapunits with pre-selected plots were either “water” or a miscellaneous mapunit “pits, gravel and sand, 0 to 60 percent slopes” for which description and sampling would provide data of limited applicability. From the analysis, we selected 15 plots to describe, sample, and characterize. The 19 plots not selected to be sampled either occurred in non-typical locations, were within 10 m of a delineation boundary, were duplicates of a soil component sampled elsewhere (not necessarily duplicates of a soil mapunit), or were within a miscellaneous mapunit or water.

Approximately 73 percent of the unique mapunit acres at WOOD were sampled, while 27 percent of the unique mapunits acres within the site were not sampled. Of the 27 percent, 10 percent of total mapunit acres within the site could not be sampled due to lack of a pre-selected plot within those identified mapunits. The following three tables summarize the sampled, unsampled, and unavailable mapunits.

Sampled Soil Map Units at WOOD		
Map Unit Symbol	**Soil Mapunit Name**	**Percent of Total Acres (2,626)**
C165F	Zahl-Max-Parnell complex, 0 to 35 percent slopes	18
C156F	Zahl-Max-Bowbells loams, 6 to 35 percent slopes	14
C870E	Wabek-Lehr-Appam complex, 9 to 25 percent slopes	10
C5A	Southam silty clay loam, 0 to 1 percent slopes	8
C819B	Lehr-Wabek loams, 2 to 6 percent slopes	8
C132C	Williams-Zahl-Zahill complex, 6 to 9 percent slopes	7
C135D	Zahl-Williams loams, 9 to 15 percent slopes	4
C276A	Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes	4
	Total	**73**

Not Sampled Soil Map Units of NEON Plots		
C210B	Williams-Bowbells loams, 3 to 6 percent slopes	5
C996	Water	5
C990F	Pits, gravel and sand, 0 to 60 percent slopes	3
C893C	Williams-Wabek sandy loams, 2 to 9 percent slopes	2
C275A	Hamerly-Bowbells loams, 0 to 3 percent slopes	1
C814A	Bowdle-Lehr loams, 0 to 2 percent slopes	1
C806A	Appam-Wabek complex, 0 to 2 percent slopes`	0
C874B	Wabek-Appam complex, 2 to 6 percent slopes	0
	Total	**17**

Soil Map Units at WOOD That Do Not Contain Plots		
C897E	Wabek-Max-Zahl loams, 9 to 25 percent slopes	4
C874C	Wabek-Appam complex, 6 to 9 percent slopes	2
C819B	Lehr-Wabek loams, 2 to 6 percent slopes	2
C827A	Divide-Marysland loams, 0 to 2 percent slopes	1
C3A	Parnell silty clay loam, 0 to 1 percent slopes	1
C814B	Lehr-Wabek loams, 2 to 6 percent slopes	0
C210A	Williams-Bowbells loams, 0 to 3 percent slopes	0
	Total	**10**

Plot Findings

The 15 described and sampled pedons represent eight uniquely named soil mapunits. The major components of these mapunits are the Appam, Bowbells, Hamerly, Lehr, Max, Parnell, Southam, Tonka, Wabek, Williams, Zahill, and Zahl soils. Upon field description soils that were described at plot locations were the Bryant, Colvin, Makoti, McDonaldsville-Taxadjunct, Parnell, Schaller, Southam, Southam-Taxadjunct, Tonka, Wabek-Taxadjunct, Williams, Wyard, and Zahl. A taxadjunct, while described as a recognized, existing soil series for reference has one or more differentiating characteristic(s) outside of taxonomic class limits for the named soil series. Soil taxonomic classifications were done according to the Keys to Soil Taxonomy 12th Edition. Plots were dominated by grass/herbaceous cover and varied from marshland, other grass/herbaceous cover, and grassland rangeland.

Summary of Soils

Six of the 15 plots sampled had soils with surface organic horizons; the remaining 9 plots had mineral soil at the surface. Organic surface horizons ranged from the relatively thin 1 cm in thickness to as thick as 18 cm.

Of the 15 samples, Parnell, Schaller, and Zahl series soils were observed slightly more frequently than other soils such as the Bryant, Colvin, Makoti, Southam, Tonka, Williams, Wyard, series soils and McDonaldsville, Southam, and Wabek Taxadjunct soils.

Two plots (WOOD_026, 028) were identified as Parnell series soil. WOOD_026 was identified within a Southam silty clay loam, 0 to 1 percent slopes mapunit and WOOD_028 was identified within a Zahl-Max-Parnell complex, 0 to 35 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_026, Parnell series soils was a minor component within the composition of the mapunit (major component: Southam; minor components: Lallie, Minnewaukan, Parnell, Water, Vallers, Marysland). Within the mapunit that coincided with plot WOOD_028, Parnell series soils was a major component within the composition of the mapunit (major components: Zahl, Max, Parnell; minor components: Tonka, Wabek, Vallers, Southam, Bowbells, Hamerly, Noonan). The Parnell series classifies as Fine, smectitic, frigid Vertic Argiaquolls; it is typically formed from well sorted glacial sediments that have been transported a short distance to depressions, swales, and drainageways on moraines. Key diagnostic features of the Parnell series are that $CaCO_3$ is found from 90 to > 200 cm in the soil profile and that the Mollic epipedon is between 60 to > 200 cm in thickness.

Two plots (WOOD_009, 045) were identified as Zahl series soil. WOOD_009 was identified within a Zahl-Williams loams, 9 to 15 percent slopes mapunit and WOOD_045 was identified within a Zahl-Max-Parnell complex, 0 to 35 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_009, Zahl series soils was a major component within the composition of the mapunit (major component: Zahl, Williams; minor components: Hamerly, Noonan, Wabek, Bowbells, Parnell, and Tonka). Within the mapunit that coincided with plot WOOD_045, Zahl series soils was a major component within the composition of the mapunit (major component: Zahl, Max, Parnell; minor component: Wabek, Bowbells, Hamerly, Noonan, Southam, Vallers, Tonka). The Zahl series classifies as Fine-loamy, mixed, superactive, frigid Typic Calciustolls; it is typically formed from calcareous till on moraines and sideslopes of hillslopes. One key diagnostic feature of the Zahl series is that the Mollic epipedon is between 18 to < 40 cm in thickness. Another key diagnostic feature of the Zahl series is that a Calcic diagnostic horizon is found within 100 cm of the mineral soil surface.

Plot WOOD_030 was identified as Southam series soil and plot WOOD_022 was identified as Southam-Taxadjunct soil. WOOD_030 was identified within a Southam silty clay loam, 0 to 1 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_030, Southam series soils was a major component within the composition of the mapunit (major component: Southam; minor components: Water, Marysland, Lallie, Minnewaukan, Parnell, Vallers). WOOD_022 was identified within a Williams-Zahl-Zahill complex, 6 to 9 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_022, Southam-Taxadjunct soils were neither a major component (Williams, Zahl, Zahill) or a minor component (Lehr, Noonan, Parnell, Hamerly, Tonka, Bowbells). The plot location is within 15 meters of a Southam silty clay loam, 0 to 1 percent slopes mapunit and finding a taxadjunct or even series near a delineation edge or within the main body of a delineation but not consistently across the mapunit is not uncommon at this order of mapping. The Southam series classifies as fine, smectitic, calcareous, frigid Cumulic Vertic Endoaquolls; it is typically formed from local alluvium from till that has been transported a short distance on moraines, till plains, and lake plains. One key diagnostic feature of the Southam series is that the significantly thick Mollic epipedon is between 18 to < 40 cm in thickness. Another key diagnostic feature of the Southam series is that it also has a qualification for a Vertic subgroup. The Southam-Taxadjunct in this particular case is a taxadjunct due to the thickness of the Mollic epipedon, while it is thick enough to qualify a Mollic, it is not thick enough to meet the qualifications for the Cumulic taxonomic subgroup (>60 cm).

Plot WOOD_044 was identified as Bryant series soil within a Lehr-Wabek loams, 2 to 6 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_044, Bryant series soil was not a major component (Lehr, Wabek) or a minor component (Tonka, Colvin, Divide, Parshall, Bowdle, Appam). The identification of Bryant series soil at this plot would commonly illustrate an unnamed minor component soil. For the Bryant series soil identified at plot WOOD_044, it is most reflective of the Lehr series soil major component. The primary difference is that Bryant soils would have a Fine-silty and Lehr soils would have a Fine-loamy over sandy or sandy-skeletal particle-size control section.

Plot WOOD_021 was identified as Colvin series soil within a Southam silty clay loam, 0 to 1 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_021, Colvin series soil was not a major component (Southam) or a minor component (Lallie, Minnewaukan, Parnell, Vallers, Marysland, Water). The identification of Colvin series soil at this plot would commonly illustrate an unnamed minor component soil. For the Colvin series soil identified at plot WOOD_021, it is most reflective of the Marysland series soil minor component. The primary difference is that Colvin soils would have a Fine-loamy and Marysland soils would have a Fine-loamy over sandy or sandy-skeletal particle-size control section.

Plot WOOD_043 was identified as Makoti series soil within a Wabek-Lehr-Appam complex, 9 to 25 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_043, Makoti series soil was not a major component (Wabek, Lehr, Appam) or a minor component (Marysland, Divide, Parshall, Parnell). The identification of Makoti series soil at this plot would commonly illustrate an unnamed minor component soil. When mapunit composition is drafted, components that are not commonly expressed in every delineation of a mapunit, do not add to the overall understanding, add significantly to the reflection of soil properties and qualities and thereby interpretative value and response to use and management are often included conceptually by another similar component serving as a proxy for that soil. For the Makoti series soil identified at plot WOOD_043, it is most reflective of the Parshall series soil minor component. The primary differences is that Makoti soils would have a Fine-silty and Parshall soils would have a Coarse-loamy particle-size control section.

Plot WOOD_017 was identified as Schaller series soil within a Wabek-Lehr-Appam complex, 9 to 25 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_017, Schaller series soil was not a major component (Wabek, Lehr, Appam) or a minor component (Parshall, Marysland, Parnell, Divide). The identification of Schaller series soil at this plot would commonly illustrate an unnamed minor component soil or similar soils to one of the major named series in composition. For the Schaller series soil identified at plot WOOD_017, it is most reflective of the Appam series soil major component. The primary difference is that Schaller soils would have a qualification for the Entic taxonomic subgroup and Appam soils do not have this qualification.

Plot WOOD_042 was identified as Tonka series soil within a Wabek-Lehr-Appam complex, 9 to 25 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_042, Tonka series soil was not a major component (Wabek, Lehr, Appam) or a minor component (Marysland, Divide, Parshall, Parnell). The identification of Tonka series soil at this plot would commonly illustrate an unnamed minor component soil. For the Tonka series soil identified at plot WOOD_042, it is most reflective of the Parnell series soil minor component. The primary difference is that of taxonomic subgroup qualifications. Tonka series classifies as Argiaquic Argialbolls. Parnell series classifies as Vertic Argiaquolls.

Plot WOOD_019 was identified as a Williams soil series within a Zahl-Max-Parnell complex, 0 to 35 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_019, Williams series soil was not a major component (e,g, Zahl, Max, Parnell) or a minor component (Noonan, Southam, Tonka, Vallers, Wabek, Bowbells, Hamerly). The identification of Williams series soil at this plot would commonly illustrate an unnamed minor component soil or similar soils to one of the major named series in composition. For the Williams series soil identified at plot WOOD_019, it is most closely related to the Zahl and Max series soil major components. The primary difference the taxonomic subgroup. Williams series classifies as Typic Argiustolls (has an Argillic horizon). Zahl series classifies as Typic Calciustolls. Max series classifies as Typic Haplustolls (has the taxonomic qualifications for Ustic soil moisture regime Mollisols, but no other features that provides finer categorization).

Plot WOOD_013 was identified as Wyard series soil within a Zahl-Max-Bowbells loams, 6 to 35 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_013, Wyard series soil was not a major component (Zahl, Max, Bowbells) or a minor component (Noonan, Wabek, Hamerly, Tonka, Southam, Parnell). The identification of Wyard series soil at this plot would commonly illustrate an unnamed minor component soil. For the Wyard series soil identified at plot WOOD_043, it is most reflective of the Southam series soil minor component. The Southam series classifies as fine, smectitic, calcareous, frigid Cumulic Vertic Endoaquolls; it is typically formed from local alluvium from till that has been transported a short distance on moraines, till plains, and lake plains. One key diagnostic feature of the Southam series is that the significantly thick Mollic epipedon is between 18 to < 40 cm in thickness. Another key diagnostic feature of the Southam series is that it also has a qualification for a Vertic subgroup. Wyard series soil on the other hand classifies in the taxonomic subgroup of Typic Endoaquolls, having neither the qualifications for Vertic nor Cumulic that Southam does, but having properties, qualities, responses and interpretations that are otherwise the same or similar.

Plot WOOD_029 was identified as McDonaldsville-Taxadjunct soil within a Hamerly-Tonka-Parnell complex, 0 to 3 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_029, McDonaldsville-Taxadjunct soil was not a major component (Hamerly, Tonka, Parnell) or a minor component (Wyard, Vallers, Noonan, Williams, Bowbells). The McDonaldsville-Taxadjunct soil identified at plot WOOD_029 is reflective of an inclusion of a soil component that is not specifically named in the composition of the mapunit. As a taxadjunct to the McDonaldsville series, this soil lacks the contrasting mineralogy class that the series has (i.e. taxadjunct has smectitic mineralogy and episaturation vs the series which has smectitic over mixed mineralogy and endosaturation). Smectitic mineralogy indicates a dominance within the mineralogy control section by weight of montmorillonite, beidellite, and nontronite whereas mixed mineralogy indicates a no such dominance.

Plot WOOD_010 was identified as Wabek-Taxadjunct soil within a Lehr-Wabek loams, 2 to 6 percent slopes mapunit. Within the mapunit that coincided with plot WOOD_010, Wabek-Taxadjunct soil was not a major component (Lehr, Wabek) or a minor component (Colvin, Divide, Parshall, Appam, Tonka, Bowdle). The identification of Wabek-Taxadjunct soil at this plot would commonly illustrate an unnamed minor component soil or similar soils to one of the major named series in composition. In this particular case, the Wabek-Taxadjunct soil differs from the Wabek series soils by particle-size control section and taxonomic subgroup qualification. The particle-size control section of Wabek series is Sandy-skeletal, whereas the Wabek-Taxadjunct is Fine-loamy over sandy or sandy-skeletal. (A fine-loamy over sandy or sandy-skeletal particle-size control section is a strongly contrasting particle-size class characterized by the fine-loamy qualifications described previously over a sandy texture class or a sandy texture class with rock fragments ≥ 35% or more by volume). The taxonomic difference between Wabek series and Wabek-Taxadjunct is that Wabek series soils would have a qualification for the Entic taxonomic subgroup and Wabek-Taxadjunct soils in this case do not have this qualification.

Definitions

Calcic horizon – A diagnostic subsurface horizon of secondary $CaCO_3$ that has accumulated to a significant extent - is ≥ 15 cm thick and has one or more of the following: ≥ 15% by weight $CaCO_3$ equivalent and ≥ 5% absolute $CaCO_3$ equivalent more than an underlying horizon or ≥ 15% by weight $CaCO_3$ equivalent and ≥ 5% by volume identifiable secondary carbonates, or ≥ 5% by weight $CaCO_3$ equivalent and < 18% clay and has a particle size-class of sandy, sandy-skeletal, coarse-loamy or loamy-skeletal and ≥ 5% by volume identifiable secondary carbonates or is ≥ 5% absolute $CaCO_3$ equivalent more than an underlying horizon, and is not cemented or indurated in any part by carbonates in a layer that is > 10 cm thick.

Mollic epipedon – A diagnostic surface horizon with dry primary or secondary structure diameter of ≤ 30cm or moderately hard or softer rupture-resistance (< 40 N) < ½ of volume is rock structure, dominant colors with value of ≤ 3 moist and ≤ 5 dry with Chroma of ≤ 3 moist, or a fine-earth fraction with $CaCO_3$ equivalent of 15-40 % and color with a value and Chroma of ≤ 3, or a fine-earth fraction with $CaCO_3$ of ≥ 40 % and a moist color value of ≤ 5, and has a base saturation of ≥ 50%, and an organic carbon content of ≥ 2.5% if moist color value of 4 or 5 or 0.6 % more than that of the C horizon if present, and some part of the epipedon is moist for ≥ 90 days cumulative in a year when soil temperature at a depth of 50 cm is ≥ 5°C or higher is soil is not irrigated and the *n* value is less than 0.7.

Unnamed minor component soil – Is a soil in a mapunit that is known to exist in some delineations, but in not included in the mapunit name because of limited interpretative value and response to use and management.

Endosaturation - Saturation with water in all layers from the upper boundary of saturation to a depth ≥ 200 cm.

Episaturation - Saturation with water in one or more layers within 200 cm of the mineral soil surface with some layers within that depth being unsaturated.

References

Soil Survey Staff. 2014. Keys to Soil Taxonomy 12th ed. USDA-Natural Resources Conservation Service, Washington, D.C.