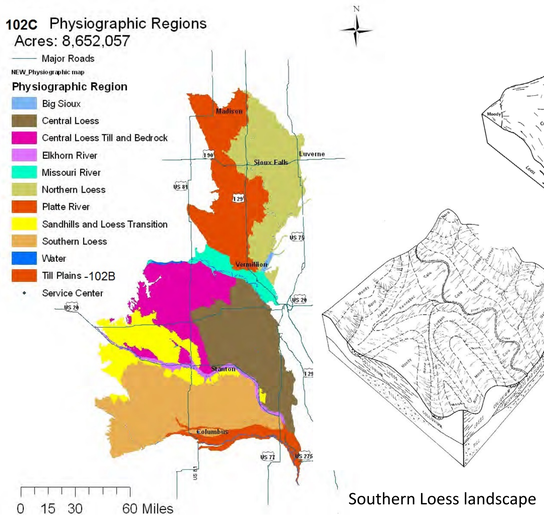
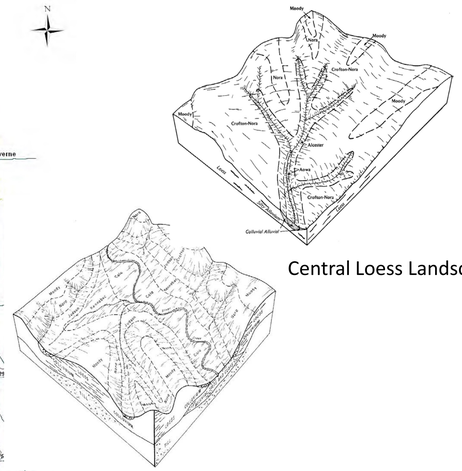
DSP and Ksat Investigation of the Benchmark Catenas of MLRA 102C - Loess Uplands

Daniel Shurtliff, Patrick Cowsert , Bruce Evans , Grant Jackson, Phillip Schoeneberger, Cathy Seybold, Skye Wills

INTRODUCTION: MLRA 102C - Loess Uplands is about 7, 324,000 acres in Size and located in Nebraska, South Dakota, Iowa and Minnesota. The dominant parent material, loess, consistently has between 25 and 30 percent clay – silt loam and silty clay loam. The legacy Ksat data associated with these textures straddle important class limits for engineering and other interpretations.





Central Loess Landscape

Southern Loess landscape

In a multiyear project, Ksat is being measured on the benchmark catenas in Central loess and Southern loess areas of 102C. The soil series on these Catenas (Alcester, Crofton, Nora and Moody) account for about 50% of the acres in the MLRA

In Conjunction with the Amoozemeter data collection, Dynamic Soil Property (DSP) data is being gathered for the benchmark Catena Soils Under long term grass cover, and no/mulch till corn-bean rotation – the prevailing land use.

The study started in the Fall of 2014 on a 102C Southern Loess Moody, Nora, Alcester Landscape. Data shown here is preliminary, some fragmentary, Even so, the Saturated Hydraulic Conductivity (Ksat) and Bulk density does illustrate some trends.

TRENDS: Ksat – Average of 4 repetitions

Table 1

Summit (interfluve): Moody soil (sampled as Moody) Soil Class: fine-silty, mixed, superactive, mesic, Udic Haplustolls S2014NE053002A Dodge Co., NE			In Situ Saturated Hydraulic Conductivity (Ksat) (10 / 15 / 2014)	
Soil Horizon	Depth (cm)	Lab * Texture ** (Field Text)	X (± S.D.) C.V. (%) n = 5 (unless otherwise stated) (cm/hour)	(in/hour)
A	18 (7 in)	-- (silty clay loam)	**2.9474** (± 2.0705) 70.25 %	**1.1604** (± 0..8152) 70.24 %
Bw1	44 (17 in)	-- (silty clay loam)	**0.1435** (± 0.1045) 72.87 %	**0.0565** (± 0.0411) 72.74 %
Bw2	65 (26 in)	-- (silty clay loam)	**0.0741** (± 0.0344) 46.35 %	**0.0292** (± 0.0135) 46.23 %
Bw3	100 (39 in)	-- (silty clay loam)	**0.1229** (± 0.0498) 40.52 %	**0.0484** (± 0.0196) 40.52 %
Bw4	145 (57 in)	-- (silty clay loam)	**0.4636** (± 0.3193) 68.87 %	**0.1825** (± 0.1257) 68.86 %

Table 2

Backslope (side slope): Nora (sampled as: Nora) Soil Class: fine-silty, mixed, superactive, mesic, Udic Haplustolls S2014NE053003A Dodge Co., NE			In Situ Saturated Hydraulic Conductivity (Ksat) (10 / 17 / 2014)	
Soil Horizon	Depth (cm)	Lab * Texture ** (Field Text)	X (± S.D.) C.V. (%) n = 5 (unless otherwise stated) (cm/hour)	(in/hour)
A	17 (7 in)	-- (silty clay loam)	**0.4830** (± 0.5137) 106.36 %	**0.1902** (± 0.2022) 106.36 %
Bw	40 (16 in)	-- (silty clay loam)	**0.9171** (± 0.1597) 17.41 %	**0.3611** (± 0.0629) 17.41 %
Bk2	110 (43 in)	-- (silt loam)	**0.6920** (± 0.3350) 48.41%	**0.2724** (± 0.1319) 48.42%
C1	155 (61 in)	-- (silt loam)	**0.7234** (± 0.1727) 23.88 % n = 4	**0. 2848** (± 0.0680) 23.88 % n = 4

Ksat does not drop off with depth, and usually increases. This may be due to the coarse prismatic structure of the loess parent material of these soils. Water flow is not impeded with depth.

Table 3

Footslope (base slope): Alcester soil (sampled as: Alcester) Soil Class: fine-silty, mixed, superactive, mesic, Cumulic Haplustolls S2014NE053001A Dodge Co., NE			In Situ Saturated Hydraulic Conductivity (Ksat) (10 / 16 / 2014)	
Soil Horizon	Depth (cm)	Lab * Texture ** (Field Text)	X (± S.D.) C.V. (%) n = 5 (cm/hour)	(in/hour)
A1	17 (7 in)	-- (silty clay loam)	**0.3206** (± 0. 2024) 63.14 %	**0.1262** (± 0.0797) 63.14 %
A2	45 (18 in)	-- (silty clay loam)	**0.6622** (± 0.3040) 45.92 %	**0.2607** (± 0.1197) 45.91 %
Bw11	78 (31 in)	-- (silty clay loam)	**0.9504** (± 0.9278) 97.62 %	**0.3742** (± 0.3653) 97.62 %
Bw12	113 (44 in)	-- (silty clay loam)	**0.8463** (± 0.6991) 82.61 %	**0.3332** (± 0.2752) 82.61 %
Bw3	150 (59 in)	-- (silty clay loam)	**2.6949** (± 2.4071) 89.32 %	**1.0610** (± 0.9477) 89.32 %

X = Average Ksat;
(S.D. = standard deviation);
C.V. = (Coefficient of Variation);
n = number of "replications"
Lab texture -- (not ready);
(Field Text) est. whole soil

TRENDS: Dynamic Soil Properties

- Grassland and Crop (Corn-Soybean) Avg of 3 sites

Series	Depth (cm)	Cover	pH	BIOBGLUCO p-nitrophenol, ß-Glucosidase	CEC	Bulk Density Core	Bulk Density Clod	Organic Carbon
Alcester	0-5	Grass		434	29	0.99	1.03	5.95
Alcester	5-23	Grass		103	25	1.37	1.31	1.81
Alcester	0-5	Crop				1.14		
Alcester	5-22	Crop				1.49		
Moody	0-5	Grass		447	29	1.08	0.93	5.11
Moody	5-18	Grass		161	25	1.38	1.25	2.61
Moody	0-5	Crop				1.19		
Moody	5-22	Crop				1.48		
Nora	0-5	Grass		463	31	0.96	1.00	4.70
Nora	5-18	Grass		127	27	1.34	1.29	1.61
Nora	0-5	Crop				1.16		
Nora	5-19	Crop				1.42		

Fragmentary data of some dynamic soil properties. The Bulk Density (.33 Bar) is significantly higher in the cropped field, as opposed to the grassland field. Differences in the other properties between crop and grassland land use is anticipated. The BIOBGLUCO column is a measure of enzyme activity. There is a significant drop in enzyme activity below 5 cm.

The data gathered during this multi year project will be valuable for accurate prediction and NASIS database population of the range and representative value of the organic matter, bulk density and saturated hydrologic conductivity of these soils under different land uses. It will assist greatly in interpreting these soils correctly for engineering and agronomic uses.