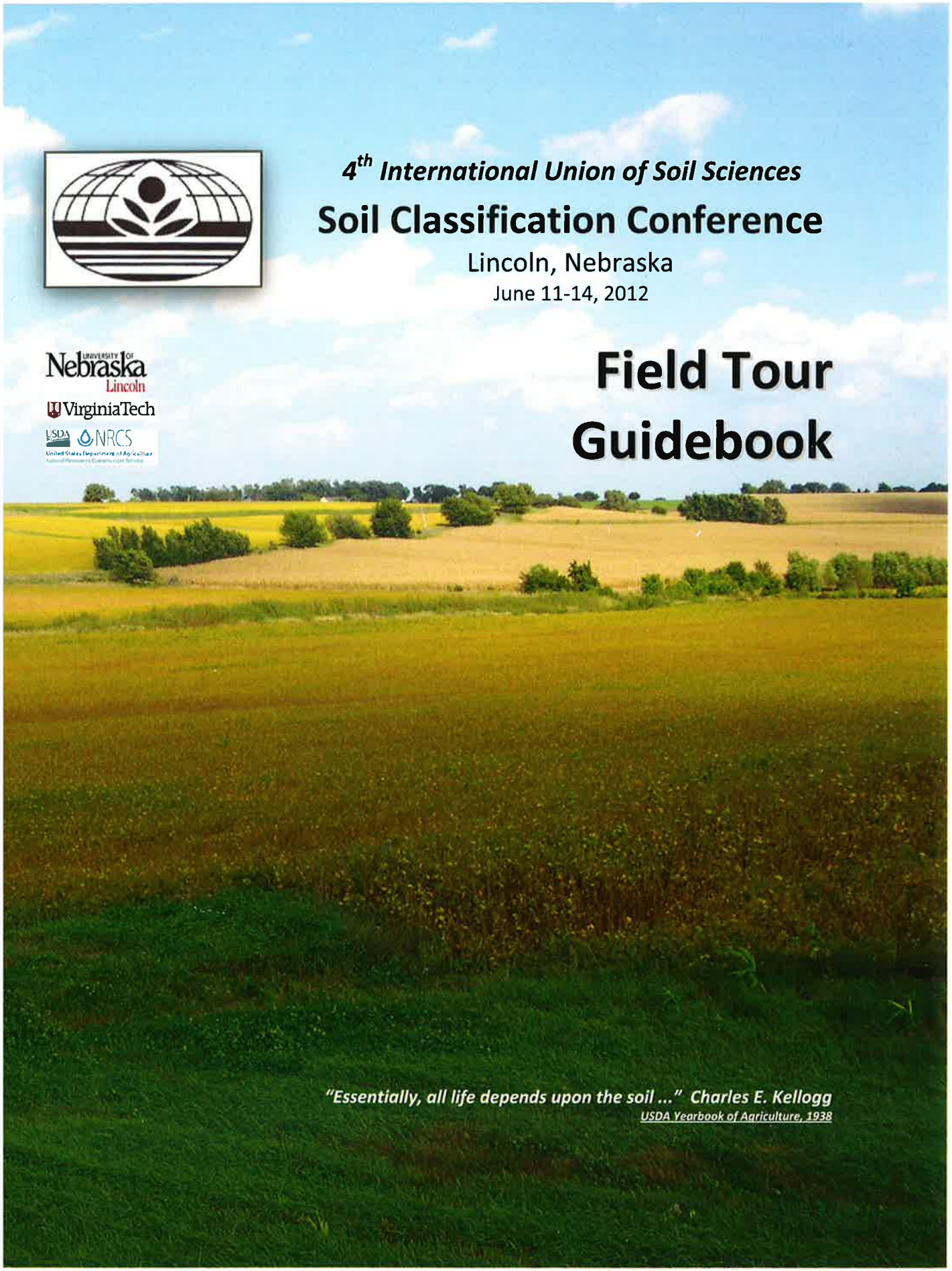
6-2012

4th International Union of Soil Sciences Soil Classification Conference Field Tour Guidebook



4th International Union of Soil Sciences

Soil Classification Conference

Lincoln, Nebraska

June 11-14, 2012

Field Tour Guidebook

"Essentially, all life depends upon the soil ..." Charles E. Kellogg

USDA Yearbook of Agriculture, 1938

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Welcome to Nebraska

The University of Nebraska, Virginia Tech, and the NRCS National Soil Survey Center are proud to host the 4th Soil Classification Conference of the International Union of Soil Scientists in Lincoln, Nebraska USA, June 11-14, 2012.

Nebraska, located near the center of the United States, is in the great agricultural region known as the Midwest or *America's Breadbasket*. With 46,800 farms and ranches utilizing 45.5 million acres or about 92 percent of the state's total land area, agriculture is Nebraska's primary source of wealth and its dominant industry. Approximately half of the land is used for ranching with cattle grazing on the abundant rangeland prairies and pasture. Croplands, found predominantly in the central and eastern parts of the state, produce abundant corn, soybean, wheat, and small grains.

Sustaining the health and productivity of the soil is important to the economy and people of Nebraska. Nebraska soils are a product of the soil-forming factors acting upon three dominant types of soil parent materials. Loess covers much of the state to varying thickness. The west-central part of the state is covered with extensive deposits of eolian sand that serves as the parent material for one the largest dune fields in North America called the Nebraska Sandhills. Livestock grazing there and in the north-central part of the state is home to many of the state's ranches. In the eastern part of the state, most soils have formed in clayey, Pleistocene till or in younger wind-blown loess originating from the Great Plains as well as the Missouri River flood plain in extreme eastern Nebraska.

The University of Nebraska at Lincoln, founded in 1869, is the state's Land Grant University and has one of the nation's largest and most successful agricultural colleges. The Institute of Agriculture and Natural Resources includes the College of Agricultural Sciences and Natural Resources, the Agricultural Research Division, the Cooperative Extension Division, and the Conservation and Survey Division.

The College of Agricultural Sciences and Natural Resources (CASNR) offers 28 academic programs to students. University of Nebraska–Lincoln scientists have been some of the most-cited in the world in the last 10 years in the area of agricultural research according to the IS1 Essential Science Indicators Report. Scientists in the UNL Institute of Agriculture and Natural Resources (IANR) alone published 1,028 papers, which were cited 6,056 times from January 1994 through January 2004.

The goal of CASNR is to prepare students as leaders for a future in which demands on food, energy and water systems will challenge sustainability. The areas of study are broad and span animal, plant, and human health and well-being, earth systems analysis, agricultural production and processing, global

climate change, agricultural market structures, water resources, and land-use change. The College also has the coordinates all agricultural sciences and natural resources programs in higher education within the State of Nebraska.

Many of the University of Nebraska –Lincoln sports and academic teams carry the name Cornhuskers or simply 'Huskers' with obvious reference to its agricultural heritage.

Nebraska's capitol city, Lincoln, is also home to the USDA-NRCS National Soil Survey Center (NSSC) and the Kellogg Soil Survey Laboratory. National Soil Survey Center is viewed as the primary source for the Nation's soil information. The NSSC works tirelessly to inventory and interpret soils information and make it available in useful formats to a variety of customers. As part of USDA, Natural Resources Conservation Service (NRCS), the Center also provides technical assistance and promotes the use of soil survey information for a wide range of planning and development issues affecting both farm and nonfarm uses as well as homeland security needs. The NSSC delivers the best and most current soils information in the form of soils standards and classifications, soils information systems, laboratory and technical support, data delivery, education materials, investigations, and interpretations. The five branches at the NSSC are Standards, Interpretations, Research and Laboratory, Soil Business Systems, and Soil Quality and Ecosystems. Together, the staffs of the Center are focused on fulfilling the U.S. Secretary of Agriculture's soil survey charge to inventory the soils of the USA; keep the inventory current; provide interpretations and understanding to soil survey users; and provide access and promote the use of soil information.

The Kellogg Soil Survey Laboratory (KSSL) was established as a result of the consolidation of the NRCS laboratories in Beltsville, Maryland, and Riverside, California, the lab provides national leadership in the area of soil analysis. The lab supports the National Cooperative Soil Survey (NCSS) with laboratory data on the properties and behavior of soils; develops, implements, and publishes standard soil analysis methods; trains soil scientists in soil analysis and the use of laboratory data; supports NRCS Major Land Resource Area Soil Survey Office laboratory operations; and stores soil property data and makes it readily available for use by Federal and State agencies, universities, and the public. Each year, highly trained analysts perform thousands of chemical, physical, mineralogical, and biological analyses on soil samples from throughout the United States and other countries. The lab is equipped with a broad range of cutting-edge analytical instruments to meet ever-changing data needs in support of soil survey activities, soil quality assessments, and pedologic and environmental research. The lab also maintains one of the largest archives of soil samples in the world and collaborates with university laboratories to compile, verify, and incorporate soil property data into a centralized NCSS database, thus expanding access to soil information.

We wish to acknowledge and thank the people and organizations that have contributed to the success of the conference and field tour activities for the 4th IUSS Soil Classification Conference. Ms. Jacki Loomis, Sales and Events Manager at the School of Natural Resources, coordinated the social and more enjoyable aspects of the conference including the reception, banquet, Indian dancers, food and beverages for breaks and lunches and socials. Mr, Mike Eckert of the Civil Design Group, Inc. provided access to the Aksarben soil-Paleosol site for the Wednesday field trip. Mr. Chad Graeve and the

Hitchcock Nature Center hosted our visit to the Loess Hills in western Iowa. Mr. Duaine Brigman and the Division of Environmental Control hosted our discussions of anthropogenic soils and landscapes at the Sarpy County Landfill. Mr. Jerry Herbster and the Chalco Hills Recreation Area granted the access for our look at soils formed in colluvium from loess and glacial till. Finally, we wish to extend our thanks to the many tour presenters for sharing their experiences and expertise in soils, landforms, and natural resources.

Kenneth F. Scheffe
Tour Leader/Guidebook Editor
Soil Scientist
Soil Survey Standards Branch
National Soil Survey Center

AGENDA

IUSS Soil Classification Conference

Monday, June 11 – Thursday, June 14, 2012

Sunday, June 10th		
Time	**Event**	**Location**
5:00 – 7:30 pm	Check-in	Holiday Inn

DAY 1 - Monday, June 11th		
Time	**Event**	**Location**
6:00 – 8:00 am	Breakfast on your own	Holiday Inn
8:00 – 8:30 am	Shuttle	From Holiday Inn to Hardin Hall
7:30 – 5:00 pm	Check-in Desk open, pick-up namebadge, agenda, Kindle, gift	1st Floor Lobby Hardin Hall
7:30 – 9:30 am	Poster Set-up (self-service, mounting supplies available at Check-in Desk)	1st & 2nd Floor Lobbies Hardin Hall
9:30 – 10:30 am	Welcome - Ron Yoder, IANR Assoc. Vice Chancellor Pavel Krasilnikov, John Galbraith, Karl Stahr Jon Hempel, Cameron Loerch Overview of Nebraska Soils – Mark Kuzila	# 107 Hardin Hall
10:30 – 10:45 am	Break	2nd floor lobby Hardin Hall
10:45 – 11:00 am	Group Photo	
11:00 am – noon	Guy Smith Medal Award Presentation Lucia Anjos-History of Medal Amy Smith – Life of Guy Smith – My Grandfather Presentation of award to Hari Eswaran	# 107 Hardin Hall
Noon – 1:30 pm	Luncheon	2nd floor lobby Hardin Hall
1:30 – 3:00 pm	Meeting Session 1 – Soil Classification **Moderator and Discussant: John Galbraith** 1. **1:30-2:00 Keynote: Pavel Krasilnikov** Milestones of soils classification: A review of the history with an emphasis on Russian experience. 2. **2:00-2:15 Jon Hempel:** Universal Soil Classification System 3. **2:15-2:30 Cameron Loerch:** Developing and submitting proposals to amend Soil Taxonomy 4. **2:30-2:45 Larry West:** The place of the Laboratory in Soil Classification 5. **2:45-3:00 Discussion**	# 107 Hardin Hall
3:00 – 3:30 pm	Break	2nd floor lobby Hardin Hall
3:30 – 5:15 pm	Meeting Session 2 – Towards a Universal Soil Classification **Moderator and Discussant: Ben Harms** 1. **3:30-4:00 Keynote: Schad, Peter** WRB: State of the art and next steps 2. **4:00-4:15 Goryachkin, Sergey** Universal Soil Classification system and problems of classification of cold soils 3. **4:15-4:30 Anda, Markus** Development of	# 107 Hardin Hall

DAY 1 - Monday, June 11th		
Time	**Event**	**Location**
	various Soil Classification Systems: Contribution to Universal Soil Classification from Indonesian experiences 4. **4:30-4:45 Fox, Catherine A.** A Proposal for a Universal Framework of Enhanced A-Horizon Lowercase Suffixes for Addressing Dynamic Soil Change in Topsoils 5. **4:45-5:00 Hudnall, Wayne** Gypsiferous Soils and the Universal Soil Taxonomic System 6. **5:00-5:15 Discussion**	
5:00 – 5:30 pm	Shuttle	From Hardin Hall to Holiday Inn
6:00 – 6:30 pm	Shuttle	From Holiday Inn to Morrill Hall
6:30 – 8:30 pm	Reception Welcome - Patricia Freeman, Professor	Morrill Hall
8:15 – 8:45 pm	Shuttle	From Morrill Hall to Holiday Inn

DAY 2 - Tuesday, June 12th		
Time	**Event**	**Location**
6:00 – 8:00 am	Breakfast on your own	Holiday Inn
8:00 – 8:30 am	Shuttle	From Holiday Inn to Hardin Hall
7:30 – 5:00 pm	Check-in Desk open	1st Floor Lobby Hardin Hall
8:30 – 10:00 am	Meeting Session 3a – Worldwide classifications: their improvement, correlation and harmonization **Moderator and Discussant: Peter Schad** 1. **8:30-9:00 Keynote: Joe Chiaretti:** Soil Taxonomy: Past, Present, and Future 2. **9:00-9:15 Comerma, Juan A.** Proposals of Soil Classification from Venezuela 3. **9:15-9:30 Dondeyne, Stefaan** Converting the soil map of Belgium into the World Reference Base for Soil Resources: strength and constraints of WRB for international soil correlation and as a map legend 4. **9:30-9:45 Kabala, Cezary** Origin and classification of extremely skeletal Podzols in WRB and Soil Taxonomy 5. **9:45-10:00 Discussion**	# 107 Hardin Hall
10:00 – 10:30 am	Break	2nd floor lobby Hardin Hall
10:30 am – noon	Meeting Session 3B - Worldwide classifications: their improvement, correlation and harmonization **Moderator and Discussant: Peter Schad** **1. 10:30-10:45 Van Huyssteen, Cornie - TBA** 2. **10:45-11:00 Einar Ebarhardt** Automated WRB classification – software tool and initial experience with its application 3. **11:00-11:15 Harms, Ben** Issues pertaining to the classification of Australian soils 4. **11:15-11:30 Anjos, Lúcia Helena:** Evolution of the Brazilian Soil Classification System 5. **11:30-11:45 Owens, Philip** Evaluating the US Soil Taxonomy Soil Moisture Regimes:	# 107 Hardin Hall

DAY 2 - Tuesday, June 12th		
Time	**Event**	**Location**
	Application Across Scales and Continents **11:45-12:00 Discussion**	
Noon – 1:30 pm	Luncheon	2nd floor lobby Hardin Hall
1:30 – 3:00 pm	Meeting Session 4a – Marginal Soils: Strongly transformed and subaqueous soils **Moderator and Discussant: Juan Comerma** 1. **1:30-2:00 Keynote: John Galbraith** Development of Anthropogenic Soil Classification 2. **2:00-2:20 Cook, Terry D.** Altered Soils Due to Urban Development & Construction of Vernal Pools: Case Study in the Sacramento Valley, California 3. **2:20-2:35 Schoeneberger, Philip J.** Anthroscapes and other anthropogenic features: how should human-modified features fit into geomorphic descriptions? 4. **2:35-2:50 Zhang, Fengrong** The reclamation effects should be considered for saline soil criteria in soil classification system 5. **2:50-3:00 Discussion**	# 107 Hardin Hall
3:00 – 3:30 pm	Break	2nd floor lobby Hardin Hall
3:30 – 5:00 pm	Meeting Session 4b – Marginal Soils: Strongly transformed and subaqueous soils **Moderator and Discussant: Juan Comerma** 1. **3:30-3:45 Wyosocki, Doug** Fen Histosols: Subaqueous or terrestrial? 2. **3:45-4:00 Krasilnikov, Pavel** Marginal soils 3. **4:00-4:15 Wilson, Michael** Pedogenisis and Classification of Alluvial Soils with Surficial Deposition of Anthropogenic Mine Sediments; Coeur d'Alene River, Idaho 4. **4:15-4:30 Anjos, Lúcia Helena** Attributes to Classify Strongly Weathered Soils in the Brazilian and Australian Soil Classification Systems 5. **4:30-4:45** 6. **4:45-5:00 Discussion**	# 107 Hardin Hall
5:00 – 6:00 pm	Poster Session with refreshments	1st & 2nd Floor Lobbies Hardin Hall
6:00-6:30 pm	Shuttle	From Hardin Hall to Holiday Inn
Evening	Dinner on your own	

DAY 3 - Wednesday, June 13th		
Time	**Event**	**Location**
6:00 – 8:00 am	Breakfast on your own	Holiday Inn
8:00 – 8:30 am	Shuttle	From Holiday Inn to Hardin Hall
8:30– 10:00 am	Meeting Session 5 – Case Studies: examples from (sub)tropical areas **Moderator and Discussant: Lucia Helena Anjos** 1. **8:30-9:00 Keynote: Curtis Monger** Soil	# 107 Hardin Hall

DAY 3 - Wednesday, June 13th		
Time	**Event**	**Location**
	Classification of Desert Soils; Past, Present, and Future 2. **9:00-9:15 Zhang, Ganlin** Progress of Chinese Soil Taxonomy; soil series identification and inventory. 3. **9:15-9:30 Cattle, Stephen** Texture-contrast and sodicity: A Taxonomic elephant and wombat in the Australian system 4. **9:30-9:45 Okusami, Temitope A.:** Some soils of the derived savanna of southwest Nigeria: clay mineralogy and comparative adaptive soil classification for soil mapping 5. **9:45-10:00 Discussion**	
10:00 – 10:30 am	Break	2nd floor lobby Hardin Hall
10:30 am – noon	Meeting Session 6 – Novel methods and approaches in soil classification **Moderator and Discussant: Pavel Krasilnikov** 1. **10:30-11:00 Keynote: Erika Micheli** Numerical Classification for Defining Diagnostic Horizons 2. **11:00-11:15 Monger, H. Curtis:** Phenetic versus phylogenetic: deriving meaning from soil classification 3. **11:15-11:30 Dylan Beaudette:** A generalized algorithm for determining pair-wise dissimilarity between soil profiles 4. **11:30-11:45** Reinsch, Thomas: Toward a Global Soil Series Warehouse 5. **11:45-12:00 Discussion**	# 107 Hardin Hall
Noon – 1:15 pm	Luncheon	2nd floor lobby Hardin Hall
1:15 – 5:15 pm	Bus departs from Hardin Hall Paleosol Exposure Field Trip Break, Dairy Store Ice Cream Mark will deliver to site	Departs from and returns to Hardin Hall
5:15	Hardin Hall drop off, bus continues on to Holiday Inn	From Hardin Hall to Holiday Inn
6:30 - 7:00 pm	Walk to Lincoln Station Social Hour	Lincoln Station
7:00 – 9:30 pm	Banquet Entertainers end 7:45 Dinner served 7:45 Dessert served 8:10 Keynote speakers, Robert & Anne Diffendall "Lewis & Clark (30-45 minutes) 8:10 – 8:55	Lincoln Station

DAY 4 - Thursday, June 14th		
Time	**Event**	**Location**
6:00 – 7:00 am	Breakfast on your own	Holiday Inn
7:00 – 7:30 am	Congregate in Holiday Inn lobby, Buses depart for Field Trip	From Holiday Inn
7:30 – 5:30 pm	Field Trip	TBD
	Break	Hitchcock nature Area, Loess Hills Lodge upstairs and patio
11:30 – 12:30 -pm	Lunch	TBD

DAY 4 - Thursday, June 14th		
Time	**Event**	**Location**
5:30 – 6:00 -pm	Travel to Social location	
6:00 – 8:00 pm	Social	Lee Sapp Riverview Lodge @ Mahoney State Park

2012 IUSS Field Trip Eastern NE and Western IA:

Introduction

Douglas Wysocki and Philip Schoeneberger
Research Soil Scientists
NSSC, Lincoln, NE

The 2012 IUSS field trip includes three eastern Nebraska sites and one in the western Iowa Loess Hills The soilscape patterns, soil characteristics, and soil classification in the area strongly reflect middle to late Pleistocene substrate emplacement and episodic landscape evolution. We provide here an introduction to soil substrates, geomorphology, and landscape evolution in the field trip area.

Figure WS1. Field Trip Location and Geomorphic setting

Glaciations

The field trip area (Figure WS1) lies in the eastern glaciated Missouri River Basin of Midcontinent USA. Three major glacial episodes and deposits occurred across the Midcontinent (Hallberg, 1986). Youngest to oldest these are the Wisconsin (OIS 2), Illinoisan (OIS 6, 8), and pre-Illinoisan (OIS 10-18?). Figure WS1 shows the ice margin boundaries. The field area

contains only the pre-Illinoisan glacial deposits, which overlie an irregular bedrock surface (Boellstorff 1978a). The most recent glaciation occurred after 780 ka (Brunhes-Matuayma paleomagnetic boundary) and before 640ka (Lava Creek B tephra deposition, Yellowstone Caldera) (Boellstorff 1978 a, b). Subsequent, episodic erosion, however, has greatly modified the original glacial landforms and loess burial has further muted the glacial expression.

Classically, the pre-Illinoisan glacial deposits were known as Kansan and Nebraskan (Chamberlain, 1895). A number of studies (Boellstorff, 1978a, 1978b, 1978c; Hallberg, 1980) identified multiple glacial deposits with intervening paleosols under stable divides in eastern NE and Iowa. The stratigraphic complexity, lack of chronological control, and the inability to resolve regional till correlations compelled abandonment of the terms Kansan and Nebraskan (Hallberg 1986).

Loess

Four Pleistocene loess units and one Holecene loess exist in NE. Figure WS2 presents the general loess stratigraphy with inclusive paleosols and the undifferentiated, underlying pre-Illinoisan glacial deposits. Youngest to oldest the loesses are Bignell (Holocene), Peoria (Wisconsin), Gilman Canyon (Wisconsin), Loveland (Illinoisan), and the Kennard formation (pre-Illinoisan). The Bignell Loess occurs in western NE; it is not a distinct unit in the field area. It does influence upper soil profile characteristics in eastern NE (Jacobs and Mason 2007). Peoria Loess is commonly the surficial loess in eastern NE. It is the most widespread and generally the thickest loess in NE and the Midcontinent.

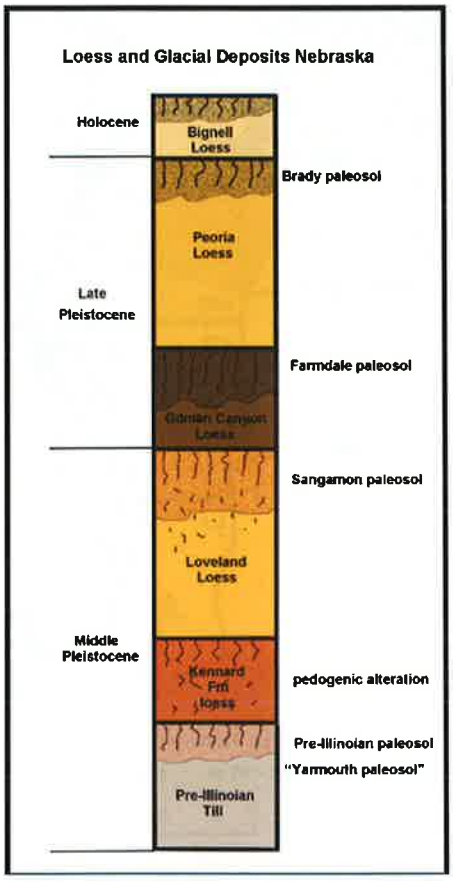


Figure WS2 Field area Quaternary stratigraphy including paleosols.

The Gilman Canyon Loess is thinner than and underlies the Peoria Loess. Gilman Canyon is pedogenically modified throughout and has a characteristic dark brown color. The Farmdale paleosol (geosol) occurs in the uppermost Gilman Canyon. Elsewhere in the Midcontinent this loess is known as the Roxana silt (Markewich et al., 1998). The Loveland Loess underlies the Gilman Canyon. The Sangamon Geosol marks the upper Loveland (Markewich et al., 2010). The Loveland loess approaches a thickness similar to the Peoria loess, but in the Lincoln area occurs only under the stable, primary divides. The Kennard Formation (Mason et al., 2007) is pedogenically altered throughout, and like the Loveland its occurrence is restricted to stable divides and is observable in drill core only..

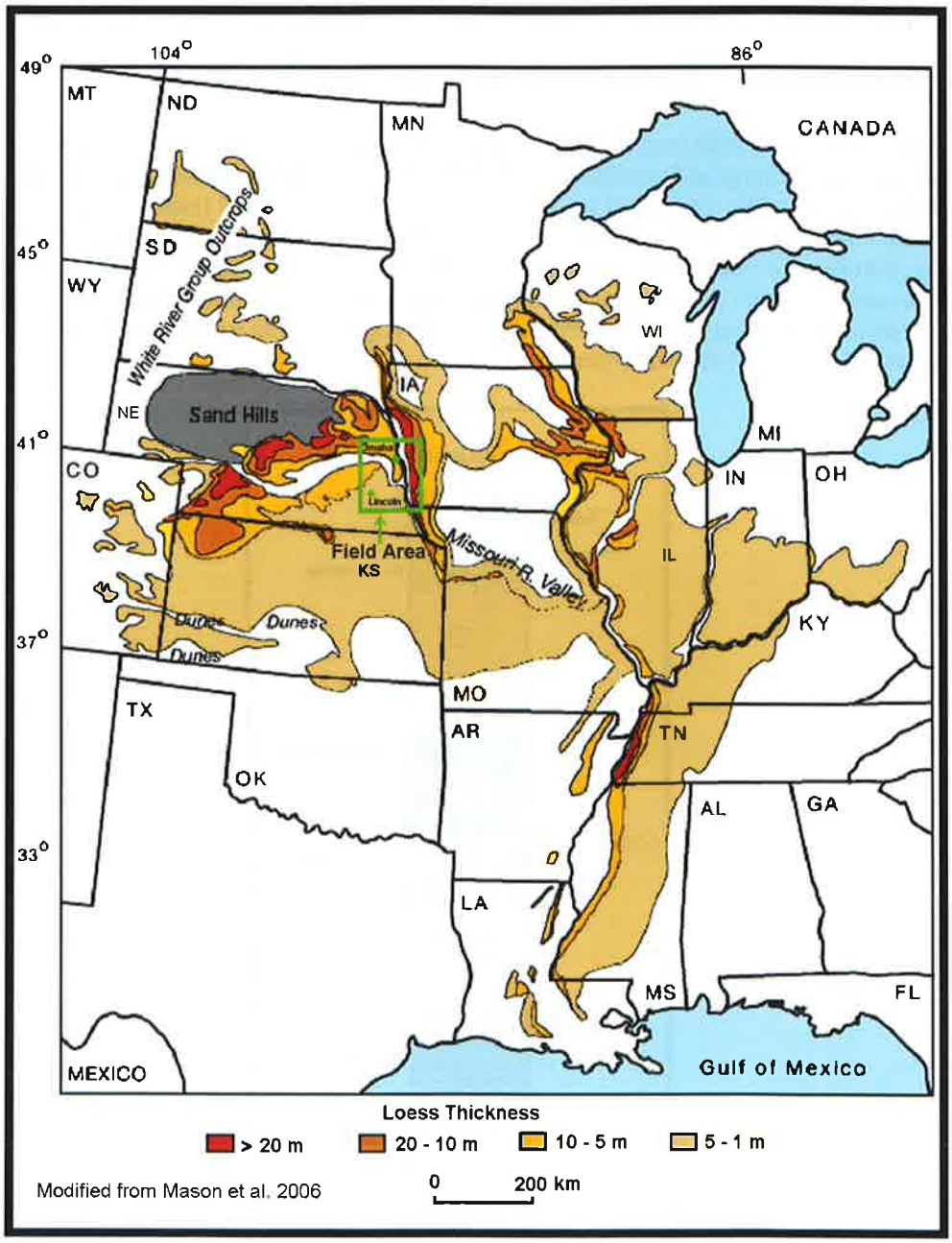


Figure WS3 Loess thickness in Midcontinent USA.

Figure WS3 presents the general loess thickness in the Midcontinent. The thickest loess occurs in western Iowa and south central NE. Two loess sources account for this distribution. One source is the Missouri Valley (Ruhe et al., 1967; Simonson and Hutton, 1954; Muhs and Bettis, 2000), which served as glacial outlet beginning, at least during Illinoisan time (Mason, 2006.). Aleinikoff et al. (1998, 1999), using geochemical analysis showed that Peoria Loess across Nebraska came from non-glacial sources of the western Great Plains (White River and Arikeree siltstones). Mason (2001) reached similar conclusions using Peoria Loess thickness trends.

Landscape Evolution

Despite widespread occurrence of glacial and loess deposits, the field area is an erosional landscape that displays dissection and a well-integrated drainage. The terrain resembles erosional landscapes developed solely on relatively flat-lying sedimentary rocks. As the landscape declines in elevation from higher primary divides to lower secondary divides, younger stratigraphic units are truncated by erosion and older units are exhumed and exposed at the land surface (Hallberg, 1980). Ruhe1967, following extensive field study, developed a soil landscape and geomorphic model for southwest IA. This model is appropriate to the field area. Fig WS4 depicts this model.

Four geomorphic surfaces descend from stream divides to major drainages. The uppermost surface is blanketed by loess that overlies a paleosol developed on till or a clay-rich material known as gumbotil (Kay, 1916), which is interpreted as weathering product from till. . The clay-rich material may alternatively represent an early loess deposit (Woida and Thompson, 1993). Ruhe (1967) named the paleosol for time period it represented, the Yarmouth Sangamon (YS) paleosol (Yarmouth is the classical North American interglacial between Kansan and Illinoisan glaciations).

Episodic erosion cut a pediment below the YS surface and the associated materials. This geomorphic surface Ruhe (1967) named the late-Sangamon Pediment. In Ruhe's study area (Greenfield quadrangle, Adair County) the Loveland Loess is absent, elsewhere this erosion cycle removes or truncates the Loveland Loess. Hence, the paleosol formation period spans only a portion of the Sangamon interglacial and Ruhe refers to it as the Late Sangamon. The paleosol under this surface is formed in transported material called pedisediment (Ruhe and Cady, 1954). A traceable stone line lies below the pedisediment, which in turn is underlain by pre-Illinoisan till.

Episodic erosion produced a second pediment during early Wisconsin time. This erosion cycle removed the pre-existing soil. The modern soil on this surface has reformed in the truncated, less-weathered pre-Illinoisan till. Wisconsin age loess originally covered this surface, but subsequent hillslope erosion removed it at the site shown in Figure WS4.

An erosional down cutting cycle accompanied by headward stream incision and hillslope backwearing began in late Wisconsin time. All loess deposition predates this surface, hence modern soils form into the truncated pre-Illinoisan till. This erosional surface descends to Holocene alluvial deposits. This surface Ruhe (1967) called the late-Wisconsin dissection slope.

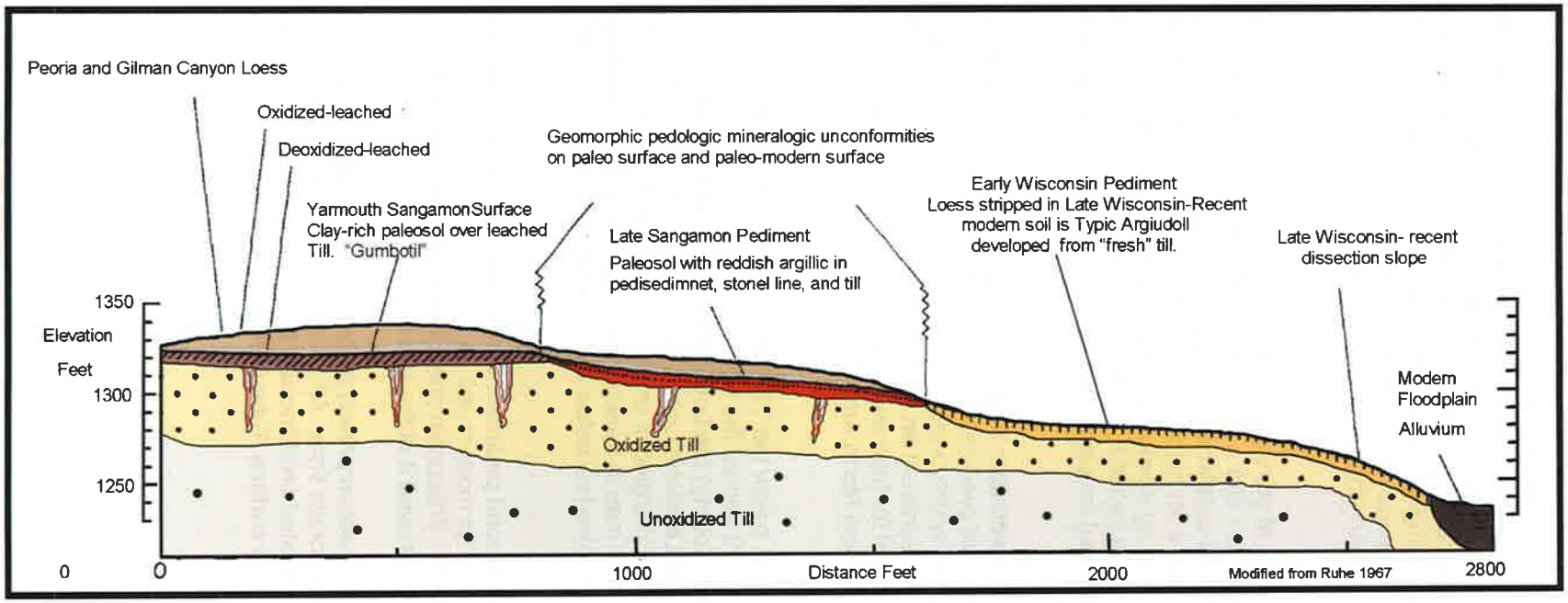


Fig WS4 Landscape evolution in dissected, stepped pre-Illinoisan till landscapes SW IA.

References

Aleinikoff, J.N., Muhs, D.R., Fanning, C.M., 1998. Isotopic evidence for the sources of Late Wisconsin (Peoria) Loess, Colorado and Nebraska: implications for paleoclimate. In: Busacca, A.J. (Ed.), Dust Aerosols, Loess Soils, and Global Change. College of Agriculture and Home Economics Miscellaneous Publication MISC0190. Washington State University, Pullman, WA, pp. 124–127.

Aleinikoff, J.N., Muhs, D.R., Sauer, R.R., Fanning, C.M., 1999. Late Quaternary loess in northeastern Colorado; Part II, Pb isotopic evidence for the variability of loess sources. Geological Society of America Bulletin 111, 1876–1883.

Boellstorff, J.D.1978a. A need for redefinition of North American Pleistocene stages. Gulf Coast Association of Geological Societies Transactions, 28, 65-74.

Boellstorff, J.D. 1978b. Chronology of some late Cenozoic deposits from the central United States and the ice ages. Nebraska Academy of Sciences, Transactions, 6: 35-49.

Boellstorff, J.D. 1978c. North American Pleistocene stages reconsidered in light of probable Pliocene-Pleistocene continental glaciation. Science, 202, 305-307.

Chamberlain, T.C. (1895). The classification of American glacial deposits. Journal of Geology, 3, 270-277.

Hallberg, G.R. (1980a). Pleistocene stratigraphy in east-central Iowa. Iowa Geological Survey Technical Information Series 10,168 pp.

Hallberg, G. R., 1986, Pre-Wisconsin glacial stratigraphy of the central plains region in Iowa, Nebraska, Kansas, and Missouri; in, Quaternary Glaciations in the Northern Hemisphere., V. Sibrava, D. Q. Bowen, and G. M. Richmond, eds.: Pergamon Oxford, United Kingdom, p. 11-15.

Jacobs, P.M. and Mason, J. A. 2007. Late Quaternary climate change, loess sedimentation, and soil profile development in the central Great Plains: A pedosedimentary model. Geological Society of America Bulletin. 119: no. 3-4 p. 462-475

Kay, G.F. 1916 Gumbotil, a new term in Pleistocene geology, Science Vol.44 p35-40.

Markewich, H.W., D.A. Wysocki, M.J. Pavich, E.M. Rutledge, H.T. Millard Jr., F.J. Rich, P.B Maat, Meyer Rubin, and J.P. McGeehin. 1998. Paleopedology plus TL 10Be and 14C dating as tools in stratigraphic and paleoclimatic investigations Mississippi river Valley, U.S.A. Quaternary Intern. 51/52: 143-167

Markewich, H.W., Wysocki, D.A., Pavich, M.J., and Rutledge, E.M. 2010. Age, genesis, and paleoclimatic interpretation of the Sangamon/Loveland complex in the Lower Mississippi Valley, U.S.A. Geological Society of America Bulletin Vol. 123, no 1/2, 21-39

Mason, J.A., 2001. Transport direction of Peoria Loess in Nebraska and implications for loess sources on the central Great Plains. Quaternary Research 56, 79–86.

Mason, J. A., Bettis, A. E., Roberts, H. M., Muhs, D. R., and Joeckel, R. M., 2006, Last glacial loess sedimentary system of eastern Nebraska and western Iowa; AMQUA post-meeting

field trip no. 1; in, Guidebook of the 18th Biennial Meeting of the American Quaternary Association, R. Mandel, ed.: Kansas Geological Survey, Technical Series 21, p. 1-1–1-22.

Mason, J.A., Joeckel, R.M., and Bettis, A.E., 2007 Middle to Late Pleistocene loess record in eastern Nebraska, USA, and implications for the unique nature of Oxygen Isotope Stage 2. Quaternary Science Reviews 26: 773–792

Muhs, D.R., Bettis III, E.A., 2000. Geochemical variations in Peoria Loess of western Iowa indicate paleowinds of midcontinental North America during last glaciation. Quaternary Research 53, 49–61.

Ruhe, R.V., 1967. Geomorphology of parts of the Greenfield quadrangle, Adair County, Iowa. In: Ruhe, R.V., Daniels, R.B., Cady, J.G. (Eds.), Landscape Evolution and Soil Formation in Southwestern Iowa. Technical Bulletin 1349, Department of Agriculture, United States. US Department of Agriculture, Washington, DC, USA, pp. 93- 160 (Chapter 2).

Ruhe, R.V., Daniels, R.B., Cady, J.G., 1967. Landscape Evolution and Soil Formation in Southwestern Iowa. Technical Bulletin 1349. US Department of Agriculture, Washington, DC 220 p.

Ruhe, R.V., and Cady, J.G. 1954. Latosolic soils of central African interior high plateaus. 5th International Cong. Soil Sci. Trans., Leopoldville, Congo. 4: 401-407.

Simonson, R.W., Hutton, C.E., 1954. Distribution curves for loess [Iowa-Missouri]. American Journal of Science 252, 99–105.

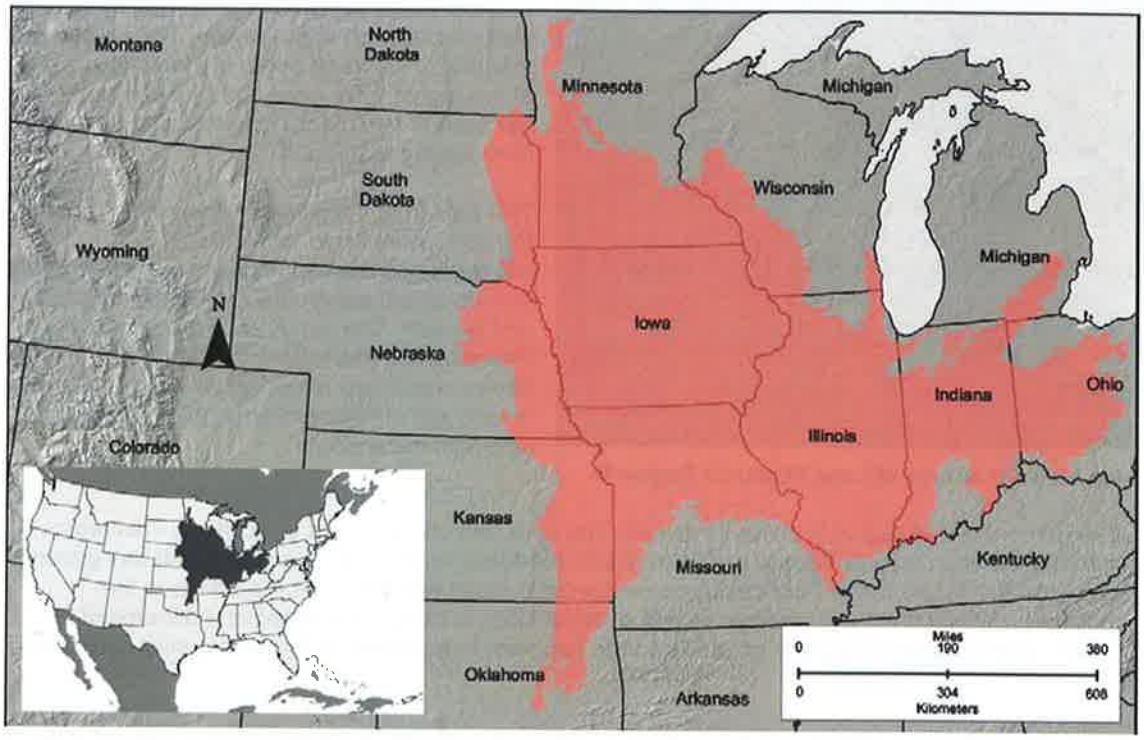
Woida, K., Thompson, M.L., 1993. Polygenesis of a Pleistocene paleosol in southern Iowa. Geological Society of America Bulletin 105, 1445–1461.

Selected Sections from

Major Land Resource Area (MLRA)

Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin

(U.S. Department of Agriculture Handbook 296, 2006)



Location of Land Resource Region M

M—Central Feed Grains and Livestock Region

This region is in Iowa (20 percent), Illinois (18 percent), Missouri (13 percent), Minnesota (11 percent), Indiana (9 percent), Kansas (6 percent), Nebraska (6 percent), Ohio (6 percent), Wisconsin (4 percent), South Dakota (4 percent), Oklahoma (2 percent), and Michigan (1 percent). Also, very small parts are in North Dakota and Kentucky. The region makes up 282,450 square miles (731,905 square kilometers).

Typically, the land surface is a nearly level to gently sloping, dissected glaciated plain. The average annual precipitation is typically 32 to 39 inches (815 to 990 millimeters), but it ranges from 19 to 48 inches (485 to 1,220 millimeters), increasing from north to south. Most of the precipitation occurs during the growing season. In most of the region, the average annual temperature is 47 to 53 degrees F (8 to 12 degrees C), but it ranges from 38 to 62 degrees F (4 to 17 degrees C), increasing from north to south. The freeze-free period generally is 170 to 210 days. It increases in length from north to south.

Riparian buffer in an area of Land Resource Region M

The total withdrawals of freshwater in this region average about 35,945 million gallons per day (136,050 million liters per day). This is one of six land resource regions that use more than 30,000 million gallons per day (113,550 million liters per day). This region is second only to the Northwestern Wheat and Range Region (LRR B) in total amount of water used. About 87 percent is from surface water sources, and 13 percent is from ground water sources. Abundant precipitation and numerous perennial streams provide ample supplies of good-quality surface water for all uses in the region. The lower reaches of the large rivers in the southern part of the region have poor-quality water primarily because of sediment, nutrients, and pesticides from agricultural runoff.

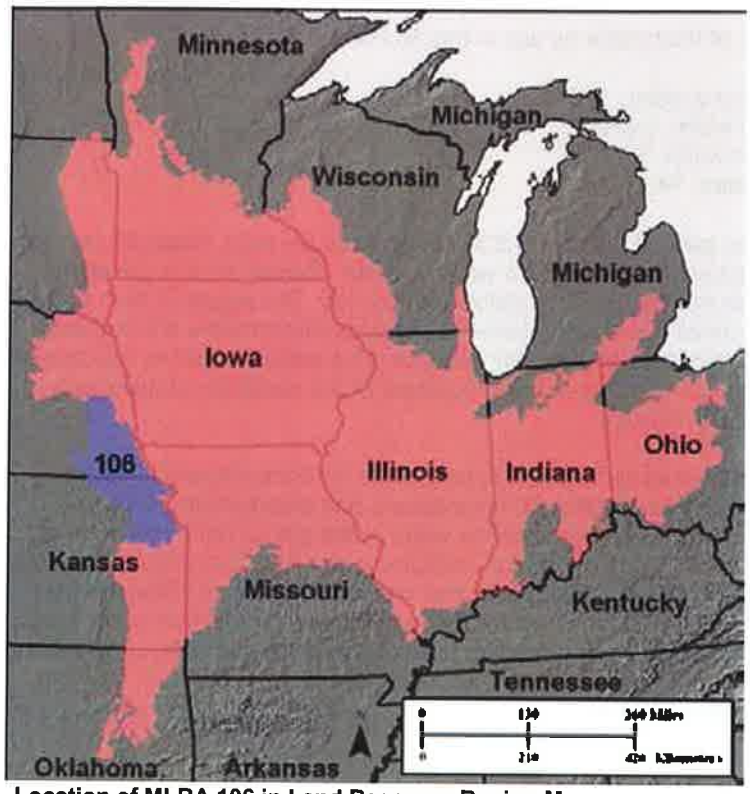
The soils in this region are dominantly Alfisols, Entisols, Inceptisols, or Mollisols. Some Histosols occur on flood plains and in wetlands. The dominant suborders are Udalfs, Aqualfs, and Aquolls. The sandy soils are typically Psamments. The soils in the region dominantly have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed or smectitic mineralogy.

About 99 percent of this region is privately owned. The soils and climate favor agriculture. This region produces most of the corn, soybeans, and feed grains produced in the U.S. The grains and hay grown in the region commonly are fed to beef cattle. Some specialty crops are grown near markets in the metropolitan areas. Much of the cropland near the larger cities is being subdivided and developed for urban uses. Small areas in the parts of this region in southern Indiana and in Illinois are strip-mined for coal.

The major soil resource concerns are water erosion, wetness, and maintenance of the content of organic matter and productivity of the soils. Wind erosion is a hazard in some of the northern parts of the region where the lighter textured soils occur. Protecting wildlife habitat and preserving the quality of surface water and ground water are additional concerns in many parts of this region.

106—Nebraska and Kansas Loess-Drift Hills

This area is in Nebraska (52 percent) and Kansas (48 percent). It makes up about 10,920 square miles (28,295 square kilometers). It includes the town of Beatrice, Nebraska; the city of Lincoln, Nebraska; and the cities of Topeka and Lawrence, Kansas. Interstate 80 crosses the northern part this MLRA, passing through an area just north of Lincoln, and Interstates 70 and 470 pass through Topeka and Lawrence, Kansas, in the southern part of the MLRA. The Iowa Sac and Fox, Kickapoo, and Potawatomi Indian Reservations are in the part of this area in Kansas. Part of the Iowa Sac and Fox Reservation is in Nebraska. The Homestead National Monument, commemorating pioneer life on the prairie, is just west of Beatrice, Nebraska.



Location of MLRA 106 in Land Resource Region M

Physiography

This area is almost entirely in the Dissected Till Plains Section of the Central Lowland Province of the Interior Plains. The southern tip is in the Osage Plains Section of the same province and division. Interstate 70 is close to the boundary between these two sections in this MLRA. This area is a dissected glacial drift plain. Ridgetops are broad and smooth, and slopes are nearly level to strongly sloping. Stream valleys are bordered by relatively narrow bands of hilly and steep slopes. Valley floors are typically narrow, except along the larger rivers and their primary tributaries. Elevation ranges from 980 to 1,650 feet (300 to 505 meters), increasing from east to west. Local relief is mainly 10 to 20 feet (3 to 6 meters), but some of the larger valley floors are 80 to 160 feet (25 to 50 meters) or more below the level of the adjacent uplands.

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Kansas (1027), 51 percent; Missouri-Nishnabotna (1024), 32 percent; and Platte (1020), 17 percent. The Little Nemaha River and the North Fork of the Big Nemaha River flow into the Missouri River, which is just east of the part of this area in Nebraska. The Big Blue River flows through Beatrice, Nebraska, and on into the part of this area in Kansas. Salt- Wahoo Creeks flow through Lincoln and Wahoo and on into the Platte River in the northern part of the area. The Big Blue joins the Black Vermillion River at Tuttle Creek Lake in the southern end of the MLRA, in Kansas. The Soldier and Delaware Rivers also are in the part of the MLRA in Kansas.

Geology

Loess covers the surface of almost all of the uplands in this MLRA. Glacial drift underlies the loess. Alluvial clay, silt, sand, and gravel are deposited in all of the stream and river valleys. The alluvial deposits can be extensive in the major river valleys. Paleozoic sandstone, shale, and limestone units are exposed in a few road cuts and in the walls of valleys along the major streams on the east side of the area, near the bluffs along the Missouri River. Limestone and shale (clay) quarries are in this MLRA.

Climate

The average annual precipitation in most of this area is 28 to 40 inches (710 to 1,015 millimeters), increasing from northwest to southeast. About three-fourths of the precipitation falls as high-intensity, convective thunderstorms from late in spring through early in autumn. The scant precipitation in winter occurs mainly as snow. The average annual temperature is 50 to 55 degrees F (10 to 13 degrees C). The freeze-free period averages about 195 days and ranges from 175 to 215 days.

Water

Following are the estimated withdrawals of freshwater by use in this MLRA:

Public supply—surface water, 6.5%; ground water, 18.7%
Livestock—surface water, 1.3%; ground water, 2.5%
Irrigation—surface water, 11.4%; ground water, 31.9%
Other—surface water, 13.6%; ground water, 14.1%

The total withdrawals average 485 million gallons per day (1,835 million liters per day). About 67 percent is from ground water sources, and 33 percent is from surface water sources. Precipitation is generally adequate for crops, but in years of little or no precipitation, yields are reduced. The supply of both surface and ground water is limited in this area. Small areas along some of the perennial streams are irrigated. Small ponds and reservoirs are important sources of water for livestock. The surface water in this area is generally of good quality, but it typically is not used for drinking because of the variability of the supply. Many streams flow only in direct response to rainfall.

Shallow wells in glacial drift and in alluvium in stream valleys supply water for domestic and livestock needs on most farms. This water primarily contains calcium, magnesium, and bicarbonate and is very hard. The level of total dissolved solids varies considerably in the water in the glacial drift. The water in the alluvial deposits has a median level of 390 parts per million (milligrams per liter) total dissolved solids. In some areas deep wells in glacial drift provide very hard water that contains more than 700 parts per million (milligrams per liter) total dissolved solids. Many communities and households obtain water from the Dakota Formation. This water is very hard and has a median level of 840 parts per million (milligrams per liter) total dissolved solids. The public water supply for Lincoln, Nebraska, is pumped from alluvium along the Platte River, almost 30 miles east of the city.

Soils

The dominant soil orders in this MLRA are Mollisols, Alfisols, and Entisols. The soils in the area dominantly have a mesic soil temperature regime, a udic soil moisture regime, and mixed or smectitic mineralogy. They generally are very deep, well drained or moderately well drained, and loamy or clayey. Hapludolls formed in alluvium on flood plains (Kennebec series), in colluvium on footslopes and alluvial fans (Judson series), and in loess on uplands (Marshall series). Argiudolls formed in loess (Aksarben and Wymore series), till (Burchard, Morrill, Pawnee, and Shelby series), and colluvium and/or residuum (Martin series) on uplands. Udifluvents (Nodaway series) formed in alluvium on flood plains. Udorthents (Steinauer series) formed in till on uplands. Hapludalfs formed in loess on uplands and stream terraces (Yutan and Otoe series) and in till on uplands (Malmo series).

Biological Resources

This area supports grassland vegetation characterized by mid and tall grasses. Big bluestem, little bluestem, switchgrass, Indiangrass, porcupinegrass, and sideoats grama are the dominant species on silty soils in the uplands. Clayey soils in the uplands support a similar plant community but have a higher percentage of switchgrass and have some wildrye. Green ash, hackberry, oak, boxelder, black walnut, and maple trees grow along streams and intermittent drainageways. Some of the major wildlife species in this area are whitetailed deer, raccoon, opossum, tree squirrel, pheasant, bobwhite quail, and mourning dove.

Land Use

Following are the various kinds of land use in this MLRA:

Cropland—private, 62%
Grassland—private, 22%; Federal, 1%
Forest—private, 6%
Urban development—private, 5%
Water—private, 2%

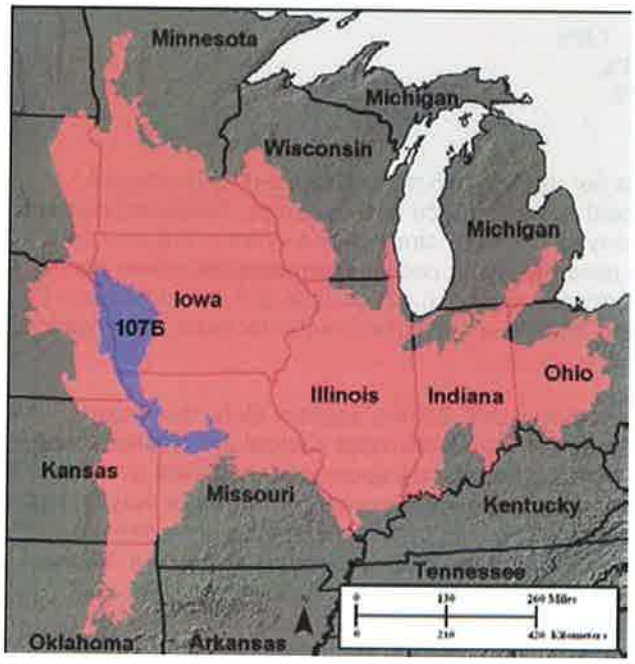
Nearly all of this area is farmland, and about two-thirds is cropland. The cropland is more extensive on the less sloping soils that formed in loess than on other soils. Wheat and corn are important cash crops, but grain sorghum, soybeans, and alfalfa and other hay crops are grown on a large percentage of the area. Most of the grain and hay is fed to livestock on the farms where it is grown. About one-fourth of the area is used as pasture or range. Pastures of native grasses are more extensive on the strongly sloping to steep soils that formed in glacial till than on other soils. Pastures of introduced grasses and legumes are on the more productive soils, and native grasses are common on the more sloping, shallow soils. Native woodland is confined to narrow bands bordering drainageways and streams and to some nearly level, wet soils on bottomland.

The major soil resource concerns are water erosion and maintenance of the content of organic matter in the soils. The resource concerns on pasture and rangeland are plant productivity, health, and vigor; noxious and invasive plants; and inadequate wildlife habitat. Conservation practices on cropland generally include high-residue crops in the cropping system, systems of crop residue management (such as no-till, strip-till, and mulch-till systems), gradient terraces and grassed waterways, underground outlets, contour farming, conservation crop rotations, and nutrient and pest management.

Conservation practices on rangeland and pasture generally include prescribed grazing, brush management, management of upland wildlife habitat, and proper distribution of watering.

107B—Iowa and Missouri Deep Loess Hills

This area is in Iowa (53 percent), Missouri (32 percent), Nebraska (12 percent), and Kansas (3 percent). It makes up about 14,410 square miles (37,335 square kilometers). It includes the cities or towns of Atlantic, Council Bluffs, and Sioux City, Iowa; St. Joseph, Kansas City, Independence, and Marshall, Missouri; Atchison, Leavenworth, and Kansas City, Kansas; and Omaha, Nebraska. Interstates 29, 35, 70, and 80 cross different parts of this area. Fort Leavenworth Military Reservation and parts of the Winnebago and Omaha Indian Reservations are in this MLRA. A number of State parks are throughout the area, and a number of national wildlife refuges are in the area, especially along the Missouri River.



Location of MLRA 107B in Land Resource Region M

Physiography

This area is almost entirely in the Dissected Till Plains Section of the Central Lowland Province of the Interior Plains. The farthest southern part of the area in Missouri is in the Osage Plains Section of the same province and division. Slopes are mostly rolling to hilly, but some broad ridgetops are nearly level to undulating. Slopes bordering the major stream valleys are steep. Nearly level, broad valley floors are along a few large rivers. Elevation ranges from 600 feet (185 meters) where the Missouri River exits the area to 1,565 feet (475 meters) on the highest ridges. Local relief is mainly 10 to 100 feet (3 to 30 meters), but valley floors can be 80 to 300 feet (25 to 90 meters) below the adjacent uplands. Also, some upland flats and valley floors have local relief of only 3 to 6 feet (1 to 2 meters).

The extent of the major Hydrologic Unit Areas (identified by four-digit numbers) that make up this MLRA is as follows: Missouri-Nishnabotna (1024), 45 percent; Missouri-Little Sioux (1023), 33 percent; Lower Missouri (1030), 15 percent; Des Moines (0710), 2 percent; Platte (1020), 2 percent; Chariton-Grand (1028), 2 percent; and Missouri-Big Sioux (1017), 1 percent. A small part of the Kansas (1027) and Elkhorn (1022) Hydrologic Unit Areas also occur in this MLRA. The Missouri River forms the "centerline" of this MLRA. The major tributaries that join the Missouri River in this area include, from north to south, the Floyd, Little Sioux, Soldier, Boyer, Platte (Nebraska), Nishnabotna, Little Nemaha, Tarkio, Big Nemaha, Nodaway, Platte and Little Platte (Missouri), Kansas, Grand, and Thompson Rivers.

Geology

This area includes the Missouri Alluvial Plain, the Loess Hills, and part of the Southern Iowa Drift Plain landform regions of Iowa. Most of the area is overlain by loess deposits that reach a thickness of 65 to 200 feet (20 to 60 meters) in the Loess Hills and thin to about 20 feet (6 meters) in the eastern part of the area. The loess is underlain by pre-Illinoian till, which was deposited more than 500,000 years ago and has since undergone extensive erosion and dissection. In the Loess Hills, Holocene cycles of erosion and deposition, or "cut and fill," have produced deeply incised gullies and fine grained alluvial deposits. The Quaternary overburden ranges from 150 to 450 feet (45 to 135 meters) in thickness throughout most of the area, but it is generally less than 150 feet (45 meters) thick in the southeastern part of the area. The glacial materials are underlain by Pennsylvanian and Cretaceous bedrock, which consists of shale, mudstones, and sandstones.

Climate

The average annual precipitation in this area is 26 to 41 inches (660 to 1,040 millimeters). Most of the rainfall occurs as convective thunderstorms during the growing season. About 10 percent of the precipitation occurs as snow in the winter. The average annual temperature is 46 to 56 degrees F (8 to 13 degrees C). The freeze-free period averages about 190 days and ranges from 155 to 220 days.

Water

Following are the estimated withdrawals of freshwater by use in this MLRA:

Public supply—surface water, 5.1%; ground water, 1.8%
Livestock—surface water, 0.2%; ground water, 0.4%
Irrigation—surface water, 0.4%; ground water, 1.7%
Other—surface water, 89.1%; ground water, 1.3%

The total withdrawals average 4,210 million gallons per day (15,935 million liters per day). About 5 percent is from ground water sources, and 95 percent is from surface water sources. Sediment, nutrients, and pesticides from agricultural activities impair many of the major streams and rivers in this area (not including the Missouri River). The surface water is used mainly for cooling thermoelectric power plants along the Missouri River. The Missouri River also provides most of the municipal and industrial water for the major cities in the area. Other streams and rivers provide some surface water for livestock, irrigation, and public supplies in parts of the area.

The principal sources of ground water in the area are glacial drift, alluvial aquifers along the major streams, buried valley aquifers, the Dakota Sandstone, and Paleozoic rocks. Glacial drift aquifers supply many rural homeowners with domestic water. The buried channels are sources of moderate or moderately large supplies of generally good-quality water. The mineral content of the water may be high if this aquifer is hydraulically connected to bedrock aquifers beneath it. Alluvial deposits are extensive across the broad flood plain along the Missouri River. This aquifer is used for public supplies in Missouri. It has very hard water that contains a median level of 467 parts per million (milligrams per liter) total dissolved solids. The other shallow aquifers in Iowa have water very similar in quality to that in the Missouri River alluvium. They provide water for domestic use, livestock, some irrigation, and public supply.

The Cretaceous-age Dakota Sandstone is at a shallow or moderate depth in the northern half of this area. It is tapped by many domestic and livestock wells. A few irrigation wells tap this aquifer. In areas where more shallow aquifers do not occur, a number of communities obtain their public supplies from this aquifer. Locally, the base of the Dakota Sandstone has beds of gravel from which moderately large yields can be obtained. The median level of total dissolved solids in the aquifer in Iowa and Nebraska is 824 and 840 parts per million (milligrams per liter), respectively, and the water is very hard.

The Jordan aquifer is the most extensively used aquifer in Iowa. It consists of Ordovician-Cambrian sandstone and dolomite beds. Its water has a median level of total dissolved solids that exceeds 800 parts per million (milligrams per liter) and may contain levels of radium that exceed the national standards for drinking water. Some communities in the part of this area in Iowa depend on this aquifer for public supplies, even though the wells are very deep. Paleozoic units serve as aquifers in the parts of this area in southeastern Nebraska and northwestern Missouri. Water from these aquifers has a median level of total dissolved solids of 1,300 parts per million (milligrams per liter) in Nebraska. Many farmers and communities in Missouri have abandoned wells in these units because of high levels of dissolved salts.

Soils

The dominant soil orders in this MLRA are Mollisols and, to a lesser extent, Alfisols and Entisols. The soils in the area dominantly have a mesic soil temperature regime, an aquic or udic soil moisture regime, and mixed mineralogy. They generally are very deep, well drained or moderately well drained, and silty or loamy. Well drained and moderately well drained, gently sloping to strongly sloping Hapludolls (Marshall and Monona series) formed on loess-mantled uplands. Well drained, strongly sloping Alfisols (Knox series) formed in loess. Well drained, strongly sloping Udorthents on side slopes (Steinauer series) and Argiudolls (Shelby series) formed in clay loam glacial till. Somewhat excessively drained and well drained, strongly sloping to very steep Udorthents (Hamburg and Ida series) on uplands formed in thick layers of loess bordering the Missouri River. Well drained and moderately well drained Udifluvents (Haynie and McPaul series) and Hapludolls (Keg, Kennebec, Napier, and Salix series), somewhat poorly drained or poorly drained Fluvaquents (Onawa and Albaton series), and poorly drained or very poorly drained Haplaquolls (Colo, Luton, and Wabash series) formed in alluvium on bottom land.

Biological Resources

Prairies in this area support tall grasses on moist soils and xeric short grasses on uplands. Within the prairies, grama, muhly, lovegrass, and wheatgrass commonly grow beside the more familiar little bluestem, big bluestem, Indiangrass, and wildrye. The most common forbs are eared milkweed, Missouri milkvetch, prairie tea, western prairie fringed orchid, yucca, Baldwin ironweed, painted cup, pale gentian, silky aster, and skeletonweed (in the loess hills).

The wooded areas on uplands commonly support red oak, white oak, hackberry, shagbark hickory, and bitternut hickory. The wooded areas on bottomland commonly support mulberry, sycamore, cottonwood, willow, elms, green ash, silver maple, and American elder.

The wildlife species in the prairies include barn and longeared owls; broad-winged hawk; Leonard's, Pawnee, Ottoe, and dusted skippers; wild indigo and sleepy dusky wings; and zebra swallowtail, Great Plains toad, plains leopard frog, plains spadefoot, massasauga rattlesnake, prairie skink, ornate box turtle, six lined racerunner, bobcat, black-tailed jackrabbit, plains pocket mouse, and least shrew. The wildlife species in the wooded areas include blue grosbeak, great crested flycatcher, western meadowlark, western fox snake, western worm snake, and Woodhouse's toad. This area has 47 threatened or endangered species or species of special concern, including piping plover, blacknose and Topeka shiners, pallid sturgeon, least tern, small white lady's slipper, bog buckbean, yellow monkey flower, and spring ladies-tresses.

Land Use

Following are the various kinds of land use in this MLRA:

Cropland—private, 69%

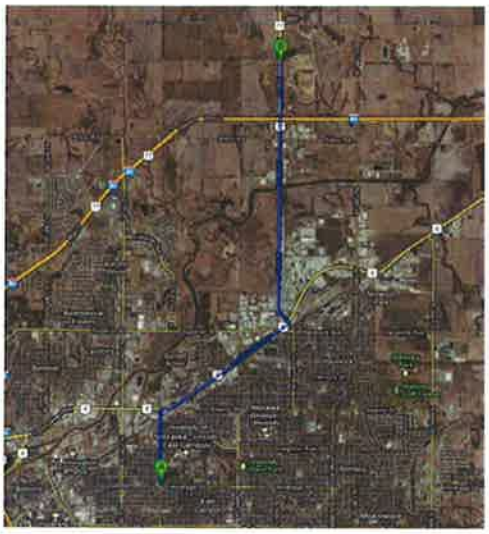
Grassland—private, 11%; Federal, 1%
Forest—private, 7%
Urban development—private, 8%
Water—private, 2%
Other—private, 2%

Historically, 92 percent of this MLRA was prairie. Forests made up 4 percent of the area; savannas, 2 percent; rivers and streams, 1 percent; wetlands, 1 percent; ponds and lakes, 0.2 percent; and shrub land, 0.2 percent. The increase in the forested acreage from 4 percent of the historic landscape to 7 percent of the current landscape occurred mainly on the loess hills, where the forested acreage increased significantly because of fire suppression.

Farms currently make up nearly all of this area. They produce cash and grain crops and livestock. The major resource concerns are water erosion, depletion of organic matter in the soils, and poor water quality.

Conservation practices on cropland generally include systems of crop residue management (especially no-till, strip-till, and mulch-till systems), cover crops, pest and nutrient management, grassed waterways, terraces, manure management, pasture and hayland planting, and grade-stabilization structures.

Paleosol Site - Aksarben Series (Wednesday, June 13, 2012)



Depart Hardin Hall at precisely 1:30PM in route to Paleosol Site on US 77 about 7.5 miles (17 minutes driving time).

Paleosol exposure (Aksarben Series) Site is on the west side of US 77 in borrow pit. Participants will need to walk from near Highway 77 to the site if the un-surfaced access road is wet.

Pit boss Ken Scheffe will give very brief overview of the activities at the site and introduce Neil Dominy Nebraska State Soil Scientist, who will give welcome and provide a general overview of soils and agriculture of Nebraska.

The return trip on Wednesday afternoon will stop at Hardin Hall first and then continue on to Holiday Inn Downtown arriving by 5:30 pm.

Activities

- Geomorphology Presentation – Phil Schoeneberger and Doug Wysocki- 30 minutes
- Photos of site and soil exposure(s) – 30 minutes
- Poke around the Pit – 30 minutes
- Ice Cream Social sponsored by UNL-(Jacki Loomis)
- Additional time for discussions, examination around the pit–20 minutes
- Soil Taxonomy and laboratory analyses- Joe Chiaretti – 15 minutes
- WRB Classification - Peter Schad
- Wrap up questions and answers – 25 minutes
- Bus departs 5:00PM to return participants to Hardin Hall first, then continues on to Holiday Inn Hotel arriving approximately 5:30PM

Stratigraphic, Pedologic, and Paleo-Topographic Relationships on a Glaciated Upland Interfluve Near Lincoln, Nebraska

Philip J. Schoeneberger* and Douglas A. Wysocki, National Soil Survey Center, USDA - NRCS, Lincoln, NE

Introduction

Soils are a synthograph, a record of earth system processes that can lead to an understanding of landscape history, soil geography, and the dynamic processes that formed them. These insights substantively explain what otherwise appears to be random soil variability, and can be applied to better manage soil and water resources.

Methods

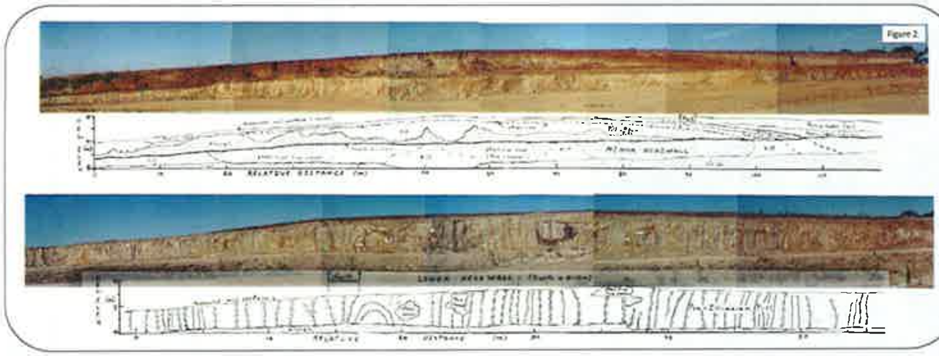
Primary field observations were made along headwalls of an extensive borrow-pit site cut through an interfluve of dissected till plains adjacent to Lincoln, Nebraska (**Figure 1**). Cross-sectional documentation is shown (**Figure 2**). Standard laboratory analyses were conducted on soil horizons (Burt, 2004).

Results

An upland interfluve was investigated in a loess-mantled, pre-Illinoian glaciated landscape near Lincoln, NE. The site retains a record of the stratigraphic, pedologic and paleo-topographic relationships of multiple depositional and soil development episodes over the last several hundred thousand years. The sequence of layers (from the surface down; **Figure 3**) are:

1) Greyish-brown loess *(locally colluviated, homogeneous eolian-derived silt with scattered till-derived gravels, and an oxidized upper portion (including a black, modern mollic surface) and an intermittent, deoxidized lower portion).*
2) Brown loess *(locally colluviated with scattered, till-derived gravels).*
3) Pedisediment unit including a reddish-brown paleosol *(reworked, loess-derived slope alluvium, including scattered gravels and channel-fills, rather than primary air-fall loess deposits)*
4) Stone line *(erosional lag concentration of gravels and stones)*
5) Glacial till *(3 zones)*:
   a) A truncated, red paleosol developed in the uppermost portion of the leached, oxidized till *(weathered, reddish, strong pedogenic structure, leached, in an oxidized, till – derived matrix)*
   b) Oxidized, leached till *(weathered, weak pedo-geogenic structure, oxidized till matrix)*
   c) Unoxidized, unleached till (**Figure 4**) *(weathered, with strong geogenic structure, grey till matrix. The upper 5-10m of the till is dominated by prominent, deep polygonal fractures. The fractures are lined with a thin, black Mn / Fe-Mn film along the primary fracture face which is surrounded by white secondary $CaCO_3$, which is bounded by a thick yellow halo (hypocoats) of Fe and Mn oxides. These polygonal seams are nearly vertical at depth (>5-10m). Near the upper limit of the till the seams are vertical in proximity to the interfluve axis, but bend obliquely in a down-slope direction on sideslopes*

NRCS Natural Resources Conservation Service



Pit 6 Profile Description and Lab Data [1]

Relative Depth (cm)	Horiz.	Soil Texture	Co. Frags. %	Matrix Color (m)	Soil Structure	Efferv. Class
(top 40 cm removed)	--	--	--	--	--	--
0-10	A	sicl	1	10YR 3/1	3,f-m, sbk	NE
10-40	Bt1	sicl	0	10YR 4/3 & 5/3	2, m-c, sbk	NE
40-70	Bt2	sicl	1	10YR 4/3	2, m, pr parts to 2, m, sbk	NE
70-100	Bt3	sicl	2	7.5YR 4/3	1, co, pr parts to 1, m,sbk	NE
100-130	Bt4	sicl	2	5YR 3/3 & 4/3	1, m-c, pr parts to 2, m, sbk	NE
130-145	2Bt1	extr. gr. l	85	7.5YR 4/6	1, m	NE
145-160	2Bt2	cl	7	7.5YR 4/6	2, m, sbk	NE
160-210	3Bt	cl	2	7.5YR 4/4	3 co-vco pr parts to 3, f-m, sbk	NE
210-230	3BC	c	2	2.5Y 5/2	3 co-vco pr parts to 3, f-m, sbk	NE
230-260	3C	c	2	2.5Y 5/2	3 co-vco pr parts to 3, f-m, abk	SL
260+	--	c	2	2.5Y 5/2	3 co-vco pr parts to 3, f-m, abk	SL

[1] Burt, 2004

References

Burt, R. 2004. Soil Survey Laboratory Methods Manual, ver. 4.0. USDA-NRCS. SSIR 42.

Mason, J.A., Jacobs, P.M., Bettis, E.A. III. 2007. [illegible] Oxygen Isotope Stage 2. Quaternary Science Reviews 26 pp 773-792

Summary & Landscape History

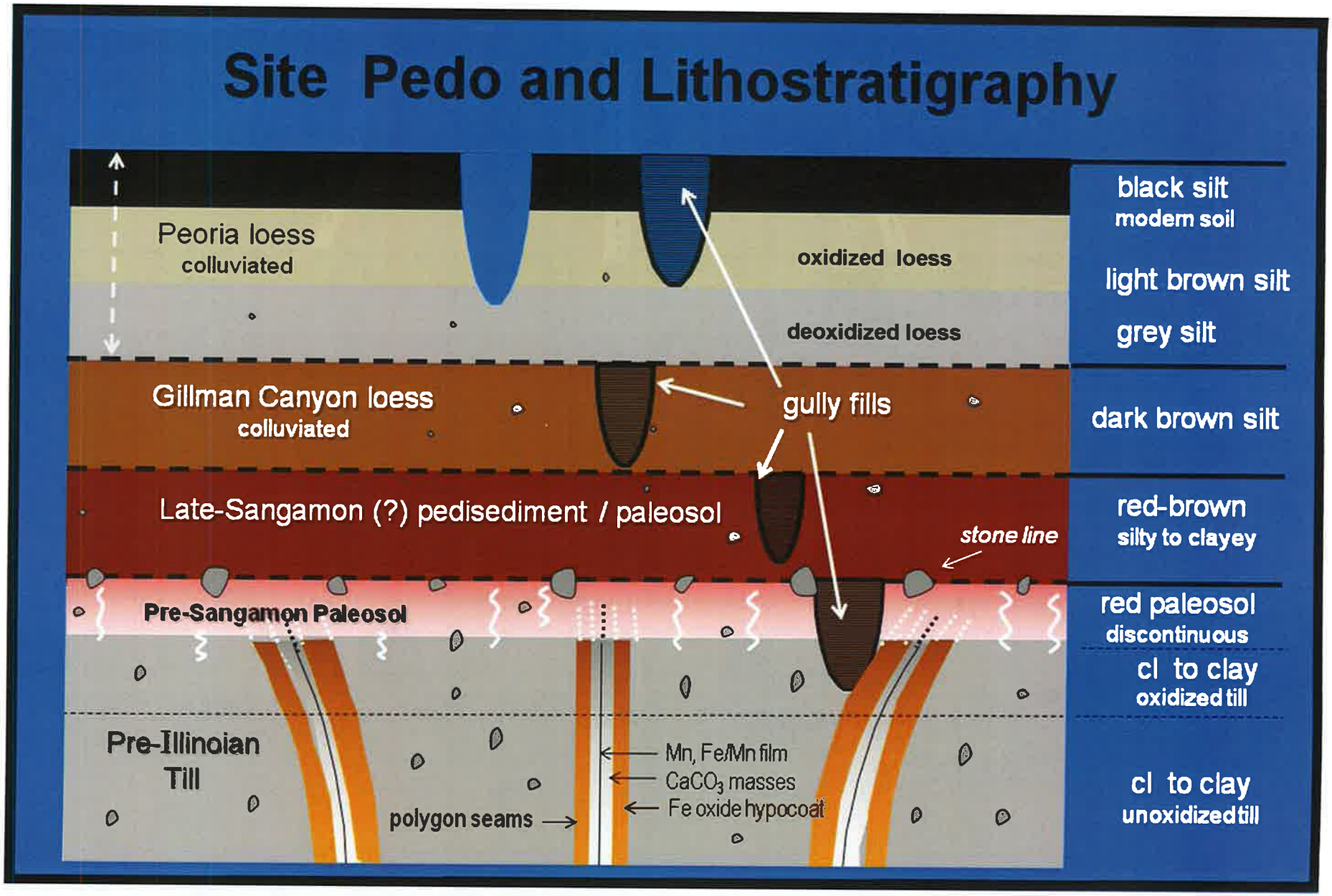
Site morphology and sediment body composition and configuration detail a dynamic, varied landscape history. The sequence of layers (from the surface down; **Figure 5**) are interpreted as:

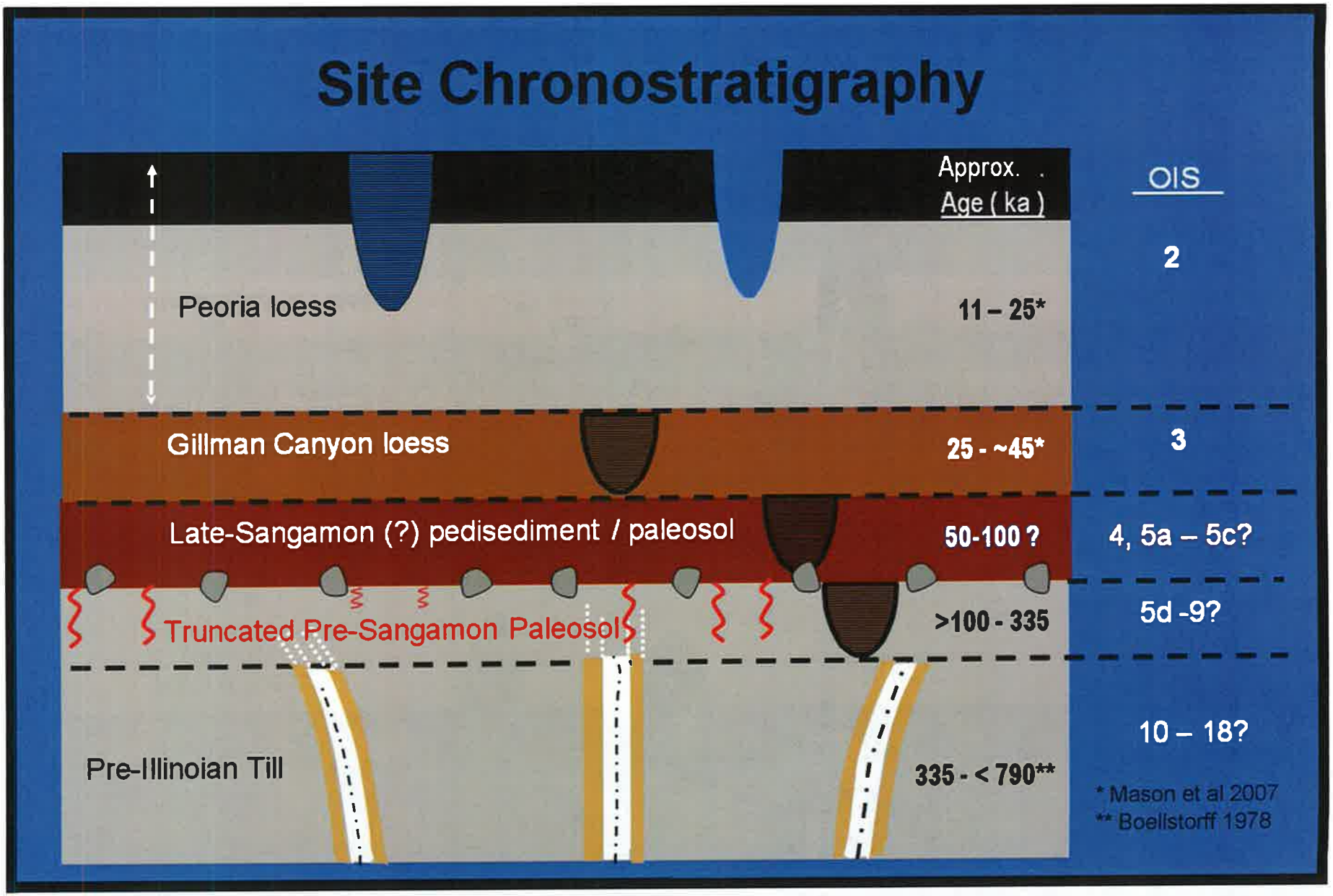
0) Anthropogenic land surface modification by removal of most of the modern mollic surface and exposure of headwalls (borrow-pit activities).
1) Peoria-aged* loess (>11 to <20 ka; OIS2): Downslope thickening of silty strata, containing scattered till-derived gravels and multiple infilled gullies indicated local colluviation.
2) Gilman Canyon* loess (>20 to <41 ka): Similar evidence of local colluviation as in the Peoria loess, including substantial downslope thickening of strata into adjacent drainageways, lateral slickensides, platy structure and associated redoximorphic color patterns,
3) Late-Sangamon pedisediment unit (>50 to <120 ka; OIS 4&5): with a reddish-brown paleosol (Late Sangamon erosion): Considerable biopores, soil structure, etc. indicate robust pedogenesis especially at it's base, but gradually overwhelmed by loess deposition. The unit dips at a much more oblique angle into adjacent drainageways than the modern surface, indicating a post-glacial reduction in local relief of the land surface
4) Stone line: Demarks a strong, Pre-Sangamon erosional era sufficient to remove most of an underlying paleosol. Infilled gullies include substantially larger coarse fragments (coarse gravels & cobbles) than any of the overlying strata, indicative of higher energy erosion and post-glacial changes in relief.
5) Pre-Illinoian* Glacial till [>640 ka *(Lava Creek – B tephra)* to <780 ka *(Bruhnes-Matuyama reversal)*] *(3 zones)*:
   a) Truncated, Pre-Sangamon paleosol: The extant, lower Bt reveals a much more developed soil than any subsequent soils/paleosols. It leached the till derived matrix and obliterated the extensive polygon network evident below.
   b) Oxidized, leached, till: This consists of a BC & upper C horizon with faint pseudomorphs of the extensive polygon network evident below.
   c) Unoxidized, unleached, Till: This weathered grey till matrix has strong geogenic structure. The prominent vertical polygonal seams are prominent bypass pathways for water and gas exchange within the system as evidenced by the mineral transformations and translocations comprising the seams. The change in orientation of the seams near their top are evidence of soil creep towards lower elevations

* Assigned lithostratigraphic names and dates are consistent with stratigraphy and dated materials in the general area (Mason et al, 2007)

Conclusions

Primary field observations were used to document broad exposures cut through an upland interfluve. This information, augmented by laboratory analyses, allows the reconstruction of site history of a loess capped, dissected till landscape that spans major mid-continent events and conditions of the last 700,00 years. Multiple episodes of loess deposition are prominent. What is generally interpreted as primary loess deposits (e.g., Peoria loess, Gilman Canyon loess) show evidence consistent with local colluviation. The presence of locally colluviated, loess-derived sediments, several paleosols, and a prominent stone line indicate extensive and episodic, post-glacial reworking of hillslopes and their constituent sediments. This evidence constitutes a record of dynamic earth-surface processes of deposition, erosion, pedogenesis and provide a context for sediment and soil variability in this benchmark landscape.


Site Pedo and Lithostratigraphy
Peoria loess
colluviated
oxidized loess
deoxidized loess
black silt
modern soil
light brown silt
grey silt
Gillman Canyon loess
colluviated
gully fills
dark brown silt
Late-Sangamon (?) pedisediment / paleosol
stone line
red-brown
silty to clayey
Pre-Sangamon Paleosol
red paleosol
discontinuous
cl to clay
oxidized till
Pre-Illinoian
Till
Mn, Fe/Mn film
CaCO3 masses
Fe oxide hypocoat
polygon seams
cl to clay
unoxidized till


Site Chronostratigraphy
Approx. Age (ka)
OIS
Peoria loess
11 – 25*
2
Gillman Canyon loess
25 - ~45*
3
Late-Sangamon (?) pedisediment / paleosol
50-100 ?
4, 5a – 5c?
Truncated Pre-Sangamon Paleosol
>100 - 335
5d -9?
Pre-Illinoian Till
335 - < 790**
10 – 18?
* Mason et al 2007
** Boellstorff 1978

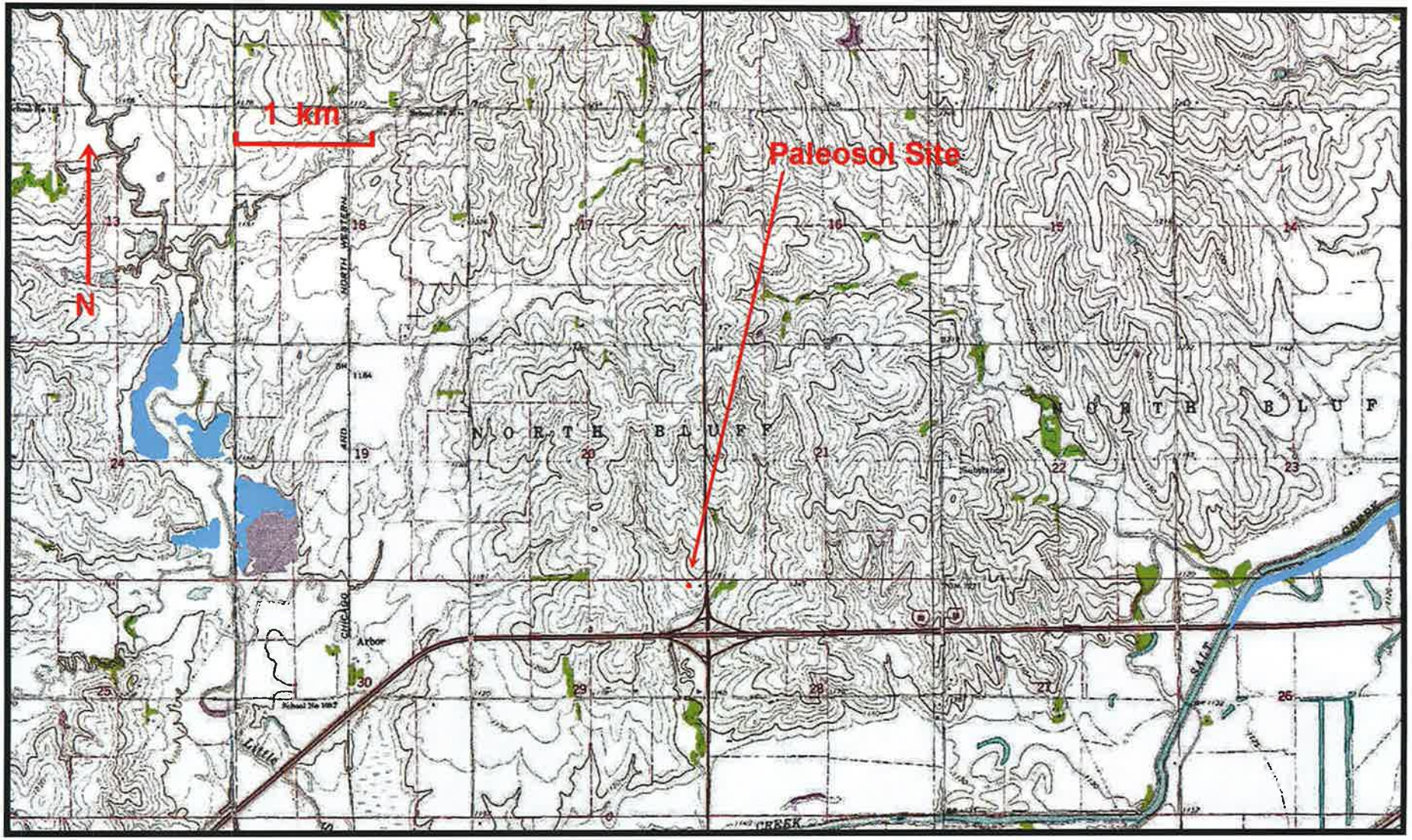


Figure WS5 Topographic map paleosol site.

Figure WS6 Paleosol Site Aerial View.

Aksarben Series

NSSC soil scientists Joe Chiaretti and Phil Schoeneberger record a soil description training video with Brad Mills, electronic media Producer at the University of Nebraska-Lincoln at the Aksarben-Paleosol site.

These training videos as well as other NCSS technical documents, standards, databases, and other soils information are available on the NRSC National Soils Web Site at http://soils.usda.gov/

The well-drained Aksarben Series is an extensive and important cropland soil formed in the Peoria loess cap in eastern Nebraska and northeastern Kansas. The series was established in 1994 when it was separated from the similar, but moderately well drained Sharpsburg series. The Aksarben is usually of Land Capability Class 2 or 3 and is a *Prime Farmland* soil when it occurs on gentle slopes. Corn, soybeans, and grain sorghum are the principle crops grown. The primary concern or limitation concerns in crop production is susceptibility to water erosion on sloping areas.

PEDON DESCRIPTION

Print Date: 03/08/2012
Description Date: 11/14/2011
Describer: J. Chiaretti, S. McVey
Site ID: S2011NE109006

Site Note: Soil mining exposure west of Hwy 77 and north of I-80.
Pedon ID: S2011NE109006

Pedon Note:
Lab Pedon #: 12N0040

Soil Name as Described/Sampled: Aksarben

Soil Name as Correlated: Aksarben

Classification: Fine, smectitic, mesic Typic Argiudolls
Pedon Type: Within range of series
Pedon Purpose: Full pedon description
Taxon Kind: Series
Physiographic Division: Interior Plains
Physiographic Province: Central Lowland Province
Physiographic Section: Dissected till plains

State Physiographic Area:

Local Physiographic Area:
Geomorphic Setting: on shoulder of dissected till plain; wall of borrow pit
Upslope Shape: convex
Cross Slope Shape: convex
Particle Size Control Section: 23 to 73 cm.
Description origin: NASIS

Diagnostic Features: mollic epipedon 0 to 40 cm. argillic horizon 23 to 88 cm.

Country: USA
State: Nebraska
County: Lancaster
MLRA: 106 -- Nebraska and Kansas Loess-Drift Hills
Soil Survey Area: NE109 -- Lancaster County, Nebraska
Map Unit: 7207—Aksarben silty clay loam, 6 to 11 percent slopes
Quad Name:
Legal Description: of Section 20, Township 11N , Range 7E
Latitude: 40 degrees 54 minutes 15.00 seconds north
Longitude: 96 degrees 38 minutes 48.90 seconds west
Datum: NAD83
UTM Zone:
UTM Easting:
UTM Northing:
Primary Earth Cover: Crop cover
Secondary Earth Cover: Row crop
Existing Vegetation: foxtail, buttonwood, sunflower, cocklebur, lambs quarters, sorghum
Parent Material: loess over slope alluvium over pedisediment over till
Bedrock Kind:
Bedrock Depth:
Bedrock Hardness:
Bedrock Fracture Interval:
Surface Fragments:
Description database: KSSL

Cont. Site ID: S2011NE109006 **Pedon ID:** S2011NE109006

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
8.0	375.0	180						well		

Aksarben silty clay loam, 6 to 11 percent slopes

Ap1--0 to 10 centimeters; very dark grayish brown (10YR 3/2) crushed silty clay loam, dark grayish brown (10YR 4/2) broken face, dry; 32 percent clay; weak very fine granular, and moderate thin platy structure; very friable, slightly hard, moderately sticky, moderately plastic; common fine roots between peds and many very fine roots between peds; common very fine interstitial pores; noneffervescent; strongly acid, pH 5.2; clear smooth boundary.

Ap2--10 to 23 centimeters; very dark grayish brown (10YR 3/2) crushed silty clay loam, dark grayish brown (10YR 4/2) broken face, dry; 32 percent clay; moderate fine and medium angular blocky structure; friable, hard, moderately sticky, moderately plastic; common fine roots between peds and many very fine roots between peds; few very fine interstitial pores; noneffervescent; strongly acid, pH 5.2; abrupt wavy boundary.

Bt1--23 to 40 centimeters; dark brown (10YR 3/3) crushed silty clay loam, grayish brown (10YR 5/2) broken face, dry; 35 percent clay; moderate medium angular blocky, and moderate medium prismatic structure; friable, very hard, moderately sticky, moderately plastic; few fine roots throughout and common very fine roots throughout; few very fine interstitial pores; 30 percent faint clay films on all faces of peds; 15 percent medium 7.5YR 5/6 masses of oxidized iron; noneffervescent; strongly acid, pH 5.3; abrupt wavy boundary.

Bt2--40 to 61 centimeters; brown (10YR 4/3) crushed silty clay loam, brown (10YR 5/3) broken face, dry; 37 percent clay; weak fine and medium angular blocky, and moderate medium prismatic structure; friable, hard, very sticky, moderately plastic; few fine roots throughout and common very fine roots throughout; few very fine interstitial pores; 30 percent distinct clay films on all faces of peds; 7 percent fine 7.5YR 5/6 masses of oxidized iron; noneffervescent; slightly acid, pH 6.1; clear smooth boundary.

Bt3--61 to 88 centimeters; brown (10YR 4/3) crushed silty clay loam, brown (10YR 5/3) broken face, dry; 36 percent clay; strong medium and coarse prismatic structure; firm, very hard, moderately sticky, moderately plastic; few fine roots throughout and common very fine roots throughout; few very fine and fine tubular pores; 30 percent distinct clay films on all faces of peds; 1 percent fine 10YR 2/2 manganese masses and 15 percent fine 10YR 5/6 masses of oxidized iron; noneffervescent; neutral, pH 6.6; gradual smooth boundary.

Bt4--88 to 160 centimeters; brown (10YR 5/3) crushed silty clay loam, pale brown (10YR 6/3) broken face, dry; 34 percent clay; moderate coarse and very coarse prismatic structure; firm, hard, moderately sticky, moderately plastic; few very fine and fine roots throughout; few very fine and fine tubular and few medium tubular pores; 10 percent faint clay films on all faces of peds and 20 percent distinct skeletans on vertical faces of peds; 10 percent fine 10YR 2/2 manganese masses and 25 percent fine 10YR 5/8 masses of oxidized iron; noneffervescent; neutral, pH 7.2; vf carbonate threads in lower horizon; horizontal intermingling of material from above and below; clear wavy boundary.

2Btkb1--160 to 186 centimeters; brown (10YR 5/3) crushed silty clay loam, pale brown (10YR 6/3) broken face, dry; 34 percent clay; moderate coarse subangular blocky, and moderate very coarse prismatic structure; friable, hard, moderately sticky, moderately plastic; few very fine and fine roots throughout; few very fine and fine tubular and few medium tubular pores; 20 percent distinct skeletans on vertical faces of peds and 30 percent prominent clay films on vertical faces of peds; 5 percent very fine 10YR 2/3 manganese masses and 10 percent fine 5YR 4/5 masses of oxidized iron and 15 percent fine 7.5YR 4/6 masses of oxidized iron; 1 percent medium spherical carbonate nodules and 1 percent coarse irregular carbonate masses; 1 percent nonflat 2- to 5-millimeter unspecified fragments; noneffervescent; slightly alkaline, pH 7.4; clear wavy boundary.

2Btkb2--186 to 240 centimeters; dark brown (10YR 3/3) crushed silty clay loam, brown (10YR 5/3) broken face, dry; 36 percent clay; weak coarse subangular blocky, and weak very coarse prismatic structure; friable, moderately hard, moderately sticky, moderately plastic; few very fine and fine roots throughout; common very fine and fine tubular and few medium tubular pores; 10 percent distinct skeletans on

vertical faces of peds and 10 percent distinct clay films on all faces of peds and 75 percent distinct clay bridges on all faces of peds; 5 percent very fine 10YR 2/2 manganese masses; 1 percent coarse irregular carbonate masses; 3 percent nonflat 2- to 20-millimeter unspecified fragments; 2 percent krotovinas (volume percent); noneffervescent; slightly alkaline, pH 7.6; gradual smooth boundary.. At 200 cm, moved 3 M north to continue description.

2Btkb3--240 to 279 centimeters; dark brown (7.5YR 3/2) broken face clay loam, brown (7.5YR 5/3) broken face, dry; 39 percent clay; weak very coarse prismatic, and moderate coarse subangular blocky structure; friable, moderately hard, moderately sticky, moderately plastic; few fine roots throughout and common very fine roots throughout; common very fine and fine tubular and few fine and medium tubular pores; 1 percent prominent carbonate coats on rock fragments and 10 percent distinct skeletans on vertical faces of peds and 30 percent distinct clay bridges on all faces of peds and 75 percent distinct clay films on all faces of peds; 2 percent very fine 10YR 2/2 manganese masses; 1 percent coarse irregular carbonate nodules; 1 percent nonflat 75- to 250-millimeter unspecified fragments and 5 percent nonflat 2- to 20-millimeter unspecified fragments; noneffervescent; moderately alkaline, pH 7.9; clear broken boundary.

3Btkb--279 to 301 centimeters; brown (10YR 5/3) broken face gravelly clay loam, pale brown (10YR 6/3), dry; 39 percent clay; moderate medium and coarse subangular blocky, and weak medium prismatic structure; firm, hard, very sticky, moderately plastic; few very fine and fine roots throughout; few very fine and fine tubular pores; 10 percent prominent carbonate coats on rock fragments and 75 percent distinct clay films on all faces of peds and 75 percent distinct skeletans on vertical faces of peds; 5 percent fine and medium 10YR 2/1 manganese masses; 1 percent nonflat 250- to 600-millimeter unspecified fragments and 10 percent nonflat 75- to 250-millimeter unspecified fragments and 20 percent nonflat 2- to 20-millimeter unspecified fragments; noneffervescent; moderately alkaline, pH 8.0; stone zone at top of horizon; clear wavy boundary.

4Btb--301 to 330 centimeters; grayish brown (2.5Y 5/2) broken face clay, light brownish gray (2.5Y 6/2), dry; 42 percent clay; strong medium angular blocky, and moderate coarse prismatic structure; firm, hard, very sticky, moderately plastic; few very fine roots between peds; few very fine and fine tubular pores; 30 percent distinct clay films on all faces of peds; 15 percent medium 10YR 2/1 manganese masses and 35 percent coarse 7.5YR 4/6 masses of oxidized iron; 10 percent nonflat 2- to 20-millimeter unspecified fragments; 3 percent krotovinas (volume percent); noneffervescent; moderately alkaline, pH 8.2; abrupt wavy boundary.

4Btkb1--330 to 420 centimeters; grayish brown (2.5Y 5/2) broken face clay, light brownish gray (2.5Y 6/2), dry; 44 percent clay; strong medium and coarse angular blocky, and moderate medium and coarse prismatic structure; very firm, very hard, very sticky, moderately plastic; few fine irregular and few coarse interstitial pores; 10 percent distinct clay films on all faces of peds; 20 percent coarse 10YR 2/1 manganese masses and 30 percent very coarse 7.5YR 4/6 masses of oxidized iron; 3 percent medium and coarse carbonate masses in cracks; 5 percent nonflat 5- to 75-millimeter unspecified fragments; very slight effervescence; strongly alkaline, pH 8.8; gradual smooth boundary.

4Btkb2--420 to 500 centimeters; brown (10YR 5/3) broken face clay, pale brown (10YR 6/3), dry; 44 percent clay; strong medium and coarse angular blocky, and moderate medium and coarse prismatic structure; very firm, very hard, very sticky, moderately plastic; common interstitial pores; 10 percent distinct clay films on all faces of peds; 5 percent medium 2.5Y 6/1 iron depletions in cracks and 15 percent coarse 10YR 2/1 manganese masses and 20 percent fine and medium 7.5YR 4/6 masses of oxidized iron; 5 percent medium carbonate masses in cracks; 5 percent nonflat 5- to 75-millimeter unspecified fragments; very slight effervescence; very strongly alkaline, pH 9.3.

Seq. #	Horizon depth (cm)	Horizon designation		Diagnostic horizon		Diagnostic characteristics or properties		Diagnostic materials	
		Tour Book	Tour	Soil Taxonomy	World Reference Base	Diagnostic characteristics of Soil Taxonomy	Diagnostic properties of World Reference Base	Soil Taxonomy	World Reference Base
1	0 10	Ap1	~	mollic epipedon	anthric horizon, mollic horizon			mineral soil material	mineral material
2	10 23	Ap2	~	mollic epipedon	anthric horizon, mollic horizon			mineral soil material	mineral material
3	23 40	Bt1	~	mollic epipedon, argillic horizon	mollic horizon, argic horizon	relict redoximorphic features	relict stagnic colour pattern	mineral soil material	mineral material
4	40 61	Bt2	~	argillic horizon	argic horizon	relict redoximorphic features	relict stagnic colour pattern	mineral soil material	mineral material
5	61 88	Bt3	~	argillic horizon	argic horizon	relict redoximorphic features	relict stagnic colour pattern	mineral soil material	mineral material
6	88 160	Bt4	~	argillic horizon	argic horizon	lithologic discontinuity at 160 cm, relict redoximorphic features	lithological discontinuity at 160 cm, relict stagnic colour pattern	mineral soil material	mineral material
7	160 186	2Btkb1	~	buried argillic horizon	buried argic horizon	identifiable secondary carbonates, relict redoximorphic features	relict gleyic colour pattern	mineral soil material	mineral material
8	186 240	2Btkb2	~	buried argillic horizon	buried argic horizon	identifiable secondary carbonates, relict redoximorphic features	relict gleyic colour pattern	mineral soil material	mineral material
9	240 279	2Btkb3	~	buried argillic horizon	buried argic horizon	identifiable secondary carbonates, lithologic discontinuity at 279 cm, relict redoximorphic features	secondary carbonates, lithological discontinuity at 279 cm, relict oximorphic colours	mineral soil material	mineral material
10	279 301	3Btkb	~	buried argillic horizon	buried argic horizon	identifiable secondary carbonates, lithologic discontinuity at 301 cm, relict redoximorphic features	secondary carbonates, lithological discontinuity at 301 cm, relict gleyic colour pattern	mineral soil material	mineral material
11	301 330	4Btb	~	buried argillic horizon	buried argic horizon	relict redoximorphic features	relict gleyic colour pattern	mineral soil material	mineral material
12	330 420	4Btkb1	~	buried argillic horizon	buried argic horizon	relict redoximorphic features, identifiable secondary carbonates	relict gleyic colour pattern, secondary carbonates	mineral soil material	mineral material
13	420 500	4Btkb2	~	buried argillic horizon	buried argic horizon	relict redoximorphic features, identifiable secondary carbonates	relict gleyic colour pattern, secondary carbonates	mineral soil material	mineral material

Taxonomic Classifications of surface soil - Arksarben pedon (12N0040)

Soil Taxonomy Fine, smectitic, mesic Typic Argiudolls 2.)

WRB Luvic Phaeozems (Anthric, Siltic, Bathythaptoluvic?) 2.)

Taxonomic Classifications of buried Paleosols 3.)

160 - 279 cm *Accretionary, Truncated, Carbonate-enriched, Oxidized,* ***Kryptic Paleoevolvisols,*** *colluvial, extensive*

301 - 500 cm *Truncated, Carbonate-enriched, Oxidized,* ***Kryptic Paleoevolvisols,*** *extensive*

1.) Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th ed. USDA-Natural Resources Conservation Service, Washington, DC.

IUSS Working Group WRB. 2007. World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No.103. FAO, Rome.

2.) Measured and estimated COLE data (0.05) and calculated LE (5.2 cm) preclude Vertic subgroup (ST) and Vertic prefix qualifier (WRB).

3.) Nettleton, W.D., Olson, C.G. and Wysocki, D.A. 2000. Paleosol classification: Problems and solutions, Catena 41, vol. 1, pp 61-92.

Calcium carbonate masses fill polygon seams within the Pre-Illinoian till in the Paleosol below 3 meters depth. Dark Fe and Mn films coat ped surfaces (left) and the Fe oxide hypocoat is visible (right).

*** Primary Characterization Data ***

Pedon ID: S2011NE109006 (Lancaster, Nebraska) Print Date: May 16 2012 3:48PM
Sampled as on Nov 14, 2011: Aksarben ; Fine, smectitic, mesic Typic Argiudoll
Revised to :

SSL - Project C2012USNE013 IUSS Aksarben
- Site ID S2011NE109006 Lat: 40° 54' 15.00" north Long: 96° 38' 48.90" west NAD83 MLRA: 106
- Pedon No. 12N0040
- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
12N00193	Ap1		0.0-10.0	S2011NE109006-1			SICL	SICL
12N00194	Ap2		10.0-23.0	S2011NE109006-2			SICL	SICL
12N00195	Bt1		23.0-40.0	S2011NE109006-3			SICL	SICL
12N00196	Bt2		40.0-61.0	S2011NE109006-4			SICL	SICL
12N00197	Bt3		61.0-88.0	S2011NE109006-5			SICL	SICL
12N00198	Bt4		88.0-160.0	S2011NE109006-6			SICL	SICL
12N00199	2Btkb1		160.0-186.0	S2011NE109006-7			SICL	SICL
12N00200	2Btkb2		186.0-240.0	S2011NE109006-8			SICL	SICL
12N00201	2Btkb3		240.0-279.0	S2011NE109006-9			CL	C
12N00202	3Btkb		279.0-301.0	S2011NE109006-10			GR-CL	CL
12N00203	4Btb		301.0-330.0	S2011NE109006-11			C	CL
12N00204	4Btkb1		330.0-420.0	S2011NE109006-12			C	CL
12N00205	4Btkb2		420.0-500.0	S2011NE109006-13			C	CL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	0.436	% wt
Volume, >2mm, Weighted Average	0	% vol
Clay, total, Weighted Average	35.258	% wt
Clay, carbonate free, Weighted Average	35.258	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 4	0.727	(NA)

Weighted averages based on control section: 23-73 cm

PSDA & Rock Fragments

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(----- Total -----)			(-- Clay ---)		(---- Silt ----)		(------------ Sand -----------)					(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(-------- Weight --------)				>2 mm
	Depth			< .002	.002 -.05	.05 -2	< .0002	< .002	.002 -.02	.02 -.05	.05 -.10	.10 -.25	.25 -.50	.5 -1	1 -2	2 -5	5 -20	20 -75	.1- 75	wt % whole soil
Layer	(cm)	Horz	Prep	(------------------------- % of <2mm Mineral Soil --------------------)												(------- % of <75mm ---)				
				3A1a1a			3A1a1a	3A1a1a	3A1a1a		3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a					
12N00193	0-10	Ap1	S	34.1	61.6	4.3	24.4		23.1	38.5	3.1	0.5	0.4	0.1	0.2	3	--	--	4	3
12N00194	10-23	Ap2	S	33.2	62.5	4.3	23.7		22.9	39.6	3.7	0.3	0.2	0.1	tr	--	--	--	1	--
12N00195	23-40	Bt1	S	35.9	61.0	3.1	25.8		23.7	37.3	2.7	0.3	0.1	tr	--	--	--	--	tr	--
12N00196	40-61	Bt2	S	36.2	61.1	2.7	21.6		27.2	33.9	2.1	0.5	0.1	tr	--	--	--	--	1	--
12N00197	61-88	Bt3	S	32.7	65.1	2.2	18.2		30.6	34.5	2.0	0.1	0.1	tr	--	--	--	--	tr	--
12N00198	88-160	Bt4	S	30.0	67.7	2.3	14.0		34.0	33.7	1.8	0.2	0.2	0.1	--	--	--	--	tr	--
12N00199	160-186	2Btkb1	S	31.2	59.6	9.2	19.9	--	32.5	27.1	3.4	2.8	2.4	0.5	0.1	--	--	--	6	--
12N00200	186-240	2Btkb2	S	35.3	49.6	15.1	22.3	--	26.4	23.2	4.5	7.5	1.4	1.4	0.3	tr	--	--	11	tr
12N00201	240-279	2Btkb3	S	40.5	38.1	21.4	22.5	--	19.5	18.6	5.8	5.8	6.9	1.9	1.0	2	--	--	17	2
12N00202	279-301	3Btkb	S	39.2	33.1	27.7	19.5	--	17.7	15.4	6.1	7.0	7.7	3.0	3.9	6	12	1	36	19
12N00203	301-330	4Btb	S	36.3	35.6	28.1	17.7		19.1	16.5	7.0	8.1	7.7	3.5	1.8	1	1	--	23	2
12N00204	330-420	4Btkb1	S	33.2	39.8	27.0	11.0	2.1	22.4	17.4	7.0	8.9	5.6	3.3	2.2	2	1	--	22	3
12N00205	420-500	4Btkb2	S	34.1	38.5	27.4	11.9	2.4	21.2	17.3	7.7	7.7	8.6	2.4	1.0	1	1	--	21	2

*** Primary Characterization Data ***

Pedon ID: S2011NE109006 (Lancaster County, Nebraska) Print Date: May 16 2012 3:48

Sampled As : Aksarben Fine, smectitic, mesic Typic Argiudoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0040

Bulk Density & Moisture

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(Bulk Density)		Cole	(- - - - - - - - - - - Water Content - - - - - - - - - - -)						WRD	Aggst		
				33	Oven	Whole	6	10	33	1500	1500 kPa	Ratio	Whole	Stabl	(- - Ratio/Clay	
	Depth			kPa	Dry	Soil	kPa	kPa	kPa	kPa	Moist	AD/OD	Soil	2-0.5mm	CEC7	1500 kPa
Layer	(cm)	Horz	Prep	(- - - g cm^{-3} - - -)			(- - - - - - - - - - - - pct of < 2mm - - - - - - - - - - - -)						cm^3 cm^{-3} %			
				DbWR1	DbWR1				DbWR1	3C2a1a		3D1				
12N00193	0-10	Ap1	S							16.7		1.022			0.71	0.49
12N00194	10-23	Ap2	S							18.5		1.024			0.70	0.56
12N00195	23-40	Bt1	S	1.48	1.75	0.057			26.0	18.2		1.028	0.12		0.70	0.51
12N00196	40-61	Bt2	S							20.0		1.032			0.73	0.55
12N00197	61-88	Bt3	S	1.36	1.62	0.060			23.9	17.8		1.030	0.08		0.76	0.54
12N00198	88-160	Bt4	S	1.39	1.54	0.035			28.2	18.1		1.030	0.14		0.80	0.60
12N00199	160-186	2Btkb1	S	1.36	1.53	0.040			26.0	16.5		1.027	0.13		0.73	0.53
12N00200	186-240	2Btkb2	S							16.7		1.027			0.68	0.47
12N00201	240-279	2Btkb3	S	1.41	1.65	0.053			23.1	19.7		1.034	0.05		0.69	0.49
12N00202	279-301	3Btkb	S	1.52	1.78	0.047			21.1	18.4		1.033	0.04		0.70	0.47
12N00203	301-330	4Btb	S							17.4		1.030			0.66	0.48
12N00204	330-420	4Btkb1	S							16.4		1.024			0.58	0.49
12N00205	420-500	4Btkb2	S							17.8		1.024			0.55	0.52

Water Content

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(- - Atterberg - -)		(- - - - - Bulk Density - - - - -)			(- Water Content -)							
				(- - - Limits - - -)		Field	Recon	Recon	Field	Recon	(- - - - - - - - - - - - - - - Sieved Samples - - - - - - - - - - - - - - -)					
				LL	PI		33 kPa	Oven Dry		33 kPa	6 kPa	10 kPa	33 kPa	100 kPa	200 kPa	500 kPa
	Depth															
Layer	(cm)	Horz	Prep	pct <0.4mm		(- - - - - - - - - g cm^{-3} - - - - - - - -)			(- % of < 2mm -)							
															3C1e1a	
12N00193	0-10	Ap1	S												17.2	
12N00194	10-23	Ap2	S												21.3	
12N00195	23-40	Bt1	S												19.1	
12N00196	40-61	Bt2	S												23.1	
12N00197	61-88	Bt3	S												19.8	
12N00198	88-160	Bt4	S												21.5	
12N00199	160-186	2Btkb1	S												19.3	
12N00200	186-240	2Btkb2	S												17.5	
12N00201	240-279	2Btkb3	S												20.0	
12N00202	279-301	3Btkb	S												18.8	
12N00203	301-330	4Btb	S												17.8	
12N00204	330-420	4Btkb1	S												17.1	
12N00205	420-500	4Btkb2	S												19.3	

*** Primary Characterization Data ***

Pedon ID: S2011NE109006 (Lancaster County, Nebraska) Print Date: May 16 2012 3:48PM
Sampled As : Aksarben Fine, smectitic, mesic Typic Argiudoll
USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0040

Carbon & Extractions

Layer	Depth (cm)	Horz	Prep	-1- C	-2- N	-3- S	-4- Est OC	-5- OC (WB)	-6- C/N Ratio	-7- Fe	-8- Al	-9- Mn	-10- Al+½Fe	-11- ODOE	-12- Fe	-13- Al	-14- Si	-15- Mn	-16- C	-17- Fe	-18- Al	-19- Mn
				(- - - - - Total - - - - -)						(- - - Dith-Cit Ext - - -)			(- - - - - - Ammonium Oxalate Extraction - - - - -)						(- - - Na Pyro-Phosphate - - -)			
				(- - - - - - - - - - % of <2 mm - - - - - - - - - -)						(- % of < 2mm - - - - - - - - - - - - - - - -								mg kg^{-1}	(- - - - - - % of < 2mm - - - - -)			
				4H2a	4H2a	4H2a				4G1	4G1	4G1		4G2a	4G2a	4G2a	4G2a	4G2a		4G3	4G3	4G3
12N00193	0-10	Ap1	S	1.75	0.16	0.01	1.8		11	0.7	0.1	tr	0.25	0.06	0.20	0.15	0.03	444.9		0.7	1.4	tr
12N00194	10-23	Ap2	S	1.75	0.17	0.01	1.7		10	0.7	0.1	tr	0.28	0.06	0.25	0.15	0.04	479.7		0.7	1.5	--
12N00195	23-40	Bt1	S	1.36	0.13	0.01	1.3		11	0.8	0.1	0.1	0.27	0.05	0.25	0.14	0.04	459.5		0.7	1.4	--
12N00196	40-61	Bt2	S	0.60	0.10	0.01	0.6		6	0.8	0.1	0.1	0.24	0.03	0.21	0.14	0.05	470.7		0.6	1.2	--
12N00197	61-88	Bt3	S	0.32	0.04	--	0.3		7	0.7	0.1	tr	0.20	0.02	0.19	0.11	0.06	442.7		0.5	0.9	--
12N00198	88-160	Bt4	S	0.21	0.08	--	0.2		2	0.6	0.1	tr	0.19	0.02	0.20	0.09	0.07	448.6		0.5	0.6	--
12N00199	160-186	2Btkb1	S	0.33	0.07	--	0.3		4	0.8	0.1	tr	0.21	0.02	0.22	0.10	0.07	558.3		0.6	1.0	--
12N00200	186-240	2Btkb2	S	0.45	0.12	--	0.4		4	0.9	0.1	tr	0.23	0.03	0.24	0.11	0.06	578.7		0.6	1.3	--
12N00201	240-279	2Btkb3	S	0.33	0.15	--	0.3		2	0.8	0.1	tr	0.19	0.02	0.15	0.12	0.06	378.8		0.7	1.2	--
12N00202	279-301	3Btkb	S	0.20	0.02	--	0.2		8	0.8	0.1	tr	0.15	0.01	0.11	0.09	0.05	446.4		0.6	1.0	--
12N00203	301-330	4Btb	S	0.10	0.05	--	0.1		1	1.0	0.1	tr	0.11	0.01	0.10	0.06	0.05	268.3		0.5	0.7	--
12N00204	330-420	4Btkb1	S	1.21	0.04	--	0.1		2	0.7	tr	tr	0.09	0.01	0.11	0.04	0.04	485.1		0.2	0.2	--
12N00205	420-500	4Btkb2	S	0.98	0.04	--	0.1		2	0.9	tr	tr	0.10	0.01	0.13	0.04	0.04	186.4		0.2	0.1	--

CEC & Bases

Layer	Depth (cm)	Horz	Prep	-1- Ca	-2- Mg	-3- Na	-4- K	-5- Sum Bases	-6- Acid-ity	-7- Extr Al	-8- KCl Mn	-9- CEC8 Sum Cats	-10- CEC7 NH_4 OAC	-11- ECEC Bases +Al	-12- Al Sat	-13- Base Saturation Sum	-14- Base Saturation NH_4OAC
				(- - - - - - NH_4OAC Extractable Bases - - - - -)													
				(- - - - - - - - - - - - - - - - - cmol(+) kg^{-1} - - - - - - - - - - - - - - - - - - -)							mg kg^{-1}	(- - - - cmol(+) kg^{-1} - - -)			(- - - - - - - - % - - - - - - - - -)		
				4B1a1a	4B1a1a	4B1a1a	4B1a1a		4B2b1a1	4B3a1a	4B3a1a		4B1a1a				
12N00193	0-10	Ap1	S	14.0	5.6	--	2.1	21.7	10.3	tr	3.4	32.0	24.1			68	90
12N00194	10-23	Ap2	S	13.3	4.9	--	0.9	19.1	12.5	0.2	6.5		23.4				82
12N00195	23-40	Bt1	S	15.1	6.1	--	0.9	22.1	11.5	0.3	4.6		25.1				88
12N00196	40-61	Bt2	S	18.1*	8.0	--	1.0	27.1	7.8				26.5				100
12N00197	61-88	Bt3	S	17.9*	7.8	--	0.9	26.6	5.3				24.8				100
12N00198	88-160	Bt4	S	18.1*	7.5	--	0.9	26.5	4.5				23.9				100
12N00199	160-186	2Btkb1	S	18.4*	6.9	--	0.8	26.1					22.9				100
12N00200	186-240	2Btkb2	S	19.6*	7.1	tr	0.8	27.5					24.0				100
12N00201	240-279	2Btkb3	S	21.9*	8.3	0.1	0.8	31.1					27.9				100
12N00202	279-301	3Btkb	S	22.0*	8.2	0.1	0.8	31.1					27.4				100
12N00203	301-330	4Btb	S	19.2*	7.3	0.1	0.7	27.3	1.7				24.1				100
12N00204	330-420	4Btkb1	S	53.2*	5.9	0.3	0.7	60.1					19.1				100
12N00205	420-500	4Btkb2	S	54.8*	5.2	0.4	0.7	61.1					18.6				100

*Extractable Ca may contain Ca from calcium carbonate or gypsum. CEC7 base saturation set to 100.

Salt

Layer	Depth (cm)	Horz	Prep	-1- Ca	-2- Mg	-3- Na	-4- K	-5- CO_3	-6- HCO_3	-7- F	-8- Cl	-9- PO_4	-10- Br	-11- OAC	-12- SO_4	-13- NO_2	-14- NO_3	-15- H_2O	-16- Total Salts	-17- Elec Cond	-18- Pred Elec Cond	-19- Exch Na	-20- SAR
				(- Water Extracted From Saturated Paste -)																			
				(- - - - - mmol(+) L^{-1} - - -)				(- mmol(-) L^{-1} - - - - - - - - - - - - -)										(- - - - % - - -)		(- - dS m^{-1} - -)		%	
				4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2		4F2	4F1a1a1		
12N00193	0-10	Ap1	S	2.8	1.3	--	0.8	--	0.5	--	2.3	--	tr	--	0.7	1.1	0.3	53.5		0.60	0.21	--	
12N00194	10-23	Ap2	S	1.6	0.6	--	0.1	--	0.3	--	1.1	--	--	--	0.6	tr	tr	49.7		0.25	0.08	--	
12N00195	23-40	Bt1	S	1.4	0.4	--	--	--	--	--	0.4	--	--	--	0.6	tr	tr	51.5		0.18	0.06	--	
12N00196	40-61	Bt2	S	1.4	0.4	--	--	--	1.1	--	0.3	--	--	--	0.5	tr	tr	54.9		0.18	0.05	--	
12N00197	61-88	Bt3	S	1.1	0.4	--	--	--	0.9	--	0.4	--	tr	--	0.3	0.1	tr	54.2		0.15	0.05	--	
12N00198	88-160	Bt4	S	1.2	0.3	--	--	--	0.7	--	0.3	--	--	--	0.3	0.1	tr	55.4		0.15	0.06	--	
12N00199	160-186	2Btkb1	S	1.5	0.4	--	--	--	1.2	0.2	0.4	--	--	--	0.4	0.1	tr	52.6		0.22	0.09	--	
12N00200	186-240	2Btkb2	S	1.5	0.3	--	--	--	1.3	0.1	0.2	--	--	--	0.2	0.1	tr	53.6		0.21	0.10	tr	
12N00201	240-279	2Btkb3	S	1.5	0.4	--	--	--	1.6	tr	0.2	--	tr	--	0.3	0.1	0.1	62.8		0.22	0.11	tr	
12N00202	279-301	3Btkb	S	1.8	0.5	--	tr	--	1.9	--	0.3	--	--	--	0.4	0.1	0.1	58.1		0.28	0.12	1	
12N00203	301-330	4Btb	S	1.6	0.4	--	--	--	1.4	--	0.2	--	tr	--	0.4	0.1	0.1	62.1		0.24	0.11	1	
12N00204	330-420	4Btkb1	S	1.8	0.4	0.2	--	--	1.9	--	0.2	--	--	--	0.4	0.1	0.1	66.0		0.30	0.18	1	
12N00205	420-500	4Btkb2	S	1.0	0.3	0.9	tr	--	2.0	--	0.1	--	--	--	0.4	0.1	0.1	74.5		0.29	0.20	2	

*** Primary Characterization Data ***

Pedon ID: S2011NE109006 (Lancaster County, Nebraska) Print Date: May 16 2012 3:48

Sampled As : Aksarben Fine, smectitic, mesic Typic Argiudoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0040

pH & Carbonates

Layer	Depth (cm)	Horz	Prep	-1- KCl	-2- $CaCl_2$ 0.01M 1:2 4C1a2a	-3- H_2O 1:1 4C1a2a	-4- Sat Paste 4F2	-5- Oxid	-6- NaF	-7- Carbonate As $CaCO_3$ <2mm (%) 4E1a1a1a1	-8- Carbonate As $CaCO_3$ <20mm (%) 4E1a1a1a1	-9- Gypsum As $CaSO_4*2H_2O$ <2mm (%) 4E2a1a1a1	-10- Gypsum As $CaSO_4*2H_2O$ <20mm (%) 4E2a1a1a1	-11- Resist ohms cm^{-1}
12N00193	0-10	Ap1	S		5.1	5.8	5.2			--		--		
12N00194	10-23	Ap2	S		4.8	5.5	5.0			tr		--		
12N00195	23-40	Bt1	S		4.7	5.5	5.0			tr		--		
12N00196	40-61	Bt2	S		5.4	6.1	5.6			tr		--		
12N00197	61-88	Bt3	S		6.0	6.7	6.0			tr		--		
12N00198	88-160	Bt4	S		6.5	7.4	6.5			tr		--		
12N00199	160-186	2Btkb1	S		6.9	7.7	7.1			tr		--		
12N00200	186-240	2Btkb2	S		7.0	7.7	7.2			tr		--		
12N00201	240-279	2Btkb3	S		7.1	7.8	7.4			tr		--		
12N00202	279-301	3Btkb	S		7.2	8.0	7.4			tr		--		
12N00203	301-330	4Btb	S		7.3	7.9	7.6			tr		--		
12N00204	330-420	4Btkb1	S		7.7	8.2	7.9			9		--		
12N00205	420-500	4Btkb2	S		7.7	8.1	8.0			8		--		

Phosphorous

Layer	Depth (cm)	Horz	Prep	-1- Melanic Index	-2- NZ %	-3- Acid Oxal 4G2a	-4- Anion Exch Resin Available	-5- Anion Exch Resin Capacity	-6- Bray 1 4D3	-7- Bray 2	-8- Olsen 4D5a1	-9- H_2O	-10- Citric Acid	-11- Mehlich III 4D6b	-12- KCl Extr NO_3
						(Phosphorous mg kg^{-1})									
12N00193	0-10	Ap1	S			171.1			17.3		8.7			27.4	
12N00194	10-23	Ap2	S			167.5			10.3		9.9			25.7	
12N00195	23-40	Bt1	S			168.2			12.8		9.1			22.4	
12N00196	40-61	Bt2	S			189.5			5.9		5.0			12.6	
12N00197	61-88	Bt3	S			270.2			7.8		6.4			16.3	
12N00198	88-160	Bt4	S			251.2			6.9		6.8			26.4	
12N00199	160-186	2Btkb1	S			216.5			19.4		15.5			54.7	
12N00200	186-240	2Btkb2	S			192.6			41.8		32.9			60.9	
12N00201	240-279	2Btkb3	S			104.6			21.5		15.2			27.4	
12N00202	279-301	3Btkb	S			128.1			11.1		9.7			17.7	
12N00203	301-330	4Btb	S			265.2			6.5		5.8			38.3	
12N00204	330-420	4Btkb1	S			234.1			--		2.2			5.5	
12N00205	420-500	4Btkb2	S			237.1			--		2.8			8.5	

Phosphorous

Layer	Depth (cm)	Horz	Prep	-1- Melanic Index	-2- NZ %	-3- Acid Oxal	-4- Anion Exch Resin Available	-5- Anion Exch Resin Capacity	-6- Bray 1	-7- Bray 2	-8- Olsen	-9- H_2O	-10- Citric Acid	-11- Mehlich III 4D6a1	-12- KCl Extr NO_3
						(Phosphorous mg kg^{-1})									
12N00193	0-10	Ap1	S											21.5	
12N00194	10-23	Ap2	S											18.0	
12N00195	23-40	Bt1	S											17.6	
12N00196	40-61	Bt2	S											9.0	
12N00197	61-88	Bt3	S											13.4	
12N00198	88-160	Bt4	S											19.4	
12N00199	160-186	2Btkb1	S											42.3	
12N00200	186-240	2Btkb2	S											55.2	
12N00201	240-279	2Btkb3	S											25.2	
12N00202	279-301	3Btkb	S											15.4	
12N00203	301-330	4Btb	S											18.7	
12N00204	330-420	4Btkb1	S											1.9	
12N00205	420-500	4Btkb2	S											4.1	

*** Primary Characterization Data ***

Pedon ID: S2011NE109006 (Lancaster County, Nebraska) Print Date: May 16 2012 3:48PM

Sampled As : Aksarben Fine, smectitic, mesic Typic Argiudoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0040

Trace Elements Tier 1

Layer	Depth (cm)	Horz	Prep	-1- Ag mg/kg 4H1a	-2- As mg/kg 4H1a	-3- Ba mg/kg 4H1a	-4- Be mg/kg 4H1a	-5- Cd mg/kg 4H1a	-6- Co mg/kg 4H1a	-7- Cr mg/kg 4H1a	-8- Cu mg/kg 4H1a	-9- Mn mg/kg 4H1a	-10- Mo mg/kg 4H1a	-11-	-12- Hg ug/kg 4H1a
12N00193	0-10	Ap1	HM	0.05	8.20	273.69	1.06	0.35	8.50	32.65	15.76	483.88	0.76		23
12N00194	10-23	Ap2	HM	0.06	7.62	262.74	1.07	0.37	8.25	31.38	14.75	480.20	0.71		20
12N00195	23-40	Bt1	HM	0.06	9.15	277.61	1.18	0.44	9.14	34.64	17.86	522.02	0.83		22
12N00196	40-61	Bt2	HM	0.06	9.22	344.43	1.28	0.34	9.16	36.43	19.50	514.34	0.78		26
12N00197	61-88	Bt3	HM	0.05	8.60	371.85	1.29	0.33	8.53	36.90	18.16	493.79	0.71		14
12N00198	88-160	Bt4	HM	0.04	7.76	355.98	1.11	0.30	7.95	31.95	15.77	499.28	0.63		12
12N00199	160-186	2Btkb1	HM	0.05	8.12	299.17	1.09	0.30	7.87	33.45	14.73	512.00	0.89		20
12N00200	186-240	2Btkb2	HM	0.05	9.20	295.86	1.17	0.22	8.44	34.76	15.20	551.74	0.90		11
12N00201	240-279	2Btkb3	HM	0.03	11.03	234.19	1.35	0.16	8.41	40.67	15.44	460.97	1.11		26
12N00202	279-301	3Btkb	HM	0.04	10.99	219.52	1.32	0.19	9.26	42.16	16.11	507.02	1.15		21
12N00203	301-330	4Btb	HM	0.03	11.03	191.80	1.16	0.23	8.26	40.47	15.79	335.75	1.21		24
12N00204	330-420	4Btkb1	HM	0.03	10.76	211.23	1.06	0.60	7.03	36.33	16.30	526.24	1.68		19
12N00205	420-500	4Btkb2	HM	0.03	7.67	189.15	1.09	0.49	7.91	37.07	15.52	347.27	1.35		17

Trace Elements Tier 2

Layer	Depth (cm)	Horz	Prep	-1- Ni mg/kg 4H1a	-2- P mg/kg 4H1a	-3- Pb mg/kg 4H1a	-4- Sb mg/kg 4H1a	-5- Se ug/kg 4H1a	-6- Sn mg/kg 4H1a	-7- Sr mg/kg 4H1a	-8- Tl mg/kg	-9- V mg/kg 4H1a	-10- W mg/kg 4H1a	-11- Zn mg/kg 4H1a
12N00193	0-10	Ap1	HM	22.12	344.56	16.75	0.49	368.42	1.14	44.96		68.65	0.01	60.52
12N00194	10-23	Ap2	HM	21.29	320.84	16.75	0.46	449.38	1.08	44.02		65.82	tr	59.18
12N00195	23-40	Bt1	HM	24.31	325.09	17.98	0.53	474.94	1.21	47.64		74.34	0.01	76.84
12N00196	40-61	Bt2	HM	26.60	397.75	15.76	0.48	201.80	1.29	60.99		77.58	0.01	69.97
12N00197	61-88	Bt3	HM	26.65	454.91	15.37	0.47	235.82	1.28	68.46		73.50	0.02	67.95
12N00198	88-160	Bt4	HM	22.95	456.21	14.34	0.40	132.09	1.15	68.91		63.89	0.01	71.16
12N00199	160-186	2Btkb1	HM	21.38	345.03	14.55	0.37	150.30	1.09	53.36		64.44	0.01	63.34
12N00200	186-240	2Btkb2	HM	22.66	285.64	15.14	0.40	149.31	1.08	44.97		69.85	0.01	61.96
12N00201	240-279	2Btkb3	HM	26.48	195.14	14.89	0.47	138.85	1.24	43.62		81.09	tr	66.34
12N00202	279-301	3Btkb	HM	31.78	230.94	15.57	0.51	135.75	1.16	46.97		87.29	0.01	64.22
12N00203	301-330	4Btb	HM	25.86	448.92	14.31	0.45	219.30	1.04	49.92		93.03	tr	62.71
12N00204	330-420	4Btkb1	HM	24.86	416.44	13.26	0.48	277.90	0.98	93.74		82.39	0.01	61.00
12N00205	420-500	4Btkb2	HM	23.53	464.51	13.03	0.47	187.64	0.95	92.42		82.85	0.01	70.42

Major Elements

Layer	Depth (cm)	Horz	Prep	-1- Al mg/kg 4H1b	-2- Ca mg/kg 4H1b	-3- Fe mg/kg 4H1b	-4- K mg/kg 4H1b	-5- Mg mg/kg 4H1b	-6- Mn mg/kg 4H1b	-7- Na mg/kg 4H1b	-8- P mg/kg 4H1b	-9- Si mg/kg 4H1b	-10- Sr mg/kg 4H1b	-11- Ti mg/kg 4H1b	-12- Zr mg/kg 4H1b
12N00193	0-10	Ap1	HM	53694	4859	22306	16910	5304	470	7132	357	285851	120	3287	141
12N00194	10-23	Ap2	HM	56109	5080	22883	17490	5295	504	7632	397	305189	129	3572	153
12N00195	23-40	Bt1	HM	60799	5438	26580	18049	6413	565	7568	392	306662	133	3644	167
12N00196	40-61	Bt2	HM	62387	6831	28006	17859	7494	551	7773	450	300027	154	3504	146
12N00197	61-88	Bt3	HM	63071	7746	26825	18433	7766	519	8576	525	307651	180	3539	138
12N00198	88-160	Bt4	HM	59293	8352	24530	17398	7337	526	8590	590	303052	185	3504	147
12N00199	160-186	2Btkb1	HM	57763	7122	24684	16546	6449	552	7896	378	319466	145	3815	157
12N00200	186-240	2Btkb2	HM	52800	5697	23046	13921	5330	536	6269	330	292873	104	3376	128
12N00201	240-279	2Btkb3	HM	61483	6659	28352	14304	6424	490	5832	193	312498	103	3522	140
12N00202	279-301	3Btkb	HM	61394	7331	28511	15036	6445	549	6588	256	315212	120	3274	130
12N00203	301-330	4Btb	HM	61157	7379	26937	15668	6368	342	6535	498	318747	132	3406	119
12N00204	330-420	4Btkb1	HM	52673	43833	23769	14613	5620	555	6027	509	295782	164	2946	112
12N00205	420-500	4Btkb2	HM	53972	32983	23362	15214	5718	343	6393	624	297805	168	3026	109

*** Primary Characterization Data ***

Pedon ID: S2011NE109006 (Lancaster County, Nebraska) Print Date: May 16 2012 3:48

Sampled As : Aksarben Fine, smectitic, mesic Typic Argiudoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0040

Mehlich3 Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-	-2
Layer	Depth (cm)	Horz.	Prep.	Al	As	Ba	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Se	Si	Sr	Zn
				(mg/kg)																				
				4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b		4D6b	4D6b	4D
12N00193	0-10	Ap1	S	1002.	2.4	64.0	2505.0	0.3	0.9	0.1	2.2	203.1	730.2	609.2	88.8	0.4	34.9	2.6	27.4	2.6		439.0	20.4	4.
12N00194	10-23	Ap2	S	1126.	1.7	99.4	2373.0	0.3	1.6	0.1	2.5	455.6	313.1	543.4	128.3	0.5	19.5	3.5	25.7	3.7		518.2	20.7	2.
12N00195	23-40	Bt1	S	1040.	1.3	106.4	2680.7	0.3	1.0	0.1	2.6	293.5	291.2	667.4	91.6	0.7	18.6	2.8	22.4	3.3		459.4	22.8	2.
12N00196	40-61	Bt2	S	1052.	4.6	146.8	3372.4	0.2	1.1	0.1	2.5	178.7	320.9	894.4	85.3	0.5	32.5	2.2	12.6	2.3		631.3	29.0	1.
12N00197	61-88	Bt3	S	843.0	2.3	131.1	3277.1	0.2	1.2	tr	2.5	142.0	288.3	878.6	91.4	0.4	37.7	2.2	16.3	2.0		672.5	27.9	1.
12N00198	88-160	Bt4	S	719.2	2.8	116.2	3365.3	0.2	1.8	0.2	2.8	179.1	275.3	870.7	140.5	0.7	56.2	3.2	26.4	2.7		835.9	25.8	1.
12N00199	160-186	2Btkb1	S	734.7	2.4	118.5	3503.0	0.2	1.9	0.1	2.7	127.5	212.3	807.4	171.0	0.7	91.9	3.3	54.7	2.3		804.2	21.9	1.
12N00200	186-240	2Btkb2	S	809.9	2.5	121.6	3607.6	0.2	1.7	0.1	2.6	101.3	210.5	815.6	152.7	0.6	96.7	3.4	60.9	2.0		738.7	20.1	1.
12N00201	240-279	2Btkb3	S	845.5	2.3	101.3	4131.4	0.1	1.0	0.1	2.2	82.3	245.9	922.7	78.8	0.3	111.5	2.2	27.4	1.5		774.1	20.3	1.
12N00202	279-301	3Btkb	S	676.0	3.4	93.1	4005.0	0.1	1.4	0.1	1.7	68.5	239.7	917.8	80.3	0.5	115.7	2.4	17.7	1.7		728.6	19.4	1.
12N00203	301-330	4Btb	S	448.3	1.9	68.7	3662.0	0.1	2.2	0.1	1.4	73.8	229.9	832.9	89.5	0.6	123.9	2.9	38.3	2.5		660.1	18.0	1.
12N00204	330-420	4Btkb1	S	32.5	4.3	39.1	12040.	0.3	0.8	0.1	1.5	49.3	230.6	660.6	83.9	0.8	138.3	1.8	5.5	1.5		355.8	26.3	2.
12N00205	420-500	4Btkb2	S	14.5	3.2	35.2	8950.0	0.3	1.3	0.1	1.5	61.6	237.5	605.7	68.2	0.6	175.6	1.2	8.5	1.7		436.1	26.5	2.

Clay Mineralogy (				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
						X-Ray					Thermal						Elemental					EGME	Int
													SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	Na_2O	Retn	pre
Layer	Depth (cm)	Horz	Fraction	7A1b1 peak size					7A4a				%							mg g^{-1}	tic
12N00193	0-10	Ap1	tcly	MT 3	MI 2	KK 2					KK 33										SMI
12N00194	10-23	Ap2	tcly	MT 3	MI 3	KK 2					KK 32										SMI
12N00195	23-40	Bt1	tcly	MT 4	MI 3	KK 2					KK 33										SMI
12N00196	40-61	Bt2	tcly	MT 5	MI 2	KK 2					KK 26										SMI
12N00197	61-88	Bt3	tcly	MT 5	MI 2	KK 2					KK 24										SMI
12N00198	88-160	Bt4	tcly	MT 5	MI 2	KK 2					KK 24										SMI
12N00199	160-186	2Btkb1	tcly	MT 3	KK 2	MI 2	VR 1				KK 32										SMI
12N00200	186-240	2Btkb2	tcly	MT 3	KK 2	VR 2	MI 1				KK 35										SMI
12N00201	240-279	2Btkb3	tcly	MT 4	KK 2	MI 1					KK 33										SMI
12N00202	279-301	3Btkb	tcly	MT 5	KK 2	MI 1					KK 31										SMI
12N00203	301-330	4Btb	tcly	MT 4	KK 2	VR 2	MI 1				KK 33										SMI
12N00204	330-420	4Btkb1	tcly	MT 4	KK 2	MI 2					KK 32										SMI
12N00205	420-500	4Btkb2	tcly	MT 3	KK 2	VR 2	MI 2				KK 32										SMI

FRACTION INTERPRETATION:

tcly - Total Clay,

MINERAL INTERPRETATION:

KK - Kaolinite MI - Mica MT - Montmorillonite VR - Vermiculite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

*** Primary Characterization Data ***

Pedon ID: S2011NE109006 (Lancaster County, Nebraska) Print Date: May 16 2012 3:48PM
Sampled As : Aksarben Fine, smectitic, mesic Typic Argiudoll
USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0040

Sand - Silt Mineralogy (2.0-0.002 mm) -1- -2- -3- -4- -5- -6- -7- -8- -9- -10- -11- -12- -13- -14- -15- -16- -17- -18-

				X-Ray					Thermal			Tot Re	Optical						EGME	Inter
													Grain Count						Retn	preta
	Depth		Fract										7B1a2							tion
Layer	(cm)	Horz	ion	(peak size)					(%)			(%)							$mg\ g^{-1}$	
12N00193	0-10	Ap1	csi									75	QZ 72	FK 21	PR 2	BT 1	FE 1	HN 1		SMIX
													MS 1	OP 1	PO 1	BY tr	GN tr			
12N00194	10-23	Ap2	csi									73	QZ 68	FK 21	PR 3	BT 2	CD 2	FE 2		SMIX
													GS 1	HN 1	MS 1	OP 1	BY tr	GC tr		
													GN tr	PO tr	ZR tr					
12N00195	23-40	Bt1	csi									74	QZ 70	FK 20	CD 2	OP 2	PR 2	BT 1		SMIX
													HN 1	MS 1	BY tr	FE tr	GN tr	GS tr		
													PO tr	RU tr	SS tr	ZR tr				
12N00196	40-61	Bt2	csi									72	QZ 67	FK 18	BT 4	MS 4	CD 3	FE 2		SMIX
													GS 1	HN 1	PR 1	BY tr	FP tr	GC tr		
													GN tr	OP tr	PO tr	ZR tr				
12N00197	61-88	Bt3	csi									72	QZ 68	FK 22	CD 3	PR 2	BT 1	FE 1		SMIX
													FP 1	GS 1	MS 1	BY tr	GC tr	HN tr		
													OP tr	PO tr	RU tr	SS tr	ZR tr			
12N00198	88-160	Bt4	csi									68	QZ 65	FK 22	BT 2	GC 2	MS 2	PR 2		SMIX
													CD 1	FE 1	FP 1	HN 1	PO 1	BY tr		
													GN tr	GS tr	OP tr	ZE tr	ZR tr			
12N00199	160-186	2Btkb1	csi									74	QZ 68	FK 18	CD 3	BT 2	BY 1	GC 1		SMIX
													GN 1	GS 1	MS 1	OP 1	PR 1	FE tr		
													FP tr	HN tr	PO tr	RU tr	ZE tr	ZR tr		
12N00200	186-240	2Btkb2	csi									70	QZ 66	FK 26	CD 3	PR 2	BT 1	FE 1		SMIX
													GS 1	HN 1	BY tr	GC tr	GN tr	MS tr		
													OP tr	PO tr	RU tr	ZR tr				
12N00201	240-279	2Btkb3	csi									69	QZ 64	FK 28	CD 3	PR 2	FE 1	MS 1		SMIX
													OP 1	BT tr	BY tr	GS tr	HN tr	PO tr		
													RU tr	ZR tr						
12N00202	279-301	3Btkb	csi									72	QZ 71	FK 23	CD 1	HN 1	MS 1	PR 1		SMIX
													BT tr	BY tr	CA tr	GN tr	OP tr	RU tr		
													ZR tr							
12N00203	301-330	4Btb	csi									70	QZ 66	FK 26	CD 3	BT 1	HN 1	PR 1		SMIX
													RU 1	BY tr	FE tr	GS tr	MS tr	OP tr		
													PO tr	ZR tr						
12N00204	330-420	4Btkb1	csi									67	QZ 63	FK 24	CA 5	BT 2	CD 2	OP 2		SMIX
													PR 2	MS 1	BY tr	FE tr	GS tr	HN tr		

Soil Map—Sarpy County, Nebraska
(Chalco Sites)

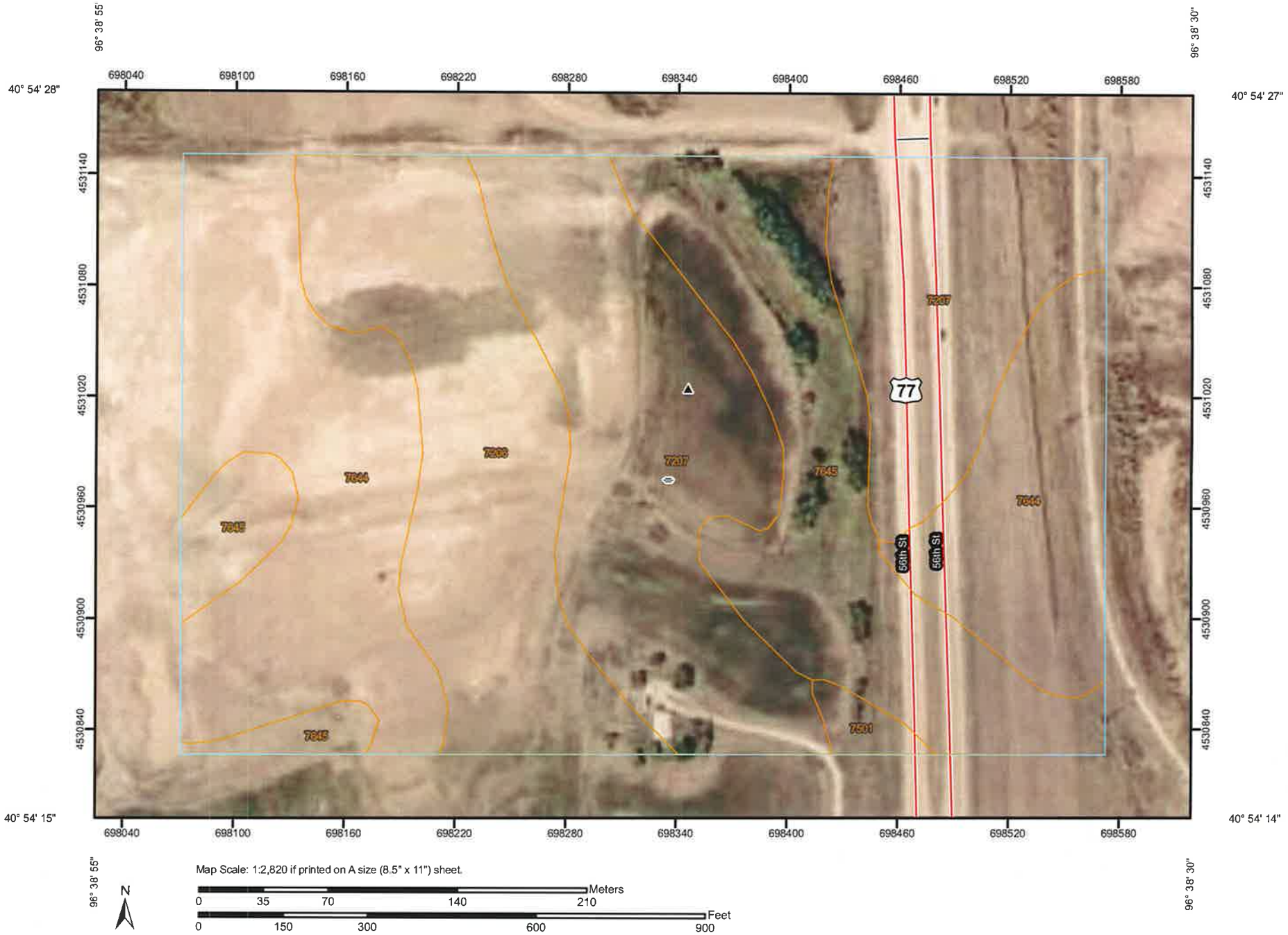
96° 9' 39"
96° 9' 9"
41° 9' 27"
41° 9' 26"
738270 738340 738410 738480 738550 738620 738690 738760 738830 738900
4560070 4560000 4559930 4559860 4559790 4559720
41° 9' 12"
41° 9' 11"
96° 9' 40"
96° 9' 9"

Map Scale: 1:3,390 if printed on A size (8.5" x 11") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900


96° 38' 55"
96° 38' 30"
40° 54' 28"
40° 54' 27"
698040
698100
698160
698220
698280
698340
698400
698460
698520
698580
4531140
4531080
4531020
4530960
4530900
4530840
7237
7844
7845
7845
7845
7845
7591
77
56th St
56th St
40° 54' 15"
40° 54' 14"
Map Scale: 1:2,820 if printed on A size (8.5" x 11") sheet.
N
Meters
0 35 70 140 210
Feet
0 150 300 600 900

Map Unit Legend

Lancaster County, Nebraska (NE109)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
7206	Aksarben silty clay loam, 2 to 6 percent slopes	7.4	18.3%
7207	Aksarben silty clay loam, 6 to 11 percent slopes	12.7	31.7%
7501	Pawnee clay loam, 4 to 8 percent slopes, eroded	0.4	0.9%
7644	Yutan silty clay loam, 6 to 11 percent slopes, eroded	11.4	28.4%
7645	Yutan silty clay loam, 11 to 17 percent slopes, eroded	8.3	20.6%
Totals for Area of Interest		**40.2**	**100.0%**

LOCATION AKSARBEN NE +KS
Established Series
SAS, LGR, PTC
06/2008

AKSARBEN SERIES

The Aksarben series consists of very deep, well drained soils formed in loess on uplands. Slope ranges from 0 to 11 percent. Mean annual air temperature is about 11 degrees C, and mean annual precipitation is about 74 centimeters.

TAXONOMIC CLASS: Fine, smectitic, mesic Typic Argiudolls

TYPICAL PEDON: Aksarben silty clay loam with a convex slope of 1 percent - cultivated. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 15 centimeters; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable; many very fine and fine roots throughout; many fine and medium tubular pores; moderately acid; abrupt smooth boundary.

A--15 to 30 centimeters; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; many very fine and fine roots throughout; many fine and medium tubular pores; moderately acid; clear smooth boundary. (Combined thickness of the A horizons is 15 to 51 centimeters)

Bt1--30 to 46 centimeters; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure parting to strong fine subangular blocky; hard, firm; common fine roots throughout; common fine tubular pores; many faint very dark grayish brown (10YR 3/2) continuous clay films (cutans) on vertical and horizontal faces of peds; slightly acid; clear smooth boundary.

Bt2--46 to 66 centimeters; brown (10YR 4/3) silty clay loam; brown (10YR 5/3) dry; few fine distinct dark yellowish brown (10YR 4/6) iron masses in the soil matrix; the iron accumulations are relict redox features; moderate coarse subangular blocky structure parting to strong fine and medium subangular blocky; hard, firm; few fine roots throughout; few fine tubular pores; many faint dark brown (10YR 3/3) continuous clay films (cutans) on vertical and horizontal faces of peds; few fine irregular soft masses of iron-manganese; slightly acid; gradual smooth boundary.

Bt3--66 to 86 centimeters; brown (10YR 4/3) silty clay loam, pale brown (10YR 6/3) dry; prominent strong brown (7.5YR 5/6) iron masses in the soil matrix; the iron accumulations are relict redox features; moderate coarse prismatic structure parting to strong medium subangular blocky; hard, firm; few very fine roots throughout; few very fine tubular pores; many faint dark brown (10YR 3/3) continuous clay films (cutans) on vertical and horizontal faces of peds; common fine irregular soft masses of iron-manganese; slightly acid; gradual smooth boundary.

Bt4--86 to 107 centimeters; brown (10YR 5/3) silty clay loam, pale brown (10YR 6/3) dry; prominent strong brown (7.5YR 5/6) iron masses in the soil matrix; the iron accumulations are relict redox features; strong coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots throughout; common very fine tubular pores; common distinct brown (10YR 4/3) discontinuous clay films (cutans) on vertical and horizontal faces of peds; common fine irregular soft masses of iron-manganese; slightly acid; gradual smooth boundary. (combined thickness of the Bt horizons is 46 to 122 centimeters)

BC--107 to 152 centimeters; brown (10YR 5/3) silty clay loam, very pale brown (10YR 7/3) dry; many coarse distinct yellowish brown (10YR 5/6) iron masses in the soil matrix; the iron accumulations are relict redox features; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; few very fine roots throughout; common fine tubular pores; common discontinuous pressure faces on vertical faces of peds; many fine and medium irregular soft masses of iron-manganese; slightly acid; gradual smooth boundary. (15 to 51 centimeters thick)

C--152 to 203 centimeters; grayish brown (2.5Y 5/2) silt loam, light gray (2.5Y 7/2) dry; many fine prominent strong brown (7.5YR 5/8) and common medium strong brown (7.5YR 5/6) iron masses in the soil matrix; the iron accumulations are relict redox features; massive; hard, friable; common fine tubular pores; discontinuous pressure faces on vertical faces of peds; many fine and medium irregular soft masses of iron-manganese; neutral.

TYPE LOCATION: Saunders County, Nebraska; about 9.7 kilometers south and 6.4 kilometers east of Wahoo; 247 meters north and 571 meters west of the southeast corner, Sec. 4, T. 13 N., R. 8 E. USGS Wahoo Southeast topographic quadrangle; lat. 41 degrees, 7 minutes, 12 seconds N. and long. 96 degrees, 31 minutes, 39 seconds W.,NAD 83.

RANGE IN CHARACTERISTICS:

Depth to argillic horizon: 15 to 51 centimeters
Depth to redox concentrations: 30 to 91 centimeters. The redox pattern is a relict feature and not considered indicative of present drainage conditions.
Thickness of the mollic epipedon: 25 to 61 centimeters (extends into the upper part of the Bt horizon) (>50 cm is Pachic would change classification)
Particle-size control section (weighted average):
Clay content: 35 to 42 percent

A horizon:
Hue: 10YR
Value: 2 or 3 (3 or 4 dry)
Chroma: 1 or 2 (moist and dry)
Texture: silty clay loam
Clay content: 27 to 35 percent
Reaction: slightly acid to strongly acid

Bt horizon:
Hue: 10YR/upper part; 10YR or 2.5Y/lower part
Value: 3 or 4 (4 or 5 dry)upper part, 4 to 6 (5 to 7 dry)lower part
Chroma: 2 or 3 upper part, 2 to 4 lower part (moist and dry for both)
Redox Concentrations: hue 7.5YR or 10YR; chroma 4 or 5; value 4 to 6
Texture: silty clay loam or silty clay
Clay content: 35 to 42 percent
Reaction: slightly acid to strongly acid

BC horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6 (5 to 7 dry)
Chroma: 2 to 4 (moist and dry)
Redox Concentrations: hue 7.5YR or 10YR; chroma 4 or 5; value 4 to 6
Texture: silty clay loam
Clay content: 27 to 35 percent
Reaction: slightly acid to moderately acid

C horizon:
Hue: 10YR or 2.5Y
Value: 4 to 6 (5 to 7 dry)
Chroma: 2 to 4 (moist and dry)
Redox Concentrations: hue 7.5YR or 10YR; chroma 4 or 5; value 4 to 6
Texture: silty clay loam or silt loam
Clay content: 24 to 35 percent
Reaction: neutral to slightly acid

COMPETING SERIES: These are the Mulholland, Polo, Sarcoxie, and Sharpsburg soils. Mulholland soils are substantially more moist in the soil moisture control section during the 120 days following the summer solstice.
Polo soils have 7.5YR and 5YR hue in the lower part of the B horizon.
Sarcoxie soils have till at depths of 50 to 144 centimeters
Sharpsburg soils are substantially more moist in the soil moisture control section during the 120 days following the summer solstice, and have redoximorphic features which are indicative of wetness within the series control section.

GEOGRAPHIC SETTING:
Parent material: loess that contains less than 5 percent sand
Landform: convex ridgetops, shoulders, backslopes and upland divides.
Slopes: 0 to 11 percent
Elevation: 305 to 457 meters
Mean annual temperature: 11 to 12 degrees C.
Mean annual precipitation: 71 to 81 centimeters
Frost-free period: 160 to 180 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Butler, Geary, Judson, Mayberry, Pawnee and Yutan soils.
Butler soils are somewhat poorly drained and form a drainage sequence with the Aksarben soils and commonly are in the swale parts of the landscape.
Judson soils are on footslopes and formed in local colluvium.
Mayberry soils are on adjoining lower parts of the landscape. They formed in till or in paleosols formed in till.
Pawnee soils are on adjoining lower parts of the landscape. They formed in till or in paleosols formed in till.
Yutan soils have mollic colors less than 10 inches thick, average less clay in the particle size control section and are on shoulders and backslopes.

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage: Well drained.
Surface runoff: Low to moderately high.
Saturated hydraulic conductivity: Moderately low

USE AND VEGETATION: Most areas are cultivated.
The main crops are corn, soybeans, small grains and grain sorghum.
Native vegetation is tall prairie grasses.

DISTRIBUTION AND EXTENT: Southeastern Nebraska and northeastern Kansas. LRR 5, MLRA 106. They are extensive.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: Salina, Kansas

SERIES ESTABLISHED: Brown County, Kansas, 1994.

REMARKS: Diagnostic horizons and features recognized in this pedon are:
Particle-size control section: 30 to 80 centimeters. (Bt1, Bt2, and Bt3 horizons)
Mollic epipedon: 0 to 46 centimeters. (Ap, A, and Bt1 horizons)
Argillic horizon: 30 to 107 centimeters. (Bt1, Bt2, Bt3, and Bt4 horizons)
Redoximorphic concentrations (relict): 46 to 203 centimeters. (Bt2, Bt3, Bt4, BC, and C horizons)
Moisture regime: Udic

These soils were previously mapped as Sharpsburg soils. The Sharpsburg soils are moderately well drained and have a perched water table at a depth of 1.2 to 1.8 meters.

CL 6/30/2008 Removed the term mottling from the OSD and replaced with redox or redoximorphic features. All SE units were removed.

National Cooperative Soil Survey
U.S.A.

IUSS Soil Classification Conference Field Tour (Thursday, June 14, 2012)

Buses to arrive at hotel at 7:00 am; begin loading buses at 7:15 am; buses depart hotel at 7:30 am

Ken Scheffe will coordinate overall tour logistics.

Route for the Thursday Tour

Start at Holiday Inn Downtown, Lincoln, NE (F)

B – Stop 2 - Hitchcock Nature Center, Honey Creek, IA arrive at 9:00 am (Sites 2a, 2b, and 2c)

C – Stop 3 - Closed Sarpy County Landfill, Bellevue, NE arrive at 1:30 pm (Sites 3a and 3b)

D – Stop 4- Chalco Hills Recreation Area, Omaha, NE arrive at 3:30 pm (Sites 4a and 4b)

E – Mahoney State Park, Platte River, NE arrive at 5:30 pm

F – Holiday Inn Downtown, Lincoln, NE arrive 8:30 pm (?)

Stop 2 - Hitchcock Nature Center

- Unload buses and walk to the Hitchcock Nature Center, Loess Hills Lodge. Congregate at the lodge at 9:00AM.
- Very brief orientation by Ken regarding tour activities at the nature center for that day (5 minutes)
- Welcome and overview by Chad Graeve, Natural Resource Specialist (10 minutes)
- Geomorphic orientation to the Loess Hills and Missouri River Valley by Doug Wysocki (10 minutes)
- Overview of the soils of the Loess Hills by Richard Lensch, retired NRCS soil scientist (10 minutes)

- Participants welcome to view the displays and center, go up to the overlook, take photos, etc.
- At 9:45AM, reconvene at the tables/displays where soil cores on display (2nd level)

Site 2a - Soils of the Missouri River Floodplain –Onawa Series soil cores (Pit boss – Shawn McVey)

- Overview of the soil cores by Shawn McVey (5 minutes)
- Participant Examination and photographs of soil cores (3) – 15 minutes
- Discussion of lab data and soil classification (Soil Taxonomy and WRB) - Joe Chiaretti– (10 minutes or more)

Site 2b – Soils of the Loess Hills, Monona Series, north exposure Mollisols (Pit boss- Dan Pulido)

- Overview of the site and series – Dan Pulido
- Photos of the profile – 10 minutes
- Pick and poke in the pit – 30 minutes
- Discussion of lab data and soil classification (Soil Taxonomy and WRB) - Joe Chiaretti– (5 minutes)

Site 2c –South exposure Inceptisols (Pit boss – Dan Pulido)

- Very brief discussion of exposure (description, no lab data) - Dan Pulido – (5 minutes)
- Discussion of mollic vs. non-mollic as function of aspect/exposure – Joe Chiaretti – (5 minutes)
- Return to Visitor's Center- 11:30AM

Lunch Break at Visitors Center) **- provided by University of Nebraska - Lincoln- 11:30AM - 12:30PM**

- Load buses and depart Hitchcock Nature Center 12:30PM
- Travel to closed Sarpy County landfill site with arrival at 1:00PM (26 miles, 0:34 travel time)

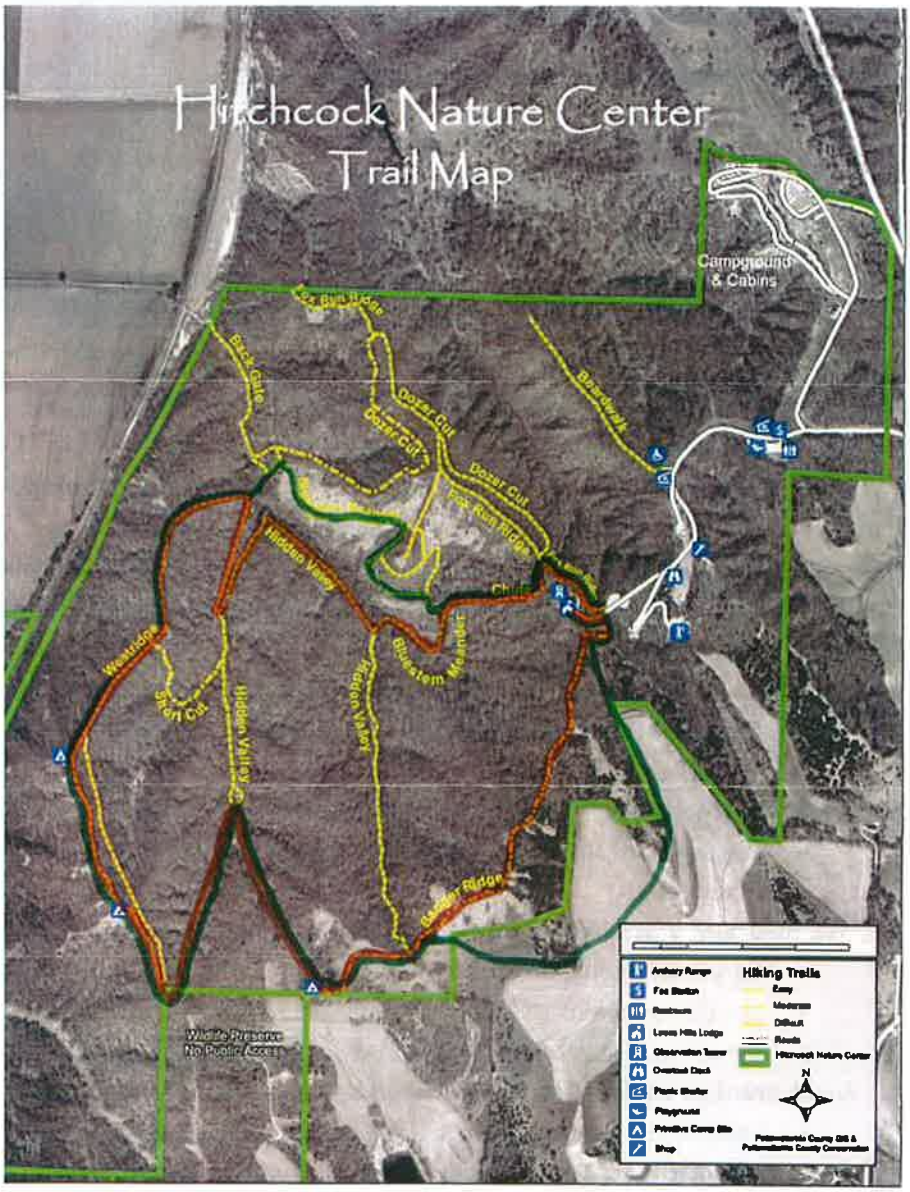
Hitchcock Nature Center

The Hitchcock Nature Center exists to develop and foster appreciation and understanding of the Loess Hills as a globally significant landform through land management, environmental education and low-impact recreation.

Acquired by Pottawattamie County in 1991, Hitchcock Nature Center (HNC) currently consists of 1274 acres located in the heart of the globally significant Loess Hills. The Loess Hills harbor some of the largest remaining prairie remnants in Iowa and provide refuge for plants and animals found nowhere else in the state. Hitchcock is open every day of the year for hiking, camping, picnicking, bird watching, snow sledding, star gazing, or simply enjoying nature.

Hitchcock Nature Center is also the headquarters of two county-wide conservation programs: **Environmental Education** and **Natural Areas Management**.

Hitchcock Nature Center
27792 Ski Hill Loop
Honey Creek, IA 51542
Phone: (712) 545-3283



Overview of the Loess Hills
By Richard Lensch
Soil Scientist (Retired)

Iowa Loess Hills

The loess hills of western Iowa are divided into two Major Land Resource areas-MLRA 107A and MLRA 107B. MLRA107A is located on the Northern Iowa drift plane and MLRA107B is located on the Southern Iowa drift plane.

The Northern Iowa drift plane, which occupies Northwestern Iowa, was covered by the Tazewell ice sheet approximately 40,000 BP. Little modification of the landscape occurred between the recession of the early Wisconsin ice sheet and the beginning of Wisconsin loess deposition about 31,000 years BP. It is characterized by broad loess covered flats with glacial till at depths of 1 and 8 meters.

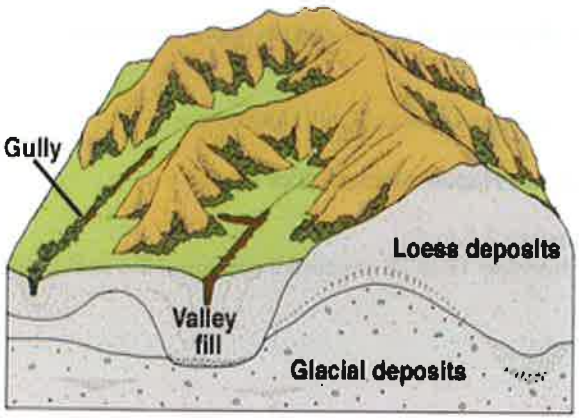
In stark contrast to the Northern Iowa drift plane, the Southern Iowa drift plane is a much more mature landscape that is heavily dissected by geologic erosion. Erosion began on the Southern Iowa drift plane in Pre-Illinoian time, and is characterized by hills with narrower interfluves and steeper side slopes than the Northern Iowa drift plane. Loess thickness ranges from more than 22 meters to 2 meters on the Southern Iowa drift plane.

Loess deposition started approximately 159,000 yeas BP on the Southern Iowa drift plane. The Loess Hills are comprised of three major layers. From oldest to youngest, the layers are known as the Loveland Loess, (120,000 to 159,000 years old), the Pisgah Loess (25,000 to 31,000 years old), and the Peoria Loess (12,500-25,000 years old). (1)

Thickness of the loess, in MLRA 107B, ranges in from more than 22 meters at the bluffs to about 5 meters at the eastern boundary. As the loess thickness thins with the distance from the source area, sand content and coarse silt to fine silt ratios decrease, and clay content increases, within the solum. Soil solums show increased weathering and maturity as the distance increases from the source area.

Erosion has exposed other geologic formations beneath the loess, such as glacial deposits of sand and gravel, glacial till, and paleosols. Limestone and shale bedrock can be observed in deep quarries along the western edge of the loess hills. A thin layer of volcanic ash can be seen in some road cuts. This ash layer is the result of eruption of a mega volcano near Yellowstone National Park in Wyoming more than 640,000 years ago.

In MLRA 107B, gullies are an integral part of the landscape. Loess is eroded from the side hills and deposits this sediment in drainage ways and on floodplains. Many gullies can be many miles long and pose a serious problem. Some gullies in the Monona-Ida association, near the loess bluffs can be more than 100 feet wide, and as deep as 80 feet. Bridges and roads can collapse as the gullies widen restricting travel.



(1) U.S. Department of the Interior; U.S. Geological Survey Information Handout, July 1999. This page is http://pubs.usgs.gov/info-handout/loess/. Maintained by Eastern Publications Web Team. Last revised 8-18-99

Principle loess soils of MLRA 107B

Hamburg silt loam

Loess Depth: 22 meters
Parent material: calcareous loess.
Landscape position: very steep convex shoulders or back slopes on uplands.
Percent slope: 2-90%
Classification: Coarse-silty, mixed, superactive, calcareous, mesic Typic Udorthents
Drainage class: Somewhat excessively drained
Associated soils: Castana silt loam (foot slope)
Sand content: 10 to 50 percent, mostly very fine sand.
Silt content: coarse silt to fine ratio is approximately 3 to 1.
Clay content: 6 to 15%

Hamburg silt loam lab data:

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - Total - - - -)			(- Clay - -)		(- - Silt - - -)		(- - - - - - - Sand - - - - - - -)					(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - Weight - - - - - -)				>2 mm
				<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt %
	Depth			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whole
Layer	(cm)	Horz	Prep	(- - - - - - - - - - - % of <2mm Mineral Soil - - - - - - - - - - - - - - -)												(- - % of <75mm - - - -)				soil
				3A1	3A1	3A1		3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3B1	3B1	3B1		
96P01769	0-18	Ap	S	14.1	74.4	11.5		0.7	15.6	58.8	10.8	0.4	0.2	0.1	tr	--	--	--	1	--
96P01770	18-33	AC	S	12.6	79.9	7.5		1.0	20.9	59.0	6.8	0.5	0.2	tr	tr	--	--	--	1	--
96P01771	33-56	C1	S	12.2	79.1	8.7		1.0	20.2	58.9	7.9	0.5	0.2	0.1	tr	--	--	--	1	--
96P01772	56-91	C2	S	13.4	79.7	6.9		1.0	23.4	56.3	6.2	0.4	0.2	0.1	tr	--	--	--	1	--
96P01773	91-123	C3	S	13.5	79.0	7.5		0.7	22.8	56.2	6.8	0.5	0.2	tr	tr	--	--	--	1	--
96P01774	123-151	C4	S	14.2	79.2	6.6		1.5	23.0	56.2	5.9	0.5	0.1	0.1	tr	--	--	--	1	--
96P01775	151-198	C5	S	14.1	78.0	7.9		1.0	22.2	55.8	7.1	0.6	0.2	tr	tr	--	--	--	1	--
96P01776	198-216	C6	S	13.7	78.6	7.7			19.9	58.7	6.9	0.6	0.2	tr	--	--	--	--	1	--

Ida silt loam

Loess Depth: 20 to 5 meters
Parent material: calcareous loess
Landscape position: side slopes and crests on dissected till plains and on risers on stream terraces.
Percent slope: 2-60%
Classification: Fine-silty, mixed, superactive, calcareous, mesic Typic Udorthents
Drainage class: Well drained
Associated soils: Castana silt loam (foot slope) and Napier silt loam (foot slope)
Sand content: less than 10 percent.
Silt content: coarse silt to fine ratio is approximately 2.5 to 1.
Clay content: 18 to 30 percent in A horizon, otherwise 18 to 25 percent throughout the rest of the solum.

Ida silt loam lab data:

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - Total - - - -)			(- Clay - -)		(- -- Silt - - -)		(- - - - - - - Sand - - - - - - - -)					(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - Weight - - - - - -)				>2 mm
				<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt %
	Depth			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whole
Layer	(cm)	Horz	Prep	(- - - - - - - - - - - - - - - - % of <2mm Mineral Soil - - - - - - - - - - - - - - - -)												(- - - % of <75mm - - -)				soil
				3A1	3A1	3A1		3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3B1	3B1	3B1		
96P01769	0-18	Ap	S	14.1	74.4	11.5		0.7	15.6	58.8	10.8	0.4	0.2	0.1	tr	--	--	--	1	--
96P01770	18-33	AC	S	12.6	79.9	7.5		1.0	20.9	59.0	6.8	0.5	0.2	tr	tr	--	--	--	1	--
96P01771	33-56	C1	S	12.2	79.1	8.7		1.0	20.2	58.9	7.9	0.5	0.2	0.1	tr	--	--	--	1	--
96P01772	56-91	C2	S	13.4	79.7	6.9		1.0	23.4	56.3	6.2	0.4	0.2	0.1	tr	--	--	--	1	--
96P01773	91-123	C3	S	13.5	79.0	7.5		0.7	22.8	56.2	6.8	0.5	0.2	tr	tr	--	--	--	1	--
96P01774	123-151	C4	S	14.2	79.2	6.6		1.5	23.0	56.2	5.9	0.5	0.1	0.1	tr	--	--	--	1	--
96P01775	151-198	C5	S	14.1	78.0	7.9		1.0	22.2	55.8	7.1	0.6	0.2	tr	tr	--	--	--	1	--
96P01776	198-216	C6	S	13.7	78.6	7.7			19.9	58.7	6.9	0.6	0.2	tr	--	--	--	--	1	--

Monona silt loam

Loess Depth: 20 to 15 meters
Parent material: leached loess
Landscape position: interfluves and side slopes on dissected till plains and risers and treads on loess covered stream terraces.
Percent slope: 0-40%
Classification: Fine-silty, mixed, superactive, mesic Typic Hapludolls
Drainage class: Well drained
Associated soils: Napier silt loam (foot slope)
Sand content: less than 5 percent
Silt content: coarse silt to fine ratio is approximately 1.75 to 1.
Clay content:

Monona silt loam Lab data:

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - Total - - - -)			(- -lay - - -)		(- -- Silt - - -)		(- - - - - - - Sand - - - - - - - -)					(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - Weight - - - - - -)				>2 mm
				<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt %
	Depth			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whole
Layer	(cm)	Horz	Prep	(- - - - - - - - - - - - - - - - % of <2mm Mineral Soil - - - - - - - - - - - - - - - -)												(- - - - of <75mm - - - -)				soil
				3A1	3A1	3A1			3A1	3A1	3A1	3A1	3A1	3A1	3A1	3B1	3B1	3B1		
40A11007	0-18	A1	S	23.9	73.1	3.0			26.3	46.8	2.6	0.2	tr	0.1	0.1	--	--	--	tr	--
40A11008	18-25	A2	S	23.5	73.9	2.6			26.6	47.3	2.6	tr	tr	tr	tr	--	--	--	tr	--
40A11009	25-41	B11	S	24.5	73.3	2.2			27.4	45.9	2.2	tr	tr	tr	tr	--	--	--	tr	--
40A11010	41-61	B12	S	23.9	73.8	2.3			28.5	45.3	2.3	tr	tr	tr	tr	--	--	--	tr	--
40A11011	61-107	B2	S	24.2	73.4	2.4			30.0	43.4	2.4	tr	tr	tr	tr	--	--	--	tr	--
40A11012	107-229	C1	S	20.6	76.2	3.2			28.2	48.0	3.1	0.1	tr	tr	tr	--	--	--	tr	--
40A11013	234-267	C2	S	15.5	80.0	4.5			29.3	50.7	4.2	0.3	tr	tr	tr	--	--	--		

Monona silty clay loam
Loess Depth: 15 to 5 meters
Parent material: leached loess
Landscape position: interfluves and side slopes on dissected till plains and risers and treads on loess covered stream terraces.
Percent slope: 0-40%
Classification: Fine-silty, mixed, superactive, mesic Typic Hapludolls
Drainage class: Well drained
Associated soils: Judson silty clay loam (foot slope)
Sand content: less than 5 percent
Silt content: coarse silt to fine ratio is approximately 1.5 to 1.75 to 1 in the B horizon
Clay content: 27 to 30 percent in the upper B horizon

Monona silty clay loam Lab data:

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - Total - - - -)			(- Clay - -)		(- - Silt - - - -)		(- - - - - - - - Sand - - - - - - - -)						(Rock Fragments (mm))			
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - Weight - - - - - -)				>2 mm
				<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt %
	Depth			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whole
Layer	(cm)	Horz	Prep	(- - - - - - - - - - - - - - - % of <2mm Mineral Soil - - - - - - - - - - - - - - - - -)												(- - - % of <75mm - - -)				soil
				3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3B1	3B1	3B1			
96P01792	0-15	Ap1	S	28.7	67.6	3.7	16.6		26.4	41.2	3.0	0.3	0.2	0.2	tr	tr	--	--	1	--
96P01793	15-28	Ap2	S	30.0	67.0	3.0	18.4		27.0	40.0	2.8	0.1	0.1	tr	tr	--	--	--	tr	--
96P01794	28-41	AB	S	32.0	65.3	2.7	18.8		27.7	37.6	2.6	0.1	tr	tr	--	--	--	--	tr	--
96P01795	41-61	Bw1	S	29.8	66.4	3.8	16.2		26.6	39.8	3.5	0.2	0.1	tr	tr	--	--	--	tr	--
96P01796	61-76	Bw2	S	27.0	69.4	3.6	13.7		25.8	43.6	3.5	0.1	tr	tr	tr	--	--	--	tr	--
96P01797	76-104	Bw3	S	25.2	71.1	3.7	10.8		28.0	43.1	3.4	0.2	0.1	tr	--	--	--	--	tr	--
96P01798	104-124	BC	S	20.3	73.2	6.5	7.9		22.5	50.7	6.2	0.2	0.1	tr	--	--	--	--	tr	--
96P01799	124-148	C1	S	19.0	72.6	8.4	6.2		21.1	51.5	7.8	0.4	0.1	0.1	--	--	--	--	1	--
96P01800	148-183	C2	S	17.4	76.3	6.3	4.7	0.7	26.2	50.1	5.9	0.3	tr	0.1	--	--	--	--	tr	--
96P01801	183-198	C3	S	17.3	75.0	7.7	4.3	0.7	24.5	50.5	7.2	0.4	0.1	tr	tr	--	tr	--	1	--
96P01802	198-206	C4	S	18.1	74.1	7.8	4.9	1.0	24.5	49.6	7.1	0.4	0.2	0.1	--	--	--			

Marshall silty clay loam
Loess Depth: 5 meters on the summits
Parent material: leached loess
Landscape position: interfluves and side slopes on uplands and on risers and treads on stream terraces.
Percent slope: 0-25%
Classification: Fine-silty, mixed, superactive, mesic Typic Hapludolls
Drainage class: Well drained
Associated soils: Exira silty clay loam (sideslopes) Judson silty clay loam (foot slope)
Sand content: less than 10 percent
Silt content: coarse silt to fine ratio is approximately 1.2 to 1.4 to 1 in the B horizon.
Clay content: 27 to 35 percent in the B horizon

Marshall silty clay loam lab data:

PSDA & Rock Fragments				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - Total - - -)(- -Clay - -)(- - Silt - - -) (- - - - - Sand - - - - - -)												(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - Weight - - - - -)				>2 mm
				<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt %
	Depth			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whole
Layer	(cm)	Horz	Prep	(- - - - - - - - - - - - - - - - - % of <2mm Mineral Soil - - - - - - - - - - - - - - - -) (- - - % of <75mm - - -)																soil
				3A1	3A1	3A1			3A1	3A1	3A1	3A1	3A1	3A1	3A1	3B1	3B1	3B1		
87P01854	0-15	Ap	S	31.0	65.6	3.4			26.5	39.1	3.2	0.2	--	--	--	--	--	--	tr	--
87P01855	15-25	A1	S	33.9	62.9	3.2			25.9	37.0	2.7	0.3	0.2	--	--	--	--	--	1	--
87P01856	25-41	A2	S	34.7	63.1	2.2			27.0	36.1	2.1	0.1	--	--	--	--	--	--	tr	--
87P01857	41-53	A3	S	34.8	62.6	2.6			17.7	44.9	2.2	0.2	0.2	--	--	--	--	--	tr	--
87P01858	53-66	Bw1	S	30.8	66.1	3.1			29.8	36.3	2.8	0.2	0.1	--	--	--	--	--	tr	--
87P01859	66-86	Bw2	S	33.0	58.5	8.5			19.5	39.0	7.6	0.6	0.2	0.1	--	--	--	--	1	--
87P01860	86-114	Bw3	S	24.4	72.4	3.2			30.0	42.4	3.1	0.1	--	--	--	--	--	--	tr	--

Soil and Landscape Development of the Soils of the Missouri River Floodplain

The Missouri River Valley in Eastern Nebraska and Western Iowa consists of three distinct geomorphic regions; the three are not always present at specific locations. The geomorphic regions are: the channel belt which consists of bar and channel topography and braided stream remnants, the meander belt which is a floodplain step that consists of meander scrolls and splays and abandon oxbows, and the flood basin which consists of a natural levee and backswamp area which has upland steam channels snaking across it (fig. 1).

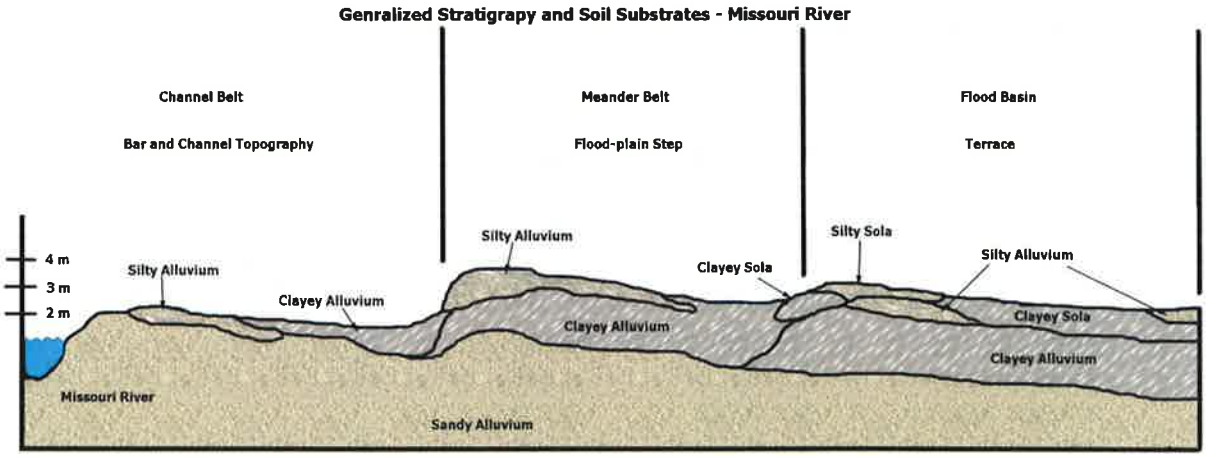


Figure 1.—Overview of the relationship between parent materials and position on the Missouri River flood plain.

The *channel belt* is the area adjacent to the Missouri River (fig. 2). It is nearly continuous from north to south. It includes the area thought to have been occupied by the Missouri River within about the last 100 years. This area was frequently flooded with 2 to 3 meters of water before the construction of dams on the Missouri River.

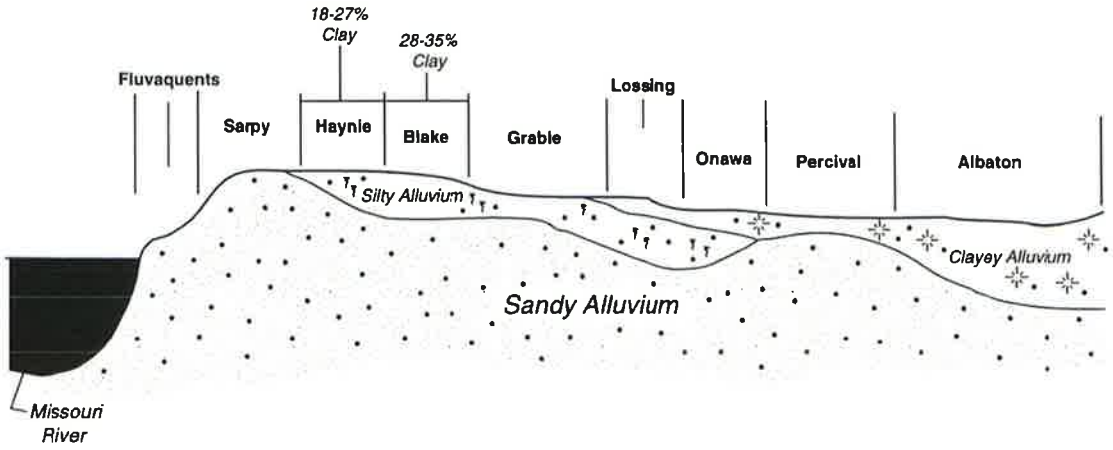


Figure 2.—The relationship of the major soils to parent material and position in the bar area of the Missouri River flood plain

The Army Corps of Engineers built dams upstream on the Missouri River in South Dakota and North Dakota to control downstream flooding. These dams were completed in 1955. Since that time the only remaining frequently flooded areas are chutes, low swales, and other low areas adjacent to the Missouri River. Because of the dams, the flooding frequency of the soils in the bar area is now rated as *occasional.*

There are no farmsteads in the bar area, but a few vacation cabins have been built in recent years. Some of the soils in this area are the occasionally flooded phases of Albaton and Percival soils. Taxonomically the soils in this area consist of Entisols that range in particle-size class from mixed to fine and from excessively well drained to poorly drained.

Sarpy	Mixed, mesic typic Udipsamments
Kenmoor	Sandy over clayey, mixed, superactive, calcareous, mesic, Oxyaqic Usdipsamments
Morconick	Sandy, mixed, mesic Mollic Udifluvents
Wathena	Sandy, mixed, mesic Mollic Udifluvents
Carr	Coarse-loamy, mixed, superactive, calcareous, mesic Typic Udifluvient
Waubounsie	Coarse-loamy over clayey, mixed, superactive, mesic Fluventic Hapludolls
Haynie,	Coarse-silty, mixed, superactive, calcareous, mesic Mollic Udifluvents
Grable	Coarse-silty over sandy or sandy-skeletal, mixed, superactive, calcareous, mesic Mollic Udifluvents
Modale	Coarse-silty over clayey, mixed, superactive, calcareous, mesic Aquic Udifluvents
Rodney	Fine-silty over clayey, mixed, superactive, calcareous, mesic Mollic Fluvaquents
Blake	Fine-silty, mixed, superactive, calcareous, mesic Aquic Udifluvents
Lossing	Fine-silty, mixed, superactive, calcareous, mesic Aquic Udifluvents
Scroll	Fine-silty over sandy or sandy-skeletal, mixed, active, calcareous, mesic Aquic Udifluvents
Vore	Fine-silty over sandy or sandy-skeletal, mixed, superactive, calcareous, mesic Aquic Udifluvents
Onawa	Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvents
Percival	Clayey over sandy or sandy-skeletal, smectitic over mixed, calcareous, mesic Aquic Udifluvents
Albaton	Fine, smectitic, calcareous, mesic Vertic Fluvaquents

The *meander belt* is the area between the *channel belt* and the *flood basin* (fig. 3). The Missouri River occupied channels in this area during the past 100 to 300 years. As the river meandered, meander loops and channels were abandoned. Some of the loops and channels were partly filled by deposition during later flooding. Most of the area in the meander belt was covered with floodwater during the flood of 1952. Some areas of Haynie, Blake, and Modale soils were not flooded because they are at the higher elevations. Because of the dams on the Missouri River, the flooding frequency of the some soils on the young bottom land is now rated *rare*.

Many of the same soils are mapped both in the bar area and on the young bottom land. These soils are identified on the soil maps with different map unit symbols because of the difference in flooding frequency. Also, the soils on the young bottom land tend to be somewhat less stratified than the corresponding soils in the channel belt (fig 4).

Taxonomically the soils in this area consist of Entisols and a few Fluventic Mollisolls ranging from coarse-silty to fine particle-size class and well drained to poorly drained.

Haynie,	Coarse-silty, mixed, superactive, calcareous, mesic Mollic Udifluvents
Waubounsie	Coarse-loamy over clayey, mixed, superactive, mesic Fluventic Hapludolls
Grable	Coarse-silty over sandy or sandy-skeletal, mixed, superactive, calcareous, mesic Mollic Udifluvents
Modale	Coarse-silty over clayey, mixed, superactive, calcareous, mesic Aquic Udifluvents
Rodney	Fine-silty over clayey, mixed, superactive, calcareous, mesic Mollic Fluvaquents
Blake	Fine-silty, mixed, superactive, calcareous, mesic Aquic Udifluvents
Lossing	Fine-silty, mixed, superactive, calcareous, mesic Aquic Udifluvents
Vore	Fine-silty over sandy or sandy-skeletal, mixed, superactive, calcareous, mesic Aquic Udifluvents

Onawa	Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvents
Percival	Clayey over sandy or sandy-skeletal, smectitic over mixed, calcareous, mesic Aquic Udifluvents
Owego	Fine, smectitic, nonacid, mesic Vertic Endoaquepts
Forney	Fine, smectitic, nonacid, mesic Vertic Fluvaquents
Albaton	Fine, smectitic, calcareous, mesic Vertic Fluvaquents

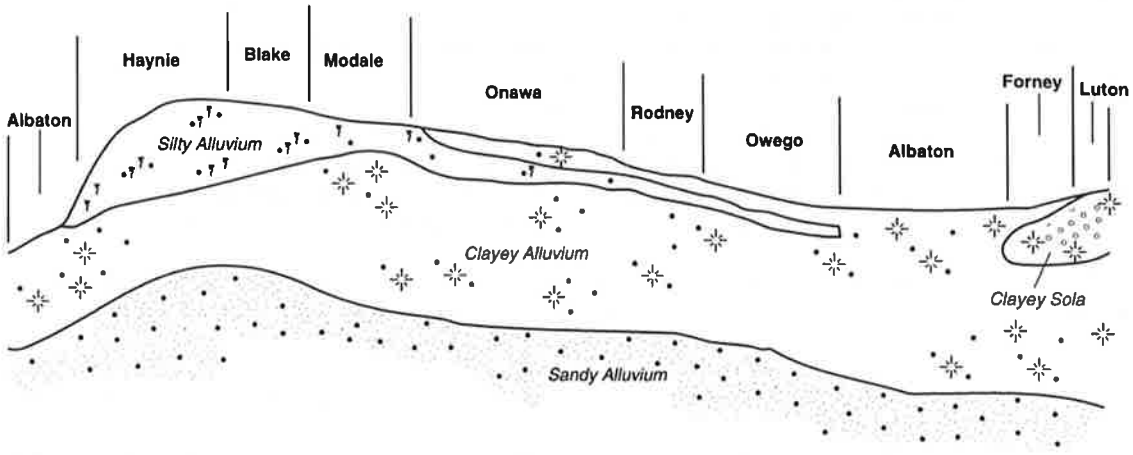


Figure 3.—Major soil to parent material and position relationships on the meander belt of the Missouri River flood plain.

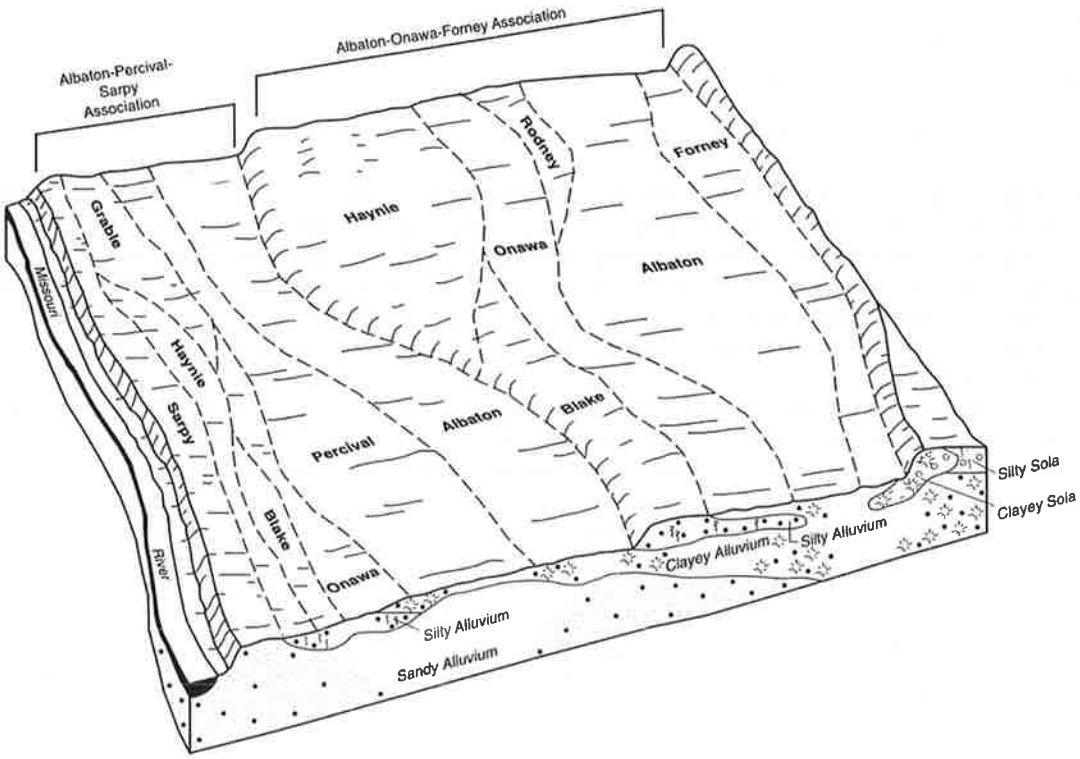


Figure 4.—Typical pattern of soils and parent material in the Albaton-Percival-Sarpy and Albaton-Onawa-Forney associations on the channel belt and meander belt areas of the Missouri River floodplain.

The flood basin consists of a natural levee and backswamp area and is the area between the meander

belt and the loess hills in the uplands (fig. 5). Near the loess hills low gradient fluvial fan onlap the flood basin. The flood basin is a low relief that lacks distinct meander scars and obows. The backswamp of the flood basin may be lower than the adjacent meander belt. Low areas of the flood basin often display flood distributary patterns. Because it does not have meander scars and oxbows left behind from the meandering Missouri River, the flood basin has fewer surface features than the channel belt or the meander belt. Most of the flood basin is at a lower elevation than the meander belt, but the flood basin has been flooded less frequently than the meander belt. At the conjunction of the meander belt and the flood basin, the meander belt is cut deeper into the Missouri River Valley and leaves behind an area that acts as a natural levee that is higher in elevation than the remaining bottom-land areas of the Missouri River valley.

The rarely flooded Keg and Salix soils are typical of the soils on this natural levee (fig 6). Because floodwaters have not crested this natural levee for hundreds or even thousands of years, the soils are more developed than those on the channel belt or meander belt areas of the floodplain. Flooding in the flood basin is mainly caused by flooding tributary rivers and streams. These have all been diked or channelized in order to reduce this occurrence.

Taxonomically the soils in this area consist of Mollisolls which range from well drained to poorly drained.

Keg	Fine-silty, mixed, superactive, mesic Typic Hapludolls
Salix	Fine-silty, mixed, superactive, mesic Typic Hapludolls
Lakeport	Fine, smectitic, mesic Aquertic Hapludolls
Cooper	Fine-silty over clayey, mixed, superactive, mesic Fluvaquentic Hapludolls
Blencoe	Clayey over loamy, smectitic over mixed, superactive, mesic Aquertic Hapludolls
Woodbury	Fine, smectitic, mesic Vertic Endoaquolls
Luton	Fine, smectitic, mesic Typic Endoaquerts
Tieville	Fine, smectitic, calcareous, mesic Vertic Endoaquolls
Moville	Coarse-silty over clayey, mixed, superactive, calcareous, mesic Aquic Udifluvents

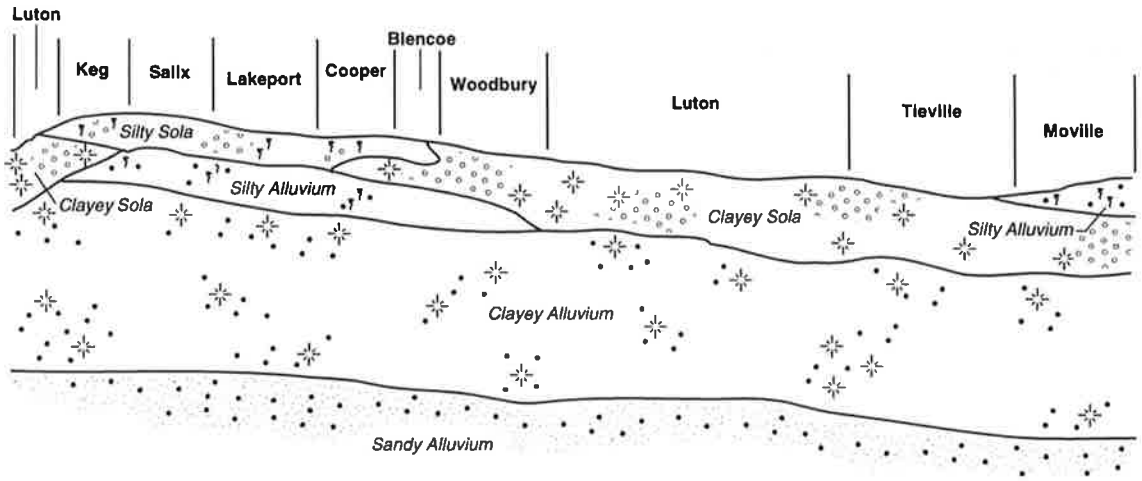


Figure 5.—Major soil to parent material and position relationships of the Flood Basin of the Missouri River flood plain.

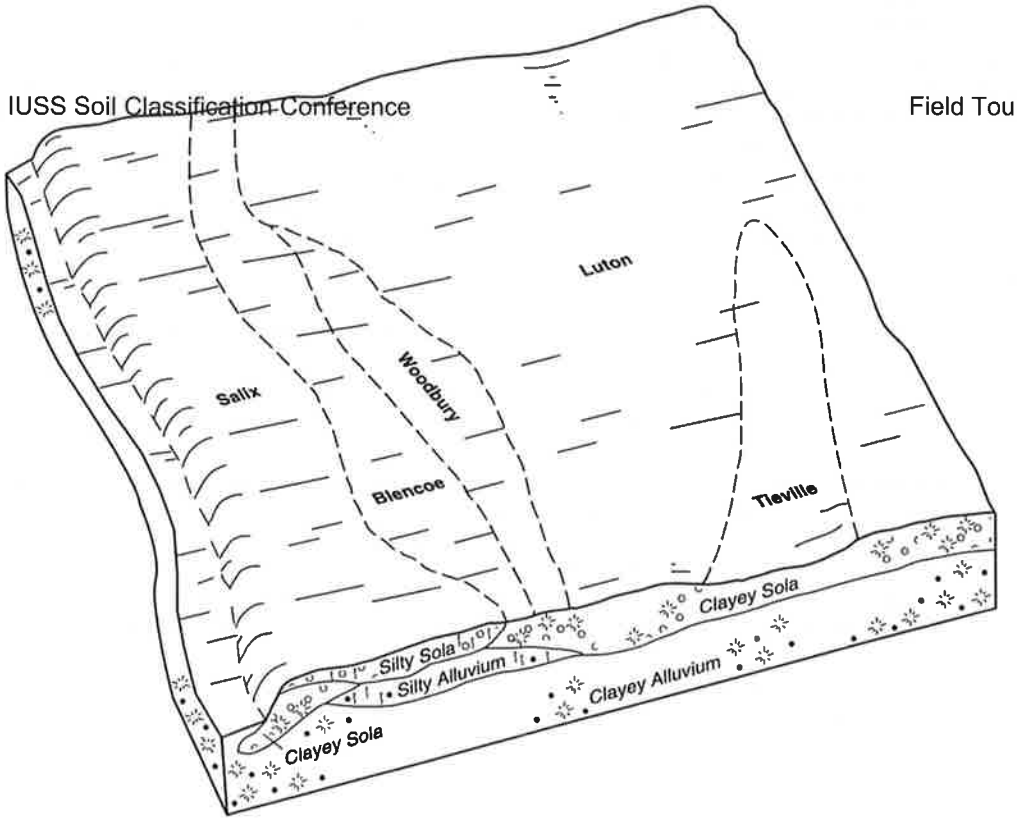


Figure 6.—Typical pattern of soils and parent material in the Luton-Salix association in the flood basin area of the Missouri River floodplain.

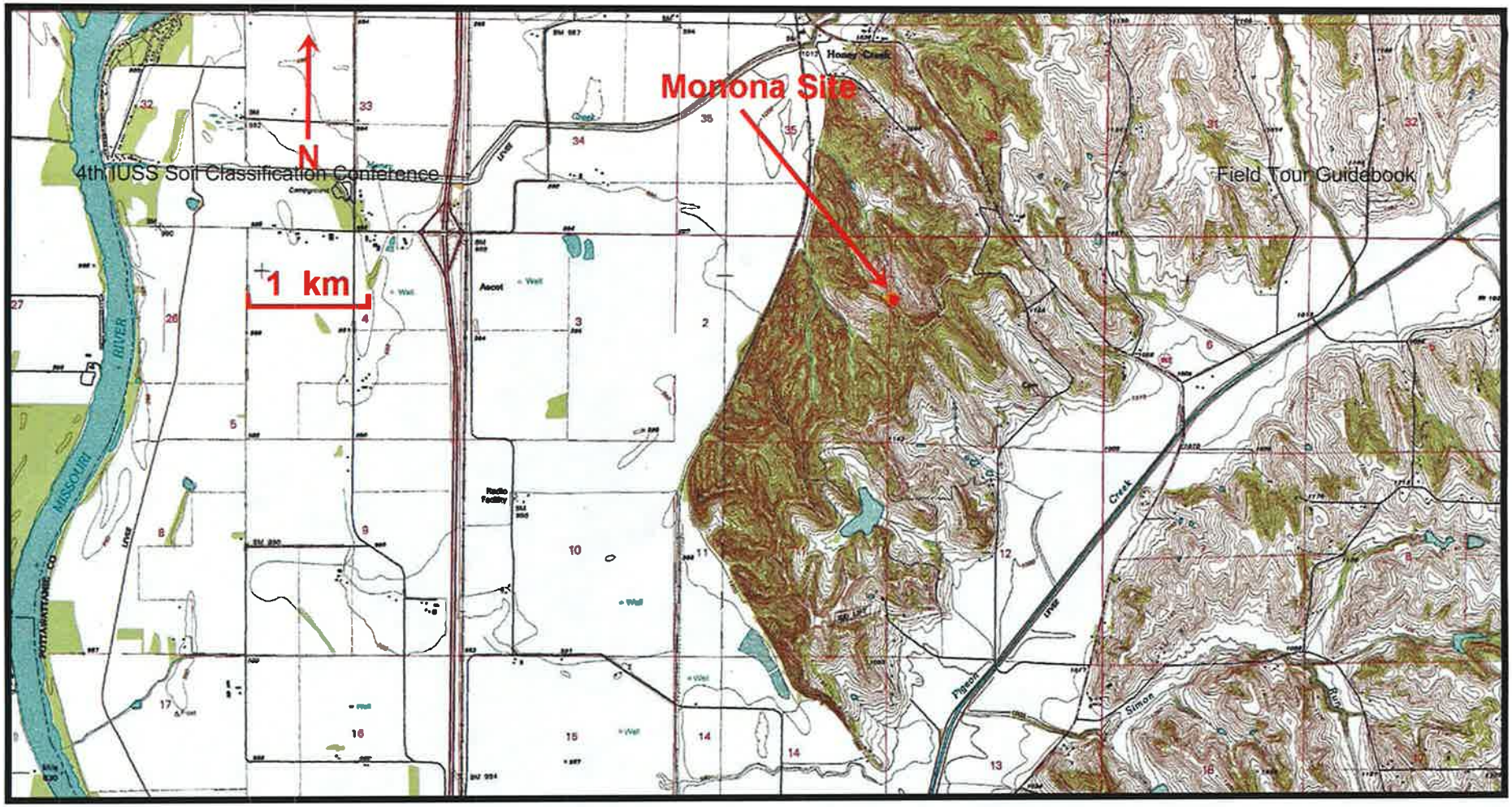


Figure WS7 Topographic Map Loess Hills Site.

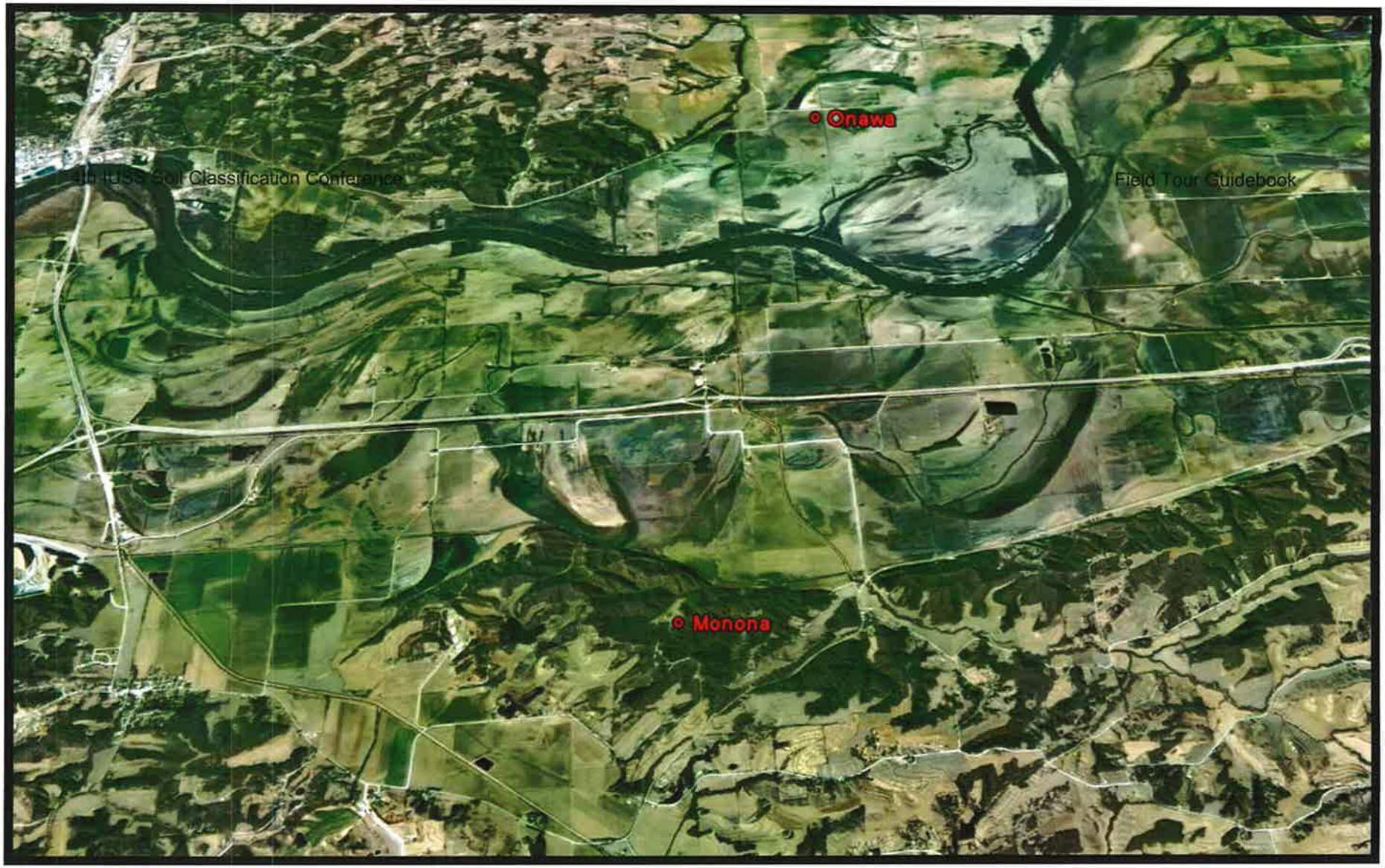


Figure WSS Loess Hills Site Aerial View.

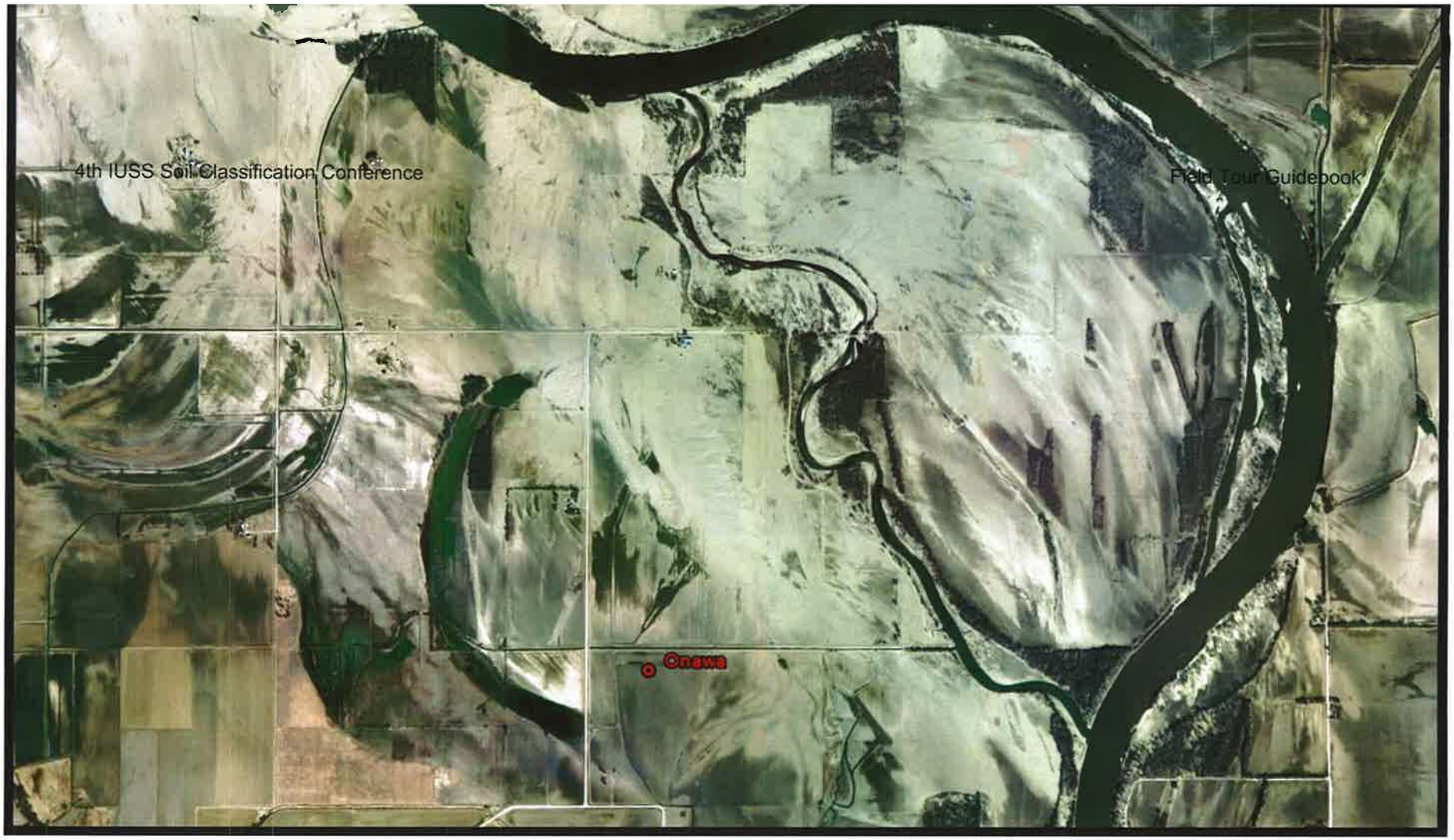


Figure WS9 Aerial View Onawa Sample Site Missouri River Valley.

Site 2a – Onawa Series

One of the soils we will observe at the Hitchcock Nature Center is the Onawa series taken from the Missouri River flood plain. We collected the soil profiles and transported them to this location to save time during the tour and avoid possible flooding. Onawa soils are very deep, somewhat poorly drained soils on flood plains. These soils formed in clayey alluvium over loamy alluvium. The loamy materials in the lower part of the profile represent the source materials for the loess hills formation at the Hitchcock Nature Center.

Flooding on the Missouri River in in 2011 lasted from May through August along much of its reach closing roads, major highways, railways disrupting transportation around the region. At right, an aerial photo of the Interstate 29 and Interstate 680 intersection shows the extent of the flooding across the valley.

When the floodwaters receded, I-29 and I-680 interchange was not structurally damaged and was reopened, but thick silty deposits covered the road and right of ways the kill zone due to inundation is evident on the overpass embankment (center).

Upon drying, the silty sediments were again susceptible to the wind erosion and are carried eastward into the Hitchcock Recreation Area (below). The flooding, sedimentation, erosion, and deposition cycles that created the Loess Hills of western Iowa clearly continues today.

PEDON DESCRIPTION

Print Date: 03/12/2012

Description Date: 11/10/1994

4th 1998 Soil Classification Conference Field Tour Guidebook

Describer: Stephen L. Hartung, Francis Belohlavy, Mark Kuzila, Neal Stolpe

Site ID: 94NE177015

Site Note:

Pedon ID: 94NE177015

Pedon Note: The Ap horizon (0-6 inch) has scattered fragments of snail shells. The Cg1 (6-10 inch) has few snail shells. The texture of the Ap through Cg3 may be silty clay rather than clay. The Cg1, Cg2, and Cg3 all appear to have some form of stratification but the strata seem to have been mostly obscured by the shrink-swell of the clays.

Lab Source ID: SSL

Lab Pedon #: 95P0326

Soil Name as Described/Sampled: Onawa

Soil Name as Correlated:

Classification: Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvents

Pedon Type: within range of series

Pedon Purpose: full pedon description

Taxon Kind: series

Associated Soils: Albaton, Luton

Physiographic Division:

Physiographic Province:

Physiographic Section:

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: river valley flood plain

Upslope Shape: linear

Cross Slope Shape: linear

Particle Size Control Section: 25 to 100 cm.

Description origin: Converted from PDP 3.x

Diagnostic Features: ochric epipedon 0 to 15 cm
free carbonates 15 to 203 cm
lithologic discontinuity at 69 cm.

Country: USA

State: Nebraska

County: Washington

MLRA: 107 -- Iowa and Missouri Deep Loess Hills

Soil Survey Area: NE177 -- Washington County, Nebraska

Map Unit: 7880 – Onawa silty clay, occasionally flooded

Quad Name: Loveland, Iowa

Legal Description: 900 feet east and 300 feet south of the northwest corner of Section 21, Township 17N , Range 13E

Latitude: 41 degrees 26 minutes 8.00 seconds north

Longitude: 95 degrees 57 minutes 37.00 seconds west

Datum:

UTM Zone:

UTM Easting:

UTM Northing:

Primary Earth Cover: Crop cover

Secondary Earth Cover:

Existing Vegetation:

Parent Material:

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments:

Description database: NSSL

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
0.0	302.0							somewhat poorly		

Profile Description:

Ap--0 to 15 centimeters; very dark grayish brown (2.5Y 3/2) crushed clay, grayish brown (2.5Y 5/2), dry; massive; very firm, very hard; many very fine and fine roots throughout; many very fine and fine moderate-continuity tubular pores; 3 percent medium irregular 10YR 2/1 iron-manganese masses throughout; few medium faint olive brown (2.5Y 4/3) irregular shaped soft iron depletions with diffuse boundaries in matrix; abrupt wavy boundary. Lab sample # 95P02554

Cg1--15 to 25 centimeters; dark gray (2.5Y 4/1) crushed stratified clay, grayish brown (2.5Y 5/2), dry; massive; very firm, very hard; many very fine and fine roots throughout; many very fine and fine low-continuity tubular pores; 3 percent coarse irregular 10YR 2/1 iron-manganese masses throughout; 1 percent fine and medium spherical 10YR 7/2 carbonate nodules throughout; very slight effervescence, by HCl, unspecified; many fine and medium faint olive brown (2.5Y 4/3) irregular shaped soft iron depletions with diffuse boundaries in matrix; clear wavy boundary. Lab sample # 95P02555

Cg2--25 to 48 centimeters; dark gray (2.5Y 4/1) crushed stratified clay, grayish brown (2.5Y 5/2), dry; moderate very fine angular blocky structure; very firm, very hard; many very fine and fine roots throughout; many very fine and fine low-continuity tubular pores; 75 percent faint pressure faces on all faces of peds; slight effervescence, by HCl, unspecified; many coarse prominent dark yellowish brown (10YR 4/6) irregular shaped soft masses of iron accumulation with diffuse boundaries in matrix and few fine prominent yellowish red (5YR 4/6) irregular shaped soft masses of iron accumulation with sharp boundaries in matrix; clear wavy boundary. Lab sample # 95P02556

Cg3--48 to 69 centimeters; gray (2.5Y 5/1) crushed stratified clay, gray (2.5Y 6/1), dry; moderate coarse angular blocky structure; very firm, very hard; common fine roots throughout; many fine moderate-continuity tubular pores; 75 percent faint pressure faces on all faces of peds; strong effervescence, by HCl, unspecified; many medium and coarse prominent dark yellowish brown (10YR 4/6) irregular shaped soft masses of iron accumulation with diffuse boundaries in matrix and common fine prominent brown (7.5YR 4/4) cylindrical soft masses of iron accumulation with clear boundaries lining pores; abrupt wavy boundary. Lab sample # 95P02557

2Cg4--69 to 107 centimeters; gray (2.5Y 6/1) crushed stratified very fine sandy loam, light gray (2.5Y 7/2), dry; massive; very friable, soft; common fine roots throughout; many fine high-continuity tubular and few coarse high-continuity tubular pores; 3 percent fine and medium irregular 10YR 2/2 iron-manganese masses throughout; strong effervescence, by HCl, unspecified; very many coarse prominent dark yellowish brown (10YR 4/6) irregular shaped soft masses of iron accumulation with diffuse boundaries in matrix and common fine and medium prominent brown (7.5YR 4/4) irregular shaped soft masses of iron accumulation with clear boundaries in matrix; gradual wavy boundary. Lab sample # 95P02558

2Cg5--107 to 150 centimeters; light olive brown (2.5Y 5/3) crushed stratified very fine sandy loam, light yellowish brown (2.5Y 6/3), dry; massive; very friable, soft; few fine roots throughout; many fine high-continuity tubular pores; 3 percent fine and medium irregular 10YR 2/2 iron-manganese masses throughout; strong effervescence, by HCl, unspecified; many medium prominent strong brown (7.5YR 4/6) cylindrical soft masses of iron accumulation with diffuse boundaries surrounding many coarse distinct gray (2.5Y 6/1) cylindrical soft iron depletions with diffuse boundaries lining pores; gradual wavy boundary. Lab sample # 95P02559

2Cg6--150 to 180 centimeters; light brownish gray (2.5Y 6/2) crushed stratified very fine sandy loam to silt loam, light gray (2.5Y 7/2), dry; massive; very friable, soft; common fine high-continuity tubular pores; 3 percent fine cylindrical 10YR 2/1 iron-manganese masses throughout; strong effervescence, by HCl, unspecified; very many coarse prominent reddish brown (5YR 4/4) platelike soft masses of iron accumulation with sharp boundaries on faces of peds; many medium prominent strong brown (7.5YR 4/6) irregular shaped soft masses of iron accumulation with clear boundaries in matrix; common fine and medium prominent reddish brown (5YR 4/4) cylindrical soft masses of iron accumulation with sharp boundaries lining pores; diffuse wavy boundary. Lab sample # 95P02560

2Cg7--180 to 203 centimeters; grayish brown (2.5Y 5/2) crushed stratified very fine sandy loam, light gray (2.5Y 7/2), dry; massive; very friable, soft; common fine high-continuity tubular pores; 3 percent medium platy 10YR 2/1 iron-manganese masses; strong effervescence, by HCl, unspecified; many medium and coarse prominent yellowish brown (10YR 5/6) cylindrical soft masses of iron accumulation with diffuse boundaries surrounding many medium and coarse distinct gray (2.5Y 6/1) cylindrical soft iron depletions with clear boundaries lining pores and few fine and medium prominent yellowish red (5YR 4/6) cylindrical soft masses of iron accumulation with sharp boundaries lining pores. Lab sample # 95P02561

Classifications and Comparison of Diagnostics between Soil Taxonomy and World Reference Base (WRB) 1.)

Seq. #	Horizon depth (cm)	Horizon designation		Diagnostic horizon		Diagnostic characteristics or properties		Diagnostic materials	
		Tour Book	Tour	Soil Taxonomy	World Reference Base	Diagnostic characteristics of Soil Taxonomy	Diagnostic properties of World Reference Base	Soil Taxonomy	World Reference Base
1	0 15	Ap	~	ochric epipedon 2.)	2.)	high linear extensibility (9.5 cm/m)	vertic properties (ave. COLE = 0.09 to 100 cm)	mineral soil material	fluvic material, mineral material
2	15 25	Cg1	~			free carbonates, redoximorphic features	gleyic colour pattern, vertic properties	mineral soil material	fluvic material, mineral material
3	25 48	Cg2	~			free carbonates, redoximorphic features	gleyic colour pattern, vertic properties	mineral soil material	fluvic material, mineral material
4	48 69	Cg3	~			free carbonates, redoximorphic features	gleyic colour pattern, vertic properties	mineral soil material	calcaric material, fluvic material, mineral material
5	69 107	2Cg4	~			aquic conditions, free carbonates, lithologic discontinuity at 69 cm	gleyic colour pattern, lithological discontinuity at 69 cm, reducing conditions	mineral soil material	calcaric material, fluvic material, mineral material
6	107 150	2Cg5	~			aquic conditions, free carbonates	gleyic colour pattern, reducing conditions	mineral soil material	calcaric material, fluvic material, mineral material
7	150 180	2Cg6	~			aquic conditions, free carbonates	gleyic colour pattern, reducing conditions	mineral soil material	calcaric material, fluvic material, mineral material
8	180 203	2Cg7	~			aquic conditions, free carbonates	gleyic colour pattern, reducing conditions	mineral soil material	calcaric material, fluvic material, mineral material

Classifications and Comparison of Diagnostics between Soil Taxonomy and World Reference Base (WRB) 1.)

Taxonomic Classifications of Chiawa pedon (95P0326)

Soil Taxonomy Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvents

WRB Gleyic Fluvisols (Calcaric, Humic, Endosiltic) 3.)

1.) Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th ed. USDA-Natural Resources Conservation Service, Washington, DC.

IUSS Working Group WRB. 2007. World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No.103. FAO, Rome.

2.) Fails mollic epipedon (ST) and mollic horizon (WRB) criteria either due to thickness (1994 pedon) or a structureless state (massive) and very hard rupture resistance when dry. If a mollic is recognized, the ST subgroup changes to Aquertic Hapludolls (and minus calcareous class) and the prefix qualifiers change to Mollic Gleyic for Fluvisols reference soil group in WRB.

3.) The Vertic qualifier should be added to the prefix qualifiers list for the Fluvisols reference soil group (e.g., Gleyic Vertic Fluvisols).

*** Primary Characterization Data ***

Pedon ID: 94NE177015 (Washington, Nebraska) Print Date: Mar 29 2012 2:33

Sampled as : Onawa ; Clayey over loamy, montmorillonitic (calcareous), mesic Aquic Udifluvent

Revised to : Onawa ; Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvent

SSL - Project CP95NE122 WASHINGTON COUNTY
- Site ID 94NE177015 Lat: 41° 26' 8.00" north Long: 95° 57' 37.00" west MLRA: 107B
- Pedon No. 95P0326
- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
95P02554	Ap	Ap	0-15				C	SIC
95P02555	Cg1	Cg1	15-25				C	SIC
95P02556	Cg2	Cg2	25-48				C	C
95P02557	Cg3	Cg3	48-69				C	SIC
95P02558	2Cg4	2Cg4	69-107				VFSL	SIL
95P02559	2Cg5	2Cg5	107-150				VFSL	SIL
95P02560	2Cg6	2Cg6	150-180				VFSL	SIL
95P02561	2Cg7	2Cg7	180-203				VFSL	SIL

Pedon Calculations

Calculation Name	Result	Units of Measure
CEC Activity, CEC7/Clay, Weighted Average	0.93	(NA)
Clay, carbonate free, Weighted Average	37	% wt
Weighted Particles, 0.1-75mm, 75 mm Base	1	% wt
Volume, >2mm, Weighted Average	0	% vol
Clay, total, Weighted Average	38	% wt
LE, Whole Soil, Summed to 1m	10	cm/m

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - - Total		- - - - -)	(- - Clay	- - -)	(- - - Silt	- - -)	(- - - - - -	- - -	- - Sand	- - -	- - - - -)	(Rock Fragments		(mm))		
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - - -	- Weight	- - - -	- - - -)	>2 mm
				<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt %
Layer	Depth (cm)	Horz	Prep	.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whole
				(- - - - - - - - -	- - - - - -	- - - - - -	- - - - - -	- - - - - % of	<2mm Mineral Soil	- - - -	- - - -	- - - -	- - - -	- - - -	- - - - -)	(- - - -	- % of <75mm	- - - -	- -)	soil
				3A1	3A1	3A1		3A1	3A1	3A1	3A1	3A1	3A1	3A1	3A1	3B1	3B1	3B1		
95P02554	0-15	Ap	S	51.7	47.7	0.6			38.4	9.3	0.5	0.1	tr	tr	tr	--	--	--	tr	--
95P02555	15-25	Cg1	S	55.2	44.0	0.8			36.4	7.6	0.6	0.1	tr	0.1	--	--	--	--	tr	--
95P02556	25-48	Cg2	S	60.0	38.9	1.1		2.1	37.8	1.1	0.7	0.3	0.1	tr	tr	--	--	--	tr	--
95P02557	48-69	Cg3	S	52.2	47.2	0.6		0.7	41.9	5.3	0.4	0.1	0.1	tr	tr	--	--	--	tr	--
95P02558	69-107	2Cg4	S	12.4	79.2	8.4		1.5	25.1	54.1	7.7	0.4	0.1	0.1	0.1	--	--	--	1	--
95P02559	107-150	2Cg5	S	9.5	65.8	24.7			18.0	47.8	23.7	0.7	0.2	0.1	tr	--	--	--	1	--
95P02560	150-180	2Cg6	S	21.7	67.2	11.1		0.7	30.9	36.3	10.4	0.5	0.1	0.1	--	--	--	--	1	--
95P02561	180-203	2Cg7	S	8.0	59.0	33.0			14.1	44.9	31.6	1.1	0.2	0.1	tr	--	--	--	1	--

*** Primary Characterization Data ***

Pedon ID: 94NE177015 (Washington, Nebraska) Print Date: Mar 29 2012 2:33PM

Sampled as : Onawa ; Clayey over loamy, montmorillonitic (calcareous), mesic Aquic Udifluvent

4th IUSS Soil Classification Conference Field Tour Guidebook

Revised to : Onawa ; Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvent

Bulk Density & Moisture

Layer	Depth (cm)	Horz	Prep	-1- (Bulk Density) 33 kPa (- - - g cm^{-3} - - -) 4A1d	-2- (Bulk Density) Oven Dry (- - - g cm^{-3} - - -) 4A1h	-3- Cole Whole Soil	-4- (- - - - - - - - - Water Content - - - - - - - - - -) 6 kPa (- - - - - - - - - - % of < 2mm - - - - - - - - - -) 4B1c	-5- 10 kPa	-6- 33 kPa	-7- 1500 kPa	-8- 1500 kPa Moist	-9- WRD Ratio AD/OD 4B5	-10- WRD Whole Soil cm^3 cm^{-3} 4C1	-11- Aggst Stabl 2-0.5mm	-12- (- - Ratio/Clay - -) CEC7 8D1	-13- 1500 kPa 8D1
95P02554	0-15	Ap	S	1.24	1.79	0.130			35.9	22.4		1.036	0.17		0.73	0.43
95P02555	15-25	Cg1	S	1.28	1.81	0.122			34.5	22.3		1.039	0.16		0.68	0.40
95P02556	25-48	Cg2	S	1.17	1.67	0.126			38.6	24.4		1.043	0.17		0.66	0.41
95P02557	48-69	Cg3	S	1.23	1.77	0.129			37.5	22.2		1.037	0.19		0.66	0.43
95P02558	69-107	2Cg4	S	1.32	1.41	0.022			34.4	8.0		1.015	0.35		1.14	0.65
95P02559	107-150	2Cg5	S	1.39	1.41	0.005			30.7	6.9		1.013	0.33		1.32	0.73
95P02560	150-180	2Cg6	S	1.38	1.46	0.019			30.7	11.2		1.019	0.27		0.86	0.52
95P02561	180-203	2Cg7	S	1.42	1.45	0.007			29.6	6.0		1.010	0.34		1.29	0.75

Water Content

Layer	Depth (cm)	Horz	Prep	-1- (- - Atterberg - -) (- - - Limits - - -) LL pct <0.4mm	-2- PI	-3- (- - - - - Bulk Density - - - -) Field (- - - - - g cm^{-3} - - - - -)	-4- Recon 33 kPa Oven Dry	-5- Recon	-6- (- Water Content -) Field	-7- Recon 33 kPa	-8- 6 kPa	-9- 10 kPa	-10- (- - - - - - - - - - - - - Sieved Samples - - - - - - - - - - - - -) 33 kPa	-11- 100 kPa	-12- 200 kPa	-13- 500 kPa
															4B1a	
95P02554	0-15	Ap	S												27.0	
95P02555	15-25	Cg1	S												27.5	
95P02556	25-48	Cg2	S												30.0	
95P02557	48-69	Cg3	S												28.3	
95P02558	69-107	2Cg4	S												9.8	
95P02559	107-150	2Cg5	S												8.1	
95P02560	150-180	2Cg6	S												21.1	
95P02561	180-203	2Cg7	S												8.1	

Carbon & Extractions

Layer	Depth (cm)	Horz	Prep	-1- (- - - - - Total - - - -) C (- - - - % of <2 mm - - - -) 6B4a	-2- N	-3- S	-4- Org C 6A1c	-5- C/N Ratio	-6- (- - Dith-Cit Ext - -) Fe (- - - - - - - - - - - - - - % of < 2mm - - - - - - - - - - - - - -)	-7- Al	-8- Mn	-9- (- - - Ammonium Oxalate Extraction - - - -) Al+½FeODOEFe	-10- Fe	-11- Al	-12- Si	-13- Mn	-14- (- Na Pyro-Phosphate - -) C (- - - - mg kg^{-1} - - - -)	-15- Fe (- - - % of < 2mm - - - -)	-16- Al	-17- Mn	-18-
95P02554	0-15	Ap	S		0.200		1.49	7													
95P02555	15-25	Cg1	S		0.140		1.03	7													
95P02556	25-48	Cg2	S		0.107		0.70	7													
95P02557	48-69	Cg3	S		0.101		0.66	7													
95P02558	69-107	2Cg4	S		0.057		0.58	10													
95P02559	107-150	2Cg5	S				0.58														
95P02560	150-180	2Cg6	S				0.59														
95P02561	180-203	2Cg7	S				0.34														

*** Primary Characterization Data ***

Pedon ID: 94NE177015 (Washington, Nebraska) Print Date: Mar 29 2012 2:33

Sampled as : Onawa ; Clayey over loamy, montmorillonitic (calcareous), mesic Aquic Udifluvent
Onawa ; Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvent

Revised to :

CEC & Bases

Layer	Depth (cm)	Horz	Prep	-1- Ca (NH4OAC Extractable Bases, cmol(+) kg-1) 6N2e	-2- Mg 6O2d	-3- Na 6P2b	-4- K 6Q2b	-5- Sum Bases	-6- Acidity 6H5a	-7- Extr Al	-8- KCl Mn (mg kg-1)	-9- CEC8 Sum Cats	-10- CEC7 NH4 OAC (cmol(+) kg-1) 5A8b	-11- ECEC Bases +Al	-12- Al Sat	-13- Base Saturation Sum (%) 5C3	-14- Base Saturation NH4C (%) 5C1
95P02554	0-15	Ap	S	35.0*	8.2	0.1	1.6		2.3				37.6			95	100
95P02555	15-25	Cg1	S	40.1*	8.2	0.1	1.3		2.4				37.4			95	100
95P02556	25-48	Cg2	S	50.5*	8.8	0.2	1.2						39.7			100	100
95P02557	48-69	Cg3	S	52.1*	8.8	0.2	1.1						34.3			100	100
95P02558	69-107	2Cg4	S	40.4*	5.9	0.3	0.5						14.1			100	100
95P02559	107-150	2Cg5	S	33.7*	5.2	0.4	0.5						12.5			100	100
95P02560	150-180	2Cg6	S	40.5*	7.5	0.6	0.8						18.7			100	100
95P02561	180-203	2Cg7	S	30.7*	4.7	0.4	0.5						10.3			100	100

*Extractable Ca may contain Ca from calcium carbonate or gypsum., CEC7 base saturation set to 100.

Salt

Layer	Depth (cm)	Horz	Prep	-1- Ca (Water Extracted From Saturated Paste, mmol(+) L-1)	-2- Mg	-3- Na	-4- K	-5- CO3 (mmol(-) L-1)	-6- HCO3F	-7- Cl	-8- PO4	-9- Br	-10- OAC	-11- SO4	-12- NO2	-13- NO3	-14- H2O	-15- Total Salts (%)	-16- Elec Cond (dS m-1)	-17- Pred Elec Cond	-18- Exch Na %	-19- SA
95P02554	0-15	Ap	S																		tr	
95P02555	15-25	Cg1	S																		tr	
95P02556	25-48	Cg2	S																		1	
95P02557	48-69	Cg3	S																		1	
95P02558	69-107	2Cg4	S																		2	
95P02559	107-150	2Cg5	S																		3	
95P02560	150-180	2Cg6	S																		3	
95P02561	180-203	2Cg7	S																		4	

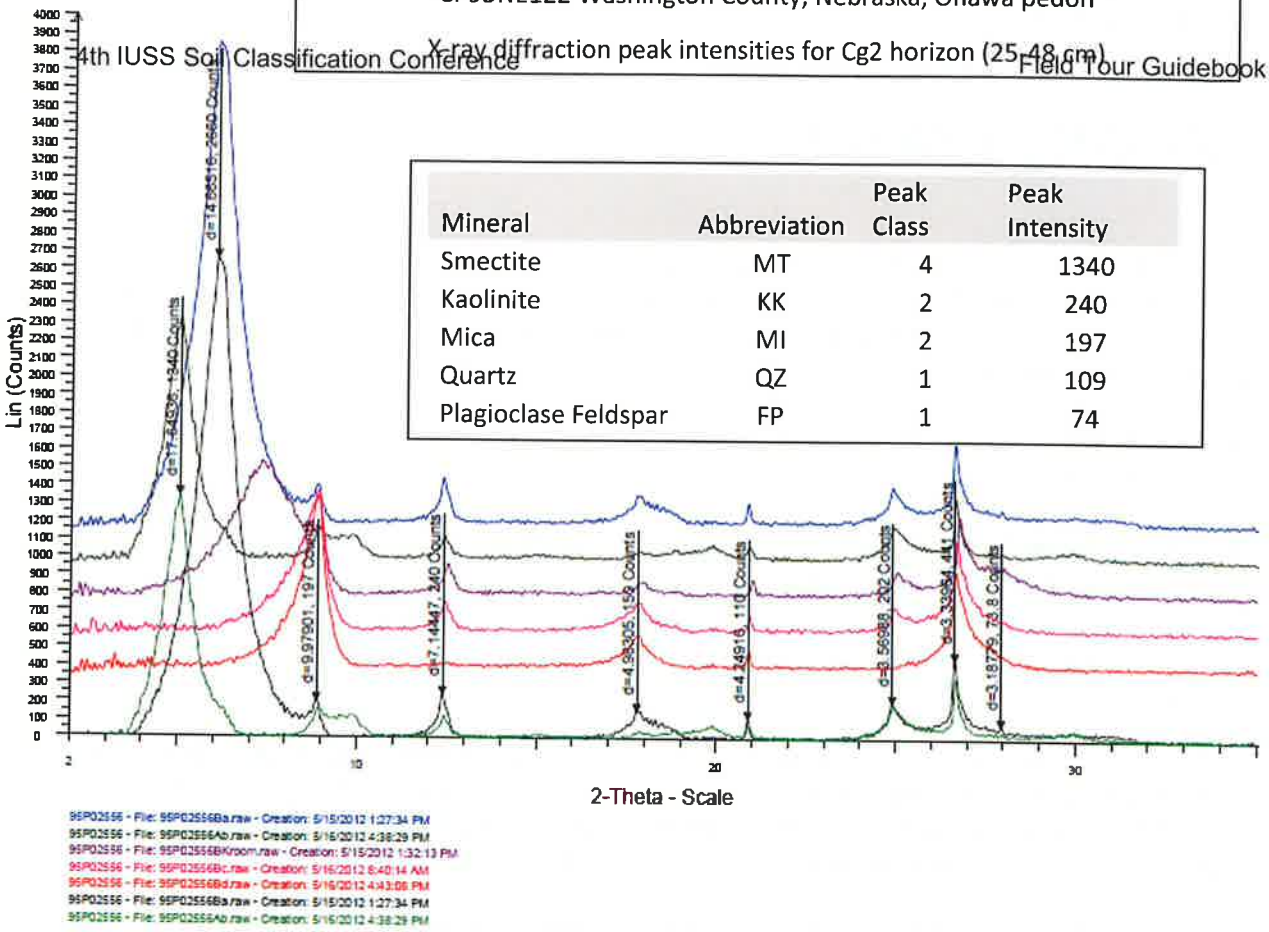
pH & Carbonates

Layer	Depth (cm)	Horz	Prep	-1- KCl (pH)	-2- CaCl2 0.01M 1:2 4C1a2a	-3- H2O 1:1 4C1a2a	-4- Sat Paste	-5- Oxid	-6- NaF	-7- Carbonate As CaCO3 <2mm (%) 6E1g	-8- Carbonate As CaCO3 <20mm (%)	-9- Gypsum As CaSO4*2H2O <2mm (%)	-10- Gypsum As CaSO4*2H2O <20mm (%)	-11- Resis ohms cm-1
95P02554	0-15	Ap	S		7.3	7.4				1				
95P02555	15-25	Cg1	S		7.5	7.7				2				
95P02556	25-48	Cg2	S		7.5	7.7				3				
95P02557	48-69	Cg3	S		7.6	7.8				4				
95P02558	69-107	2Cg4	S		7.8	8.0				8				
95P02559	107-150	2Cg5	S		7.8	8.0				7				
95P02560	150-180	2Cg6	S		7.7	8.1				7				
95P02561	180-203	2Cg7	S		7.8	8.1				7				

CP95NE122 Washington County, Nebraska, Onawa pedon

X-ray diffraction peak intensities for Cg2 horizon (25-48 cm)

Mineral	Abbreviation	Peak Class	Peak Intensity
Smectite	MT	4	1340
Kaolinite	KK	2	240
Mica	MI	2	197
Quartz	QZ	1	109
Plagioclase Feldspar	FP	1	74



CP95NE122 Washington County
Onawa pedon
Optical Mineral and Counts for
2Cg4 horizon (69-107 cm)

Sample 95P02558	Quartz	K Feldsp.	Calcite	Musco-vite	Chal-cedony	Iron Oxide	Pyro-xene	Biotite	Glass	Carbon. Aggreg.	Horn-blende	Plant Opal	Opaque	Glass Coated	Plag. Feldsp.	Rutile	Beryl	Zircon
Coarse Silt Size Fraction	172	64	19	9	6	6	6	5	5	3	3	3	2	2	2	1	0	0
Calculated Percentage	55.8	20.8	6.2	2.9	1.9	1.9	1.9	1.6	1.6	1.0	1.0	1.0	0.6	0.6	0.6	0.3	0.0	0.0

Total grains = 308

Interpretation for sand/silt mineralogy = mixed

ONAWA SERIES

The Onawa series consists of very deep, somewhat poorly drained soils on flood plains. These soils formed in 18 to 30 inches of clayey alluvium and the underlying loamy alluvium. Slopes range from 0 to 2 percent. Mean annual air temperature is about 51 degrees F. Mean annual precipitation is about 27 inches.

TAXONOMIC CLASS: Clayey over loamy, smectitic over mixed, superactive, calcareous, mesic Aquertic Udifluvents

TYPICAL PEDON: Onawa silty clay, on a nearly level flood plain, in a cultivated field. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 7 inches; very dark grayish brown (2.5Y 3/2) silty clay; moderate fine subangular blocky structure; firm; slightly alkaline; abrupt smooth boundary. (6 to 10 inches thick)

Cg1--7 to 22 inches; dark grayish brown (2.5Y 4/2) silty clay; massive with weak, thin alluvial stratification; firm; 1 inch layer of silty clay loam at 18 to 19 inches; few fine prominent red (2.5YR 5/8) and strong brown (7.5YR 5/8) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary. (12 to 20 inches thick)

2Cg2--22 to 60 inches; dark grayish brown (10YR 4/2) and very dark gray (10YR 3/1) silt loam; massive; firm; few fine prominent strong brown (7.5YR 5/6) and few fine distinct reddish brown (5YR 4/3) redoximorphic concentrations; strongly effervescent; slightly alkaline.

TYPE LOCATION: Monona County, Iowa; about 50 feet west and 1,980 feet north of the southeast corner of sec. 1, T. 84 N., R. 47 W.; USGS Macy quadrangle; lat. 42 degrees 7 minutes 26 seconds N. and long. 96 degrees 15 minutes 8 seconds W., NAD 27

RANGE IN CHARACTERISTICS:
Depth to carbonates--0 to 10 inches
Depth to loamy alluvium--18 to 30 inches
Content of clay in the upper third to upper half of the particle-size control section (weighted average)--50 to 70 percent
Content of clay in the lower half to lower two thirds of the particle-size control section (weighted average)--10 to 18 percent
Content of sand in the upper third to upper half of the particle-size control section (weighted average)--1 to 5 percent fine sand and sand coarser than fine sand
Content of sand in the lower half to lower two thirds of the particle-size control section (weighted average)--10 to 75 percent fine sand and sand coarser than fine sand

A or Ap horizon:
Hue--10YR or 2.5Y
Value--2 or 3
Chroma--1 or 2

Texture--silty clay, clay, silty clay loam, loam, or silt loam
Clay content--15 to 50 percent
Sand--1 to 50 percent
Calcium carbonate equivalent--5 to 30 percent
Reaction--slightly alkaline or moderately alkaline

Overwash phase:
Texture--fine sandy loam or loamy fine sand
Clay content--2 to 20 percent
Sand content--50 to 90 percent
Thickness--10 to 20 inches

Cg horizon:
Hue--10YR, 2.5Y, 5Y, or is neutral
Value--3 to 5
Chroma--0 to 2
Texture--clay or silty clay
Clay content--50 to 70 percent
Sand--1 to 5 percent
Calcium carbonate equivalent--5 to 30 percent
Reaction--slightly alkaline or moderately alkaline

Many pedons have strata of silty or clayey materials with individual strata up to 1 to 2 inches thick

Some pedons have a transitional layer, less than 5 inches thick, between the Cg1 and 2Cg2 horizons of silty clay loam, with sand content up to 15 percent fine sand and sand coarser than fine sand

2Cg horizon:
Hue--10YR, 2.5Y, 5Y, or is neutral
Value--3 to 5
Chroma--0 to 2
Texture--silt loam, very fine sandy loam, loam with a high amount of very fine sand, or loamy very fine sand
Clay content--10 to 18 percent
Sand content--10 to 75 percent
Calcium carbonate equivalent--5 to 30 percent
Reaction--slightly alkaline or moderately alkaline

Some pedons have strata of loamy fine sand or fine sand below a depth of 40 inches

COMPETING SERIES: There are no competing series.

GEOGRAPHIC SETTING:
Parent material--18 to 30 inches of clayey alluvium and the underlying loamy alluvium
Landform--flood plains
Slopes--0 to 2 percent
Elevation--700 to 1,260 feet above sea level
Mean annual air temperature--46 to 56 degrees F.
Mean annual precipitation--19 to 36 inches
Frost-free period--135 to 185 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Albaton, Blake, Percival, Grable, Haynie, and Modale soils.
Albaton--are in the slightly lower landscape positions, have a saturated zone within a depth of 1 foot during March to June in most years, and have a clay content of 50 to 60 percent throughout the particle-size control section
Blake--are in landscape positions similar to those of the Onawa soils and have a clay content of 22 to 35 percent throughout the particle-size control section
Percival--are in the slightly higher landscape positions, have a clay content of less than 10 percent in the lower half of the particle-size control section
Grable--are in the higher landscape positions, have a clay content of 12 to 16 percent in the upper half of the particle-size control section, and do not have a saturated zone within a depth of 6 feet during April to June in most years
Haynie--are in the slightly higher landscape positions, have a clay content of 15 to 18 percent throughout the particle-size control section, and have a saturated zone between depths of 4 to 6 feet during April to June in most years
Modale--are in the slightly higher landscape positions, have a clay content of 10 to 18 percent in the upper third to upper half of the particle-size control section, and have a saturated zone between depths of 1 to 3 feet during April to June in most years

DRAINAGE AND PERMEABILITY:
Drainage class--somewhat poorly drained--a saturated zone occurs within depths of 1 to 3 feet during March to June in most years and is considered apparent
Permeability--slow in the clayey alluvium and moderate or moderately rapid in the underlying loamy alluvium
Surface runoff potentiallow or medium
Flooding--rare to occasional flooding with very brief or brief duration during the months of February to November from precipitation events and snowmelt and flooding from streambank overflow is limited where dams and levees protect areas

USE AND VEGETATION:
Most areas are cultivated. The principal crops are corn, soybeans, and small grains. Some areas are land-leveled and irrigated. The native vegetation is big bluestem, little bluestem, western wheatgrass, indiangrass, switchgrass, and other grasses of the tall grass prairie.

Site 2b – Monona Series

The Monona series consists of very deep, well drained soils formed in loess. These soils are on interfluves and side slopes on dissected till plains and risers and treads on loess covered stream terraces. Slopes range from 0 to 40 percent.

Most areas are cultivated. The principal crops are corn, soybeans, small grains, and hay. The native vegetation is big bluestem, little bluestem, Indiangrass, switchgrass, and other grasses of the tall grass prairie.

Some steeply sloping areas are pastured or forested as is the case at the Hitchcock Nature center. Here, the woody components consist of bur oak, cottonwood, green ash, hickory, and raspberry.

PEDON DESCRIPTION

Print Date: 03/29/2012
Description Date: 10/21/2011
Describer: D. Pulido, J. Hammerly, S. Monteith
Site ID: S12IA155001
Site Note:

Pedon ID: S12IA155001

Pedon Note:
Lab Source ID: SSL
Lab Pedon #: 12N0013

Soil Name as Described/Sampled: Monona

Soil Name as Correlated:

Classification: Fine-silty, mixed, superactive, mesic Typic Hapludolls
Pedon Type:
Pedon Purpose:
Taxon Kind:
Associated Soils:
Physiographic Division: Interior Plains
Physiographic Province: Central Lowland Province
Physiographic Section: Dissected till plains

State Physiographic Area:
Local Physiographic Area:
Geomorphic Setting: on backslope of side slope of upland
on backslope of side slope of hill
Upslope Shape: concave
Cross Slope Shape: linear
Particle Size Control Section: 25 to 100 cm.
Description origin: NASIS

Country: USA
State: Iowa
County: Pottawattamie
MLRA: 107B -- Iowa and Missouri Deep Loess Hills
Soil Survey Area: IA155 -- Pottawattamie County, Iowa
Map Unit: 10G—Monona silt loam, 30 to 40 percent slopes
Quad Name:

Legal Description:

Latitude: 41 degrees 24 minutes 54.96 seconds north
Longitude: 95 degrees 51 minutes 37.02 seconds west
Datum:
UTM Zone:
UTM Easting:
UTM Northing:

Primary Earth Cover: Tree cover
Secondary Earth Cover: Hardwoods
Existing Vegetation: bur oak, cottonwood, green ash, hickory, raspberry
Parent Material: loess
Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:
Bedrock Fracture Interval:
Surface Fragments:
Description database: NSSL

Diagnostic Features: mollic epipedon 0 to 30 cm.
cambic horizon 30 to 99 cm.

Cont. Site ID: S12IA155001 **Pedon ID:** S12IA155001

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
22.0		45						well		

Monona silt loam occurs primarily on north and east slope aspects at the Hitchcock Nature Center

Profile Description:

A--0 to 18 centimeters; black (10YR 2/1) silt loam; moderate fine granular, and moderate fine subangular blocky structure; friable, soft, nonsticky, nonplastic; many fine roots; common very fine and fine interstitial pores; clear wavy boundary.

AB--18 to 30 centimeters; 80 percent black (10YR 2/1) and 20 percent brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable, soft, nonsticky, nonplastic; many fine roots; common very fine and fine interstitial pores; clear wavy boundary.

Bw1--30 to 52 centimeters; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky, and moderate medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; many fine roots; common fine tubular and few very fine tubular pores; 2 percent black (10YR 2/1) organic stains; gradual smooth boundary.

Bw2--52 to 79 centimeters; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common fine roots; common fine tubular and few very fine tubular pores; gradual smooth boundary.

Bw3--79 to 99 centimeters; dark yellowish brown (10YR 4/4) silt loam; weak coarse subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common very fine roots; few very fine and fine tubular pores; gradual smooth boundary.

BC--99 to 117 centimeters; dark yellowish brown (10YR 4/4) silt loam; weak coarse prismatic parts to weak medium subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; common very fine roots; few very fine tubular pores.

Seq. #	Horizon depth (cm)	Horizon designation		Diagnostic horizon		Diagnostic characteristics or properties		Diagnostic materials	
		Tour Book	Tour	Soil Taxonomy	World Reference Base	Diagnostic characteristics of Soil Taxonomy	Diagnostic properties of World Reference Base	Soil Taxonomy	World Reference Base
1	0 18	A	~	mollic epipedon	mollic horizon			mineral soil material	mineral material
2	18 30	AB	~	mollic epipedon	mollic horizon			mineral soil material	mineral material
3	30 52	Bw1	~	cambic horizon	cambic horizon			mineral soil material	mineral material
4	52 79	Bw2	~	cambic horizon	cambic horizon			mineral soil material	mineral material
5	79 99	Bw3	~	cambic horizon	cambic horizon			mineral soil material	mineral material
6	99 117	BC	~					mineral soil material	mineral material

Taxonomic Classifications of Monona pedon (12N0013)

Soil Taxonomy Fine-silty, mixed, superactive, mesic Typic Hapludolls

WRB Haplic Phaeozems (Siltic)

1.) Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th ed. USDA-Natural Resources Conservation Service, Washington, DC.

IUSS Working Group WRB. 2007. World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No.103. FAO, Rome.

*** Primary Characterization Data ***

Pedon ID: S12IA155001 (Pottawattamie, Iowa) Print Date: May 2 2012 9:15
Sampled as on Oct 21, 2011: Monona ; Fine-silty, mixed, superactive, mesic Typic Hapludoll
Revised to :

SSL - Project C2012USNE004 IUSS Tour
- Site ID S12IA155001 Lat: 41° 24' 55.00" north Long: 95° 51' 37.00" west NAD83 MLRA: 107B
- Pedon No. 12N0013
- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
12N00052	A		0.0-18.0	S12IA155001-1			SIL	SIL
12N00053	AB		18.0-30.0	S12IA155001-2			SIL	SIL
12N00054	Bw1		30.0-52.0	S12IA155001-3			SIL	SIL
12N00055	Bw2		52.0-79.0	S12IA155001-4			SIL	SIL
12N00056	Bw3		79.0-99.0	S12IA155001-5			SIL	SIL
12N00057	BC		99.0-117.0	S12IA155001-6			SIL	SIL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	0.595	% wt
Volume, >2mm, Weighted Average	0	% vol
Clay, total, Weighted Average	19.446	% wt
Clay, carbonate free, Weighted Average	19.446	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 4	0.761	(NA)
LE, Whole Soil, Summed to 1m	2.3	cm/m

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - - - Total	- - - - -)		(- - Clay	- - -)	(- - - Silt	- - - -)	(- - - - - - - -	- - - Sand	- - -	- - -	- - - -)	(Rock Fragments	(mm))			
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - - -	Weight	- - - - - - -	-)>2 r	
				<	.002	.05	<	<	.002	.02	.05	.10	.25	.5	1	2	5	20	.1-	wt ?
	Depth			.002	-.05	-2	.0002	.002	-.02	-.05	-.10	-.25	-.50	-1	-2	-5	-20	-75	75	whc
Layer	(cm)	Horz	Prep	(- - - - - - - - - - - - - -	- - - - - - -	% of <2mm	Mineral Soil	- - - - - -	- - - - - -	- - - - - -	- - - -)	(- - -	- - % of	<75mm-	- - - -)	soil
				3A1a1a			3A1a1a		3A1a1a		3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a					
12N00052	0-18	A	S	19.8	70.8	9.4	12.5		25.5	45.3	8.6	0.4	0.2	0.1	0.1	--	--	--	1	--
12N00053	18-30	AB	S	20.7	71.3	8.0	13.4		24.8	46.5	7.4	0.4	0.1	tr	0.1	--	--	--	1	--
12N00054	30-52	Bw1	S	19.5	72.8	7.7	11.2		22.4	50.4	7.3	0.3	0.1	tr	--	--	--	--	tr	--
12N00055	52-79	Bw2	S	21.3	67.8	10.9	11.5		27.7	40.1	10.0	0.7	0.1	0.1	--	--	--	--	1	--
12N00056	79-99	Bw3	S	16.9	75.2	7.9	8.7		23.6	51.6	7.5	0.3	0.1	tr	--	--	--	--	tr	--
12N00057	99-117	BC	S	14.6	76.4	9.0	7.8		22.8	53.6	8.5	0.3	0.1	0.1	--	--	--	--	tr	--

*** Primary Characterization Data ***

Pedon ID: S12IA155001 (Pottawattamie County, Iowa) Print Date: May 2 2012 9:15AM

Sampled As : Monona Fine-silty, mixed, superactive, mesic Typic Hapludoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0013

Bulk Density & Moisture

Layer	Depth (cm)	Horz	Prep	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(Bulk Density)		Cole	(- - - - - - - - - - Water Content - - - - - - - - - - - -)						WRD	Aggst		
				33 kPa	Oven Dry	Whole Soil	6 kPa	10 kPa	33 kPa	1500 kPa	1500 kPa Moist	Ratio AD/OD	Whole Soil	Stabl 2-0.5mm	(- - Ratio/Clay - -) CEC7	1500 kPa
				(- - - g cm^{-3} - - -)			(- - - - - - - - - - pct of < 2mm - - - - - - - - - - - -)						cm^3 cm^{-3}	%		
				DbWR1	DbWR1				DbWR1	3C2a1a		3D1				
12N00052	0-18	A	S	1.19	1.28	0.025			28.6	14.5		1.025	0.17		1.48	0.73
12N00053	18-30	AB	S	1.22	1.35	0.034			26.7	13.8		1.024	0.16		1.26	0.67
12N00054	30-52	Bw1	S	1.29	1.37	0.020			21.1	8.6		1.018	0.16		0.76	0.44
12N00055	52-79	Bw2	S	1.31	1.39	0.020			22.4	8.0		1.018	0.19		0.64	0.38
12N00056	79-99	Bw3	S	1.33	1.41	0.020			19.7	7.8		1.018	0.16		0.79	0.46
12N00057	99-117	BC	S	1.27	1.34	0.018			19.5	7.4		1.017	0.15		0.87	0.51

Water Content

Layer	Depth (cm)	Horz	Prep	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(- - Atterberg - -)		(- - - - - Bulk Density - - - -)			(- - - - - - - - - - Water Content - - - - - - - - - -)							
				(- - - Limits - - -)		Field	Recon	Recon	Field	Recon	(- - - - - - - - Sieved Samples - - - - - - - -)					
				LL	PI		33 kPa	Oven Dry		33 kPa	6 kPa	10 kPa	33 kPa	100 kPa	200 kPa	500 kPa
				pct <0.4mm		(- - - - - - - g cm^{-3} - - - - - - -)			(- - - - - - - - - - % of < 2mm - - - - - - - - - -)							
															3C1e1a	
12N00052	0-18	A	S												26.6	
12N00053	18-30	AB	S												20.4	
12N00054	30-52	Bw1	S												12.9	
12N00055	52-79	Bw2	S												12.1	
12N00056	79-99	Bw3	S												12.1	
12N00057	99-117	BC	S												11.3	

Carbon & Extractions

Layer	Depth (cm)	Horz	Prep	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
				(- - - - Total - - - - -)			Est	OC	C/N	(- - Dith-Cit Ext - -)			(- - Ammonium Oxalate Extraction - - - -)						(- Na Pyro-Phosphate -)			
				C	N	S	OC	(WB)	Ratio	Fe	Al	Mn	Al+½Fe	ODOE	Fe	Al	Si	Mn	C	Fe	Al	Mn
				(- - - - - - - % of <2 mm - - - - - -)						(- - - - - - - - - % of < 2mm - - - - - - - - -)								mg kg^{-1}	(- - - % of < 2mm - - -)			
				4H2a	4H2a	4H2a				4G1	4G1	4G1		4G2a	4G2a	4G2a	4G2a	4G2a		4G3	4G3	4G3
12N00052	0-18	A	S	3.79	0.36	0.02	3.8		10	0.9	0.1	0.1	0.23	0.08	0.21	0.12	0.04	794.5		0.2	0.3	0.06
12N00053	18-30	AB	S	2.79	0.29	--	2.8		10	0.8	0.1	0.1	0.22	0.09	0.21	0.11	0.04	621.0		0.3	0.4	0.04
12N00054	30-52	Bw1	S	0.38	0.06	--	0.4		6	0.9	0.1	0.1	0.25	0.03	0.24	0.13	0.03	501.3		0.2	0.3	--
12N00055	52-79	Bw2	S	0.34	0.08	tr	0.3		4	1.0	0.1	0.1	0.26	0.03	0.29	0.12	0.03	554.9		0.2	0.2	--
12N00056	79-99	Bw3	S	0.26	0.08	tr	0.3		3	1.1	0.1	0.1	0.28	0.03	0.36	0.10	0.04	621.3		0.2	0.2	--
12N00057	99-117	BC	S	0.25	0.06	tr	0.3		4	1.1	0.1	0.1	0.31	0.03	0.44	0.09	0.05	719.2		0.2	0.1	--

CEC & Bases

Layer	Depth (cm)	Horz	Prep	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-
				(- - - - - NH_4OAC Extractable Bases - - -)				Sum	Acid-	Extr	KCl	CEC8	CEC7	ECEC	Al	(- - - Base - - - -)	
				Ca	Mg	Na	K	Bases	ity	Al	Mn	Sum Cats	NH_4 OAC	Bases +Al	Sat	(- Saturation -) Sum	NH_4OAC
				(- - - - - - - - - - - - - - - cmol(+) kg^{-1} - - - - - - - - - - - - - - - -)							mg kg^{-1}	(- - - - cmol(+) kg^{-1} - - -)			(- - - - - - - - % - - - - - - - -)		
				4B1a1a	4B1a1a	4B1a1a	4B1a1a		4B2b1a1	4B3a1a	4B3a1a		4B1a1a				
12N00052	0-18	A	S	31.9*	4.8	--	0.9	37.6	5.5			43.1	29.4			87	100
12N00053	18-30	AB	S	29.5*	3.8	--	0.4	33.7	5.0			38.7	26.1			87	100
12N00054	30-52	Bw1	S	10.7*	5.0	--	0.4	16.1	4.5			20.6	14.8			78	100
12N00055	52-79	Bw2	S	8.4	4.7	--	0.3	13.4	5.6	0.3	1.5	19.0	13.7			71	98
12N00056	79-99	Bw3	S	5.7	5.2	--	0.3	11.2	4.9	0.1	1.4	16.1	13.4			70	84
12N00057	99-117	BC	S	7.2*	5.4	--	0.3	12.9	4.4			17.3	12.7			75	100

*Extractable Ca may contain Ca from calcium carbonate or gypsum. CEC7 base saturation set to 100.

*** Primary Characterization Data ***

Pedon ID: S12IA155001 (Pottawattamie County, Iowa) Print Date: May 2 2012 9:15

Sampled As : Monona Fine-silty, mixed, superactive, mesic Typic Hapludoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0013

Salt

Layer	Depth (cm)	Horz	Prep	Ca	Mg	Na	K	CO_3	HCO_3F	Cl	PO_4	Br	OAC	SO_4	NO_2	NO_3	H_2O	Total Salts	Elec Cond	Pred Elec Cond	Exch Na	SA
				(- - - mmol(+) L^{-1} - - - -)				(- - - - - - - - - - - - - - - - - - mmol(-) L^{-1} - - - - - - - - - - - - - - - - - -)									(- - % - - -)		(- - dS m^{-1} - -)		
				4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2		4F2	4F1a1a1		
12N00052	0-18	A	S	5.4	1.4	0.2	0.4	--	4.5	0.5	0.4	--	tr	--	0.4	0.2	tr	79.3		0.62	0.30	--	
12N00053	18-30	AB	S	3.9	0.8	0.2	0.1	--	2.8	0.4	0.5	--	tr	--	0.3	0.1	tr	68.8		0.42	0.19	--	
12N00054	30-52	Bw1	S	0.9	0.3	0.1	--	--	0.3	0.1	0.4	--	--	--	0.2	tr	0.1	54.5		0.12	0.06	--	
12N00055	52-79	Bw2	S	0.7	0.3	0.2	tr	--	--	tr	0.7	--	tr	--	0.2	tr	0.1	50.5		0.14	0.05	--	
12N00056	79-99	Bw3	S	0.5	0.2	0.1	--	--	--	0.1	0.3	--	tr	--	0.3	tr	tr	53.1		0.09	0.03	--	
12N00057	99-117	BC	S	0.7	0.3	0.2	--	--	0.1	0.1	0.4	--	tr	--	0.4	tr	tr	54.6		0.12	0.05	--	

pH & Carbonates

Layer	Depth (cm)	Horz	Prep	KCl	$CaCl_2$ 0.01M 1:2	H_2O 1:1	Sat Paste	Oxid	NaF	(- - Carbonate - -) As $CaCO_3$ <2mm	(- - Carbonate - -) As $CaCO_3$ <20mm	(- - Gypsum - - -) As $CaSO_4*2H_2O$ <2mm	(- - Gypsum - - -) As $CaSO_4*2H_2O$ <20mm	Resist ohms cm^{-1}
				(- - - - - - - - - - - - - - - - - - pH - - - - - - - - - - - - - - - - - -)						(- % -)				
					4C1a2a	4C1a2a	4F2		4C1a1a1					
12N00052	0-18	A	S		6.9	7.4	7.0		8.9					
12N00053	18-30	AB	S		6.7	7.4	6.9		8.9					
12N00054	30-52	Bw1	S		5.9	6.8	6.3		9.1					
12N00055	52-79	Bw2	S		4.9	5.8	5.3		8.8					
12N00056	79-99	Bw3	S		5.0	6.0	5.5		8.6					
12N00057	99-117	BC	S		5.5	6.4	6.0		8.6					

Phosphorous

Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ	Acid Oxal	Anion Exch Available	Resin Capacity	Bray 1	Bray 2	Olsen	H_2O	Citric Acid	Mehlich III	KCl Extr NO_3
					%	(- mg kg^{-1} -)									
						4G2a			4D3					4D6b	
12N00052	0-18	A	S			346.7			28.9					40.1	
12N00053	18-30	AB	S			268.7			10.3					17.6	
12N00054	30-52	Bw1	S			214.6			32.8					33.9	
12N00055	52-79	Bw2	S			203.7			24.8					25.2	
12N00056	79-99	Bw3	S			226.3			18.4					20.3	
12N00057	99-117	BC	S			240.4			11.5					14.5	

Phosphorous

Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ	Acid Oxal	Anion Exch Available	Resin Capacity	Bray 1	Bray 2	Olsen	H_2O	Citric Acid	Mehlich III	KCl Extr NO_3
					%	(- mg kg^{-1} -)									
														4D6a1	
12N00052	0-18	A	S											28.8	
12N00053	18-30	AB	S											10.7	
12N00054	30-52	Bw1	S											30.9	
12N00055	52-79	Bw2	S											24.4	
12N00056	79-99	Bw3	S											19.5	
12N00057	99-117	BC	S											14.1	

*** Primary Characterization Data ***

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Sampled As : Monona Fine-silty, mixed, superactive, mesic Typic Hapludoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0013

Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a		Hg ug/kg 4H1a
12N00052	0-18	A	HM	0.15	10.35	374.50	0.87	0.53	7.62	27.69	16.42	789.30	1.06		69
12N00053	18-30	AB	HM	0.14	11.56	397.30	0.89	0.67	8.02	30.78	15.94	730.37	0.95		62
12N00054	30-52	Bw1	HM	0.11	11.95	288.77	0.88	0.41	8.46	29.50	15.26	537.68	0.81		46
12N00055	52-79	Bw2	HM	0.10	12.15	303.63	0.82	0.36	8.37	28.93	14.28	581.06	0.85		63
12N00056	79-99	Bw3	HM	0.11	13.44	333.41	0.86	0.29	8.43	29.28	16.25	622.68	0.80		66
12N00057	99-117	BC	HM	0.10	13.14	370.77	0.87	0.40	8.58	31.07	17.11	704.29	0.73		72

Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a
12N00052	0-18	A	HM	21.01	739.28	24.00	0.67	686.13	0.89	40.56		52.56	0.04	77.36
12N00053	18-30	AB	HM	21.73	605.99	25.89	0.72	663.92	0.98	43.31		57.73	0.04	80.62
12N00054	30-52	Bw1	HM	22.00	430.33	11.91	0.35	285.54	0.76	30.81		56.35	0.03	66.61
12N00055	52-79	Bw2	HM	20.81	466.64	11.81	0.32	156.18	0.72	31.90		55.73	0.03	68.20
12N00056	79-99	Bw3	HM	22.30	500.26	12.02	0.33	134.93	0.71	36.34		56.83	0.02	68.24
12N00057	99-117	BC	HM	23.55	568.08	12.03	0.36	198.91	0.76	41.55		60.88	0.03	66.82

Major Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Al mg/kg 4H1b	Ca mg/kg 4H1b	Fe mg/kg 4H1b	K mg/kg 4H1b	Mg mg/kg 4H1b	Mn mg/kg 4H1b	Na mg/kg 4H1b	P mg/kg 4H1b	Si mg/kg 4H1b	Sr mg/kg 4H1b	Ti mg/kg 4H1b	Zr mg/kg 4H1b
12N00052	0-18	A	HM	52514	10590	22087	18062	5592	971	9511	956	311229	157	3670	156
12N00053	18-30	AB	HM	55840	10149	22484	17763	5454	894	9790	868	314467	156	3797	171
12N00054	30-52	Bw1	HM	57440	6530	24626	18485	5960	698	10270	616	332133	150	3967	175
12N00055	52-79	Bw2	HM	57520	6683	24915	18921	5939	759	10896	757	334515	160	3856	160
12N00056	79-99	Bw3	HM	56817	6935	25579	18459	5985	812	11219	655	335126	169	3799	156
12N00057	99-117	BC	HM	59017	7686	25351	18389	5876	910	11418	839	331352	178	3747	169

Mehlich3 Elements				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-	-20-	-21-
Layer	Depth (cm)	Horz.	Prep.	Al	As	Ba	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Se	Si	Sr	Zn
				(-	-	-	-	-	-	-	-	-	-	-mg/kg-	-	-	-	-	-	-	-	-	-	-)
				4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b		4D6b	4D6b	4D6b
12N000520-18		A	S	604.6	2.2	123.2	4851.8	0.5	1.3	0.1	2.4	143.7	265.2	488.2	278.6	0.4	9.9	2.2	40.1	9.5		448.8	15.3	11.2
12N0005318-30		AB	S	669.4	2.3	127.2	4502.6	0.4	1.1	0.1	2.1	151.1	135.5	384.3	242.9	0.2	14.1	2.2	17.6	9.8		496.0	15.1	8.7
12N0005430-52		Bw1	S	934.5	0.9	128.6	2102.3	0.1	0.9	0.1	1.7	133.0	124.1	523.7	98.1	0.2	16.7	1.1	33.9	2.0		482.4	9.6	1.4
12N0005552-79		Bw2	S	877.4	0.7	133.2	1694.6	0.1	0.7	0.1	1.5	144.6	107.0	501.7	76.6	0.4	24.1	0.9	25.2	1.3		424.1	9.3	1.3
12N0005679-99		Bw3	S	754.4	0.2	137.2	1612.5	0.1	0.9	0.1	1.6	165.1	101.6	541.6	92.1	0.2	22.3	1.1	20.3	1.2		471.7	10.1	1.3
12N0005799-117		BC	S	652.6	1.1	119.9	1669.0	0.2	0.8	0.1	1.8	184.2	93.5	557.8	91.9	0.1	23.3	1.2	14.5	1.1		480.9	10.3	1.5

*** Primary Characterization Data ***

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Sampled As : Monona Fine-silty, mixed, superactive, mesic Typic Hapludoll
USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0013

Clay Mineralogy

Layer	Depth (cm)	Horz	Fraction	-1- -2- -3- -4- -5- -6- -7- -8- -9- X-Ray / Thermal (peak size; %)	-10- SiO_2	-11- Al_2O_3	-12- Fe_2O_3	-13- MgO	-14- CaO	-15- K_2O	-16- Na_2O	-17- EGME Retn ($mg\ g^{-1}$)	-18- Int pre tio
				7A1b1 / 7A4a	Elemental (%)								
12N00054	30-52	Bw1	tcly	MT 3 MI 3 KK 2 VR 2 KK 32									SME
12N00057	99-117	BC	tcly	MT 5 MI 2 KK 2 KK 33									SME

FRACTION INTERPRETATION:
tcly - Total Clay,

MINERAL INTERPRETATION:
KK - Kaolinite MI - Mica MT - Montmorillonite VR - Vermiculite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Sı

Sand - Silt Mineralogy (2.0-0.002 mm)

Layer	Depth (cm)	Horz	Fraction	-1- -2- -3- -4- -5- -6- -7- -8- -9- X-Ray / Thermal (peak size; %)	-10- Tot Re	-11- -12- -13- -14- -15- -16- Optical Grain Count (7B1a2; %)	-17- EGME Retn ($mg\ g^{-1}$)	-18- Int pre tio
12N00054	30-52	Bw1	csi		69	QZ 65 FK 18 BT 5 MS 4 CD 2 AR 1 FE 1 OP 1 PR 1 BY tr FP tr GC tr GN tr GS tr HN tr PO tr ZR tr		SMI
12N00057	99-117	BC	csi		73	QZ 66 FK 15 BT 4 CD 4 MS 4 FE 2 FP 1 GC 1 GN 1 HN 1 PR 1 AR tr BY tr CA tr GS tr OP tr PO tr SS tr ZR tr		SMI

FRACTION INTERPRETATION:
csi - Coarse Silt, 0.02-0.05 mm

MINERAL INTERPRETATION:

AR - Weatherable Aggregates	BT - Biotite	BY - Beryl	CA - Calcite	CD - Chert (Chalcedony
FE - Iron Oxides (Goethite	FK - Potassium Feldspar	FP - Plagioclase Feldspar	GC - Glass Coated Grain	GN - Garnet
GS - Glass	HN - Hornblende	MS - Muscovite	OP - Opaques	PO - Plant Opal
PR - Pyroxene	QZ - Quartz	SS - Sponge Spicule	ZR - Zircon	

INTERPRETATION (BY HORIZON):
SMIX - Mixed Sand

LOCATION MONONA IA+KS MO NE
Established Series
Rev. FFR-RAL-TWN
07/2004

MONONA SERIES

The Monona series consists of very deep, well drained soils formed in loess. These soils are on interfluves and side slopes on dissected till plains and risers and treads on loess covered stream terraces. Slopes range from 0 to 40 percent. Mean annual air temperature is about 10 degrees C (51 degrees F). Mean annual precipitation is about 71 centimeters (29 inches).

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Typic Hapludolls

TYPICAL PEDON: Monona silt loam, on a slope of 1 percent, in a cultivated field, at an elevation of 418 meters (1,370 feet) above sea level. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 18 centimeters (0 to 7 inches); very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine pores; slightly acid; clear smooth boundary.

A--18 to 38 centimeters (7 to 15 inches); very dark brown (10YR 2/2) and dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak very fine subangular blocky structure parting to weak very fine granular; friable; few very fine pores; slightly acid; clear smooth boundary. [Combined thickness of the A horizon is 25 to 61 centimeters (10 to 24 inches).]

Bw1--38 to 53 centimeters (15 to 21 inches); brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; common very fine pores; neutral; gradual smooth boundary.

Bw2--53 to 76 centimeters (21 to 30 inches); brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; many very fine pores; few very fine dark concretions (oxides); neutral; gradual smooth boundary. [Combined thickness of the Bw horizon is 30 to 114 centimeters (12 to 45 inches).]

C--76 to 152 centimeters (30 to 60 inches); brown (10YR 4/3) silt loam; massive; very friable; few very fine pores; many very fine dark concretions (oxides); common very fine distinct brown (7.5YR 4/4) relict redoximorphic concentrations; few fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; neutral grading with depth to slightly alkaline.

TYPE LOCATION: Major Land Resource Area (MLRA) 107; Harrison County, Iowa; about 7 miles east of Woodbine; about 67 meters (220 feet) north and 318 meters (1,044 feet) east of southwest corner of section 13, T. 80 N., R. 41 W.; USGS Portsmouth quadrangle; lat. 41 degrees 43 minutes 59 seconds N. and long. 95 degrees 34 minutes 22 seconds W., NAD 83.

RANGE IN CHARACTERISTICS:
Thickness of the mollic epipedon--25 to 61 centimeters (10 to 24 inches)
Depth to relict redoximorphic features--56 to 165 centimeters (22 to 65 inches)
Depth to carbonates--61 to more than 203 centimeters (24 to more than 80 inches)
Content of clay in the particle-size control section (weighted average)--20 to 27 percent
Content of sand in the particle-size control section (weighted average)--less than 5 percent

Clay content decreases regularly with depth

A or Ap horizon:
Hue--10YR
Value--2 or 3
Chroma--1 to 3
Texture--silt loam or silty clay loam
Clay content--20 to 35 percent
Sand content--less than 5 percent
Reaction--moderately acid to neutral

AB or BA horizon (if it occurs):
Hue--10YR
Value--2 or 3
Chroma--2 or 3
Texture--silt loam or silty clay loam
Clay content--20 to 30 percent
Sand content--less than 5 percent
Reaction--slightly acid or neutral
Thickness--0 to 6 inches

Bw horizon:
Hue--10YR
Value--4 or 5
Chroma--3 or 4
Texture--silt loam or silty clay loam
Clay content--20 to 27 percent
Sand content--less than 5 percent
Reaction--slightly acid or neutral

BC horizon (if it occurs):
Hue--10YR
Value--4 or 5
Chroma--3 or 4
Texture--silt loam
Clay content--18 to 26 percent
Sand content--less than 5 percent
Reaction--neutral or slightly alkaline
Thickness--0 to 12 inches

Redoximorphic features present in this horizon are believed to be relict and not considered to be related to present day saturation

C horizon:
Hue--10YR
Value--4 or 5
Chroma--3 to 6
Texture--silt loam
Clay content--18 to 24 percent
Sand content--less than 10 percent
Calcium carbonate equivalent--0 to 25 percent
Reaction--neutral to moderately alkaline
Redoximorphic features present in this horizon are believed to be relict and not considered to be related to present day saturation
Some pedons have sandy and gravelly sediments within a depth of 60 inches

COMPETING SERIES: These are the Annieville, Biggsville, Dinsmore, Exira, Galva, Keg, Marshall, Northboro, Ponca, Port Byron, Raddle, Salix, and Truman series.
Annieville--have a sand content of more than 10 percent within depths of 102 to 152 centimeters (40 to 60 inches)
Biggsville--have zones within a depth of 152 centimeters (60 inches) that are frequently saturated for periods longer than one month in most years
Dinsmore--have a sand content of 30 to 70 percent within depths of 102 to 152 centimeters (40 to 60 inches)
Exira--have a clay content of 30 to 35 percent in the particle-size control section and have many or common redoximorphic features within depths of 76 centimeters (30 inches)
Galva--have a clay content of 30 to 35 percent in the particle-size control section and have carbonates within depths of 81 to 183 centimeters (32 to 72 inches)
Keg--have a sand content of 10 to 35 percent in the lower half of the series control section
Marshall--have a clay content of 27 to 35 percent in the particle-size control section
Northboro--have cambic horizons with matrix hues of 5YR or 7.5YR
Ponca--have carbonates within a depth of 61 centimeters (24 inches)
Port Byron--are more acid throughout the series control section
Raddle--are more acid throughout the series control section and have a sand content of more than 5 percent in the lower half of the series control section
Salix--have a sand content of 15 to 60 percent in the lower third of the series control section and have carbonates within depths of 51 to 91 centimeters (20 to 36 inches)
Truman--have a sand content of more than 10 percent in the series control section

GEOGRAPHIC SETTING:
Parent material--loess
Landform--interfluves and side slopes on dissected till plains and risers and treads on loess covered stream terraces
Slopes--0 to 40 percent
Elevation--335 to 457 meters (1,100 to 1,500 feet) above sea level
Mean annual air temperature--8 to 12 degrees C (47 to 54 degrees F)

Mean annual precipitation--66 to 81 centimeters (26 to 32 inches)
Frost-free period--145 to 175 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Dow, Ida, Napier, and Steinauer soils.
Dow--are at lower elevations on side slopes, have carbonates within a depth of 25 centimeters (10 inches), and have a matrix chroma of 2 in the lower two thirds of the series control section
Ida--are at lower elevations on side slopes, have carbonates within a depth of 25 centimeters (10 inches), and have a matrix chroma greater than 2 in the lower two thirds of the series control section
Napier--are at lower elevations on base slopes and have a mollic epipedon 61 to 102 centimeters (24 to 40 inches) thick
Steinauer--are at lower elevations on side slopes, have carbonates within a depth of 25 centimeters (10 inches), and have a sand content of 20 to 52 percent in the particle-size control section

DRAINAGE AND PERMEABILITY:
Drainage class--well drained--saturation does not occur within a depth of 1.8 meters (6 feet) during the wettest periods of most years
Saturated hydraulic conductivity--moderately high
Surface runoff potential--negligible to high

USE AND VEGETATION:
Most areas are cultivated. Some steeply sloping areas are forested or pastured. The principal crops are corn, soybeans, small grains, and hay. The native vegetation is big bluestem, little bluestem, indiangrass, switchgrass, and other grasses of the tall grass prairie.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowland
Physiographic section--Dissected till plains
MLRAs--Nebraska and Kansas Loess-Drift Hills (106) and Iowa and Missouri Deep Loess Hills (107)
LRR M; western Iowa, northeastern Kansas, eastern Nebraska, and possibly northwestern Missouri along the Missouri River
Extent--large

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Monona County, Iowa, 1957.

REMARKS:
Particle-size control section--the zone from a depth of 25 to 100 centimeters (10 to 40 inches) (A, Bw1, Bw2, and C horizons);
series control section--the zone from the surface to a depth of 150 centimeters (0 to 60 inches) (Ap, A, Bw1, Bw2, and C horizons).

Diagnostic horizons and features recognized in this pedon:
mollic epipedon--the zone from the surface to a depth of 38 centimeters (15 inches) (Ap and A horizons);
cambic horizon--the zone from a depth of 38 to 76 centimeters (15 to 30 inches) (Bw1 and Bw2 horizons);
udic moisture regime.

Cation-exchange class is supported by lab sample number S87IA-155-003, NSSL.

Taxonomy version--Keys to Soil Taxonomy, ninth edition, 2003

The loess deposits are typically 24 to 32 feet thick but is as thin as 6 feet on some convex side slopes and as thin as 5 feet on loess covered stream terraces

ADDITIONAL DATA:
Laboratory data--Iowa State University, Ames, IA, many pedons
Laboratory data--National Soil Survey Laboratory, Lincoln, Nebraska, many pedons
(http://ssldata.sc.egov.usda.gov/)

National Cooperative Soil Survey
U.S.A.

Site 2c – South Exposures in the Loess Hills (Entisols and Inceptisols)

South and western exposures in the Loess Hills exhibit weaker soil development and lesser accumulations of soil of organic matter due to the greater sun exposure, and increased soil erosion rates owing to the influence of topography upon soil development. Mollisols dominate on north and eastern exposures.

In addition, south and west exposures are often dominated by grasslands as compared to woodlands on the cooler and more effectively moist north aspects. The influence of aspect upon soil development is apparent in the Loess Hills. Inseptisols and Entisols dominate on the south and west aspects.


95° 51' 43"
95° 51' 21"
41° 24' 55"
41° 24' 56"
260800
260850
260900
260950
261000
261050
261100
261150
261200
261250
261300
4588800
4588750
4588700
4588650
4588600
4588550
4588500
2G
10G
2G
12C
1F
41° 24' 44"
41° 24' 45"
95° 51' 42"
95° 51' 20"
Map Scale: 1:2,440 if printed on A size (8.5" x 11") sheet.
N
Meters
0 30 60 120 180
Feet
0 100 200 400 600

Soil Map–Pottawattamie County, Iowa
(Hitchcock Nature Center)

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:2,440 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:15,840.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Pottawattamie County, Iowa
Survey Area Data: Version 15, Jan 28, 2010

Date(s) aerial images were photographed: 9/13/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Pottawattamie County, Iowa (IA155)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1F	Ida silt loam, 20 to 30 percent slopes	0.6	2.1%
2G	Hamburg silt loam, 40 to 75 percent slopes	17.6	62.0%
10G	Monona silt loam, 30 to 40 percent slopes	7.6	26.6%
12C	Napier silt loam, 5 to 9 percent slopes	2.6	9.2%
Totals for Area of Interest		**28.4**	**100.0%**

Stop 3 - Bellevue, Sarpy County, NE – Anthroscapes and Human-altered –transported materials (closed landfill site)

- Arrive at closed Sarpy County landfill approximately 1:00pm. Unload from the buses at gate and meet just inside the gate, possibly near trees.
- Very brief orientation by Ken/Cam regarding tour activities at the landfill (5 minutes)
- Welcome– Duwaine Brigman, Director, Sarpy Environmental control (10 minutes)
- Split participants into two groups sending each to one of the two pit sites (45 minutes/site)

The capped and closed Sarpy County Landfill

Site 3a – Filled depression post closure

Site 3b – Original closure surface

Site 3a - Recent fill site – (north pit) – (Pit boss – Shawn McVey)

- Photographs of pit – (10 minutes)
- Discussion of site and ***Human-altered –transported materials, buried soils***– (10 minutes)
- Pick and Poke – (15 minutes)
- Soil Classification – (10 minutes)
- View and discuss this site and the soil formed in ***Human-altered –transported materials*** as well as the ICOMANTH Circular 7 proposals regarding surface mantle of new soil material and buried soils (summary attached at the end) for approximately 1 hour. (Anthropogenic soils classification discussions - No soil series identified)

Site 3b- Original surface – (south pit) – (Pit boss – Joe Chiaretti)

- Photographs of pit – (10 minutes)
- Discussion of site and ***Human-altered –transported materials*** – (10 minutes)
- Pick and Poke – (15 minutes)
- Soil Classification – (10 minutes)
- View and discuss this site and the soil formed in ***Human-altered –transported materials*** as well as the ICOMANTH Circular 7 proposals (summary attached at the end) for approximately 1 hour. (Anthropogenic soils classification discussions - No soil series identified)

Reconvene group to buses for final questions – (15 minutes) Depart landfill at 3:00PM

This stop is at the closed Sarpy County landfill in Bellevue, Nebraska. Duwaine Brigman, Director of the Sarpy County Division of Environmental Control, will speak to us regarding the history and closure of the landfill. The landfill has been closed for 23 years, hence time zero for soil formation is known. The pictures below represent the type of equipment used to close the landfill in the late 1980's.

Figures xx. Heavy equipment used to compact and create the earthen cap when closing the Sarpy County, Nebraska landfill in the late 1980's.

The entire property is a "constructional" anthropogenic landform (i.e., sanitary landfill). The landfill did not exist at the time the field work for a prior soil survey was conducted between 1963 and 1969. The property is currently mapped and delineated in the Sarby County soil survey area (NE153) as map unit 9967--Sanitary landfill, but no soil property data is provided. Null data is not permitted for human-created landforms which are soil-covered, such as landfills. Landfills are not an approved kind of miscellaneous area for the National Cooperative Soil Survey and standards now dictate that soils be correlated and property data populated for closed (i.e., soil-covered) landfills.

The final recommendations of ICOMANTH proposed changes for human-transported material (HTM), buried soils, the surface mantle of new soil material, and human-altered and human–transported material family classes that will be discussed here. We will observe 2 soils formed in the landfill cap. Nitrile gloves are available for your use at this site. Please use them and avoid getting any of the soil material in your mouth or on any other mucous membranes. If you note the trace element data, the ^Bwb1 horizon at pit 1 contains elevated levels of Hg. The soils were described by Dan Pulido, Valerie Jaehrling, Steve Montieth, Shawn McVey, Dan Shurtliff, and Ken Scheffe.

Soils at pit one experienced settling several years ago and ponded water. The original design of the landfill cap was to shed water and minimize infiltration. Additional fill was brought in 3 years ago to eliminate the ponding and help stop further settling. As a result, pit 1 contains a buried soil under a 47 cm mantle of new soil material. The proposed ICOMANTH changes eliminate the sliding scale (30-50 cm) used for HTM and this soil would no longer be classified as a buried soil in *Soil Taxonomy*. The ICOMANTH proposal for HATM material classes would place this soil in a spolic class even though subsidence is known to have occurred at the site.

The soil at pit 2 contains many artifacts and what we believe to be reduction of iron without saturation by ground water. No evidence for a perched water table (i.e., episaturation) or a seasonal high water table (i.e., endosaturation) exists for the site. Methane production is assumed given the artifacts present in the soil and the unpleasant smells (e.g., methanethiol or methyl mercaptan) associated with rotting garbage. Methane production from a landfill such as this would drive out the oxygen from the soil and provide a carbon source for reduction reactions to occur. The ICOMANTH proposal for HATM material classes would place this soil in a methanogenic class. The methanogenic class is the first class in the key to human-altered and human-transported material classes to highlight the significance of using soils which potentially emit dangerous amounts of methane gas.

The soil at pit 2 contains a weakly developed cambic horizon, as does the buried soil at pit 1. Is a few decades adequate elapsed time for pedogenic processes to form cambic horizons in the absence of fluctuating ground water?

INTERNATIONAL COMMITTEE FOR CLASSIFICATION OF ANTHROPOGENIC SOILS

FINAL RECOMMENDATIONS

April 15, 2011

TO: National Cooperative Soil Survey Partners and Other Colleagues Interested in Soil Classification
FROM: John M. Galbraith, Chairman of ICOMANTH
Department of Crop and Soil Environmental Sciences
Virginia Polytechnic Institute and State University
239 Smyth Hall (0404)
Blacksburg, VA 24061 USA

SUBJECT: Request for Review of Final Recommendations for Changes to US Soil Taxonomy for Inclusion and Standardization of Taxa for Human-Altered and Human-Transported Soils.

Summary of Proposed Changes and Rationale, compiled from seven Circular Letters and responses. All documents are available at the ICOMANTH web site: http://clic.cses.vt.edu/ICOMANTH/

Circular letter 1 (August-1995) – Established committee charges, and posed four basic questions about "anthropogenic" soils. Responses were summarized.

Circular Letter 2 (August, 1997) – Discussed terms to compile human activities and human-modified materials, a brief history of the ways that human modified or transported soils have been recognized in Soil Taxonomy, and posed 18 conceptual questions for the committee members.

Circular letter 3 (January, 1998) – Compiled responses to the questions from Circular 2 and asked 10 more questions in anticipation of the International Tour of NV and CA in 1998. Robert Ahrens and Robert Engel, USDA-NRCS Soil Taxonomy staff supported the tour, funded through World soil resources and Hari Eswaran, organized by Terry Cook and Roger Poff, soil scientist consultants.

Circular letter 4 (July, 2003) – Announced distribution of Version 1.0 of the Anthropogenic Soils CD-ROM, announced new committee activities, discussed additions and changes to Soil Taxonomy, answered commonly-asked questions, and solicited reader feedback to new questions.

Circular letter 5 and 6 (March, 2005; June, 2006) – Proposed changes to the USDA-NRCS soil survey system. Announced distribution of Version 2.0 of the Anthropogenic Soils CD-ROM. The USDA-NRCS system is defined here to include Soil Taxonomy (Soil Survey Staff, 1999), Keys to Soil Taxonomy (Soil Survey Staff, 2003), the Soil Survey Manual (SSM) (Soil Survey Division Staff, 1993), NASIS, the National Soil Survey Handbook (NSSH) (USDA-NRCS, 2003), and the Field Book for Describing and Sampling Soils (Schoeneberger et al., 2002). Provided examples of applications of the proposed changes, and the rationale behind some of the proposals. Almost all were adopted and implemented under the direction of Craig Ditzler, USDA-NRCS, Lincoln, NE.

Circular Letter 7 (December, 2010) – Following field tours, feedback from field soil scientists and academics, SUITMA meeting in New York City, and responses from the international community, ICOMANTH has made its recommendations for creating new classes at the family level and new taxa at the subgroup level of US Soil Taxonomy. Changes were proposed for definitions of diagnostic materials, and changes proposed to the National Soil Survey Handbook to include anthropogenic microfeatures and landforms.

ICOMANTH has met the charges of the committee and will disband with the formal proposal for amendment of Soil Taxonomy, to be reviewed at the National Cooperative Soil Survey Conference in the summer of 2011. Additional efforts may include the compilation of distribution of Version 3.0 of the Anthropogenic Soils CD-ROM. The ICOMANTH web site will be maintained.

A summary of the changes accepted and proposed by ICOMANTH to be added to the NRCS soil survey system and Soil Taxonomy include:

1) Definition of human-transported materials added to Soil Taxonomy.
2) Definition of anthropogenic features added to Soil Taxonomy.
3) Manufactured layers and manufactured layer contact defined, added to Soil Taxonomy.
4) Proposal to add "^" (caret) before the master horizon letter of horizons and layers formed in human-transported materials accepted. Caret added to list of Master Horizon prefixes, added to Soil Taxonomy.
5) Proposal to add new master horizon letter M for human-manufactured impervious subsurface layers [geotextile liners, asphalt, concrete, rubber, and plastic] accepted, added to Soil Taxonomy.
6) Proposal to add "u" as a choice of suffix lowercase letters to indicate the presence of artifacts was accepted, added to Soil Taxonomy.
7) Definition of terms for artifacts added to NRCS soil survey system including National Soil Survey Handbook and NASIS:
   a) Artifacts defined.
      1) Safety categories added (not accepted).
      2) Size Categories added (not accepted).
      3) Type categories defined (not accepted, individual type described).
      4) Rupture resistance (use the same as for other soil material).
      5) Texture Modifiers (categories added for artifactual, very artifactual, extremely artifactual using the same percentage volume as rock fragments). Added artifacts as a term in lieu of texture [similar to fragmental].
   b) Modification of definition of fragments to include artifacts.

8) Current proposals to amend Soil Taxonomy, to be evaluated May, 2011 at the National Soil Survey Conference in Asheville, NC:

CHAPTER 1. CHANGES TO THE DEFINITION OF "BURIED SOILS"

Proposed Action 1: Change the definition of buried soils to list plaggen epipedon and human-transported material as equivalent to the mantle.

CHAPTER 3. CHANGES TO HORIZONS AND CHARACTERISTICS OF MINERAL SOILS

Proposed Action 2: Insert a more explicit definition before the required characteristics for the anthropic epipedon

Proposed Action 3: Modify the definition of the anthropic epipedon to delete some requirements that are the same as mollic epipedon, exclude evidence of long-term manuring, modify the minimum thickness, and modify the carbon requirement.

Proposed Action 4: Change item 7 of the definition of the mollic epipedon on page 8 and the umbric epipedon to exclude human-transported materials, anthraquic conditions, artifacts, and intentional additions of human-applied organic amendments to meet the minimum organic carbon content.

Proposed Action 5: Change the definition of plaggen epipedon to include reference to the ad hoc proposal to amend the National Soil Survey Handbook, *Part 629:* Glossary of Landform and Geologic Terms where raised landforms are discussed, and mention of human-altered and human-transported materials.

Proposed Action 6: Change the following parts of the definition of folistic, histic, and melanic epipedons to exclude them from meeting the definition of anthropic epipedon.

Proposed Action 7: Add definition of Artifacts to Chapter 3.

Proposed Action 8: Add: Definition of Human-altered Material to Chapter 3, including a specific description and evidence (e.g., similar to the evidence listed for lithologic discontinuity rather than the specific criteria requirements for andic soil properties).

Proposed Action 9: Add definition of Human-transported Material to Chapter 3, including a specific description and evidence (e.g., similar to the evidence listed for lithologic discontinuity rather than the specific criteria requirements for andic soil properties).

Proposed Action 10: Add definition of Manufactured Layer to Chapter 3.

Proposed Action 11: Add definition of Manufactured Layer Contact to Chapter 3.

Proposed Action 12: Modify and move definition of Surface Mantle of New Soil Material from Chapter 1 to Chapter 3. Criteria listed in a format consistent with other defined materials.

CHAPTER 4. MODIFICATION TO THE KEY TO SOIL ORDERS

Proposed Action 13: Modify the Key to Soil Orders for Inceptisols to include anthropic and folistic epipedons to the list of epipedons (such as histic, mollic, or umbric) that qualify soils in the order.

CHAPTER 5-16: CHANGES IN KEYS IN MULTIPLE PLACES

Changes to Chapter 7: Key to Aridisols.

Proposed Action 14: Delete Anthracambids great group and Typic Anthracambids subgroup.

Changes to Chapter 8: The Key to Entisols.

Proposed Action 15: Delete the Key to Arents, and the Key to Great Groups of Arents. Move Torriarents and Xerarents from a suborder to subgroup level.

Proposed Action 16: Delete the Key to Arents, and the Key to Great Groups of Arents. Move Ustarents and Udarents from a suborder to subgroup level recognition.

Proposed Action 17: Delete the Plagganthreptic intergrade subgroup of Udipsamments.

Proposed Action 18: Delete the subgroup of Anthropic Torrifluvents.

Proposed Action 19: Add an exclusionary statement to Fluvents to prevent human-transported soils from being classified as Fluvents. These soils would then be classified as Orthents.

Proposed Action 20: Add an exclusionary statement to Fluvaquents on page 124 to prevent human-transported soils from being classified as Fluvaquents. These soils would then be classified as Epiaquents or Endoaquents.

Changes to Chapter 11: Key to Suborders of Inceptisols.

Proposed Action 21: Eliminate Anthrepts.

Changes to Chapter 14: Key to Spodosols.

Proposed Action 22: Eliminate Plagganthreptic Fragiaquods.

Proposed Action 23: Eliminate Plagganthreptic Haplohumods.

Proposed Action 24: Eliminate Plagganthreptic Alorthods.

Proposed Action 25: Eliminate Plagganthreptic Fragiorthods.

Changes to Chapter 15: key to Ultisols.
Proposed Action 26: Delete the subgroup of Anthropic Kandihumults.

Proposed Action 27: Delete the subgroup of Anthropic Kanhaplohumults.

CHANGES THROUGHOUT SOIL TAXONOMY
Proposed Action 28: Add an exclusionary statement to subgroups that contain the terms Fluventic or ____fluventic throughout the Keys to prevent human-transported soils from being classified in those taxa. These pertain to Irregular Decrease in OC with depth.

Proposed Action 29: Clearly define and propose a consistent set of additional extragrade subgroup formative elements for use throughout Soil Taxonomy, to be added as soil series are established.

Anthraltic (from Gr. *Anthropos,* Human and L. *alterāre,* to change).
Anthraquic (clearly defined anthraquic conditions).
Anthropic Humic (have an anthropic epipedon and meets the color and carbon requirements of the mollic epipedon throughout).
Anthropic (have an anthropic epipedon).
Anthroportic (from Gr. *Anthropos* Human and L. *portāre* to carry) (i.e., the materials described in the Arents suborder).
Plaggic (have an plaggen epipedon)
Plagghaplic (have 25 cm of material that qualifies for plaggen epipedon but not ther required 50 cm).

Combinations with existing formative elements at the subgroup level are encouraged as needed.

CHAPTER 17: FAMILY AND SERIES DIFFERENTIAE AND NAMES
Proposed Action 30: Add Add Human-altered and human–transported Material Family Class in Chapter 17 to be used for soils with significant mantles of human-altered or human-transported materials. To be inserted between Particle-size classes and their substitutes and Mineralogy classes in soils that use one of the set of additional extragrade subgroup formative elements in Proposed Action 29 and others clearly tied to human-altered or human-transported materials added later. The 17 classes are defined in order of importance to human health and safety and use and management of the soil, the control section defined, and the taxa identified where they are to be used.

Proposed Action 31: The manufactured layer contact is added to the list of root-limiting layers for mineral soils.

Proposed Action 32: The manufactured layer contact is added to the list of root-limiting layers for Histels.

Proposed Action 33: The manufactured layer contact is added to the list of root-limiting layers for Histosols.

APPENDIX
Proposed Action 34: Add two references.

Proposed Action 35: Delete this reference to citric acid since it is no longer proposed to be used in the definition of the anthropic epipedon.

9) An ad-hoc proposal to amend Part 629 of the National Soil Survey Handbook (Glosssary of Landform and Geologic Terms) to include several new anthropogenic microfeatures (less than the size of a pedon) and anthropogenic landforms.

Soil Map—Sarpy County, Nebraska
(Sarpy Co Landfill (closed))

Map Unit Legend

Sarpy County, Nebraska (NE153)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
7234	Judson silty clay loam, 2 to 6 percent slopes	5.3	3.2%
7235	Judson-Nodaway channeled-Contrary complex, 3 to 10 percent slopes	11.8	7.1%
8035	Marshall-Contrary silty clay loams, 2 to 7 percent slopes	2.3	1.4%
8155	Contrary-Monona silty clay loams, 6 to 11 percent slopes	41.2	25.0%
8157	Contrary-Monona-Ida complex, 6 to 17 percent slopes	4.8	2.9%
9719	Urban land-Udorthents-Marshall complex, 0 to 9 percent slopes	29.3	17.7%
9720	Urban land-Udorthents-Pohocco complex, 0 to 16 percent slopes	35.8	21.7%
9967	Sanitary landfill	34.6	21.0%
Totals for Area of Interest		**165.0**	**100.0%**

PEDON DESCRIPTION

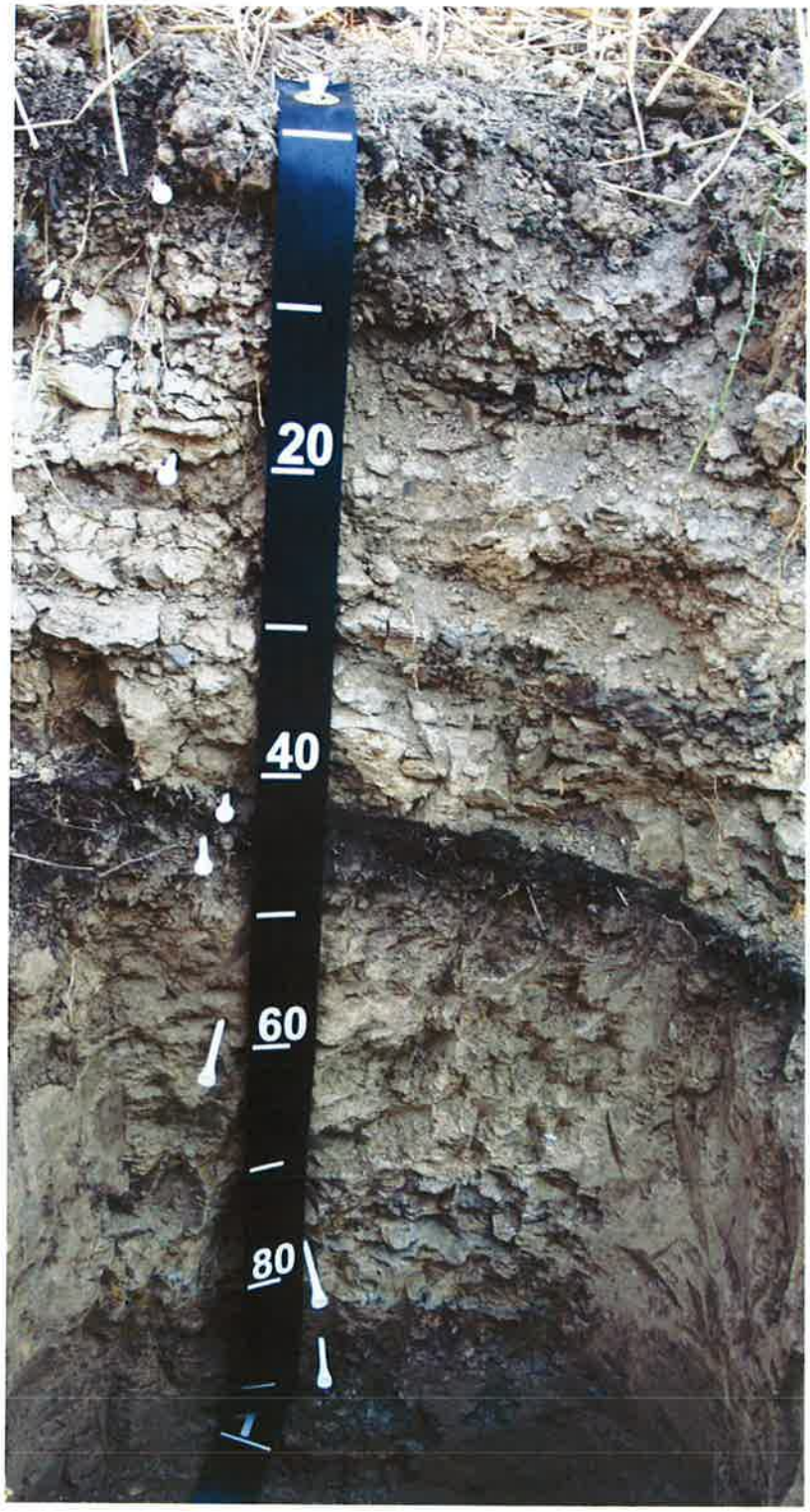
Print Date: 03/29/2012
Description Date: 10/7/2011
Describer: D. Pulido, V. Jaehrling, S. Monteith
Site ID: S11NE153001
Site Note: Site is in original landfill cap placed 21 years with about 50 cm of fill and grading 1 year ago to treat settling and ponding.
Pedon ID: S11NE153001
Pedon Note:
Lab Source ID: SSL
Lab Pedon #: 12N0009
Soil Name as Described/Sampled: Sanitary Landfill #1
Soil Name as Correlated:
Classification: Fine-silty, mixed, superactive, nonacid, mesic Typic Udifluvents
Pedon Type:
Pedon Purpose:
Taxon Kind:
Associated Soils:
Physiographic Division: Interior Plains
Physiographic Province: Central Lowland Province
Physiographic Section: Dissected till plains
State Physiographic Area:
Local Physiographic Area:
Geomorphic Setting: on summit of hill
on summit of upland
on summit of sanitary landfill
Upslope Shape: linear
Cross Slope Shape: concave
Particle Size Control Section: 25 to 100 cm.
Description origin: NASIS

Country: USA
State: Nebraska
County: Sarpy
MLRA: 107B -- Iowa and Missouri Deep Loess Hills
Soil Survey Area: NE153 -- Sarpy County, Nebraska
Map Unit: 9967—Sanitary landfill
Quad Name:
Legal Description:
Latitude: 41 degrees 9 minutes 51.95 seconds north
Longitude: 95 degrees 57 minutes 24.77 seconds west
Datum:
UTM Zone:
UTM Easting:
UTM Northing:
Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Other grass/herbaceous cover
Existing Vegetation: annual sunflower, ragweed
Parent Material: human transported material
Bedrock Kind:
Bedrock Depth:
Bedrock Hardness:
Bedrock Fracture Interval:
Surface Fragments:
Description database: NSSL

Diagnostic Features: ochric epipedon 0 to 8 cm.
ochric epipedon 47 to 50 cm.
cambic horizon 50 to 83 cm.

Cont. Site ID: S11NE153001 **Pedon ID:** S11NE153001

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
1.0	335.3	90						well		



Soil Profile at Stop 3A (Landfill Site #1) showing recent burial of original landfill cap seen below 40+ cm.

^AC--0 to 8 centimeters; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2), dry; weak fine granular structure; firm, slightly hard, slightly sticky, slightly plastic; common very fine and fine roots throughout; few very fine and fine interstitial pores; abrupt smooth boundary.

^C1--8 to 24 centimeters; brown (10YR 4/3) silt loam, brown (10YR 5/3), dry; 15 percent fine faint (10YR 5/3) mottles; weak medium angular blocky, and moderate medium platy structure; very firm, hard, slightly sticky, slightly plastic; common very fine roots throughout; few very fine interstitial pores; clear smooth boundary.

^C2--24 to 47 centimeters; brown (10YR 4/3) silt loam, pale brown (10YR 6/3), dry; 15 percent fine faint (10YR 4/4) mottles; moderate medium angular blocky structure; firm, hard, slightly sticky, slightly plastic; few very fine roots between peds; few very fine interstitial pores; 7.5YR 3/4 iron-manganese masses on faces of peds and manganese coatings along root channels; abrupt smooth boundary.

^Ab--47 to 50 centimeters; black (7.5YR 2.5/1) silt loam, very dark brown (7.5YR 2.5/2), dry; weak fine subangular blocky, and weak fine granular structure; friable, moderately hard, slightly sticky, slightly plastic; very few very fine and fine roots throughout; few very fine and fine irregular pores; abrupt smooth boundary.

^Bwb1--50 to 64 centimeters; brown (10YR 4/3) silt loam, yellowish brown (10YR 5/4), dry; 15 percent fine faint (10YR 2/1) mottles; massive; firm, slightly hard, slightly sticky, slightly plastic; very few very fine roots throughout; few very fine interstitial and tubular pores; 10 percent 7.5YR 3/4 iron-manganese masses; clear wavy boundary.

^Bwb2--64 to 83 centimeters; brown (10YR 4/3) silt loam, pale brown (10YR 6/3), dry; weak fine and medium platy structure; firm, moderately hard, slightly sticky, slightly plastic; few very fine roots throughout; few very fine interstitial and tubular pores; 7.5YR 2.5/1 manganese coatings on faces of peds and 2 percent 7.5YR 4/4 iron-manganese masses; clear wavy boundary.

^C'1--83 to 92 centimeters; brown (10YR 4/3) silt loam, brown (10YR 5/3), dry; massive; firm, moderately hard, slightly sticky, slightly plastic; few very fine roots throughout; few very fine interstitial pores; 15 percent 7.5YR 4/4 iron-manganese masses and 20 percent 10YR 4/2 iron depletions; clear wavy boundary.

^C'2--92 to 102 centimeters; dark yellowish brown (10YR 4/4) silt loam, brown (10YR 5/3), dry; moderate medium angular blocky structure; firm, moderately hard, slightly sticky, slightly plastic; few very fine roots throughout; few very fine interstitial pores; 3 percent 7.5YR 4/4 iron-manganese masses in matrix and 10 percent 10YR 4/2 iron depletions on faces of peds and 30 percent 7.5YR 2.5/1 manganese coatings on faces of peds.

Seq. #	Horizon depth (cm)	Horizon designation		Diagnostic horizon		Diagnostic characteristics or properties		Diagnostic materials	
		Tour Book	Tour	Soil Taxonomy	World Reference Base	Diagnostic characteristics of Soil Taxonomy	Diagnostic properties of World Reference Base	Soil Taxonomy	World Reference Base
1	0 8	^AC	~	ochric epipedon 2.)		free carbonates		mineral soil material	calcaric material, mineral material
2	8 24	^C1	~	2.)				mineral soil material	mineral material
3	24 47	^C2	~	2.)				mineral soil material	mineral material
4	47 50	^Ab	~	buried ochric epipedon				mineral soil material	mineral material
5	50 64	^Bwb1	~	buried cambic horizon	buried cambic horizon	free carbonates		mineral soil material	calcaric material, mineral material
6	64 83	^Bwb2	~	buried cambic horizon	buried cambic horizon	free carbonates		mineral soil material	calcaric material, mineral material
7	83 92	^C'1	~					mineral soil material	mineral material
8	92 102	^C'2	~			free carbonates		mineral soil material	calcaric material, mineral material

Taxonomic Classifications of SND (12N0009)

Soil Taxonomy

KST, 11th ed. 2010 Fine-silty, mixed, superactive, nonacid, mesic Typic Udifluvents

ICOMANTH (2-22-2012) Fine-silty, spolic, mixed, superactive, mesic Anthroportic Eutrudepts 3., 4.)

WRB Haplic Cambisols (Humic, Hypereutric, Siltic, Escalic?, Transportic) 5., 6., 7.)

1.) Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th ed. USDA-Natural Resources Conservation Service, Washington, DC.

IUSS Working Group WRB. 2007. World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No.103. FAO, Rome.

2.) These horizons constitute the "surface mantle of new soil material" as defined for buried soils in Chapter 1 of Soil Taxonomy and the Keys to Soil Taxonomy. Their aggregate thickness (47 cm) is within the range of 30 to 50 cm and equals at least half of the total thickness (i.e., 36 cm × 0.5 = 18 cm) of the named diagnostic horizons that are preserved in the buried soil. The current classification (based on KST, 2010) reflects presence of a buried soil.

3.) The ICOMANTH classification reflects the presence of human-transported material (HTM) on a constructional anthropogenic landform (landfill) and less than 50 cm of HTM mantling the underlying genetic horizons (formed in an older deposit of HTM).

4.) Pedon would classify in either the methanogenic or subsidic class if the proposed control section for human-altered and human-transported material classes extended to 200 cm.

5.) Weighted average organic carbon content is 2 percent in upper 50 cm of soil (i.e., Humic qualifier).

6.) Since new material is less than 50 cm thick, the buried soil is classified at the first level.

7.) Is the Escalic qualifier intended only for agricultural terraces?
The Transportic qualifier was used alone without the Novic qualifier to avoid redundancy. Is the Novic qualifier intended for natural parent materials instead of human-made materials?

*** Primary Characterization Data ***

Pedon ID: S11NE153001 (Sarpy, Nebraska) Print Date: May 18 2012 1:51PM
Sampled as on Oct 07, 2011: SND ; Coarse-silty, mixed, mesic Typic Udifluvent
Revised to :

SSL - Project C2012USNE004 IUSS Tour
- Site ID S11NE153001 Lat: 41° 9' 51.94" north Long: 95° 57' 24.76" west NAD83 MLRA: 107B
- Pedon No. 12N0009
- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
12N00026	^A		0.0-8.0	S11NE153001-1			SIL	SIL
12N00027	^C1		8.0-24.0	S11NE153001-2			SIL	SIL
12N00028	^C2		24.0-47.0	S11NE153001-3			SIL	SIL
12N00029	^Ab		47.0-50.0	S11NE153001-4			SIL	SIL
12N00030	^Bw1b		50.0-64.0	S11NE153001-5			SIL	SIL
12N00031	^Bw2b		64.0-83.0	S11NE153001-6			SIL	SIL
12N00032	^C'3b		83.0-92.0	S11NE153001-7			SIL	SIL
12N00033	^C'4b		92.0-102.0	S11NE153001-8			SIL	SIL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	2.737	% wt
Volume, >2mm, Weighted Average	0.612	% vol
Clay, total, Weighted Average	24.629	% wt
Clay, carbonate free, Weighted Average	24.629	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 4	0.887	(NA)
LE, Whole Soil, Summed to 1m	3.4	cm/m

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - - - Total - - -)			(- - Clay - - -)		(- - - - Silt - - -)			(- - - - - - - - - - - - Sand - - - - - - - - - - -)				(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - - - - Weight - - -)				>2 mm
				< .002	.002 -.05	.05 -2	< .0002	< .002	.002 -.02	.02 -.05	.05 -.10	.10 -.25	.25 -.50	.5 -1	1 -2	2 -5	5 -20	20 -75	.1- 75	wt % whole
Layer	Depth (cm)	Horz	Prep	(- % of <2mm Mineral Soil -)												(- - - - - - - % of 75mm)				soil
				3A1a1a			3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a
12N000260-8		^A	S	25.3	70.5	4.2	13.9	--	32.8	37.7	2.7	0.4	0.6	0.3	0.2	1	1	--	3	2
12N000278-24		^C1	S	25.4	71.6	3.0	14.2	--	31.0	40.6	2.7	0.2	0.1	tr	tr	--	--	--	tr	--
12N0002824-47		^C2	S	26.0	70.5	3.5	14.5	--	30.2	40.3	3.0	0.3	0.1	0.1	tr	--	--	--	tr	--
12N0002947-50		^Ab	S	24.3	55.4	20.3	6.8	--	29.2	26.2	3.3	4.8	4.9	4.2	3.1	7	3	--	25	10
12N0003050-64		^Bw1b	S	22.4	72.7	4.9	11.2	--	33.4	39.3	2.2	0.7	1.3	0.3	0.4	1	tr	--	4	1
12N0003164-83		^Bw2b	S	23.1	73.6	3.3	9.0	--	34.9	38.7	2.2	0.4	0.3	0.2	0.2	1	1	--	3	2
12N0003283-92		^C'3b	S	26.4	69.7	3.9	12.2	--	29.9	39.8	3.5	0.2	0.1	0.1	--	tr	--	--	tr	tr
12N0003392-102		^C'4b	S	26.6	68.3	5.1	14.6	--	28.1	40.2	4.5	0.4	tr	0.1	0.1	tr	tr	--	1	1

*** Primary Characterization Data ***

Pedon ID: S11NE153001 (Sarpy County, Nebraska) Print Date: May 18 2012 1:51

Sampled As : SND Coarse-silty, mixed, mesic Typic Udifluvent

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0009

Bulk Density & Moisture

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(Bulk Density)		Cole	(- - - - - - - - - - Water Content - - - - - - - - -)						WRD	Aggst		
				33	Oven	Whole	6	10	33	1500	1500 kPa	Ratio	Whole	Stabl	(- - Ratio/Clay	
	Depth			kPa	Dry	Soil	kPa	kPa	kPa	kPa	Moist	AD/OD	Soil	2-0.5mm	CEC7	1500 kPa
Layer	(cm)	Horz	Prep	(- - - g cm^{-3} - - -)			(- - - - - - - - - - - - pct of < 2mm - - - - - - - -)						cm^3 cm^{-3}	%		
				DbWR1	DbWR1				DbWR1	3C2a1a		3D1				
12N00026	0-8	^A	S	1.31	1.41	0.025			17.1	14.8		1.027	0.03		0.96	0.58
12N00027	8-24	^C1	S	1.52	1.69	0.036			24.3	13.3		1.023	0.17		0.74	0.52
12N00028	24-47	^C2	S	1.49	1.65	0.035			22.7	14.3		1.024	0.13		0.77	0.55
12N00029	47-50	^Ab	S	0.77	0.99	0.084			45.3	41.0		1.050	0.03		2.71	1.69
12N00030	50-64	^Bw1b	S	1.48	1.60	0.026			26.7	12.3		1.023	0.21		0.91	0.55
12N00031	64-83	^Bw2b	S	1.54	1.68	0.029			24.2	12.2		1.025	0.18		0.85	0.53
12N00032	83-92	^C'3b	S	1.52	1.72	0.042			21.4	13.2		1.026	0.12		0.76	0.50
12N00033	92-102	^C'4b	S	1.64	1.80	0.031			20.7	13.6		1.026	0.12		0.74	0.51

Water Content

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(- - Atterberg -)		(- - - - - Bulk Density - - -)	(- Water Content - - - - - - - - - -									
				(- - - Limits - - -)		Field	Recon 33	Recon Oven	Field	Recon 33	(- - - - - - - - - - - - - - - Sieved Samples - - - - - - - -					
				LL	PI		kPa	Dry		kPa	6 kPa	10 kPa	33 kPa	100 kPa	200 kPa	500 kPa
	Depth															
Layer	(cm)	Horz	Prep	pct <0.4mm		(- - - - - - - - g cm^{-3} - - - -)			(- % of < 2mm - - - - - - - - - - - - - - - - - -							
															3C1e1a	
12N00026	0-8	^A	S												21.2	
12N00027	8-24	^C1	S												19.4	
12N00028	24-47	^C2	S												20.8	
12N00029	47-50	^Ab	S												47.4	
12N00030	50-64	^Bw1b	S												18.1	
12N00031	64-83	^Bw2b	S												18.7	
12N00032	83-92	^C'3b	S												19.5	
12N00033	92-102	^C'4b	S												19.8	

Carbon & Extractions

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-1
				(- - - - - Total - - -)			Est	OC	C/N	(- - - Dith-Cit Ext)			(- - - - - - Ammonium Oxalate Etraction						(- Na Pyro-Phospha			
	Depth			C	N	S	OC	(WB)	Ratio	Fe	Al	Mn	Al+½FeODOEFe		Al	Si	Mn	C	Fe	Al	Mi
Layer	(cm)	Horz	Prep	(- - - - - % of <2 mm - - - - -)						(- % of < 2mm - - - - - - -)							mg kg^{-1}	(- - - - - % of < 2mm				
				4H2a	4H2a	4H2a				4G1	4G1	4G1		4G2a	4G2a	4G2a	4G2a	4G2a		4G3	4G3	4C
12N000260-8		^A	S	3.52	0.34	0.04	3.2		10	0.8	0.1	tr	0.21	0.10	0.25	0.08	0.05	400.5		0.5	0.5	0.(
12N000278-24		^C1	S	0.67	0.10	--	0.5		5	0.9	0.1	tr	0.24	0.04	0.29	0.09	0.05	475.2		0.5	0.7	tr
12N0002824-47		^C2	S	0.64	0.07	--	0.5		7	0.9	0.1	0.1	0.26	0.05	0.32	0.10	0.05	568.0		0.5	0.7	0.(
12N0002947-50		^Ab	S	16.65	1.35	0.11	16.1		12	0.6	tr	0.1	0.27	0.59	0.34	0.10	0.04	460.2		0.3	--	0.(
12N0003050-64		^Bw1b	S	1.09	0.13	--	0.7		6	0.8	tr	tr	0.20	0.05	0.26	0.07	0.05	682.6		0.3	0.3	0.(
12N0003164-83		^Bw2b	S	0.79	0.06	--	0.2		3	0.8	tr	0.1	0.19	0.02	0.24	0.07	0.06	664.7		0.3	0.3	--
12N0003283-92		^C'3b	S	0.43	0.03	--	0.2		8	1.0	0.1	0.1	0.24	0.03	0.27	0.10	0.05	505.3		0.5	0.5	--
12N0003392-102		^C'4b	S	0.34	0.04	--	0.2		5	0.8	0.1	tr	0.19	0.02	0.18	0.10	0.05	325.5		0.5	0.8	--

*** Primary Characterization Data ***

Pedon ID: S11NE153001 (Sarpy County, Nebraska) Print Date: May 18 2012 1:51PM

Sampled As : SND Coarse-silty, mixed, mesic Typic Udifluvent

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0009

CEC & Bases

Layer	Depth (cm)	Horz	Prep	-1- Ca	-2- Mg	-3- Na	-4- K	-5- Sum Bases	-6- Acidity	-7- Extr Al	-8- KCl Mn	-9- CEC8 Sum Cats	-10- CEC7 NH_4 OAC	-11- ECEC Bases +Al	-12- Al Sat	-13- Sum	-14- NH_4OAC
				(- - - NH_4OAC Extractable Bases - - -)												(- -- Base -- -) (- Saturation -)	
				(- - - - - - - - - - - - - - - cmol(+) kg^{-1} - - - - - - - - - - - - - - -)							mg kg^{-1}	(- - - - cmol(+) kg^{-1} - - -)				(- - - - - - - % - - - - - - -)	
				4B1a1a	4B1a1a	4B1a1a	4B1a1a		4B2b1a				4B1a1a				
12N00026	0-8	^A	S	36.0*	8.7	--	1.3	46.0	3.3				24.3				100
12N00027	8-24	^C1	S	19.6*	7.8	--	0.5	27.9	2.4				18.9				100
12N00028	24-47	^C2	S	19.6*	8.6	--	0.7	28.9	2.7				19.9				100
12N00029	47-50	^Ab	S	87.4*	14.0	--	1.9	103.3	13.2				65.8				100
12N00030	50-64	^Bw1b	S	26.5*	9.1	--	0.9	36.5	0.4				20.4				100
12N00031	64-83	^Bw2b	S	37.1*	11.0	--	0.5	48.6					19.6				100
12N00032	83-92	^C'3b	S	18.3*	10.5	--	0.5	29.3	0.9				20.1				100
12N00033	92-102	^C'4b	S	15.3*	11.1	--	0.5	26.9	2.2				19.6				100

*Extractable Ca may contain Ca from calcium carbonate or gypsum. CEC7 base saturation set to 100.

Salt

Layer	Depth (cm)	Horz	Prep	-1- Ca	-2- Mg	-3- Na	-4- K	-5- CO_3	-6- HCO_3	-7- F	-8- Cl	-9- PO_4	-10- Br	-11- OAC	-12- SO_4	-13- NO_2	-14- NO_3	-15- H_2O	-16- Total Salts	-17- Elec Cond	-18- Pred Elec Cond	-19- Exch Na	-20- SAR
				(- Water Extracted From Saturated Paste - - - - -)																			
				(- - - - - mmol(+) L^{-1} - -)(- mmol(-) L^{-1} - - - - - - - - -)(- - - - % - -)												(- - dS m^{-1} - -)		%	
				4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2		4F2	4F1a1a1		
12N000260-8		^A	S	5.2	2.5	1.4	1.0	--	4.9	tr	1.6	--	--	--	1.9	0.2	0.1	68.9		0.87	0.41	--	
12N000278-24		^C1	S	6.4	3.2	2.9	0.2	--	2.4	tr	2.7	--	--	--	6.5	0.1	--	62.6		1.15	0.49	--	
12N0002824-47		^C2	S	5.4	3.0	1.3	0.2	--	2.3	--	2.4	--	--	--	4.5	0.1	--	68.1		0.94	0.49	--	
12N0002947-50		^Ab	S	9.1	3.4	0.9	0.8	--	5.9	0.1	2.4	--	--	--	3.4	0.2	0.1	157.2		1.18	1.24	--	
12N0003050-64		^Bw1b	S	5.0	2.3	1.0	0.3	--	2.9	--	1.9	--	--	--	2.9	0.1	tr	65.0		0.81	0.44	--	
12N0003164-83		^Bw2b	S	5.3	3.4	1.9	0.1	--	2.1	tr	1.9	--	--	--	5.7	0.1	tr	65.3		0.99	0.46	--	
12N0003283-92		^C'3b	S	4.8	3.3	1.5	0.1	--	1.7	--	2.2	--	--	--	4.9	0.2	tr	67.4		0.92	0.44	--	
12N0003392-102		^C'4b	S	4.0	3.2	1.2	0.1	--	1.8	--	2.2	--	--	--	3.7	0.1	0.1	68.6		0.82	0.40	--	

pH & Carbonates

Layer	Depth (cm)	Horz	Prep	-1- KCl	-2- $CaCl_2$ 0.01M 1:2	-3- H_2O 1:1	-4- Sat Paste	-5- Oxid	-6- NaF	-7- (- - Carbonate - -) As $CaCO_3$ <2mm	-8- (- - Carbonate - -) As $CaCO_3$ <20mm	-9- (- - Gypsum - - -) As $CaSO_4*2H_2O$ <2mm	-10- (- - Gypsum - - -) As $CaSO_4*2H_2O$ <20mm	-11- Resist ohms cm^{-1}
				(- - - - - - - - - - - - - - - - - - pH - - - - - - - - - - - - - - - - - -)						(- - - - - - - - - - - - % - - - - - - - - - - -)				
					4C1a2a	4C1a2a	4F2		4C1a1a1	4E1a1a1a1				
12N00026	0-8	^A	S		7.4	7.8	7.2		9.5	2				
12N00027	8-24	^C1	S		7.4	7.8	7.4		9.5	1				
12N00028	24-47	^C2	S		7.4	7.7	7.4		9.6	1				
12N00029	47-50	^Ab	S		7.1	7.4	7.0		9.3	4				
12N00030	50-64	^Bw1b	S		7.5	8.0	7.5		9.5	3				
12N00031	64-83	^Bw2b	S		7.7	8.0	7.7		9.7	5				
12N00032	83-92	^C'3b	S		7.6	8.0	7.7		9.7	2				
12N00033	92-102	^C'4b	S		7.5	7.9	7.6		9.7	1				

*** Primary Characterization Data ***

Pedon ID: S11NE153001 (Sarpy County, Nebraska) Print Date: May 18 2012 1:51

Sampled As : SND Coarse-silty, mixed, mesic Typic Udifluvent

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0009

Phosphorous				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
						(---------- Phosphorous ----------									KCl
Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ %	Acid Oxal (----------	Anion Exch Available	Resin Capacity	Bray 1 mg kg^{-1}	Bray 2 ----------	Olsen	H_2O ----------)	Citric Acid	Mehlich III	Extr NO_3
						4G2a			4D3					4D6b	
12N00026	0-8	^A	S			599.8			156.7					256.4	
12N00027	8-24	^C1	S			300.0			23.7					41.6	
12N00028	24-47	^C2	S			307.4			16.8					33.0	
12N00029	47-50	^Ab	S			1882.7			124.5					506.2	
12N00030	50-64	^Bw1b	S			389.8			21.8					62.9	
12N00031	64-83	^Bw2b	S			276.4			1.3					5.9	
12N00032	83-92	^C'3b	S			215.0			4.9					10.6	
12N00033	92-102	^C'4b	S			200.2			10.5					22.3	

Phosphorous				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
						(---------- Phosphorous ----------									KCl
Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ %	Acid Oxal (----------	Anion Exch Available	Resin Capacity	Bray 1 mg kg^{-1}	Bray 2 ----------	Olsen	H_2O ----------)	Citric Acid	Mehlich III	Extr NO_3
														4D6a1	
12N00026	0-8	^A	S											244.2	
12N00027	8-24	^C1	S											34.9	
12N00028	24-47	^C2	S											28.8	
12N00029	47-50	^Ab	S											513.0	
12N00030	50-64	^Bw1b	S											55.6	
12N00031	64-83	^Bw2b	S											2.7	
12N00032	83-92	^C'3b	S											6.7	
12N00033	92-102	^C'4b	S											18.6	

Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a		Hg ug/kg 4H1a
12N00026	0-8	^A	HM	0.23	7.63	352.41	0.91	0.36	8.52	30.56	29.10	481.83	1.31		78
12N00027	8-24	^C1	HM	0.07	8.71	326.16	0.93	0.41	9.37	29.89	17.20	502.89	0.96		40
12N00028	24-47	^C2	HM	0.09	9.27	339.83	0.99	0.33	10.10	30.10	17.90	629.40	1.07		46
12N00029	47-50	^Ab	HM	0.63	5.53	312.45	0.54	0.76	5.48	32.71	43.50	583.26	1.34		289
12N00030	50-64	^Bw1b	HM	1.18	10.13	374.32	0.95	0.49	9.11	36.97	21.12	736.64	1.61		1933
12N00031	64-83	^Bw2b	HM	0.07	10.63	388.54	0.91	0.54	9.45	26.84	17.97	801.67	1.40		64
12N00032	83-92	^C'3b	HM	0.08	10.81	374.24	1.10	0.45	10.05	34.57	18.92	588.85	1.16		57
12N00033	92-102	^C'4b	HM	0.05	8.51	249.44	0.95	0.40	9.08	25.49	15.75	436.16	1.12		39

*** Primary Characterization Data ***

Pedon ID: S11NE153001 (Sarpy County, Nebraska) Print Date: May 18 2012 1:51PM

Sampled As : SND Coarse-silty, mixed, mesic Typic Udifluvent

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0009

Major Elements

Layer	Depth (cm)	Horz	Prep	-1- Al mg/kg 4H1b	-2- Ca mg/kg 4H1b	-3- Fe mg/kg 4H1b	-4- K mg/kg 4H1b	-5- Mg mg/kg 4H1b	-6- Mn mg/kg 4H1b	-7- Na mg/kg 4H1b	-8- P mg/kg 4H1b	-9- Si mg/kg 4H1b	-10- Sr mg/kg 4H1b	-11- Ti mg/kg 4H1b	-12- Zr mg/kg 4H1b
12N00026	0-8	^A	HM	54760	15064	23276	18897	7774	637	9169	1443	293340	169	3685	173
12N00027	8-24	^C1	HM	59302	9946	24682	18633	7678	599	9524	780	308629	157	3870	167
12N00028	24-47	^C2	HM	62666	10333	26801	20816	8458	790	9818	859	317800	170	4000	179
12N00029	47-50	^Ab	HM	37875	39071	15658	14358	6072	720	6711	3587	211676	194	2214	114
12N00030	50-64	^Bw1b	HM	57874	16590	25202	19339	9629	886	9940	1228	305595	187	3688	151
12N00031	64-83	^Bw2b	HM	61194	20763	25359	18453	11530	994	9707	806	290974	179	3541	147
12N00032	83-92	^C'3b	HM	63273	10677	27651	20185	8922	778	9550	734	318986	163	3908	166
12N00033	92-102	^C'4b	HM	63342	8490	26016	20284	8311	595	9101	693	329732	149	4103	185

Mehlich3 Elements

Layer	Depth (cm)	Horz.	Prep.	-1- Al	-2- As	-3- Ba	-4- Ca	-5- Cd	-6- Co	-7- Cr	-8- Cu	-9- Fe	-10- K	-11- Mg	-12- Mn	-13- Mo	-14- Na	-15- Ni	-16- P	-17- Pb	-18- Se	-19- Si	-20- Sr	-21- Zn
				(mg/kg)																				
				4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b
12N000260-8		^A	S	469.7	4.0	42.8	4996.6	0.3	1.2	0.1	5.5	249.5	605.6	837.7	148.1	0.9	74.0	1.5	256.4	5.3		535.3	18.7	18.0
12N000278-24		^C1	S	617.6	2.1	18.0	3285.7	0.3	1.6	0.2	4.4	303.8	227.7	789.1	167.3	0.7	125.8	2.4	41.6	4.8		593.7	11.8	3.5
12N0002824-47		^C2	S	654.7	1.7	20.8	3205.0	0.3	1.7	0.2	4.4	316.7	240.4	877.2	247.0	0.5	70.6	2.6	33.0	4.4		592.1	13.5	3.0
12N0002947-50		^Ab	S	162.1	6.1	28.9	10765.8	0.5	0.4	0.1	9.2	350.5	603.0	1249.4	92.5	0.7	84.5	0.5	506.2	11.8		293.8	38.8	69.1
12N0003050-64		^Bw1b	S	412.2	2.6	34.2	3930.8	0.3	1.4	0.2	5.9	356.7	292.2	740.7	234.7	0.6	58.0	3.3	62.9	5.2		559.6	13.6	7.9
12N0003164-83		^Bw2b	S	376.3	3.0	13.5	5436.2	0.3	2.0	0.2	3.6	184.3	209.8	1011.8	362.1	0.6	97.2	3.9	5.9	3.3		539.4	11.7	2.8
12N0003283-92		^C'3b	S	664.3	3.1	14.2	3406.3	0.3	2.3	0.2	3.3	164.7	200.6	1016.0	257.0	0.6	80.2	2.9	10.6	4.1		579.7	11.7	2.2
12N0003392-102		^C'4b	S	730.7	3.5	22.5	2957.3	0.2	2.5	0.2	3.3	189.1	238.0	1168.4	219.0	0.2	73.7	2.8	22.3	5.3		665.3	12.3	2.7

*** Primary Characterization Data ***

Pedon ID: S11NE153001 (Sarpy County, Nebraska) Print Date: May 18 2012 1:51

Sampled As : SND Coarse-silty, mixed, mesic Typic Udifluvent

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0009

Clay Mineralogy (

Layer	Depth (cm)	Horz	Fraction	-1- -2- -3- -4- X-Ray 7A1b1 (peak size)	-5- -6- -7- -8- -9- Thermal 7A4a (%)	-10- -11- -12- -13- -14- -15- -16- Elemental (SiO_2 Al_2O_3 Fe_2O_3 MgO CaO K_2O Na_2O) (%)	-17- EGME Retn (mg g^{-1})	-18 Int pre tic
12N000278-24		^C1	tcly	MT 3 MI 3 KK 2 VR 2	KK 29			SM
12N0003164-83		^Bw2b	tcly	MT 4 MI 2 VR 2 KK 2	KK 27			SM
12N0003392-102		^C'4b	tcly	MT 3 MI 2 KK 2 VR 2	KK 28			SM

FRACTION INTERPRETATION:

tcly - Total Clay,

MINERAL INTERPRETATION:

KK - Kaolinite MI - Mica MT - Montmorillonite VR - Vermiculite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

Sand - Silt Mineralogy (2.0-0.002 mm)

Layer	Depth (cm)	Horz	Fraction	-1- -2- -3- -4- X-Ray (peak size)	-5- -6- -7- -8- -9- Thermal (%)	-10- Tot Re	-11- -12- -13- -14- -15- -16- Optical Grain Count 7B1a2 (%)	-17- EGME Retn (mg g^{-1})	-18 In pr tic
12N0002824-47		^C2	csi			68	QZ 64 FK 18 MS 5 BT 3 CD 3 CA 1 FE 1 FP 1 GC 1 HN 1 PR 1 AR tr BY tr FG tr GN tr GS tr OP tr PO tr RU tr ZR tr		SM
12N0003164-83		^Bw2b	csi			67	QZ 60 FK 13 CD 5 MS 5 BT 4 CA 4 PR 3 AR 1 FE 1 FP 1 GC 1 OP 1 BY tr FG tr GN tr HN tr PO tr RU tr ZR tr		SM

FRACTION INTERPRETATION:

csi - Coarse Silt, 0.02-0.05 mm

MINERAL INTERPRETATION:

AR - Weatherable Aggregates BT - Biotite BY - Beryl CA - Calcite CD - Chert (Chalcedony

FE - Iron Oxides (Goethite FG - Glass Coated Feldspar FK - Potassium Feldspar FP - Plagioclase Feldspar GC - Glass Coated Grain

GN - Garnet GS - Glass HN - Hornblende MS - Muscovite OP - Opaques

PO - Plant Opal PR - Pyroxene QZ - Quartz RU - Rutile ZR - Zircon

INTERPRETATION (BY HORIZON):

SMIX - Mixed Sand

The surface of the closed Sarpy County Landfill (Stop 3) is well vegetated with Indiangrass, goldenrod smooth brome and tall grass prairie species. The convex shape prevents ponding and enhanced infiltration by precipitation. This view is from Landfill Site 2 northeastward toward Landfill Site 1.

PEDON DESCRIPTION

Print Date: 03/29/2012
Description Date: 10/7/2011
Describer: S. McVey, D. Shurtliff, K. Scheffe
Site ID: S11NE153002
Site Note: Site is original landfill cap replaced 21 yr b.p.
Pedon ID: S11NE153002
Pedon Note: Artifacts: 0-6 cm, 52-102 cm
Lab Source ID: SSL
Lab Pedon #: 12N0010
Soil Name as Described/Sampled: Sanitary Landfill #2
Soil Name as Correlated:
Classification: Fine-silty, mixed, superactive, mesic Fluventic Eutrudepts
Pedon Type:
Pedon Purpose:
Taxon Kind:
Associated Soils:
Physiographic Division: Interior Plains
Physiographic Province: Central Lowland Province
Physiographic Section: Dissected till plains
State Physiographic Area:
Local Physiographic Area:
Geomorphic Setting: on shoulder of upland
on shoulder of hill
on shoulder of sanitary landfill
Upslope Shape: convex
Cross Slope Shape: linear
Particle Size Control Section: 25 to 100 cm.
Description origin: NASIS

Country: USA
State: Nebraska
County: Sarpy
MLRA: 107B -- Iowa and Missouri Deep Loess Hills
Soil Survey Area: NE153 -- Sarpy County, Nebraska
Map Unit: 9967—Sanitary landfill
Quad Name:
Legal Description:
Latitude: 41 degrees 9 minutes 42.00 seconds north
Longitude: 95 degrees 57 minutes 25.00 seconds west
Datum:
UTM Zone:
UTM Easting:
UTM Northing:
Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Other grass/herbaceous cover
Existing Vegetation: Indiangrass, Missouri goldenrod, smooth brome, thistle
Parent Material: human transported material
Bedrock Kind:
Bedrock Depth:
Bedrock Hardness:
Bedrock Fracture Interval:
Surface Fragments:
Description database: NSSL

Diagnostic Features: ochric epipedon 0 to 18 cm.
cambic horizon 6 to 52 cm.
free carbonates 6 to 46 cm.

Cont. Site ID: S11NE153002 **Pedon ID:** S11NE153002

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
4.0	335.3	270						well		

Soil profile at Stop 3b (Landfill Site #2) at Sarpy County Landfill showing the original surface cap underlain by artifacts.

^Au--0 to 6 centimeters; brown (10YR 4/3) silt loam, pale brown (10YR 6/3), dry; strong medium and coarse granular structure; firm, slightly hard, slightly sticky, slightly plastic; very fine and fine roots throughout and medium roots throughout; very fine and fine interstitial pores; artifacts: 1% plastic - 2 mm; abrupt smooth boundary.

^Bw1--6 to 22 centimeters; brown (10YR 4/3) silt loam, pale brown (10YR 6/3), dry; moderate thick platy, and moderate medium granular structure; firm, slightly hard, slightly sticky, slightly plastic; fine and medium roots throughout; very fine and fine interstitial pores; clear wavy boundary.

^Bw2--22 to 46 centimeters; brown (10YR 5/3) silt loam, pale brown (10YR 6/3), dry; moderate thick platy, and moderate very thick platy structure; firm, slightly hard, slightly sticky, slightly plastic; very fine roots throughout; very fine tubular pores; 1 percent fine and medium faint 10YR 4/4 masses of oxidized iron on faces of peds; negative reaction to alpha-alpha' dipyridyl; clear wavy boundary.

^Bw3--46 to 52 centimeters; brown (10YR 5/3) silt loam; weak thick platy structure; firm, slightly hard, slightly sticky, slightly plastic; very fine roots; very fine tubular pores; 2 percent medium distinct 10YR 3/3 manganese masses on faces of peds and 5 percent extremely coarse distinct 5YR 4/4 masses of oxidized iron on faces of peds; negative reaction to alpha-alpha' dipyridyl; clear irregular boundary.

^Cug--52 to 102 centimeters; gray (10YR 5/1) artifactual silt loam; weak thick platy structure; friable, soft, nonsticky, nonplastic; very fine roots; very fine tubular pores; 2 percent medium distinct 10YR 3/3 manganese masses on faces of peds and 5 percent extremely coarse prominent 5YR 4/4 masses of oxidized iron on faces of peds; positive reaction to alpha-alpha' dipyridyl; artifacts: 1% metal - 12 cm; 2% rubber - 10 cm; 2% plastic - 14 cm; 10% untreated wood - 6 cm; 5% cloth - 5 cm.

Seq. #	Horizon depth (cm)	Horizon designation		Diagnostic horizon		Diagnostic characteristics or properties		Diagnostic materials	
		Tour Book	Tour	Soil Taxonomy	World Reference Base	Diagnostic characteristics of Soil Taxonomy	Diagnostic properties of World Reference Base	Soil Taxonomy	World Reference Base
1	0 6	^Au	~	ochric epipedon				mineral soil material	artefacts, mineral material
2	6 22	^Bw1	~	cambic horizon	cambic horizon	free carbonates		mineral soil material	calcaric material, mineral material
3	22 46	^Bw2	~	cambic horizon	cambic horizon	free carbonates		mineral soil material	calcaric material, mineral material
4	46 52	^Bw3	~	cambic horizon	cambic horizon			mineral soil material	mineral material
5	52 102	^Cug	~			reduction of iron 2.)	reducing conditions 2.)	mineral soil material	artefacts, mineral material

Taxonomic Classifications of SND (12N0010)

Soil Taxonomy

KST, 11th ed. 2010 Fine-silty, mixed, superactive, mesic Fluventic Eutrudepts

ICOMANTH (2-22-2012) Fine-silty, methanogenic, mixed, superactive, mesic Anthroportic Eutrudepts 3., 4.)

WRB Haplic Cambisols (Hypereutric, Siltic, Escalic?, Transportic) 5.)

1.) Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th ed. USDA-Natural Resources Conservation Service, Washington, DC.

IUSS Working Group WRB. 2007. World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No.103. FAO, Rome.

2.) Reduced iron (ferrous) is present without saturation by water. Assumption is methane is both excluding oxygen from the horizon and providing a carbon source for microbial activity.

3.) The ICOMANTH classification reflects the presence of human-transported material (HTM) on a constructional anthropogenic landform (landfill).

4.) Pedon classifies in the methanogenic class since there is detectible evolution of odors (e.g., methyl mercaptan) associated with methane evolution within 100 cm of the soil surface.

5.) Is the Escalic qualifier intended only for agricultural terraces?

A close-up view of the irregular topography of the boundary between the ^Bw2 and ^Cug horizons at a depth of 52 cm. The ^Cug horizon is a gray (10YR 6/1) artifactual silt loam which contains about 20 percent, by volume, artifacts of metal, rubber, plastic, untreated wood, and cloth. Reduced or ferrous iron (Fe^{2+}) is present in the absence of saturation by ground water. Methane produced by the decomposition of organic refuse may be enhancing the reducing conditions by providing a ready carbon source for microbes and by excluding oxygen from the horizon.

*** Primary Characterization Data ***

Pedon ID: S11NE153002 (Sarpy, Nebraska) Print Date: May 18 2012 2:13PM
Sampled as on Oct 07, 2011: SND ; Coarse-loamy, mixed, mesic Dystric Eutrudept
Revised to :

SSL - Project C2012USNE004 IUSS Tour
- Site ID S11NE153002 Lat: 41° 9' 32.50" north Long: 95° 56' 31.50" west NAD83 MLRA: 107B
- Pedon No. 12N0010
- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
12N00034	^Au		0.0-6.0	S11NE153002-1			SIL	SIL
12N00035	^Bw		6.0-22.0	S11NE153002-2			SIL	SIL
12N00036	^C		22.0-46.0	S11NE153002-3			SIL	SIL
12N00037	^B'w		46.0-52.0	S11NE153002-4			SIL	SIL
12N00038	^Cgu		52.0-102.0	S11NE153002-5			SIL	SIL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	0.516	% wt
Volume, >2mm, Weighted Average	0	% vol
Clay, total, Weighted Average	21.508	% wt
Clay, carbonate free, Weighted Average	21.508	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 4	0.843	(NA)
LE, Whole Soil, Summed to 1m	3	cm/m

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-
				(- - - - Total - - - - - -)(- - Clay - - -)					(- - - - Silt - - - -)(- - - - - - - - - - - - Sand - - - - - - - - - -)							(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - - - - Weight - - - - - - - -)				>2 mm
				< .002	.002 -.05	.05 -2	< .0002	< .002	.002 -.02	.02 -.05	.05 -.10	.10 -.25	.25 -.50	.5 -1	1 -2	2 -5	5 -20	20 -75	.1- 75	wt % whole
Layer	Depth (cm)	Horz	Prep	(- % of <2mm Mineral Soil -)(- - - - % of <75mm - - - -)																soil
				3A1a1a			3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a	
12N000340-6		^Au	S	24.1	72.7	3.2	14.7	--	31.5	41.2	2.6	0.2	0.2	0.1	0.1	--	--	--	1	--
12N000356-22		^Bw	S	22.6	74.8	2.6	10.3	--	34.1	40.7	2.3	0.1	0.1	0.1	tr	--	--	--	tr	--
12N0003622-46		^C	S	23.0	72.8	4.2	8.9	--	30.3	42.5	3.9	0.2	0.1	tr	tr	--	--	--	tr	--
12N0003746-52		^B'w	S	23.5	73.9	2.6	9.6		33.2	40.7	2.0	0.2	0.2	0.1	0.1	--	--	--	1	--
12N0003852-102		^Cgu	S	20.6	77.1	2.3	9.0		34.7	42.4	1.7	0.1	0.1	0.1	0.3	--	--	--	1	--

*** Primary Characterization Data ***

Pedon ID: S11NE153002 (Sarpy County, Nebraska) Print Date: May 18 2012 2:13PM
Sampled As : SND Coarse-loamy, mixed, mesic Dystric Eutrudept
USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0010

Bulk Density & Moisture

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(Bulk Density)		Cole	(- - - - - - - - - - Water Content - - - - - - - - - -)						WRD	Aggst		
				33	Oven	Whole	6	10	33	1500	1500 kPa	Ratio	Whole	Stabl	(- - Ratio/Clay - -)	
	Depth			kPa	Dry	Soil	kPa	kPa	kPa	kPa	Moist	AD/OD	Soil	2-0.5mm	CEC7	1500 kPa
Layer	(cm)	Horz	Prep	(- - - g cm^{-3} - - -)			(- - - - - - - - - - pct of < 2mm - - - - - - - - - -)						cm^3 cm^{-3}		%	
				DbWR1	DbWR1				DbWR1	3C2a1a		3D1				
12N00034	0-6	^Au	S	1.22	1.39	0.044			20.1	14.9		1.025	0.06		0.90	0.62
12N00035	6-22	^Bw	S	1.40	1.55	0.035			23.1	12.2		1.024	0.15		0.83	0.54
12N00036	22-46	^C	S	1.38	1.53	0.035			26.2	12.5		1.026	0.19		0.84	0.54
12N00037	46-52	^B'w	S	1.44	1.55	0.025			27.2	12.9		1.024	0.21		0.79	0.55
12N00038	52-102	^Cgu	S	1.47	1.58	0.024			27.2	11.4		1.022	0.23		0.85	0.55

Water Content

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(- - Atterberg - -)		(- - - - - Bulk Density - - - -)	(- Water Content -)									
				(- - - Limits - - - -)		Field	Recon 33 kPa	Recon Oven Dry	Field	Recon 33 kPa	(- - - - - - - - - - - - - - - Sieved Samples - - - - - - - - - - - - - - -) 6 kPa	10 kPa	33 kPa	100 kPa	200 kPa	500 kPa
	Depth			LL	PI											
Layer	(cm)	Horz	Prep	pct <0.4mm		(- - - - - - - - g cm^{-3} - - - - - -)	(- % of < 2mm -)									
															3C1e1a	
12N00034	0-6	^Au	S												22.3	
12N00035	6-22	^Bw	S												18.0	
12N00036	22-46	^C	S												19.3	
12N00037	46-52	^B'w	S												20.7	
12N00038	52-102	^Cgu	S												17.8	

Carbon & Extractions

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-	-19-
				(- - - Total - - - -)			Est	OC	C/N	(- - Dith-Cit Ext - -)			(- - - Ammonium Oxalate Extraction - - - -)						(- Na Pyro-Phosphate- -)			
	Depth			C	N	S	OC	(WB)	Ratio	Fe	Al	Mn	Al+½FeODOEFe		Al	Si	Mn	C	Fe	Al	Mn
Layer	(cm)	Horz	Prep	(- - - - - - - of <2 mm - - - - - -)						(- - - - - - - - - - - - - - - - % of < 2mm - - - - - - - - - - - - -)								mg kg^{-1}	(- - - - % of < 2mm - - - -)		
				4H2a	4H2a	4H2a				4G1	4G1	4G1			4G2a	4G2a	4G2a	4G2a	4G2a		4G3	4G3	4G3
12N000340-6		^Au	S	2.49	0.22	0.01	2.3		11	0.9	0.1	0.1	0.19		0.06	0.22	0.08	0.06	1232.6		0.3	0.3	0.03
12N000356-22		^Bw	S	0.80	0.07	--	0.4		6	0.9	0.1	0.1	0.17		0.02	0.20	0.07	0.06	702.3		0.3	0.3	--
12N0003622-46		^C	S	0.55	0.05	--	0.3		6	1.0	0.1	0.1	0.22		0.03	0.27	0.09	0.06	637.7		0.2	0.2	--
12N0003746-52		^B'w	S	0.63	0.05	--	0.2		4	0.9	tr	0.1	0.21		0.02	0.27	0.07	0.06	654.9		0.4	0.4	tr
12N0003852-102		^Cgu	S	0.56	0.05	--	0.2		4	0.9	tr	0.1	0.24		0.03	0.36	0.06	0.05	595.2		0.4	0.3	0.05

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USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0010

CEC & Bases

Layer	Depth (cm)	Horz	Prep	Ca	Mg	Na	K	Sum Bases	Acidity	Extr Al	KCl Mn	CEC8 Sum Cats	CEC7 NH_4 OAC	ECEC Bases +Al	Al Sat	Base Saturation (Sum)	Base Saturation (NH_4OAC)
				cmol(+) kg^{-1}							mg kg^{-1}	cmol(+) kg^{-1}			%		
				4B1a1a	4B1a1a	4B1a1a	4B1a1a		4B2b1a1				4B1a1a				
12N00034	0-6	^Au	S	17.7*	9.3	--	1.0	28.0	3.6				21.8				100
12N00035	6-22	^Bw	S	19.1*	10.4	--	0.6	30.1	2.4				18.7				100
12N00036	22-46	^C	S	18.7*	11.8	--	0.6	31.1	2.1				19.4				100
12N00037	46-52	^B'w	S	22.2*	11.4	--	0.7	34.3	9.6				18.5				100
12N00038	52-102	^Cgu	S	17.9*	9.9	--	0.7	28.5	1.6				17.5				100

*Extractable Ca may contain Ca from calcium carbonate or gypsum. CEC7 base saturation set to 100.

Salt

Layer	Depth (cm)	Horz	Prep	Ca	Mg	Na	K	CO_3	HCO_3F	Cl	PO_4	Br	OAC	SO_4	NO_2	NO_3	H_2O	Total Salts	Elec Cond	Pred Elec Cond	Exch Na	SAR
				mmol(+) L^{-1}				mmol(-) L^{-1}										%	dS m^{-1}		%	
				4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2		4F2	4F1a1a1		
12N00034	0-6	^Au	S	6.9	4.2	0.1	0.8	--	6.9	0.8	0.7	0.2	--	--	0.6	0.1	tr	82.7	0.99	0.36	--	
12N00035	6-22	^Bw	S	3.2	1.8	0.3	0.2	--	2.6	0.4	0.8	--	tr	--	0.3	0.1	tr	65.1	0.50	0.22	--	
12N00036	22-46	^C	S	2.6	1.5	0.2	0.2	--	2.6	0.1	0.3	--	--	--	0.3	0.1	tr	64.2	0.40	0.18	--	
12N00037	46-52	^B'w	S	2.6	1.5	0.3	0.3	--	2.7	tr	0.4	--	--	--	0.7	0.1	tr	66.2	0.42	0.29	--	
12N00038	52-102	^Cgu	S	3.9	2.6	0.4	0.4	--	2.0	tr	0.5	--	--	--	2.0	0.1	1.8	65.3	0.72	0.30	--	

pH & Carbonates

Layer	Depth (cm)	Horz	Prep	pH KCl	pH $CaCl_2$ 0.01M 1:2	pH H_2O 1:1	pH Sat Paste	pH Oxid	pH NaF	Carbonate As $CaCO_3$ <2mm	Carbonate As $CaCO_3$ <20mm	Gypsum As $CaSO_4*2H_2O$ <2mm	Gypsum As $CaSO_4*2H_2O$ <20mm	Resist ohms cm^{-1}
										%				
					4C1a2a	4C1a2a	4F2		4C1a1a1	4E1a1a1a1				
12N00034	0-6	^Au	S		7.1	7.6	6.9		9.2	2				
12N00035	6-22	^Bw	S		7.3	7.9	7.4		9.5	3				
12N00036	22-46	^C	S		7.5	8.1	7.6		9.6	2				
12N00037	46-52	^B'w	S		7.6	8.1	7.7		9.6	4				
12N00038	52-102	^Cgu	S		7.5	7.9	7.7		9.4	3				

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USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0010

Phosphorous

Layer	Depth (cm)	Horz	Prep	-1- Melanic Index	-2- NZ	-3- Acid Oxal	-4- Anion Exch Available	-5- Resin Capacity	-6- Bray 1	-7- Bray 2	-8- Olsen	-9- H_2O	-10- Citric Acid	-11- Mehlich III	-12- KCl Extr NO_3
						(- Phosphorous -)									
					%	4G2a	(- mg kg^{-1} -)		4D3					4D6b	
12N00034	0-6	^Au	S			311.7			18.9					33.3	
12N00035	6-22	^Bw	S			274.0			2.9					14.3	
12N00036	22-46	^C	S			212.9			1.7					7.5	
12N00037	46-52	^B'w	S			249.5			0.8					7.1	
12N00038	52-102	^Cgu	S			269.2			2.7					12.9	

Phosphorous

Layer	Depth (cm)	Horz	Prep	-1- Melanic Index	-2- NZ	-3- Acid Oxal	-4- Anion Exch Available	-5- Resin Capacity	-6- Bray 1	-7- Bray 2	-8- Olsen	-9- H_2O	-10- Citric Acid	-11- Mehlich III	-12- KCl Extr NO_3
						(- Phosphorous -)									
					%	(- mg kg^{-1} -)								4D6a1	
12N00034	0-6	^Au	S											23.5	
12N00035	6-22	^Bw	S											10.2	
12N00036	22-46	^C	S											5.4	
12N00037	46-52	^B'w	S											5.3	
12N00038	52-102	^Cgu	S											9.6	

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Trace Elements Tier 1

Layer	Depth (cm)	Horz	Prep	-1- Ag mg/kg 4H1a	-2- As mg/kg 4H1a	-3- Ba mg/kg 4H1a	-4- Be mg/kg 4H1a	-5- Cd mg/kg 4H1a	-6- Co mg/kg 4H1a	-7- Cr mg/kg 4H1a	-8- Cu mg/kg 4H1a	-9- Mn mg/kg 4H1a	-10- Mo mg/kg 4H1a	-11-	-12- Hg ug/kg 4H1a
12N00034	0-6	^Au	HM	0.07	9.72	306.06	0.87	0.52	8.78	27.50	16.98	672.16	1.49		51
12N00035	6-22	^Bw	HM	0.06	9.86	317.70	0.87	0.42	9.73	24.29	17.38	776.03	1.66		42
12N00036	22-46	^C	HM	0.07	11.23	343.88	0.99	0.49	9.94	28.88	19.21	734.39	1.43		40
12N00037	46-52	^B'w	HM	0.06	10.22	380.35	1.01	0.44	9.80	32.59	16.99	802.46	1.27		45
12N00038	52-102	^Cgu	HM	0.09	10.32	335.15	0.93	0.55	9.15	30.82	16.93	778.87	1.58		41

Trace Elements Tier 2

Layer	Depth (cm)	Horz	Prep	-1- Ni mg/kg 4H1a	-2- P mg/kg 4H1a	-3- Pb mg/kg 4H1a	-4- Sb mg/kg 4H1a	-5- Se ug/kg 4H1a	-6- Sn mg/kg 4H1a	-7- Sr mg/kg 4H1a	-8- Tl mg/kg	-9- V mg/kg 4H1a	-10- W mg/kg 4H1a	-11- Zn mg/kg 4H1a
12N00034	0-6	^Au	HM	21.94	656.77	14.08	0.52	250.17	0.96	46.56		60.66	0.02	66.34
12N00035	6-22	^Bw	HM	24.48	609.31	13.96	0.44	392.02	0.84	48.20		55.58	tr	65.32
12N00036	22-46	^C	HM	25.59	548.26	15.04	0.62	317.04	0.99	54.11		68.52	0.01	69.35
12N00037	46-52	^B'w	HM	24.58	554.74	14.64	0.44	283.62	1.02	64.23		71.03	0.02	67.22
12N00038	52-102	^Cgu	HM	24.00	580.61	14.18	0.50	252.69	0.96	58.80		66.30	0.02	915.96

Major Elements

Layer	Depth (cm)	Horz	Prep	-1- Al mg/kg 4H1b	-2- Ca mg/kg 4H1b	-3- Fe mg/kg 4H1b	-4- K mg/kg 4H1b	-5- Mg mg/kg 4H1b	-6- Mn mg/kg 4H1b	-7- Na mg/kg 4H1b	-8- P mg/kg 4H1b	-9- Si mg/kg 4H1b	-10- Sr mg/kg 4H1b	-11- Ti mg/kg 4H1b	-12- Zr mg/kg 4H1b
12N00034	0-6	^Au	HM	55480	11175	23934	19084	8231	871	9580	1004	300209	163	3736	167
12N00035	6-22	^Bw	HM	66165	15653	28936	22206	11710	1028	10957	1040	340907	195	4214	180
12N00036	22-46	^C	HM	63003	12945	28188	20083	10253	904	9921	794	317113	180	3800	152
12N00037	46-52	^B'w	HM	58645	15525	25758	19154	10458	962	9825	812	299746	180	3812	172
12N00038	52-102	^Cgu	HM	56731	14663	26123	19509	9630	954	10606	885	312277	183	3992	210

Mehlich3 Elements

Layer	Depth (cm)	Horz.	Prep.	-1- Al	-2- As	-3- Ba	-4- Ca	-5- Cd	-6- Co	-7- Cr	-8- Cu	-9- Fe	-10- K	-11- Mg	-12- Mn	-13- Mo	-14- Na	-15- Ni	-16- P	-17- Pb	-18- Se	-19- Si	-20- Sr	-21- Zn
				(mg/kg)																				
				4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b		4D6b	4D6b	4D6b
12N000340-6		^Au	S	486.3	3.6	97.7	3268.8	0.3	2.3	0.1	3.3	128.9	446.5	923.9	253.9	0.3	16.1	3.2	33.3	3.0		547.4	11.0	6.1
12N000356-22		^Bw	S	485.4	1.5	103.1	2958.3	0.3	2.5	0.1	3.1	151.3	257.2	895.9	296.1	0.5	27.0	4.1	14.3	2.8		631.8	11.4	2.7
12N0003622-46		^C	S	580.4	3.0	125.8	3287.3	0.3	2.2	0.1	3.4	165.0	206.8	963.5	275.0	0.5	26.7	4.0	7.5	3.1		649.1	15.6	8.6
12N0003746-52		^B'w	S	461.6	3.5	102.0	3753.3	0.3	1.9	0.2	4.1	336.9	234.5	916.8	356.0	0.6	31.6	3.6	7.1	3.3		665.0	16.1	5.3
12N0003852-102		^Cgu	S	354.8	2.6	56.7	3105.0	0.4	1.1	0.2	4.1	680.0	265.4	888.0	516.7	0.3	34.8	1.7	12.9	0.9		587.0	12.8	4.7

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USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0010

Clay Mineralogy (				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
						X-Ray					Thermal					Elemental				EGME	Inter
													SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	Na_2O	Retn	preta
	Depth		Fract			7A1b1					7A4a										tion
Layer	(cm)	Horz	ion	(- - - - - - - peak size - - - - - - - -)					(- - - - - - - - % - - - - - - - - -)				(- - - - - - - - - - - - - - - - - % - - - - - - - - - - - - - - - -)							mg g^{-1}	
12N00037	46-52	^B'w	tcly	MT 3	MI 3	KK 2	VR 2				KK 27										SMEC
12N00038	52-102	^Cgu	tcly	MT 5	MI 2	KK 2					KK 28										SMEC

FRACTION INTERPRETATION:
tcly - Total Clay,

MINERAL INTERPRETATION:
KK - Kaolinite MI - Mica MT - Montmorillonite VR - Vermiculite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small

Sand - Silt Mineralogy (2.0-0.002 mm)				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18-
						X-Ray					Thermal					Optical				EGME	Inter
													Tot Re			Grain Count				Retn	preta
	Depth		Fract													7B1a2					tion
Layer	(cm)	Horz	ion	(- - - - - - peak size - - - - - - - - -)					(- - - - - - - % - - - - - - - - - -)				(- - - - - - - - - - - - - - - - - % - - - - - - - - - - - - - - - -)							mg g^{-1}	
12N00036	22-46	^C	csi										68	QZ 63	FK 18	BT 4	CA 4	CD 4	MS 3		SMIX
														FP 2	AR 1	OP 1	PR 1	BY tr	FE tr		
														GC tr	GN tr	GS tr	HN tr	PO tr	RU tr		
														ZR tr							
12N00038	52-102	^Cgu	csi										62	QZ 56	FK 21	BT 6	CD 4	FP 3	MS 3		SMIX
														AR 1	CA 1	FE 1	GC 1	GS 1	OP 1		
														PR 1	BY tr	GN tr	HN tr	PO tr	ZR tr		

FRACTION INTERPRETATION:
csi - Coarse Silt, 0.02-0.05 mm

MINERAL INTERPRETATION:

AR - Weatherable Aggregates BT - Biotite BY - Beryl CA - Calcite CD - Chert (Chalcedony
FE - Iron Oxides (Goethite FK - Potassium Feldspar FP - Plagioclase Feldspar GC - Glass Coated Grain GN - Garnet
GS - Glass HN - Hornblende MS - Muscovite OP - Opaques PO - Plant Opal
PR - Pyroxene QZ - Quartz RU - Rutile ZR - Zircon

INTERPRETATION (BY HORIZON):
SMIX - Mixed Sand

Draft of new section on Artifacts for the National Soil Survey Handbook, Part 618--Soil Properties and Qualities

618.5 Artifacts in the Soil

A. Definition.—"Artifacts" are objects or materials created or modified by humans, usually for a practical purpose in habitation, manufacturing, excavation, or construction activities. Examples of artifacts include bitumen (asphalt), brick, concrete, metal, paper, plastic, rubber, and wood products. Artifacts are commonly referred to as "discrete artifacts" if they are 2 mm or larger in diameter and are not compacted into a root-limiting layer that impedes root growth or water movement.

B. Significance.—Artifacts can constitute a significant portion of the soil. The amount and type of particulate artifacts can contribute substantially to various trace metals and total carbon contents of soils. Discrete artifacts which are both cohesive *and* persistent, defined below, are treated in a similar manner as rock fragments when populating the standard sieves or in calculations involving sieve entries. Discrete artifacts which are noncohesive, nonpersistent, or both are not considered fragments for sieve entries or calculations involving those entries.

C. Measurement.—The fraction from 2 to 75 mm in diameter may be measured in the field. However, 50 to 60 kg of sample material may be necessary if there is an appreciable amount of fragments near 75 mm. An alternative means of measuring is to visually estimate the volume of the 20 to 75 mm fraction, then sieve and weigh the 2 to 20 mm fraction. The fraction 75 mm (3 inches) or greater is usually not included in soil samples taken in the field for laboratory testing. Measurements can be made in the field by weighing the dry sample and the portion retained on a 3-inch screen. The smallest dimension of discrete artifacts is used to determine whether these items pass through a sieve. The quantity is expressed as a weight percentage of the total soil. A sample as large as 200 pounds to more than a ton may be needed to assure that the results are representative. Measurements of the fraction from 75 to 250 mm (3 to 10 inches) and the fraction greater than 250 mm (10 inches) in diameter are usually obtained from volume estimates.

D. Estimates

(1) Estimates of discrete artifacts are made similarly to the way estimates of rock fragments are made. These estimates are usually made by visual means and are on the basis of percent by volume. The percent by volume is converted to percent by weight by using the average bulk unit weights for the soil and the specific artifacts. These estimates are made during investigation and mapping activities in the field. They are expressed as ranges that include the estimating accuracy as well as the range of values for a component.
(2) Treated and untreated wood products (e.g., lumber) are considered artifacts. They are not considered wood fragments such as those associated with the woody materials (e.g., tree branches) described in organic soils.
(3) Measurements or estimates of discrete artifacts less than strongly cemented are made prior to any rolling or crushing of the sample.

E. Artifact Cohesion

(1) Definition.—"Artifact Cohesion" is the relative ability of the artifact to remain intact after significant disturbance.
(2) Significance.—Artifacts that break down easily are similar to pararock fragments in that these artifacts break down to become part of the fine-earth fraction of the soil. Noncohesive artifacts are excluded from entries for the standards sieves and are not used in sieve calculations.

Draft of new section on Artifacts for the National Soil Survey Handbook, Part 618--Soil Properties and Qualities

(3) Entries.—Enter cohesive or noncohesive in the Component Horizon Human Artifacts and the Pedon Horizon Human Artifacts tables of the NASIS database. Cohesion is based on whether the artifact can be easily broken into <2 mm size pieces either in the hands or with a mortar and pestle. Artifacts that cannot easily be broken are cohesive. All others are considered noncohesive.

F. Artifact Kind

(1) Definition.—"Artifact Kind" is the type of object or material being described.
(2) Significance.—Each type of artifact is associated with a combination of other property entries that is used to determine whether the artifact is considered for sieve entries and calculations. The type of artifact also gives clues to the age of the deposit as well as the potential toxicity.
(3) Entries.—Enter the artifact kind in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables. Enter the appropriate choice for the kind of discrete artifact from the following list—

(i) Bitumen (asphalt)
(ii) Boiler slag
(iii) Bottom ash
(iv) Brick
(v) Cardboard
(vi) Carpet
(vii) Cloth
(viii) Coal combustion by-products
(ix) Concrete
(x) Debitage
(xi) Fly ash
(xii) Glass
(xiii) Metal
(xiv) Paper
(xv) Plasterboard
(xvi) Plastic
(xvii) Potsherd
(xviii) Rubber
(xix) Treated wood
(xx) Untreated wood.

G. Artifact Penetrability

(1) Definition.—"Artifact Penetrability" is the relative ease with which roots can penetrate the artifact and potentially extract any stored moisture, nutrients, or toxic elements.
(2) Significance.—Artifacts that are penetrable may increase the available water holding capacity of a soil and should be factored in such calculations. The availability of supplemental nutrients and toxic elements is also greatest in penetrable artifacts.
(3) Entries.—Enter nonpenetrable or penetrable in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables based on whether roots can penetrate the solid parts of the artifact or between the component parts of the artifact.

H. Artifact Persistence

(1) Definition.—"Artifact Persistence" is the relative ability of solid artifacts to withstand weathering and decay over time.

Draft of new section on Artifacts for the National Soil Survey Handbook, Part 618--Soil Properties and Qualities

(2) Significance.—Artifacts that decay quickly are similar to pararock fragments and are treated as such in sieve calculations.

(3) Entries.—Enter nonpersistent or persistent in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables based on whether the artifact is expected to decay in less than a decade or greater than a decade. Nonpersistent artifacts are expected to decay in less than a decade. Persistent artifacts remain intact for a decade or more.

I. Artifact Roundness

(1) Definition.—"Artifact Roundness" is an expression of the sharpness of edges and corners of objects.

(2) Significance.— The roundness of artifacts impacts water infiltration, root penetration, and macropore space.

(3) Classes.—The artifact roundness classes follow those used for fragment roundness:

Roundness Class	Definition
Very angular	Strongly developed faces with very sharp, broken edges.
Angular	Strongly developed faces with sharp edges (*Soil Survey Manual* (SSM)).
Subangular	Detectable flat faces with slightly rounded corners.
Subrounded	Detectable flat faces with well-rounded corners (SSM).
Rounded	Flat faces absent or nearly absent with all corners rounded (SSM).
Well rounded	Flat faces absent with all corners rounded.

(4) Entries.—Enter the appropriate artifact roundness class name for the record of artifacts populated in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables.

J. Artifact Safety

(1) Definition.—"Artifact Safety" is the degree of risk to humans from contact with soils that contain artifacts. Physical contact with soils containing dangerous or harmful artifacts should be avoided unless proper training and protective closthing is available. The risk is based on toxicity to living organisms and not the physical risk that may be present from sharp or heavy objects. Harmful toxicity may be immediate or long-term, or through direct or indirect contact. Examples of innocuous artifacts include brick, concrete, glass, plastic, unprinted paper and cardboard, and untreated wood. Some examples of noxious artifacts are batteries, bitumen (asphalt), fly ash, garbage, paper printed with metallic ink, and wood treated with arsenic.

(2) Significance.—Noxious artifacts are dangerous and require special handling when sampling. Areas with noxious artifacts should have restricted human contact.

(3) Entries.—Enter innocuous or noxious in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables based on whether the artifacts are potentially toxic to living beings.

K. Artifact Shape

(1) Definition.—"Artifact Shape" is a description of the overall shape of the object.
(2) Significance.—Artifact shape differs from rock, pararock, and wood fragment shape descriptions and is important for fluid flow in the soil as well as influencing excavation difficulty.
(3) Classes.—The artifact shape classes are elongated, equidimensional, flat, and irregular.
(4) Entries.—Enter the appropriate artifact shape class name for each record of artifacts populated in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables.

L. Artifact Size

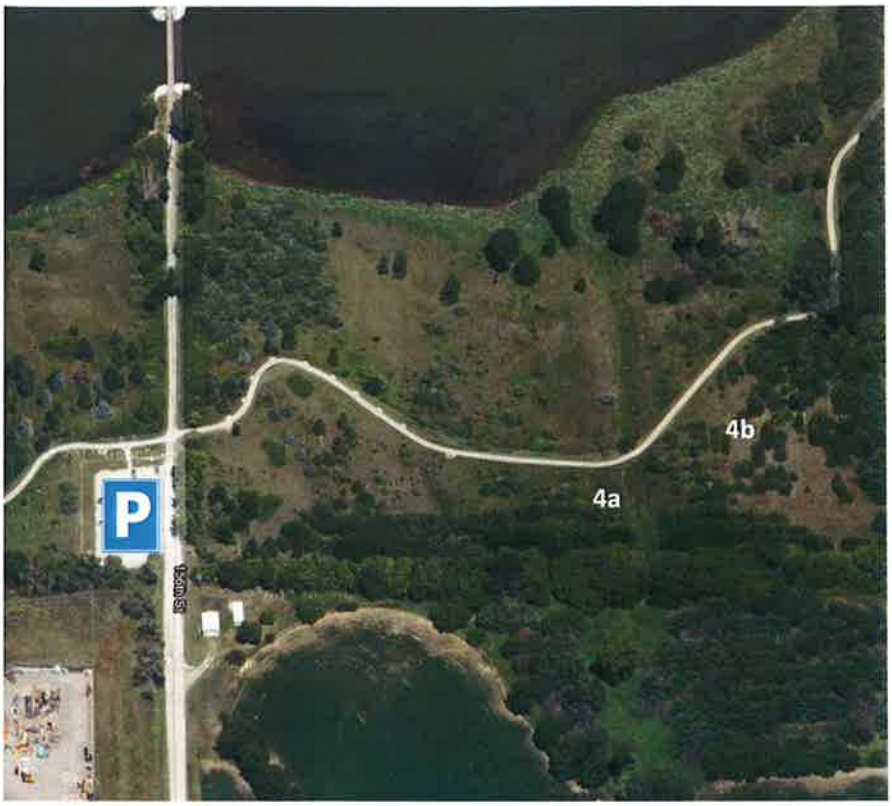
(1) Definition.—"Artifact Size" is based on the cross-sectional diameter of the object.
(2) Significance.—The size of discrete artifacts is significant to the use and management of the soil. Artifact sizes ranging from 2 mm to 75 mm that are both cohesive and persistent are considered when estimating the percent passing the sieves. It affects equipment use, excavation, construction, and recreational uses.
(3) Entries.—Enter the cross-sectional diameter size of the ≥ 2 mm artifacts described in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables. The range of valid entries is from 2 to 3,000 millimeters, and only whole numbers (integers) are allowed.

M. Artifact Volume

(1) Definition.—"Artifact Volume" is the volume percentage of the horizon occupied by the 2 mm or larger fraction (20 mm or larger for wood artifacts) on a whole soil base.
(2) Significance.—The volume occupied by discrete artifacts (2 mm or larger fraction) is important in selecting appropriate texture modifiers (i.e., artifactual, very artifactual, extremely artifactual). Some soil horizons contain combinations of artifacts and rock fragments. See Section 618.70 H. (iv) for guidance in assigning either single (artifact only), compound (artifact and rock fragment), or dual (rock fragment-artifact) texture modifiers for horizons containing artifacts.
(3) Entries.—Enter the high, low, and representative values for the percent volume present of each size class and kind of artifact populated in the Component Horizon Human Artifacts and Pedon Horizon Human Artifacts tables. The range of valid entries is from 0 to 100 percent, and only whole numbers (integers) are allowed.

Stop 4 - Chalco Hills Recreation Area

Travel to Chalco Hill Recreation Area arriving approximately 3:30 PM (13 miles, 0:25 minutes)



The soils tour stop is located on the south end of the Chalco Hills Recreation Area and is accessible from 156th Street at I-80. (County Road 60)

Geology and Geomorphic Setting **– Doug Wysocki**

Site 4a – Judson Series, colluvial modified loess (Pit boss – Dan Shurtliff)
Brief presentation at the pit – Dan Shurtliff – (5 minutes)
Photo opportunity at the pit – (10 minutes)
Poke the pit – (20 minutes)
Discussion of lab analyses and soil classification – Joe Chiaretti – (15 minutes)

Site 4b - Liston Series, glacial till (Pit boss – Patrick Cowsert)
Brief presentation at the pit – Patrick Cowsert – (5 minutes)
Photo opportunity at the pit – (10 minutes)
Poke the pit – (20 minutes)
Discussion of lab analyses and soil classification – Joe Chiaretti – (15 minutes)
Return to buses at 5:15PM at area parking and travel to Mahoney State Park.

Chalco Hill Recreation Area

Chalco Hills Recreation Area is located in northwestern Sarpy County, Nebraska, and approximately 12 miles (19 km) west of downtown Omaha. Chalco Hills consists of 1,186 acres (4.80 km^2) of which 246 acres (1.00 km^2) is covered by Wehrspann Lake, an artificial reservoir. The recreation area was opened in 1988 as part of Papio-Missouri River Natural Resources District efforts to provide flood control and improve recreation opportunities. The Dam was built by the Corps of Engineers and the recreation area is managed by the Natural Resources District.[1]

Featured at this recreation area is the Natural Resources Center, the NRD's headquarters. Also located at the Recreation Area are two US Department of Agriculture Agencies: The Natural Resources Conservation Service and the Farm Services Agency, as well as a field office for the US Army Corps of Engineers, NE Department of Environmental Quality and the Civil Air Patrol. The District works closely with these agencies for effective management of natural resources, and are nationally known for this co-location of resource management offices convenient for all interested in our environment.

There are seven picnic areas and several have covered pavilions, the largest of which can accommodate up to 100 people. Seven miles (11 km) of walking trails encircle Wehrspann Lake. Soccer fields, baseball fields, and playgrounds adjacent to picnic areas are easily reached from nearby parking areas. The soccer fields are also used as launch sites for hot-air balloons and radio controlled airplanes. The area is used for cross-country running events during the fall, and cross-country skiing and ice fishing are popular in the winter. Fishing is more popular in the warmer seasons, and there is parking for 30 trailers. Motorized boats must comply with the no-wake regulation by maintaining speeds under 5 miles (8 km) per hour.

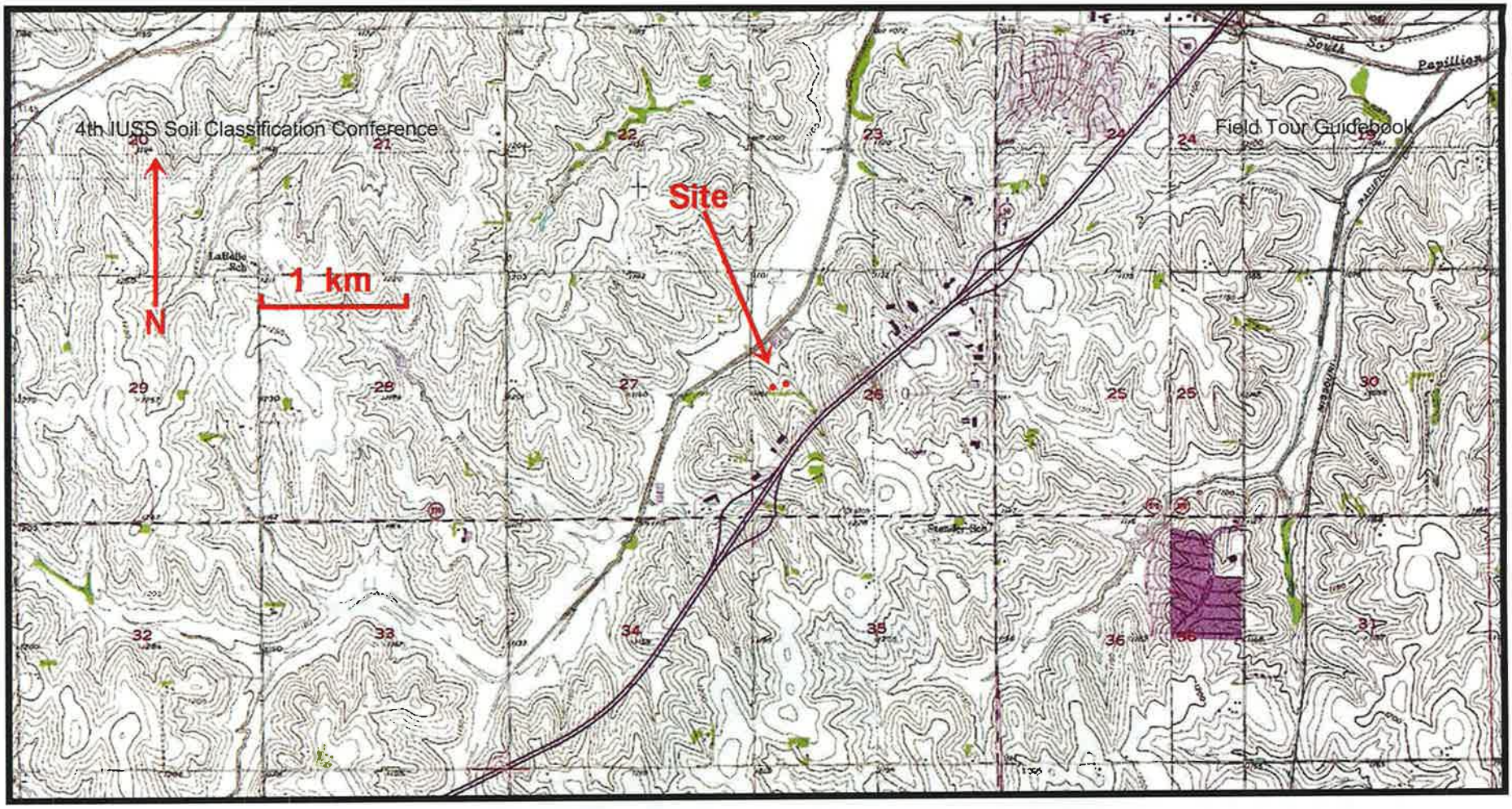


Figure WS10 Topographic Map Chalco Hills Site.

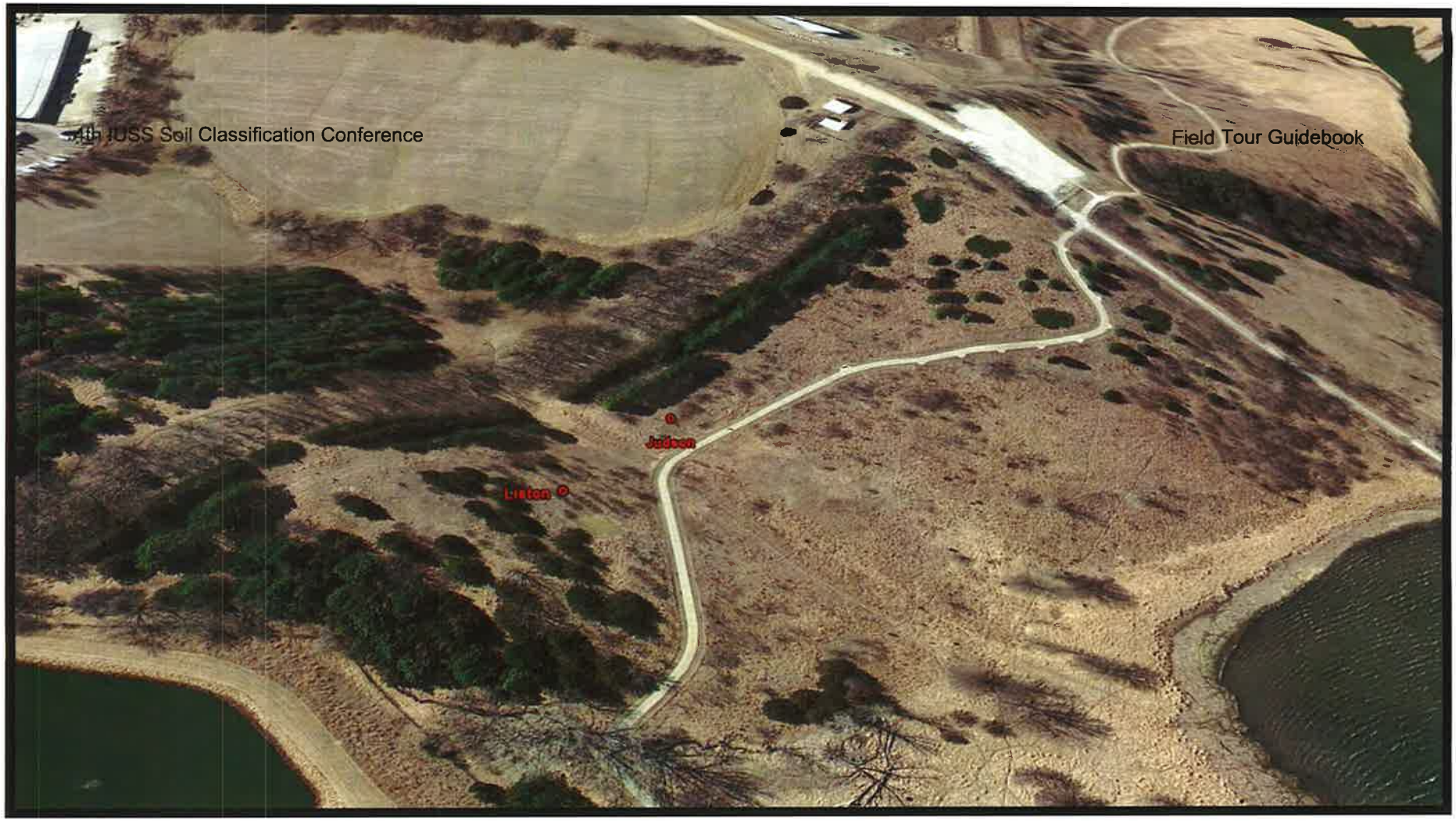


Figure WS11 Chalco Hills Site AerialView.

Glacial till derived soils in MLRA 107B

by: Patrick Cowsert, RSS, Stanton Nebraska

The landscape in MLRA 107B is dominated by a thick deposits of Wisconsin age loess which overlays pre-Illinoisan glacial till. The pre-Illinoisan glacial period was between 500,000 and 2.5 million years ago during the early to middle Pleistocene Era. The pre-Illinoisan period was once thought to consist of two distinct glacial events, however it has had 11 distinct glacial stages identified during that time. During the post glacial period, a till paleosol developed which was later exposed in some places. The landscape that developed in the glacial till dictated the larger 1st order stream valleys prior to, and after, loess deposition. As the loess landscape developed and the loess blanket was eroded and the secondary drainage systems developed, the glacial till was re-exposed. In some locations the till is exposed in isolated areas in the upland sideslopes and in others the drainageways are so entrenched and the degree of erosion on the side slopes is so great that little or no loess can be found over the till. The exposed till in some areas has been truncated and the paleo-surface eroded away.

The exposed till is characterized by generally little sorting with a variety of rock fragment sizes throughout the soil profile. Many hillsides of glacial derived soils are scattered with glacial erratics . The till is well drained, but relict redoximorphic concentrations and depletions from a previous climatic period are common with coarse to extremely coarse features visible. Manganese is associated with the iron in the concentrations. Calcium carbonate is common and ranges from free calcium carbonate to soft masses and nodules to concretions which can be quite large. Many stones have a rind of calcium carbonate on the lower side. Some pedogenic development has begun on these till exposures and soil structure and clay films are present in some soils.

Pre-Illinoian glacial till is calcareous and it has an average clay content of 24 to 35% clay and an average sand content of 20-40% with some pedons as high as 52%. The typical soil texture is clay loam or loam with loam, silt loam or silty clay loam at the surface. Rock fragments are generally less than 10% of mixed origin. Mean annual temperature ranges from 10 to 13 degrees C, and mean annual precipitation ranges from 71 to 86 centimeters with some areas as high as 94 centimeters. Average frost-free period ranges between 130 to 180 days with some areas 200 days.

The glacial derived soils of this area, in order from least to most developed are: Steinauer, Liston, Burchard, and Shelby. The Steinauer and Liston soils are usually found on more eroded landscape positions on steeper side slopes and exposed nose slopes (see figure 4). The slope range here is from 5 to 75% slope. Steinauer soils are an AC profile with non-pedogenic free calcium carbonate to the surface. Liston soils have a B horizon. Next are the Burchard and Shelby soils (see figure 2 and 4). The slope range is 2 to 40 % slope. Burchard soils have a mollic epipedon and are leached of carbonates in the upper part. Shelby soils have a thicker mollic epipedon and are leached to a greater depth.

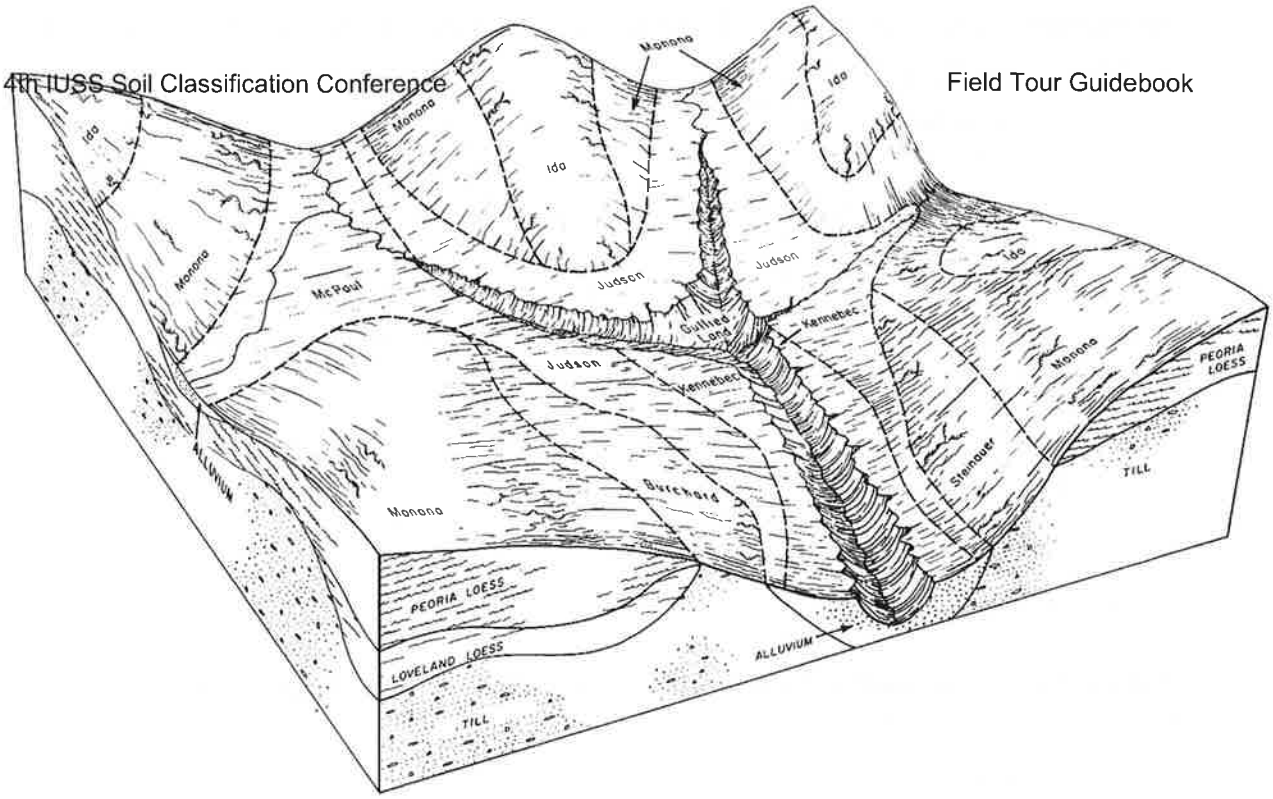


Figure 4.—Soils of the Monona-Ida association.

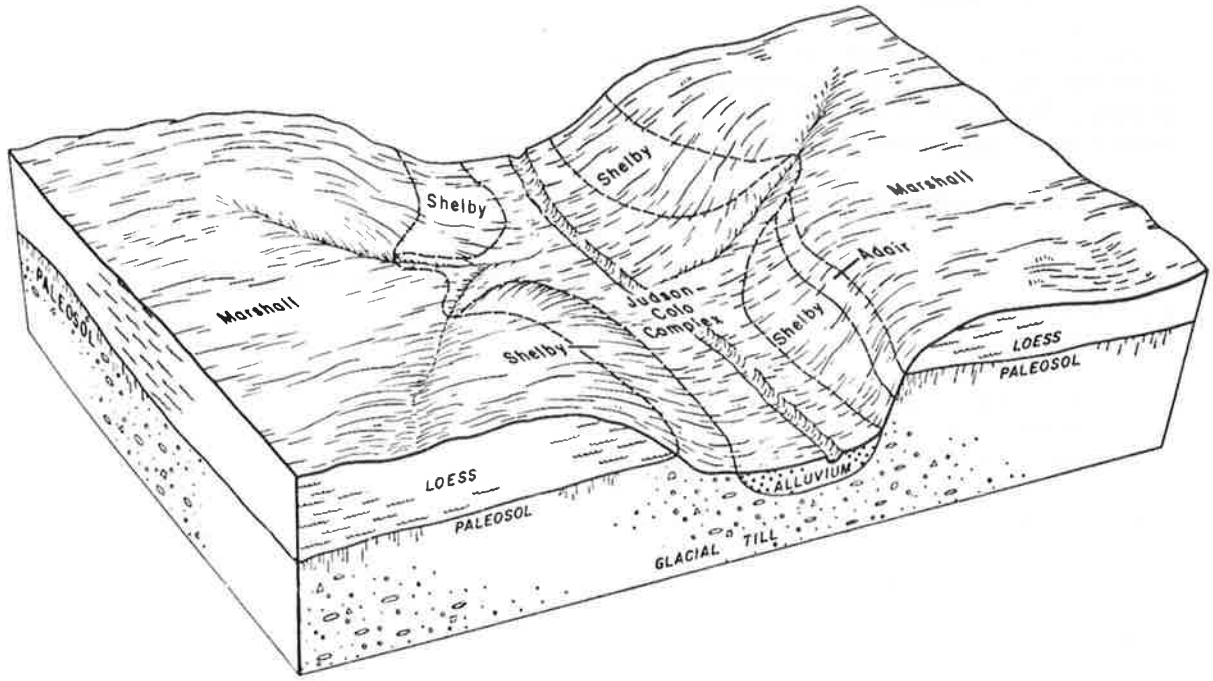


Figure 2.—Relationship of the soils in association 2 to the landscape and to the parent material.

Steinauer Fine-loamy, mixed, superactive, calcareous, mesic Typic Udorthents

RANGE IN CHARACTERISTICS:
Horizonation:
A: 10-18 cm thick
AC: 0-36 cm thick
C
Depth to secondary calcium carbonate: 0 to 25 centimeters (0 to 10 inches)

158,813 total acres in MLRA 102C, 106, and 107B

Liston Fine-loamy, mixed, superactive, mesic Typic Eutrudepts

RANGE IN CHARACTERISTICS:
Horizonation:
A: 10 -18 cm thick
Bw: 0-41cm thick
Bk: 20-97cm thick
C
Depth to carbonates--0 to 25 centimeters (0 to 10 inches)

6,115 total acres in MLRA 107B

Burchard Fine-loamy, mixed, superactive, mesic Typic Argiudolls

RANGE IN CHARACTERISTICS:
Horizonation:
A: 20 -46 cm thick
Bt: 10-61 cm thick
Btk: 25-76cm thick
Bk: 0-38cm thick
C
Thickness of the mollic epipedon--20 to 46 centimeters
Depth to argillic horizon--20 to 46 centimeters
Depth to carbonates--30 to 76 centimeters
Depth to redox concentrations (if they occur)--56 to 203 centimeters

211,592 total acres in MLRA 106 and 107B

Shelby Fine-loamy, mixed, superactive, mesic Typic Argiudolls

RANGE IN CHARACTERISTICS:
Horizonation:
A: 15 -25 cm thick
AB: 10-20cm thick
Bt: 50-145cm thick
Btk: 0-38cm thick
C
Thickness of the mollic epipedon--25 to 50 centimeters
Depth to argillic horizon--25 to 50 centimeters
Depth to carbonates--greater than 75 centimeters

1,266,023 total acres in MLRA 106, 107B, 108, 109

Loess Derived Soils at Chalco Hills Recreation Area

(provided by Dan Shurtliff)

Ida Fine-silty, mixed, superactive, calcareous, mesic Typic Udorthents

RANGE IN CHARACTERISTICS:
Horizonation:
- A: 8-23 cm thick
- AC: 0-15 cm thick
- C

Depth to secondary calcium carbonate: 0 centimeters (carbonates at the surface)

679,142 total acres in MLRA 102C, 106, and 107B

Contrary Fine-silty, mixed, superactive, mesic Dystric Eutrudepts

RANGE IN CHARACTERISTICS:
Horizonation:
- A: 10-23 cm thick
- Bw: 51 –122 cm thick
- BC: 0-25 cm thick
- C

Depth to carbonates—Greater than 102 cm

103,902 total acres in MLRA 107B

Monona Fine-silty, mixed, superactive, mesic Typic Hapludolls

RANGE IN CHARACTERISTICS:
Horizonation:
- A: 25-61 cm thick
- Bw: 30-114 cm thick
- C

Thickness of the mollic epipedon--25 to 61 centimeters
Depth to carbonates—Greater than 61 centimeters (typically absent)

873,344 total acres in MLRA 102C, 106 and 107B

Marshall Fine-silty, mixed, superactive, mesic Typic Hapludolls

RANGE IN CHARACTERISTICS:
Horizonation:
- A: 25-60 cm thick
- Bw: 50-125 cm thick
- Bg: 0-30 cm thick
- Cg

Thickness of the mollic epipedon--25 to 61 centimeters
Depth to Redoximorphic features – Greater than 75 centimeters
Depth to carbonates—Greater than 183 centimeters (typically absent)

1,410,276 total acres in MLRA 102C,106, 107B, 108, 109

***Judson** Fine-silty, mixed, superactive, mesic Cumulic Hapludolls

RANGE IN CHARACTERISTICS:

Horizonation:

A: 50 -75 cm thick
AB: 10-25 cm thick
Bt or Bw: 15-100 cm thick
BC: 15-50 cm thick
C

Thickness of the mollic epipedon—80 to 150 centimeters
Depth to carbonates--greater than 150 centimeters
Note: If Bt horizon present, increase in clay content is too little to qualify as an argillic horizon
*Sampled for IUSS Tour

888,295 total acres in MLRA 102C,106, 107B, 108, 109


96° 9' 39"
96° 9' 9"
738270
738340
738410
738480
738550
738620
738690
738760
738830
738900
41° 9' 27"
41° 9' 26"
4th IUSS Soil Classification Conference
Field Tour Guidebook
4560070
4560000
4559930
4559860
4559790
4559720
9999
7234
9711
9686
156th St
8157
8153
7210
Sapp Brothers Dr
41° 9' 12"
41° 9' 11"
96° 9' 40"
96° 9' 6"
Map Scale: 1:3,390 if printed on A size (8.5" x 11") sheet.
N
Meters
0 45 90 180 270
Feet
0 150 300 600 900

Map Unit Legend

4th IUSS Soil Classification Conference

Field Tour Guidebook

Sarpy County, Nebraska (NE153)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
7210	Burchard-Contrary-Steinauer complex, 7 to 16 percent slopes	5.6	10.3%
7234	Judson silty clay loam, 2 to 6 percent slopes	9.3	17.2%
8153	Contrary-Marshall silty clay loams, 6 to 11 percent slopes	9.3	17.2%
8157	Contrary-Monona-Ida complex, 6 to 17 percent slopes	11.6	21.4%
9711	Urban land-Udarents complex, 0 to 16 percent slopes	0.8	1.4%
9986	Miscellaneous water, sewage lagoon	7.5	13.9%
9999	Water	10.1	18.6%
Totals for Area of Interest		**54.2**	**100.0%**

The Judson series formed in silty colluvium derived from non-calcareous loess on foot slopes, upland drainageways, and alluvial fans. Slope ranges from 0 to 12 percent and most areas are cultivated producing crops such as corn, small grain, and alfalfa. Areas of native vegetation consisting of big bluestem, little bluestem, Indiangrass, switchgrass, as well as other grasses of the tall grass prairie remain in isolated locations.

PEDON DESCRIPTION

Print Date: 03/29/2012

Description Date: 10/12/2011

Describer: S. McVey, P. Cowsert, V. Jaehrling, E. Benham, D. Shurtliff

Site ID: S11NE153003

Site Note:

Pedon ID: S11NE153003

Pedon Note:

Lab Source ID: SSL

Lab Pedon #: 12N0011

Soil Name as Described/Sampled: Judson

Soil Name as Correlated:

Classification: Fine-silty, mixed, superactive, mesic Cumulic Hapludolls

Pedon Type:

Pedon Purpose:

Taxon Kind:

Associated Soils:

Physiographic Division: Interior Plains

Physiographic Province: Central Lowland Province

Physiographic Section: Dissected till plains

State Physiographic Area:

Local Physiographic Area:

Geomorphic Setting: on footslope of base slope of upland

Upslope Shape: linear

Cross Slope Shape: concave

Particle Size Control Section: 25 to 100 cm.

Description origin: NASIS

Country: USA

State: Nebraska

County: Sarpy

MLRA: 107B -- Iowa and Missouri Deep Loess Hills

Soil Survey Area: NE153 – Sarpy County, Nebraska

Map Unit: 7234—Judson silty clay loam, 2 to 6 percent slopes

Quad Name:

Legal Description: SW 1/4 of NW 1/4 of Section 26, Township 14N , Range 11E

Latitude: 41 degrees 9 minutes 17.60 seconds north

Longitude: 96 degrees 9 minutes 22.60 seconds west

Datum:

UTM Zone:

UTM Easting:

UTM Northing:

Primary Earth Cover: Grass/herbaceous cover

Secondary Earth Cover: Grassland rangeland

Existing Vegetation: goldenrod, Indiangrass, Kentucky bluegrass, little bluestem, Maximilian sunflower, smooth brome

Parent Material: slope alluvium

Bedrock Kind:

Bedrock Depth:

Bedrock Hardness:

Bedrock Fracture Interval:

Surface Fragments:

Description database: NSSL

Diagnostic Features: mollic epipedon 0 to 95 cm.
cambic horizon 95 to 170 cm.

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
4.0		0						well		

Judson silty clay loam at Chalco Hills Recreation Area

Profile Description:

Ap--0 to 18 centimeters; black (10YR 2/1) silty clay loam; 28 percent clay; moderate fine granular parts to weak fine subangular blocky structure; friable, slightly hard, slightly sticky, slightly plastic; very fine and fine roots throughout; very fine and fine interstitial pores; filled worm burrows; clear smooth boundary.

A1--14 to 36 centimeters; black (10YR 2/1) exterior and very dark brown (10YR 2/2) interior silty clay loam; 30 percent clay; moderate thin platy parts to moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; very fine and fine roots throughout and medium roots throughout; very fine and fine tubular pores; abrupt smooth boundary.

A2--36 to 56 centimeters; black (10YR 2/1) exterior and very dark brown (10YR 2/2) interior silty clay loam; 30 percent clay; moderate medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; fine roots throughout and very fine roots throughout; fine tubular pores; gradual wavy boundary.

AB--56 to 95 centimeters; very dark brown (10YR 2/2) exterior and very dark grayish brown (10YR 3/2) interior silty clay loam; 32 percent clay; moderate medium subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; very fine roots throughout; fine tubular pores; clear smooth boundary.

Bw1--95 to 119 centimeters; very dark grayish brown (10YR 3/2) exterior and dark grayish brown (10YR 4/2) interior silty clay loam; 32 percent clay; moderate fine subangular blocky structure; friable, slightly hard, moderately sticky, moderately plastic; very fine roots throughout; very fine tubular pores; 6 percent prominent clay films on vertical faces of peds; clear smooth boundary.

Bw2--119 to 170 centimeters; dark grayish brown (10YR 4/2) exterior and brown (10YR 4/3) interior silty clay loam; 30 percent clay; moderate medium subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; very fine roots throughout; very fine tubular pores; 30 percent distinct very dark grayish brown (10YR 3/2) organic stains on vertical faces of peds.

Seq. #	Horizon depth (cm)	Horizon designation		Diagnostic horizon		Diagnostic characteristics or properties		Diagnostic materials	
		Tour Book	Tour	Soil Taxonomy	World Reference Base	Diagnostic characteristics of Soil Taxonomy	Diagnostic properties of World Reference Base	Soil Taxonomy	World Reference Base
1	0 14	Ap	~	mollic epipedon	mollic horizon			mineral soil material	mineral material
2	14 36	A1	~	mollic epipedon	mollic horizon	lithologic discontinuity at 36 cm	lithological discontinuity at 36 cm	mineral soil material	mineral material
3	36 56	A2	~	mollic epipedon	mollic horizon			mineral soil material	mineral material
4	56 95	AB	~	mollic epipedon	mollic horizon			mineral soil material	mineral material
5	95 119	Bw1	~	cambic horizon	cambic horizon			mineral soil material	mineral material
6	119 170	Bw2	~	cambic horizon	cambic horizon			mineral soil material	mineral material

Taxonomic Classifications of Judson (12N0011)

Soil Taxonomy Fine-silty, mixed, superactive, mesic Cumulic Hapludolls

WRB Haplic Phaeozems (Pachic, Siltic)

1.) Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th ed. USDA-Natural Resources Conservation Service, Washington, DC.

IUSS Working Group WRB. 2007. World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No.103. FAO, Rome.

*** Primary Characterization Data ***

Pedon ID: S11NE153003 (Sarpy, Nebraska) Print Date: May 18 2012 3:30PM
Sampled as on Oct 12, 2011; Judson ; Fine-silty, mixed, superactive, mesic Cumulic Hapludoll
Revised to :

SSL - Project C2012USNE004 IUSS Tour
- Site ID S11NE153003 Lat: 41° 9' 17.60" north Long: 96° 9' 22.60" west NAD83 MLRA: 107B
- Pedon 4th IUSS Soil Classification Conference
- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Soil Survey Laboratory Field Tour Guidebook
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
12N00039	Ap		0.0-14.0	S11NE153003-1			SICL	SIL
12N00040	A2		14.0-36.0	S11NE153003-2			SICL	SIL
12N00041	A3		36.0-56.0	S11NE153003-3			SICL	SICL
12N00042	AB		56.0-95.0	S11NE153003-4			SICL	SICL
12N00043	Bw1		95.0-119.0	S11NE153003-5			SICL	SICL
12N00044	Bw2		119.0-170.0	S11NE153003-6			SICL	SICL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	1.67	% wt
Volume, >2mm, Weighted Average	0.009	% vol
Clay, total, Weighted Average	28.349	% wt
Clay, carbonate free, Weighted Average	28.349	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 4	0.677	(NA)
LE, Whole Soil, Summed to 1m	3.8	cm/m

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments

Layer	Depth (cm)	Horz	Prep	Clay < .002	Silt .002-.05	Sand .05-2	Fine < .0002	CO_3 < .002	Fine Silt .002-.02	Coarse Silt .02-.05	VF Sand .05-.10	F Sand .10-.25	M Sand .25-.50	C Sand .5-1	VC Sand 1-2	Rock Fragments (mm) Weight 2-5	5-20	20-75	.1-75	>2 mm wt % whole soil
				Total			Clay		Silt		Sand									
				% of <2mm Mineral Soil												% of <75mm				
				3A1a1a			3A1a1a		3A1a1a		3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a					
12N000390-14		Ap	S	21.6	56.2	22.2	15.7		19.3	36.9	7.3	6.5	6.2	1.9	0.3	--	--	--	15	--
12N0004014-36		A2	S	24.6	57.7	17.7	17.1		21.1	36.6	7.4	6.3	2.5	1.3	0.2	tr	--	--	10	tr
12N0004136-56		A3	S	28.7	66.5	4.8	20.1		24.7	41.8	4.5	0.2	0.1	tr	--	--	--	--	tr	--
12N0004256-95		AB	S	29.0	65.7	5.3	19.3		25.6	40.1	5.2	0.1	tr	--	--	--	--	--	tr	--
12N0004395-119		Bw1	S	29.9	64.5	5.6	18.5		25.9	38.6	5.2	0.2	0.1	0.1	--	--	--	--	tr	--
12N00044119-170		Bw2	S	30.3	62.5	7.2	17.2		25.6	36.9	6.6	0.5	0.1	tr	tr	--	--	--	1	--

Bulk Density & Moisture

Layer	Depth (cm)	Horz	Prep	Bulk Density 33 kPa	Bulk Density Oven Dry	Cole Whole Soil	Water Content 6 kPa	10 kPa	33 kPa	1500 kPa	1500 kPa Moist	Ratio AD/OD	WRD Whole Soil	Aggst Stabl 2-0.5mm	Ratio/Clay CEC7	Ratio/Clay 1500 kPa
				g cm^{-3}			pct of < 2mm						cm^3 cm^{-3}	%		
				DbWR1	DbWR1				DbWR1	3C2a1a		3D1				
12N000390-14		Ap	S	1.47	1.63	0.035			21.9	11.5		1.017	0.15		0.81	0.53
12N0004014-36		A2	S	1.53	1.65	0.025			20.6	11.5		1.019	0.14		0.71	0.47
12N0004136-56		A3	S	1.35	1.48	0.031			26.3	13.0		1.022	0.18		0.69	0.45
12N0004256-95		AB	S	1.35	1.56	0.049			28.0	13.0		1.023	0.20		0.66	0.45
12N0004395-119		Bw1	S	1.37	1.54	0.040			23.4	14.2		1.025	0.13		0.69	0.47
12N00044119-170		Bw2	S	1.46	1.63	0.037			22.3	13.8		1.027	0.12		0.71	0.46

Water Content

Layer	Depth (cm)	Horz	Prep	Atterberg Limits LL	Atterberg Limits PI	Bulk Density Field	Bulk Density Recon 33 kPa	Bulk Density Recon Oven Dry	Water Content Field	Water Content Recon 33 kPa	Water Content Sieved Samples 6 kPa	10 kPa	33 kPa	100 kPa	200 kPa	500 kPa
				pct <0.4mm		g cm^{-3}			% of < 2mm							
															3C1e1a	
12N00039	0-14	Ap	S												17.5	
12N00040	14-36	A2	S												16.6	
12N00041	36-56	A3	S												19.4	
12N00042	56-95	AB	S												19.6	
12N00043	95-119	Bw1	S												22.8	
12N00044	119-170	Bw2	S												21.4	

*** Primary Characterization Data ***

Pedon ID: S11NE153003 (Sarpy County, Nebraska) Print Date: May 18 2012 3:30PM

Sampled As : Judson Fine-silty, mixed, superactive, mesic Cumulic Hapludoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0011

Carbon & Extractions

Layer	Depth (cm)	Horz	Prep	-1- C	-2- N	-3- S	-4- Est OC	-5- OC (WB)	-6- C/N Ratio	-7- Fe	-8- Al	-9- Mn	-10- Al+½Fe	-11- ODOE	-12- Fe	-13- Al	-14- Si	-15- Mn	-16- C	-17- Fe	-18- Al	-19- Mn
				(- - - - Total - - - -)			Est			(- - Dith-Cit Ext - -)			(- - - Ammonium Oxalate Extraction - - - -)						(- Na Pyro-Phosphate -)			
				(- - - - - - - -of <2 mm- - - - - - -)						(- - - - - - - - - - - - - - - % of < 2mm - - - - - - - - - - - -)								mg kg^{-1}	(- - - - % of < 2mm - - -)			
				4H2a	4H2a	4H2a				4G1	4G1	4G1		4G2a	4G2a	4G2a	4G2a	4G2a		4G3	4G3	4G3
12N00039	0-14	Ap	S	1.69	0.19	0.01	1.7		9	0.6	0.1	0.1	0.19	0.06	0.15	0.11	0.03	594.7		0.4	0.6	0.01
12N00040	14-36	A2	S	1.29	0.13	--	1.3		10	0.7	0.1	0.1	0.20	0.06	0.14	0.13	0.02	595.4		0.5	0.8	tr
12N00041	36-56	A3	S	1.39	0.15	--	1.4		9	0.7	0.1	0.1	0.24	0.05	0.17	0.16	0.03	483.7		0.5	0.8	--
12N00042	56-95	AB	S	0.89	0.09	--	0.9		10	0.8	0.1	0.1	0.24	0.05	0.18	0.15	0.03	539.1		0.5	0.8	--
12N00043	95-119	Bw1	S	0.46	0.09	--	0.5		5	0.9	0.1	0.1	0.25	0.04	0.23	0.13	0.04	688.0		0.6	0.9	--
12N00044	119-170	Bw2	S	0.30	0.11	--	0.3		3	0.9	0.1	0.1	0.23	0.03	0.25	0.11	0.05	781.3		0.6	0.8	--

CEC & Bases

Layer	Depth (cm)	Horz	Prep	-1- Ca	-2- Mg	-3- Na	-4- K	-5- Sum Bases	-6- Acid-ity	-7- Extr Al	-8- KCl Mn	-9- CEC8 Sum Cats	-10- CEC7 NH_4 OAC	-11- ECEC Bases +Al	-12- Al Sat	-13- Sum	-14- NH_4OAC
				(- - - - - NH_4OAC Extractable Bases - - - -)												(- - - Base - - - -) (- Saturation -)	
				(- - - - - - - - - - - - - - - - cmol(+) kg^{-1} - - - - - - - - - - - - - - - - -)							mg kg^{-1}	(- - - - cmol(+) kg^{-1} - - -)				(- - - - - - - - % - - - - - - - -)	
				4B1a1a	4B1a1a	4B1a1a	4B1a1a		4B2b1a1				4B1a1a				
12N00039	0-14	Ap	S	12.4	2.6	--	1.5	16.5	15.9			32.4	17.4			51	95
12N00040	14-36	A2	S	11.3	2.6	--	1.1	15.0	9.6			24.6	17.5			61	86
12N00041	36-56	A3	S	13.4	4.2	--	0.7	18.3	8.1			26.4	19.7			69	93
12N00042	56-95	AB	S	13.2	5.1	--	0.7	19.0	6.4			25.4	19.2			75	99
12N00043	95-119	Bw1	S	14.0*	6.1	--	0.9	21.0	5.9			26.9	20.6			78	100
12N00044	119-170	Bw2	S	14.6*	6.7	--	0.9	22.2	4.2			26.4	21.6			84	100

*Extractable Ca may contain Ca from calcium carbonate or gypsum. CEC7 base saturation set to 100.

Salt

Layer	Depth (cm)	Horz	Prep	-1- Ca	-2- Mg	-3- Na	-4- K	-5- CO_3	-6- HCO_3	-7- F	-8- Cl	-9- PO_4	-10- Br	-11- OAC	-12- SO_4	-13- NO_2	-14- NO_3	-15- H_2O	-16- Total Salts	-17- Elec Cond	-18- Pred Elec Cond	-19- Exch Na	-20- SAR
				(- - - - - - - - - - - - - - - - Water Extracted From Saturated Paste - - - - - - - - - - - - - - - - -)																			
				(- - - mmol(+) L^{-1} - - - -)				(- - - - - - - - - - - - - - - - - - mmol(-) L^{-1} - - - - - - - - - - - - - - - - -)										(- - - % - - -)		(- - dS m^{-1} - -)		%	
				4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2		4F2	4F1a1a1		
12N00039	0-14	Ap	S	2.2	0.6	0.1	0.9	--	1.7	0.2	0.6	--	tr	--	0.5	0.1	tr	64.2		0.36	0.15	--	
12N00040	14-36	A2	S	1.1	0.3	0.1	0.5	--	0.8	0.2	0.3	--	--	--	0.2	0.1	tr	62.3		0.17	0.07	--	
12N00041	36-56	A3	S	1.2	0.3	0.2	0.3	--	0.4	0.2	0.6	--	--	--	0.2	tr	tr	69.9		0.20	0.08	--	
12N00042	56-95	AB	S	0.8	0.2	0.1	0.3	--	0.4	0.1	0.3	--	--	--	0.2	tr	tr	67.7		0.13	0.05	--	
12N00043	95-119	Bw1	S	0.8	0.2	0.1	0.3	--	0.3	--	0.3	--	--	--	0.4	--	tr	62.0		0.15	0.07	--	
12N00044	119-170	Bw2	S	0.9	0.2	tr	0.3	--	0.2	--	0.2	--	tr	--	0.5	--	0.1	62.5		0.15	0.07	--	

pH & Carbonates

Layer	Depth (cm)	Horz	Prep	-1- KCl	-2- $CaCl_2$ 0.01M 1:2	-3- H_2O 1:1	-4- Sat Paste	-5- Oxid	-6- NaF	-7- <2mm	-8- <20mm	-9- <2mm	-10- <20mm	-11- Resist ohms cm^{-1}
				(- - - - - - - - - - - - - - - - - - pH - - - - - - - - - - - - - - - - - -)						(- - Carbonate - -) As $CaCO_3$		(- - Gypsum - - -) As $CaSO_4$*$2H_2O$		
										(- - - - - - - - - - - - % - - - - - - - - - - - -)				
					4C1a2a	4C1a2a	4F2		4C1a1a1					
12N00039	0-14	Ap	S		5.7	6.3	6.0		8.6					
12N00040	14-36	A2	S		5.2	6.0	5.7		8.7					
12N00041	36-56	A3	S		5.3	6.1	5.7		8.8					
12N00042	56-95	AB	S		5.6	6.4	6.0		9.2					
12N00043	95-119	Bw1	S		5.9	6.7	6.2		9.5					
12N00044	119-170	Bw2	S		6.2	6.8	6.4		9.4					

*** Primary Characterization Data ***

Pedon ID: S11NE153003 (Sarpy County, Nebraska) Print Date: May 18 2012 3:30

Sampled As : Judson Fine-silty, mixed, superactive, mesic Cumulic Hapludoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0011

Phosphorous				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
					(- - - - - - - - - - - - - - - - - - Phosphorous - - - - - - - - - - - - - - - - - -)										
Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ %	Acid Oxal (- mg kg^{-1} - - - - - - - - - - - - - - - - - -) 4G2a	Anion Exch Available	Resin Capacity	Bray 1 4D3	Bray 2	Olsen	H_2O	Citric Acid	Mehlich III 4D6b	KCl Extr NO_3
12N00039	0-14	Ap	S			155.4			8.1					20.1	
12N00040	14-36	A2	S			166.2			5.8					18.7	
12N00041	36-56	A3	S			166.1			6.0					15.5	
12N00042	56-95	AB	S			161.5			8.9					14.8	
12N00043	95-119	Bw1	S			259.0			24.2					29.9	
12N00044	119-170	Bw2	S			328.9			34.0					43.4	

Phosphorous				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
					(- - - - - - - - - - - - - - - - - - Phosphorous - - - - - - - - - - - - - - - - - -)										
Layer	Depth (cm)	Horz	Prep	Melanic Index	NZ %	Acid Oxal (- mg kg^{-1} - - - - - - - - - - - - - - - - - -)	Anion Exch Available	Resin Capacity	Bray 1	Bray 2	Olsen	H_2O	Citric Acid	Mehlich III 4D6a1	KCl Extr NO_3
12N00039	0-14	Ap	S											6.4	
12N00040	14-36	A2	S											5.0	
12N00041	36-56	A3	S											4.3	
12N00042	56-95	AB	S											7.2	
12N00043	95-119	Bw1	S											22.7	
12N00044	119-170	Bw2	S											34.0	

Trace Elements Tier 1				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
Layer	Depth (cm)	Horz	Prep	Ag mg/kg 4H1a	As mg/kg 4H1a	Ba mg/kg 4H1a	Be mg/kg 4H1a	Cd mg/kg 4H1a	Co mg/kg 4H1a	Cr mg/kg 4H1a	Cu mg/kg 4H1a	Mn mg/kg 4H1a	Mo mg/kg 4H1a		Hg ug/kg 4H1a
12N00039	0-14	Ap	HM	0.09	8.36	243.18	0.92	0.60	8.75	27.89	16.06	716.75	1.21		37
12N00040	14-36	A2	HM	0.10	8.70	249.10	0.93	0.55	8.78	28.25	16.28	655.53	0.90		32
12N00041	36-56	A3	HM	0.11	9.69	293.53	1.12	0.48	9.92	32.33	18.70	567.13	0.94		28
12N00042	56-95	AB	HM	0.10	9.22	285.70	1.18	0.46	9.91	31.59	18.68	563.85	0.85		24
12N00043	95-119	Bw1	HM	0.12	11.67	297.94	1.16	0.46	12.11	29.16	20.67	743.72	0.87		33
12N00044	119-170	Bw2	HM	0.12	10.95	351.21	1.20	0.77	13.35	34.20	22.83	795.69	12.44		34

Trace Elements Tier 2				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-
Layer	Depth (cm)	Horz	Prep	Ni mg/kg 4H1a	P mg/kg 4H1a	Pb mg/kg 4H1a	Sb mg/kg 4H1a	Se ug/kg 4H1a	Sn mg/kg 4H1a	Sr mg/kg 4H1a	Tl mg/kg	V mg/kg 4H1a	W mg/kg 4H1a	Zn mg/kg 4H1a
12N00039	0-14	Ap	HM	23.24	388.08	14.33	0.47	566.21	0.89	34.46		60.20	0.04	63.81
12N00040	14-36	A2	HM	22.49	319.02	13.83	0.44	468.63	0.91	35.02		61.30	0.03	65.23
12N00041	36-56	A3	HM	23.89	409.74	13.85	0.43	486.87	1.04	42.75		67.70	0.03	74.50
12N00042	56-95	AB	HM	24.35	387.04	13.51	0.41	272.72	1.00	44.71		65.96	0.02	72.20
12N00043	95-119	Bw1	HM	28.66	496.15	14.92	0.07	248.18	0.49	46.54		64.09	0.03	70.93
12N00044	119-170	Bw2	HM	31.97	540.62	16.69	0.53	159.96	1.06	54.26		73.66	0.04	78.90

*** Primary Characterization Data ***

Pedon ID: S11NE153003 (Sarpy County, Nebraska) Print Date: May 18 2012 3:30PM

Sampled As : Judson Fine-silty, mixed, superactive, mesic Cumulic Hapludoll

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0011

Major Elements

Layer	Depth (cm)	Horz	Prep	-1- Al mg/kg 4H1b	-2- Ca mg/kg 4H1b	-3- Fe mg/kg 4H1b	-4- K mg/kg 4H1b	-5- Mg mg/kg 4H1b	-6- Mn mg/kg 4H1b	-7- Na mg/kg 4H1b	-8- P mg/kg 4H1b	-9- Si mg/kg 4H1b	-10- Sr mg/kg 4H1b	-11- Ti mg/kg 4H1b	-12- Zr mg/kg 4H1b
12N00039	0-14	Ap	HM	52708	6765	19920	19507	4356	851	9564	596	337242	156	3559	181
12N00040	14-36	A2	HM	56222	6478	21512	20122	4827	858	9507	606	331987	157	3658	183
12N00041	36-56	A3	HM	59382	5921	22328	19529	5181	660	9026	604	299741	142	3644	183
12N00042	56-95	AB	HM	61419	6355	24292	21045	5956	725	9365	650	314253	154	3772	169
12N00043	95-119	Bw1	HM	64548	7272	26806	21420	6918	971	9295	765	311620	165	3798	169
12N00044	119-170	Bw2	HM	66915	8250	28382	22359	7601	970	9649	911	320767	180	3944	177

Mehlich3 Elements

Layer	Depth (cm)	Horz.	Prep.	-1- Al	-2- As	-3- Ba	-4- Ca	-5- Cd	-6- Co	-7- Cr	-8- Cu	-9- Fe	-10- K	-11- Mg	-12- Mn	-13- Mo	-14- Na	-15- Ni	-16- P	-17- Pb	-18- Se	-19- Si	-20- Sr	-21- Zn
				(mg/kg)																				
				4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b		4D6b	4D6b	4D6b
12N000390-14		Ap	S	821.6	2.2	84.3	2149.6	0.2	0.9	0.1	2.3	175.4	516.3	310.3	116.3	0.4	14.8	2.1	20.1	2.9		450.2	14.7	2.7
12N0004014-36		A2	S	996.0	2.4	90.0	2050.0	0.2	0.6	0.1	2.1	156.7	369.3	320.3	78.4	0.4	20.3	2.1	18.7	2.0		397.1	16.1	1.8
12N0004136-56		A3	S	1050.	81.1	102.7	2416.0	0.2	0.4	tr	2.3	117.1	257.1	425.7	38.1	0.2	40.4	2.3	15.5	2.0		385.9	20.6	1.4
12N0004256-95		AB	S	1046.	10.9	106.4	2456.3	0.2	0.3	0.1	2.5	85.4	258.1	526.2	26.0	0.4	38.1	1.6	14.8	1.6		428.1	23.0	1.2
12N0004395-119		Bw1	S	977.6	1.5	93.2	2649.5	0.2	1.0	0.1	3.0	152.1	311.0	626.8	93.1	0.5	33.4	2.0	29.9	1.6		537.9	24.5	1.5
12N00044	119-170	Bw2	S	800.7	2.8	91.5	2988.4	0.2	1.5	0.1	3.2	136.1	313.0	695.6	132.8	0.4	31.4	2.5	43.4	2.4		549.6	25.9	1.6

Clay Mineralogy

Layer	Depth (cm)	Horz	Fraction	-1- X-Ray 7A1b1 (peak size)	-2-	-3-	-4- Thermal 7A4a (%)	-5-	-6-	-7-	-8-	-9-	-10- Elemental SiO_2 (%)	-11- Al_2O_3 (%)	-12- Fe_2O_3 (%)	-13- MgO (%)	-14- CaO (%)	-15- K_2O (%)	-16- Na_2O (%)	-17- EGME Retn ($mg\ g^{-1}$)	-18- Interpretation
12N00043	95-119	Bw1	tcly	MT 4	MI 3	KK 2	KK 32														SMEC
12N00044	119-170	Bw2	tcly	MT 4	MI 3	KK 2	KK 30														SMEC

FRACTION INTERPRETATION:

tcly - Total Clay,

MINERAL INTERPRETATION:

KK - Kaolinite MI - Mica MT - Montmorillonite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

LOCATION JUDSON IA+KS MN MO NE WI
Established Series
Rev. JCR-RAL-TWN
10/2008

JUDSON SERIES

The Judson series consists of very deep, well drained soils formed in silty colluvium derived from non-calcareous loess. These soils are on foot slopes, upland drainageways, and alluvial fans. Slope ranges from 0 to 12 percent. Mean annual air temperature is about 10 degrees C. Mean annual precipitation is about 810 millimeters.

TAXONOMIC CLASS: Fine-silty, mixed, superactive, mesic Cumulic Hapludolls

TYPICAL PEDON: Judson silty clay loam, on a south-facing slope of 4 percent, in a cultivated field. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 23 centimeters; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry, very dark grayish brown (10YR 3/2) kneaded; weak medium granular structure, friable; slightly acid; abrupt smooth boundary.

A1--23 to 38 centimeters; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry, very dark grayish brown (10YR 3/2) kneaded; weak fine granular and weak very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.

A2--38 to 56 centimeters; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry, very dark grayish brown (10YR 3/2) kneaded; weak very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary. (Combined thickness of the A horizon is 50 to 75 centimeters.)

AB--56 to 71 centimeters; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry, dark brown (10YR 3/3) kneaded; moderate fine subangular blocky structure; friable; many tubular pores; moderately acid; gradual smooth boundary. (10 to 25 centimeters thick)

Bt--71 to 89 centimeters; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry, dark brown (10YR 3/3) kneaded; moderate medium subangular blocky structure; friable; many tubular pores; common very dark grayish brown (10YR 3/2) organoargillans on faces of peds; very few clay films; slightly acid; gradual smooth boundary. (15 to 100 centimeters thick)

BC--89 to 132 centimeters; brown (10YR 4/3) silty clay loam; yellowish brown (10YR 5/4) kneaded; weak coarse subangular blocky structure; friable; many tubular pores; few very dark gray (10YR 3/1) stains on root channels; few fine faint grayish brown (10YR 5/2) redoximorphic

depletions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid; gradual smooth boundary. (15 to 50 centimeters thick)

C--132 to 152 centimeters; brown (10YR 4/3) silty clay loam; massive; friable; few fine dark oxides; few fine faint grayish brown (10YR 5/2) redoximorphic depletions; common fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid.

TYPE LOCATION: Major Land Resource Area (MLRA) 108D-Illinois and Iowa Deep Loess and Drift, Western Part, Madison County, Iowa subset; about 7 miles north and 3 miles east of Winterset; located about 2,000 feet south and 300 feet west of the northeast corner of section 33, T. 77 N., R. 27 W.; USGS Saint Charles NW topographic quadrangle; lat. 41 degrees 25 minutes 34 seconds N. and long. 93 degrees 57 minutes 22 seconds W., NAD 83.

RANGE IN CHARACTERISTICS:
Thickness of the mollic epipedon--80 to 150 centimeters
Depth to carbonates--more than 150 centimeters
Clay content in the particle-size control section (weighted average)--30 to 35 percent
Sand content in the particle-size control section (weighted average)--1 to 10 percent fine sand and sand coarser than fine sand

Ap or A horizon:
Hue--10YR
Value--2 or 3
Chroma--1 or 2
Texture--silty clay loam or silt loam
Clay content--24 to 32 percent
Sand content--1 to 10 percent
Reaction--very strongly acid to neutral

AB horizon:
Hue--10YR
Value--2 or 3
Chroma--2
Texture--silty clay loam
Clay content--27 to 32 percent
Sand content--1 to 10 percent
Reaction--moderately acid to neutral

Bt or Bw horizon:
Hue--10YR
Value--3 to 5
Chroma--3 to 5
Texture--silty clay loam
Clay content--30 to 35 percent
Sand content--1 to 10 percent
Reaction--moderately acid to neutral

Common dark-colored coats on faces of peds

Some pedons have redoximorphic features of low or high chroma within a depth of 75 centimeters

BC horizon:
Hue--10YR
Value--3 to 5
Chroma--3 or 4
Texture--silty clay loam or silt loam
Clay content--25 to 32 percent
Sand content--1 to 10 percent
Reaction--slightly acid to slightly alkaline

Some pedons have common redoximorphic features with chroma range of 1 to 6

C horizon:
Hue--10YR
Value--3 to 5
Chroma--3 or 4
Texture--silty clay loam or silt loam
Clay content--25 to 32 percent
Sand content--1 to 10 percent
Reaction--slightly acid to slightly alkaline

Some pedons have common redoximorphic features with chroma range of 1 to 6

COMPETING SERIES: These are the Allison, Anthon, Huntsville, Ivan, Kahola, Kennebec, Kenridge, Lindstrom, Napier, Rossville, Sturkie, and Worthen series.
Allison--have strata with a sand content of more than 10 percent below a depth of 75 centimeters
Anthon--have a sand content of more than 35 percent within a depth of 150 centimeters
Huntsville--have a clay content that averages 18 to 27 percent in the particle-size control section
Ivan--have carbonates within a depth of 25 centimeters
Kahola--have carbonates within a depth of 100 centimeters
Kennebec--have a clay content that averages 18 to 30 percent in the particle-size control section and have a matrix chroma of 1 or 2 in the throughout the series control section
Kenridge--have a matrix chroma of 2 immediately below the mollic epipedon
Lindstrom--have a clay content that averages 18 to 24 percent in the particle-size control section
Napier--have a clay content that averages 20 to 27 percent in the particle-size control section
Rossville--are in areas with a mean annual air temperature ranges from 11 to 13 degrees C and have a clay content of 12 to 26 percent in the lower third of the series control section
Sturkie--have a clay content that averages less than 30 percent in the particle-size control section
Worthen--have a clay content that averages 15 to 26 percent in the particle-size control section

GEOGRAPHIC SETTING:
Parent material--silty colluvium derived from non-calcareous loess

Landform--foot slopes, upland drainageways, and alluvial fans
Slope--0 to 12 percent
Elevation--155 to 610 meters above sea level
Mean annual air temperature--6 to 13 degrees C
Mean annual precipitation--585 to 1,040 millimeters
Frost-free period--155 to 220 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Marshall, Otley, Sharpsburg, and Tama soils.
Marshall--are on higher landscape positions and have mollic epipedons that are 25 to 60 centimeters thick
Otley--are on higher landscape positions and have a clay content that averages 36 to 42 percent in the particle-size control section
Sharpsburg--are on higher landscape positions and have a clay content that averages 36 to 42 percent in the particle-size control section
Tama--are on higher landscape positions and have mollic epipedons that are 25 to 50 centimeters thick

DRAINAGE AND SATURATED HYDRAULIC CONDUCTIVITY:
Drainage class--well drained--a frequently saturated zone does not occur within a depth of 1.8 meters during the wettest periods of years when precipitation is within one standard deviation of the 30 year mean of annual precipitation
Saturated hydraulic conductivity--1.00 to 10.00 micrometers per second

USE AND VEGETATION:
Most areas are cultivated. The principal crops are corn, small grain, and alfalfa or clover. The native vegetation is big bluestem, little bluestem, indiangrass, switchgrass, and other grasses of the tall grass prairie.

DISTRIBUTION AND EXTENT:
Physiographic Division--Interior Plains
Physiographic Province--Central Lowlands
Physiographic sections--Western lake section, Wisconsin driftless section, and Dissected till plains
MLRAs--Till Plains (102B),
Central Iowa and Minnesota Till Prairies (103),
Eastern Iowa and Minnesota Till Prairies (104),
Northern Mississippi Valley Loess Hills (105),
Nebraska and Kansas Loess-Drift Hills (106),
Iowa and Minnesota Loess Hills (107A),
Iowa and Missouri Deep Loess Hills (107B),
Illinois and Iowa Deep Loess and Drift, West-Central Part (108C), and
Illinois and Iowa Deep Loess and Drift, Western Part (108D)
LRR M; Iowa, Nebraska, Kansas, Minnesota, and Wisconsin
Extent--large

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Blue Earth County, Minnesota, 1906.

REMARKS:
Particle-size control section--the zone from a depth of 25 to 100 centimeters (A1, A2, AB, Bt, and BC horizons);
series control section--the zone from the surface to a depth of 150 centimeters (Ap, A1, A2, AB, Bt, BC, and C horizons).

Diagnostic horizons and features recognized in this pedon include:
mollic epipedon--the zone from the surface to a depth of 89 centimeters (Ap, A1, A2, AB, and Bt horizons);
cambic horizon-the zone from a depth of 89 to 132 centimeters (BC horizon);
udic moisture regime.

The Bt horizon does not have the 1.2 percent clay increase to meet the requirements of an argillic horizon.

Cation-exchange class is supported by lab sample number S96IA-193-005, NSSL.

Taxonomy version--tenth edition, 2006.

A cherty silt loam phase is mapped in MLRA 105, this soil is considered a fine-loamy taxadjunct of the Judson series.

ADDITIONAL DATA:
Laboratory data--National Soil Survey Laboratory, Lincoln, Nebraska, user pedonid number S96IA-193-005, (http://ssldata.sc.egov.usda.gov/).

National Cooperative Soil Survey
U.S.A.

Site 4b – Liston Series

Soil scientists Shawn McVey, Dan Shurtliff, and Steve Monteith search for a representative soil forming in glacial till in Chalco Hills Recreation Area. A wide variety of soil taxa are found over very short distances on the dissected till landscapes in eastern Nebraska.

PEDON DESCRIPTION

Print Date: 03/29/2012
Description Date: 10/12/2011
Describer: P.T.C., V.M.J.
Site ID: S11NE153004
Site Note:

Pedon ID: S11NE153004

Pedon Note:
Lab Source ID: SSL
Lab Pedon #: 12N0012

Soil Name as Described/Sampled: Liston

Soil Name as Correlated:

Classification: Fine-loamy, mixed, active, mesic Typic Calciudolls
Pedon Type:
Pedon Purpose:
Taxon Kind:
Associated Soils:

Physiographic Division: Interior Plains
Physiographic Province: Central Lowland Province
Physiographic Section: Dissected till plains
State Physiographic Area:
Local Physiographic Area:
Geomorphic Setting: on footslope of upland on footslope of hillslope
Upslope Shape: linear
Cross Slope Shape: concave
Particle Size Control Section:

Description origin: NASIS

Country: USA
State: Nebraska
County: Sarpy
MLRA: 107B -- Iowa and Missouri Deep Loess Hills
Soil Survey Area: NE153 – Sarpy County, Nebraska
Map Unit: 7210—Burchard-Contrary-Steinauer complex, 7 to 16 percent slopes
Quad Name:

Legal Description:

Latitude: 41 degrees 9 minutes 18.70 seconds north
Longitude: 96 degrees 9 minutes 20.60 seconds west
Datum:
UTM Zone:
UTM Easting:
UTM Northing:

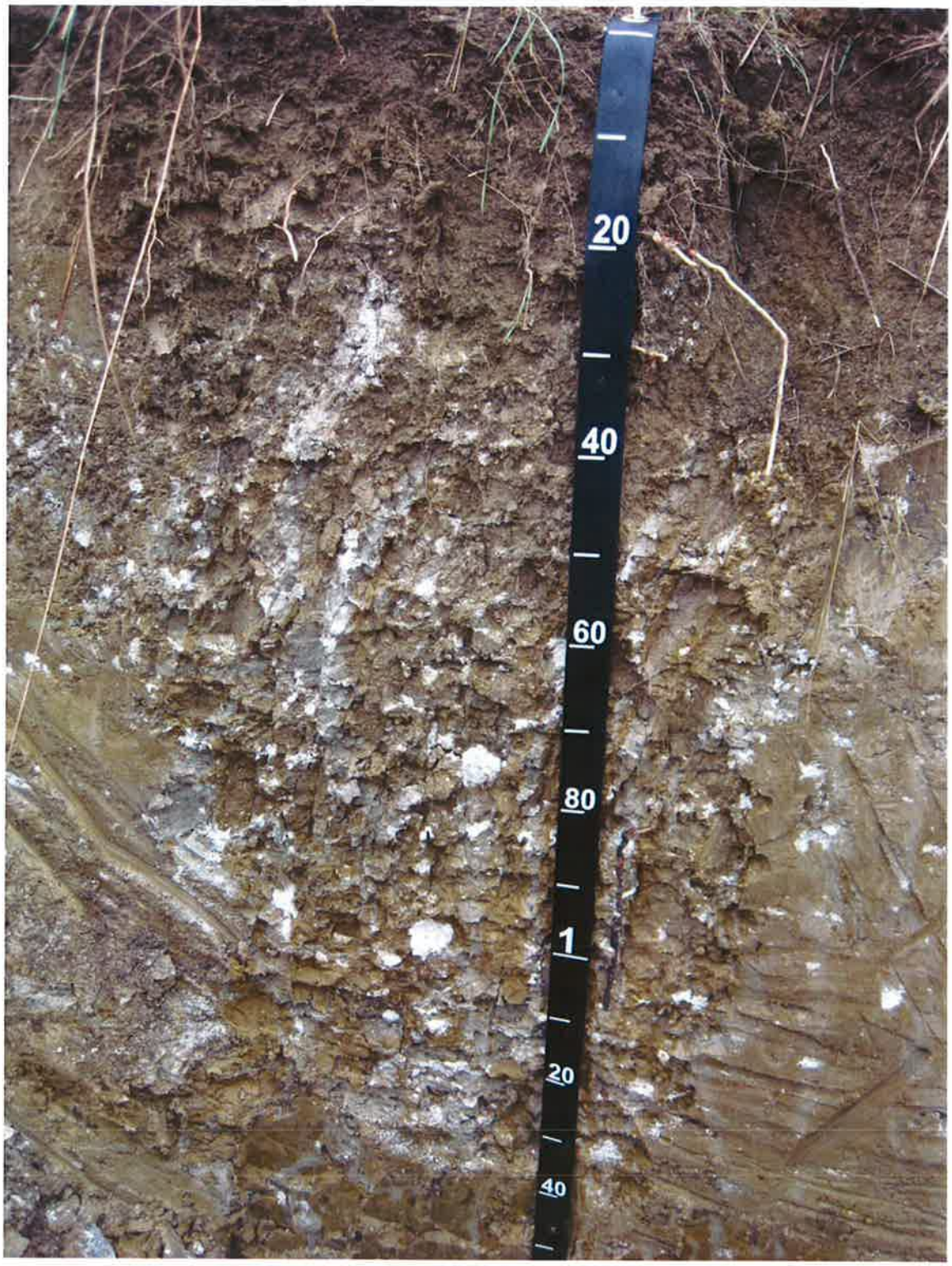
Primary Earth Cover: Grass/herbaceous cover
Secondary Earth Cover: Other grass/herbaceous cover
Existing Vegetation:
Parent Material: till
Bedrock Kind:
Bedrock Depth:
Bedrock Hardness:
Bedrock Fracture Interval:
Surface Fragments: 10.0 percent nonflat 2- to 75-millimeter

Description database: NSSL

Diagnostic Features: mollic epipedon 0 to 23 cm.
free carbonates 0 to 170 cm.
secondary carbonates 23 to 170 cm.
calcic horizon 23 to 50 cm.
cambic horizon 50 to 102 cm.

Cont. Site ID: S11NE153004 **Pedon ID:** S11NE153004

Slope (%)	Elevation (meters)	Aspect (deg)	MAAT (C)	MSAT (C)	MWAT (C)	MAP (mm)	Frost-Free Days	Drainage Class	Slope Length (meters)	Upslope Length (meters)
5.0		315						well		


20
40
60
80
1
20
40

Profile Description:

Ap1--0 to 9 centimeters; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2), dry; weak fine subangular blocky, and weak medium granular structure; very friable, slightly hard, moderately sticky, moderately plastic; common medium roots; few fine interstitial pores; 7 percent nonflat 2- to 75-millimeter unspecified fragments; slight effervescence, by HCl, 1 normal; clear wavy boundary.

Ap2--9 to 23 centimeters; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3), dry; weak fine subangular blocky, and weak medium granular structure; very friable, slightly hard, moderately sticky, moderately plastic; few very fine roots; few fine interstitial pores; 7 percent nonflat 2- to 75-millimeter unspecified fragments; slight effervescence, by HCl, 1 normal; clear wavy boundary.

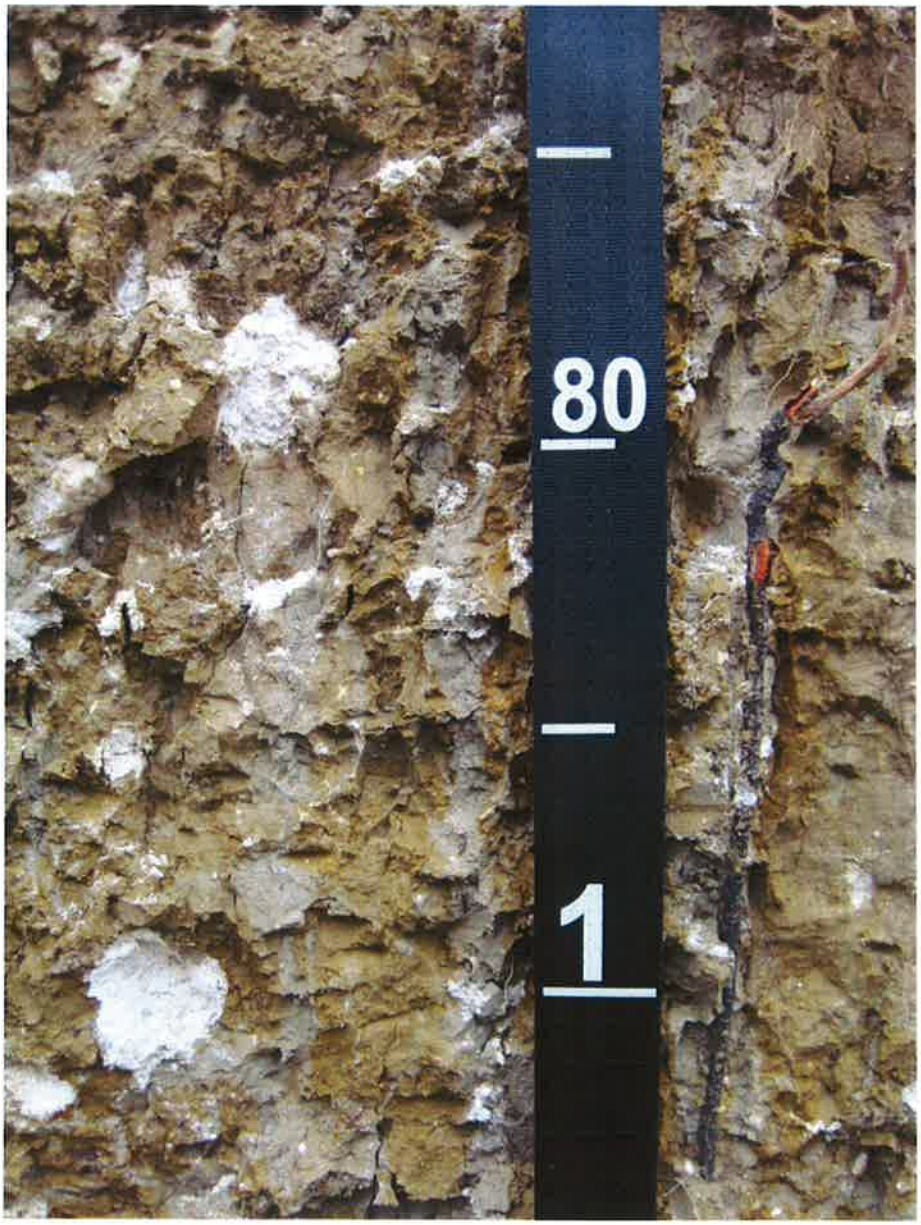
Bk--23 to 50 centimeters; brown (10YR 4/3) exterior and yellowish brown (10YR 5/4) interior with gray (10YR 5/1) silty clay loam; moderate coarse subangular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots; few very fine interstitial pores; 15 percent medium carbonate masses; 7 percent nonflat 2- to 75-millimeter unspecified fragments; strong effervescence, by HCl, 1 normal; clear wavy boundary.

Btk1--50 to 79 centimeters; 75 percent brown (10YR 5/3) with 25 percent gray (10YR 5/1) silty clay loam; strong coarse angular blocky structure; firm, moderately sticky, moderately plastic; few very fine roots; few very fine interstitial pores; 1 percent clay films on all faces of peds; 2 percent manganese coatings; 5 percent medium carbonate concretions and 15 percent medium and coarse carbonate masses; 7 percent nonflat 2- to 75-millimeter unspecified fragments; strong effervescence, by HCl, 1 normal; clear wavy boundary.

Btk2--79 to 102 centimeters; 65 percent yellowish brown (10YR 5/4) with 35 percent gray (10YR 5/1) silty clay loam; strong coarse and very coarse prismatic, and strong coarse angular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots; few very fine interstitial pores; 1 percent clay films on all faces of peds; 5 percent manganese coatings; 2 percent medium carbonate concretions and 7 percent medium carbonate masses; 7 percent nonflat 2- to 75-millimeter unspecified fragments; slight effervescence, by HCl, 1 normal; clear wavy boundary.

B'k--102 to 138 centimeters; 50 percent yellowish brown (10YR 5/4) and 50 percent gray (10YR 5/1) silty clay loam; strong coarse and very coarse prismatic, and strong coarse angular blocky structure; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots; few very fine interstitial pores; 7 percent manganese coatings; 2 percent medium carbonate concretions and 15 percent medium carbonate masses; 7 percent nonflat 2- to 75-millimeter unspecified fragments; slight effervescence, by HCl, 1 normal; abrupt wavy boundary.

BCk--138 to 170 centimeters; 75 percent yellowish brown (10YR 5/4) with 25 percent gray (10YR 5/1) silty clay loam; massive; firm, moderately hard, moderately sticky, moderately plastic; few very fine roots; few very fine interstitial pores; 10 percent manganese coatings; 1 percent medium carbonate concretions and 5 percent medium carbonate masses; 7 percent nonflat 2- to 75-millimeter unspecified fragments; very slight effervescence, by HCl, 1 normal.



Calcium carbonate masses in the matrix and and gleying along prisms and polygons are visible in the Liston soil.

Seq. #	Horizon depth (cm)	Horizon designation		Diagnostic horizon		Diagnostic characteristics or properties		Diagnostic materials	
		Tour Book	Tour	Soil Taxonomy	World Reference Base	Diagnostic characteristics of Soil Taxonomy	Diagnostic properties of World Reference Base	Soil Taxonomy	World Reference Base
1	0 9	Ap1	~	mollic epipedon	anthric horizon, mollic horizon	free carbonates		mineral soil material	calcaric material, mineral material
2	9 23	Ap2	~	mollic epipedon	anthric horizon, mollic horizon	free carbonates		mineral soil material	calcaric material, mineral material
3	23 50	Bk	~	calcic horizon	calcic horizon	free carbonates, identifiable secondary carbonates	secondary carbonates	mineral soil material	calcaric material, mineral material
4	50 79	Btk1	~	cambic horizon	cambic horizon	free carbonates, identifiable secondary carbonates, relict redoximorphic features	relict gleyic colour pattern, secondary carbonates	mineral soil material	calcaric material, mineral material
5	79 102	Btk2	~	cambic horizon	cambic horizon	free carbonates, identifiable secondary carbonates, relict redoximorphic features	relict gleyic colour pattern, secondary carbonates	mineral soil material	calcaric material, mineral material
6	102 138	B'k	~			free carbonates, identifiable secondary carbonates, relict redoximorphic features	relict gleyic colour pattern, secondary carbonates	mineral soil material	calcaric material, mineral material
7	138 170	BCk	~			free carbonates, identifiable secondary carbonates, relict redoximorphic features	relict gleyic colour pattern, secondary carbonates	mineral soil material	calcaric material, mineral material

Taxonomic Classifications of Liston (12N0012)

Soil Taxonomy Fine-loamy, mixed, active, mesic Typic Calciudolls

WRB Calcic Kastanozems (Anthric)

1.) Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436

Soil Survey Staff. 2010. Keys to Soil Taxonomy, 11th ed. USDA-Natural Resources Conservation Service, Washington, DC.

IUSS Working Group WRB. 2007. World Reference Base for Soil Resources 2006, first update 2007. World Soil Resources Reports No.103. FAO, Rome.

*** Primary Characterization Data ***

Pedon ID: S11NE153004 (Sarpy, Nebraska) Print Date: May 18 2012 3:32

Sampled as on Oct 12, 2011: Liston ; Fine-loamy, mixed, superactive, mesic Typic Eutrudept

Revised to :

SSL - Project C2012USNE004 IUSS Tour
- Site ID S11NE153004 Lat: 41° 9' 18.50" north Long: 96° 9' 20.50" west NAD83 MLRA: 107B
- Pedon No. 12N0012
- General Methods 1B1A, 2A1, 2B

United States Department of Agriculture
Natural Resources Conservation Service
National Soil Survey Center
Soil Survey Laboratory
Lincoln, Nebraska 68508-3866

Layer	Horizon	Orig Hzn	Depth (cm)	Field Label 1	Field Label 2	Field Label 3	Field Texture	Lab Texture
12N00045	Ap1		0.0-9.0	S11NE153004-1			SICL	CL
12N00046	Ap2		9.0-23.0	S11NE153004-2			SICL	CL
12N00047	Bk		23.0-50.0	S11NE153004-3			SICL	CL
12N00048	Btk1		50.0-79.0	S11NE153004-4			SICL	CL
12N00049	Btk2		79.0-102.0	S11NE153004-5			SICL	CL
12N00050	B'k2		102.0-138.0	S11NE153004-6			SICL	CL
12N00051	C		138.0-170.0	S11NE153004-7			SICL	CL

Pedon Calculations

Calculation Name	Result	Units of Measure
Weighted Particles, 0.1-75mm, 75 mm Base	27.013	% wt
Volume, >2mm, Weighted Average	3.206	% vol
Clay, total, Weighted Average	33.618	% wt
Clay, carbonate free, Weighted Average	30.125	% wt
CEC Activity, CEC7/Clay, Weighted Average, CECd, Set 4	0.532	(NA)
LE, Whole Soil, Summed to 1m	5.2	cm/m

Weighted averages based on control section: 25-100 cm

PSDA & Rock Fragments

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17
				(- - - Total - - - - -)			(- - Clay - - -)		(- - - Silt - - -)		(- - - - - - - - - - - Sand - - - - - - - - - - - -)					(Rock Fragments (mm))				
				Clay	Silt	Sand	Fine	CO_3	Fine	Coarse	VF	F	M	C	VC	(- - - - - - Weight - - - - - - -)				>2 mm
	Depth			< .002	.002 -.05	.05 -2	< .0002	< .002	.002 -.02	.02 -.05	.05 -.10	.10 -.25	.25 -.50	.5 -1	1 -2	2 -5	5 -20	20 -75	.1- 75	wt whole soil
Layer	(cm)	Horz	Prep	(- % of <2mm Mineral Soil											- - - - - - -)	(- - - - - % of <75mm - - - -)				
				3A1a1a			3A1a1a	3A1a1a	3A1a1a		3A1a1a	3A1a1a	3A1a1a	3A1a1a	3A1a1a					
12N00045	0-9	Ap1	S	29.6	32.2	38.2	14.7	1.9	17.5	14.7	7.9	11.8	11.3	4.8	2.4	2	3	1	34	6
12N00046	9-23	Ap2	S	32.9	34.5	32.6	12.2	3.8	20.2	14.3	7.9	10.8	8.4	3.6	1.9	3	1	3	30	7
12N00047	23-50	Bk	S	32.4	36.1	31.5	11.8	3.8	21.0	15.1	8.0	11.0	7.6	3.6	1.3	4	2	--	28	6
12N00048	50-79	Btk1	S	34.1	34.9	31.0	12.4	3.5	20.4	14.5	7.8	12.5	4.5	3.5	2.7	4	1	tr	27	5
12N00049	79-102	Btk2	S	34.5	34.1	31.4	11.5	3.2	19.4	14.7	8.0	9.6	9.2	2.2	2.4	--	1	2	26	3
12N00050	102-138	B'k2	S	34.1	34.8	31.1	12.5	3.2	19.1	15.7	8.4	10.1	7.8	3.1	1.7				23	
12N00051	138-170	C	S	33.9	35.8	30.3	13.2	3.2	19.7	16.1	7.9	9.4	8.2	3.3	1.5	1	1	--	24	2

Bulk Density & Moisture

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-
				(Bulk Density)		Cole	(- - - - - - - - - - - Water Content				- - - - - - - - - -)		WRD	Aggst		
				33	Oven	Whole	6	10	33	1500	1500 kPa	Ratio	Whole	Stabl	(- - Ratio/Clay	
	Depth			kPa	Dry	Soil	kPa	kPa	kPa	kPa	Moist	AD/OD	Soil	2-0.5mm	CEC7	1500 kPa
Layer	(cm)	Horz	Prep	(- - - g cm^{-3} - - -)			(- - - - - - - - - - - pct of < 2mm				- - - - - - - - - -)		cm^3 cm^{-3}	%		
				DbWR1	DbWR1				DbWR1	3C2a1a		3D1				
12N00045	0-9	Ap1	S	1.37	1.58	0.047			22.9	14.7		1.025	0.11		0.67	0.50
12N00046	9-23	Ap2	S	1.45	1.58	0.028			21.3	13.1		1.025	0.11		0.57	0.40
12N00047	23-50	Bk	S	1.64	1.95	0.057			21.2	14.8		1.025	0.10		0.55	0.46
12N00048	50-79	Btk1	S	1.53	1.80	0.054			21.0	15.5		1.025	0.08		0.53	0.45
12N00049	79-102	Btk2	S	1.66	1.99	0.061			20.6	16.0		1.026	0.07		0.51	0.46
12N00050	102-138	B'k2	S	1.64	1.92	0.054			22.8	17.8		1.025			0.52	0.52
12N00051	138-170	C	S	1.62	1.90	0.054			22.7	16.3		1.023	0.10		0.51	0.48

*** Primary Characterization Data ***

Pedon ID: S11NE153004 (Sarpy County, Nebraska) Print Date: May 18 2012 3:32PM

Sampled As : Liston Fine-loamy, mixed, superactive, mesic Typic Eutrudept

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0012

Water Content

Layer	Depth (cm)	Horz	Prep	-1- LL (Atterberg Limits) pct <0.4mm	-2- PI	-3- Field (Bulk Density, g cm^{-3})	-4- Recon 33 kPa	-5- Recon Oven Dry	-6- Field (Water Content, % of < 2mm)	-7- Recon 33 kPa	-8- 6 kPa (Sieved Samples)	-9- 10 kPa	-10- 33 kPa	-11- 100 kPa	-12- 200 kPa	-13- 500 kPa
															3C1e1a	
12N00045	0-9	Ap1	S												19.8	
12N00046	9-23	Ap2	S												19.1	
12N00047	23-50	Bk	S												20.1	
12N00048	50-79	Btk1	S												22.4	
12N00049	79-102	Btk2	S												23.2	
12N00050	102-138	B'k2	S												23.9	
12N00051	138-170	C	S												23.6	

Carbon & Extractions

Layer	Depth (cm)	Horz	Prep	-1- Total C	-2- Total N	-3- Total S	-4- Est OC	-5- OC (WB)	-6- C/N Ratio	-7- Dith-Cit Ext Fe	-8- Dith-Cit Ext Al	-9- Dith-Cit Ext Mn	-10- Ammonium Oxalate Extraction Al+½Fe	-11- ODOE	-12- Fe	-13- Al	-14- Si	-15- Mn	-16- Na Pyro-Phosphate C	-17- Fe	-18- Al	-19- Mn
				(% of <2 mm)						(% of < 2mm)								mg kg^{-1}	(% of < 2mm)			
				4H2a	4H2a	4H2a				4G1	4G1	4G1		4G2a	4G2a	4G2a	4G2a	4G2a		4G3	4G3	4G3
12N000450-9		Ap1	S	2.39	0.16	0.01	1.3		8	0.8	tr	0.1	0.10	0.03	0.05	0.07	0.04	546.0		0.2	0.2	--
12N000469-23		Ap2	S	2.44	0.05	--	0.6		11	0.6	tr	0.1	0.09	0.02	0.04	0.07	0.03	425.4		0.2	0.2	--
12N0004723-50		Bk	S	1.93	0.02	--	0.1		8	0.7	tr	tr	0.08	0.01	0.04	0.06	0.03	282.4		0.1	0.1	--
12N0004850-79		Btk1	S	1.71	0.06	--	--		--	0.8	tr	tr	0.07	0.01	0.06	0.04	0.04	223.6		0.1	0.1	--
12N0004979-102		Btk2	S	1.46	0.04	--	--		--	0.8	--	tr	0.06	0.01	0.05	0.03	0.04	312.8		0.1	tr	--
12N00050102-138		B'k2	S	1.28	0.07	--	--		--	0.8	tr	0.1	0.06	0.01	0.04	0.04	0.04	300.7		0.1	0.1	--
12N00051138-170		C	S	1.27	0.03	--	--		--	1.0	tr	0.1	0.06	0.01	0.05	0.03	0.04	447.4		0.1	0.1	--

CEC & Bases

Layer	Depth (cm)	Horz	Prep	-1- Ca (NH$_4$OAC Extractable Bases)	-2- Mg	-3- Na	-4- K	-5- Sum Bases	-6- Acidity	-7- Extr Al	-8- KCl Mn	-9- CEC8 Sum Cats	-10- CEC7 NH$_4$OAC	-11- ECEC Bases +Al	-12- Al Sat	-13- Base Saturation Sum	-14- Base Saturation NH$_4$OAC
				(cmol(+) kg^{-1})							mg kg^{-1}	(cmol(+) kg^{-1})			(%)		
				4B1a1a	4B1a1a	4B1a1a	4B1a1a						4B1a1a				
12N00045	0-9	Ap1	S	63.3*	1.4	--	0.7	65.4					19.7				100
12N00046	9-23	Ap2	S	65.0*	1.7	--	0.6	67.3					18.6				100
12N00047	23-50	Bk	S	64.8*	2.3	--	0.5	67.6					17.8				100
12N00048	50-79	Btk1	S	64.5*	3.8	--	0.5	68.8					18.2				100
12N00049	79-102	Btk2	S	62.9*	4.5	--	0.6	68.0					17.6				100
12N00050	102-138	B'k2	S	61.4*	5.5	--	0.6	67.5					17.8				100
12N00051	138-170	C	S	61.3*	5.6	--	0.5	67.4					17.3				100

*Extractable Ca may contain Ca from calcium carbonate or gypsum. CEC7 base saturation set to 100.

*** Primary Characterization Data ***

Pedon ID: S11NE153004 (Sarpy County, Nebraska) Print Date: May 18 2012 3:32

Sampled As : Liston Fine-loamy, mixed, superactive, mesic Typic Eutrudept

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0012

Salt

Layer	Depth (cm)	Horz	Prep	-1- Ca	-2- Mg	-3- Na	-4- K	-5- CO_3	-6- HCO_3	-7- F	-8- Cl	-9- PO_4	-10- Br	-11- OAC	-12- SO_4	-13- NO_2	-14- NO_3	-15- H_2O	-16- Total Salts	-17- Elec Cond	-18- Pred Elec Cond	-19- Exch Na	-20- SA
				(- - - - - - - - - - - - - - - - - - Water Extracted From Saturated Paste														- - - - - - - - - - - - - - - - -)					
				(- - - - mmol(+) L^{-1} - - - -)				(- - - - - - - - - - - - - - - - - - mmol(-) L^{-1} - - - - - - - - - - - - - - - - -)										(- - - % - - -)	(- - dS m^{-1} - -)		%	
				4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2	4F2		4F2	4F1a1a1		
12N00045	0-9	Ap1	S	5.8	0.3	--	0.5	--	4.2	0.2	0.5	--	--	--	0.4	0.1	tr	72.0		0.57	0.30	--	
12N00046	9-23	Ap2	S	4.7	0.3	--	0.4	--	3.3	0.1	0.3	--	tr	--	0.2	0.2	tr	61.3		0.49	0.22	--	
12N00047	23-50	Bk	S	2.4	0.2	--	0.3	--	2.1	tr	0.2	--	--	--	0.1	0.1	tr	66.1		0.27	0.17	--	
12N00048	50-79	Btk1	S	2.3	0.4	--	0.2	--	2.1	0.1	0.1	--	--	--	tr	tr	tr	67.7		0.27	0.18	--	
12N00049	79-102	Btk2	S	2.3	0.5	0.3	0.1	--	2.0	0.1	0.3	--	tr	--	0.1	0.1	tr	62.1		0.28	0.24	--	
12N00050	102-138	B'k2	S	2.1	0.6	0.3	0.1	--	2.0	0.1	0.3	--	--	--	0.1	0.1	--	66.8		0.29	0.21	--	
12N00051	138-170	C	S	2.0	0.6	0.2	0.1	--	2.0	0.1	0.2	--	--	--	0.1	0.1	--	72.6		0.26	0.24	--	

pH & Carbonates

Layer	Depth (cm)	Horz	Prep	-1- KCl	-2- $CaCl_2$ 0.01M 1:2	-3- H_2O 1:1	-4- Sat Paste	-5- Oxid	-6- NaF	-7- Carbonate As $CaCO_3$ <2mm	-8- Carbonate As $CaCO_3$ <20mm	-9- Gypsum As $CaSO_4*2H_2O$ <2mm	-10- Gypsum As $CaSO_4*2H_2O$ <20mm	-11- Resist ohms cm^{-1}
				(- - - - - - - - - - - - - - - - - pH					- - - - - - - - - - - - - - - - -)	(- - - - - - - - - - - - %			- - - - - - - - - - -)	
					4C1a2a	4C1a2a	4F2		4C1a1a1	4E1a1a1a1				
12N00045	0-9	Ap1	S		7.5	8.0	7.5		10.1	9				
12N00046	9-23	Ap2	S		7.5	8.1	7.5		10.4	16				
12N00047	23-50	Bk	S		7.6	8.0	7.8		10.4	15				
12N00048	50-79	Btk1	S		7.5	7.9	7.7		10.3	14				
12N00049	79-102	Btk2	S		7.5	7.9	7.4		10.2	12				
12N00050	102-138	B'k2	S		7.6	8.0	7.6		10.2	11				
12N00051	138-170	C	S		7.6	8.0	7.7		10.2	11				

Phosphorous

Layer	Depth (cm)	Horz	Prep	-1- Melanic Index	-2- NZ %	-3- Acid Oxal	-4- Anion Exch Resin Available	-5- Capacity	-6- Bray 1	-7- Bray 2	-8- Olsen	-9- H_2O	-10- Citric Acid	-11- Mehlich III	-12- KCl Extr NO_3
					(- - - - Phosphorous						- - - -)				
						(- - - - - - - - mg kg^{-1}					- - - - - - - -)				
						4G2a			4D3					4D6b	
12N00045	0-9	Ap1	S			203.7			2.1					7.4	
12N00046	9-23	Ap2	S			254.8			0.2					5.7	
12N00047	23-50	Bk	S			234.9			0.1					6.2	
12N00048	50-79	Btk1	S			264.9			0.1					5.5	
12N00049	79-102	Btk2	S			276.2			0.1					5.2	
12N00050	102-138	B'k2	S			260.4			0.1					0.8	
12N00051	138-170	C	S			264.6			0.1					2.7	

Phosphorous

Layer	Depth (cm)	Horz	Prep	-1- Melanic Index	-2- NZ %	-3- Acid Oxal	-4- Anion Exch Resin Available	-5- Capacity	-6- Bray 1	-7- Bray 2	-8- Olsen	-9- H_2O	-10- Citric Acid	-11- Mehlich III	-12- KCl Extr NO_3
					(- - - - Phosphorous						- - - -)				
						(- - - - - - - - mg kg^{-1}					- - - - - - - -)				
														4D6a1	
12N00045	0-9	Ap1	S											1.8	
12N00046	9-23	Ap2	S											1.3	
12N00047	23-50	Bk	S											1.1	
12N00048	50-79	Btk1	S											1.5	
12N00049	79-102	Btk2	S											2.1	
12N00050	102-138	B'k2	S											3.2	
12N00051	138-170	C	S											3.5	

*** Primary Characterization Data ***

Pedon ID: S11NE153004 (Sarpy County, Nebraska) Print Date: May 18 2012 3:32PM

Sampled As : Liston Fine-loamy, mixed, superactive, mesic Typic Eutrudept

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0012

Trace Elements Tier 1

Layer	Depth (cm)	Horz	Prep	-1- Ag mg/kg 4H1a	-2- As mg/kg 4H1a	-3- Ba mg/kg 4H1a	-4- Be mg/kg 4H1a	-5- Cd mg/kg 4H1a	-6- Co mg/kg 4H1a	-7- Cr mg/kg 4H1a	-8- Cu mg/kg 4H1a	-9- Mn mg/kg 4H1a	-10- Mo mg/kg 4H1a	-11-	-12- Hg ug/kg 4H1a
12N00045	0-9	Ap1	HM	0.08	8.77	210.12	1.05	0.61	7.97	34.28	18.36	770.28	1.45		31
12N00046	9-23	Ap2	HM	0.08	8.13	189.60	1.08	0.82	8.22	37.35	21.06	673.34	1.58		36
12N00047	23-50	Bk	HM	0.08	11.26	180.04	1.14	0.92	7.80	39.19	21.41	467.54	1.89		38
12N00048	50-79	Btk1	HM	0.09	15.12	194.65	1.10	0.81	7.74	37.85	22.43	382.33	2.49		41
12N00049	79-102	Btk2	HM	0.07	10.16	191.55	1.09	0.75	8.20	36.46	22.02	396.96	1.91		36
12N00050	102-138	B'k2	HM	0.08	13.00	206.25	1.12	0.95	7.86	37.96	20.10	468.35	2.32		48
12N00051	138-170	C	HM	0.07	14.31	209.63	1.07	0.85	8.28	38.57	21.45	508.28	2.59		40

Trace Elements Tier 2

Layer	Depth (cm)	Horz	Prep	-1- Ni mg/kg 4H1a	-2- P mg/kg 4H1a	-3- Pb mg/kg 4H1a	-4- Sb mg/kg 4H1a	-5- Se ug/kg 4H1a	-6- Sn mg/kg 4H1a	-7- Sr mg/kg 4H1a	-8- Ti mg/kg	-9- V mg/kg 4H1a	-10- W mg/kg 4H1a	-11- Zn mg/kg 4H1a
12N00045	0-9	Ap1	HM	26.56	521.85	12.62	0.57	256.96	0.98	61.28		83.83	0.02	63.20
12N00046	9-23	Ap2	HM	28.27	524.39	12.14	0.53	398.09	0.98	89.93		93.27	0.02	64.44
12N00047	23-50	Bk	HM	30.18	509.86	11.86	0.53	289.01	0.99	106.36		98.67	0.03	70.65
12N00048	50-79	Btk1	HM	31.96	511.69	12.32	0.55	350.92	0.94	107.45		95.08	0.03	72.77
12N00049	79-102	Btk2	HM	29.82	539.44	12.42	0.42	296.28	0.95	103.21		90.29	0.02	74.29
12N00050	102-138	B'k2	HM	29.49	552.78	12.17	0.49	193.79	0.99	111.90		93.91	0.02	75.88
12N00051	138-170	C	HM	30.41	542.09	12.00	0.48	242.64	1.04	110.22		95.17	0.03	79.08

Major Elements

Layer	Depth (cm)	Horz	Prep	-1- Al mg/kg 4H1b	-2- Ca mg/kg 4H1b	-3- Fe mg/kg 4H1b	-4- K mg/kg 4H1b	-5- Mg mg/kg 4H1b	-6- Mn mg/kg 4H1b	-7- Na mg/kg 4H1b	-8- P mg/kg 4H1b	-9- Si mg/kg 4H1b	-10- Sr mg/kg 4H1b	-11- Ti mg/kg 4H1b	-12- Zr mg/kg 4H1b
12N00045	0-9	Ap1	HM	53029	41547	22332	16220	5393	943	7539	795	302796	176	2796	126
12N00046	9-23	Ap2	HM	54107	65794	22008	15854	6480	857	6467	869	270719	182	2777	119
12N00047	23-50	Bk	HM	57285	64204	24758	16314	7710	608	6469	810	277142	200	2985	125
12N00048	50-79	Btk1	HM	57662	59866	26254	15364	8270	480	6605	792	268107	198	2917	116
12N00049	79-102	Btk2	HM	56188	52826	25717	16096	8499	532	6782	762	283617	200	3021	128
12N00050	102-138	B'k2	HM	60026	47869	25257	16378	8696	610	6982	720	286527	206	3047	118
12N00051	138-170	C	HM	55742	45646	25203	16371	8457	659	6498	806	284853	195	3039	120

Mehlich3 Elements

Layer	Depth (cm)	Horz.	Prep.	-1- Al	-2- As	-3- Ba	-4- Ca	-5- Cd	-6- Co	-7- Cr	-8- Cu	-9- Fe	-10- K	-11- Mg	-12- Mn	-13- Mo	-14- Na	-15- Ni	-16- P	-17- Pb	-18- Se	-19- Si	-20- Sr	-21- Zn
				(mg/kg)																				
				4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b	4D6b		4D6b	4D6b	4D6b
12N000450-9		Ap1	S	48.9	1.5	37.8	7894.9	0.4	1.3	0.1	3.1	37.5	233.5	147.2	233.8	0.6	11.5	1.7	7.4	3.2		405.3	12.4	2.6
12N000469-23		Ap2	S	45.5	3.3	30.1	11246.3	0.3	0.6	0.1	3.1	30.9	200.2	182.8	134.1	0.6	14.8	1.0	5.7	1.9		256.1	16.6	2.1
12N0004723-50		Bk	S	49.9	4.1	40.0	12529.4	0.4	0.5	0.1	2.8	34.1	192.9	264.8	95.8	0.7	20.6	0.6	6.2	1.5		264.6	24.7	2.4
12N0004850-79		Btk1	S	61.5	5.3	48.9	11925.7	0.4	0.5	0.1	2.9	39.8	185.5	406.1	99.9	0.8	23.1	1.0	5.5	1.7		322.8	30.1	2.5
12N0004979-102		Btk2	S	48.9	2.6	47.1	12080.7	0.6	0.8	0.1	4.0	52.6	196.7	484.6	132.4	0.5	26.6	2.2	5.2	2.2		367.2	32.3	16.0
12N00050	102-138	B'k2	S	1.5	1.0	44.7	10039.0	0.5	0.9	0.2	2.7	47.2	188.0	510.6	169.0	0.9	28.5	2.6	0.8	2.0		382.4	31.8	4.6
12N00051	138-170	C	S	2.3	3.2	46.7	9833.7	0.4	1.1	0.2	2.6	49.6	183.0	526.2	198.4	0.6	26.2	2.3	2.7	2.5		388.8	31.6	3.9

*** Primary Characterization Data ***

Pedon ID: S11NE153004 (Sarpy County, Nebraska) Print Date: May 18 2012 3:32

Sampled As : Liston Fine-loamy, mixed, superactive, mesic Typic Eutrudept

USDA-NRCS-NSSC-National Soil Survey Laboratory ; Pedon No. 12N0012

Clay Mineralogy

				-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-	-13-	-14-	-15-	-16-	-17-	-18
						X-Ray					Thermal					Elemental				EGME	In
													SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	K_2O	Na_2O	Retn	pr
	Depth		Fract			7A1b1					7A4a										ti
Layer	(cm)	Horz	ion	(- - - - - - - peak size - - - - - - - -)							(- - - - - - - - % - - - - - - - -)		(- - - - - - - - - - - - - - - - % - - - - - - - - - - - - - - - - -) mg g^{-1}								
12N00047	23-50	Bk	tcly	MT 4	KK 2	MI 2					KK 33										SM
12N00048	50-79	Btk1	tcly	MT 3	KK 2	MI 2	VR 1				KK 29										SM
12N00050	102-138	B'k2	tcly	MT 3	KK 2	MI 2					KK 31										SM
12N00051	138-170	C	tcly	MT 3	KK 3	MI 2					KK 32										SM

FRACTION INTERPRETATION:

tcly - Total Clay,

MINERAL INTERPRETATION:

KK - Kaolinite MI - Mica MT - Montmorillonite VR - Vermiculite

RELATIVE PEAK SIZE: 5 Very Large 4 Large 3 Medium 2 Small 1 Very Small 6 No Peaks

LOCATION LISTON IA
Established Series
RAL-PTC-TWN
12/2003

LISTON SERIES

The Liston series consists of very deep, well drained soils on convex shoulder slopes on uplands. These soils formed in calcareous pre-Illinoian glacial till. Slopes range from 9 to 75 percent. Mean annual air temperature is about 9 degrees C (49 degrees F). Mean annual precipitation is about 74 centimeters (29 inches).

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, mesic Typic Eutrudepts

TYPICAL PEDON: Liston clay loam, on a southwest-facing, convex, 14 percent slope, in a pasture at an elevation of 390 meters (1,280 feet) above sea level. (Colors are for moist soil unless otherwise stated.)

A--0 to 13 centimeters (0 to 5 inches); very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many very fine and fine roots; many very fine and fine tubular pores; strongly effervescent; moderately alkaline; clear smooth boundary. [10 to 18 centimeters (4 to 7 inches) thick]

Bw--13 to 30 centimeters (5 to 12 inches); brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; firm; many very fine roots; many very fine and fine tubular pores; common faint dark brown (10YR 3/3) organic coats on vertical faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary. [0 to 41 centimeters (0 to 16 inches) thick]

Bk1--30 to 46 centimeters (12 to 18 inches); yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; firm; many very fine roots; common very fine and fine tubular pores; common fine and medium very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2--46 to 74 centimeters (18 to 29 inches); yellowish brown (10YR 5/4) clay loam; moderate medium and coarse prismatic structure parting to moderate fine subangular blocky; firm; common very fine roots; common very fine and fine tubular pores; common medium and coarse very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk3--74 to 97 centimeters (29 to 38 inches); yellowish brown (10YR 5/4) clay loam; moderate medium and coarse prismatic structure parting to moderate fine angular blocky; firm; common very fine roots; common very fine and fine tubular pores; common medium and coarse very pale

brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions and few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary. [Combined thickness of the Bk horizons is 20 to 97 centimeters (8 to 38 inches).]

C1--97 to 140 centimeters (38 to 55 inches); brown (10YR 5/3) clay loam; massive; firm; common very fine roots; common very fine and fine tubular pores; common fine and medium very pale brown (10YR 8/2) masses of carbonate; common fine and medium very pale brown (10YR 8/2) carbonate concretions; common fine and medium distinct strong brown (7.5YR 4/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2--140 to 170 centimeters (55 to 67 inches); about 50 percent strong brown (7.5YR 5/6) and about 50 percent grayish brown (2.5Y 5/2) clay loam; massive; firm; common very fine and fine tubular pores; common fine and medium very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few distinct very dark brown (7.5YR 2/2) manganese stains on faces of peds and in pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

C3--170 to 203 centimeters (67 to 80 inches); about 50 percent strong brown (7.5YR 5/6) and about 50 percent gray (2.5Y 6/1) clay loam; massive; firm; common very fine and fine tubular pores; common fine and medium very pale brown (10YR 8/2) masses of carbonate; few fine and medium very pale brown (10YR 8/2) carbonate concretions; few distinct very dark brown (7.5YR 2/2) manganese stains on faces of peds and in pores; strongly effervescent; moderately alkaline.

TYPE LOCATION: MLRA 107B-Iowa and Missouri Deep Loess Hills, Crawford County, Iowa subset; about 9.5 miles northeast of Dennison; about 840 feet north and 1,410 feet west of the southeast corner of sec. 28, T. 85 N., R. 38 W.; USGS Kiron quadrangle; lat. 42 degrees 8 minutes 29.4 seconds N. and long. 95 degrees 16 minutes 8.9 seconds W., NAD 83

RANGE IN CHARACTERISTICS:
Depth to carbonates--0 to 25 centimeters (0 to 10 inches)
Content of clay in the particle-size control section (weighted average)--27 to 35 percent
Content of sand in the particle-size control section (weighted average)--25 to 45 percent

A or Ap horizon:
Hue--10YR
Value--2 or 3
Chroma--1 or 2
Texture--loam or clay loam
Clay content--24 to 35 percent
Sand content--30 to 52 percent
Rock fragment content--1 to 5 percent
Calcium carbonate equivalent--5 to 10 percent

Reaction--neutral to moderately alkaline
Moist bulk density--1.45 to 1.60 g/cc

AB horizon (if it occurs):
Hue--10YR
Value--2 or 3
Chroma--1 or 2
Texture--clay loam
Clay content--27 to 35 percent
Sand content--25 to 45 percent
Rock fragment content--1 to 5 percent
Calcium carbonate equivalent--5 to 15 percent
Reaction--slightly alkaline or moderately alkaline
Moist bulk density--1.60 to 1.70 g/cc
Thickness: 0 to 15 centimeters (0 to 6 inches)

Bw horizon:
Hue--10YR or 2.5Y
Value--4 or 5
Chroma--3 or 4
Texture--clay loam
Clay content--27 to 38 percent
Sand content--25 to 40 percent
Rock fragment content--1 to 5 percent
Calcium carbonate equivalent--5 to 15 percent
Reaction--slightly alkaline or moderately alkaline
Moist bulk density--1.65 to 1.80 g/cc

Bk horizon:
Hue--10YR or 2.5Y
Value--4 or 5
Chroma--2 to 4
Texture--clay loam
Clay content--34 to 40 percent
Sand content--25 to 35 percent
Rock fragment content--1 to 5 percent
Calcium carbonate equivalent--15 to 25 percent
Reaction--slightly alkaline or moderately alkaline
Moist bulk density--1.7 to 1.85 g/cc

C horizon:
Hue--7.5YR, 10YR, 2.5Y, or 5Y
Value--4 to 6
Chroma--1 to 6
Texture--clay loam
Clay content--30 to 40 percent

Sand content--25 to 35 percent
Rock fragment content--1 to 5 percent
Calcium carbonate equivalent--10 to 15 percent
Reaction--slightly alkaline or moderately alkaline
Moist bulk density--1.8 to 1.9 g/cc

COMPETING SERIES: This is the Storden series.
Storden--have a clay content of 18 to 27 percent in the particle-size control section

GEOGRAPHIC SETTING:
Parent material--calcareous pre-Illinoian glacial till
Landform--convex shoulder slopes on uplands
Slopes--9 to 75 percent
Elevation--305 to 457 meters (1,000 to 1,500 feet) above sea level
Mean annual air temperature--8 to 11 degrees C (47 to 52 degrees F)
Mean annual precipitation--66 to 81 centimeters (26 to 32 inches)
Frost-free period--145 to 175 days

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Burchard, Deloit, Ida, Marshall, and Monona soils.
Burchard--are in lower landscape positions on concave back slopes, do not have carbonates within a depth of 30 centimeters (12 inches), and have an argillic horizon
Deloit--are in lower landscape positions on foot slopes and have mollic epipedons that are more than 61 centimeters (24 inches) thick
Ida--are in landscape positions similar to those of the Liston soils, have a clay content of 18 to 25 percent in the particle-size control section and have a sand content of less than 10 in the particle-size control section
Marshall--are in higher landscape positions on summits, have a clay content of 30 to 35 percent in the particle-size control section, and have sand content of less than 10 percent in the particle-size control section
Monona--are in higher landscape positions on summits, have a clay content of 20 to 30 percent in the particle-size control section, and have sand content of less than 10 percent in the particle-size control section

DRAINAGE AND PERMEABILITY:
Drainage class--well drained--a saturated zone does not occur within a depth of 183 centimeters (6 feet) during April to June in most years
Permeability--moderately slow
Surface runoff potential--medium to high

USE AND VEGETATION:
Most areas are pastured. A few areas are cultivated. Bluegrass is the principal pasture species. The native vegetation is big bluestem, little bluestem, indiangrass, switchgrass, sideoats grama and other grasses of the tall grass prairie and scattered oak trees.

DISTRIBUTION AND EXTENT:
LRR M, MLRA 107; western Iowa. These soils are of small extent.

MLRA SOIL SURVEY REGIONAL OFFICE (MO) RESPONSIBLE: St. Paul, Minnesota

SERIES ESTABLISHED: Woodbury County, Iowa, 2003

REMARKS:
Particle-size control section--the zone from a depth of 25 to 100 centimeters (10 to 40 inches) (Bw, Bk1, Bk2, Bk3, and C1 horizons);
series control section--the zone from the surface to a depth of 152 centimeters (0 to 60 inches) (A, Bw, Bk1, Bk2, Bk3, C1, and C2 horizons).

Diagnostic horizons and features recognized in this pedon:
ochric epipedon--the zone from the surface to a depth of 13 centimeters (0 to 5 inches) (A horizon);
calcic horizon--the zone from a depth of 30 to 97 centimeters (12 to 38 inches) (Bk1, Bk2, and Bk3 horizons);
udic moisture regime.

Cation-exchange activity class is supported by lab sample number S97IA-047-015, National Soil Survey Laboratory.

Taxonomy version--second edition, 1999.

The redoximorphic features occurring in the Bk, and C horizons are not considered as indicators of present-day wetness and therefore were not considered in the classification of these soils.

This series replaces the Steinauer series that was correlated in the Soil Survey of Woodbury County, Iowa (1972).

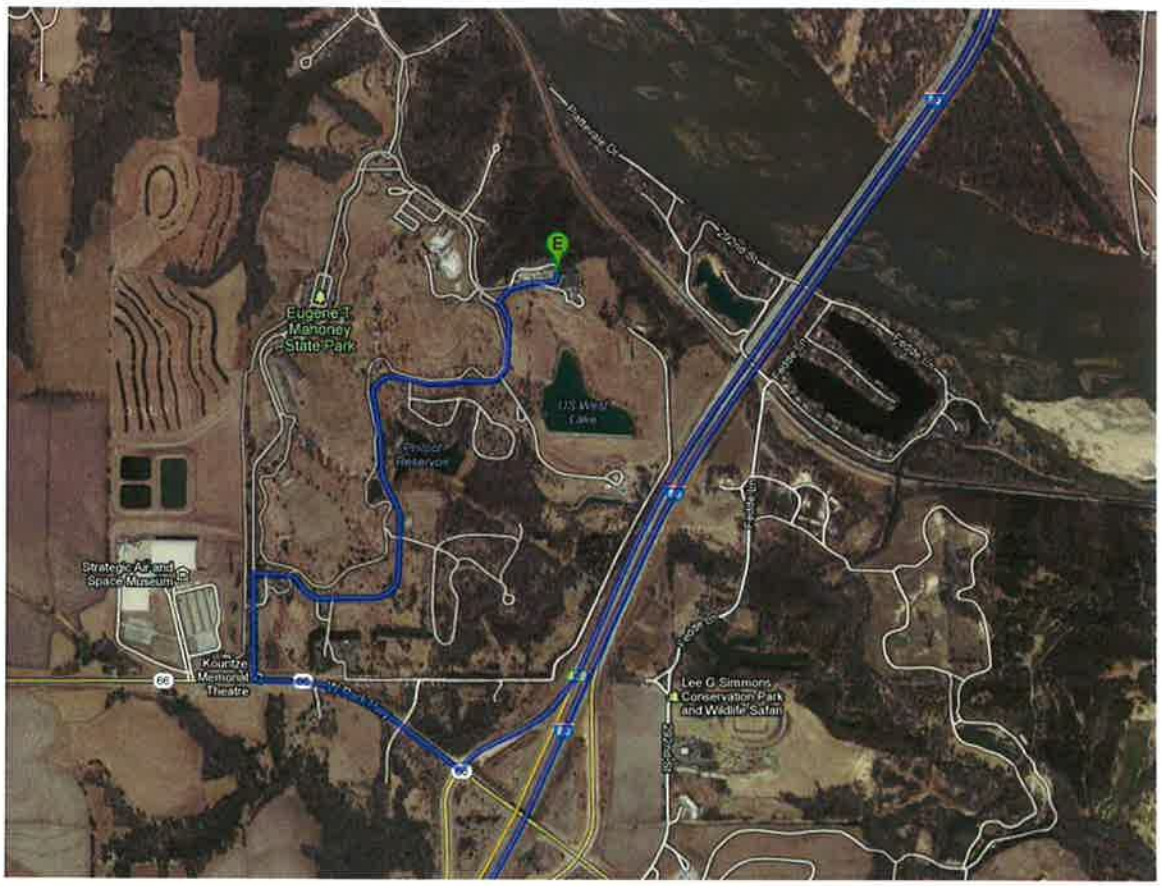
Pre-Illinoian glacial till does not have shale fragments, has half as much very coarse sand in the sand fraction, has a moderate shrink-swell potential, and has less calcium carbonate and less dolomite content than early Wisconsin (Tazewell) glacial till.

Refer to DMUid 277,044 in NASIS for property data.

ADDITIONAL DATA:
Laboratory data--National Soil Survey Laboratory, Lincoln, Nebraska pedon S97IA047015 (http://ssldata.sc.egov.usda.gov/).

National Cooperative Soil Survey
U.S.A.

Stop 5 - Eugene T. Mahoney State Park



Mahoney State Park (Tour Ending Evening Meal and Social)

Arrive Mahoney State Park on Platt River at I-80 at approximately 5:45pm. Have evening meal and conference ending social at Parker's Smokehouse Restaurant in Mahoney State Park overlooking the Platte River. (Food and beverage provided).

Load buses at approximately 8:00pm and return to the Holiday Inn Downtown Lincoln, NE at approximately 8:30pm. (30.5 mi – about 35 minutes)

Eugene T. Mahoney State Park is located just off Interstate 80 near Ashland, Nebraska, approximately 20 miles (32 km) from the Omaha metropolitan area.

History

Mahoney State Park, as it is typically referred to, was named after Eugene T. Mahoney, a former policeman, state senator, and director of the Nebraska Game and Parks Commission. Mahoney was seen as a very powerful man in politics, state government, and throughout the business community. When he took over the Game and Parks Commission, the Nebraska state parks began to grow and greatly improve. He was able to gather contributions to improve facilities statewide, particularly for the park that was to be later named after him.

Features

There are a number of activities and features at the park. They include horseback trail rides, fishing, a marina with paddleboat rental, miniature golf and a driving range. Athletic facilities include an aquatic center, tennis and basketball courts, and softball fields. There are also extensive picnicking areas and hiking trails, as well as a 70-foot (21 m) observation tower overlooking the Platte River Valley. There are also winter activities, including cross country skiing, sledding and toboggan runs, ice fishing, and an ice skating rink. An activity center, indoor playground and activity simulators are open year-round. The Kountze Theater is a cultural highlight of the park.

The park is located near several other tourist attractions including the Platte River State Park, the Strategic Air and Space Museum, the Conservation Park and Wildlife Safari, and several golf courses.

Biographical Sketches of Field Tour Presenters

Joseph ("Joe") Chiaretti

Joe is a soil scientist with the USDA-NRCS and works on the soil survey standards staff at the National Soil Survey Center in Lincoln, Nebraska.

He previously worked for 11 years conducting quality assurance on soil survey data in the States of California, Idaho, Nevada, Oregon, and Utah from the Northern Basin and Range MLRA regional office in Reno, NV. He has 19 years experience in field mapping and project management on 5 soil survey projects in the State of New Mexico and 3 short-term details in Florida and Montana with the Soil Conservation Service and Natural Resources Conservation Service. He worked on the soil survey of Shiprock Area NM-AZ, located on the Navajo Indian Reservation, throughout the entire project and authored the survey manuscript.

Joe currently has responsibility for developing and maintaining NRCS soil science division handbooks and other technical documents and helped draft the eleventh edition of the Keys to Soil Taxonomy (2010). His main interest has always been in soil classification and he has primary responsibility to teach, interpret, and maintain soil taxonomy. He is chairing a task group on descriptive standards as part of the effort to develop a universal soil classification system.

He received a Bachelor of Science in Agronomy from the Pennsylvania State University in 1978, is a 34-year member of the Soil Science Society of America, and has been a Certified Professional Soil Scientist and Soil Classifier with ARCPACS since 1992.
Joe loves dogs, traveling and exploring new places with his wife Deb, gardening, and occasionally catching fish.

Patrick Cowsert

Patrick is originally from Murphysboro, Illinois.
1993: MS from Southern Illinois University, Carbondale, in Plant and Soil Science (water infiltration in reclaimed mine soils).
1993-1999: Soil Scientist with NRCS in Onawa, Iowa. Soil survey updates in Monona, Woodbury, and Crawford counties and Sampling pilot project with Iowa State University.
1999-2005: Project Leader/Resource Soil Scientist in Omaha, Nebraska. Soil survey updates for Washington, Douglas, and Sarpy counties and technical soil services to 8 counties eastern Nebraska.
2005-present: Resource Soil Scientist in Stanton, Nebraska. Provide technical soil services to 25 counties in northeast Nebraska (MLRA 107B, 106, 63B, 65, 66).

Richard Lensch

Richard Lensch, retired, worked 36 years as a soil scientist for NRCS. He has extensive experience throughout Iowa where he has worked in 12 counties. He has also served as Resource soil scientist for 2 years in Fort Dodge, Iowa. He wrote 4 soil survey manuscripts that include Cass, Adams, Hancock, and Woodbury Counties. Richard has been retired for a year and a half.

Shawn McVey

Shawn is a Soil Scientist at the National Soil Survey Center, USDA-NRCS. Received a Master of Science in Soil Classification from the Plant Science Department at the University of Connecticut and a Bachelor of Science in Agronomy from Iowa State University. Currently, and since 2010, Shawn works at the National Soil Survey Center on the Soil Survey Standards staff where he provides training coordination and maintenance of soil survey technical standards.

Previous professional experience includes conducting subaerial and subaqueous soil surveys, authoring two soil survey manuscripts, providing Farm Bill technical soil services in Idaho, Montana, Connecticut and Rhode Island, perfecting conservation easements for the Farm and Ranch Lands Protection Program and teaching Soil Formation and Classification at the University of Connecticut as an adjunct faculty member in the Plant Science Department. Shawn has volunteered for three soil survey details throughout Idaho and Montana as well as served a detail to Vermont to assist with programmatic requirements of Farm Bill programs.

Shawn has served as the AAPI SEPM in CT and was elected to the APIO National Council in 2009 as the East Region Representative. He has returned to the National Council as the Northern Plains Representative and serves as the current AAPI SEPM in Nebraska. Shawn is a Lifetime member of the Asian Pacific Islander Organization, member of the Soil Science Society of America and certified by ARCPACS, the national soil science certification authority, as a Certified Professional Soil Classifier.

Dan Pulido

Work Experience

Dan Pulido is a Soil Scientist with the NRCS and is currently an MLRA Project Leader stationed in Atlantic, Iowa. He is responsible for MLRAs 107A, 107B, and 108D, which are dominantly located in the western third of Iowa.

He has worked 13 years with the USDA—11 years with NRCS and 2 years with ARS. He was also the Project Leader for two soil survey update counties on the Des Moines Lobe in MLRA 103.

Education

- 1999 B.S. Agronomy—Soils Emphasis- Iowa State University
- 2001 M.S. in Soil Morphology and Genesis- Iowa State University

Kenneth (Ken) F. Scheffe

Ken is a Soil Scientist on the Soil Survey Standards Staff at the National Soil Survey Center in Lincoln, NE. He is the liaison to the MLRA Regions of the soil survey program and serves as laboratory investigations liaison to MO Region 9. Ken has served as the national coordinator of the Rapid Carbon Assessment Project since 2011 assists in the update and maintenance of NCSS soil survey standards and technical documents.
He came to the NSSC after serving 31 years as soil scientist in New Mexico, 15 years of which were as State Soil Scientist. He has BS and MS degrees from Texas Tech University in Soil Science and is member of the Soil Science Society of America, and the Soil and Water Conservation Society.
Education
Iowa Park High School, Iowa Park, TX – 1975
Texas Tech University, Lubbock TX – Bachelor of Science in Soil Science 1979
Texas Tech University, Lubbock TX – Master of Science in Soil Science 1982

Work Experience
Raised on farm and ranch operation, Iowa Park, TX
Farm/Ranch laborer, 1971-1975
Construction worker (iron worker/equipment operator)- summer 1976-78
Student Assistant/Research Assistant, TTU, Soils Laboratory, 1978-1982
Career Conditional Student Trainee, Truth or Consequences, NM, 1978-79
Soil Scientist, Santa Rosa, NM, 1982-1988 and Clovis, NM, 1988
Area Soil Scientist, Rio Rancho, NM 1988-1993
Assistant State Soil Scientist, Albuquerque, NM 1993-1995
Asst. St. Conservationist, Resource Inventories and Assessments, Alb., NM, 1995-1998
State Soil Scientist, Albuquerque, NM, 1998-2010

Daniel R. Shurtliff

Daniel R. Shurtliff was born in Casper, Wyoming in 1954. He attended the University of Nebraska-Lincoln and received a bachelor's degree in Soil Science in 1977. His professional career has been spent with USDA-NRCS. Dan performed Field Soil Survey work in Nebraska, Montana, Florida and South Korea between 1977 and 1998. He authored the Soil Surveys of Garfield, Loup and Blaine Counties in Nebraska, and Sweet Grass County in Montana. In 1998 Dan became the Assistant State Soil Scientist of South Dakota. In 2010, he became the Assistant State Soil Scientist of Nebraska.

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Philip J. Schoeneberger

Degrees Received
B.S., 1976, University Wisconsin
M.S., 1983, Oregon State University
Ph.D., 1990, North Carolina State University [Soil Science: (Applied) Soil Physics, Minor – Geology].

Professional Employment
Research Soil Scientist, 1990-present, USDA - NRCS
Adjunct Faculty, 1992-1998, University of Nebraska
Soil Scientist Consultant– NASA-Jet Prop. Lab / National Geographic Society; TREE project, 1989-1990
Research Graduate Assistant, 1985 -1989.
Soil Scientist, 1983 – 1985, USDA-SCS.
Soil Consultant, 1982, North Carolina
Forest Soils Specialist, 1979-1981, Dept. Natural Resources, WA
Forest Soil Scientist, 1978, USDA- Forest Service

Professional Activities & Interests
Research emphasis on soil geomorphology, water movement through landscapes, weathered rock
Author / co-author 17 refereed publications and proceedings, 5 book chapters, Field Book for Describing & Sampling Soils, Geomorphic Description System, 55 abstracts, 8 technical reports
Chair – SSSA Glossary Soil Science Committee S374 (2001- 2003, 2010-present), Member – SSSA Geomorphology Committee S880 (1990-1993, 1995-1998, 2001-2004), Co-organizer SSSA Symposium – Division S5 (1992, 2008), Core Instructor – (4 weeks) USDA Soil Science Institute (2002, 2004); Core Instructor – (3 weeks) Soil Geomorphology Institute [2007 (2), 2008 (2), 2009, 2010], Instructor, 55 technical short courses (1991-present),
Member: Soil Science Society America, Intl. Union Soil Science, Geological Society America, Sigma Xi, Gamma Sigma Delta

Douglas A. Wysocki

Education

B.S., 1977, University of Wisconsin River Falls (Soil Science)
M.S., 1979, Virginia Polytechnic Institute and State University (Agronomy)
Ph.D., 1984, Iowa State University (Agronomy)
Research Soil Scientist 1991-Present USDA NRCS National Soil Survey Center

Professional Activities and Interests

Research soil-geomorphology and landscape evolution, pedology, paleosols, and soil micromorphology
Author/ co-author 40+ publications
Author 4 book chapters
Co-author Field Book for Describing and Sampling Soils
Membership in Professional Societies
American Geologic Institute
American Society of Agronomy
International Soil Science Society Soil Science Society of America
Nebraska Academy of Sciences
Geological Society of America
Nebraska Professional Soil Scientist Association
Arkansas Professional Soil Scientist Association
ARCPACS Certified Professional Soils Scientist

Offices and Committee Assignments in Professional Societies

Soil Science Society of America – Division S-5 Pedology Chair, 2005-2006
SSSA Nomination Committee for Division S-5 Pedology Officers, 2006-2008
SSSA Nominations for SSSA President-Elect Committee, 2006-2008
Soil Science Society of America - Soil Geomorphology Committee (S880) 1994 to 2000
INQUA/ISSS Paleopedology Comm. Work Group on Stratigraphy. (1993-present)
Soil Science Society of America - Soil Science Glossary Committee Member 1994-1996
SSSA – Soil Micromorphology Committee (S-888) 2000-2003, 2006-2008, 2010-2012.
Soil Science Society of America – Soil Micromorp Committee (S888) Chair 2004-2005
Soil Science Society of America - Smithsonian Committee Member 1994-1997
Soil Science Society of America – Soil Science Practice Act 1994