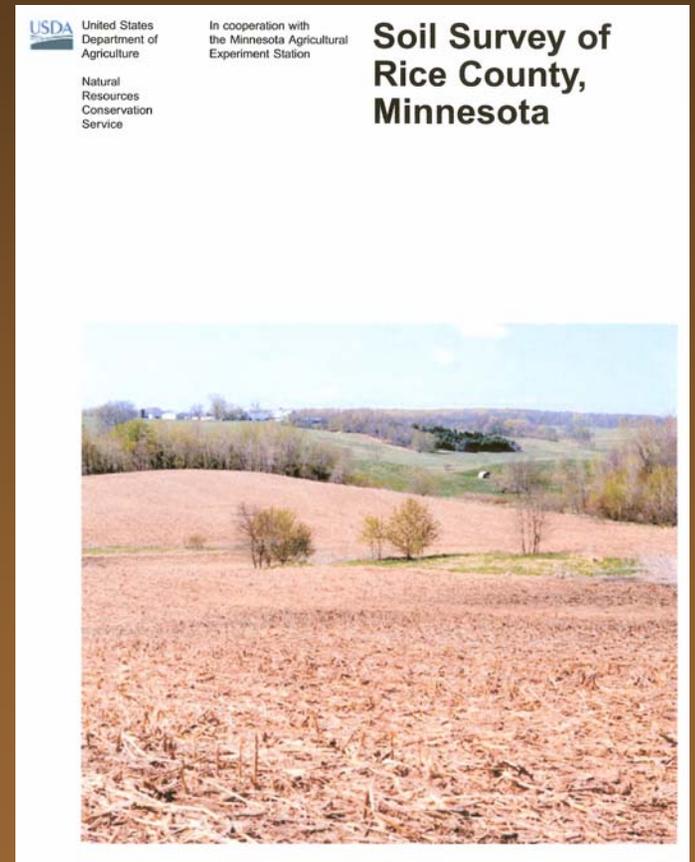


NRCS and NCSS Approach to Redoximorphic Features

Maurice J. Mausbach

Discussion Points

- Soil-Landscape Paradigm
 - The Context
- Soil Classification
- Soil Interpretations
- Summary
- Open Discussion



Soil-Landscape Paradigm

The Context



Photo by Ron Nichols, 1989 – WI

- Factors of Soil Formation
 - Parent Material
 - Climate
 - Organisms
 - Relief
 - Time
- Soil-landscape units are spatially predicable
- Field Based Activity

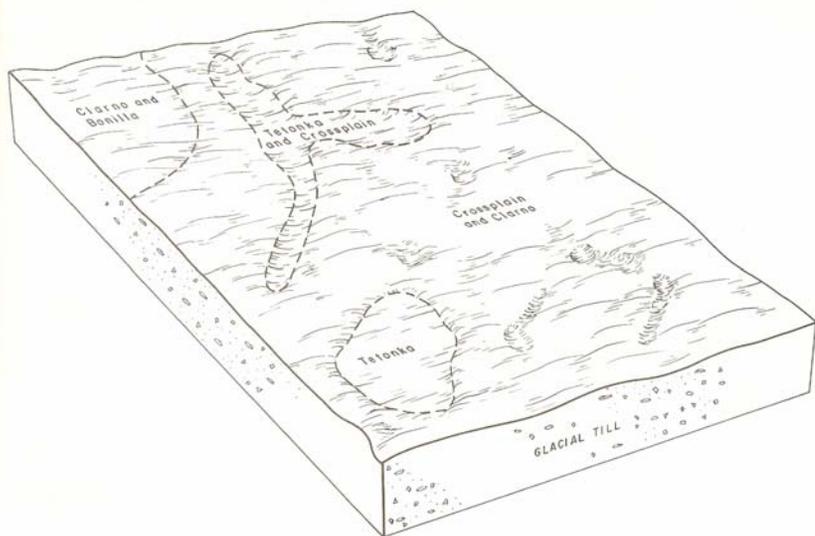


Figure 1.—Pattern of soils and topography in the Crossplain-Clarno-Tetonka association.

Example Landscape Units

Co- Crossplain-Clarno Complex

CdA Clarno-Bonilla Loams

CeB Clarno-Davison Loams

Tb Tetonka Silt Loam

Wo Worthing Silty Clay Loam



Example Landscape Units

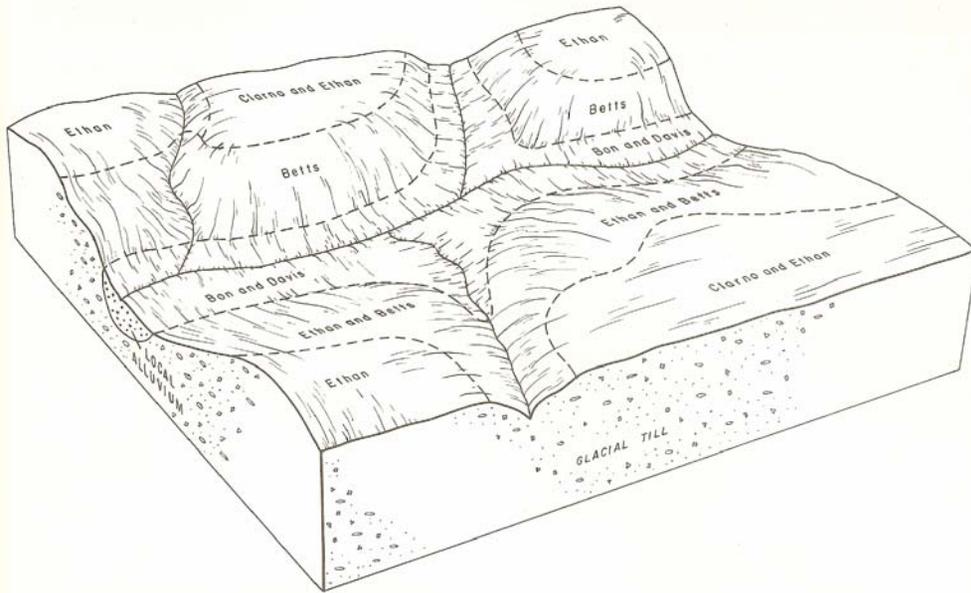
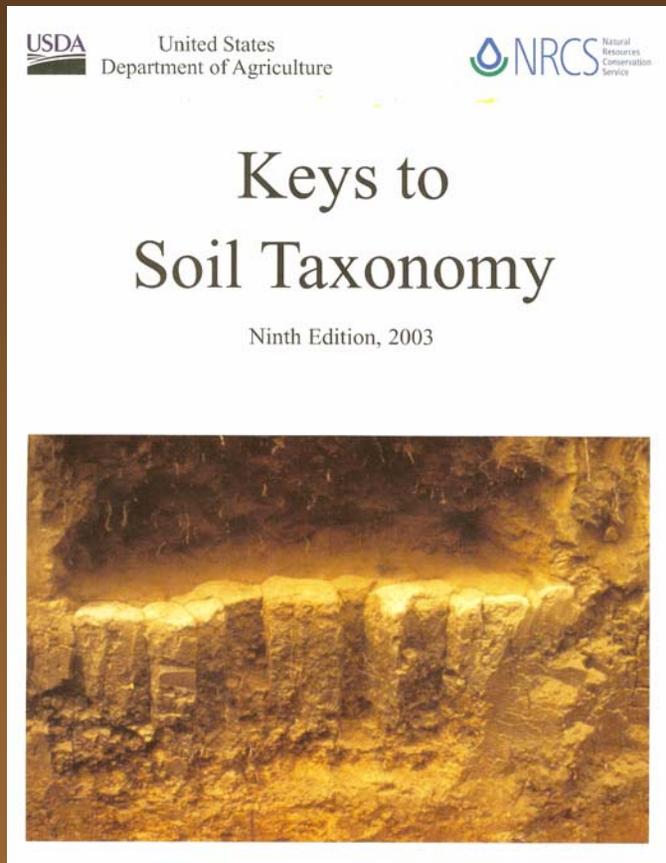


Figure 2.—Pattern of soils and topography in the Ethan-Betts association.

- BcE Betts Loam 15-40 % Slopes
- Bo Bon Loam
- Ca Chaska Loam Channeled
- CcB Clarno Loam 3-6% Slopes
- CdA Clarno-Bonilla Loams 0-3 % Slopes
- EbC Ethan Loam 6-9 % Slopes
- EcD Ethan-Betts loams, 9-15 % Slopes



SOIL CLASSIFICATIONS



- Soil Taxonomy
- Hydric Soils

SOIL TAXONOMY

Differentiae



- Higher Categories – Most useful properties are:
 - Those that result from soil genesis
 - or, that affect soil genesis
 - Those that are important to plant growth
- Redoximorphic properties relate to soil genesis and plant growth
 - Are used at the Suborder, Great Group and Subgroup higher taxa levels and the Soil Series

REDOXIMORPHIC FEATURES

Higher Taxa

Suborder	Great Group	Subgroup
Alb	Alb	Aquic
Aqu	Aqu	Aeric
	Endo	Oxyaquic
	Epi	
	Gloss	

AQUIC CONDITIONS

- Periodic or continuous saturation or reduction
- Presence is indicated by redoximorphic features
- Verified by measuring saturation or reduction

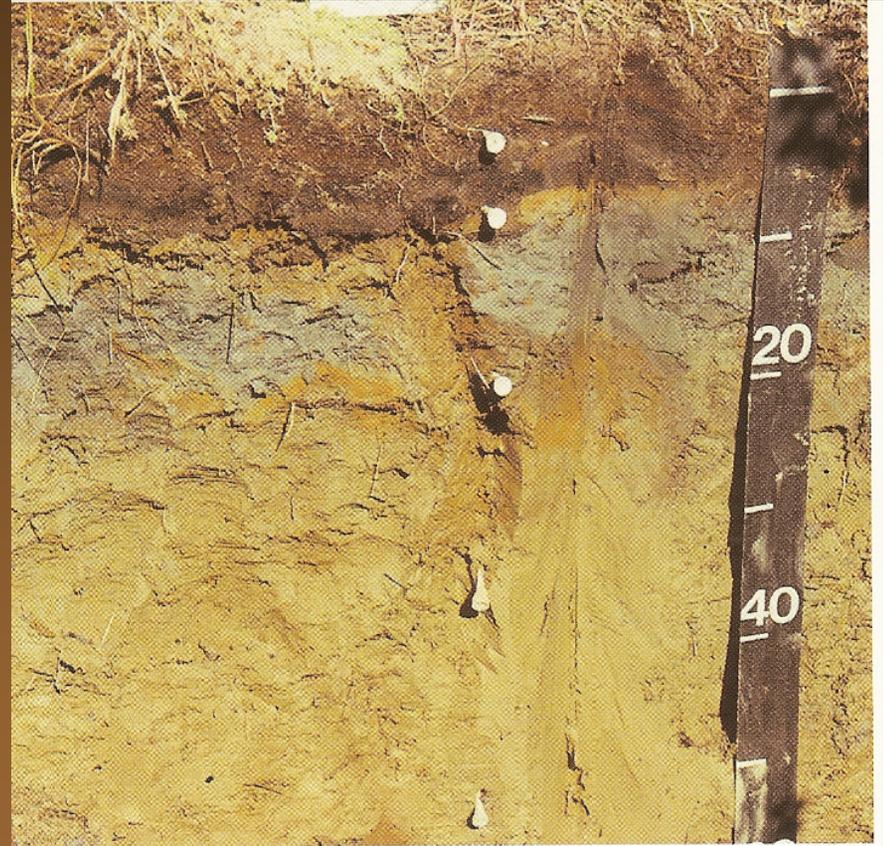


Photo 35.—A pedon with aquic conditions close to the surface.

AQUIC CONDITIONS

Exception

- Artificial Drainage – removal of free water from soils with aquic conditions
- Artificial drained soils are included with soils with aquic conditions in the keys
- Implication – Soil Taxonomy is based on the genesis of the soil and tries to avoid human disturbances
- Exception also pertains to Hydric Soils

TYPES OF SATURATION

- Endo – soil is saturated in all layers
- Epi – soil is saturated with water in one or more layers within 200 cm of the mineral soil surface and also has one or more unsaturated zones with an upper boundary above 200 cm
- Anthric – aquic conditions in cultivated soils that are flood irrigated

MEASURING REDOXIMPROHIC FEATURES vs. MORPHOLOGY

- Measuring
 - difficult to integrate over time
 - Expensive
 - Indicator dyes can give false positives
- Morphology
 - integrates over time
 - relatively inexpensive
 - Subjective – requires experienced soil scientist

HYRIC SOIL



Photo 2001 MI

- Is a soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part

HYDRIC SOIL CONCEPT

- Support growth and regeneration of hydrophytic vegetation
- Artificially wet (anthric) soils are considered hydric
- Artificially drained soils are considered hydric
- Some soils have phases that may non-hydric

HYDRIC SOIL CRITERIA

1.

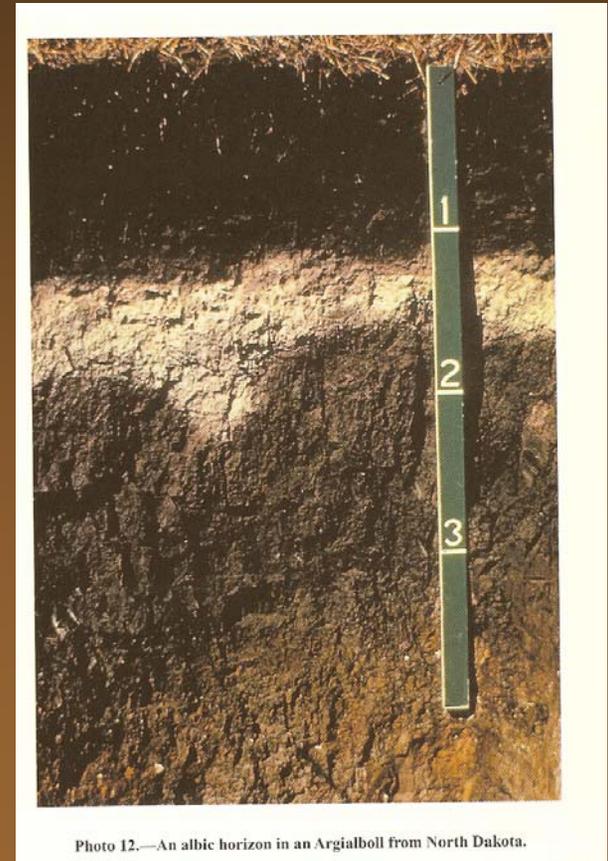


- All Histels except Folistels and Histosols except Folists, or

HYDRIC SOIL CRITERIA

2.a

- Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Historubels great group, Pachic subgroups, or Cumulic subgroups that are:
 - a. Somewhat poorly drained and a water table equal to 0.0 foot (ft.) from the surface during the growing season, or



HYDRIC SOIL CRITERIA

2.b

- Poorly drained or very poorly drained and have either:
 - i. water table equal to 0.0 ft. during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches (in.) or for other soils
 - ii. water table at less than or equal to 0.5 ft from the surface during the growing season if permeability is equal to or greater than 6.0 in/h in all layers within 20 in, or
 - iii. water table at less than or equal to 1.0 ft from the surface during the growing season if permeability is less than 6.0 in/h in any layer within 20 in, or

HYDRIC SOIL CRITERIA 3 and 4



Photo by Lynn Betts, 1999 IA

- Soils that are frequently ponded for long duration or very long duration during the growing season, or
- Soils that are frequently flooded for long duration or very long duration during the growing season.

FIELD INDICATORS OF HYDRIC SOILS

USDA
United States
Department of
Agriculture



Natural
Resources
Conservation
Service

Wetland
Science
Institute

Soil Survey
Division

Field Indicators of Hydric Soils in the United States

Guide for Identifying and
Delineating Hydric Soils,
Version 5.01, 2003



In cooperation with the
National Technical Committee for Hydric Soils

- Guide to help identify and delineate hydric soils in the field
- Do not replace criteria
- Largely based on presence of redoximorphic features

SOIL INTERPRETATIONS

- Soil Properties
 - Particle size
 - Soil Moisture Status (water table)
 - Flooding
- Soil Qualities
 - Natural Drainage
 - Frost Action

SOIL MOISTURE STATUS

Water State Classes

Water State Class	Definition
Dry	≥ 15 bar suction
Moist	< 15 Bar to ≥ 0.00001 bar
Wet	< 0.00001 bar; free water present (satiated)

SOIL MOISTURE STATE BY MONTH AND DEPTH

Udic Mesic

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Ppt (mm)	50	60	80	80	100	100	110	90	70	50	80	70
⁰ SOIL DEPTH 200 cm			M <u>W</u>	M <u>W</u>	M <u>W</u>	M	M	<u>D</u> M	<u>D</u> M	M	M <u>W</u>	M <u>W</u>

NATURAL DRAINAGE

Classes

- Excessively
- Somewhat Excessively
- Well
- Moderately Well
- Somewhat Poorly
- Poorly
- Very Poorly

Based on:

- Hydraulic Conductivity
- Frequency and duration of wetness
- Depth of wetness
- Relationship to plant growth

SOIL QUALITIES

- Corrosion of Uncoated Steel
 - Ratings based on natural drainage Class and stratification of parent material
- Potential Frost Action
 - Ratings based on Soil Moisture Regime and Particle Size Class

SOIL INTERPRETATIONS

Examples

- Soils are rated as to limitations or suitability for specific land uses
 - Based on restrictive features
- Building Sites
 - Construction Material
 - Recreational Development
 - Sanitary Facilities
 - Waste Management
 - Wildlife Habitat
 - Agronomic

INTERPRETATIONS GUIDE

	PROPERTY	LIMITS			RESTRICTIVE FEATURE
		SLIGHT	MODERATE	SEVERE	
	1.USDA TEXTURE	---	---	ICE	PERMAFROST
2.	TOTAL SUBSIDENCE (IN)	---	---	>24	SUBSIDES
3.	FLOODING NONE	RARE		FREQ, OCCAS	FLOODING
4.	DEPTH TO BEDROCK (IN)	>72	40-72	<40	EPH TO ROCK
5.	DEPTH TO CEMENTED PAN (IN)	>72	40-72	<40	CEMENTED PAN
	6.PONDING	---	---	+	PONDING
7.	DEPTH TO HIGH WATER TABLE (FT)	>6	4-6	<4	WETNESS
8.	PERMEABILITY (24-60", IN/H)	2.0-6.0	0.6-2.0	<0.6 SLOWLY	PERCS
8a.	PERMEABILITY (24-60", IN/H)	---	---	>6.0 FILTER	POOR
9.	SLOPE (PCT)	<8	8-15	>15	SLOPE
10.	WEIGHT PERCENT >3" (WEIGHTED AV. TO 40")	<25	25-50	>50	LARGE STONES

RESTRICTIVE FEATURES

Related to Redoximorphic Features

- Flooding
- Frost Action
- Ponding
- Shallow to Water
- Wetness



Photo by Bob Nichols, 2000 NE

EXAMPLE INTERPRETATIONS

Dwellings with Basements

- Severe
 - depth to water table < 2.5 ft (Wetness)
 - flooding (Flooding)
 - ponding (Ponding)

EXAMPLE INTERPRETATIONS

Septic Tank Absorption Fields

- Severe
 - occasional flooding (Flooding)
 - ponding (Ponding)
 - water table < 4 ft (Wetness)
- Moderate
 - rare Flooding (Flooding)
 - water table 4-6 ft. (Wetness)

SOIL INTERPRETATIONS

Prime Farmlands

- Soils that either have no water table or have a water table that is maintained at a sufficient depth during the cropping season to allow cultivated crops common to the area to be grown
- Soils that are not flooded frequently during the growing season

SOIL INTERPRETATIONS

Land Capability Classification

- Capability Classes (I-VIII)
 - w – excess water
- Capability subclasses
 - e – erosion and runoff
 - w – excess water
 - s – root-zone limitations
 - c – climatic limitations
 - Poor drainage
 - High water table
 - overflow

SUMMARY

- Soil Survey is a Field-Based Activity
 - Reading the Landscape
 - Morphology
 - Landscape Relationships
 - Factors of Soil Formation



Photo By Lynn Betts, 1999, Iowa

SUMMARY

Use of Redoximorphic Features



Photo by Tim McCabe, 1999, Iowa

- Development of the Landscape model for mapping
- Soil Taxonomy – Suborder, Great Group, Subgroup
- Hydric Soils – field indicators
- Soil Interpretations
Soil qualities
Land use limitations

OPEN DISCUSSION



- Questions