State Board of Registration for Professional Soil Classifiers
Lawrence Edland
for
January 14, 2014 Interim Ag Committee Meeting

Reason for legislative bill and update

- Ease reference requirements for out of state soil classifiers, while still guaranteeing quality work
- Review requirements for soil classifier in training
- Update century code language (recommended by legislative counsel, language date back to 1973)
- Licensure is for protecting the resource for the welfare of the ND public
- The classifier Law has been around longer than the concept of hydric soils and no exclusion have been made for other soils in those 40 years

Soil Classifier

- A 4 year degree approved by the board of registration for registered soil classifiers
- Curriculum emphasizes, soil and related courses; geography, geology
- Focus is on morphology and genesis, that being the landscape/landform and how the soils formation. Documenting soil properties; horizons, depths, physical (texture and structure) and chemical properties (areas affected by salinity, sodicity) and the interpretation related to those properties.
- Four years of experience, reviewed and approved by the board
- Additional options for registration in the century code

Order 2 NRCS Soil Survey (photo)

Uses

Not site specific and for multi use.

- Legislative mandate for property tax
- ND Soil Conservation District Planning
- Identify area with potential for building sites (high water table areas)
- Identify potential hazardous waste site areas (gravel areas)

High Intensity Soil Survey (photo)

Identifies site specific soil for an on site interpretation single use.

- Suitable plant growth material (SPGM) for reclamation
    - Identify lift depths for suitable topsoil and subsoil material (optimum amount of recoverable SPGM
- Agronomic
    - Precision farming, hydric soil, salinity, irrigation surveys
- Septic Tank Absorption Field (limitations)
    - Slow water movement
    - Depth to saturation zone

Field Indicators of Hydric Soils (A Guide for Identifying and Delineating Hydric Soils)

Indictors are a guide and not criteria

Requires a soil description and interpretation of the landscape & landform, not just a checked box

- Many hydric soils are delineated using hydric indicators
- Hydric soils can be the most complex and difficult soils to observe, requiring years of experience

Problem soils (common in the northern plains)

- Some hydric soils lack any current listed indicator. The lack of any listed indicator **does not** prevent classification of the soil as hydric.
- Black soils and soils with high pH are difficult to interpret. As long as the soil meets the definition of a hydric soil, the lack of an indicator **does not** preclude the soil from being hydric
- For soils with thick, dark surface layers, deeper examination may be required when field indicators are not easily seen within 20 inches (50 cm) of the surface. Examination to a depth of 40 inches or more may be needed to determine whether the soils meet the requirements of an indicator.
- Drained soil where vegetation and hydrology has been affected
    - Hydric soil is the only indicator remaining of the wetland

Additional Issues

- Relict features are common, so knowledge and understanding of soil/landscape relationships is essential
- Features related to wetness can develop within weeks or months and persist
- Knowledge of subtle landscape differences (only inches in relief differences)

Results from non qualified practicing individuals

- Substantial money may be at stake when dealing with agricultural and other wetland issues
    - Location the wetland boundary for mitigation
    - Farm program compliance
    - Drainage
- Potential for ineligibility for farm programs
- Loss of the soil resource for future generations of ND citizens

Liability

- Professional insurance is required by some clients of registered soil classifiers
- Be able to defend their work to clients, reviewers and as an expert witness
    - ND law requires RSC do hydric part (not hydrology or vegetation)
    - Do not certify wetlands (jurisdictional decision)
    - Other states have certification for wetland delineators (no licensure is required
- Liability requirements of non registered soil classifier

    - Accountability for work performed by non-registered
    - What is the clients recourse
- Potential for cease and desist letter

New Soil Classifiers

- More practicing registered classifiers than in the past
- Making changes to the classifier legislation
- PSCAND soil judging program
- Encourage students into soil science program
- NDSU and DSU soils science program
- Firms with full time soils professionals on staff

North Dakota was the first to recognize the need for licensure of registered soil classifiers to protect the ND soil resources. Perhaps other states should be with us, in using experienced professionals to protect the soil resources for the health and wellness of its citizens.

Legend

Soil Symbol	Map Unit Name	Acres	Percent of AOI
F655A	Astad-Tonka complex, west, 0 to 3 percent slopes	12.20	18.28%
F658A	Forman-Aastad loams, west, 0 to 3 percent slopes	53.10	79.55%
F661B	Forman-Buse loams, west, 3 to 6 percent slopes	1.44	2.16%
	Total Acreage	**66.75**	**100.00%**

Soil Map Units
Site Boundary
Roads

N

1:2,400
0 100 200 400
Feet

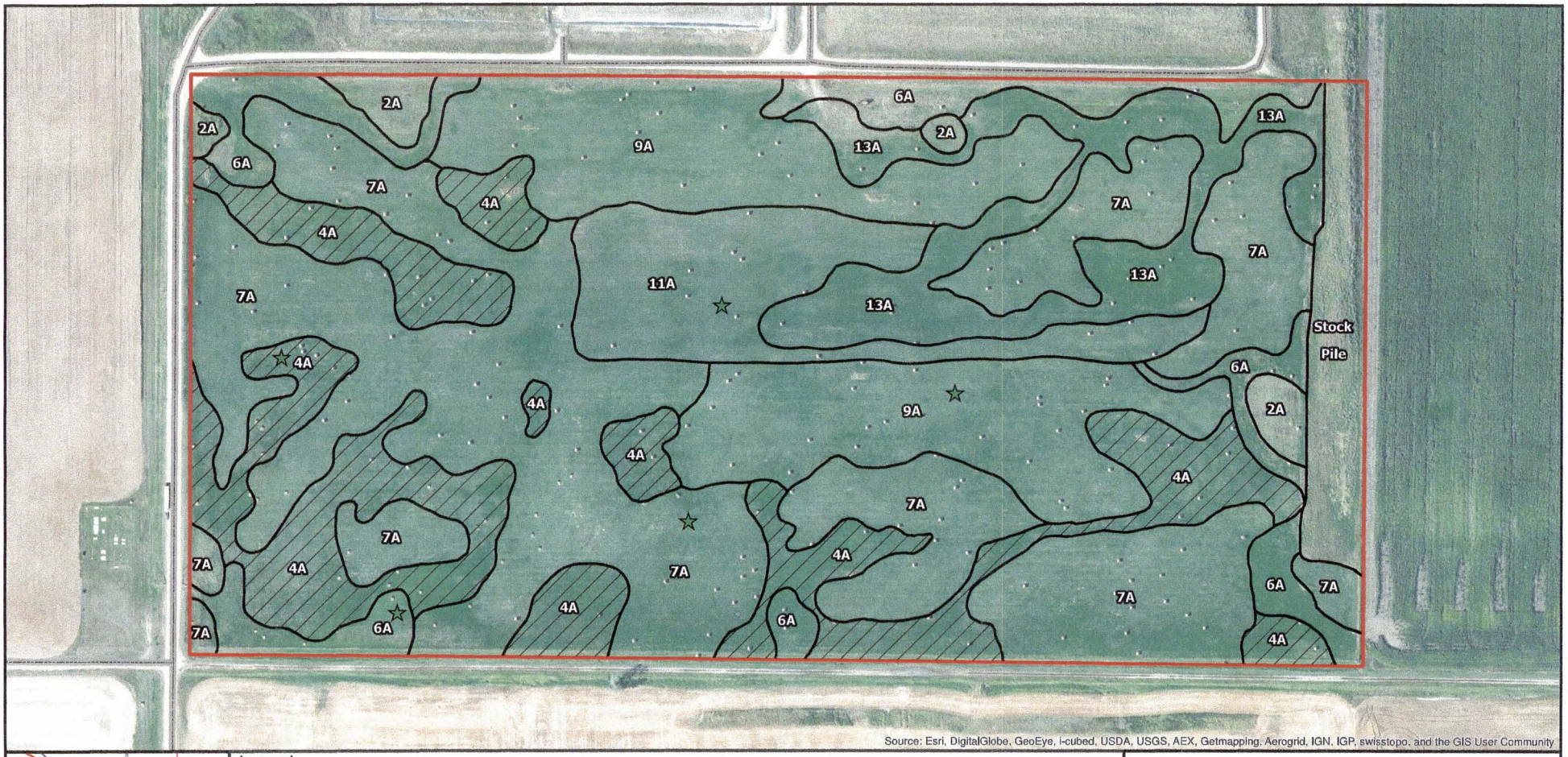
Clean Harbors Environmental Services
Appendix A-II

Order 2 Soil Survey

Registered Soil Scientist
Edland's Soil Consulting
1400 9th Ave. NW
Mandan, ND 58554
701-663-0458

Project Area
S2SW4 Sec 7 T152N R81W

Printed: 6/25/2013



Legend

Soil Symbol	Map Unit Name	Acres	Percent of AOI
2A	Tonka like, 0 to 1 percent slopes	1.13	1.70%
4A	Aastad loam, 0 to 1 percent slopes	11.86	17.77%
6A	Badger silt loam, 0 to 1 percent slopes	4.99	7.48%
7A	Forman loam, 0 to 2 percent slopes	24.49	36.69%
9A	Peever clay loam, 0 to 2 percent slopes	11.45	17.15%
11A	Udolls Fine-loamy, 0 to 1 percent slopes	4.86	7.28%
13A	Udolls Fine-loamy, 0 to 1 percent slopes (Wet)	5.47	8.20%
Stock Pile	Stock Piled Soil	2.50	3.74%
	Total Acreage	**66.75**	**100.00%**

Sample Site
Soil Map Units
Prime Farmland
Site Boundary
Roads

N

1:2,400
0 100 200 400
Feet

Clean Harbors Environmental Services
Appendix A-I
High Intensity Soil Survey
Prime Farmland and Sample Site Map

Registered Soil Scientist
Edland's Soil Consulting
1400 9th Ave. NW
Mandan, ND 58554
701-663-0458

Project Area
S2SW4 Sec 7 T152N R81W

Printed: 6/24/2013

USDA-NRCS

PEDON DESCRIPTION

PEDON ID #: 5

DRAFT 3/2002

Series or Component Name: Badger	Map Unit Symbol:	Photo #:	Classification: Fine, smectitic, Frigid Vertic Argiaquoll	Soil Moist. Regime (Tax.): Udic

Describer(s): L. Edland	Date: 6/7/13	Weather: Temp.: Air: Soil: Depth:	Latitude: 47° 59' 37" N Datum: Longitude: 101° 05' 51" W ± 45'	Location: S2 SW4 Sec. 7 T. 152 R. 81

UTM: Zone: mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #: 2013 ND Ward 5	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:	

Landscape: Till Plain	Landform: Swale	Microfeature:	Anthro:	Elevation:	Aspect: S	Slope (%): 0	Slope Complexity: Simple	Slope Shape: (Up & Dn / Across) Concave - linear

Hillslope Profile Position: TS	Geom. Component: Dip	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage: SWP	Flooding: None	Ponding:	Soil Moisture Status: Moist throughout	Permeability: K_{sat}: Slow .015-.5	Land Cover / Use:

Parent Material: glacial Till	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:	

Erosion: Kind: Degree: water Slight	Runoff: slow	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

P. S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range:	

VEGETATION :

SYMBOL	COMMON NAME	% GD COVER
	Bromegrass	50
	Kentucky Bluegrass	40
	Alfalfa	2
	Dandelions	8

MISCELLANEOUS FIELD NOTES / SKETCH :

Very wet spring - Some ponding in lower areas, about 1-3".

Component Name: | Map Unit Symbol: | Date:

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd %	Rock Frags Rnd	Structure Sz	Structure Grade	Structure Sz	Structure Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles %	Mottles Sz	Mottles Cn	Mottles Col	Mottles Mst	Mottles Sp	Mottles Loc
1	Sample 1	0	8	Ap	as		10YR 3/1	l				1	f	gr		fr	ss	sp							
2		8	14	A	aw		10YR 3/1	l				2	f	sbk		fr	ss	sp							
3	Sample 2	14	24	Bt1	gw		10YR 3/1 - 80% 10YR 5/2 - 20%	c				3 3	m f/m	pr sbk		fr	s	vp							
4		24	29	Bt2	gw		10YR 5/2 - 60% 10YR 4/3 - 40	c				2 2	m m	pr sbk		fr	s	vp	3			10YR 4/6			
5		29	38	Bt3	gw		2.5Y 4/3 - 70 2.5Y 4/1 - 30	cl				1 2	m m	pr sbk		fr	s	p							
6		38	44	Bk	gw		2.5Y 4/3	cl	3			1	m	sbk		fr	s	p	2			10YR 4/6			
7		44	60	Cky	cw		2.5Y 5/3	cl	5				m			fi	s	p				10YR 4/6 5Y 5/1			
8																						10YR 2/1 Coal			
9																									
10																									

	Redoximorphic Features	Concentrations	Ped / V. Surface Features	Roots	Pores	pH (meth)	Effer (agent)	Clay %	CCE	Notes
1				5 F T 1 C T				25		Horizon Sampled
2			K	10 F T 2 C T				27		0 - 14
3			30/0/0/cvf/APf/10YR 3/1	5 FT 10 VFT				42		14 - 29
4	3/f/p/ / / 7.5YR 4/6		20/0/0/cvf/APf/10YR 3/1	6 VFT				38		29 - 44
5	3/f/p 10YR 4/6 2/f/p 5Y 6/1			2 VFT				33		Anomalous crack into Bt
6	5/f/p 10YR 4/6 2/f/p/ 5Y 6/1						es	33		
7							cs	30		
8										
9										
10										

Topsoil Source

Topsoil Source— Summary by Map Unit — Ward County, North Dakota (ND101)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
F655A	Aastad-Tonka complex, west, 0 to 3 percent slopes	Good	Aastad, west (54%)		68.9	20.8%
			Forman, west (5%)			
F656A	Aastad loam, west, 0 to 3 percent slopes, drainageway	Good	Aastad, west (65%)		34.1	10.3%
			Forman, west (12%)			
F658A	Forman-Aastad loams, west, 0 to 3 percent slopes	Good	Forman, west (52%)		213.0	64.4%
			Aastad, west (25%)			
F658B	Forman-Aastad loams, west, 3 to 6 percent slopes	Good	Forman, west (58%)		8.1	2.4%
			Aastad, west (26%)			
F661B	Forman-Buse loams, west, 3 to 6 percent slopes	Good	Forman, west (55%)		6.5	2.0%
			Aastad, west (10%)			
Totals for Area of Interest					**330.6**	**100.0%**

Topsoil Source— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Good	330.6	100.0%
Totals for Area of Interest	**330.6**	**100.0%**

Septic Tank Absorption Fields

Septic Tank Absorption Fields— Summary by Map Unit — Ward County, North Dakota (ND101)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
F655A	Aastad-Tonka complex, west, 0 to 3 percent slopes	Very limited	Aastad, west (54%)	Depth to saturated zone (1.00)	68.9	20.8%
				Slow water movement (0.73)		
			Tonka (20%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Slow water movement (1.00)		
			Cresbard (8%)	Slow water movement (1.00)		
				Depth to saturated zone (1.00)		
			Vallers (5%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Slow water movement (0.73)		
			Forman, west (5%)	Slow water movement (1.00)		
				Depth to saturated zone (0.43)		
			Wyard (3%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Slow water movement (0.73)		
			Hamerly (3%)	Depth to saturated zone (1.00)		
				Slow water movement (0.73)		
			Parnell (2%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Slow water		

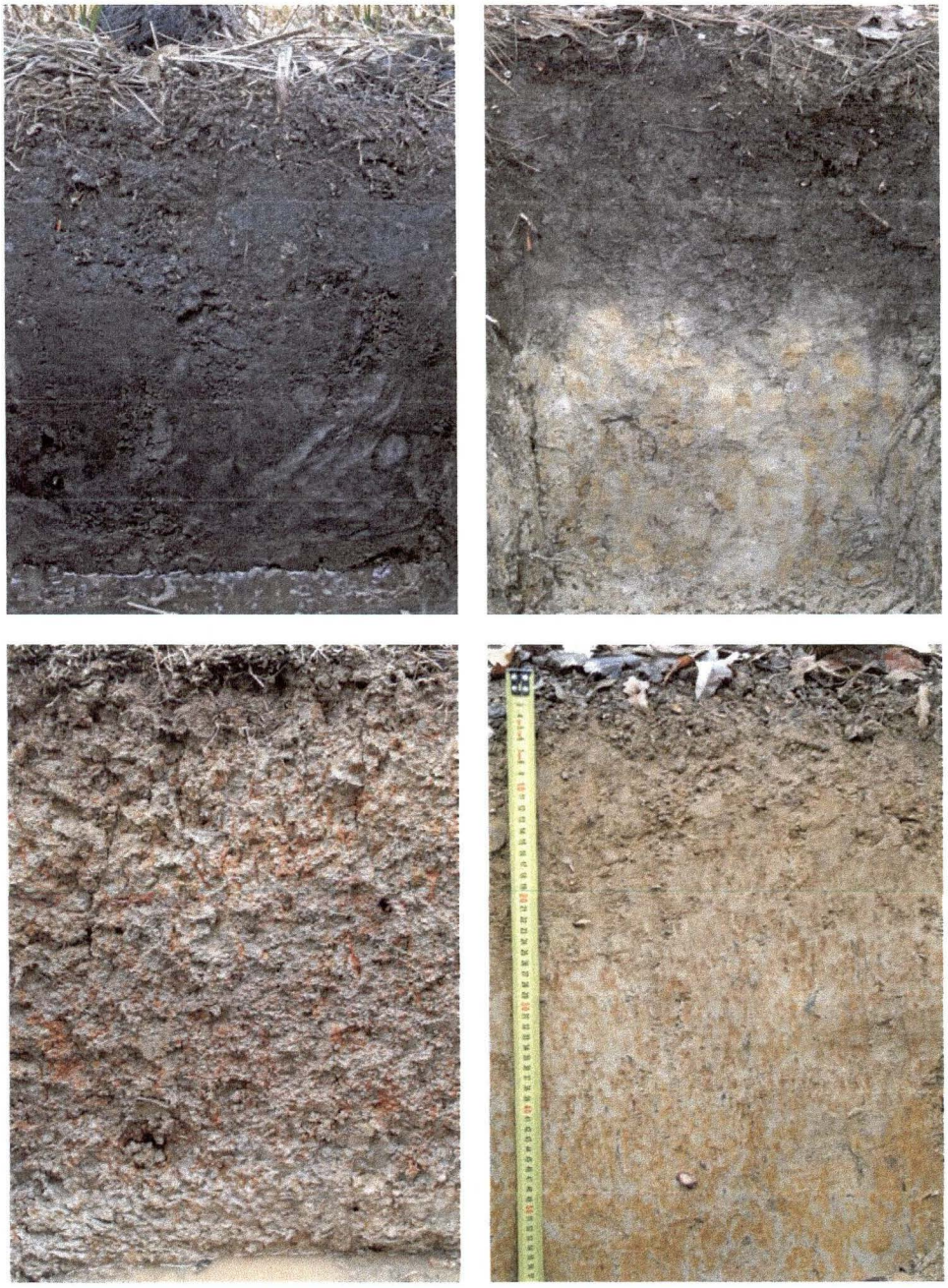
United States Department of Agriculture

In cooperation with the National Technical Committee for Hydric Soils

Natural Resources Conservation Service

Field Indicators of Hydric Soils in the United States

A Guide for Identifying and Delineating Hydric Soils, Version 7.0, 2010



used. The geographic extent of LRRs and MLRAs is defined in U.S. Department of Agriculture Handbook 296 (USDA, NRCS, 2006b). See map (figure 6, page 7) and LRR-specific indicators (Appendices 1 and 2). The indicators are used to identify the hydric soil component of wetlands; however, there are some hydric soils that lack any of the currently listed indicators. Therefore, the lack of any listed indicator does not prevent classification of the soil as hydric. Such soils should be studied and their characteristic morphologies identified for inclusion in this guide.

The NTCHS defines a hydric soil as 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 (Federal Register, 1994). Most hydric soils exhibit characteristic morphologies that result from repeated periods of saturation or inundation that last more than a few days. Saturation or inundation, when combined with microbial activity in the soil, causes the depletion of oxygen. This anaerobiosis promotes certain biogeochemical processes, such as the accumulation of organic matter and the reduction, translocation, or accumulation of iron and other reducible elements. These processes result in distinctive characteristics that persist in the soil during both wet and dry periods, making them particularly useful for identifying hydric soils in the field.

The list of indicators is dynamic; changes and additions are anticipated with new research and field testing. The current version of the indicators is available on the NRCS hydric soils Web site (http://soils.usda.gov/use/hydric).

Concept

Hydric soil indicators are formed predominantly by the accumulation or loss of iron, manganese, sulfur, or carbon compounds in a saturated and anaerobic environment. These processes and the features that develop are described in the following paragraphs.

Iron and Manganese Reduction, Translocation, and Accumulation

In an anaerobic environment, soil microbes reduce iron from the ferric (Fe^{3+}) to the ferrous (Fe^{2+}) form and manganese from the manganic (Mn^{4+}) to the manganous (Mn^{2+}) form. Of the two, evidence of iron reduction is more commonly observed in soils. Areas in the soil where iron is reduced often develop characteristic bluish gray or greenish gray colors known as *gley* (colors with value of 4 or more on the gley pages in the Munsell color book). Ferric iron is insoluble, but ferrous iron easily enters the soil solution and may be moved or translocated to other areas of the soil. Areas that have lost iron typically develop characteristic gray or reddish gray colors and are known as *redox depletions*. If a soil reverts to an aerobic state, iron that is in solution will oxidize and become concentrated in patches as soft masses and along root channels and other pores. These areas of oxidized iron are called *redox concentrations*. Since water movement in these saturated or inundated soils can be multidirectional, redox depletions and concentrations can occur anywhere in the soil and have irregular shapes and sizes. Soils that are saturated and contain ferrous iron at the time of sampling may change color upon exposure to the air, as ferrous iron is rapidly converted to ferric iron in the presence of oxygen. Such soils are said to have a *reduced matrix* (Vepraskas, 1994).

While indicators related to iron or manganese depletion or concentration are most common in hydric soils, they cannot form in soils with parent materials that are low in content of Fe or Mn. Soils that formed in such materials may have low-chroma colors that are not related to saturation and reduction. Such soils may have morphological features that formed through accumulation of organic matter.

Sulfate Reduction

Sulfur is one of the last elements to be reduced by microbes in an anaerobic environment. The microbes convert SO_4^{2-} to H_2S, or hydrogen sulfide gas. This conversion results in a very pronounced "rotten egg" odor in some soils that are inundated or saturated for very long periods. In soils that are not saturated or inundated, sulfate is not reduced and there is no rotten egg odor. The presence of hydrogen sulfide is a strong indicator of a hydric soil, but this indicator occurs only on the wettest sites, in soils that contain sulfur-bearing compounds.

Organic-Matter Accumulation

Soil microbes use carbon compounds that occur in organic matter as an energy source. The rate at which soil microbes use organic carbon, however, is considerably lower in a saturated and anaerobic environment than under aerobic conditions. Therefore, in saturated soils, partially decomposed organic matter may accumulate. The result in wetlands is often the development of thick organic surface horizons, such as peat or muck, or dark organic-rich mineral surface layers.

Determining the Texture of Soil Materials High in Organic Carbon

Material high in organic carbon could fall into three categories: organic, mucky mineral, and mineral. In lieu of laboratory data, the following estimation method can be used for soil material that is wet or nearly saturated with water. This method may be inconclusive with loamy or clayey mineral soils. Gently rub the wet soil material between forefinger and thumb. If upon the first or second rub the material feels gritty, it is mineral soil material. If after the second rub the material feels greasy, it is either mucky mineral or organic soil material. Gently rub the material two or three more times. If after these additional rubs it feels gritty or plastic, it is mucky mineral soil material; if it still feels greasy, it is organic soil material.

If the material is organic soil material, a further division should be made. Organic soil materials are classified as sapric, hemic, or fibric. Differentiating criteria are based on the percentage of visible fibers observable with a hand lens in an undisturbed state and after rubbing between thumb and fingers 10 times. Sapric, hemic, and fibric correspond to the textures muck, mucky peat, and peat. If there is a conflict between unrubbed and rubbed fiber content, rubbed content is used. *Live roots are not considered.*

Cautions

A soil that is drained or protected (for instance, by dikes or levees) will meet the definition of a hydric soil if the upper part formed under anaerobic conditions in an unaltered state. To be identified as hydric, the soil should generally have one or more of the indicators. Not all areas that have hydric soils qualify as wetlands, however, if they no longer have wetland hydrology or support hydrophytic vegetation.

There are hydric soils with morphologies that are difficult to interpret. These include soils with black, gray, or red parent material; soils with high pH; soils high or low in content of organic matter; recently developed hydric soils; and soils high in iron inputs. In some cases we do not currently have indicators to assist in the identification of hydric soils in these situations. As long as the soil meets the definition of a hydric soil, the lack of an indicator does not preclude the soil from being hydric.

The indicators were developed mostly to identify the boundary of hydric soil areas and generally work best on the margins. Not all of the obviously wetter hydric soils will be identified by the indicators. Redoximorphic features are most likely to occur in soils that cycle between anaerobic (reduced) and aerobic (oxidized) conditions.

Morphological features of hydric soils indicate that saturation and anaerobic conditions have existed under either contemporary or former hydrologic regimes. Where soil morphology seems inconsistent with the landscape, vegetation, or observable hydrology, it may be necessary to obtain the assistance of an experienced soil or wetland scientist to determine whether the soil is hydric.

Procedure

Observe and Document the Site

Before making any decision about the presence or absence of hydric soils, the overall site and how it interacts with the soil should be considered. The steps below, while not required to identify a hydric soil, can help to explain why one is or is not present. Always look at the landscape features of the immediate site and compare them to the surrounding areas. Try to contrast the features of wet and dry sites that are in close proximity. When observing slope features, look first at the area immediately around the sampling point. For example, a nearly level bench or depression at the sampling point may be more important to the wetness of the site than the overall landform on which the bench or depression occurs. Understanding how water moves across the site helps to clarify the reasons for the presence or absence of hydric soil indicators.

Observe and Document the Soil

To observe and document a hydric soil, first remove from the soil surface any woody material larger than 2 cm in cross section that cannot be crushed or shredded when rubbed. Do not remove the organic surface layers of the soil, which generally consist of plant remains in various stages of decomposition. Dig a hole and describe the soil profile. In general, the hole should be dug to the depth needed to document an indicator or to confirm the absence of indicators. For most soils, the recommended excavation depth is approximately 20 inches (50 cm) from the soil surface, although a shallower soil pit may suffice for some indicators (e.g., A2, Histic Epipedon). Digging may be difficult in some areas because of rocks or hardpans. Use the completed profile description to determine which hydric soil indicators have been met (USDA, NRCS, 2006a).

For soils with thick, dark surface layers, deeper examination may be required when field indicators are not easily seen within 20 inches (50 cm) of the surface. The accumulation of organic matter in these soils may mask redoximorphic features in the surface layers. Examination to a depth of 40 inches (1 m) or more may be needed to determine whether the soils meet the requirements of indicator A12 (Thick Dark Surface). A soil auger or probe may be useful for sampling soil materials below a depth of 20 inches.

Whenever possible, excavate the soil deep enough to determine if there are layers or materials present that might restrict soil drainage. This determination will help to indicate why the soil may or may not be hydric. After a sufficient number of exploratory excavations have been made to determine the soil hydrologic relationships at the site, subsequent excavations can be limited to the depth needed to identify hydric soil indicators. Consider taking photographs of both the soil and the overall site, including a clearly marked measurement scale in pictures of soil profiles.

In LRRs R, W, X, and Y, we begin our observations at the top of the mineral surface (underneath any and all fibric, hemic, and/or sapric material), except for areas of indicators A1, A2, and A3, where we begin at the actual soil surface. In LRRs F, G, H, and M, we begin our observations at the actual soil surface if the soil is sandy and in areas of indicators A1, A2, and A3 and at the muck or mineral surface for the remaining field indicators. In the remaining LRRs, we begin our observations at the top of the muck or mineral surface (underneath any fibric and/or hemic material), except for areas of indicators A1, A2, and A3, where we begin at the actual soil surface (fig. 2).

All colors noted in this guide refer to moist Munsell® colors (Gretag-Macbeth, 2000). Dry soils should be moistened until the color no longer changes, and wet soils should be allowed to dry until they no longer glisten (fig. 3). Care should be taken to avoid over-moistening dry soil. Soil chromas specified in the indicators do not have decimal points; however, intermediate colors do occur between Munsell chips. Rounding should not be used to make chroma meet the requirements of an indicator. A soil matrix with chroma between 2 and 3 should be described as having chroma of 2+. It does not have chroma of 2 and would not meet the requirements of any indicator that requires chroma of 2 or less. Always examine soil matrix colors in the field immediately after sampling. Ferrous iron in the soil can oxidize rapidly and create colors of higher chroma or redder hue.

Soils that are saturated at the time of sampling may contain reduced iron and/or manganese that cannot be detected by the eye. Under saturated conditions, redox concentrations may be absent or difficult to see, particularly in dark colored soils. It may be necessary to let the soil dry to a moist state (for 5 to 30 minutes or more) for the iron or manganese to oxidize and the redoximorphic features to become visible.

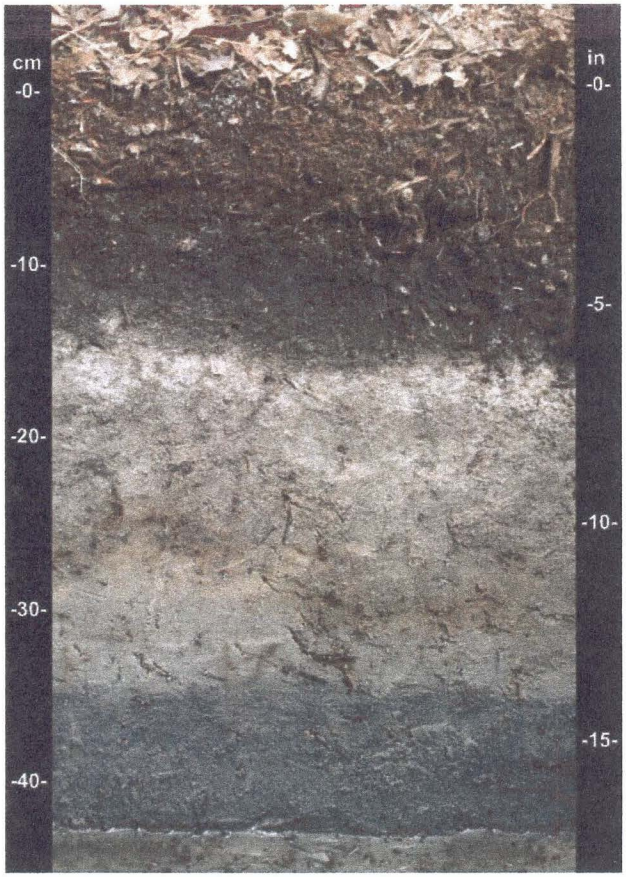


Figure 2.—To determine if a hydric soil Indicator occurs in this soil profile, begin measurements at 8 cm on the left measuring tape, excluding the organic horizons of mucky peat or peat.

Particular attention should be paid to changes in microtopography over short distances. Small changes in elevation may result in repetitive sequences of hydric/nonhydric soils, making the delineation of individual areas of hydric and nonhydric soils difficult. Commonly, the dominant condition (hydric or nonhydric) is the only reliable interpretation. The shape of the local landform can greatly affect the movement of water through the landscape. Significant changes in parent material or lithologic discontinuities in the soil can also affect the hydrologic properties of the soil.

Figure 44.—The profile on the right is from a drained wetland adjacent to a ditch. The profile on the left is from an area not affected by the ditch. Both soils meet the requirements for indicators F3 (Depleted Matrix) and A11 (Depleted Below Dark Surface) and thus are hydric soils.

Concave landscapes. Landscapes in which the surface curves downward.

***Depleted matrix.** For loamy and clayey material (and sandy material in areas of indicators A11 and A12), a depleted matrix refers to the volume of a soil horizon or subhorizon in which the processes of reduction and translocation have removed or transformed iron, creating colors of low chroma and high value (fig. 45). A, E, and calcic horizons may have low chromas and high values and may therefore be mistaken for a depleted matrix; however, they are excluded from the concept of depleted matrix unless the soil has common or many distinct or prominent redox concentrations occurring as soft masses or pore linings. In some areas the depleted matrix may change color upon exposure to air (see Reduced matrix); this phenomenon is included in the concept of depleted matrix. The following combinations of value and chroma identify a depleted matrix:

1. Matrix value of 5 or more and chroma of 1 or less with or without redox concentrations occurring as soft masses and/or pore linings; or
2. Matrix value of 6 or more and chroma of 2 or less with or without redox concentrations occurring as soft masses and/or pore linings; or

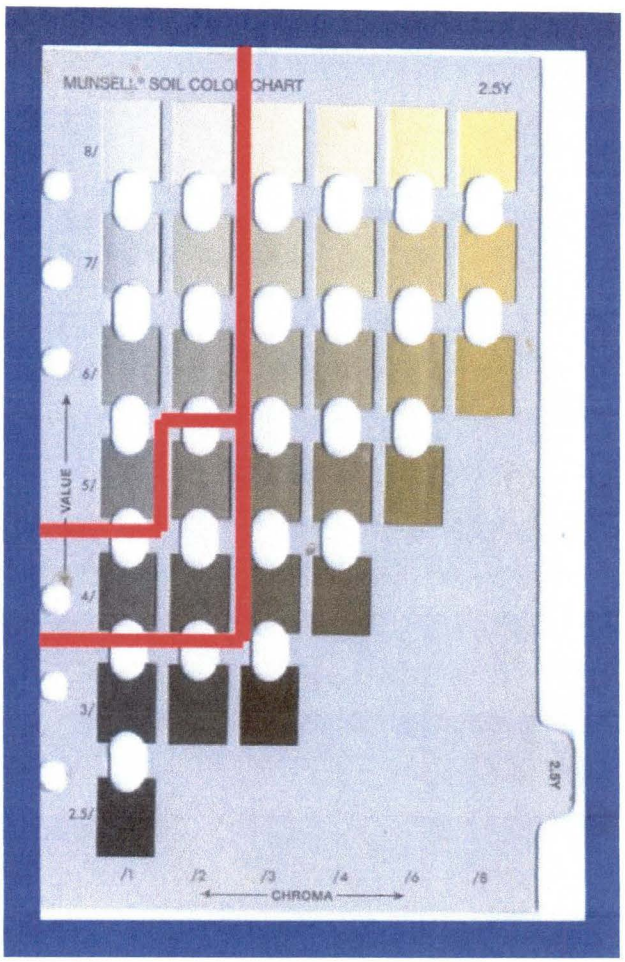


Figure 45.—Soils with depleted matrices have a matrix value of 4 or more (above the bottom horizontal red line) and chroma of 2 or less (to the left of the vertical red line). Redox concentrations are not required if the color has chroma of 2 or less and is above the top red line. For 4/1, 4/2, and 5/2 colors, two redox concentrations are required.

3. Matrix value of 4 or 5 and chroma of 2 and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings; or
4. Matrix value of 4 and chroma of 1 and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings (fig. 46).

Diffuse boundary. Used to describe redoximorphic features that grade gradually from one color to another (fig. 47). The color grade is commonly more than 2 mm wide. "Clear" is used to describe boundary color gradations intermediate between sharp and diffuse.

USDA-NRCS

PEDON DESCRIPTION

PEDON ID #:

DRAFT 3/2002

Series or Component Name: Namerly	Map Unit Symbol:	Photo #:	Classification:	Soil Moist. Regime (Tax.):

Describer(s):	Date:	Weather: Temp.: Air: Soil: Depth:	Latitude: ° ' " N Longitude: ° ' " W	Datum: Location: Sec. T. R.

UTM: Zone: mE: mN:	Topo Quad:	Site ID: Yr: State: County: Pedon #:	Soil Survey Area:	MLRA / LRU:	Transect: ID: Stop #: Interval:

Landscape: Tl Plain	Landform: Flat	Microfeature:	Anthro:	Elevation:	Aspect:	Slope (%): 2	Slope Complexity:	Slope Shape: (Up & Dn / Across) Convex/linear

Hillslope Profile Position: Toe	Geom. Component:	Microrelief:	Physio. Division:	Physio. Province:	Physio. Section:	State Physio. Area:	Local Physio. Area:

Drainage: SP	Flooding:	Ponding:	Soil Moisture Status:	Permeability: K_{sat}: Mod 0.6 - 2.0	Land Cover / Use:

Parent Material: Glacial Till	Bedrock: Kind: Fract.: Hard.: Depth:	Lithostrat. Units: Group: Formation: Member:	

Erosion: Kind: Degree:	Runoff:	Surface Frag %: GR: CB: ST: BD: CN: FL: Kind:	Diagnostic Horz. / Prop.: Kind: Depth:

P. S. Control Section: Ave. Clay %: Ave. Rock Frag %: Depth Range:	

VEGETATION:

SYMBOL	COMMON NAME	% GD COVER

MISCELLANEOUS FIELD NOTES / SKETCH:

Component Name:	Map Unit Symbol:	Date:

	Obser. Method	Depth (in)	Depth (cm)	Horizon	Bnd	Matrix Color Dry	Matrix Color Moist	Texture	Rock Frags Knd %	Rock Frags Rnd	Rock Frags Sz	Structure Grade	Structure Sz	Structure Type	Consistence Dry	Consistence Mst	Consistence Stk	Consistence Pls	Mottles %	Mottles Sz	Mottles Cn	Mottles Col	Mottles Mst	Mottles Sp	Mottles Loc
1		0	8	Ap	as	10YR 3/1	10YR 3/1	1				1		sbk			SS								
2		8	18	Bk1	gw		2.5Y 6/2	1				1	M f	sbk		FR									
3		18	25	Bk2			2.5Y 6/2	1				1	M	sbk		FR									
4		18	25	Bk2			2.5Y 5/4	1																	
5		25	60	C			2.5Y 5/4	1				1	M	sbk		FI									
6		25	60	C			2.5Y 4/4	1																	
7																									
8																									
9																									
10																									

	Redoximorphic Features %	Sz	Cn	Hd	Sp	Kd	Loc	Bd	Col	Concentrations %	Sz	Cn	Hd	Sp	Kd	Loc	Bd	Col	Ped / V. Surface Features %	Dst	Cont	Kd	Loc	Col	Roots Qty	Sz	Loc	Pores Qty	Sz	Shp	pH (meth)	Effer (agent)	Clay %	CCE	Notes
1																																es			
2																																ev			
3																																ev			
4	5					T			2.5Y 5/1																										
5	4					T			10YR 5/6																							es			
6																																			
7																																			
8																																			
9																																			
10																																			

LOCATION HAMERLY ND+MN SD

Established Series
Rev. CJH
06/1999

HAMERLY SERIES

The Hamerly series consists of very deep, somewhat poorly drained soils that formed in calcareous loamy till. Permeability is moderate in the upper horizons and moderate or moderately slow in the lower horizons. These soils are on flats on lake plains and on convex slopes surrounding shallow depressions and on slight rises on till plains. They have slopes ranging from 0 to 3 percent. Mean annual air temperature is 42 degrees F, and mean annual precipitation is 19 inches.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, frigid Aeric Calciaquolls

TYPICAL PEDON: Hamerly loam - cultivated. (Colors are for moist soil unless otherwise stated)

Ap--0 to 8 inches; very dark gray (10YR 3/1) loam, gray (10YR 5/1) dry; weak medium subangular blocky structure parting to moderate medium granular; friable; slightly sticky; strong effervescence; abrupt smooth boundary. (Combined A horizons 5 to 18 inches thick)

Bk1--8 to 18 inches; light brownish gray (2.5Y 6/2) loam; weak medium and fine subangular blocky structure; friable; violent effervescence; gradual wavy boundary.

Bk2--18 to 25 inches; light brownish gray (2.5Y 6/2) and light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; friable; few masses of carbonates; violent effervescence; gradual wavy boundary. (Combined Bk horizons 10 to 40 inches thick)

C--25 to 60 inches; light olive brown (2.5Y 5/4) and olive brown (2.5Y 4/4) loam; common medium distinct gray (2.5Y 5/1) redoximorphic depletions and yellowish brown (10YR 5/6) redoximorphic concentrations; weak medium blocky structure; firm; strong effervescence.

TYPE LOCATION: Sargent County, North Dakota; about 1/2 mile south of Gwinner; 2,090 feet south and 95 feet west of the northeast corner, Sec. 26, T. 132 N., R. 56 W.

RANGE IN CHARACTERISTICS: The mollic epipedon ranges from 7 to 18 inches in thickness. The top of the calcic horizon is at depths of less than 16 inches, and in some pedons the lower part of the mollic epipedon qualifies as part of the calcic horizon. The soil contains 1 to 10 percent by

volume of rock fragments. The 10- to 40-inch particle-size control section has visible gypsum in some pedons. It has 18 to 35 percent noncarbonate clay. Saline and stony phases are recognized.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3 and 3 to 5 dry, and chroma of 1 or 2. It commonly is loam but in some pedons it is silt loam, clay loam, silty clay loam or sandy clay loam. It is neutral to moderately alkaline. Where the soil is in native grassland, the A horizon in some pedons does not have carbonates. Some pedons have an ABk horizon.

The Bk horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 7 and 4 to 8 dry, and chroma of 1 to 4. It is loam or clay loam. It is slightly alkaline or moderately alkaline. Mottling in the Bk horizon ranges from none to common. Some pedons have Bky, Bkyz, By or BCk horizons.

The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 and 5 to 8 dry, and chroma of 1 to 4. It is loam or clay loam. It is slightly alkaline or moderately alkaline.

COMPETING SERIES: These are the Antler, Gilby, Moritz and Tetonview series. Antler soils have less than 15 percent fine sand and coarser in the upper horizons. Gilby soils have less than 18 percent clay in the upper horizons. Moritz soils do not have rock fragments in the particle-size control section and formed in alluvium. Tetonview soils have O horizons and occur at elevations above 3800 feet.

GEOGRAPHIC SETTING: Hamerly soils are on level and nearly level till plains. They are also on flats and slight rises on till plains and lake plains, and on slightly convex slopes surrounding shallow depressions on till plains. Slopes are short and commonly having gradients of less than 3 percent but range from 0 to 3 percent. The soil is formed in calcareous loamy till. Mean annual air temperature ranges from 36 to 45 degrees F, and mean annual precipitation ranges from 12 to 24 inches. Frost-free period ranges from 90 to 140 days. Elevation above sea level ranges from 650 to 2700 feet.

GEOGRAPHICALLY ASSOCIATED SOILS: The Hamerly soils are most commonly in a toposequence with Barnes, Buse, Svea, Parnell, Vallers and Tonka soils. They are in intermediate positions between the better drained Barnes, Buse and Svea soils and the wetter Parnell, Vallers and Tonka soils. Parnell and Tonka soils are in depressions and Vallers soils are on lower lying flats.

DRAINAGE AND PERMEABILITY: Somewhat poorly drained. Runoff is negligible to medium depending on slope and surface texture. Moderate permeability in the upper horizons and moderate or moderately slow in the lower horizons. Apparent seasonal high water table is at a depth of 1.5 to 3.5 feet at some time during the period April through June.

USE AND VEGETATION: Cultivated areas are used for growing small grains, flax, hay and pasture. Native vegetation is green needlegrass, little bluestem, big bluestem and western wheatgrass.

DISTRIBUTION AND EXTENT: Central and eastern North Dakota, northeastern South Dakota and northwestern Minnesota. The soils are extensive.

WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: _____ City/County: _____ Sampling Date: _____

Applicant/Owner: _____ State: _____ Sampling Point: _____

Investigator(s): _____ Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Flat Local relief (concave, convex, none) Convex/linear Slope (%): 2

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No _____
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No _____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		
% Bare Ground in Herb Stratum _____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC−): _____ (A)

Total Number of Dominant Species Across All Strata: _____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	_____	x 1 = _____
FACW species	_____	x 2 = _____
FAC species	_____	x 3 = _____
FACU species	_____	x 4 = _____
UPL species	_____	x 5 = _____
Column Totals:	_____ (A)	_____ (B)

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No _____

Remarks:

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/1	100					l	
8-18	2.5Y 6/2	100					l	
18-25	2.5Y 6/2	65					l	
18-25	2.5Y 5/4	35						
25-60	2.5Y 5/4	70	2.5Y 5/1	5	D	PL	l	
25-60	2.5Y 4/4	30	10YR 5/6	4	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR F**)
- ___ 1 cm Muck (A9) (**LRR F, G, H**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ 2.5 cm Mucky Peat or Peat (S2) (**LRR G, H**)
- ___ 5 cm Mucky Peat or Peat (S3) (**LRR F**)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ High Plains Depressions (F16) (**MLRA 72 & 73 of LRR H**)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR I, J**)
- ___ Coast Prairie Redox (A16) (**LRR F, G, H**)
- ___ Dark Surface (S7) (**LRR G**)
- ___ High Plains Depressions (F16) (**LRR H outside of MLRA 72 & 73**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Dry-Season Water Table (C2)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where not tilled**)
- ___ Presence of Reduced Iron (C4)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Oxidized Rhizospheres on Living Roots (C3) (**where tilled**)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ FAC-Neutral Test (D5)
- ___ Frost-Heave Hummocks (D7) (**LRR F**)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** _____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

NDSU EXTENSION SERVICE
NORTH DAKOTA STATE UNIVERSITY

Making a difference

Soil Classification to Improve Management

The Situation

The sustainability of soil resources, which support many different land uses and industries in North Dakota, relies upon a general understanding of and an ability to identify specific functions soils can perform within ecosystem constraints and under a variety of management approaches. Soil classification is a discipline/tool, which incorporates these concepts. For example, an individual trained in soil classification can apply concepts to their personal farming/ranching operation or help other producers refine management approaches across multiple soil types within a particular field – maximizing yields while increasing sustainability of that system. Training in soil classification also provides the necessary skillset for successful completion of the Soil Certification exams at a national and state level. Being a certified soil classifier/scientist is desirable for careers with consulting firms and government agencies in North Dakota and is highly sought after for hiring with primary industries in North Dakota (agriculture and oil development).

Extension Response

A partnership was developed between NDSU Extension, the Natural Resources Conservation Service (NRCS) and the Professional Soil Classifiers Association of North Dakota (PSCAND) to provide the necessary training in soil classification to college-level students in North Dakota. This goal behind this training was to facilitate programs in soil classification at various universities and colleges in North Dakota, which could then potentially increase certifications in soil science at the national and state level. A field day at the Burleigh County Soil Conservation District Farm in Menoken, ND was used as the platform to provide the training. This was a 2-day event (September 19-20, 2013), with approximately 20 "trainers" (both professional soil classifiers and educators) involved. Topics covered included: site characterization, field skills and agronomy. A North Dakota Sustainable Agriculture Research and Education (SARE) grant was obtained to support the purchasing of necessary supplies utilized during the field day.

Impacts

There was a positive response to this field day. A total of five universities/colleges participated (86 students and 10 advisors). A majority of the students were in their second year of their undergraduate programs and predominately from a farming and ranching background (>90%). This same group of students anticipated a career in farming/ranching post-graduation. There was a 22%, 24% and 15% increase in knowledge for site characterization, field skills and agronomy, respectively, after attending the field day. A follow up survey on how skills learned during the field day were applied to production operations and educational programs will be completed in spring of 2014. Over 70% of those attending in 2013 were also interested in attending a similar field day in 2014.

Feedback

"We should do this again" – educator

"I've never considered soils on our ranch before now" – student

"I enjoyed having the opportunity to describe soil profiles with experienced soil survey professionals" - student

Contact

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