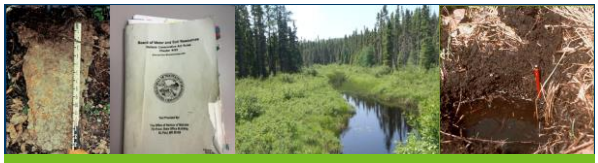


MN Wetland Professional Certification Program Regional Training

BOARD OF WATER AND SOIL RESOURCES

Minnesota Wetland Professional Certification Program

1

2023 MWPCP Schedule

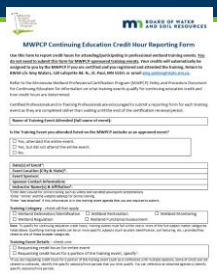
- WCA Regulatory Training- St Cloud MNDOT Training Facility- April 20
- Regional Training: Rochester - May 16-17
- Wetland Delineation and Regulation Basic Class: Arden Hills- June 12-16
- Floristic Quality Assessment (FQA)- MNDOT Shoreview Training Center – June 20
- Basic Wetland Plant ID- Farmington (July 18) or Brainerd (July 20)
- Wetland Delineation Refresher- Prairie Woods ELC- Spicer- August 8
- Regional Training: Fergus Falls – August 15-16
- Wetland Delineation and Regulation Basic Class: Brainerd - September 11-15

Minnesota Wetland Professional Certification Program

2

End of the current renewal period

- Current certification renewal period ends on December 31, 2023 for all who transferred to the MWPCP from the U of MN Wetland Delineation Certification Program.
- Credit reporting deadline for this renewal period is January 1, 2024.
- Submit the Credit Hour Reporting Form with proof of attendance no later than January 1, 2024.
- Not required to submit a credit hour reporting form for MWPCP courses.
- COVID-related temporary continuing education policies will lapse at the end of 2023.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MWPCP Continuing Education Credit Hour Reporting Form

3

Next renewal period

- The next credit renewal period begins January 1, 2024 and ends on December 31, 2026.
- MWPCP Continuing Education policy, requires 18 credit hours of MWPCP-approved training.
- Six of those may be online training.


BOARD OF WATER AND SOIL RESOURCES

April 27, 2022

Continuing Education for MWPCP – Policies and Procedures

This document explains specific Minnesota Wetland Professional Certification Program (MWPCP) policies and procedures related to Continuing Education.

Terminology:

Certified Professionals – Individuals that are recognized by the MWPCP as having a certain level of knowledge, expertise, and experience in MWPCP subject matter areas related to conducting and/or reviewing professional work associated with wetland regulatory compliance in Minnesota.

Certified In-Training Professionals – Individuals that are recognized by the MWPCP as having a certain level of knowledge and training in MWPCP subject matter areas related to conducting and/or reviewing professional work associated with wetland regulatory compliance in Minnesota.

Certification Renewal – The process of renewing certification of MWPCP Certified Professionals and In-Training Professionals every three years through attendance of professional wetland training events.

Credit Hours – Number of hours (to the nearest half hour) associated with an MWPCP-qualifying continuing education training event minus scheduled breaks.

Approved Training Event – Professional wetland training event where the MWPCP has determined the number of credit hours participants will receive for certification renewal if they attend/participate.

4

Minnesota Wetland Professional Certification Program

MWPCP Regional Training- Rochester

Day One:

- Urban wetland management panel discussion
- Incidental wetlands
- Ag bank review process- what to look for in a potential site
- Lunch
- Submitting & reviewing WCA applications
- Public waters and WCA
- Public waters and floodplain wetlands site visit along Zumbro River

Day Two:

- The Paleozoic plateau- How hydroscapes influence wetlands
- Common Data Sheet Errors & mapping sloped wetlands
- Hydric soil indicators
- Lunch
- Decorah edge
- Field exercise- small group delineation exercise along Decorah edge

Class Portal: https://bwsr.state.mn.us/node/4681

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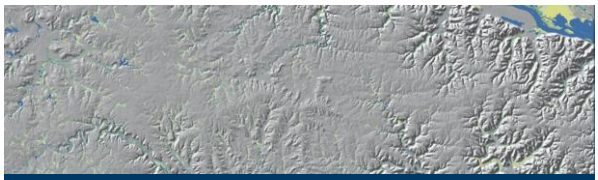


Wetlands of the Paleozoic Plateau Ecological Section

BOARD OF WATER AND SOIL RESOURCES

BWSR Wetland Section | www.bwsr.state.mn.us/wetlands

6

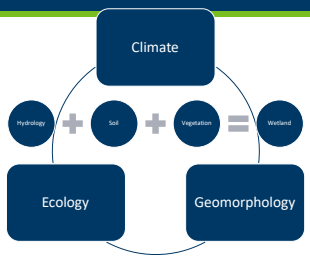
Reading a Hydroscape: Factors & Parameters

Factors:

- Climate
- Ecology
- Geomorphology

Parameters:

- Hydrology
- Soil
- Plant Communities



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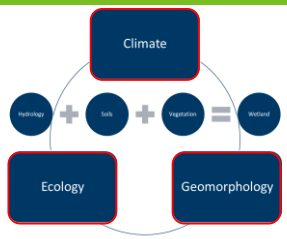
Factors

- Overarching factors that determine much of the condition of an area
- Examples:
  - Climate determines antecedent precipitation
  - Ecology determines dominate plant communities
  - Geomorphology determines landscapes and soil parent material



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Wetlands of the Paleozoic Plateau

- Ecological Classification System
- Eastern Broadleaf Forest Province
  - Paleozoic Plateau Section
    - Rochester Plateau Subsection
    - Blufflands Subsection
    - Oak Savanna Subsection

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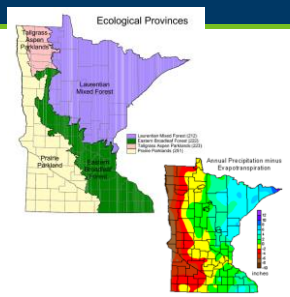
Eastern Broadleaf Forest Province

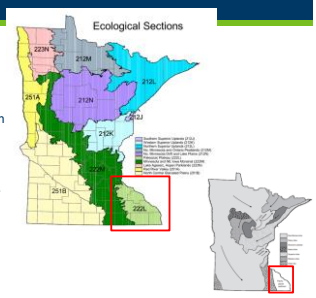
- Large province- Almost 12 million acres across MN, IA, WI, OH, NY, IL, IN, KT, MS, AR
- Transition between semi-arid prairie and semi-humid mixed forest of SE/NE
  - Prairie species meet eastern ranges
  - Forest species meet western ranges
- Landforms largely glacial deposits and recent erosion
- Precipitation approximately equals evapotranspiration
- Avg Precipitation 24-35 inches
- Avg temperatures 38-46 F



10

Paleozoic Plateau Section

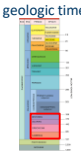
- Bluffs and Valleys with rolling plateau along west
- Relatively flat sedimentary bedrock
- Landforms shaped by deposition and erosion
- Major Rivers: Mississippi, Root, Whitewater, Zumbro, Cannon
- Capped by windblown sediment called loess
  - Parent material for silt loam
- Not glaciated during last advance

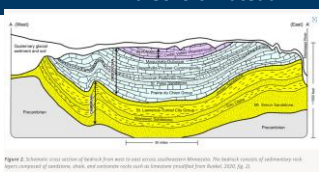


11

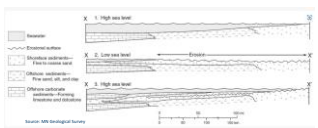
Paleozoic Plateau

- Deposition over 3 geologic time periods
  - Cambrian
  - Ordovician
  - Devonian





- Erosion- deeply eroded from glacial melt and precipitation



Geologic Atlas of Olmsted County

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Rochester Plateau Subsection

- Landforms- western boundary series of Des Moines lobe end moraines, eastern edge of dissected drainages
- Plateau capped with thick loess to east thinning to west
- Topography- Rolling till plains, bedrock controlled, sinkholes common in SW, bedrock outcrops common
- Pre-settlement Vegetation- tallgrass prairie and bur oak savanna
- Present Vegetation & Land Use- majority of subsection is farmed

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Blufflands Subsection

- Landforms- loess-capped, dissected valleys, 600 ft relief near Mississippi, river bottom floodplains
- Topography is controlled by glacial till to west, bedrock to east
- Pre-settlement Vegetation- tallgrass prairie and bur oak savanna
- Present Vegetation & Land Use- 30% cropped, 20% pasture, 50% woodland

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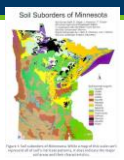
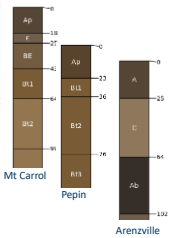
Soils of Paleozoic Plateau

- Parent material- siltstone, sandstone, shale
- Alfisols- fertile, forest soils (~27% of MN)
  - Udalfs- dominate where hardwood forests were
- Silt loam- thick relatively uniform profiles, well drained
- Mollisols- prairie soils along west edge of section
- Glacial till thickness varies from 100-200 ft in west to 10-100 feet in east
- Sediment thickness dependent on landscape position
- Bedrock outcrops common





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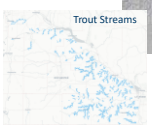
Hydrology of Paleozoic Plateau

- Few natural lakes
- Well-developed dendritic drainage patterns
- Karst topography facilitating complex groundwater systems
  - Caves, sinkholes, springs
- Coldwater trout streams



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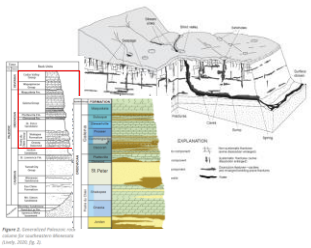
Karst landscapes

- Develop where limestone and dolomite are at or near surface
- Calcium carbonate slowly dissolved by surface and groundwater
- Erosion likely started 500 mya
- Much of SE MN underlain by carbonate rocks
- Cedar Valley Group down to Prairie du Chien have karst features
- Karst features influence local hydrology of wetlands



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Factors influencing vegetation on plateau

Factors:

- Slope
- Aspect
- Flooding
- Fire
- Substrate- local

- Prairies along west were fire prone
- Steep slopes protected by fire with oak woodlands
- Mesic forests on north and east slopes- oak with basswood, then sugar maple on downslopes
- Wet-mesic along level silt bottoms- basswood, black ash, walnut
- Sandy valley bottoms- dry prairies
- Alluvial floodplains- silver maple, river birch

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Wetlands of the Paleozoic Plateau

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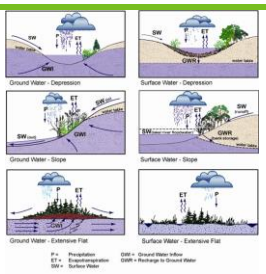
Hydrogeomorphic Method of Classifying Wetlands

RIVERINE, DEPRESSIONAL, SLOPE, MINERAL SOIL FLATS, ORGANIC SOIL FLATS, ESTUARINE FRINGE, LACUSTRINE FRINGE

- Assesses functional conditions of a specific wetland referenced to data collected from wetlands across a range of physical conditions
- Established Classes based on geomorphic, hydrology and hydraulic functions of palustrine wetlands



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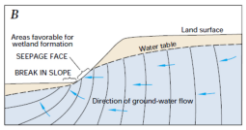
Hydraulics- how water moves



- Uni-directional
- Bi-directional
  - Estuarine and lacustrine fringe

21

Typical HGM Classes of SE MN

- Depressional – surface
- Depressional - Groundwater
- Riverine
- Sloped

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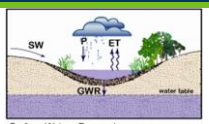
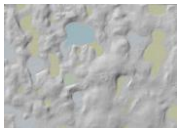
Depressional - surface



Surface Water - Depression

- Landscape position- concave, foot slope/toe slope, closed contours
- Hydraulics- unidirectional
- Water source- surface flow and precipitation, seasonal
- Outputs- Evapotranspiration, groundwater recharge



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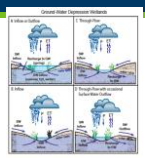
Depressional- groundwater



- Landscape position- concave, foot and toe slopes, closed contours
- Hydraulics- unidirectional
- Water source- groundwater and precipitation, *seasonal*
- Outputs- Evapotranspiration, groundwater recharge, intermittent overland flow

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Riverine

- Landscape position- floodplains and riparian corridors, often intergrade to sloped or depressional
- Hydraulics- unidirectional, surface overbank flow, groundwater, interflow (both surface and ground) from adjacent uplands
- Water source- precipitation, groundwater
- Outputs- overland surface flow (perennial flow not required), evapotranspiration

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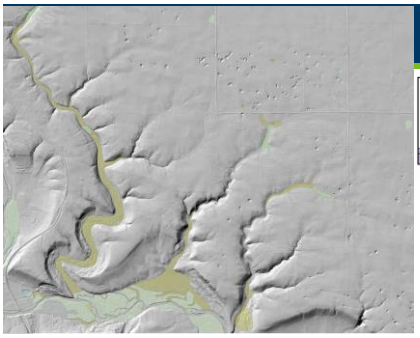
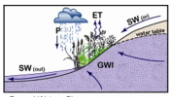
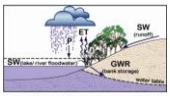
Sloped





Ground Water - Slope



Surface Water - Slope

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Common Circular 39 Wetland Types of Paleozoic Plateau

Circular 39	Eggers & Reed
1	Seasonally Flooded Basins
1	Floodplain Forests
2	Sedge Meadows
2	Fresh (wet) Meadows
2	Wet to Wet-Mesic Prairies
2	Calcareous Fens
3	Shallow Marsh
4	Deep Marsh
5	Shallow, Open Water
6	Shrub-Carr
6	Alder Thicket
7	Hardwood Swamp
7	Coniferous Swamp
8	Open Bog
8	Coniferous Bog

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Type 1 – Seasonally Flooded Basins

Landscape position: depressional basins, floodplains

Hydrology: Seasonally Flooded, dry for much of growing season

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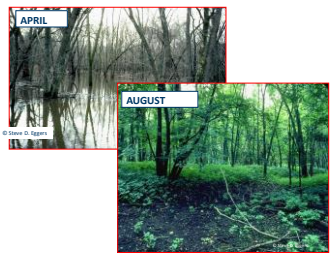
Floodplain Forests

Hydrology: seasonally inundated, relatively well-drained for most of the growing season



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Common Tree Species

- River Birch (FACW MW)
- Silver Maple (FACW MW)
- Box Elder (FAC MW)
- Green Ash (FACW MW)
- Eastern Cottonwood (FAC MW)
- American Elm (FACW MW)
- Black Willow (OBL MW)

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Common Forb Species

- Poison Ivy (FAC MW)
- Riverbank Grape (FAC MW)
- Hog Peanut (FAC MW)
- Canadian Clearweed (FACW MW)
- Wood Nettle (FACW MW)
- Stinging Nettle (FACW MW)

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Seasonally Flooded Basins

Hydrology: seasonally flooded, Typically ponded for a few weeks early in the growing season then drying out

Vegetation: Mudflats left by receding water are colonized by annuals

Condition shown is in May -- cropped corn field. By mid- to late growing season, annual species such as wild millet (FACW) and smartweeds (FACW-OBL) would dominate

32

Common Seasonally Flooded Basin Species

- Wild Millet/Barnyard Grass (FACW MW)
- Pennsylvania Smartweed (FACW MW)
- Common Ragweed (FACU MW)
- Yellow Nutsedge (FACW MW)
- Curly Dock (FAC MW)

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Type 2 – Inland Fresh Meadows/Sedge Meadow

Inland fresh meadow

Landscape position: depressions, lake fringes

Hydrology: saturated, without standing water for most of the growing season

Vegetation: grasses, sedges, rushes, or broadleaf plants

34

Fresh (Wet) Meadows

Hydrology: Water table often drop below 12 inches after early portion of growing season

Vegetation: Dominated by grasses, such as reed canary grass and redtop, and/or forbs such as giant goldenrod and marsh aster

35

Common Fresh (Wet) Meadow Species

- Reed Canary Grass (FACW MW)
- Blue Vervain (FACW MW)
- Giant Goldenrod (FACW MW)
- Canada blue-joint (OBL MW)
- Redtop (FACW MW)
- Kentucky Bluegrass (FAC MW)

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Sedge Meadows

Hydrology: Saturated soils most of the growing season.

Can have floating mat (Sedge Mat) when fringing deeper hydrologic regimes

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Common Sedge Meadow Species

- Hummock Sedge (OBL MW)
- Bebb's Sedge (OBL MW)
- Woolgrass (OBL MW)
- Green Bulrush (OBL MW)
- Marsh Milkweed (OBL MW)
- Joe-Pye Weed (OBL MW)
- Boneset (OBL MW)

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Wet to Wet-Mesic Prairies

- **Hydrology: Saturated soils most of the growing season**
- **Vegetation: Dominated by native prairie grasses, often with a rich diversity of hydrophytic prairie forbs such as Prairie cord-grass, big bluestem, gayfeather, green bulrush, mountain mint, sawtooth sunflower, New England aster, white lady-slipper, etc.**

39

Common Wet/Wet-Mesic Species

- Prairie Cord-Grass (FACW MW)
- Big Bluestem (FAC MW)
- Gayfeather
- Culver's Root
- Sawtooth Sunflower
- New England Aster

40

Calcareous Fens

- Hydrology: upwelling groundwater discharge continuously saturates organic soils, Specific soil and water chemistry (CaCo)
- Vegetation: Rarest wetland type in MN. Supports disproportionate number of T & E species: sterile sedge, beaked spikerush, hardstem bulrush, Grass of Parnassus, Kalm's lobelia, white lady-slipper, Riddell's goldenrod

MN DNR List of Known Calcareous Fens

41

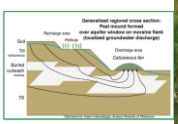
Indicators of Fens

Hydrology:

- Iron staining
- Marl Deposits
- Permanent saturation
  - ice mounding
- Drainage patterns downslope

Soil:

- Organic accumulation (histosol)
- "apron" of peat along fringe (histic epipedon)



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Type 3/4 - Shallow and Deep Marsh

Shallow marshes

Landscape position: lake fringe, seep areas of on irrigated land

Hydrology: flooded up to 6" in depth

Deep Marshes

Landscape position: shallow basins, lake fringe

Hydrology: 6" to 3 feet of near permanent surface water with open water components

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Common Shallow Marsh Species

- Narrow-Leaf, Broad-Leaf, Hybrid Cattail (OBL MW)
- Giant Bur-reed (OBL MW)
- Softstem Bulrush (OBL MW)
- Broad-Leaf Arrowhead (OBL MW)
- Lake Sedge (OBL MW)
- Blunt Spike-Rush (OBL MW)

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Type 4 – Deep Marsh

Deep marsh

Landscape position: shallow basins, lake fringe

Hydrology: 6" to 3' of near permanent surface water with open water components

Vegetation: Cattails, reeds, spike rush, bulrushes, pondweeds, duckweeds, water lilies, wild rice

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Common Deep Marsh Species

- Water Smartweed (OBL MW)
- Duckweed (OBL MW)
- Wild Rice (OBL MW)
- Purple Loosestrife (OBL MW)
- Pickerelweed (OBL MW)

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Type 5 – Shallow, Open Water

Inland open water

Landscape position: shallow basins, lake fringe

Hydrology: <8.2' (2.5m) deep

Vegetation: pondweeds, water milfoils, fringed by emergent vegetation

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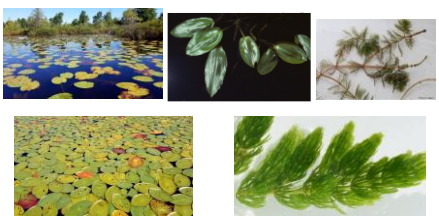
Common Shallow, Open Water Species

- Water-lily
- Pondweeds
- Milfoils
- Water Shield
- Coontail



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Type 6 – Shrub Swamps

Shrub swamps

Landscape position: sloped, along river and lake fringes

Hydrology: Saturation with seasonal shallow inundation

Vegetation: Shrub swamps dominated with willow, dogwood and alder as well as grasses/forbs.

49

Common Shrub Swamp Species

- Sandbar Willow (FACW MW)
- Red-Osier Dogwood (FACW MW)
- Glossy Buckthorn (FACW MW)
- Speckled Alder (FACW MW)
- Gray Dogwood (FAC MW)

50

Common Understory Species

- Sensitive Fern (FACW MW)
- Rough Bedstraw (OBL MW)
- Jewelweed (OBL MW)
- Canada Blue-joint Grass (OBL MW)
- Reed Canary Grass (FACW MW)
- Marsh Blue Violet (FACW MW)

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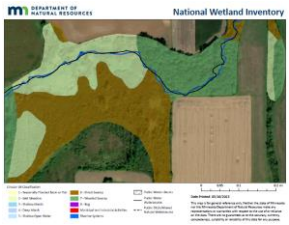
Things to Remember

- Common species are helpful, but there is often a gradient for species
- Wetlands are often comprised of more than one type, so species may be found throughout at different times of the year



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Field Approach to Delineating Sloped Wetlands

- Interpreting landscape
- "Following" Hydrology
- Finding plant community relationships
- "indicator" species

53

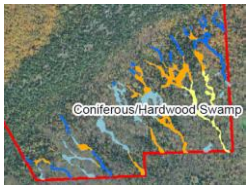
Plant Community Relationships

- Often not a lot of discernable difference in actual species composition
- "blur" vision and look for community relationships
- "indicator" species
  - Dominants in each community that "follow" indicator status or other variables such as microtopography
- For example, large leave aster and hazelnut; or bracken fern and ostrich fern; Black ash and aspen

54

How to map in the field

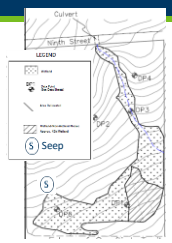
- Locate upslope contour
- Identify all seeps, springs or other surface/groundwater interaction
- Delineate wetland boundary
- Make use of remarks on data sheets
- Symbolize hydrology, mosaic areas, transect locations



55

Delineation Map Symbology

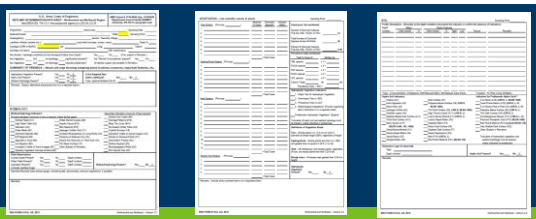
- Use of "seep" symbol
- Show all hydrologic features
- Symbolizing the source contour where appropriate
- Use of contours on delineation map
- Show transects
- Legend with all symbols



56

Mapping Sloped Wetlands with Seeps

57



Common Data Sheet Errors

bwsr.state.mn.us/minnesota-wetland-professional-certification-program

Minnesota Wetland Professional Certification Program

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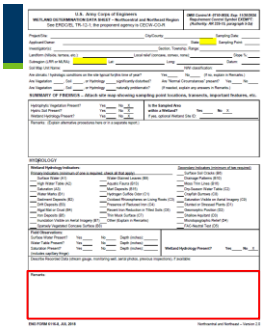
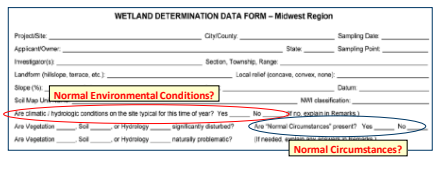


Common Data Sheets Errors- Page 1

- Normal circumstances checked on ag land
- Normal circumstances vs normal climatic conditions
- Noting disturbance on ag land
- Recognizing naturally problematic areas
- Indicating water table depth with A1, A2,A3 hydrology indicators
- Not using remarks

59

Normal Environmental Conditions vs. Normal Circumstances



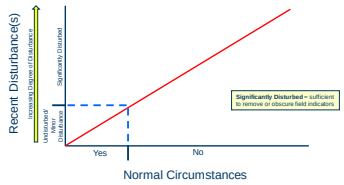
60

Normal Environmental Conditions vs. Normal Circumstances

- **Short-term:** "normal environmental conditions" refers to the climatic conditions of the current year and growing season
- **Long-term:** "normal circumstances" refers to the multiple-year/decades-long condition of the site

61

Relationship of Normal Circumstances and Recent Disturbance(s)



62

Normal Circumstances - Vegetation

- Removing, manicuring, planting, cropping, or other means of altering vegetation that is more than minor = NOT Normal Circumstances

Overgrazed to the extent that alteration of vegetation is more than minor – including the extreme case shown above where vegetation has been removed = NOT Normal Circumstances

63

Normal Circumstances - Vegetation

Light grazing of a sedge meadow – minor disturbance of natural vegetation = Normal Circumstances

Example of an unimproved pasture = no interseeding, planting, etc.

64

Normal Circumstances

WETLAND DETERMINATION DATA FORM – Midwest Region

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

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

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

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____

Slope (%): _____ 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.)

If "Yes", data collection is based on current conditions.

If "No", data collection is based on conditions that would exist in absence of recent disturbance(s).

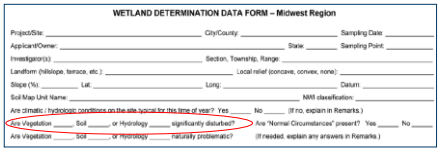
65

Problem Areas (Naturally Problematic)

- **One or more parameters are absent due to normal seasonal or annual variability, or permanently due to the nature of the soils or plant species**
  - Seasonal wetlands
  - Prairie potholes
  - Red clay parent materials
  - FACU-dominated wetlands
  - Inter-dunal swales

66

Degree of Disturbance(s)



WETLAND DETERMINATION DATA FORM – Midwest Region

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

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

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

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____

Slope (%): _____ 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.)

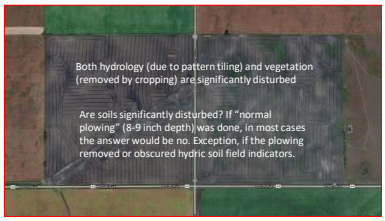
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

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

Significantly Disturbed = sufficient to remove or obscure field indicators

67

Disturbed (Atypical)



68

A3: Saturation

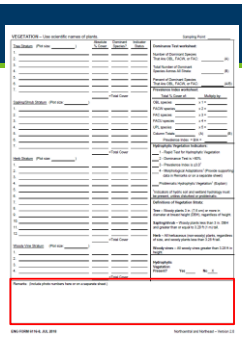
Category: Primary

Visual observation of saturated soil conditions 12 in. or less from the soil surface as indicated by water **glistening** on the surfaces and broken interior faces of soil samples.

*Must be associated with a water table immediately below the saturated zone except when zone of saturation is above a relatively impermeable layer of soil or bedrock ≤ 12 inches of the soil surface.

69

Data Sheet Common Errors- Page 2



Absolute % Cover always adding up to 100

Using wrong indicator status for the LRR

Must have 5% cover to be considered dominant in 50/20 rule

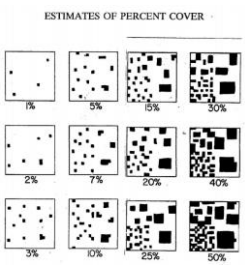
Meets prevalence index at 3 or less

Presence of hydrology and soil indicators when doing prevalence index

Not using remarks

70

Determining Dominance- Sampling



Percent Areal Cover

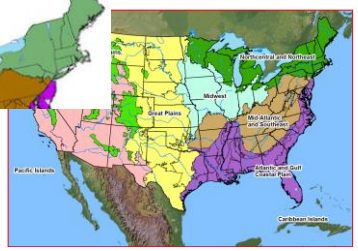
- Estimate can vary from person to person
- Almost NEVER adds up to 100%...sometimes more; sometimes less
- Is recommended method for determining cover
- Used by 50/20 Rule
- Used by Prevalence Index

- Is different that Absolute Cover = Actual or Total cover

71

NWPL Regions = Supplement Boundaries

Northern Great Lakes subregion



72

Individual Plant Indicator Status

73

Hydrophytic Vegetation – Dominance Test (50/20 Rule)

1. Estimate absolute percent cover of each species in first stratum. Species must be at least 5% to be considered dominant.
2. Rank species from most to least abundant
3. Calculate the total percent cover of all species (usually not 100 percent) in that stratum
4. Calculate 50% of total cover
5. Calculate 20% of total cover
6. Begin at top of list and add percent covers together until 50% threshold is met
7. Continuing after last species in 50%, next identify species that ALONE meet or exceed 20% threshold
8. Repeat for each stratum

74

Hydrophytic Vegetation – Prevalence Index

- Prevalence Index
  - A numerical calculation used to determine whether a hydrophytic plant community is present
  - Uses a weighted average and uses all plant species in the plot, not just dominant
  - Values range from 1 to 5
  - Values less than or equal to 3 indicate hydrophytic plant community

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 = _____

75

Hydrophytic Vegetation – Prevalence Index

Species	% Cover	Indicator
Tree Strata		
Species a	*45*	*FACW*
Species b	*30*	*OBL*
Species c	*25*	*FAC*
Species d	*10*	*FAC*
Species e	*5*	*FACU*
Species f	*5*	*UPL*
Herbaceous Strata		
Species A	55	OBL
Species B	35	FACW
Species C	35	FACW
Species D	25	FAC
Species E	20	FACU
Species F	10	UPL

Prevalence Index worksheet:

Total % Cover of		Multiply by:	
OBL species	85	x 1 =	85
FACW species	115	x 2 =	230
FAC species	60	x 3 =	180
FACU species	25	x 4 =	100
UPL species	15	x 5 =	75
Column Totals:	300 (A)		670 (B)

Prevalence Index = B/A = 2.23

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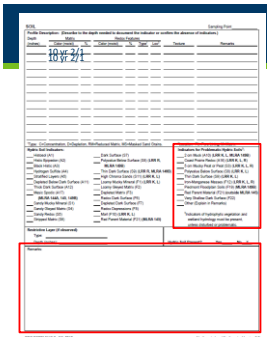
Determining Hydrophytic Vegetation

The procedure for using hydrophytic vegetation indicators is as follows:

1. Apply Indicator 1 (Rapid Test for Hydrophytic Vegetation).
2. Apply Indicator 2 (Dominance Test).
   a) If the plant community fails the dominance test, but indicators of hydric soil and wetland hydrology are both present, proceed to step 3.
3. Apply Indicator 3 (Prevalence Index).
4. Apply Indicator 4 (Morphological Adaptations).
   a) If none of the indicators is satisfied, then hydrophytic vegetation is absent unless indicators of hydric soil and wetland hydrology are present and the site meets the requirements for a problematic wetland situation

77

Common Data Sheet Errors- Page 3

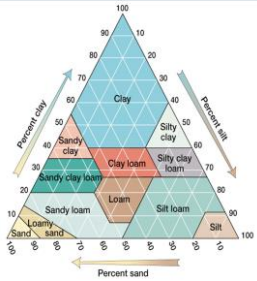


- Using wrong indicator group for texture
- Estimating redox percentages
- Every data sheet describes horizons exact same color across site
- Using uncommon indicators with no remarks

78

Field Indicator Organization- Texture

- Use regardless of texture(s)
  - All Mineral
  - All Organic
- Typically, organic matter influences near the surface
- Includes smell
  - Rotten egg

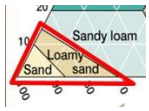


79

Soil Indicator Groups- Texture

Sandy Soil Indicators (S):

- Use when texture is:
  - Loamy Fine Sand or coarser



Fine Grained Soil Indicators (F):

- Use when texture is:
  - Loamy Very Fine Sand or finer

A group- all textures

80

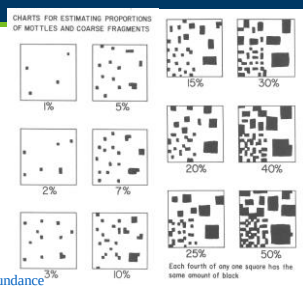
Abundance and Size of Redox

Abundance

- Few -- less than 2%
- Common -- 2 to 20%
- Many -- more than 20%

Size

- Fine -- < 5 mm
- Medium -- 5 to 15 mm
- Coarse -- > 15 mm



Several indicators require at least 2% abundance

81

Contrast

- Contrast refers to the degree of visual distinction between associated colors
  - Faint -- evident only on close examination
  - Distinct -- readily seen at arms length
  - Prominent -- contrast strongly

Contrast Class	Code	Difference in Color Between Matrix and RMF (Δ means "difference between")			
		Hue (h)	Value (v)		Chroma (c)
Faint [1]	F	Δh = 0;	Δv ≤ 2	and	Δc ≤ 1
		Δh = 1;	Δv ≤ 1	and	Δc ≤ 1
		Δh = 2;	Δv = 0	and	Δc = 0
Distinct [1]	D	Δh = 0;	Δv ≤ 2	and	Δc > 1 to < 4
			or Δv > 2 to < 4	and	Δc < 4
		Δh = 1;	Δv ≤1	and	Δc > 1 to < 3
			or Δv > 1 to < 3	and	Δc < 3
		Δh = 2;	Δv = 0	and	Δc > 0 to < 2
			or Δv > 0 to < 2	and	Δc < 2
Prominent [1]	P	Δh = 0;	Δv ≥ 4	or	Δc ≥ 4
		Δh = 1;	Δv ≥ 3	or	Δc ≥ 3
		Δh = 2;	Δv ≥ 2	or	Δc ≥ 2
		Δh ≥ 3;			

[1] If compared colors have both a value ≤3 and a chroma of ≤2, the contrast is *Faint*, regardless of hue differences.

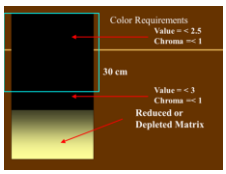
Several indicators require distinct or prominent contrast!

82

A12- Thick Dark Surface

- Applicable land resource regions (LRR)
  - Use in all LRRs
- User notes
  - Most often associated with overthickened soils in concave landscape positions.

A12.—Thick Dark Surface. *For use in all LRRs:*
A layer at least 15 cm (6 inches) thick with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less starting below 30 cm (12 inches) of the surface. The layer(s) above the depleted or gleyed matrix and starting at a depth <15 cm (6 inches) from the soil surface must have value of 2.5 or less and



chroma of 1 or less to a depth of at least 30 cm (12 inches) and value of 3 or less and chroma of 1 or less in any remaining layers above the depleted or gleyed matrix. In any sandy material above the depleted or gleyed matrix, at least 70 percent of the visible soil particles must be masked with organic material, viewed through a 10x or 15x hand lens. Observed without a hand lens, the particles appear to be close to 100 percent masked.

83

Problematic Hydric Soils

- Covered in Chapter 5 of the regional supplements
- Problematic hydric soils are the norm in some landscapes
  - **Red** Parent Material *(inhibited, or difficult to see redox features)*
  - Active floodplains *(deposition of new material)*
  - Drained systems *(relict hydric indicators)*
  - **High Value** *(bright)* / **Low Chroma** *(grey),*
  - Thick prairie soils
  - Sandy soils

84

General Procedure for Difficult Wetlands

General Procedure:

1) Verify at least one hydric soil indicator and one primary or two secondary hydrology indicators are present
2) Consider landscape position
   concave, floodplain, toe slope, flat, fringes wetland, restrictive soil layers, groundwater discharge
3) Procedures outlined in Chapter 5 for type of situation
4) Long-term monitoring

Use of Reference sites, aerial photography, hydrology data, climatic data important!

85

Procedure for Determining Problematic Soil

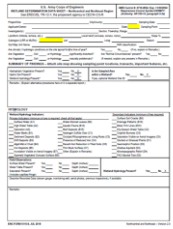
1) Determine whether hydrophytic vegetation is present (or problematic) & hydrology indicators are present
2) Describe the soil profile
3) Interpret whether landscape position has potential to concentrate water

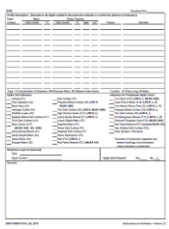
4) Use one or more of the following approaches:

- apply indicators common to problem soils (thin muck, dark surface, poly value)
- Determine whether problematic soil situations are present (examples previously listed)
- Soil changes when exposed to air
- Hydrology monitoring

86

What other Data Sheet Errors do you see?





87

Hydric Soil Indicators of the Paleozoic Plateau

BOARD OF WATER AND SOIL RESOURCES

Minnesota Wetland Professional Certification Program

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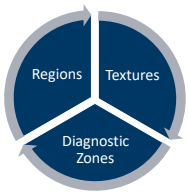
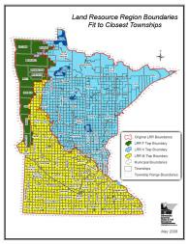
Field Indicator Organization- Regions





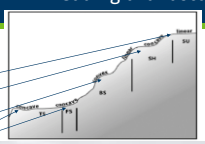
89

Reading a landscape

What do we mean "reading" the landscape?

Landscape position:

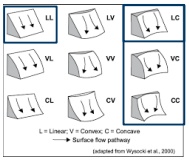
- Summit
- Shoulder
- Backslope
- Foot slope
- Toe slope

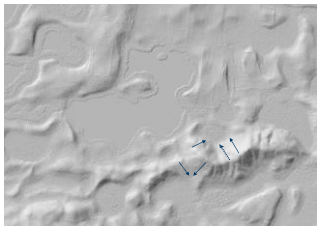


90

Surface shape

- Convex- surface curves outward
- Concave- surface curves inward
- Linear- flat, one-dimensional surface

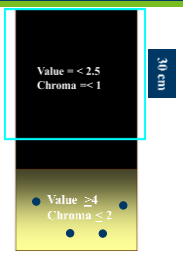




91

Diagnostic Zones

- Layers with :
  - Certain **Colors**
    - high value and low chroma
    - redoximorphic features
    - organic matter accumulations
  - Specific **Depths** from Surface
  - **Thickness** requirements



92

Diagnostic Zones for S and F indicator groups

Sandy (S)

Upper 15 cm (6")

Loamy / Clayey (F)

Upper 30 cm (12")

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Key terms to help interpret indicators:

- Aquic- moisture regime, reducing regime virtually free of dissolved oxygen
- Histic- saturated organic horizon
- Epipedon-horizon near the surface
- Depletions- areas of low chroma where oxides have been stripped away
- Concentrations-zones where oxides have accumulated

94

Problematic Hydric Soils

- Covered in Chapter 5 of the regional supplements
- Problematic hydric soils are the norm in some landscapes
  - **Red** Parent Material *(inhibited, or difficult to see redox features)*
  - Active floodplains *(deposition of new material)*
  - Drained systems *(relict hydric indicators)*
  - **High Value** *(bright)* / **Low Chroma** *(grey)*,
  - Thick prairie soils
  - Sandy soils

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Soils with relict hydric soil indicators

Drained mineral horizons:

- Redox feature- concentrations
  - Diffuse boundaries in aquic conditions
  - Abrupt boundaries when drained
- Drained organics:
- Morsch – organic material "hydrophobic" changed charge
- Texture- coffee ground

- Must demonstrate that site no longer has saturated hydrologic conditions
- Claims that redox features are relic must be backed with hydrology data
  - Drainage setback not sufficient
  - Must use Chapter 5

96

Procedure for Problematic Hydric Soils in Midwest Region

1) Verify that hydrophytic vegetation is present or is problematic or altered. If so, proceed to step 2.
2) Verify that one primary or two secondary hydrology indicators are present. If so, proceed to step 3.
3) Describe and document soil profile and landscape setting. Verify whether landscape is likely to collect or concentrate water. If yes, proceed to step 4.

4) Determine whether following indicators are present. If present, consider the soil to be hydric. Use remarks section to explain.

- Shallow soils over limestone
- Fluvial sediments within floodplain
- Recently developed soils
- Soils with high-chroma subsoils

Figure 8. Stratified layers in loamy material.

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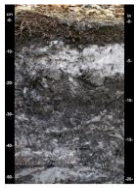
Problematic Hydric Soils in Midwest Supplement

- Shallow soils over limestone- high pH inhibits biological processes that allow redoximorphic features to develop. Found around limestone outcrop and karst topography such sinkholes.
- Fluvial sediments within floodplains- occur within active channel and floodplain. Frequent deposition of new sediment cover indicators. Redox can sometimes be found between stratifications.
- Seasonally ponded soils- depressional wetlands with perched water above restrictive soil layer such as hardpan or clay.



98

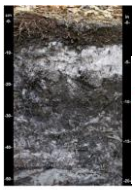
A5- Stratified Layers

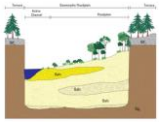
A5. Stratified Layers: Several stratified layers starting < 6 inches from the soil surface. At least one of the layers has:

a) Value ≤ 3 and chroma 1 or less; or

b) A muck, mucky peat, peat, or mucky modified mineral texture.

• The remaining layers have chroma ≤ 2. For any sandy material that constitutes the layer with value of ≤ 3 and chroma of 1 or less, at least 70% of the visible soil particles must be masked with organic material as seen with 10 or 15x hand lens (appear 100% masked without a hand lens).



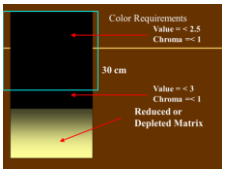


99

A12- Thick Dark Surface

- Applicable land resource regions (LRR)
  - Use in all LRRs
- User notes
  - Most often associated with overthickened soils in concave landscape positions.

A12.—Thick Dark Surface. *For use in all LRRs.* A layer at least 15 cm (6 inches) thick with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less starting below 30 cm (12 inches) of the surface. The layer(s) above the depleted or gleyed matrix and starting at a depth <15 cm (6 inches) from the soil surface must have value of 2.5 or less and



chroma of 1 or less to a depth of at least 30 cm (12 inches) and value of 3 or less and chroma of 1 or less in any remaining layers above the depleted or gleyed matrix. In any sandy material above the depleted or gleyed matrix, at least 70 percent of the visible soil particles must be masked with organic material. Viewed through a 10x or 15x hand lens. Observed without a hand lens, the particles appear to be close to 100 percent masked.

100

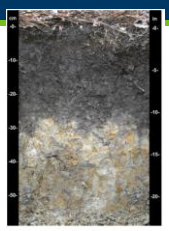
A11- Depleted Below Dark Surface

- Applicable land resource regions (LRR)
  - Use in all MN LRRs

A11.—Depleted Below Dark Surface. *For use in all LRRs, except for W, X, and Y; for testing in LRRs W, X, and Y.* A layer with a depleted or gleyed matrix that has 60 percent or more chroma of 2 or less, starting at a depth ≥30 cm (12 inches) from the soil surface, and having a minimum thickness of either:

a. 15 cm (6 inches), or
b. 5 cm (2 inches) if the 5 cm consists of fragmental soil material.

Organic, loamy, or clayey layer(s) above the depleted or gleyed matrix must have value of 3 or less and chroma of 2 or less starting at a depth <15 cm (6 inches) from the soil surface and extend to the depleted or gleyed matrix. Any sandy material above the depleted or gleyed matrix must have value of 3 or less and chroma of 1 or less starting at a depth ≥15 cm (6 inches) from the soil surface and extend to the depleted or gleyed matrix. Viewed through a 10x or 15x hand lens, at least 70 percent of the visible sand particles must be masked with organic material. Observed without a hand lens, the sand particles appear to be close to 100 percent masked.



101

A1- Histosol

- **A1. Histosol:** Classifies as a Histosol. A Histosol has a layer of organic matter accumulation of ≥ 16 inches in the upper 32 inches of soil material.
- Use in all LRRs

A1.—Histosol *(for use in all LRRs)* or **Histel** *(for use in LRRs with permafrost).* Classifies as a Histosol (except Folist) or as a Histel (except Folistel).

User Notes: In a Histosol, typically 40 cm (16 inches) or more of the upper 80 cm (32 inches) is organic soil material (fig. 7). Organic soil materials have organic carbon contents (by weight) of 12 to 18 percent or more, depending on the clay content of the soil. These materials include muck (sapric soil material), mucky peat (hemic soil material), and peat (fibric soil material). See *Keys to Soil Taxonomy* (Soil Survey Staff, 2014) for a complete definition.

102

A2- Histic Epipedon

Histic epipedon- saturated, organic horizons 8 inches or more thick in the upper part

- Applicable land resource regions (LRR)
  - Use in all LRRs

A2.—Histic Epipedon. *For use in all LRRs.* A histic epipedon underlain by mineral soil material with chroma of 2 or less.

User Notes: Most histic epipedons are surface horizons 20 cm (8 inches) or more thick of organic soil material (fig. 8). Aquic conditions or artificial drainage is required. See *Keys to Soil Taxonomy* (Soil Survey Staff, 2014) for a complete definition.

Figure 9.—Indicators A2 (Histic Epipedon) and A3 (Black Histic). This soil meets the depth criterion of A2 and the color and depth criteria of A3. The black color, a requirement of A3, results from the accumulation of organic matter when the soil is saturated and anaerobic.

103

A3- Black Histic

- A layer of peat, mucky peat, or muck 8 in or more thick that starts at a depth of ≤ 6 in from the soil surface; has hue of 10YR or yellower, value of 3 or less, and chroma of 1 or less; and is underlain by mineral soil material with chroma of 2 or less.
- Applicable land resource regions (LRR)
  - Use in all LRRs

A3.—Black Histic. *For use in all LRRs.* A layer of peat, mucky peat, or muck 20 cm (8 inches) or more thick that starts at a depth of ≤15 cm (6 inches) from the soil surface; has hue of 10YR or yellower, value of 3 or less, and chroma of 1 or less; and is underlain by mineral soil material with chroma of 2 or less.

User Notes: Unlike indicator A2, this indicator does not require proof of aquic conditions or artificial drainage (fig. 8).

Figure 9.—Indicators A2 (Histic Epipedon) and A3 (Black Histic). This soil meets the depth criterion of A2 and the color and depth criteria of A3. The black color, a requirement of A3, results from the accumulation of organic matter when the soil is saturated and anaerobic.

104

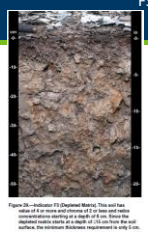
F3- Depleted Matrix

- Applicable land resource regions (LRR)
  - Use in all LRRs

F3.—Depleted Matrix. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* A layer that has a depleted matrix with 60 percent or more chroma of 2 or less and that has a minimum thickness of either:

a. 5 cm (2 inches) if the 5 cm starts at a depth ≤10 cm (4 inches) from the soil surface, or

b. 15 cm (6 inches), starting at a depth ≤25 cm (10 inches) from the soil surface.



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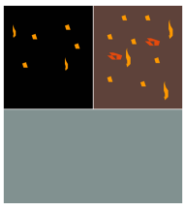
F6- Redox Dark Surface

- Applicable land resource regions (LRR)
  - Use in all LRRs

F6.—Redox Dark Surface. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* A layer that is at least 10 cm (4 inches) thick, starting at a depth ≤20 cm (8 inches) from the mineral soil surface, and has:

a. Matrix value of 3 or less and chroma of 1 or less and 2 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings, or

b. Matrix value of 3 or less and chroma of 2 or less and 5 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings.



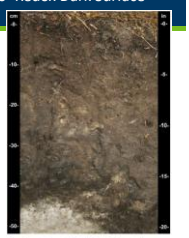


Figure 31.—Indicators F6 (Redox Dark Surface) and F7 (Depleted Dark Surface). A soil that meets the requirements of indicator F7 commonly also meets the requirements of indicator F6. If the dark surface layer has depletions, it most likely also has concentrations.

106

S5- Sandy Redox

- Applicable land resource regions (LRR)
  - Use in all LRRs

S5.—Sandy Redox. *For use in all LRRs, except for Q, V, W, X, and Y.* A layer starting at a depth ≤15 cm (6 inches) from the soil surface that is at least 10 cm (4 inches) thick and has a matrix with 60 percent or more chroma of 2 or less and 2 percent or more distinct or prominent redox concentrations occurring as soft masses and/or pore linings.

Figure 22.—Indicator S5 (Sandy Redox). This soil meets the requirements of indicator S5, having a matrix chroma of 2 or less and at least 2 percent redox concentrations starting at a depth of about 10 cm.

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