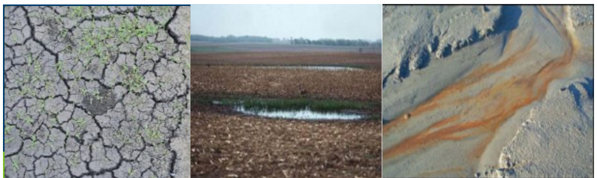


Hydrology Indicators

Minnesota Wetland Professional Certification Program

1

Hydrology

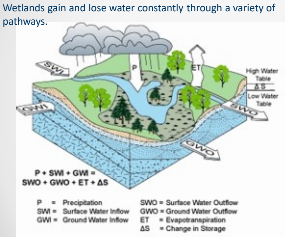
…"inundated or saturated by surface or ground water at a frequency and duration"

- Technical standard of 14 or more consecutive days of flooding or ponding;
- Water table 12 in. or less below soil surface;

2

Hydrology

Wetlands gain and lose water constantly through a variety of pathways.

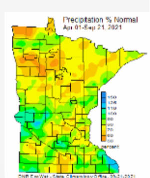


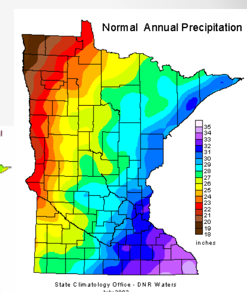
- Inputs
  - Precipitation
  - Surface water inflow
  - Groundwater inflow
- Outputs
  - Surface water outflow
  - Groundwater outflow
  - Evapotranspiration

3

Precipitation

- Average Annual precipitation varies significantly from one side of the state to the other
- A difference of 14 inches from Houston to Kittson counties





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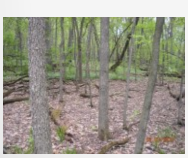
Hydrology Indicators

Evidence that there is continuing hydrology and confirms that an episode of inundation/saturation occurred recently.

Wetland hydrology indicators are divided into two categories:

Primary – provide stand-alone evidence of a current or recent hydrologic event; and

Secondary – provide evidence of recent hydrology when supported by one or more other hydrology indicators.



5

Hydrology Indicator Groups

Group A – direct observation of *water*

Group B – evidence of *flooding/ponding*

Group C – evidence of *current or recent saturation.*

Group D – *Landscape and veg. characteristics* that indicate contemporary wetland conditions.

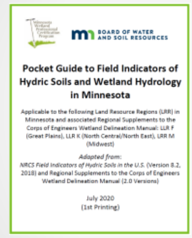
6

Land Resource Regions

- **Regions dictate which indicators are used and how they are used**

7

Flipbook


Pocket Guide to Field Indicators of Hydric Soils and Wetland Hydrology in Minnesota

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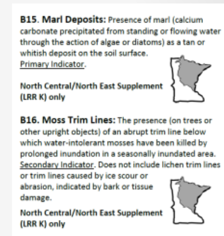
Applicable to the following Land Resource Regions (LRR) in Minnesota and associated Regional Supplements to the Corps of Engineers Wetland Delineation Manual: LLR F (Great Plains), LLR K (North Central/North East), LRR M (Midwest)

Adapted from:
NRCS Field Indicators of Hydric Soils in the U.S. (Version 8.2, 2018) and Regional Supplements to the Corps of Engineers Wetland Delineation Manual (2.0 Versions)

July 2020
(1st Printing)


B15. Marl Deposits: Presence of marl (calcium carbonate precipitated from standing or flowing water through the action of algae or diatoms) as a tan or whitish deposit on the soil surface. Primary Indicator.

North Central/North East Supplement (LRR K) only

B16. Moss Trim Lines: The presence (on trees or other upright objects) of an abrupt trim line below which water-intolerant mosses have been killed by prolonged inundation in a seasonally inundated area. Secondary Indicator. Does not include lichen trim lines or trim lines caused by ice scour or abrasion, indicated by bark or tissue damage.

North Central/North East Supplement (LRR K) only

8

Group A Indicators

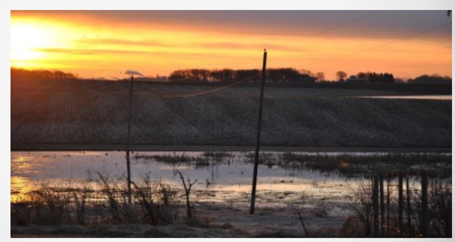
direct observation of *water*

9

A1: Surface water

Category:
Primary

Direct, visual observation of surface water during a site visit.



10

A2: High water table

Category: Primary

Water table 12 in. (30 cm) or less below the surface in a soil pit, auger hole, or shallow monitoring well.

11

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.

12

Group B Indicators

evidence of ponding or flooding – past or present

13

B1: Water Marks

Category: Primary

Water marks are discolorations or stains on the bark of woody vegetation, rocks, bridge supports, buildings, fences, or other fixed objects as a result of inundation.

14

B2: Sediment Deposits

Category: Primary

Sediment deposits are thin layers or coatings of fine-grained mineral material or organic matter remaining on tree bark, plant stems or leaves, rocks, and other objects after surface water recedes

15

B3: Drift Deposits

Category: Primary

Drift deposits consist of rafted debris that has been deposited on the ground surface or entangled in vegetation or other fixed objects.

16

B4: Algal mat or crust

Category: Primary

This indicator consists of a mat or dried crust of algae, perhaps mixed with other detritus, left on or near the soil surface after dewatering.

17

B5: Iron deposits

Category: Primary

General Description: This indicator consists of a thin orange or yellow crust or gel of oxidized iron on the soil surface or on objects near the surface.

18

B6: Surface soil cracks

Category: Secondary

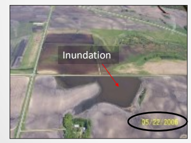
Water destroys the soil structure which facilitates the cracking. Surface soil cracks consist of shallow cracks that form when fine-grained mineral or organic sediments dry and shrink

19

B7: Inundation on aerial imagery

Category: Primary

One or more recent aerial photographs or satellite images that show the site to be inundated during the growing season.



20

B8: Sparsely vegetated concave surface

Category: Primary. (Secondary in LRR F)

On concave land surfaces, the ground surface is either unvegetated or sparsely vegetated due to long-duration ponding during the growing season.

Sparsely vegetated concave surfaces should contrast with vegetated slopes and convex surfaces in the same area. Less than 5% ground cover.

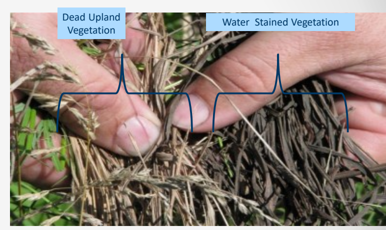
Secondary

21

B9: Water-stained leaves

Category: Primary

Water-stained leaves are fallen or recumbent dead leaves that have turned grayish or blackish in color due to inundation for long periods.

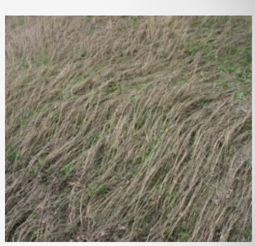


22

B10: Drainage patterns

Category: Secondary

Flow patterns visible on the soil surface or eroded into the soil, low vegetation bent over in the direction of flow, absence of leaf litter or small woody debris due to flowing water



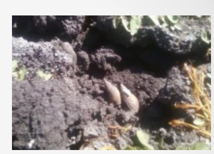
23

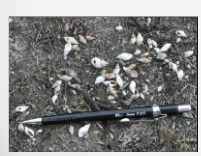
B13: Aquatic fauna

Category: Primary

Presence of live individuals, diapausing insect eggs or crustacean cysts, or dead remains of aquatic fauna,

Either on the soil surface or clinging to plants or other emergent objects.





24

B14: True aquatic plants

Category: Primary

Presence of live individuals or dead remains of true aquatic plants.

Require water for support, or desiccate in the absence of standing water

25

B15: Marl deposits

Category: Primary

Presence of marl on the soil surface.

Found mainly in calcareous fens, seeps, or white cedar swamps in areas underlain by limestone bedrock.

26

B16: Moss Trim Lines

Category: Secondary

Moss trim lines on trees or other upright objects in seasonally inundated areas.

Formed when water-intolerant mosses growing on tree trunks and other upright objects are killed by prolonged inundation.

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Group C Indicators

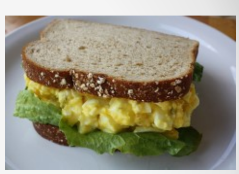
evidence of soil saturation – past or present

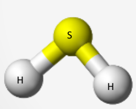
28

C1: Hydrogen sulfide odor

Category: Primary

A hydrogen sulfide (rotten egg) odor within 12 in. of the soil surface.



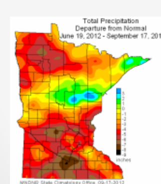


29

C2: Dry season water table

Category: Secondary

Visual observation of the water table between 12 and 24 in. (30 and 60 cm) below the surface during the normal dry season or during a drier-than-normal year.



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C3: Oxidized rhizospheres along living roots

Category: Primary. In LRR F Secondary in tilled areas

Presence of a layer containing iron-oxide coatings or plaques on the surfaces of <u>living roots</u> and/or iron-oxide coatings or linings on soil pores immediately surrounding living roots within 12 inches of the soil surface.

Secondary

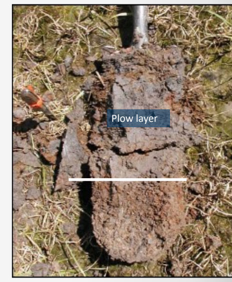
31

C6: Recent iron reduction in tilled soils

Category: Primary

Redox concentrations as pore linings or soft masses in the tilled surface layer of soils cultivated <u>within the last two years</u>.

Must be within the plow layer



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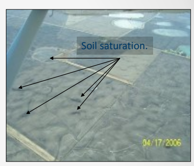
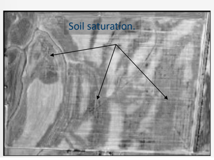
C9: Saturation visible on aerial imagery

Category: Secondary

One or more <u>recent</u> aerial photographs or satellite images indicate soil saturation. Saturated soil signatures must correspond to field-verified hydric soils, depressions or drainage patterns, differential crop management, or other evidence of a seasonal high water table.





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Group D Indicators

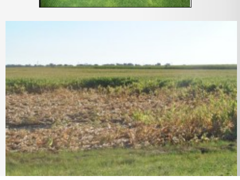
landscape and vegetation characteristics that indicate contemporary wet conditions

34

D1: Stunted or stressed plants

Category: Secondary

In agricultural or planted vegetation located in a depression, swale, or other topographically low area, this indicator is present if a majority of individuals of the same species growing in the potential wetland are clearly of smaller stature, less vigorous, or stressed compared with individuals growing in nearby drier landscape situations.



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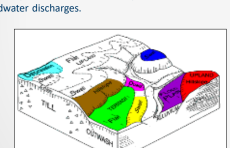
D2: Geomorphic position

Category: Secondary

This indicator is present if the area in question is located in a localized depression, linear drainageway, concave position within a floodplain, at the toe of a slope, on the low-elevation fringe of a pond or other water body, or in an area where groundwater discharges.



Except where a functioning drainage system exists*

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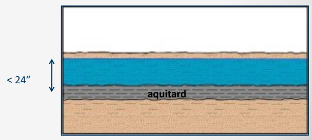
D3: Shallow Aquitard

Category: Secondary

Presence of an aquitard within 24 in. of the soil surface that is potentially capable of perching water within 12 in. of the surface.



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D4: Microtopographic relief

Category: Secondary

Microtopographic features that occur in areas of seasonal inundation or shallow water tables:

- Hummocks
- Tussocks
- Flark-and-strang topography

- Microhighs < 36 in. above the base soil level

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D5: FAC – neutral test

Category: Secondary

The plant community passes the FAC-neutral test:

1. Compile list of dominant plant species across all strata
2. Drop any with FAC (FAC, FAC-, FAC+)
3. >50 % of remaining dominant species are FACW and/or OBL

If it’s an equal number of each, then use non-dominant

*This indicator uses the longer term nature of plants

		0	= Total Cover	
	Herb stratum (Plot size:)			
1	*Andropogon gerardii*	40	Y	FAC
2	*Solidago gigantea*	12	Y	FACW
3	*Bromus inermis*	10	N	FACU
4	*Sonchus arvensis*	10	N	FACU
5	*Cirsium arvense*	8	N	FACU
6	*Phalaris arundinacea*	5	N	FACW
7	*Melilotus officinalis*	5	N	FACU
8				
9				

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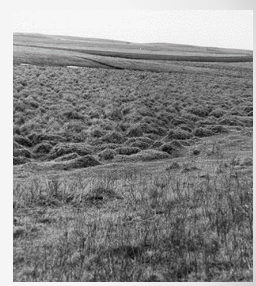
Indicator D7: Frost-heave hummocks

Category: Secondary

This indicator consists of hummocky microtopography produced by frost action in saturated wetland soils.



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Hydrology Indicators

Take home message

- Wetland hydrology is dynamic
- Indicators prove current or recent evidence of hydrology
- Proof = minimum of 1 Primary or 2 Secondary
- Lack of indicator(s) does not confirm absence of wetland hydrology! CH 5 (Difficult Wetland Situations) is a “must read”

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Hydrology Indicators?

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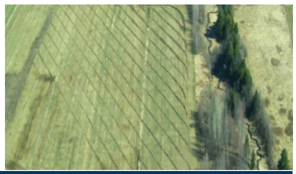

Altered Hydrology

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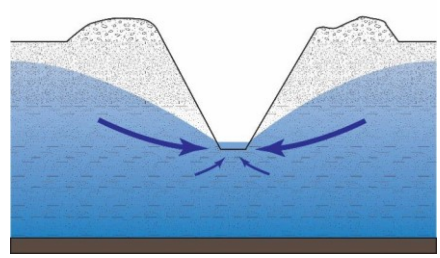
How do drains work?



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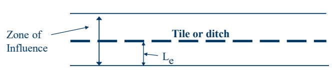
Lateral Effect

- Lateral Effect (L_e)
- The distance on each side of a tile or ditch in its longitudinal direction where the ditch or tile has an influence on the hydrology
- Measured perpendicular from midpoint of tile line or toe of ditch bank



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Lateral Effect

- Factors influencing Lateral Effect
- Depth
- Soil Properties
  - Hydraulic conductivity
  - Drainable porosity
- Grade
- Impermeable Layer

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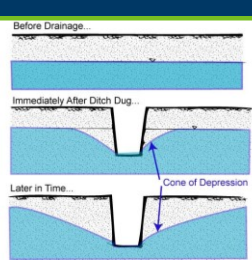
Lateral Effect



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Lateral Effect

- Why Is Lateral Effect Important?
  - Wetland impacts from a drain
  - Distance needed to avoid a wetland impact

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Why Alter Hydrology?

- Water table management
- Higher yields
- Plant earlier in spring

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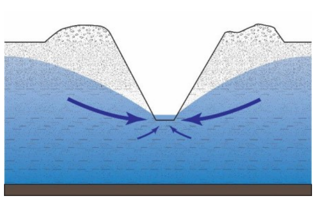
Drainage Types

- 2 Primary types of drainage
  - Surface via ditches
  - Subsurface via
    - Clay tile
    - Concrete tile
    - Corrugated plastic

50

Ditching

- How do drains work?



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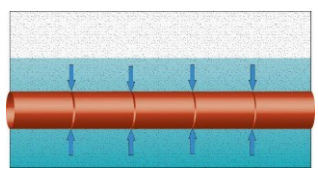
Drain Tile

- How do drains work?



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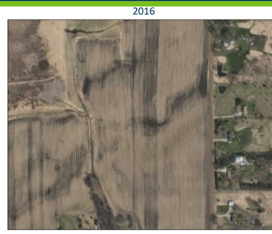
Drained Wetland

2012

2016



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Drainage Setback Tables

- Developed by NRCS using the van Schilfgaarde equation from the ND-Drain program
- **Setback distance** is the minimum distance from the wetland boundary to the tile line or ditch necessary to minimize adverse hydrologic impacts to adjacent wetlands
- Developed by NRCS to advise farmers

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Drainage Setback Tables

- County-specific
- MN NRCS uses setback distance rather than lateral effect.
- **Setback distance** and **lateral effect** are not the same thing!!
- Setback tables not directly applicable for use in determining drainage impact.
- https://bwsr.state.mn.us/lateral-effect-drainage-setback

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Effectively Drained

- A condition where ground or surface water has been removed by artificial means to the point that an area no longer meets the wetland hydrology criterion
- "Artificial means" is usually a ditch, tile or diversion
- The area will not support a dominance of hydrophytes but hydric soil will persist

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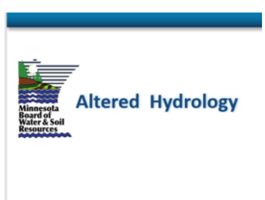
- Lateral Effect & Drainage Setback



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Hydrology

Considerations in planning hydrologic monitoring project:

- What is the question?
- What is the performance criteria?
  - Precision?
- Site characteristics
  - Landscape position, hydrology setting, soil, vegetation, drainage features
- Pre-existing data
- Timeline and available resources

- BWSR Hydrology Guidance documents

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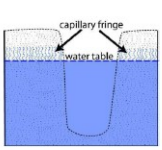
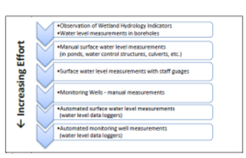
Methods to monitor hydrology

- Observation of indicators
- Staff gauges
- Open boreholes



- Monitoring wells
  - Manual measurements
  - Automated measurements



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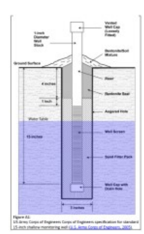
Design and location of monitoring wells

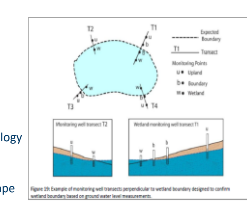


Monitoring wells

- Screen, Riser, Sand Pack, Bentonite seal

Well location

- Depends on the question:
  - Single well will tell if hydrology is present
  - Complex sites require transects based on landscape position, etc.
    - Professional judgement



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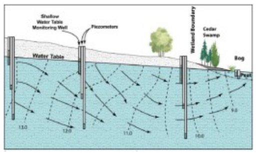
Piezometers

- Used to measure depth-specific head measurements
  - Measure vertical component
    - Hydrostatic pressure or "head"
  - May provide automated measurements
- Not typically used for standard wetland investigations



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Interpreting Hydrology

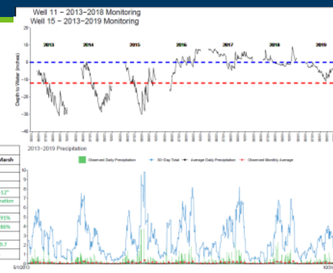

Table 1: Summary of Wetland Success Criteria for Phase I

Success Criteria	Phase I		
	Wet Meadow	Hardwood Swamp	Shallow Marsh
Duration			
Growing Seasons	5	4	5
Hydrology			
Hydrology (depth to water table)	Surface to -12"	Surface to -12"	+6" to -12"
Hydroperiod (duration within zone)	Meets duration	Meets duration	Meets duration
Vegetation			
Wetland Indicator (% FAC or wetter)	41/52 = 79%	39/51 = 76%	20/22 = 91%
Species Composition (Native Richness)	39/52 = 75%	39/51 = 76%	19/22 = 86%
Invasive Cover (% non-native)	2%	9%	2%
FQA/WFQA	20.2/26.7	20.0/21.4	16.9/19.7
Tree Coverage (trees per acre)	N/A	26.48	N/A

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Basic Soil Concepts

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Overview

- Basics of Soil
  - Soil formation
  - Landscape position
- Soil Properties
  - Texture
  - Color
- Hydric soil development
- Web Soil Survey
  - Interpreting soil reports
- Hydric soil indicators
  - All
  - Fine
  - Sandy
- Common soil indicators

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What is Soil?

- Natural body that occurs on the land surface, occupies space, and is characterized by one or both of the following:
- Horizons or layers, or
- The ability to support rooted plants in a natural environment
  - Upper limit is air or shallow (>2.5 m) water
  - Lower limit is either bedrock or the limit of biological activity
  - Lower limit for classification set at an arbitrary 2 m

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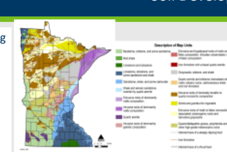
Factors That Influence Soil Development

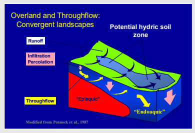
- Climate- weather conditions prevailing over long period of time
- Parent material- geologic material from which soils form
- Topography- landscape position and slope processes
- Organisms- essential role of microbes in the soil, includes humans
- Time- soil doesn't "age", it develops. vegetation, organisms and climate "act on" parent material and topography to develop soil.

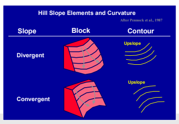


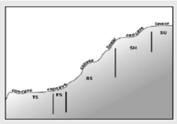
66

Landscape Position

- Location relative to other landforms
- Critically influences water flow and soil formation
- Most wetlands, even groundwater seeps, are on some sort of concave surface







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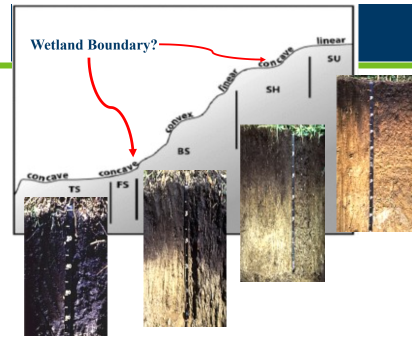
Soil Catena



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Two Categories of Soil Material - Mineral Soil/Horizons

Mineral horizons

- Primarily sand, silt, and clay, with varying amounts of organic matter

Organic horizon

- consists of mostly decomposed organic material

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Organic Matter Decomposition

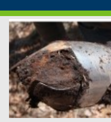
- Fibric (peat)
  - Least decomposed
  - Plant fibers identifiable
  - After rub – >40% of fibers still visible (2/3)
- Hemic (mucky peat)
  - Intermediate decomposition
- Sapric (muck)
  - Most decomposed, <1/3 ID of plant fibers
  - <1/6 of fibers visible after rubbing

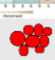
70

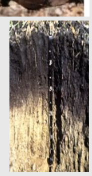
Key Soil Properties

Properties that are important to hydric soil development and recognition:

- Horizons- layer of soil with similar physical, chemical, and biologic properties
- Texture- relative proportion of soil particles (sand, silt, clay)
- Structure- arrangement of solid parts and of the pore spaces located between them
- Permeability- ability of water to move through a material
- Color- hue, value, chroma
- Organic matter- percent, thickness, and level of organic decomposition
- Drainage- presence of natural and human drainage on a landscape







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Soil Horizon- layer of soil with similar physical, chemical, and biologic properties

O horizon- Organic horizon, thickness varies

A Horizon- Organic accumulation (typically ~10%), ideally granular structure

E Horizon- Coloring agents (Fe, Organics) removed

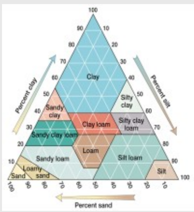
B Horizon- Subsoil accumulation of minerals, organics, and sometimes chemicals, blocky structure

C Horizon - Similar to parent material, often less developed with little structure

R Horizon- Parent material

72

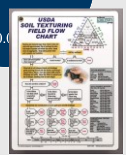
Soil Texture- Relative proportion of soil particles



Sand (0.05-2.00 mm)

Silt (0.002-0.05 mm)

Clay (<0.0



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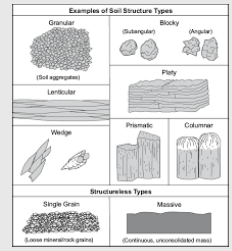
Soil Structure

- Soil Structure- arrangement of solid parts and of the pore spaces located between them
- Aggregation- interaction and arrangement of soil particles
- Precipitation of oxides, carbonates and silicates
  - Cementation
- Can decline under cultivation & irrigation



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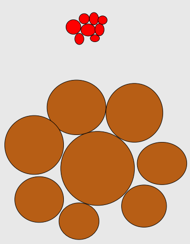
Permeability- ability of water or air to move through the soil profile

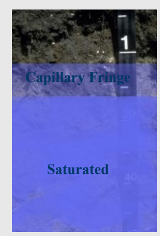
- Variables in permeability:
  - Structure- arrangement of soil characterized by size, shape (blocky, columnar, platy, etc.) and grade (weak, strong)
  - Texture- pore space of different particle sizes
- Permeability is "measured" in inches per hour
  - Permeability is actually an estimated property
- Larger grain sizes= higher permeability



75

Capillary Fringe

- Based upon permeability
- The zone above the free water table that is effectively saturated
  - Water held at tension
  - Theoretical values much higher than "real life"
  - Difficult to measure



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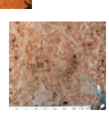
Coloring Agents in Soil

- Organic matter
  - OM will mask all other coloring agents.
- Iron (Fe)
  - brown colors are the result of Fe oxide stains coating individual particles
- Manganese (Mn)
  - resulting in a very dark black or purplish black color
- Calcium
- Lack of coatings
  - Color of the mineral soil grains (stripped)



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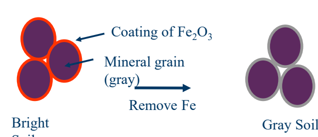
Soil Color

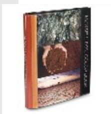


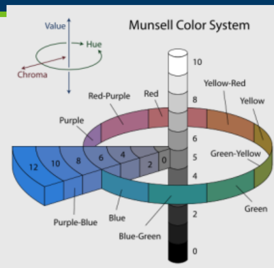
"Bright-colored" soil is bright because the gray-colored mineral grains are coated with a thin layer of "paint" formed by Fe oxides. Stripping the paint off the particles leaves the mineral grains exposed.

78

Color

- Hue- the spectrum color
- Value- lightness or darkness
- Chroma- “purity” or grayness of color





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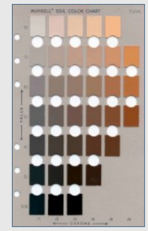
Color

- Matrix (predominant) color
- Color of redoximorphic features
  - Contrast, abundance, location, and size of redox features



80

Reading Soil Color

- Optimum conditions
  - Natural light
  - Clear, sunny day
  - Midday
  - Light at right angles
  - Soil moist

Increasing strength of color

81

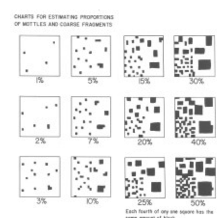
Abundance and Size of Redox

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

82

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;				

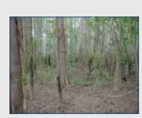
[1] If compared colors have both a value ≤3 and a chroma of ≤2, the contrast is *Faint*, regardless of hue differences.

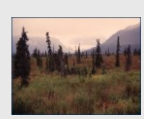
Several indicators require distinct or prominent contrast!

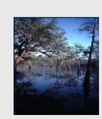
83

Definition of a Hydric Soil

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







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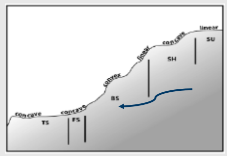
Landscape and formation of hydric soils

- Landscape position
  - Surface shape (linear, concave, convex)
  - Erosional or depositional
- Hydraulics
  - How water moves
- Hydroperiod- seasonal pattern of water table depth in a wetland
  - Long term- organic
  - Seasonal inundation- thick O, dark A
  - Seasonal saturation- thin O
  - Floodplain- thin, stratified layers



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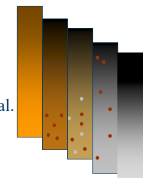
Hydric Soil Development

Hydric soils indicators develop in **anaerobic** conditions by the process of :

1. **Reduction** and Re-oxidation of Iron
2. **Organic Matter** Accumulation

Foundation of the Field Indicator Manual.



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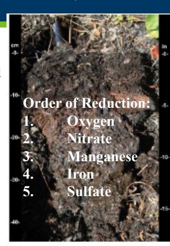
Hydric Soil Development

Soil microbes that drive reduction require:

1. Anaerobic conditions i.e. (saturated soil)
2. Organic matter (energy source)
3. Soil temperature warm enough for microbial respiration (>41F)
4. Duration of conditions (Time)

In anaerobic conditions decomposition slows and leads to organic accumulation



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Never Saturated Oxidized Matrix

Infrequently Saturated Oxidized Matrix with few concentrations

Frequently Saturated Oxidized Matrix with depletions And concentrations

Very Frequently Saturated Depleted or Reduced Matrix With concentrations

Permanently Saturated - depleted Or reduced matrix

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Depleted Matrix

Iron removed or re-organized in profile leaving Grey matrix

- **Value 4 or More**
- **Chroma 2 or Less**

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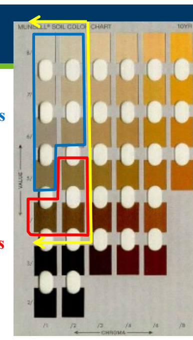
Depleted Matric Requirement



Do Not Need Concentrations

Need Concentrations (2%)

High Value (4 or more)

Low Chroma (2 or Less)

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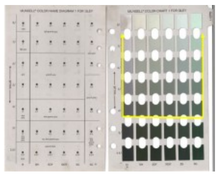
Gleyed Matrix Requirements

Gleyed Matrix

- **Iron Present, but in reduced state (Fe^{2+}) Gleyed color with value > = 4**



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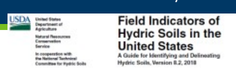
Hydric Soil Indicators

BOARD OF WATER AND SOIL RESOURCES

Minnesota Wetland Professional Certification Program

92

Field Indicators of Hydric Soils


USDA United States Department of Agriculture
Natural Resources Conservation Service
In cooperation with the National Technical Committee for Hydric Soils

Field Indicators of Hydric Soils in the United States
A Guide for Identifying and Delineating Hydric Soils, Version 8.2, 2018

Natural Resources Conservation Service

- National Technical Committee for Hydric Soils

Used for **on-site verification** of hydric soils

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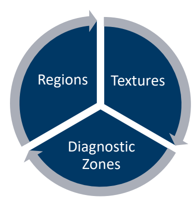
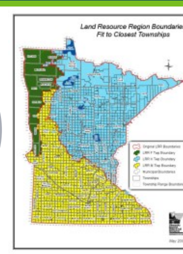
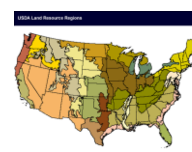
Field Indicator Organization







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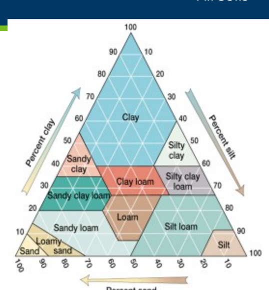
All Soils

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



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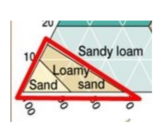
Soil Indicator Groups

Sandy Soil Indicators (S):

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



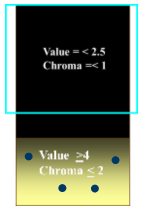
Fine Grained Soil Indicators (F):

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

96

Diagnostic Zones

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



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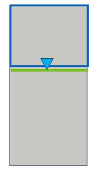
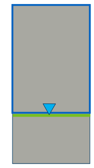
Diagnostic Zones for S and F indicator groups

Sandy (S)



Upper
15 cm (6")

Loamy / Clayey (F)



Upper
30 cm
(12")

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Couple of key terms to help interpret indicators:

Credit: USDA & NRCS for following pictures

- 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

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Format of Indicator Descriptions

- Alpha-numeric designation
  - A1
- Short name
  - Histosol
- Applicable land resource regions (LRR)
  - Use in all LRRs
- Description of the indicator
- User notes
  - Additional information, explanation and guidance
- Supplement adds regional likelihood, locations

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.

Figure 7.—Indicator A1 (Histosol or Histel). This soil has more than 40 cm (16 inches) of organic material, starting at the soil surface

100

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.

Figure 7.—Indicator A1 (Histosol or Histel). This soil has more than 40 cm (16 inches) of organic material, starting at the soil surface

101

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.

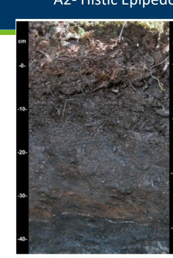

Figure 8.—Indicators A2 (Histic Epipedon) and A3 (Black Histic). This soil meets the depth criterion of A2 and the color and depth criteria of A3. The black color, a requirement of A3, results from the accumulation of organic matter when the soil is saturated and anaerobic.

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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 in 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).

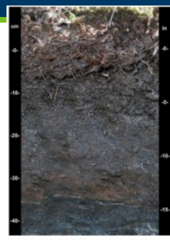


Figure 8.—Indicators A2 (Histic Epipedon) and A3 (Black Histic). This soil meets the depth criterion of A2 and the color and depth criteria of A3. The black color, a requirement of A3, results from the accumulation of organic matter when the soil is saturated and anaerobic.

103

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.

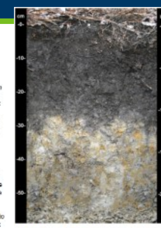
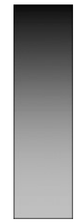


Figure 16.—Indicator A11 (Depleted Below Dark Surface). This soil has a thick dark surface horizon that meets the requirements of indicator A11. Unlike the matrix in figure 15, the depleted matrix below the dark surface horizon in this soil starts at a depth of about 29 cm, which is too deep to meet the requirements of indicator F3 (Depleted Matrix). Indicator A11 allows a deeper depleted matrix than indicator F3.



104

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.

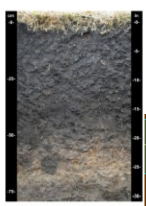
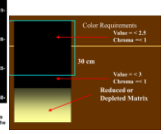


Figure 17.—Indicator A12 (Thick Dark Surface). Deep observation is needed to determine whether a soil meets the requirements of this indicator. In this soil, depth to the depleted matrix is about 55 cm.



105

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.

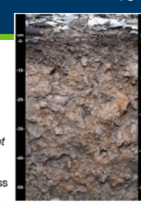
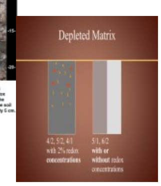


Figure 29.—Indicator F3 (Depleted Matrix). This soil has value of 4 or more and chroma of 2 or less and redox concentrations starting at a depth of 8 cm. Since the depleted matrix starts at a depth of ≤15 cm from the soil surface, the minimum thickness requirement is only 5 cm.



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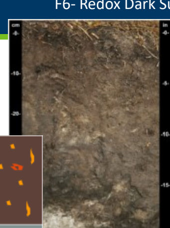
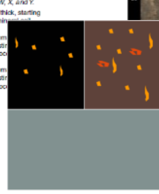
F6- Redox Dark Surface

- 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 min
surface, and has:
a. Matrix value of 3 or less and chrom
or less and 2 percent or more disti
prominent redox concentrations oc
soft masses or pore linings, or
b. Matrix value of 3 or less and chrom
or less and 5 percent or more disti
prominent redox concentrations oc
soft masses or pore linings.





ndicators F6 (Redox Dark Surface) and
leted Dark Surface). A soil that meets the
ents of indicator F7 commonly also meets the
ents of indicator F6. If the dark surface layer
letions, it most likely also has concentrations.

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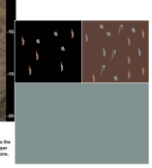
F7- Depleted Dark Surface

- Applicable land resource regions (LRR)
  - Use in all LRRs
- User notes
  - Careful to not mistake an E horizon for depletions!

F7.—Depleted Dark Surface. *For use in all LRRs, except W, X, and Y; for testing in LRRs W, X, and Y.* Redox depletions with value of 5 or more and chroma of 2 or less in 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 10 percent or more redox depletions, or
b. Matrix value of 3 or less and chroma of 2 or less and 20 percent or more redox depletions.

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.



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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.

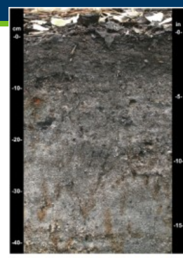

Figure 22.—Indicator S5 (Sandy Redox). This soil meets the requirements of indicator S5, having a matrix chroma of 2 or less and at least 2 percent redox concentrations starting at a depth of about 10 cm.

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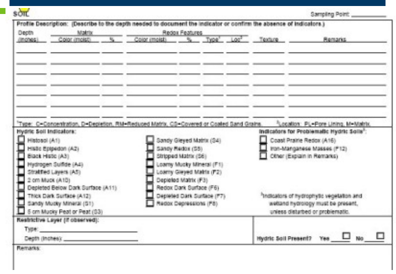
Data Sheet



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 Features %	Type[1]	Loc[2]	Texture	Remarks

[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:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ 5 cm Mucky Peat or Peat (S3)
- ☐ 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)

Indicators for Problematic Hydric Soils[3]:

- ☐ Coast Prairie Redox (A16)
- ☐ Iron-Manganese Masses (F12)
- ☐ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☐ No ☐

Remarks:

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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

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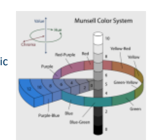
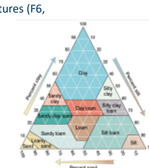
Review

- Soil formation
  - Parent material, landscape position, horizons
- Soil Properties
  - Texture
    - Sand, silt, clay
  - Color
    - Hue, value, chroma
- Hydric soil development
  - Anaerobic conditions, reduction, organic accumulation
- Web Soil Survey
  - Interpreting soil reports
- Hydric soil indicators
  - All, Fine, Sandy
- Common soil indicators
  - Organic Indicators (A1, A2, A3)
  - Depleted Matrix (F3, F7)
  - Redoximorphic features (F6, S3)





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Hydrophytic Vegetation Indicators and Determination

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Outline

- Hydrophytic Vegetation Definition
  - Define Hydrophyte
  - What makes a plant a hydrophyte
  - Why it matters
- Hydrophytic Vegetation Indicators
  - Indicator status
  - Field indicators
  - Dominance
- Determining Hydrophytic Plant Community
  - Rapids Test
  - 50/20 Rule
  - Prevalence Index
  - Morphological Adaptations

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Hydrophytic Vegetation Definition

Wetland definition includes the language: "…and that under normal circumstances do support, <u>a prevalence of vegetation typically adapted for life in saturated soil conditions</u>."

1987 Manual says in a wetland, "The prevalent vegetation consists of macrophytes that are typically adapted to areas having hydrologic and soil conditions described above. Hydrophytic species, due to morphological, physiological, and/or reproductive adaptation(s), <u>have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions."</u>

Hydrophytic Vegetation: Hydrophytic vegetation is defined herein as the sum total of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present.

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Hydrophytic Vegetation Definition

What Is a Hydrophyte

Hydro	=	Water
Phyte	=	Plant

OR

Any plant that is adapted to grow in water or in wet habitats

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Hydrophytic Vegetation Definition

- What makes a plant a hydrophyte?............ADAPTATIONS!
  - Morphological adaptations ---→ visible changes/growth habits
  - Reproductive adaptations ---→ changes in how the reproduce
  - Physiological adaptations ----→ internal chemical process changes

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Morphological Adaptations

List of Examples

- Buttressed tree trunks
- Multiple trunks
- Pneumatophores
- Adventitious roots
- Shallow roots
- Hypertrophied lenticels
- Aerenchyma
- Polymorphic leaves
- Floating leaves

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Morphological Adaptations

Buttressed bases

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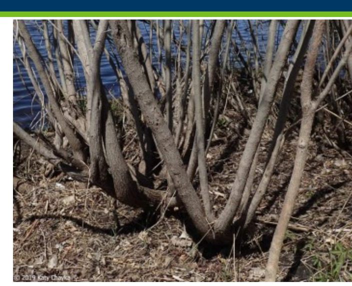
Examples

Multiple Trunks



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Examples

Shallow Roots - Adventitious Roots



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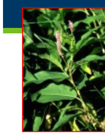
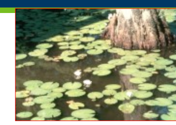
Morphological Adaptations




Polymorphic Leaves
Water Smartweed (*Persicaria amphibia*)



Floating leaves

Aerenchyma Tissue for Oxygen Transport

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Reproductive Adaptations

Overcup oak seedlings tolerate shallow inundation

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Why Hydrophytes Matter

- They have adapted to life in saturated/ponded/anaerobic conditions
- A prevalence of hydrophytes in a plant community indicates the area likely experiences a period of ponded or saturated soils such that they out compete the non-hydrophytes
- The vegetation component in wetland delineation requires each species be classified as a hydrophyte or non-hydrophyte, and then apply to the community as a whole


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Individual Plant Indicator Status

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Plant Indicator Status

Wetland Indicator Status	Indicator Symbol	Definition
Obligate Wetland	OBL	Plants that almost always grow in wetlands. Estimated probability of >99% for growing in wetland.
Facultative Wetland	FACW	Plants that usually occur in wetlands. Estimated probability of 67% - 99% for growing in wetland (1%-33% in upland)
Facultative	FAC	Plants with similar likelihood of occurring in both wetland and upland. Estimated 33%-67% for growing in wetland.
Facultative Upland	FACU	Plants that sometimes grow in wetland. Estimated 1% - <33% for growing in wetland.(>67% - 99% in upland).
Obligate Upland	UPL	Plants that rarely occur in wetland. Estimated probability of <1% for growing in wetland (>99% in upland).

Hydrophytes

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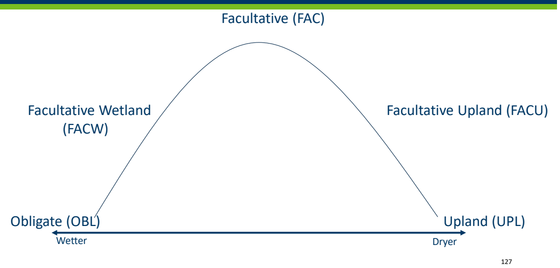
Plant Indicator Status



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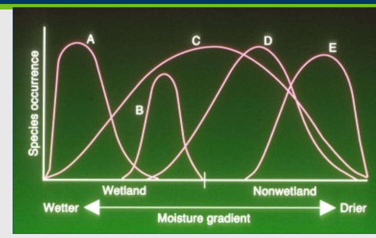
Plant Indicator Status Distributions



Indicator Status

Obligate
FACW
FAC
FACU
Upland

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NWPL Regions = Supplement Boundaries

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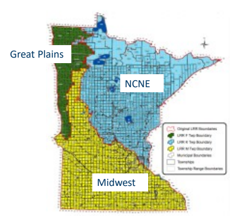
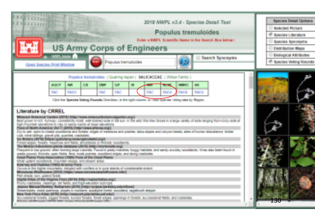
Plant Indicator Status





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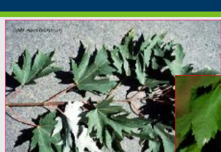
Indicator Status Comparisons

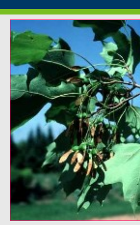


Silver Maple (**FACW**: NC/NE; Midwest)(**FAC**:GP)

Swamp Ecotype: shallow root system

Upland Ecotype: tap root to water table

Red Maple (**FAC**)



Sugar Maple (**FACU**: NC/NE; Midwest) (**UPL**: GP)

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Indicator Status Comparisons

Asclepias

Common Milkweed (**UPL**: NC/NE; GP)(**FACU**: Midwest)
A. syriaca

Swamp Milkweed (**OBL**: NC/NE; Midwest)(**FACW**: GP)
A. incarnata

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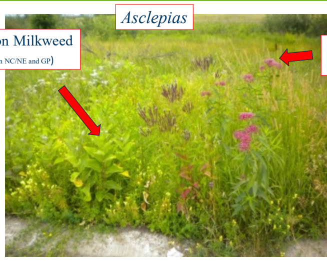
Indicator Status Trust



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OBL Species Examples

Cattail

Cardinal Flower (NC/NE and MW)

Lake Sedge

White Lady's-slipper

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FACW Species Examples

Giant Goldenrod

Showy Lady's-slipper

Red-osier Dogwood

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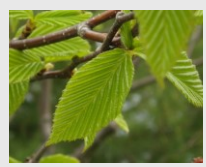
FAC Species Examples



Yellow Birch

Plains Cottonwood

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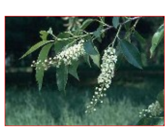
FACU Examples

Canada goldenrod



Black Cherry

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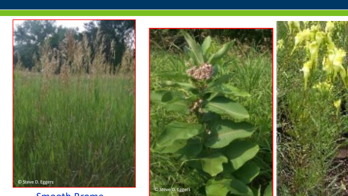
UPL Species Examples



Smooth Brome (NC/NE; GP)

Common Milkweed (NC/NE; GP)

Butter and Eggs

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Reed Canary Grass - FACW

Is RCG a true hydrophyte because it occasionally occurs in uplands?

RCG fits well within the concept of a FACW species as it usually occurs in wetlands, but may occur in non-wetlands

The fact that RCG occasionally occurs in uplands is why it wasn't assigned an OBL indicator status

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Indicator Status

Plant species is not on the list…

Malus sylvestris
(crab apple)

- Using incorrect name or synonym?
- Searching under most current scientific name? (some have changed)
- If still not on the list then species is UPL

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From Individual to the Community

Vegetation Component Focus is on plant communities and not individual plants

Focus

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From Individual to the Community

How do I determine if it's a Hydrophytic Community?

Delineation relies heavily on FIELD based INDICATORS applied to the whole veg community

Field Indicators for Hydrophytic Vegetation relies on the dominance or prevalence of hydrophytes in the community

**** Data collection/sampling is required to demonstrate/prove the veg community is dominated by hydrophytes for an indicator to be met.**

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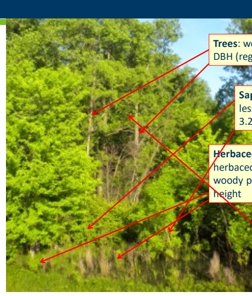
Vegetation Strata (layers of vegetation)



Trees: woody plants 3 inches or more DBH (regardless of height)

Saplings/Shrubs: woody plants less than 3 in. DBH and taller than 3.28 feet (1 m)

Herbaceous: all non-woody plants including herbaceous vines, regardless of size, and woody plants less than 3.28 feet (1 m) in height

Woody Vines: all woody vines greater than 3.28 feet (1 m) in height

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Vegetation Strata

Trees: woody plants 3 inches or more DBH regardless of height

Shrubs/Saplings: woody plants less than 3 inches DBH and taller than 1 meter (3.28 feet) in height

Herbaceous: all non-woody plants regardless of size AND woody plants less than 1 meter (3.28 feet) in height

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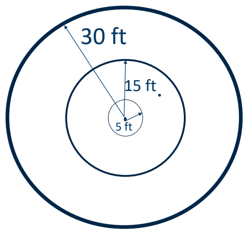
Typical Vegetation Sampling



5 ft Herbaceous; 15 ft Shrub/Sapling; 30 ft Tree/Woody Vine

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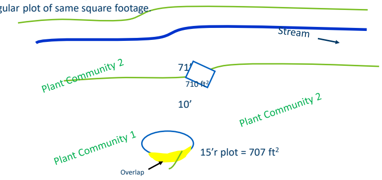
Vegetation Sampling Adjustments

Circular plot overlaps two different plant communities?
Then use rectangular plot of same square footage



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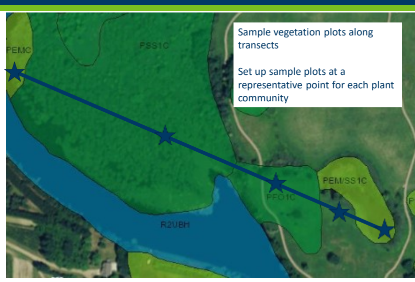
Determining Dominance- Sampling



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Determining Dominance- Sampling

- Within plots relative abundance of a species is used as the metric for determining dominance
  - Typical abundance measures include:
    - basal area for tree species
    - **percent areal cover**
    - stem density
    - frequency based on point-intercept sampling.

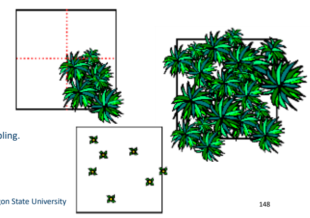

Photo Credit: © 2007 Mark V. Wilson and Oregon State University

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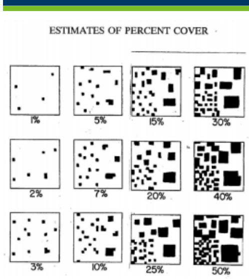
Determining Dominance- Sampling



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

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Determining Dominance- Sampling

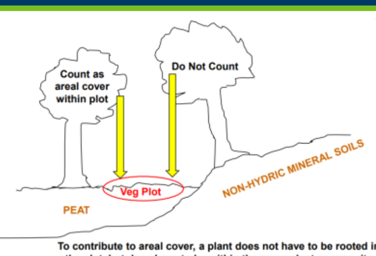

Photo credit USACE

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Determination of Hydrophytic Vegetation

Sequence of Field Indicators

1. Rapid Test
2. Dominance Test (“50/20 Rule”)
3. Prevalence Index
4. Morphological Adaptations

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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).
   a) If the plant community passes the rapid test for hydrophytic vegetation, then the vegetation is hydrophytic and no further vegetation analysis is required.
   b) If the rapid test for hydrophytic vegetation is not met, then proceed to step 2.
2. Apply Indicator 2 (Dominance Test).
   a) If the plant community passes the dominance test, then the vegetation is hydrophytic and no further vegetation analysis is required.
   b) If the plant community fails the dominance test, and indicators of hydric soil and/or wetland hydrology are absent, then hydrophytic vegetation is absent unless the site meets requirements for a problematic wetland situation (see Chapter 5).
   c) 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). This and the following step assume that at least one indicator of hydric soil and one primary or two secondary indicators of wetland hydrology are present.
   a) If the plant community satisfies the prevalence index, then the vegetation is hydrophytic. No further vegetation analysis is required.
   b) If the plant community fails the prevalence index, proceed to step 4.
4. Apply Indicator 4 (Morphological Adaptations).
   a) If the indicator is satisfied, the vegetation is hydrophytic.
   b) b. 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

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Hydrophytic Plants – Rapid Test

All dominant species across all strata are rated OBL or FACW, or a combination of these two categories, based on a visual assessment

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1. Rapid Test for Hydrophytic Vegetation

All dominant species are rated OBL or FACW, or a combination of the two, based on a visual assessment

Example:
95% areal cover by reed canary grass (FACW)

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Hydrophytic Plants – Dominance Test

- Dominance Test AKA 50/20 Rule
  - Used to determine which species are dominant in each strata (layer of veg)
  - Once dominate species are identified their percent cover does not matter; all treated equally
    - Example: Tree Strata may have low number of species compared to Shrub Strata, but may still have a dominant component.
  - IF greater than 50% of the dominant species across all strata are OBL, FACW, or FAC, THEN hydrophytic plant community exists
    - Example: 5 dominant species are identified. 3 dominant species are FACW and 2 dominants are FACU. MEETS CRITERIA FOR HYDROPHYTIC PLANT COMMUNITY; 3/5=.6 or 60% FACW dominants

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Hydrophytic Vegetation – Dominance Test

50/20 Rule How To:

1. Estimate absolute percent cover of each species in first stratum
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

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Hydrophytic Vegetation – Dominance Test

50/20 Rule Example

Species	% Cover
Species a	*45*
Species b	*30*
Species c	*25*
Species d	*10*
Species e	*5*
Species f	*5*
Total Cover	120

120 x <u>50%</u> (0.50) = 60
120 x <u>20%</u> (.20) = 24

Species a + Species b = 75 ---<u>Together</u> exceed 50%

Species c = 25 ---<u>individually</u> meet/exceed 20%

Species a, b, and c are dominant

Note: if species percent cover is a tie, include both

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50/20 Example #2

Species A: 55%
Species B: 35%
Species C: 35%
Species D: 25%
Species E: 20%
Species F: 10%

Tied; count both

125 Dominants

TOTAL : 180

180 x 0.50 = 90   180 x 0.20 = 36

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Hydrophytic Vegetation – Dominance Test

Stratum	Species Name	Wetland Indicator Status (Region 1)	Absolute Percent Cover	Dominant?
Herb	*Impatiens capensis*	FACW	15	Yes
	Geranium carolinianum	UPL	7	Yes
	Toxicodendron radicans	FAC	5	No
	Lonicera tatarica	FACU	2	No
	Glyceria striata	OBL	2	No
	Parthenocissus quinquefolia	FACU	1	No
	Arisaema triphyllum	FACW	0.5	No
	Carex laxiflora	FACU	0.5	No
		Total cover	33.0	
		50/20 Thresholds: 50% of total cover = 16.5% 20% of total cover = 6.6%		
Sapling/shrub	*Carpinus caroliniana*	FAC	35	Yes
	Carya ovata	FACU	10	No
	Acer saccharum	FACU	5	No
	Quercus rubra	FACU	5	No
		Total cover	55.0	
		50/20 Thresholds: 50% of total cover = 27.5% 20% of total cover = 11.0%		
Tree	*Quercus bicolor*	FACW	40	Yes
	Fraxinus pennsylvanica	FACW	17	Yes
	Ulmus americana	FACW	10	No
	Carya ovata	FACU	8	No
		Total Cover	75.0	
		50/20 Thresholds: 50% of total cover = 37.5% 20% of total cover = 15.0%		
Woody vine	*Toxicodendron radicans*	FAC	1	No[1]
Hydrophytic Vegetation Determination	Total number of dominant species across all strata = 5. Percent of dominant species that are OBL, FACW, or FAC = 80%. Therefore, this community is hydrophytic by Indicator 2 (Dominance Test).			

1. Tally number of dominants across all strata – 5
2. Tally number of dominants that are FAC, FACW, or OBL – 4
3. Calculate if FAC, FACW, OBL dominants comprise more than 50% of plant communities – 4/5 = 80%

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Class exercise

How many dominant species are there in the sample point data?

1, 2, 3, or 4?

Species	Strata	% Coverage
Species A	Herbaceous	20
Species B	Herbaceous	20
Species C	Herbaceous	30
Species D	Herbaceous	15
Species E	Herbaceous	30
Species F	Shrub/sapling	5
Species G	Tree	3

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Class exercise

How many dominant species are there in the sample point data?

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Species	Strata	% Coverage
Species A	Herbaceous	20
Species B	Herbaceous	20
Species C	Herbaceous	30
Species D	Herbaceous	15
Species E	Herbaceous	30
Species F	Shrub/sapling	5
Species G	Tree	3

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Hydrophytic Vegetation – Prevalence Index

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

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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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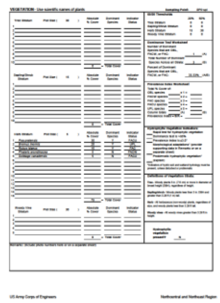
Class Exercise



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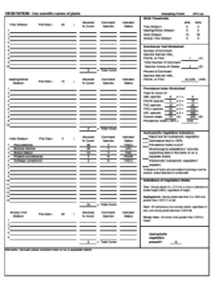
Class Exercise



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Hydrophytic Vegetation – Morphological Adaptations

Morphological Adaptations

- Use when more than 50% of FACU plants exhibit morphological adaptations to saturated soil conditions AND criteria for hydric soils and hydrology is present
  1. For each FACU species exhibiting adaptations, record percentage of individuals with morphological adaptations on data sheet so long as the adaptations are not also common in the same species within nearby uplands areas.
  2. If more than 50% have adaptations then re-assign indicator status for that species from FACU to FAC
  3. Recalculate dominance test and/or prevalence index

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Soil Map

Map Unit Symbol	Map Unit Name
162	Lino loamy fine sand
169B	Braham loamy fine sand, 1 to 6 percent slopes
170	Blomford loamy fine sand
540	Seelyeville muck
541	Rifle muck
860C	Urban land-Hayden-Kingsley complex, 3 to 15 percent slopes
1055	Aquolls and histosols, ponded

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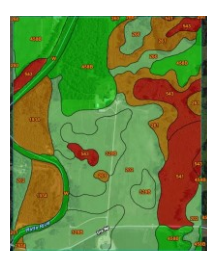
Hydric Soil Rating Map



100% Hydric

66-99% Hydric

33-66% Hydric

1-32% Hydric

Non-Hydric

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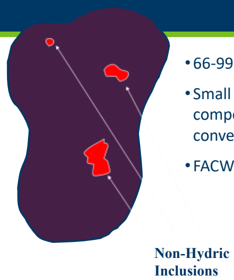
Predominately Hydric



- 66-99% Hydric
- Small areas of non-hydric components on higher or convex landscape positions
- FACW

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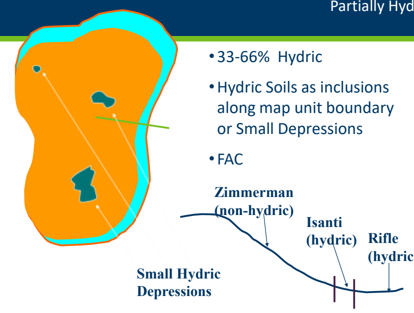
Partially Hydric Soils

- 33-66% Hydric
- Hydric Soils as inclusions along map unit boundary or Small Depressions
- FAC



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[Web Soil Survey]

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Attributes from Soil Survey to help understand Functions

- Geomorphic description
  - Landform
  - Slope shape
  - Parent material
- Typical profile
  - Textures
  - Depths
- Properties and qualities
  - Slope
  - Restrictive layer
  - Drainage class
  - Depth to water table
  - Frequency of flooding/ponding

Description of Normanna

Setting
Landform: Moraines
Landform position (two-dimensional): Summit, backslope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy material over dense loamy till

Typical profile
A - 0 to 4 inches: loam
Bw - 4 to 45 inches: gravelly sandy loam
2Bw,BC,2BC - 45 to 48 inches: gravelly sandy loam
2BCd - 48 to 80 inches: gravelly sandy loam

Properties and qualities
Slope: 3 to 8 percent
Depth to restrictive feature: 30 to 60 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 5.2 inches)

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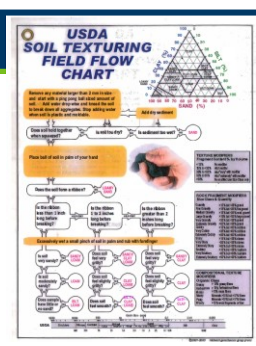

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