MWPCP Regional Training

BOARD OF WATER AND SOIL RESOURCES

Minnesota Wetland Professional Certification Program

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MWPCP Regional Training- August 16-17

Day Two

Critical Definitions

Chapter 5 & Mosaic Wetlands Procedure

Correlation of geomorphology, soils, plant communities and diversity

Difficult Vegetation Transitions

Small Group Delineation Exercise

Minnesota Wetland Professional Certification Program

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

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Critical Definitions for Wetland Delineation

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Critical Definitions

- Wetlands
- Growing Season
- Disturbed (Atypical Situations)
- Naturally Problematic (Problem Areas)
- Normal Environmental Conditions
- Normal Circumstances

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What is a Wetland?

"Wetlands are sometimes wet areas where people meet to argue."

Greg Larson

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- Technical definition:

Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

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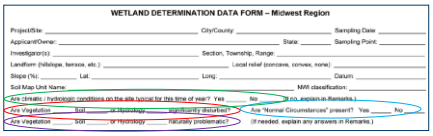
Data Sheets



WETLAND DETERMINATION DATA FORM – Midwest Region

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

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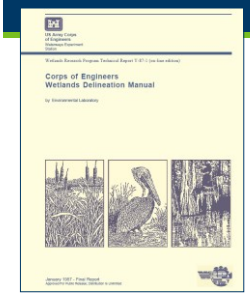
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

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

7

Definitions



Corps of Engineers Wetlands Delineation Manual

ERDC/EL TR-12-1

Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region

Environmental Laboratory

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Why do we care about Growing Season?

Growing season dates are needed to:

- Evaluate and interpret certain wetland hydrology indicators
- Analyze recorded data to determine if wetland hydrology criterion is met

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Growing Season

Green-up indicators 2 to 3 weeks earlier than safe planting period for agricultural crops

=

Observations of inundation/saturation 2 to 3 weeks earlier in the "wet" season for wetland hydrology determinations

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Indicators of Start of the Growing Season

1. **"Green-up" indicator**
2. **Soil temperature at 12 inches is 41° F. or higher**

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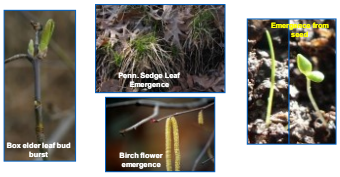
"Green-Up" Indicator for Start of Growing Season

Two or more species of non-evergreen plants show active growth in a wetland or surrounding area with similar elevation and aspect



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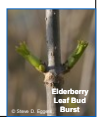
"Green-Up" Indicator (cont.)

- Record supporting information on data sheet
- Include the species observed, their abundance and location relative to the potential wetland, and type of biological activity observed
- Recommend photo documentation



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Start of Growing Season

April site visit:

Two species of non-evergreen plants – reed canary grass and lake sedge – have new, green, aerial leaf/stem growth

Meets the "green-up" indicator for the start of the growing season

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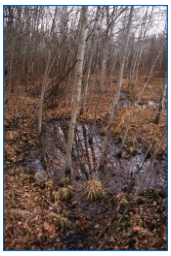
End of Growing Season

- woody deciduous species lose their leaves

and/or

- the last herbaceous plants cease flowering and their leaves die back



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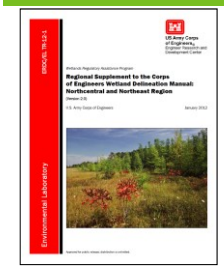
Disturbed (Atypical Situations)



- **One or more parameters altered or absent due to recent human activities or natural event**

Filling, artificial drainage, stream channelization, mechanized land clearing, levee construction, mowing, cropping, plowing, logging, change in river course, high-capacity groundwater well pumping, tree farms, etc.

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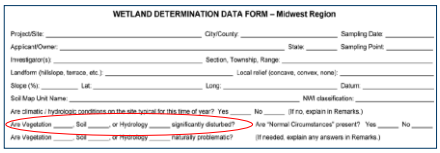
Degree of Disturbance(s)



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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

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Disturbed (Atypical)

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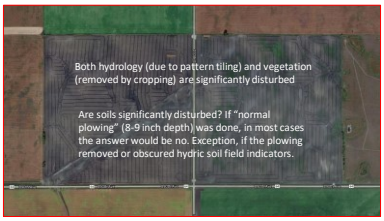
Disturbed (Atypical)



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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

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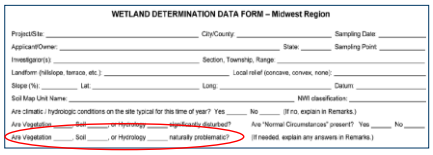
Problem Areas



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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.)

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Seasonal Wetlands

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Problem Areas

Wetlands dominated by non-hydrophytic species like white pine, a Facultative Upland species

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Chapter 5- Difficult Wetland Situations

- Atypical situations
  - Agricultural Land (NE/NC, Midwest)
  - Silviculture (NC/NE)
- Problem areas
  - Problematic vegetation
  - Problematic soil
  - Seasonal hydrology
- Procedural problems
  - Wetland/non-wetland mosaics

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Wetland Definition (1977)

- Those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions

HISTORY: In early years of implementing the Section 404 regulatory program, wetland identification was based on vegetation – there were no delineation manuals/3-parameter approach. Cases arose where wetland vegetation was removed (plowed under, burned off, herbicided, etc.) in an attempt to evade wetland regulations. Corps/EPA then adopted the approach of determining whether the area in question would support dominance by wetland vegetation under normal circumstances.

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Normal Environmental Conditions vs. Normal Circumstances

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

Normal Environmental Conditions?

Normal Circumstances?

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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

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Normal Circumstances

WETLAND DETERMINATION DATA FORM – Midwest Region

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

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Normal Circumstances Key

1. Soils, vegetation and hydrology are undisturbed.....**NC**
1. Physical alteration(s) to soils, vegetation and/or hydrology has occurred.....2

   2. Physical alteration(s) to soils, vegetation and/or hydrology is minor, i.e., insufficient to remove or obscure field indicators... .....**Normal Circumstances**

   2. Physical alteration(s) to soils, vegetation and/or hydrology is more than minor ("significantly disturbed" is checked on datasheet).....3

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Normal Circumstances Key

3. Physical alteration(s) is legally established, maintained and represents the long-term condition of the site; OR is a newly-authorized physical alteration (e.g., a permitted fill, new concrete dam).....**Normal Circumstances**

3. Physical alteration(s) is due to:
   a. an unauthorized or illegal activity;
   b. done with intent of evading wetland regulations;
   c. total or partial clearing of vegetation, or selective removal of veg
   d. presence of a crop, tree farm, improved pasture, managed veg
   e. destruction of hydric soil field indicators by cultivation, deep ripping, etc.;
   f. irrigation or pumping of surface or groundwater for agriculture;
   g. a major natural event (e.g., a river changes course).....**NOT Normal Circumstances**

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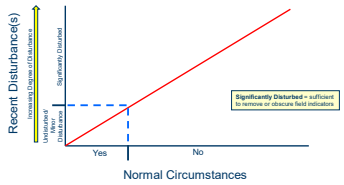
Relationship of Normal Circumstances and Recent Disturbance(s)



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Normal Circumstances

- The full range of pristine to highly disturbed conditions may constitute the normal circumstances
- The long-term condition of a site including any authorized or other legal alterations, such as highways, dams, and other relatively permanent infrastructure and development
- The extent, duration and relative permanence of the physical alteration(s) are key
- Maintenance is a factor – if a physical alteration (e.g., ditch system) is abandoned and wetlands reestablish, the NC is wetlands
- The conditions indicated by the soils and hydrology normally present on a site, in cases where the vegetation has been altered or removed

Extent and Relative Permanence Test

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Not Normal Circumstances

Recent, unauthorized fill that buried natural vegetation and native soils, and altered hydrology

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Normal Circumstances - Hydrology

Example A: Ditch legally constructed in 1950s and maintained since = ditch is established as **Normal Circumstances**. Partially drained is the normal circumstance for hydrology.

Example B: Ditch constructed last year; unauthorized side casting of fill materials in wetlands = **NOT Normal Circumstances**

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Normal Circumstances

Authorized wetland fill meets the "extent and relative permanence test" -- establishes a new Normal Circumstance

3. Physical alteration(s) is legally established, maintained and represents the long-term condition of the site; OR is a newly-authorized physical alteration (e.g., a permitted fill, new concrete dam).....**Normal Circumstances**

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Normal Circumstances – Soils

- **Normal plowing** (e.g., 8- to 9-inch depth) is not considered a "significant" disturbance to soils if does not remove or obscure field indicators of hydric soils
  - -- Examples: A1, A12
  - -- However, other field indictors (e.g., F8, some S indicators (sandy)) would be obscured or difficult to determine
- "Deep ripping" or other methods that disturb and mix soil layers at depths greater than normal plowing are **NOT Normal Circumstances**

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Normal Circumstances - Vegetation

Removal of natural vegetation and replacement with a planted crop = NOT Normal Circumstances

IGNORE the planted crop for purposes of the hydrophytic vegetation determination

When natural vegetation has been removed, focus on soils and hydrology. If a site has wetland hydrology and hydric soils, it would support dominance by hydrophytes under normal circumstances.

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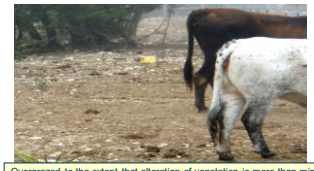
Normal Circumstances - Vegetation

- 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

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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.

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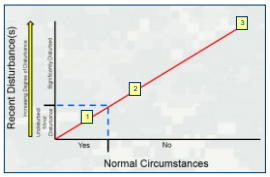
Normal Circumstances - Vegetation

What about moderate grazing sufficient to result in a shift of the plant community to species more tolerant of grazing ("increasers") at the expense of other plant species ("decreasers")[see Table 10 in Midwest Supplement for examples]. Most cases: NOT Normal Circumstances. Follow Midwest Supplement guidance.



KEY:

1 Light Grazing – Sedge Meadow

2 Moderate Grazing

3 Overgrazed – Exposed Soils

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Normal Circumstances - Vegetation

Natural vegetation removed and replaced by manipulated/manicured vegetation (seeding, mowing, fertilizing, selective herbicide applications) = NOT Normal Circumstances

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Problem Areas and Normal Circumstances

- **EXAMPLE:** Vernal pools are naturally dry outside of the first few weeks of the growing season = **Normal Circumstances**

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Problem Areas and Normal Circumstances

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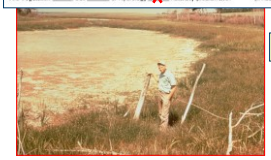
Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
Are Vegetation _____, Soil _____, or Hydrology X naturally problematic? (If needed, explain any answers in Remarks.)



Prairie pothole wetland in a drought year

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Normal Circumstances?

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Two-Step Process

Step 1: Delineate Wetlands, if Present, Within a Site

Every Data Sheet
- Normal Circumstances?
- Normal Environmental Conditions?
- Disturbed (Atypical Situations)?
- Problem Area (Naturally Problematic)?

Step 2: Apply regulations, policy and guidance

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Chapter 5- Difficult Wetland Situations

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Chapter 5- Difficult Wetland Situations

Some wetlands can be difficult to delineate because wetland indicators may be missing due to natural processes or recent disturbances.

Regional Supplements provide guidance in Chapter 5 on how to delineate regional examples of problem areas and atypical situations.

- Examples of difficult wetland situations:
  - Land use for agriculture and silviculture
  - Problematic hydrophytic vegetation
  - Problematic hydric soils
  - Wetlands that periodically lack hydrology indicators
  - Wetland/non-wetland mosaic areas

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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!

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Lands Used for Agriculture and Silviculture

Agriculture

- Lack natural plant communities
- Planted with crops or pasture species
- Altered by mowing, grazing, herbicide
- Soils altered by cultivation in surface horizons
- Hydrology often altered by drainage

Silviculture

- Lack natural plant communities
- Planted with managed community
- Soil surface horizons often disturbed (mixing and compaction) from equipment and roads
- Hydrology sometimes altered by drainage

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Vegetation Determination on Agricultural Lands

- Goal is to determine native plant community under normal circumstances
  - Look for volunteer vegetation between rows, plantings, etc.
  - Examine vegetation in undisturbed reference sites
  - Check NRCS soil survey reports for vegetation information
  - Aerial photograph interpretation
  - Allow for one of more normal seasons fallow

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Soils Determination on Agricultural Lands

- Tilling disturbs and mixes surface horizons and may cause compaction.
  - Review soil survey maps for likely presence of hydric soils
  - Use a reference area with similar landscape position and hydrology
  - Note whether soil changes color upon exposure to air
  - Monitor the hydrology on the site

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Hydrology Determination on Agricultural Lands

- Goal is to determine whether wetland hydrology is present on a managed site under normal circumstances

Methods:

- Look for existing hydrology indicators. Discount indicators that were present prior to alterations (relic water marks)
- Offsite aerial review (5 or more normal years)
- Estimate scope and effect
- Use hydrologic models
- Monitoring the hydrology

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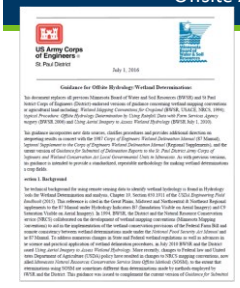
Offsite Aerial Review on Agricultural Lands



US Army Corps of Engineers
St. Paul District

July 1, 2016

Guidance for Offsite Hydrology/Wetland Determinations:

Review of aerial imagery layered with soils and topography

Minimum of 5 normal years

Precipitation Worksheet Using Gridded Database

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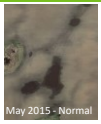
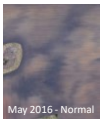
Aerial photo review

Identify hydrology signatures (saturation, drown out, crop stress, etc)

Compile observations to make determination using decision matrix

Hydric Soils present[1]	Identified on NWI or other wetland map[2]	Percent with wet signatures from Exhibit 1	Field verification required[3]	Wetland?
Yes	Yes	>50%	No	Yes
Yes	Yes	30-50%	No	Yes
Yes	Yes	<30%	Yes	Yes, if other hydrology indicators present
Yes	No	>50%	No	Yes
Yes	No	30-50%	Yes	Yes, if other hydrology indicators present
Yes	No	<30%	No	No
No	Yes	>50%	No	Yes
No	Yes	30-50%	No	Yes
No	Yes	<30%	No	No
No	No	>50%	Yes	Yes, if other hydrology indicators present
No	No	30-50%	Yes	Yes, if other hydrology indicators present
No	No	<30%	No	No





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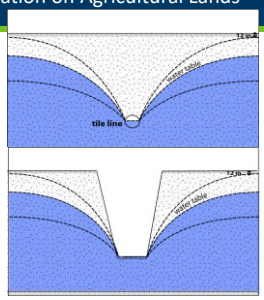
Hydrology Determination on Agricultural Lands

Lateral Effect- distance on either side of a drain which wetland hydrology is impacted

Use NRCS drainage setback table to determine how far a drain needs to be from wetland to prevent drainage

Setback table based on mapped soil unit



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Hydrology Determination on Agricultural Lands

How to use tables:

1) Determine if hydrology indicators are present
2) Overlay drains on soil map
3) Determine average depth of drain per soil type
4) Determine setback distance for each soil type using NRCS table
5) Delineate setback corridor for drain
6) Identify wetlands within or adjacent to setback corridor
7) Consider all variables to determine potential wetland impact

Map Unit Symbol	Drain Depth, feet			
	2	3	4	5
124	50	60	80	100
142	50	70	90	100
147	60	80	100	120
186	80	110	110	110
186	130	210	280	350
202	130	200	260	320
218	110	150	170	190
243	50	50	70	80
292	50	70	100	120
346	60	70	90	100
428	50	60	80	90
502	60	90	100	120
532	120	180	210	290
533	50	70	80	90
540	50	70	80	90
541	200	250	300	350
543	50	110	210	290
544	50	70	80	90
546	50	70	80	90
549	200	250	300	350
564	160	250	330	400
607	110	170	220	260
615	90	150	200	250
621	50	70	100	120
625	170	220	260	290
627	50	110	210	290
628	70	100	120	140
672	60	90	120	140
685	120	220	300	370

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Problematic Vegetation Situations

- Temporal Shifts in Vegetation
  - Seasonal shift in Plant Communities
  - Prolonged Dry to Drought Conditions
  - Long-term fluctuations in lake levels
  - Vernal pools
  - Areas affected by grazing
  - Managed plant communities
  - Areas affected by fires, floods, or other natural disturbances

Factors that can change the structure and composition of plant communities:

- Climatic variability
- Invasive species
- Land use- development, agricultural, silvicultural

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General Approaches to Problematic Vegetation

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) Use the follow approaches

4) Use undisturbed reference sites

5) Offsite review

6) If vegetation cannot be determined, make determination based on soil and hydrology indicators

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Temporal Shifts in Vegetation

- Plant communities change in response to seasonal weather patterns
  - Coastal wetlands, vernal pools, interdunal swales, wet meadows, seeps
- May lack hydrophytic vegetation in dry season

Sampling approach:

1) If possible, return to site under normal precipitation
2) Identify all identifiable plant remains
3) Use off-site resources to determine plant community under normal to wet conditions
4) Use reference site
5) If vegetation under normal to wet conditions cannot be determined, make wetland determination based on hydrology and soil indicators

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Vernal Pools

Sampling approach:

1) If inundated and emergent hydrophytic is not present, return to site under normal precipitation or soon after draw down
2) If hydrophytic prevalence cannot be determined under normal to wet conditions, make wetland determination based on hydrology and soil indicators.

60

Areas Affected by Grazing

Sampling approach:

1) Use ungrazed reference site with similar soils, landscape position, and hydrology.
2) If feasible, remove livestock in a representative area to allow vegetation to recover.
3) If possible, use offsite methods to determine conditions prior to grazing.
4) If vegetation cannot be determined, make wetland determination based on hydrology and soil indicators.

61

Managed Plant Communities

Sampling approach:

1) Use reference site with similar soils, landscape position, and hydrology.
2) If feasible, leave representative area unmanaged to allow vegetation to recover.
3) If possible, use offsite methods to determine prior conditions.
4) If unmanaged vegetation cannot be determined, make wetland determination based on hydrology and soil indicators.

62

Areas affected by natural disturbance

Sampling approach:

1) Use reference site with similar soils, landscape position, and hydrology.
2) If possible, use offsite methods to determine prior conditions.
3) If undisturbed vegetation cannot be determined, make wetland determination based on hydrology and soil indicators.

63

Areas dominated by non-vascular plants

For areas exclusively dominated by non-vascular plants, the vegetation should be considered hydrophytic if both soil and hydrology indicators are present, the site is in a landscape position able to concentrate or receive water and the hydrology has not been altered.

64

FACU species that dominate wetlands

Sampling approach:

1) Drop any FACU species for each sampling point.
2) Compile the species list for remaining species.
3) Revaluate dominance test(s) using the compiled species list. If either is met, then vegetation is hydrophytic.

65

Problematic Hydrophytic Soil

Soils could meet the hydric soil definition but may not exhibit any indicator

Examples:

- Sandy Soils
- Red Parent Material
- Dark Parent Material
- Fluvial deposits within floodplains
- Recently developed wetlands
- Seasonally ponded soils
- High Chroma Soils
- Iron enriched groundwater discharge areas

66

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

67

Wetlands that Periodically Lack Wetland Hydrology

- During the dry season and drought cycles, wetland areas that are typically inundated or ponded during normal precipitation may dry out completely and not exhibit wetland hydrology indicators.
- Every wetland delineation should consider the timing of the site visit and antecedent precipitation.

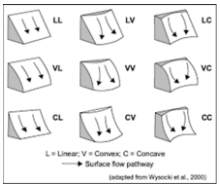
68

Wetland Hydrology Procedure

1) Confirm whether hydrophytic vegetation and hydric soil are present

or absent due to atypical or problem area

2) Determine whether site is in a landscape position capable of concentrating or collecting water



69

Wetland Hydrology Procedure

3) Use one of the following methods:

Site visits during the dry season:

a) Look for secondary hydrology indicators. If found- wetland
b) No hydrology indicators but has hydric soils and hydrophytic veg and not within influence of drainage- consider wetland

Periods with below-normal rainfall:

a) determine whether precipitation 2-3 months prior were below normal, normal, above normal

b) if precipitation is below normal, site meets vegetation and hydrology, and is not within influence of drain- consider wetland

70

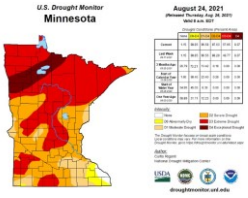
Wetland Hydrology Procedure

3) Use one of the following methods (cont'd):

Drought years:

a) Determine whether site is within drought

b) if site is under drought, site meets vegetation <u>and</u> soils, and is not within influence of drain- consider wetland



71

Wetland Non-Wetland Mosaics

- "…a landscape where wetland and nonwetland components are too closely associated to be easily delineated or mapped separately." – page 142 Corps NCNE Regional Supplement
- Areas of complex microtopography- "ridges" and "troughs"

Procedures:

- Distance – length method
- Point intercept method

72

Wetland Mosaic Procedures

Length Distance method

- Measure length of transect
- Lay measuring tape and keep
- Multiple transects should be parallel
- Other arrangements of transects can be used for odd shapes
- Transect spacing is based on mosaic area

$$\%\ wetland = \frac{Total\ wetland\ distance\ along\ all\ transects}{Total\ length\ of\ all\ transects} \cdot 100$$

73

Wetland Mosaic Procedures

Point Intercept Method

Number of wetland points along transect

- Select transect line(s)
- At fixed number of paces determine and record wetland status
- Compile data points
- Estimate the wetland % with formula

$$\%\ wetland = \frac{Number\ of\ wetland\ points\ along\ all\ transects}{Total\ number\ of\ points\ sampled\ along\ all\ transects} \cdot 100$$

Wetland/Non-Wetland Mosaic

Transect Number	Number of Wetland Pts.	Number of Upland Pts.	Total number of sampling pts.
T1(west)	5	5	10
T2(east)	3	6	9
Totals	8	11	19

Using the following formula, the percentage of wetlands within WNWM B is determined to be 42%

$$\%\ wetland = \frac{Number\ of\ wetland\ pts.\ along\ all\ transects}{Total\ number\ of\ pts.\ along\ all\ transects}$$

74

Regulatory implications of Mosaic Wetlands

Calculating wetland impacts:

- Area determined to be 50% wetland
- Driveway proposes to cross 750 ft^2 of mosaic wetland
- Total wetland impact equals 375 ft^2

75

Review of Chapter 5

- Examples of difficult wetland situations:
  - Land use for agriculture and silviculture
  - Problematic Hydrophytic Vegetation
  - Problematic hydric soils
  - Wetlands that periodically lack hydrology indicators
  - Wetland/Non-wetland mosaic areas
- Reference sites, aerial photography, hydrology data, climatic data

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
4) Long-term monitoring

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

Minnesota Wetland Professional Certification Program

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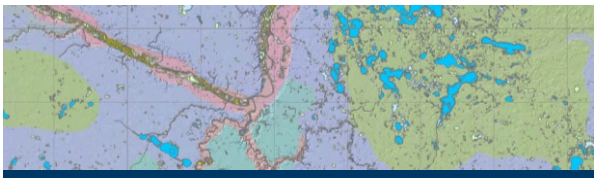

Reading Wetland Hydroscapes

The correlation of geomorphology, hydrology, wetlands, and biodiversity

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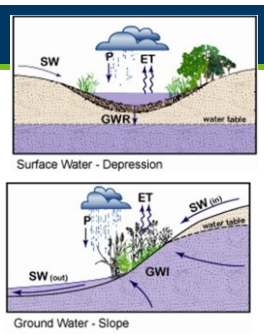
What is a hydroscape?



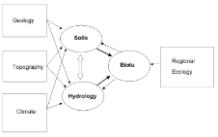
How hydrology interacts with the landscape.

Ability to interpret the landscape position and hydrology is much of what a wetland delineator does

79

Abiotic and biotic influences upon and interactions within wetlands

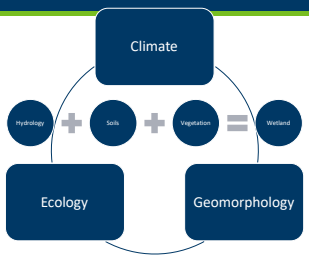
- Wetland soils, Hydrology, and geomorphology
  - Jackson, Thompsons, Kolka, US Forest Service, 2014



80

Key factors

- Climate
- Ecology
- Hydrology
- Geomorphology
- Soil
- Plant Communities
- Wetlands



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3 Parameters of a Wetland

- 3 Parameters of a wetland
  - Hydrology- frequency and duration of movement of water through a landscape
  - Soil- organic and mineral surfaces which often exhibit characteristics that it has been in saturated conditions
  - Vegetation- plant community and prevalence of species that have made adaptations to live in saturated conditions

82

Key factors

- Climate
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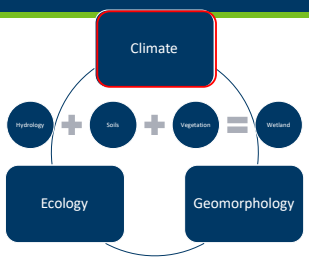
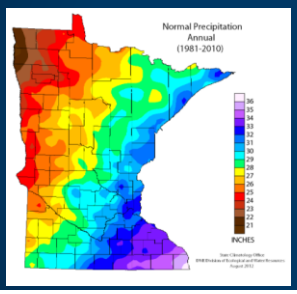
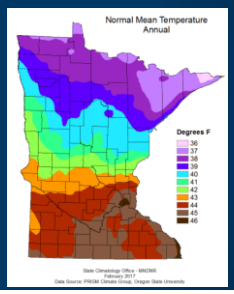
- Hydrology
- Geomorphology
- Soil
- Plant Communities
- Wetlands



83

Climate- long term weather pattern of an area





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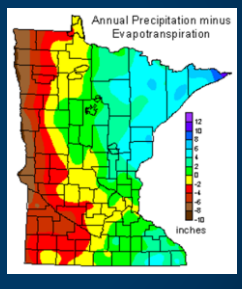
Climate to hydrology

Climate affects wetland water budgets



85

Key factors

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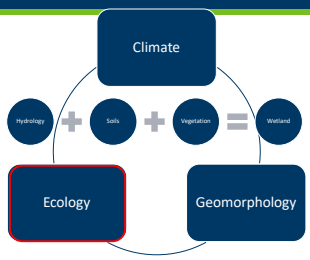

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Ecology

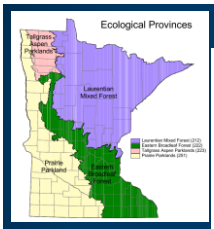
Ecology- relationship of organisms to one another and their physical surroundings

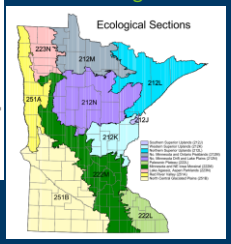
Relationships to the physical environment that influence ecology:

- Water
- Wind
- Fire
- Soil
- Climate

87

Ecological Land Classification





88

Key factors

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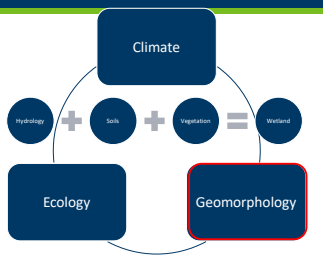
- Plant Communities
- Wetlands



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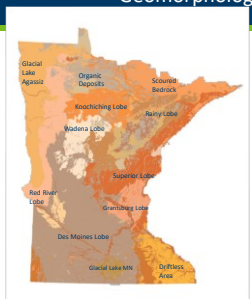
Geomorphology

Study of physical features on the surface of the earth and their relation to its geologic structures

glacial geology of MN



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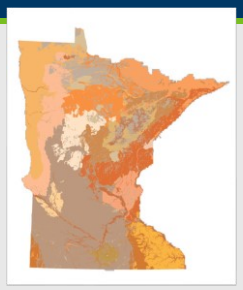
Geomorphology to Ecology



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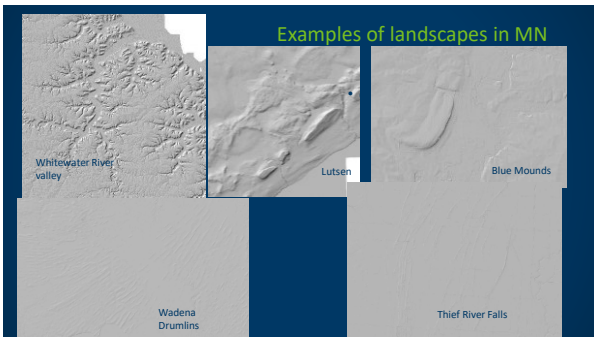
Examples of landscapes in MN



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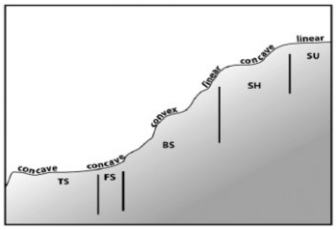
Reading a landscape

What do we mean "reading" the landscape?

Landscape position:

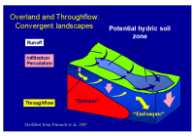
- Summit
- Shoulder
- Backslope
- Foot slope
- Toe slope

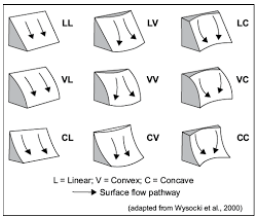


93

Surface shape

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





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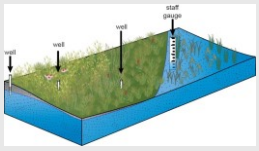
Geomorphology to Hydrology



95

Key factors

- Climate
- Ecology
- Hydrology
- Geomorphology
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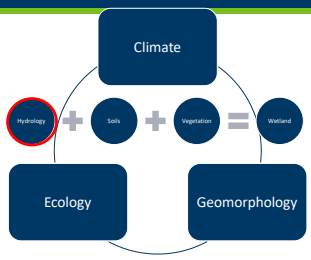
- Plant Communities
- Wetlands



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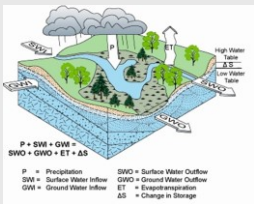
Hydrology- movement of water in relation to land



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

97

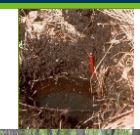
Hydrology Indicators

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.



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Storage Capacity and Evapotranspiration

- Relationship between landscape and climate
- Influences hydroperiod of wetland

Figure D1: Precipitation analysis for a growing season showing daily precipitation, monthly precipitation, the 30-day rolling sum, and the range of normal conditions.

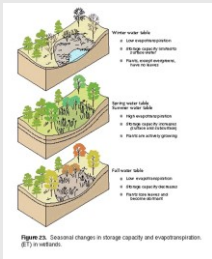


Figure 23. Seasonal changes in storage capacity and evapotranspiration (ET) in wetlands.

99

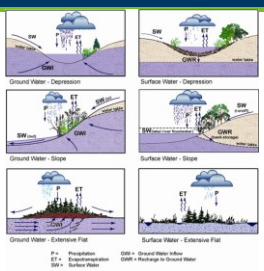
Hydrogeomorphic Method

Assesses functional conditions of a specific wetland referenced to data collected from wetlands across a range of physical conditions

- Developed by Brinson (1993), modified by Smith et al. (1995)
- Hydrogeomorphic Wetland Classification System: An Overview and Modification to Better Meet the Needs of the NRCS (2008 NRCS Technical Note No. 190-8-76)

Established Classes based on geomorphic, hydrology and hydraulic functions of palustrine wetlands

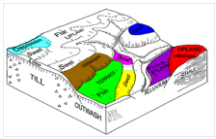
- RIVERINE, DEPRESSIONAL, SLOPE, MINERAL SOIL FLATS, ORGANIC SOIL FLATS, ESTUARINE FRINGE, LACUSTRINE FRINGE



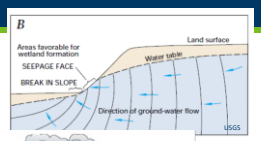
100

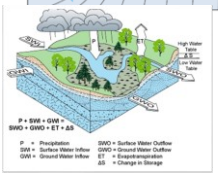
Parameters of HGM

- Geomorphology- landscape position
- Hydrology- water source and output
- Hydraulics- hydrodynamics



USGS





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HGM Classes

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

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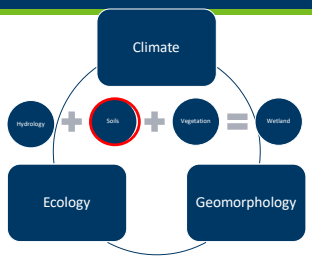
Key factors

- Climate
- Ecology
- Hydrology
- Geomorphology
- Soil
- Plant Communities
- Wetlands



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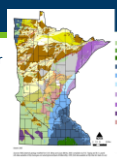
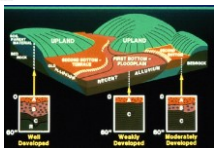
Factors That Influence Soil Development

- 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.





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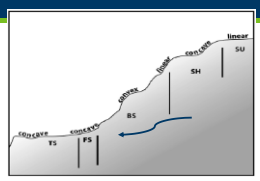
Landscape and formation of hydric soils

- 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



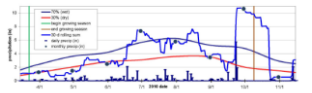


Figure D1: Precipitation analysis for a growing season showing daily precipitation, monthly precipitation, the 30-day rolling sum, and the range of normal conditions.

105

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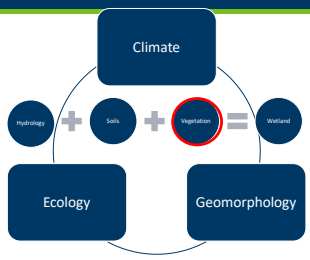

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Vegetation

"…sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions"

Wetland Indicator Status	Definition
Obligate Wetland (OBL)	Almost always occur in wetlands
Faculative Wetland (FACW)	Usually occur in wetlands, but may occur in non-wetlands
Faculative (FAC)	Occur in wetlands and non-wetlands
Faculative Upland (FACU)	Usually occur in non-wetlands, but may in occur in wetlands
Obligate Upland (UPL)	Almost never occur in wetlands

https://wetland-plants.sec.usace.army.mil/nwpl_static/v34/home/home.html

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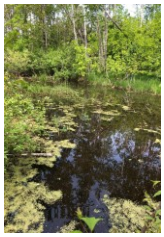
Hydrophytes

Adaptations to saturated environment:

- morphological (multiple trunks, floating leaves)
- physiological (metabolic pathways)
- reproductive (floating seedlings)



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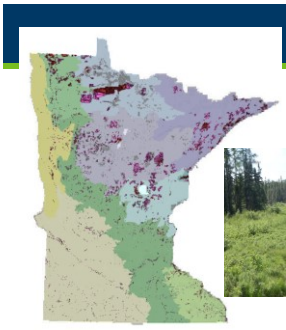
Biodiversity



- Ecological Sections & Areas of high or outstanding biodiversity

109

Mapping geomorphology, ecology, and wetlands

- Sequence of maps to illustrate correlation of geomorphology, wetlands, and areas of ecologic significance
- Offsite method to study field site
- Information that can be used to inform an efficient approach to field work

Other Resource Values
Biodiversity
Plant Community
Ecological Sections
Wetlands
Soils
Topography
Geomorphology

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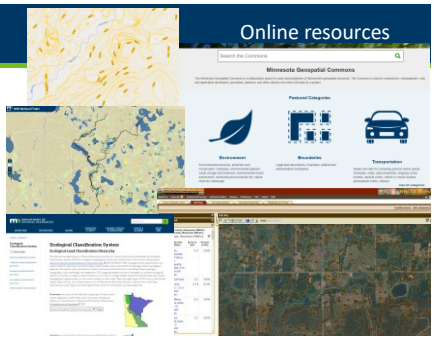
Online resources

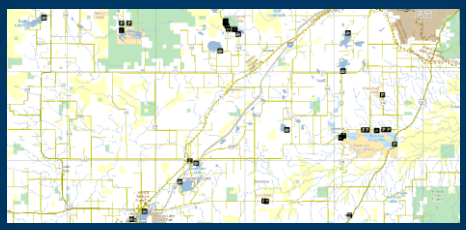
Available resources:

- MN Geospatial Commons
- MN Topo
- NRCS Web Soil Survey
- MN NWI
- MN DNR Ecological Classification System
- MN DNR Native Plant Community List



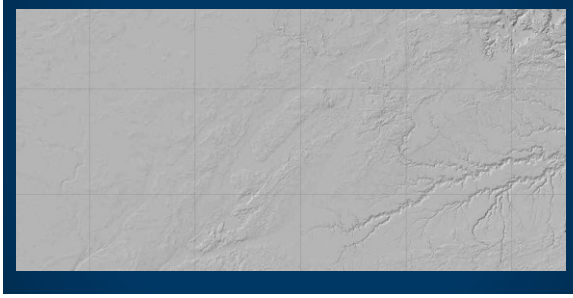
111

Nemadji



112

LIDAR



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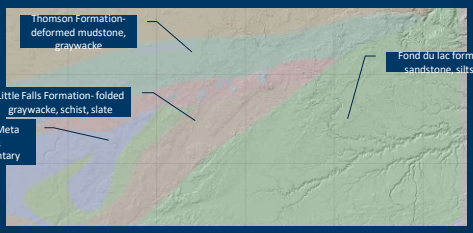
Bedrock Geology



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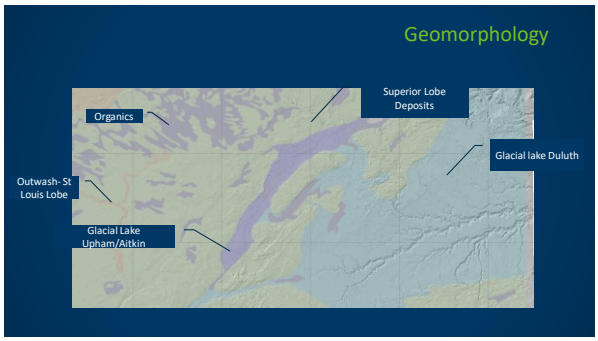

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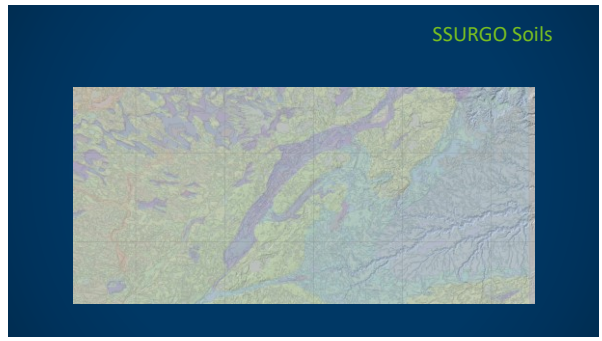

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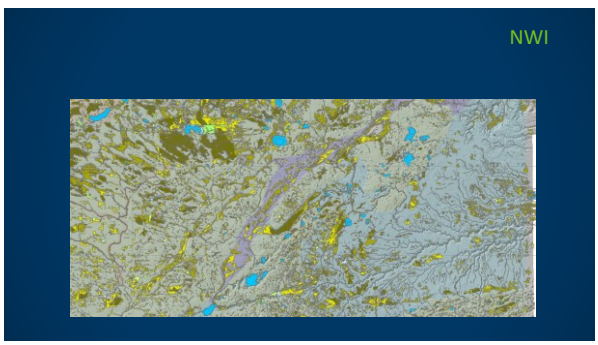

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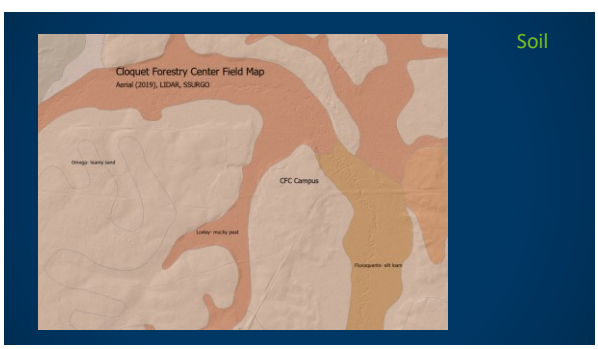

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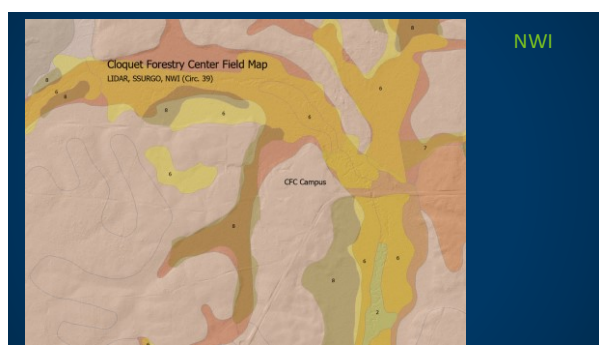

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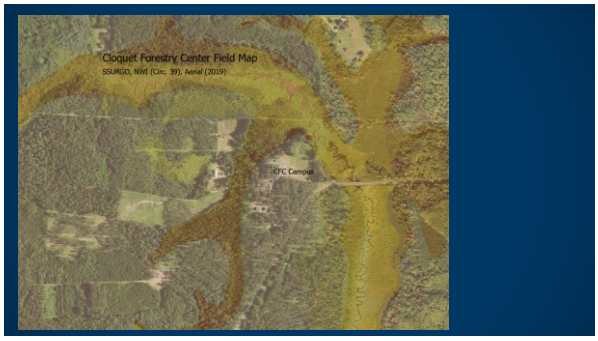

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Questions?

BOARD OF WATER AND SOIL RESOURCES

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Basic Plant ID

BOARD OF WATER AND SOIL RESOURCES

123

What are we going to cover?

- Plant ID basics
- Plant ID resources
- Plant comparison

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Species Identification

Grasses | Sedges | Rushes

Ferns & Allies | Vines | Shrubs | Trees

Forbs

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Forbs

- A broad-leaved, non-woody flowering plant

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Grasses (Poaceae Family)

- Round, hollow, jointed stems
- Sheaths usually open in front
- Leaves 2-ranked
- Floret wrapped in 2 bracts/scales
- One seed per flower (grain)

127

Grasses (Poaceae Family)

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Sedges (Cyperaceae Family)

- Stems round or triangular, solid, no joints
- Sheathes usually closed
- Leaves usually closed
- Leaves usually 3-ranked
- Flowers subtended by a single scale/bract
- One seed per flower

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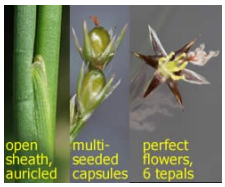
Sedges (Cyperaceae Family)

130

130

Rushes (Juncaceae Family)



- Stems round or compressed, solid, **no joints**
- Leaves few, round or flat in cross-section
- Sheaths open, often with auricles
- Flowers with 6 tepals
- Capsules with 3 or many seeds

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Ferns & Allies

- Flowerless, seedless vascular plants having roots, stems, and reproducing by spores

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Vines

- A plant with the stem not self-supporting but trailing or climbing on some type of support



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Shrubs

- A woody plant, typically shorter than 5 meters at maturity.



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Trees

- A large woody plant, usually with one to a few main stems or trunks



135

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Apps and Online Resources

- PlantNet
- Minnesota Wildflowers
- Google Lens
- PlantSnap
- Picture This

...and many more

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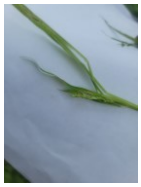
Tips for Apps



VS

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Ag Land Crops


Corn – Zea mays


Soybean – Glycine max


Wheat – Triticum aestivum


Oats – Avena sativa


Sorghum – Sorghum bicolor


Sugar Beets – Beta vulgaris


Barley – Hordeum vulgare

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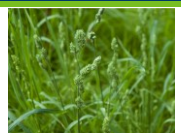
Hay

Timothy – Phleum pratense



Orchard Grass – Dactylis glomerata

Alfalfa – Medicago sativa

Smooth brome - Bromus inermis

RCG – Phalaris arundinacea

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Reed Canary Grass and Brome

Bromus inermis
GP - UPL
NC/NE - UPL
MW - FACU

Phalaris arundinacea
GP - FACW
NC/NE - FACW
MW - FACw

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Goldenrods

Canada Goldenrod – Solidago candensis
GP – FACU
MW – FACU
NCNE - FACU

Giant Goldenrod – Solidago gigantea
GP - FAC
NC/NE - FACW
MW - FACW

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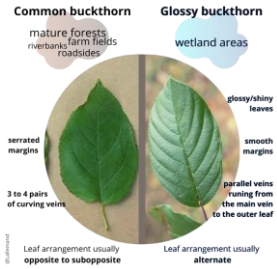
Buckthorns

Rhamnus cathartica
GP - FACU
NC/NE - FAC
MW - FAC



Rhamnus frangula
GP - FACU
NC/NE - FAC
MW - FACW

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Paper Birch and Quaking Aspen

Paper Birch – Betuala papyrifera
GP – FACU
MW – FACU
NCNE - FACU

Quaking Aspen – Populus tremuloides
GP – FAC
MW – FAC
NCNE - FACU

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Green Ash and Black Ash

145

Alder and Hazelnut

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Silver and Sugar Maple

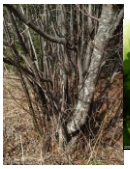
147

White and Black Spruce

148

Alder vs Buckthorn

Speckled alder (alnus incana) FACW (NENC)



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- Tough veg transitions
- Think about prevalence

150

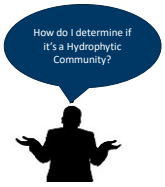
From Individual to the Community

Vegetation Component Focus is on plant communities and not individual plants

Focus

151

From Individual to the 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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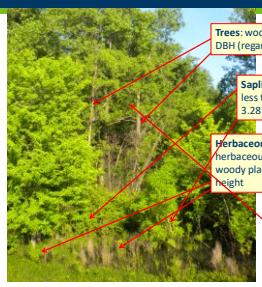
Vegetation Strata (layers of vegetation)



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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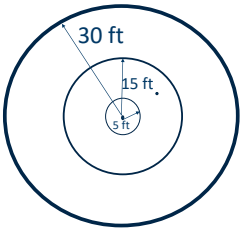
Typical Vegetation Sampling



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

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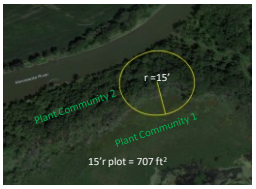
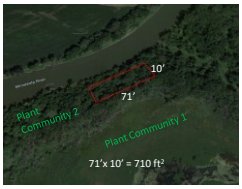
Vegetation Sampling Adjustments

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





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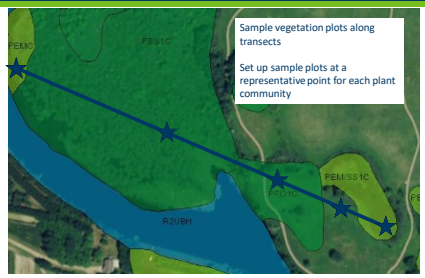
Determining Dominance- Sampling



Sample vegetation plots along transects

Set up sample plots at a representative point for each plant community

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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.

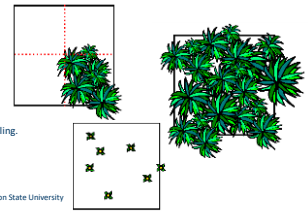

Photo Credit: © 2007 Mark V. Wilson and Oregon State University

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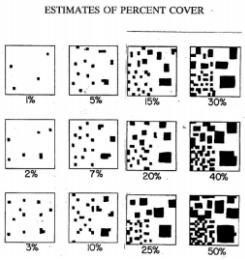
Determining Dominance- Sampling



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

159

Determining Dominance- Sampling

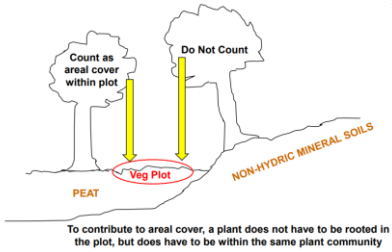
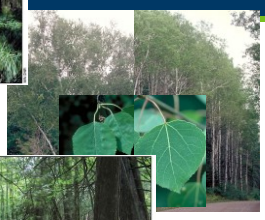


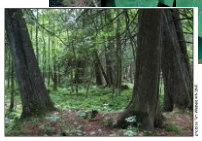
Photo credit USACE

160

trees

- Aspen, birch
- Balsam fir
- White and black spruce
- White cedar
- Green ash vs black ash
- Maples- silver vs sugar vs red
- Cottonwood and box elder





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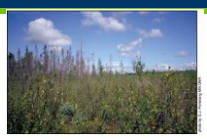
shrubs

- Alder and willow
- Hazelnut



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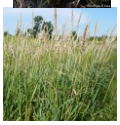
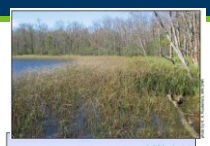
herbaceous

- Ferns- sensitive, bracken, lady, cinnamon
- Raspberry
- Large leave aster
- Bluejoint
- Sedges- Pennsylvania, lake sedge





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