Wetland Delineation Methods

BOARD OF WATER AND SOIL RESOURCES

Minnesota Wetland Professional Certification Program

1

Agenda

Day 1 (9-5)

Introductions

Wetland Delineation Methods

Critical Definitions of Wetlands

Top of Data Sheet Field Exercise

Wetland Hydrology Indicators

Wetland Vegetation

Vegetation Sampling Plot & Hydrology Indicators Field Exercise

Day 2 (9-5)

Quiz

Antecedent Precipitation Exercise

Soil Concepts

Hydric Soil Indicators

Web Soil Survey Exercise

Soil Texture Lab & Field Exercise along Landform

Day 3 (9-5)

Quiz

Wetland Delineation Field Practicum

Group discussion of Field Practicum

Submitting Wetland Delineation Reports & Course Summart

Prerequisite videos:

3 parameters of a Wetland

Wetland Classification systems

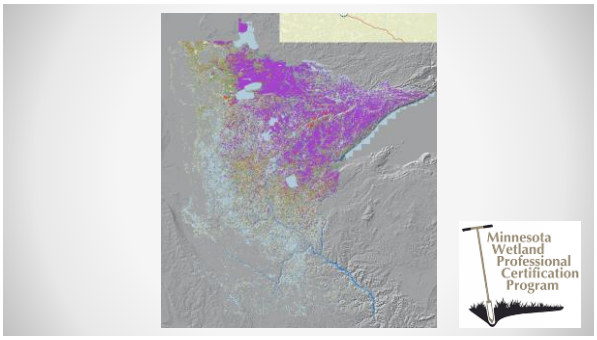
Wetland Functions

Offsite Hydrology Methods

2

MWPCP Class Portal

3



4

Pop Quiz

According to the 2019 Minnesota update of the National Wetland Inventory, how many acres of wetlands are in MN?

A) 6.3 million acres

B) 10.5 million acres

C) 12.2 million acres

D) 24.4 million acres

5

Basic Overview of Wetland Delineation

6

3-Parameter/ Indicator Approach

1. **Soils** –Longest term evidence, Historic conditions, may not reflect current condition.
2. **Hydrology** –Current condition, shortest term evidence but heavily influenced by recent climate conditions
3. **Vegetation** – Somewhere between

The 87 Manual requires 3 parameters because one source typically gives the answer in all situations

7

87 Manual and Regional Supplements

8

Wetland Delineation Types

Routine – Qualitative Data

- Indicator based (veg, soil, hydro)
- Representative sample points
- Estimate and interpret data
- 3-Types of delineations

Comprehensive – Quantitative Data

- Systematic sampling
- Precise measurements

9

Wetland Delineation Types

ROUTINE

Level 1 - Onsite Inspection Unnecessary

Level 2 - Onsite Inspection Necessary

Level 3 - Combination of Levels 1 and 2

10

Wetland Delineation Types

Routine Level 1

Use when exact wetland boundary **not necessary**

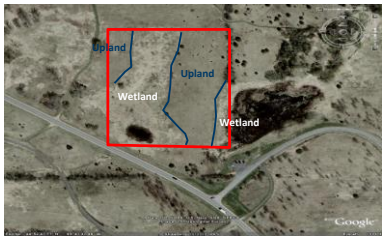
Proposed Shed

11

Routine Level 1

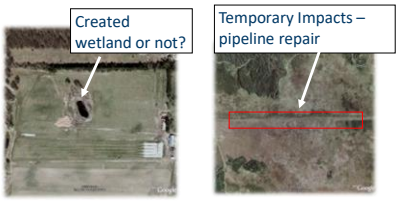
12

Routine Level 1



13

Routine Level 1 Examples



14

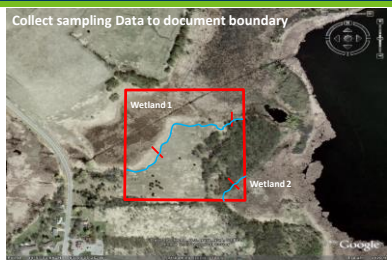
Wetland Delineation Types

Routine Level 2

- Use when an accurate boundary is critical
- Need a formal boundary approval
- Most used and focus of class

15

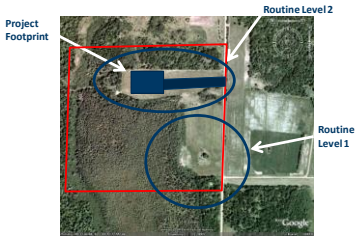
Routine 2



16

Routine Level 3

Combination of Levels 1 and 2



17

Routine Level 3

18

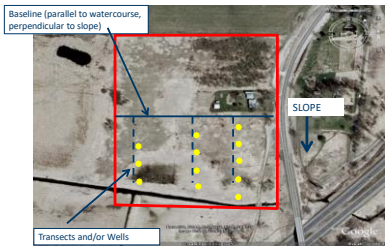
Wetland Delineation Types

Comprehensive Delineation Method

- Complex, requiring rigorous documentation and coordination
- Quantitative Measurements of:
  - Hydrology
  - Vegetation
  - Soils
- Combine with other methods

19

Comprehensive Delineation



20

Routine Level 2 Process

1. Research data sources
   - Know site before visit
   - Saves time and effort
2. Field visit and data collection
   - Data collection
   - Preponderance of evidence
3. Delineate wetland boundary
   - Document indicators of wetland/non-wetland decision
   - Only after multiple informal observations

21

Offsite Resources = Data Sources

- Aerial Photos (current and historic)
- Soil map (Web Soil Survey)
- Topographic\LiDAR
- NWI Map (updated version in MN)
- DNR Public Waters Map

22

Routine Level 2 Process

- **Field Visit and Data Collection**
- Use preliminary map to make a plan
- Recon site and make informal observations and samples
- Make notes about general characteristics
  - Plant Communities
  - Topographic changes-Landscape position
  - Changes in soils
  - Precipitation conditions (wet-dry)
- Delineate Wetland Boundary

23

Field Equipment

24

Sample Points

1. Top section of data sheet
   - Documents sample location and landscape setting
   - Site conditions Wet-Dry
2. Vegetation
   - ID species to determine if plant community is hydrophytic
   - Record comments on changes in vegetation
3. Soil
   - Describe soil and determine if it is hydric
   - Record comments on changes in soil

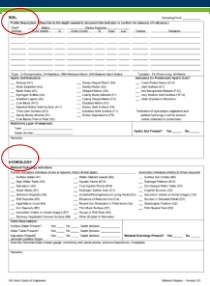
25

Sample Points

4. Topography
   - Record changes in topography
     - Abrupt
     - Gradual
     - Geomorphic position
5. Other notable remarks and observations
   - Basis for delineation line (sharp topo/veg break)
   - Hydrology inputs and outputs

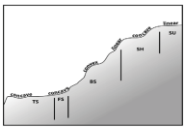
26

It's all about the documentation!



27

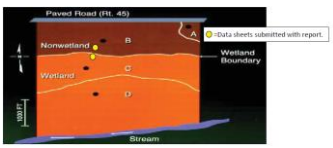
It's all about the documentation!



28

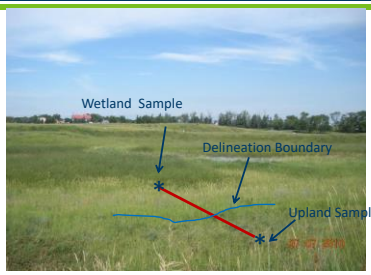
Sampling Location Should Be Representative

- Representative of soil changes (from upland to wetland)
- Representative of vegetation changes
- Representative of hydrology indicator changes
- Representative of landscape changes



29

Routine Level 2 Sampling Transects



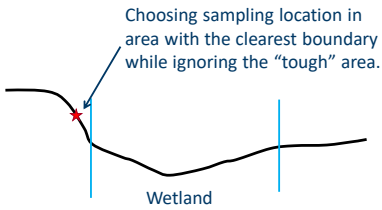
30

Sample location is important!

Good data collection cannot compensate for poor sampling location choices.

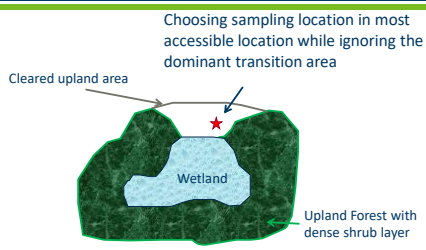
31

Common Errors – The “safe” approach



32

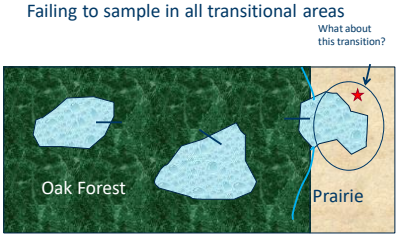
Common Errors – The “lazy” approach



33

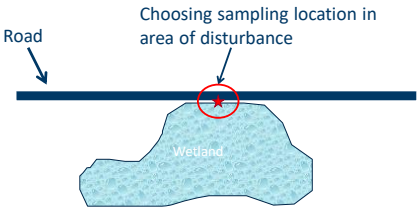
Common Errors – The "anti-community" approach

Failing to sample in all transitional areas



34

Common Errors – The "disturbed" approach



35

Make a Plan:

- Examining your offsite mapping before heading to the field.
- Do an initial site reconnaissance before settling on a sampling location.
- In tough areas, do "preliminary" sampling to help determine where you should do your "official" representative sampling (i.e. full data sheets).

36

- BWSR Wetland Delineation page

37

Critical Definitions for Wetland Delineation

38

Critical Definitions

- Wetlands
- Deepwater Aquatic Habitat
- Semipermanently and permanently flooded
- Growing Season
- Disturbed (Atypical Situations)
- Naturally Problematic (Problem Areas)
- Normal Environmental Conditions
- Normal Circumstances

39

Two-Step Process

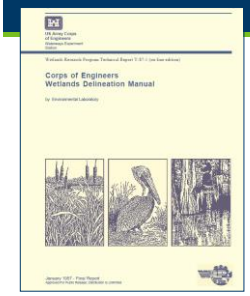
Step 1: Delineate Wetlands, if Present, Within a Site

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

Step 2: Apply regulations, policy and guidance

40

Definitions



41

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

42

What is a Wetland?

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

Greg Larson

43

- 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.

44

Deepwater Habitat

Deepwater aquatic habitats are areas that are permanently inundated at mean annual water depths >8.2 ft or permanently inundated areas less than or equal to 8.2 ft that do not support rooted-emergent or woody plant species

They have the follow diagnostic characteristics:

1) vegetetation- no rooted-emergent or woody pant species are present in these permanently inundated areas
2) Soil- the sustrate technically is not defined as a soil if the mean water depth is >8.2 ft or if it will not support rooted emergent or woody plants

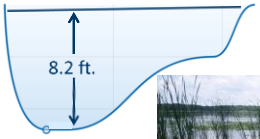
45

Limits of wetland (depth)- Deepwater Habitat

Important Considerations for Wetlands

- Must be capable of supporting rooted, emergent vegetation.
- Must have soil.

If the water is too deep or fast flowing, cannot support rooted vegetation and soil cannot form (unconsolidated bottom).



46

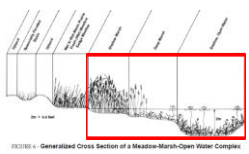
permanently and semipermanently flooded areas

- 2009 Rule language:
- Subp. 51. **Permanently and semipermanently flooded area of a ~~type 3, 4, or 5~~ wetland.** "Permanently and semipermanently flooded area of a ~~type 3, 4, or 5~~ wetland" means the portion of a ~~type 3, 4, or 5~~ wetland below the level where the water has been maintained for a sufficient period of time to leave evidence upon the landscape, commonly the point where the natural vegetation changes from predominantly aquatic to predominantly terrestrial.

47

Permanently and Semipermanently flooded areas- Circular 39 & Eggers & Reed

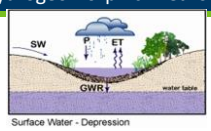
Circular 39	Eggers & Reed
1	Seasonally Flooded Basins
1	Floodplain Forests
2	Sedge Meadows
2	Fresh (wet) Meadows
2	Wet to Wet-Mesic Prairies
2	Calcareous Fens
3	Shallow Marsh
4	Deep Marsh
5	Shallow, Open Water
6	Shrub-Carr
6	Alder Thicket
7	Hardwood Swamp
7	Coniferous Swamp
8	Open Bog
8	Coniferous Bog



48

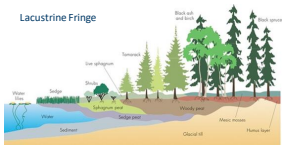
permanently and semipermanently flooded areas- Hydrogeomorphic Method

HGM Class	Typical Water Regimes
Mineral Flat	All regimes except permanently flooded (Saturated most of growing season)
Organic Flat	All regimes except permanently flooded (Saturated most of growing season)
Organic Flat	Saturated
Sloped	Saturated
Riverine	Temporary Flooded
Lacustrine Fringe	Semi permanently to permanently flooded (up to 8.2')
Depression	Seasonally Flooded
Depression	Saturated
Depression	Semi permanently flooded (up to 6")



Surface Water - Depression

Lacustrine Fringe



49

Permanently and Semipermanently Flooded areas- Cowardin

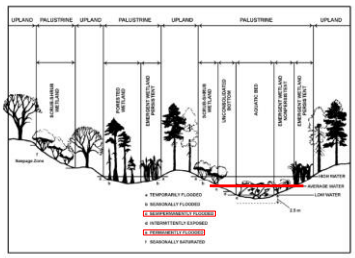


Figure 6. Distinguishing features and examples of habitats in the Palustrine System.

- Depression

50

Lacustrine Fringe

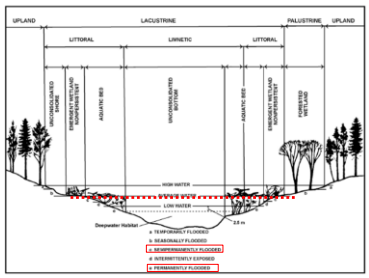


Figure 5. Distinguishing features and examples of habitats in the Lacustrine System.

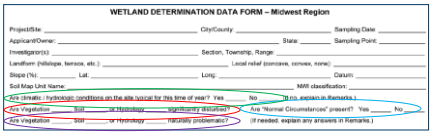
51

Mapping flooded areas

- C water modifier or deeper

52

Data Sheets



WETLAND DETERMINATION DATA FORM – Midwest Region

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

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

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

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

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

53

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

54

Indicators of Start of the Growing Season

1. **Soil temperature at 12 inches is 41° F. or higher**

Use a compost thermometer for each site

Research & Outreach Centers | College of Food, Agricultural and Natural Resource Sciences (umn.edu)

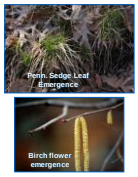
https://www.mda.state.mn.us/protecting/soilprotection/soiltemp

2. "Green-up" indicator

55

"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



56

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

57

End of Growing Season

- woody deciduous species lose their leaves

and/or

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

58

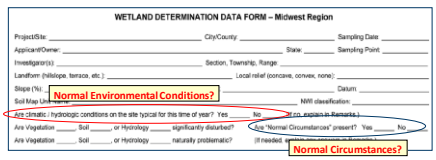
Normal Circumstance

- 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.

59

Normal Environmental Conditions vs. Normal Circumstances



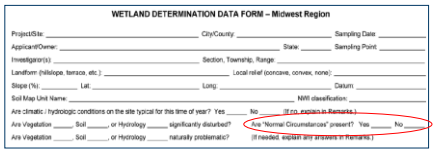
60

Normal Environmental Conditions vs. Normal Circumstances

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

61

Normal Circumstances



WETLAND DETERMINATION DATA FORM – Midwest Region

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

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

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

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

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

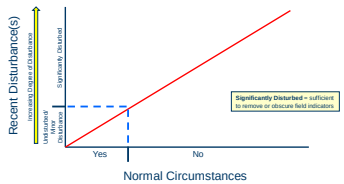
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

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

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

62

Relationship of Normal Circumstances and Recent Disturbance(s)



63

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

64

Not Normal Circumstances

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

65

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**

66

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**

67

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**

68

Normal Circumstances - Vegetation

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

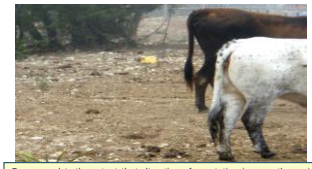
IGNORE the planted crop for purposes of the hydrophytic vegetation determination

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.

69

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

70

Normal Circumstances - Vegetation

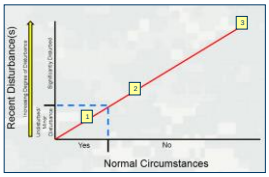
Light grazing of a sedge meadow – minor disturbance of natural vegetation = Normal Circumstances

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

71

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

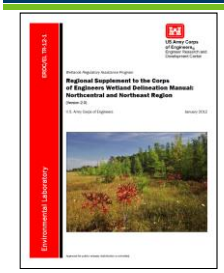
72

Normal Circumstances - Vegetation

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

73

Disturbed (Atypical Situations)

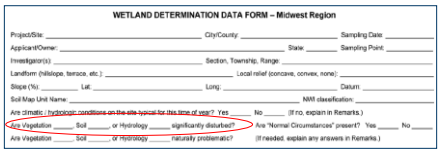


- **One or more parameters altered or absent due to recent human activities or natural event**

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.

74

Degree of Disturbance(s)



WETLAND DETERMINATION DATA FORM – Midwest Region

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

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

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

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

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

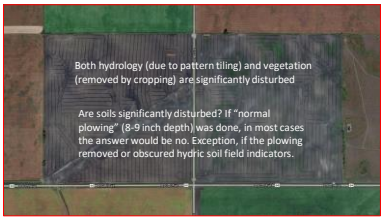
Significantly Disturbed = sufficient to remove or obscure field indicators

75

Disturbed (Atypical)

76

Disturbed (Atypical)



77

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

78

Problem Areas

WETLAND DETERMINATION DATA FORM – Midwest Region

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

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

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

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

Slope (%): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

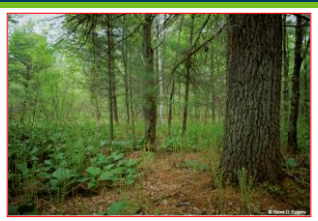
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

79

Seasonal Wetlands

80

Problem Areas



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

81

Problem Areas and Normal Circumstances

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

82

Problem Areas and Normal Circumstances

Project/Site: _____ City/County: _____ Sampling Date: _____
Applicant/Owner: _____ State: _____ Sampling Point: _____
Investigator(s): _____ Section, Township, Range: _____
Landform (hillslope, terrace, etc.) _____ Local relief (concave, convex, none): _____
Slope (%): _____ Lat.: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.)
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.)

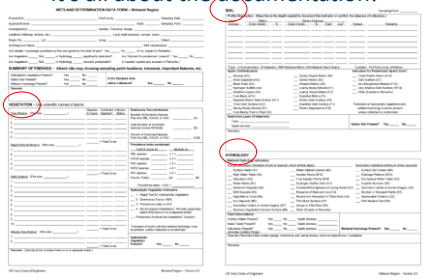
Prairie pothole wetland in a drought year

83

Normal Circumstances?

84

It's all about the documentation!



85

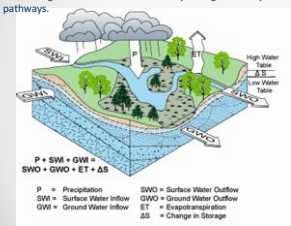
Wetland Hydrology

Minnesota Wetland Professional Certification Program

86

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

87

Hydrology of HGM Classes

HGM Class (subclass)	Hydrology Inputs	Hydrology Outputs	Hydraulics
RIVERINE	surface flow precipitation groundwater	surface flow evapotranspiration	unidirectional
DEPRESSIONAL- surface	surface flow precipitation	groundwater recharge evapotranspiration	unidirectional
DEPRESSIONAL- ground	groundwater precipitation	intermittent surface flow evapotranspiration groundwater recharge	unidirectional
SLOPED- surface	surface flow precipitation	surface flow evapotranspiration groundwater recharge	unidirectional
SLOPED- ground	groundwater surface water precipitation	surface flow evapotranspiration	unidirectional
MINERAL SOIL FLATS	precipitation intermittent surface flow	evapotranspiration intermittent surface flow	unidirectional
ORGANIC SOIL FLATS	groundwater precipitation	intermittent surface flow Evapotranspiration	unidirectional
ESTUARINE FRINGE	surface flow tidal exchange precipitation	tidal exchange surface flow Evapotranspiration	bidirectional
LACUSTRINE FRINGE	surface flow groundwater precipitation	return flow to lake surface flow evapotranspiration	bidirectional

88

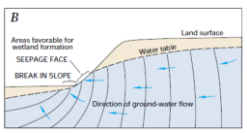
Hydrology

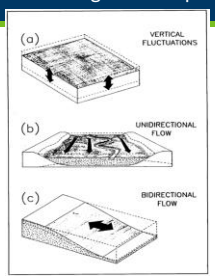
…"inundated or saturated by surface or ground water at a frequency and duration"

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

89

Hydraulics- how water moves through landscape

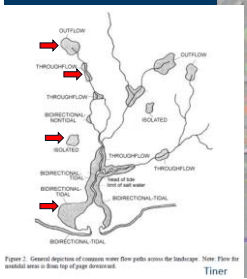




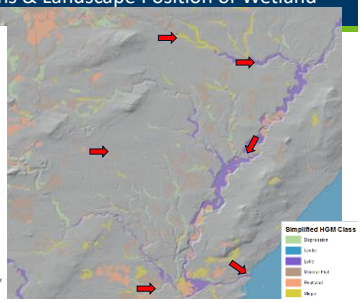
- Uni-directional
  - Horizontal or Vertical
- Bi-directional
  - Estuarine and lacustrine fringe

90

Water Flow Paths & Landscape Position of Wetland

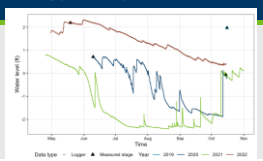


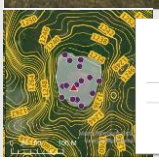
Tiner

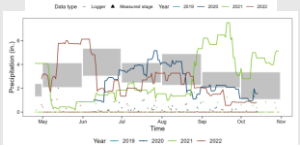


91

Hydrology of Depression Wetlands



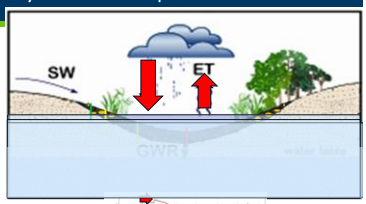


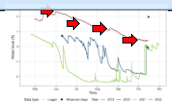


92

Hydraulics of Depression Wetlands

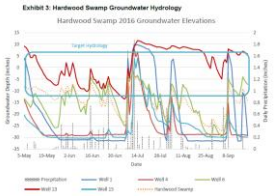
- Vertical uni-directional
- No surface outlet
- Evapotranspiration
  - Increases and decreases with growing season
- Water table “bounces” with precipitation





93

Hydrology of Mineral Flats- Saturated Lacustrine Soils

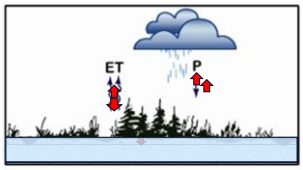


- Surface water input
- Responds to precipitation with little lag time otherwise hydrograph descending with season
- Saturated seepage flow
- Microtopography can be present
- Often intergrades into organic flats and sloped

94

Hydraulics of Mineral Flats

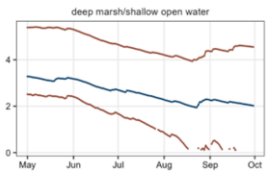
- Vertical uni-directional
- Winter Precipitation
  - overland "seepage flow"
- Evapotransporation
  - Increases and decreases with growing season
- Water table "bounces" with precipitation
- Can facilitate recharge



Surface Water - Extensive Flat

95

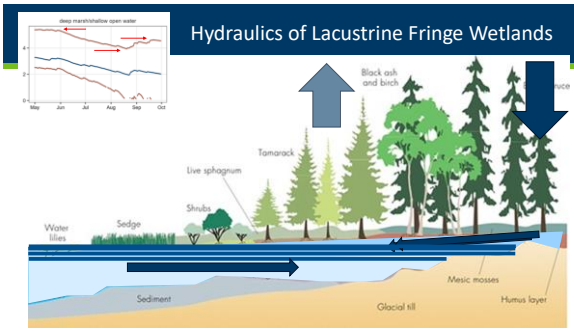
Hydrology of Lacustrine Fringe Wetlands



- Semi-permanently to permanently flooded
- Indundation levels vary with precipitation and evapotransporation
- Baseline flow and surface water input
- Lake levels can control local groundwater
- Surface flow out

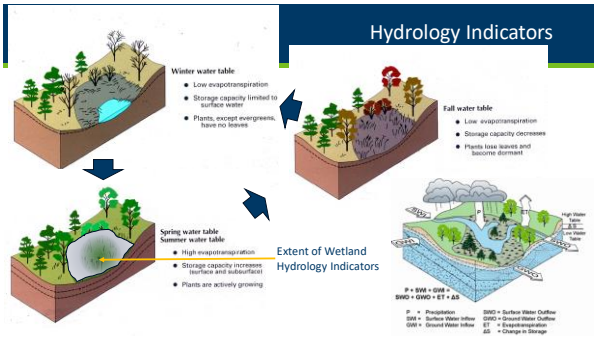
96

Hydraulics of Lacustrine Fringe Wetlands



97

Hydrology Indicators



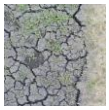
98

Different water levels leave different evidence

99

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.

100

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.

101

Land Resource Regions

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

102

Group A Indicators

direct observation of *water*

103

A1: Surface water

Category:
Primary

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

104

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.

105

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.

106

Group B Indicators

evidence of ponding or flooding – past or present

107

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.

108

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.

109

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

110

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.

111

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.

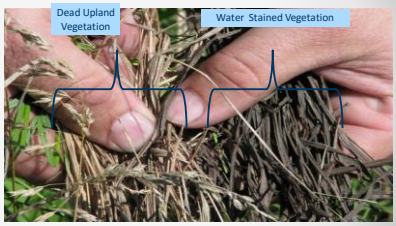
Secondary

112

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.



113

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.

114

Group C Indicators

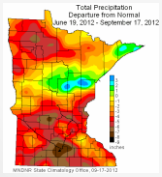
evidence of soil saturation – past or present

115

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.



116

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 living roots and/or iron-oxide coatings or linings on soil pores immediately surrounding living roots within 12 inches of the soil surface.

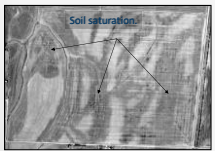
Secondary

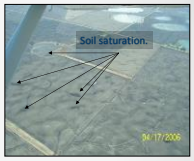
117

C9: Saturation visible on aerial imagery

Category: Secondary

One or more recent 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.





118

Group D Indicators

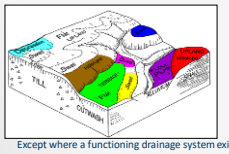
landscape and vegetation characteristics that indicate contemporary wet conditions

119

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*

120

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

121

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

Herb stratum	(Plot size:)	0	= Total Cover	
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				

122

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"

123

Hydrology Indicators?

124

Hydrophytic Vegetation Indicators and Determination

BOARD OF WATER AND SOIL RESOURCES

125

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

126

Hydrophytic Vegetation Definition

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

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), have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions."

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.

127

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

128

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

129

Morphological Adaptations

List of Examples

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

130

Morphological Adaptations

Buttressed bases

131

Examples

Multiple Trunks

132

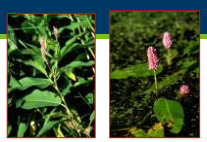
Examples

Shallow Roots - Adventitious Roots

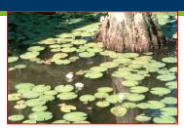


133

Morphological Adaptations



Polymorphic Leaves
Water Smartweed (*Persicaria amphibia*)



Floating leaves

Aerenchyma Tissue for Oxygen Transport

134

Reproductive Adaptations

Overcup oak seedlings tolerate shallow inundation

135

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

136

What about bryophytes?

- Bryophytes are not vascular plants.
- Sphagnum is listed as bog plant community but does not have an indicator status

137

Individual Plant Indicator Status

138

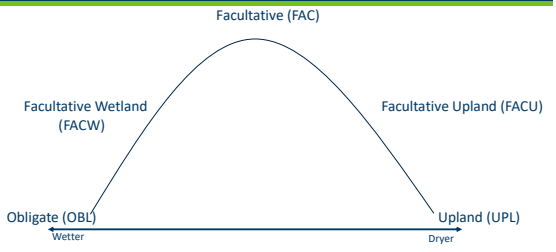
Plant Indicator Status

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

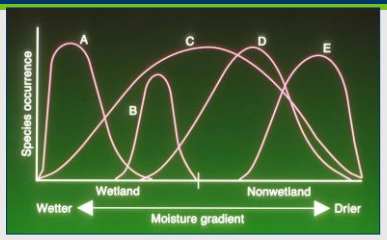
139

Plant Indicator Status



140

Plant Indicator Status Distributions



Indicator Status

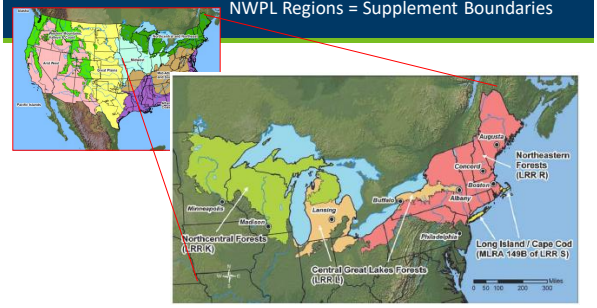
Obligate
FACW
FAC
FACU
Upland

141

NWPL Regions = Supplement Boundaries

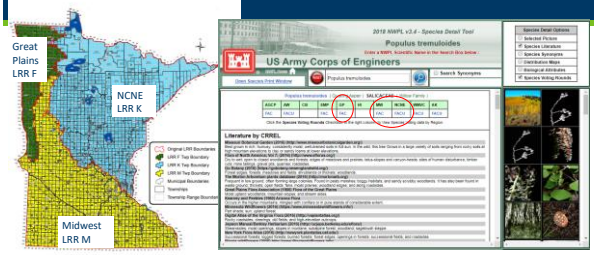
142

NWPL Regions = Supplement Boundaries



143

Plant Indicator Status



144

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)

145

Indicator Status Comparisons

Asclepias

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

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

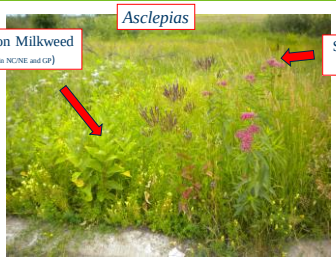
146

Indicator Status Trust

Asclepias

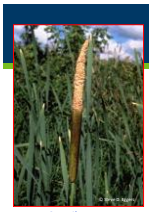
Common Milkweed (UPL in NC/NE and GP)

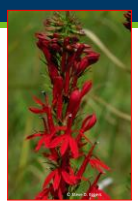
Swamp Milkweed (OBL in NC/NE and Midwest)



147

OBL Species Examples


Cattail


Cardinal Flower
(NC/NE and MW)


Lake Sedge

White Lady's-slipper


148

FACW Species Examples


Giant Goldenrod


Showy Lady's-slipper


Red-osier Dogwood

149

FAC Species Examples


Yellow Birch


Plains Cottonwood

150

FACU Examples

Canada goldenrod


Black Cherry

151

UPL Species Examples


Smooth Brome
(NC/NE; GP)


Common Milkweed
(NC/NE; GP)

Butter and Eggs

152

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

153

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

154

From Individual to the Community

Vegetation Component Focus is on plant communities and not individual plants

Focus

155

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

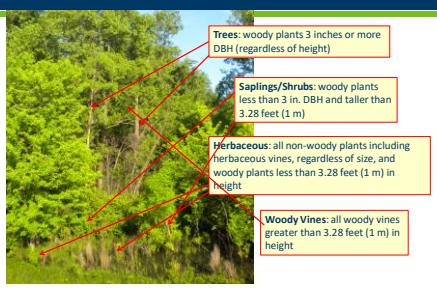
Field Indicators for Hydrophytic Vegetation relies on the dominance or prevalence of hydrophytes in the community

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

156

156

Vegetation Strata (layers of vegetation)



157

Bryophyte?

- Show pic of club moss
- Doesn't need soil
- Relationship to hydrology
- What about sphagnum moss?
- Used in classification
- Shouldn't show up at data sheets
- N/I

158

Vegetation Strata

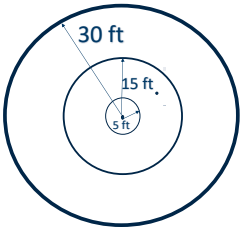
Trees: woody plants 3 inches or more DBH regardless of height

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

159

Typical Vegetation Sampling

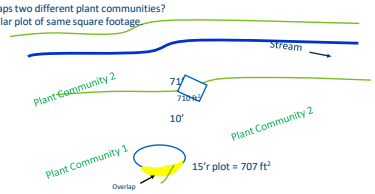


5 ft Herbaceous; 15 ft Shrub/Sapling; 30 ft Tree/Woody Vine

160

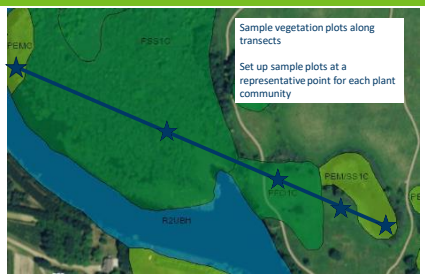
Vegetation Sampling Adjustments

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



161

Determining Dominance- Sampling



Sample vegetation plots along transects

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

162

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.

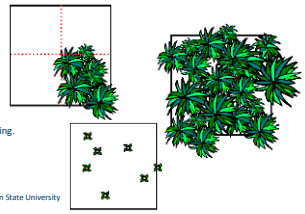
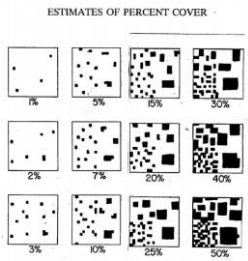


Photo Credit: © 2007 Mark V. Wilson and Oregon State University

163

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

164

Determining Dominance- Sampling

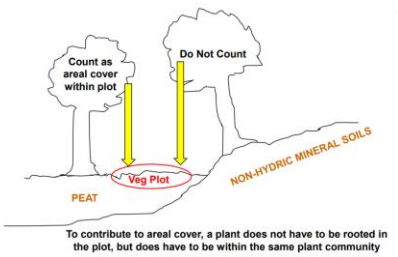


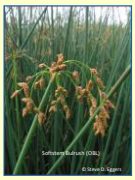
Photo credit USACE

165

Determination of Hydrophytic Vegetation

Sequence of Field Indicators

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



166

Determining Hydrophytic Vegetation

The procedure for using hydrophytic vegetation indicators is as follows:

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

167

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

168

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)

169

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

170

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

171

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 50% (0.50) = 60
120 x 20% (.20) = 24

Species a + Species b = 75 ---Together exceed 50%

Species c = 25 ---individually meet/exceed 20%

Species a, b, and c are dominant

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

172

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

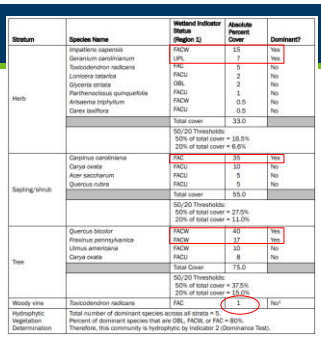
125 Dominants

TOTAL : 180

180 x 0.50 = 90 180 x 0.20 = 36

173

Dominance Test



Stratum	Species Name	Wetland Indicator Status (Region 5)	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[2]
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%

174

Class exercise

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

1, 2, 3, or 4?

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

175

Class exercise

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

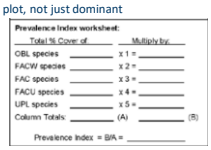
3

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

176

Hydrophytic Vegetation – Prevalence Index

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


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

177

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

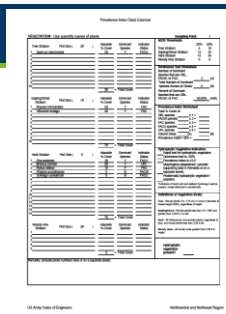
Prevalence Index worksheet:

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

178

Class Exercise



179

Class Exercise

Prevalence Index Worksheet

Total % Cover of:

OBL species	0	x 1 =	0
FACW species	0	x 2 =	10
FAC species	85	x 3 =	255
FACU species	55	x 4 =	220
UPL species	20	x 5 =	100
Column totals	165 (A)		585 (B)

Prevalence Index = B/A = 3.55

Hydrophytic Vegetation Indicators:

___ Rapid test for hydrophytic vegetation

___ Dominance test is >50%

___ Prevalence index is ≤3.0*

___ Morphological adaptations* (provide supporting data in Remarks or on a separate sheet)

___ Problematic hydrophytic vegetation* (explain)

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

180

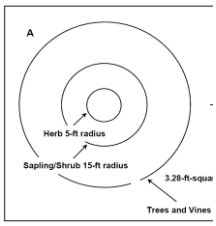
Hydrophytic Vegetation – Morphological Adaptations

Morphological Adaptations

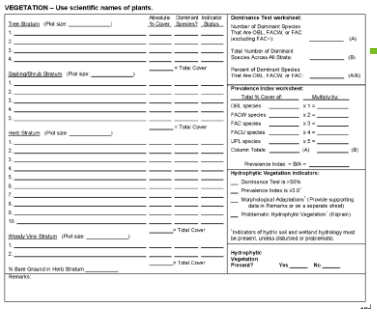
- Use when more than 50% of FACU plants exhibit morphological adaptations to saturated soil conditions AND criteria for hydric soils and hydrology is present
  1. For each FACU species exhibiting adaptations, record percentage of individuals with morphological adaptations on data sheet so long as the 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

181

Vegetation Sampling



182



VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size _____)
Absolute % Cover | Dominant Species? | Indicator Status
1. _____ _____ _____
2. _____ _____ _____
3. _____ _____ _____
4. _____ _____ _____
_____ = Total Cover

Sapling/Shrub Stratum (Plot size _____)
1. _____ _____ _____
2. _____ _____ _____
3. _____ _____ _____
4. _____ _____ _____
5. _____ _____ _____
_____ = Total Cover

Herb Stratum (Plot size _____)
1. _____ _____ _____
2. _____ _____ _____
3. _____ _____ _____
4. _____ _____ _____
5. _____ _____ _____
6. _____ _____ _____
7. _____ _____ _____
8. _____ _____ _____
9. _____ _____ _____
10. _____ _____ _____
_____ = Total Cover

Woody Vine Stratum (Plot size _____)
1. _____ _____ _____
2. _____ _____ _____
_____ = Total Cover

% Bare Ground in Herb Stratum _____

Remarks:

Dominance Test worksheet:
Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): _____ (A)
Total Number of Dominant Species Across All Strata: _____ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)

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

Hydrophytic Vegetation Indicators:
__ Dominance Test is >50%
__ Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

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

Hydrophytic Vegetation Present? Yes ____ No ____

183