Hydrology Indicators

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

Wetland hydrology indicators are divided into two categories:
- **Primary** – provide stand-alone evidence of a current or recent hydrologic event;
- **Secondary** – provide evidence of recent hydrology when supported by one or more other hydrology indicators.

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.

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

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;

Precipitation

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

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

<table>
<thead>
<tr>
<th>Group A Indicators</th>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A1: Surface water</strong></td>
<td>Primary</td>
<td>Direct, visual observation of surface water during a site visit.</td>
</tr>
<tr>
<td><strong>A2: High water table</strong></td>
<td>Primary</td>
<td>Water table 12 in. (30 cm) or less below the surface in a soil pit, auger hole, or shallow monitoring well.</td>
</tr>
<tr>
<td><strong>A3: Saturation</strong></td>
<td>Primary</td>
<td>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.</td>
</tr>
</tbody>
</table>

---

[Images: Land Resource Regions, Flipbook, Photos of wetland areas and soil samples]
Group B Indicators

evidence of ponding or flooding – past or present

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.

B2: Sediment Deposits
Category: Primary
Sediment deposits are thin layers or coatings of fine-grained mineral material or organic matter remaining on tree bark, plant stems or leaves, rocks, and other objects after surface water recedes.

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.

B4: Algal mat or crust
Category: Primary
This indicator consists of a mat or dried crust of algae, perhaps mixed with other detritus, left on or near the soil surface after dewatering.

B5: Iron deposits
Category: Primary
General Description: This indicator consists of a thin orange or yellow crust or gel of oxidized iron on the soil surface or on objects near the surface.
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.

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.

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.

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.

B10: Drainage patterns

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

B13: Aquatic fauna

Category: Primary
Presence of live individuals, diapausing insect eggs or crustacean cysts, or dead remains of aquatic fauna, either on the soil surface or clinging to plants or other emergent objects.
B14: True aquatic plants

**Category:** Primary

Presence of live individuals or dead remains of true aquatic plants. Require water for support, or desiccate in the absence of standing water.

---

B15: Marl deposits

**Category:** Primary

Presence of marl on the soil surface. Found mainly in calcareous fens, seeps, or white cedar swamps in areas underlain by limestone bedrock.

---

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.

---

Group C Indicators

evidence of soil saturation – past or present

---

C1: Hydrogen sulfide odor

**Category:** Primary

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

---

C2: Dry season water table

**Category:** Secondary

Visual observation of the water table between 12 and 36 in. (30 and 90 cm) below the surface during the normal dry season or during a drier than normal year.
C3: Oxidized rhizospheres along living roots

Category: Primary
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.

C6: Recent iron reduction in tilled soils

Category: Primary
Redox concentrations as pore linings or soft masses in the tilled surface layer of soils cultivated within the last two years.

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.

Group D Indicators

D1: Stunted or stressed plants

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

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.
**D3: Shallow Aquitard**

**Category:** Secondary

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

![Diagram of shallow aquitard](image)

**D4: Microtopographic relief**

**Category:** Secondary

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

- Hummocks
- Tussocks
- Flank-and-strang topography
- Microhighs < 36 in. above the base soil level

![Image of microtopographic features](image)

**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++
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

**Indicator D7: Frost-heave hummocks**

**Category:** Secondary

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

![Image of frost-heave hummocks](image)

**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”
How do drains work?

Lateral Effect

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

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

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

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

Drainage Types

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

Ditching

- How do drains work?

Drain Tile

- How do drains work?

Drained Wetland

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

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

Effectively Drained

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

Hydrology

- Considerations in planning hydrologic monitoring project:
  - What is the question?
  - What is the performance criteria?
  - Precision?
  - Site characteristics
    - Landscape position, hydrology setting, soil, vegetation, drainage features
  - Pre-existing data
  - Timeline and available resources

Methods to monitor hydrology

- Observation of indicators
- Staff gauges
- Open boreholes

- Monitoring wells
  - Manual measurements
  - Automated measurements
Piezometers

- Used to measure depth-specific head measurements
  - Measure vertical component
    - Hydrostatic pressure or “head”
  - May provide automated measurements

- Not typically used for standard wetland investigations

Interpreting Hydrology

Basic Soil Concepts

What is Soil?

Factors That Influence Soil Development

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

Overview

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

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.
Landscape Position

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

Overland and Throughflow:

- Convergent landscapes
- Throughflow
- Runoff
- Infiltration
- Percolation
- Potential hydric soil zone
- "Epiaquic"
- "Endoaquic"

Modified from Pennock et al., 1987

Divergent
Convergent
Slope Block Contour
Hill Slope Elements and Curvature
Upslope

After Pennock et al., 1987

Soil Catena

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

Organic horizon
- Consists of mostly decomposed organic material

Two Categories of Soil Material - Mineral Soil/Horizons

Properties that are important to hydric soil development and recognition:

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

Key Soil Properties

O horizon - Organic horizon, thickness varies
A horizon - Organic accumulation (typically ~10%), ideally granular structure
E horizon - Coloring agents (Fe, Organics) removed
B horizon - Subsoil accumulation of minerals, organics, and sometimes chemicals, blocky structure
C horizon - Similar to parent material, often less developed with little structure
R horizon - Parent material
Soil Texture - Relative proportion of soil particles

- **Sand** (0.05 - 2.00 mm)
- **Silt** (0.002 - 0.05 mm)
- **Clay** (<0.002 mm)

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

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

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

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

Soil Color
- **Coating of Fe$_2$O$_3$$^+$$^+$$^+$**
- **Mineral grain** (gray)
- **Bright Soil**
  - Remove Fe
- **Gray Soil**

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

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

Reading Soil Color

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

Abundance and Size of Redox

<table>
<thead>
<tr>
<th>Abundance</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Few --&gt; &lt; 2%</td>
<td>Fine --&gt; &lt; 5 mm</td>
</tr>
<tr>
<td>Common --&gt; 2 to 20%</td>
<td>Medium --&gt; 5 to 15 mm</td>
</tr>
<tr>
<td>Many --&gt; more than 20%</td>
<td>Coarse --&gt; &gt; 15 mm</td>
</tr>
</tbody>
</table>

Several indicators require at least 2% abundance

Contrast

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

Several indicators require distinct or prominent contrast!

Definition of a Hydric Soil

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

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

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

Foundation of the Field Indicator Manual.

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

In anaerobic conditions decomposition slows and leads to organic accumulation.

Order of Reduction:
1. Oxygen
2. Nitrate
3. Manganese
4. Iron
5. Sulfate

Never Saturated Oxidized Matrix
Infrequently Saturated Oxidized Matrix with few concentrations
Frequently Saturated Oxidized Matrix with depletions and concentrations
Very Frequently Saturated Depleted or Reduced Matrix With concentrations
Permanently Saturated - depleted or reduced matrix

Depleted Matrix
Iron removed or re-organized in profile leaving Grey matrix
- Value 4 or More
- Chroma 2 or Less

Depleted Matrix Requirement
- High Value (4 or more)
- Low Chroma (2 or Less)
- Need Concentrations (2%)
Gleyed Matrix

- Iron Present, but in reduced state (Fe$^{2+}$) Gleyed color with value $\geq 4$

Gleyed Matrix Requirements

Hydric Soil Indicators

Field Indicators of Hydric Soils

Natural Resources Conservation Service

- National Technical Committee for Hydric Soils

Used for on-site verification of hydric soils

Field Indicator Organization

All Soils

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

Sandy Soil Indicators (S):

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

Fine Grained Soil Indicators (F):

- Use when texture is:
  - Loamy very Fine sand or finer
Diagnostic Zones

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

Sandy (S)
- Upper 15 cm (6”)

Loamy / Clayey (F)
- Upper 30 cm (12”)

Couple of key terms to help interpret indicators:

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

Format of Indicator Descriptions

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

A1 - Histosol

- Use in all LRRs

A2 - Histic Epipedon

- Histic epipedon: saturated, organic horizons 8 inches or more thick in the upper part
- Applicable land resource regions (LRR)
- Use in all LRRs
A3 - Black Histic
- A layer of peat, mucky peat, or muck 8 in or more thick that starts at a depth of < 6 in from the soil surface; has hue of 10YR or yellower, value of 3 or less, and chroma of 1 or less; and is underlain by mineral soil material with chroma of 2 or less.
- Applicable land resource regions (LRR)
  - Use in all LRRs

A11 - Depleted Below Dark Surface
- Applicable land resource regions (LRR)
- Use in all LRRs

A12 - Thick Dark Surface
- Applicable land resource regions (LRR)
- User notes
  - Most often associated with overthickened soils in concave landscape positions.

F3 - Depleted Matrix
- Applicable land resource regions (LRR)
- Use in all LRRs
- User notes
  - Careful to not mistake an E horizon for depletions!

F6 - Redox Dark Surface
- Applicable land resource regions (LRR)
- User notes
  - Careful to not mistake an E horizon for depletion.

F7 - Depleted Dark Surface
- Applicable land resource regions (LRR)
- Use in all LRRs
- User notes
  - Careful to not mistake an E horizon for depletion.
Applicable land resource regions (LRR)

Use in all LRRs

Problematic Hydric Soils

Covered in Chapter 5 of the regional supplements

Problematic hydric soils are the norm in some landscapes

Red Parent Material (inhibited, or difficult to see redox features)

Active floodplains (deposition of new material)

Drained systems (relict hydric indicators)

High Value (bright) / Low Chroma (grey),

Thick prairie soils

Hydrophytic Vegetation Indicators and Determination

Hydrophytic Vegetation Indicators

Definition

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
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.

What Is a Hydrophyte

Hydro = Water
Phyte = Plant

OR

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

What makes a plant a hydrophyte? ...........ADAPTATIONS!

• Morphological adaptations — visible changes/growth habits
• Reproductive adaptations — changes in how they reproduce
• Physiological adaptations — internal chemical process changes

List of Examples

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

Examples

Morphological Adaptations

Buttressed bases

Multiple Trunks
Shallow Roots - Adventitious Roots

Examples

Morphological Adaptations

Polymorphic Leaves
Water Smartweed (Persicaria amphibia)
Aerenchyma Tissue for Oxygen Transport
Floating Leaves

Reproductive Adaptations

Overcup oak seedlings tolerate shallow inundation

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

Individual Plant Indicator Status

<table>
<thead>
<tr>
<th>Wetland Indicator Status</th>
<th>Indicator Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obligate Wetland</td>
<td>OBL</td>
<td>Plants that almost always grow in wetlands. Estimated probability of &gt;99% for growing in wetland.</td>
</tr>
<tr>
<td>Facultative Wetland</td>
<td>FACW</td>
<td>Plants that usually occur in wetlands. Estimated probability of 67% - 99% for growing in wetland (1% - 33% in upland)</td>
</tr>
<tr>
<td>Facultative</td>
<td>FAC</td>
<td>Plants with similar likelihood of occurring in both wetland and upland. Estimated 33% - 67% for growing in wetland.</td>
</tr>
<tr>
<td>Facultative Upland</td>
<td>FACU</td>
<td>Plants that sometimes grow in wetland. Estimated 1% - &lt;33% for growing in wetland (&gt;47% - 99% in upland).</td>
</tr>
<tr>
<td>Obligate Upland</td>
<td>UPL</td>
<td>Plants that rarely occur in wetland. Estimated probability of &lt;1% for growing in wetland (&gt;99% in upland).</td>
</tr>
</tbody>
</table>
Plant Indicator Status

Facultative (FAC)  
Facultative Wetland (FACW)  
Facultative Upland (FACU)  
Obligate (OBL)  
Upland (UPL)

Plant Indicator Status Distributions

Indicator Status  
Obligate (OBL)  
Facultative Wetland (FACW)  
Facultative Upland (FACU)  
Upland (UPL)

NWPL Regions = Supplement Boundaries

Silver Maple (FACW): NC/NE; Midwest  
Sugar Maple (FACU): NC/NE; Midwest  
Red Maple (FAC)

Swamp Ecotype: shallow root system  
Upland Ecotype: tap root to water table

Common Milkweed (UPL): NC/NE; GP  
Swamp Milkweed (FACU): Midwest

Asclepias
Common Milkweed (UPL in NC/NE and GP)

Swamp Milkweed (OBL in NC/NE and Midwest)

Asclepias

Cardinal Flower (NC/NE and Midwest)

Cattail

Lake Sedge

White Lady’s-slipper

Giant Goldenrod

Showy Lady’s-slipper

Red-osier Dogwood

Giant Goldenrod

Showy Lady’s-slipper

Red-osier Dogwood

Yellow Birch

Plains Cottonwood

Black Cherry

Canada goldenrod

Smooth Brome (NC/NE; GP)

Common Milkweed (UPL in NC/NE; GP)

Butter and Eggs

UPL Species Examples

FAC Species Examples

FACW Species Examples

OBL Species Examples

FACU Examples
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.

Plant species is not on the list...

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

From Individual to the Community

Vegetation Component Focus is on plant communities and not individual plants

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 1 meter (3.28 feet) in height

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

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

Vegetation Strata

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

Saplings/Shrubs: 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

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.
Typical Vegetation Sampling

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

Vegetation Sampling Adjustments

- If a circular plot overlaps two different plant communities, then use a rectangular plot of the same square footage.

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.

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 than Absolute Cover = Actual or Total cover.

Photo Credit: © 2007 Mark V. Albro and Oregon State University
Determination of Hydrophytic Vegetation

Sequence of Field Indicators

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

Determining Hydrophytic Vegetation

The procedure for using hydrophytic vegetation indicators is as follows:

1. **Rapid Test**
   - a) If the plant community passes the rapid test for hydrophytic vegetation, then the vegetation is hydrophytic and no further vegetation analysis is required.
   - b) If the rapid test for hydrophytic vegetation is not met, then proceed to step 2.

2. **Dominance Test**
   - a) If the plant community passes the dominance test, then the vegetation is hydrophytic and no further vegetation analysis is required.
   - b) If the plant community fails the dominance test, and indicators of hydric soil and/or wetland hydrology are absent, then hydrophytic vegetation is absent unless the site meets requirements for a problematic wetland situation (see Chapter 5).
   - c) If the plant community fails the dominance test, but indicators of hydric soil and wetland hydrology are both present, proceed to step 3.

3. **Prevalence Index**
   - a) If the plant community satisfies the prevalence index, then the vegetation is hydrophytic. No further vegetation analysis is required.
   - b) If the plant community fails the prevalence index, proceed to step 4.

4. **Morphological Adaptations**
   - a) If the indicator is satisfied, the vegetation is hydrophytic.
   - b) If none of the indicators is satisfied, then hydrophytic vegetation is absent unless indicators of hydric soil and wetland hydrology are present and the site meets the requirements for a problematic wetland situation.
### Hydrophytic Vegetation – Dominance Test

#### 50/20 Rule Example

<table>
<thead>
<tr>
<th>Species</th>
<th>% Cover</th>
<th>120 x 50% (0.50)</th>
<th>120 x 20% (.20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species a</td>
<td>45</td>
<td>120 x 0.50 = 60</td>
<td>120 x 0.20 = 24</td>
</tr>
<tr>
<td>Species b</td>
<td>30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species c</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species d</td>
<td>10</td>
<td>Species a + Species b = 75 — Together exceed 50%</td>
<td></td>
</tr>
<tr>
<td>Species e</td>
<td>5</td>
<td>Species c = 25 — Individually meet/exceed 20%</td>
<td></td>
</tr>
<tr>
<td>Species f</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Cover</strong></td>
<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

#### 50/20 Example #2

<table>
<thead>
<tr>
<th>Species</th>
<th>% Cover</th>
<th>120 x 50% (0.50)</th>
<th>120 x 20% (.20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species A</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species B</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species C</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species D</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species E</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species F</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>120</td>
<td>120 x 0.50 = 60</td>
<td>120 x 0.20 = 24</td>
</tr>
</tbody>
</table>

Tied; count both.

#### Class exercise

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%

### 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

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

1, 2, 3, or 4?

### Class exercise

<table>
<thead>
<tr>
<th>Specie</th>
<th>Strata</th>
<th>% Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Species A</td>
<td>Herbaceous</td>
<td>20</td>
</tr>
<tr>
<td>Species B</td>
<td>Herbaceous</td>
<td>20</td>
</tr>
<tr>
<td>Species C</td>
<td>Herbaceous</td>
<td>15</td>
</tr>
<tr>
<td>Species D</td>
<td>Herbaceous</td>
<td>10</td>
</tr>
<tr>
<td>Species E</td>
<td>Herbaceous</td>
<td>5</td>
</tr>
<tr>
<td>Species F</td>
<td>Shrubs/Sapling</td>
<td>5</td>
</tr>
<tr>
<td>Species G</td>
<td>Tree</td>
<td>1</td>
</tr>
</tbody>
</table>

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

1, 2, 3, or 4?

157 158 159 160 161 162
Hydrophytic Vegetation – Prevalence Index

<table>
<thead>
<tr>
<th>Species</th>
<th>Tree Strata</th>
<th>Herbaceous Strata</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% Cover</td>
<td>% Cover</td>
</tr>
<tr>
<td>Species a</td>
<td>45 FACW</td>
<td>Species A</td>
</tr>
<tr>
<td>Species b</td>
<td>25 FAC</td>
<td>Species B</td>
</tr>
<tr>
<td>Species c</td>
<td>10 FAC</td>
<td>Species C</td>
</tr>
<tr>
<td>Species d</td>
<td>5 FACU</td>
<td>Species D</td>
</tr>
<tr>
<td>Species e</td>
<td>5 FACU</td>
<td>Species E</td>
</tr>
<tr>
<td>Species f</td>
<td>5 OBL</td>
<td>Species F</td>
</tr>
</tbody>
</table>

Prevalence Index worksheet:
- Total % Cover of OBL species:
  - OB species: 85
  - Multiply by FACW: 115
  - FACW species: 60
  - FAC species: 25
  - FACU species: 15
  - UPL species: 15

  Column Total: 300 (A) 670 (B)

Prevalence Index = B/A = 2.23

Class Exercise

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

Class Exercise

Hydric Soil Rating Map

- 100% Hydric
- 67-99% Hydric
- 33-66% Hydric
- 1-32% Hydric
- Non-Hydric
Predominately Hydric

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

Non-Hydric Inclusions

Partially Hydric Soils

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

Zimmerman (non-hydric)
Isanti (hydric)
Rifle (hydric)

Small Hydric Depressions

Web Soil Survey
Attributes from Soil Survey to help understand Functions

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

Description of Normanna Setting

Landform:
Moraines

Landform position (two-dimensional):
Summit, backslope

Down-slope shape:
Linear

Across-slope shape:
Linear

Parent material:
Loamy material over dense loamy till

Typical profile

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

Properties and qualities

Slope:
3 to 8 percent

Depth to restrictive feature:
30 to 60 inches to dense material

Natural drainage class:
Moderately well drained

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)

Depth to water table:
About 18 inches

Frequency of flooding:
None

Frequency of ponding:
None

Available water storage in profile:
Low (about 5.2 inches)