THE HYDROGEOMORPHIC APPROACH TO FUNCTIONAL ASSESSMENT FOR PIEDMONT SLOPE WETLANDS

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Cooperators

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  - PA, MD, DE, NJ, NSSL, MO-13
- USEPA Region 3
- US Army Corps of Engineers
  - Baltimore District, Norfolk District
- US Fish and Wildlife Service
- US Federal Highways
- Maryland Department of the Environment
- Pennsylvania Department of Environmental Protection

Wetland Functions

- Definition: biological, chemical, and physical processes that occur in wetlands

- Examples
  - N removal through denitrification
  - Surface water storage
  - Soil organic matter accretion

HGM Functional Categories

- Hydrology
- Biogeochemical cycling
- Plant community
- Wildlife habitat

Functional Assessment

- Quantify the functional capacity of individual wetlands.
- Functional capacity: the degree to which a function is performed.
- Functional capacity is judged relative to a reference standard.

Functional Assessment-Why?

- Evaluation of wetland quality for Federal mandates
- Evaluation of anthropogenic impacts
- Evaluation for mitigation purposes (compensation “in kind”)
- Site selection for wetland enhancement
- Identification of environmentally-sensitive areas

HGM Approach

- Wetland classification
- Site selection
- Model development
  - Identification/selection of functions
  - Data collection
  - Generate variables
  - Calibrate

Hydrogeomorphic Classification

- Geomorphic setting-topographic position in landscape
- Primary hydrologic input-precipitation, groundwater discharge, surface flow
- Hydrodynamics-direction, energy

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Wetland Site Selection

- Reference domain
  - Wetlands under consideration
  - One subclass
  - Geographic limitations
- Reference wetlands
  - Subset of reference domain
  - Data collection sites for model development
- Reference standard wetlands
  - Subset of reference wetlands
  - Minimal anthropogenic disturbance
  - Highest functional capacity

Anthropogenic Disturbance

- Ditches
- Fill
- Roads
- Plow layers

HGM Models

- Target a regional subclass of wetlands (e.g., Piedmont slope wetlands)
- Generate a functional capacity profile

HGM Models

- Consist of a series of sub-models (Fc. assessment models) that address individual functions.

- Each sub-model shows the relationship between one function and a measurable wetland attribute (model variable).

Fc: Groundwater Discharge

Fc Index=V_{GDWR}

where V_{GDWR}=evidence of discharge

Fc: Surface Water Storage

Fc Index=$(V_{SRWR}+V_{MACTOPO}+V_{MICTOPO})/3$

where:

V_{SRWR}=presence of surface water

$V_{MACTOPO}$=macrotopographic relief

$V_{MICTOPO}$=microtopographic complexity

Model Development Variables

- Simple variables-presence of a surface flow outlet
- Complex variables-water chemistry
- Temporal variables-soil Eh

“User Friendly” Attributes

- Visual or easily measured
- No temporal restrictions
- Correlated to a quantitative measure of a variable

Hydroperiod

Seasonal pattern of water table depth in a wetland.

- Direct measurement-monitoring well
- Indirect measurement-soil morphology

Indicators of Inundation

- Fc=Surface Water Storage
  - Thick dark O and/or A horizon
  - Emergent vegetation

Indicators of Seasonal Saturation

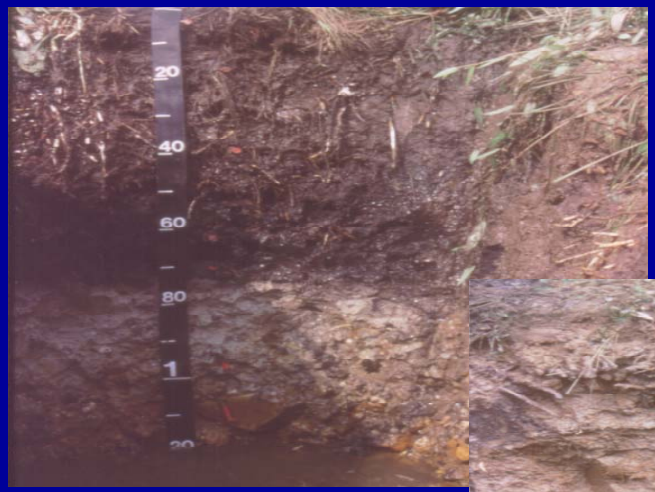
- Fc=Denitrification
  - Redox features within 30 cm of surface
  - Tree stratum

Indicators of Resonance Time

- Fc=Carbon export
  - Slope
  - Microtopography

Hydroperiod

1. permanently inundated
2. permanently saturated
3. seasonal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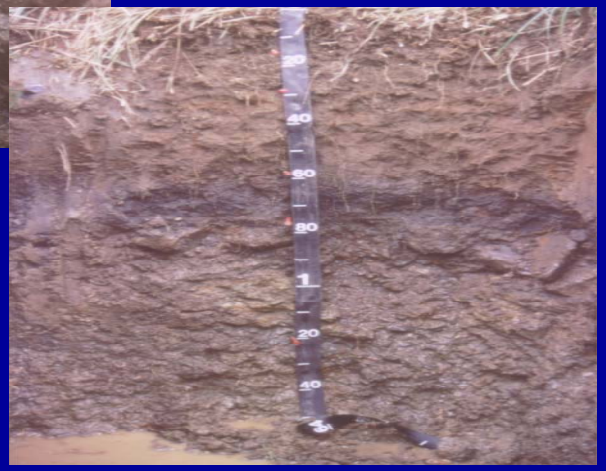
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Surrounding Land Use

- Connectivity to other wetlands-wildlife
- Agricultural-sediment and nutrient loading
- Development-hydrologic inputs

Fc. Capacity Scale

- Range: 0.0-1.0
- 1.0=reference standard
- 0.0=unrecoverable loss of function

Scale ex: % herb. groundcover

- Ref. std. wetlands:50-90%
- Ref. std.:50%

- 50%+ 1.0
- 30-49% 0.7
- 10-29% 0.4
- <10% 0.1

Piedmont Slope Functions

- Surface & subsurface water storage
- Particulate retention
- Organic C export
- Nutrient cycling
- Removal of elements
- Maint. characteristic plant communities
- Maint. characteristic wildlife habitat

Strengths

- Regionalized
- Specific to a subclass
- Attributes easily and quickly measured
- Surrounding land use considered

Limitations

- Model development is labor intensive.
- Maximum index value limited by “pristine sites”.