Delaware Wetlands Conference 2014

Science Informs Policy and Practice for Wetlands Protection and Conservation

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www.riparia.psu.edu
Riparia
A center where science informs policy & practice in wetlands ecology, landscape hydrology, and watershed management

Celebrating 20 years!

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Mid-Atlantic Freshwater Wetlands: Advances in Wetlands Science, Management, Policy, and Practice

1 Aquatic Landscapes: the importance of integrating waters
2 Hydrogeomorphic (HGM) Classification, Inventory, and Reference Wetlands
3 Linking Landscape to Wetland Condition: Case Study of Eight Headwaters
4 Hydrology of Mid-Atlantic Freshwater Wetlands
5 Hydric Soils of Mid-Atlantic Freshwater Wetlands
6 Hydrophytes of the Mid-Atlantic Region: Ecology, Communities, Assessment, and Diversity
7 Wetland-Riparian Wildlife of the Mid-Atlantic Region
8 Wetland-Riparian Birds of the Mid-Atlantic Region
9 Assessing Wetland-Riparian Amphibian and Reptile Communities
10 Freshwater Macroinvertebrates of the Mid-Atlantic Region
11 Monitoring and Assessment of Wetlands: Concepts, Case Studies, and Lessons Learned
12 Wetlands Restoration and Mitigation
13 Policy and Regulatory Programs Affecting Wetlands and Waters of the Mid-Atlantic Region
14 Conservation and Management of Wetlands and Aquatic Landscapes: Connectivity
EPA’s Core Elements of Wetlands Program

- Monitoring and Assessment
- Regulatory activities including 401 certification
- Voluntary Restoration and Protection
- Water Quality Standards for wetlands
Delaware Wetlands Conservation Strategy (2008)
A report card ... 

Update wetland inventory maps and improve access to data.

Increase monitoring to provide insight for wetland function and health.

Integrate wetland restoration, creation, enhancement, and protection efforts to ensure efficient use of resources.
Wetlands Inventory
- tremendous abundance of freshwater and estuarine types in Delaware
Wetlands Inventory
- tremendous abundance of freshwater and estuarine types in Delaware
- and you have an excellent, updated inventory!
Upper Shaver’s Creek Subwatershed – Inventory

- Wetlands (NWI + Enhanced)
- Streams
Graph of the basic (and outdated) NWI mapping
Riparian Wetland-Stream Network (n = 94)
Graph of the Enhanced Inventory
Riparian Wetland-Stream Network (n = 299)

- Federal NWI Inventory
- Enhanced Inventory

Abbey Tyrna - Riparia
Wetlands Inventory in Delaware!

Performance = A

Pennsylvania is jealous !!!
How many wetlands are there near Dover Downs?
Update wetland inventory maps and improve access to data.

Increase monitoring to provide insight for wetland function and health.

Integrate wetland restoration, creation, enhancement, and protection efforts to ensure efficient use of resources.
Delaware Wetlands Monitoring and Assessment Schedule by Watershed
Wetlands provide valuable and often irreplaceable services on the landscape. They contribute to our quality of life by protecting us from floods and storm damage, providing habitat for rare plants and animals, and purifying our water. They store water during storms thereby reducing flooding, serve as nursery grounds for commercial fisheries, and provide recreation and education opportunities.

In Delaware, we have lost about half of our original wetlands and many of our remaining wetlands have been degraded by human activities. The St. Jones River watershed has lost over 47% of its wetlands. In the watershed, the average condition of wetlands scored a C for wetland, a B for flats, and a C for tidal. This supports the need to prevent additional loss and focus on improving the health of the remaining wetlands so that they can continue to provide services to the citizens of Delaware.

Wetland health letter grades noted for each wetland type.

- Flat Wetlands
- Riverine Wetlands
- Depression Wetlands
- Tidal Wetlands
- Wetlands Lost
- Water

Wetland health letter grades noted for each wetland type.

For more information:
The full St. Jones Wetland Condition Report is available at:
http://de.gov/dnrecwetlands

Wetlands Outreach Specialist:
Margaret.Pletta@state.de.us
302-739-9939

Delaware Wetlands
Purify
Provide
Protect

Wetlands are regularly flooded by the tides and are some of the most productive ecosystems on earth supplying habitat for important fisheries. They provide coastal populations with critical services by reducing flooding and storm damage. They represent approximately 40% of the watershed’s wetlands.

Ephemeral Wetlands - are regularly flooded by the tides and are some of the most productive ecosystems on earth providing habitat for important fisheries. They provide coastal populations with critical services by reducing flooding and storm damage. They represent approximately 25% of the watershed’s wetlands.

Most of the wetland loss (98%) in the St. Jones River watershed is comprised of flats which are vulnerable due to less regulatory protection. This loss has caused expansive habitat fragmentation in the northeast portion of the watershed.

How wetlands are monitored? Staff from the 116 wetland sites in the watershed with the Wetland Assessment Protocols in 2007-2008.

How wetlands are monitored? Staff from the 116 wetland sites in the watershed with the Wetland Assessment Protocols in 2007-2008.

Tidal Wetlands

Depressions - occur in low lying areas that form depressions such as coastal plain ponds. They are seasonally wet and provide critical habitat for amphibians. Their sample size was too small to assign them a grade for the watershed as they represent approximately 2% of the watershed’s wetlands.

Tidal Wetlands - are regularly flooded by the tides and are some of the most productive ecosystems on earth providing habitat for important fisheries. They provide coastal populations with critical services by reducing flooding and storm damage. They represent approximately 25% of the watershed’s wetlands.

Riverine Wetlands

Riverine Wetlands - occur along streams and rivers and provide storage for floodwaters and groundwater. The water that moves into these wetlands is cleansed before it moves downstream. They form corridors of valuable wildlife habitat. They represent approximately 25% of the watershed’s wetlands.

Flat Wetlands

Flat Wetlands - are regularly flooded by the tides and are some of the most productive ecosystems on earth providing habitat for important fisheries. They provide coastal populations with critical services by reducing flooding and storm damage. They represent approximately 25% of the watershed’s wetlands.

Stressors:
- Ditching, invasive plants, barriers to landward migration, and soil disturbance.

Recommendations:
- Minimize hardened shorelines (e.g., rip rap, bulkhead, roads) adjacent to wetlands.
- Strengthen buffer regulation to allow room for wetlands to move landward with sea level rise.

Riverine Wetlands

Stressors:
- Invasive plants, garbage, filling, and stormwater

Recommendations:
- Enforce buffer regulations to protect wetlands from the stressors above associated with development.
- Ensure enforcement of existing Kent County buffer regulations.

You can do:
- Adopt a watershed friendly lifestyle by reducing or ting the use of fertilizers and pesticides on your lawn. Pollutants travel downstream!
- Work with local land use decisions to improve and reduce building in and too close to wetlands.
- Write to or visit DNR’s St. Jones Reserve.
- www.sacramento.gov/coastal/DONER/Pages/StJonesReserve.aspx

Volunteer at or visit DNREC’s St. Jones Reserve.
Delaware Wetlands Monitoring and Assessment Schedule by Watershed

Performance = A
Riparia’s Reference Wetlands Collection (n = 222)
How do we inventory, assess the ecological integrity, and restore natural resources across geographic scales?

Case Study #1
Watershed prioritization & assessment

Case Study #2
Stream, Wetland, Riparian (SWR) Index: Integrated RAP across aquatic resources

Case Study #3
Floristic Quality Assessment Index (FQAI) to assess condition

LEVEL 1 LANDSCAPE FROM GIS

- Condition assessment from office

LEVEL 2 RAPID FIELD ASSESSMENT

- Refined condition assessment
- Landscape profiles
- Stressor profiles

LEVEL 3 INTENSIVE FIELD ASSESSMENT

- High quality condition assessment
- FQAI, IBI, & HGM
- Functional profiles
- Calibrate 1 & 2
Level 1 – Landscape Watershed Land Use
Watersheds Selected for SWR Sampling
Level 2 – Rapid Assessment Stream, Wetland, Riparian Index

Legend:
- Selected for SWR Sampling
- Limited sampling

Land Cover Cluster:
- 1 - Forest / High Slope
- 2 - Urban
- 3 - Mixed / Low Nodal Var.
- 4 - Forest / Low Slope
- 5 - Agriculture
- 6 - Mixed / High Nodal Var.

Physiographic Provinces:
- COASTAL PLAIN
- PIEDMONT
- PLATEAU - GLACIAL
- PLATEAU - NON-GLACIAL
- RIDGE & VALLEY

Study Region

[Map showing various waterways and landmarks with color codes for land cover and physiographic provinces]
Model Used for Level 2-SWR Index

Stream-Wetland-Riparian (SWR) Index

- SHA Score
- Incision Ratio
- # Stream Stressors

Floodplain-Wetland Condition

- Buff 0-300 m
- Basal Area
- Invasives
- # FP-WL Stressors
Stream and Wetland Site Assessment
Comparing two watersheds

Legend

SHA Score
- Poor (0 - 0.25)
- Marginal (0.25 - 0.5)
- Sub-optimal (0.5 - 0.75)
- Optimal (0.75 - 1.0)

Land Cover Class
- Water
- Suburban
- Urban
- Rock
- Transitional
- Forest
- Pasture
- Row crop
- Emergent wetland

Cluster
- Forest/high slope
- Urban
- Mixed/low NV
- Forest/low slope
- Agriculture
- Mixed/high NV
Tiered Aquatic Life Use (TALU) as metric of Water Quality Standards (WQS) for Wetlands

- Used in stream monitoring programs
- Add precision and consistency to assessments
- Define categories of condition based on data
- Set restoration goals and standards
Level 3 Intensive Assessment

Floristic Quality Assessment Index (FQAI) & Plant Index of Biological Integrity

Sarah Chamberlain - Riparia
FQAI Calculator Example

mawwg.psu.edu
or
www.riparia.psu.edu (under products)
TALU Scoring based on 87 headwater complex wetlands in Ridge & Valley, PA

Sectioning Based on CART Groupings

Rapid Assessment Score

IBI Score (0-100)

SWH

WH

RWH1

RWH2

LQWH

0 10 20 30 40 50 60 70 80 90 100

0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100

Rapid Assessment Score

IBI Score (0-100)
Tier 1 wetlands are those that are capable of supporting and maintaining a high quality plant community in terms of species composition, diversity, and functional organization. Although not pristine, wetlands in this category are typically thought of as reference wetlands and can be used to establish performance criteria for mitigation sites.

- Annuals, non-native, and invasive sp typically < 10%
- FQAI score ≥ 40
- Predominately forested/Forest setting
- Tolerant cover < 30%
- Diverse assemblage of vascular cryptogams with high (≥ 6) coefficients
- No *Phalaris arundinacea*
Tier 1
Superior Wetland Habitat
Tier 5 consists of wetlands that are seriously degraded and that do not have a reasonable potential for regaining the capability of supporting and maintaining a balanced, integrated, adaptive plant community.

- Annuals, non-natives, and invasives present with many dominant
- FQAI scores <20
- Trees 5% of flora
- Tolerant cover 70-80%
- No vascular cryptogams
- *Phalaris* is dominant

Tier 5 Limited Quality Wetland Habitat
Tier 5
Limited Quality
Wetland Habitat
Delaware Wetlands Conservation Strategy (2008)

Update wetland inventory maps and improve access to data.

Increase monitoring to provide insight for wetland function and health.

Integrate wetland restoration, creation, enhancement, and protection efforts to ensure efficient use of resources.
Hydrogeomorphic (HGM) Assessments of Mitigation Sites Compared to Natural Reference Wetlands in Pennsylvania

Naomi A. Gebo - Robert P. Brooks

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Abstract The U.S. Environmental Protection Agency and U.S. Army Corps of Engineers completed revisions to the Mitigation Rule of the Clean Water Act in 2008. These revisions encourage states to carry out mitigation in a watershed context, prioritizing mitigation site design and placement by overall watershed need, to the extent appropriate and practicable (33 C.F.R. 332.3(c)). States are expected to establish monitoring programs and measurable performance standards for mitigation wetlands. In Pennsylvania, hydrogeomorphic (HGM)-based assessments involving 222 reference wetlands were used to compare mitigation wetland performance. For this study, 72 mitigation wetlands were sampled in 2007 and 2008 from three categories – Pennsylvania Wetland Replacement Program sites, Pennsylvania Department of Transportation mitigation banks, and permit required compensatory mitigation sites. Mitigation wetlands were intensively sampled using a Level 3 - Intensive methodology developed by Riparia. Field and GIS computed variables were used to derive the score of 10 HGM functional capacities. Overall, mitigation sites displayed lower potential to perform a characteristic wetland function than reference wetlands. The greatest discrepancy, while mitigating sites showed the amount of difference from reference scores. Mitigation site size, age, and type were not significant factors in functional capacity index scores.

Keywords Hydrogeomorphic functional assessment • Mitigation rule • Compensatory mitigation • Mitigation performance

Introduction
Compensatory mitigation is intended to replace the areal extent and, ideally, the functions of the impacted wetlands. The latter has proven elusive to assess and difficult to achieve. According to recent reports, wetland mitigation has resulted in a net increase in wetland area nationwide (Dahl 2006). However, functional replacement is not necessarily associated with these gains in wetland area. The need to establish a high degree of function across a variety of forms has long been neglected in the mitigation process. There is wide consensus among researchers that mitigation is not adequately compensating for natural wetland losses structurally, functionally (Race and Fonseca 1996; Misch and Wilson 1996; Zedler and Callaway 1999; Kentula et al. 2004), or with regard to temporal lags in functional performance (Garibaldi and Hintz 2004; Brooks 2009). Gebo and Brooks 2012

How do we learn to build better wetlands? By using data from reference wetlands for mitigation design and performance!
Comparison of Functions in Reference and Mitigation Wetlands in Pennsylvania

Average of 10 HGM Functions

Average Function Score

Mitigation  Reference  Reference Standard

*
Wetland “Homogeneity” Model

Reference Population

Goal for Restored and Created Populations

Disturbed Population

Created Population

Equivalence

Degradation

Restoration

Brooks et al. 2005
Variables for mitigation design and performance

• Selected ground-based variables are used in design

• All ground-based variables are used to assess performance

• Landscape variables are relevant to site selection
Web-interface displays data in tiles and tables

<table>
<thead>
<tr>
<th>Variable Description</th>
<th>N</th>
<th>Min</th>
<th>Avg</th>
<th>Max</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBIOMASS estimated total biomass</td>
<td>34</td>
<td>75.68</td>
<td>156.39</td>
<td>381.79</td>
<td>67.83</td>
</tr>
<tr>
<td>VTREE estimated % cover of trees</td>
<td>34</td>
<td>0</td>
<td>0.06</td>
<td>0.32</td>
<td>0.08</td>
</tr>
<tr>
<td>VSHRUB estimated % cover of shrubs</td>
<td>34</td>
<td>0</td>
<td>18.53</td>
<td>81.22</td>
<td>16.52</td>
</tr>
<tr>
<td>VHERB estimated % cover of herbs</td>
<td>34</td>
<td>31.25</td>
<td>78.78</td>
<td>100</td>
<td>20.25</td>
</tr>
<tr>
<td>VCWD-BA coarse woody debris est BA</td>
<td>34</td>
<td>0</td>
<td>69.2</td>
<td>633.25</td>
<td>129.12</td>
</tr>
</tbody>
</table>
Estimates above-ground vegetative biomass using percent cover of tree, shrub and herbaceous layers. This variable is used as a relative estimate of the ability of the site to temporarily sequester nitrogen in above-ground biomass. It is comprised of three sub-variables: VTREE, VSHRUB and VHERB; no dimensions.

Variable Tile

Variable Tile (Stacked)

Reference sites
Reference standard sites
DEPRESSION, SEASONAL

SLOPE
Reference Wetlands Database – Riparia/MAWWG
Status & Use

Pennsylvania (Riparia) – complete, online
Delaware (DNREC) – data compiled, next
West Virginia (DNR) – data acquired, after DE
Virginia (VIMS) – after WV
Maryland – no known reference data

Publicly available, interactive website – to enhance mitigation, restoration, and condition assessments
Delaware Wetlands Conservation Strategy (2008)

Coordinate information and resources sharing among wetland protection programs, professionals, and agencies.

Enhance education and outreach efforts to broaden wetland stewardship among all wetland stakeholders.

Work with partners to provide support for existing regulatory programs for protection of wetlands that are not covered.
Bog Turtle Recovery Areas in PA & DE

Conservation Bank-compatible Landscapes

- A key part of a Habitat Conservation Plan (HCP)
- Landscapes within the larger Service Area most likely to support bank connectivity, minimize bank isolation over time
- Strongly supported by the regulated community (as a way providing certainty)
Proposed NSF project on predicting water sustainability from 2010-2060 (Penn State, Rutgers, DRBC, DNREC)

Would collaborate with and fund DNREC to re-sample reference wetlands in St. Jones River watershed
Welcome

The Mid-Atlantic Wetlands Workgroup (MAWWG) is currently funded through a Wetland Program Development Grant from the U.S. Environmental Protection Agency Region III to Riparia at The Pennsylvania State University.

MAWWG consists of participants representing federal and state regulatory personnel and scientists from the following states: Delaware, Maryland, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Virginia, and West Virginia. This focused membership includes both users and developers of monitoring and assessment tools.

Announcements
- Delaware Wetlands Conference 2014 (Save the Date and Call for Abstracts)
- Delaware: Broadkill Watershed Website
- Mid-Atlantic Floristic Quality Index Calculator
Mid-Atlantic Wetland Work Group – 12 Years!

- Purpose - Forum for states in the Mid-Atlantic to facilitate development and implementation of wetland monitoring and assessment strategies and integration into wetland program management.

- Goals:
  - Development and implementation of state wetland monitoring strategies and methods
  - Integrate wetland monitoring activities into water assessment programs
  - More effectively manage waters on a watershed basis
  - Integrate best available science into wetland program decision-making
State and Federal Partners

- Delaware Department of Natural Resources and Environmental Control
- United States Environmental Protection Agency
- Pennsylvania Department of Environmental Protection
- New Jersey Department of Environmental Protection
- Maryland Department of Natural Resources
- Virginia Department of Environmental Quality
- Ohio EPA
- US Army Corps of Engineers
Academic Partners

- Pennsylvania State University
- Virginia Institute of Marine Science
- West Virginia University
- Virginia Tech
- Kenyon College (Ohio)
Delaware Wetlands Conservation Strategy (2008)

Coordinate information and resources sharing among wetland protection programs, professionals, and agencies.

Enhance education and outreach efforts to broaden wetland stewardship among all wetland stakeholders.

JUST LOOK AT THEIR WEBSITE ! ANOTHER A !

Work with partners to provide support for existing regulatory programs for protection of wetlands that are not covered.
Delaware Wetlands Conservation Strategy (2008)

Coordinate information and resources sharing among wetland protection programs, professionals, and agencies.

Enhance education and outreach efforts to broaden wetland stewardship among all wetland stakeholders.

Work with partners to provide support for existing regulatory programs for protection of wetlands that are not covered.
Delaware recently formed Wetlands Advisory Committee

(I served as Chair of the PADEP’s Wetlands Advisory Committee for 8 years – built lots of rapport, which helped balance interests of regulators, regulated & public)

**Performance = B**

Having a strong State Wetlands Program provides more local control than relying on just federal programs.

Essential to conserve the “free” ecosystem services provided by wetlands to society
What are those “free” ecosystem services?

Research studies and surveys have shown that citizens and the leaders and employees of corporations want and benefit from high quality water resources, including wetlands:

Higher quality of life
Enhanced outdoor recreational opportunities
Higher quality water supplies for drinking water, water for agriculture and water for energy and industrial uses
Reduction in flood damage
Applying science leads to tools that help develop policies, and assist managers in conserving wetlands in practice

- Reference wetlands database – multiple uses

- Condition assessments – wetlands, streams, watersheds, biological indicators of concern

- Can lead to formulation and adoption of Water Quality Standards for Wetlands

- Defensible guidance for policy decisions (e.g., Rapanos Significant Nexus – linking wetlands, streams, and riparian areas)
**Rapanos vs. United States**

- Supreme Court decision(s) now require an analysis of whether a wetland in question provides a **significant nexus** to traditionally navigable waters.
- Justice Kennedy explained “…jurisdiction over wetlands depends upon the existence of a **significant nexus** between the wetlands in question and navigable waters in the traditional sense."
- "...perform critical functions related to the integrity of other waters—functions such as pollutant trapping, flood control, and runoff storage."
- Guidance documents addressing **policy** (USEPA & Corps 2007) and **practice** (Corps & USEPA 2007, USEPA & Corps 2011)
Rapanos - Definitions of Features

• Abutting Wetland
  – Not separated from the tributary by an upland berm
  – Always *jurisdictional*

from Emily Brooks Dolbin
Stream Order & Wetland Connections

- **RPW (Perennial)**
- **RPW (Intermittent)**
- **Non-RPW (Draining only uplands)**
- **Non-RPW (erotional)**
- **Non-RPW (low duration flow)**
- **Non-RPW (with wetland upstream outside of study area)**
- **RPW (Perennial) (with adjacent wetland)**
- **Non-RPW (with adjacent wetland)**
Working with Delaware and DNREC ...

- Partner in MAWWG activities (12\textsuperscript{th} year)
- Developed Habitat Conservation Plan for bog turtles
- Compiling DE reference wetlands data for database
- Proposed NSF project on water availability in DRB
- Potential projects with Wm Penn Foundation sponsored work in DRB

Overall, Delaware has a strong wetlands program, with more exciting activities in the future = A
Future of Wetlands Conservation …

- Legal definition of wetlands will remain constant
- Delineation methodology will remain virtually unchanged
- Implementation of HGM and IBI tools for assessing wetland condition
- Improvements in wetlands mitigation and restoration
- Development and implementation of WQS for wetlands
- Watershed reporting of wetland condition by states
Thank you for listening!
All the best!