Creating Hydrologic Performance Standards for Wetland Mitigation Using Your Hydrologic Data

Yes, yours. You, right there

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My task today is to convince you of the following:

Wetlands are wet

Plants need water
Overview

- Mitigation Background
- Hydrologic Performance Standards
  - Example
  - Effectiveness
- Plant Sensitivity to Hydrologic Variation
- What are we missing? – Data!!!!!
Evaluating Mitigation

ECOLOGICAL ASSESSMENT OF COMPENSATORY WETLAND MITIGATION
Final Report
Assistance Agreement #CD-98752301-0
August 2008

Wetlands in Washington State
Volume 1: A Synthesis of the Science
Washington State Wetland Mitigation Evaluation Study
Phase 2: Evaluating Success

SUCCESS OF CORPS-REQUIRED WETLAND MITIGATION IN NEW ENGLAND
Paul Minkin
Ruth Ladd
U.S. Army Corps of Engineers
New England District
3 April 2003

INTEGRATED WETLAND ASSESSMENT PROGRAM.
Part 5: Biogeochemical and Hydrological Investigations of Natural and Mitigation Wetlands
Evaluating Mitigation Sites – Ohio EPA

Natural and mitigation wetlands can be substantially different
- Significantly drier/wetter
- Lower Vegetation Index of Biotic Integrity
- Lower biomass
- Lower invertebrate species richness
- Lower amphibian biotic integrity

“Mitigation is creating a new subclass of wetlands across the landscape”
Revised Regulation - 2008

“Designed to improve the effectiveness of compensatory mitigation to replace the lost aquatic resource functions and area...”

- Requires measurable and enforceable ecological performance standards
Creating Performance Standards

Eggers 2015

- Monitoring Methodology
- Comparing hydrology data to antecedent precipitation
- Target Hydrology for Specific Wetland Plant Communities
  - Seasonally flooded basins
  - Floodplain forests
  - Hardwood swamps
  - Wet meadows
  - Fens/bogs
  - Marshes

“The objective is not to establish the minimum wetland hydrology; rather, it is to establish the optimum hydrology for targeted wetland plant communities and associated functions and services”

DRAFT MEMORANDUM

To: Regulatory Branch Staff
Date: April 1, 2015
Subject: Target Hydrology for Compensatory Mitigation Sites
Plant Community Development and Hydrologic Performance Standards

BUT...what happens when the hydrologic regime is successfully restored?

If restored hydrologic regime is not similar to reference sites, mitigation sites suffer.
Does hydrologic equivalence between reference and restored wetlands lead to plant community similarity?

How sensitive are plant communities of restored wetlands to hydrologic variation?
Success Criteria

Water table in restored area matches reference wells
(mean $\pm$ 1 standard deviation of water table in appropriate reference areas) (3 inches of error allowed)
Add data from manuscript
Photos of each wetland type?

Riparian

Meadow

Fen
Nothing groundbreaking here: Wetlands are wet! Plants need water!
Creating Hydrologic Performance Standards

Which aspects of the hydrologic regime are most important for different plant communities?
- annual average, late summer average, etc

How close must the hydrologic metrics be to the reference to get the desired plant community?
Higher probability of having floristic similarity if there is hydrologic similarity?
Hydrologic Performance Standard =
\[ f(\text{Reference Hydrologic Regime}) \]

Caveat: We must identify the ecologically relevant aspect of the hydrologic regime for each wetland type
Axis 1 Distance to Reference

Annual Water Depth Difference From Reference Average
Axis 1: Distance to Reference

Annual Water Depth Difference From Reference Average

Fen
Sensitivity = 0.40

Meadow
Sensitivity = 0.54

Riparian
Sensitivity = 0.26
Hydrologic Performance Standard = 

\[ f(\text{Reference Hydrologic Regime, Sensitivity of wetland type}) \]
What are we missing? Data!!!!

<table>
<thead>
<tr>
<th>Wetland Structure and Functions</th>
<th>$n^a$</th>
<th>Variables Measured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrology</td>
<td>32</td>
<td>Water level, flooding regime, water storage</td>
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<tr>
<td>Biological components</td>
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<td>Vertebrates</td>
<td>166</td>
<td>Abundance, density, species richness, occupancy</td>
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<td>Macroinvertebrates</td>
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<td>Plants</td>
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<td>Biogeochemistry</td>
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<td>Carbon storage and cycling</td>
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<td>Soil total and organic carbon, respiration rate, mineralization rate</td>
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<td>Nitrogen storage and cycling</td>
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<td>Soil total and organic nitrogen, denitrification, and nitrification</td>
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<td>Phosphorus storage</td>
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<td>Soil total and organic phosphorus, Ca-Fe-Al bounded phosphorus</td>
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<td>Other elements storage</td>
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<td>Salinity, soil Fe, Al, Ca, K, Mn, Mg, water dissolved oxygen</td>
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<td>Organic matter accumulation</td>
<td>177</td>
<td>Soil organic matter, bulk density, soil texture, soil moisture</td>
</tr>
</tbody>
</table>

Only the most frequently measured variables were included (see Tables S1 and S2, for full description of the variables measuring restoration performance).

*a$n = number of variables used to plot each chronosequence.

doi:10.1371/journal.pbio.1001247.t001
Using existing data to create hydrologic performance standards

Do hydrologic metrics between restored and reference sites in existing datasets explain wetland plant community development across many wetland types?
Where might we get this data?

Federal sources:
- NPS
- US ACE
- Individual research programs
- NGO’s (vernal pools, prairie potholes)

Society of Wetland Scientists?

You?
Thanks!

Questions/Comments/Feedback?
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