

Sediment and Hg Movement in the South River

Geomorphology and Transport Modeling

South River Science Team Meeting 04-14-04

N Grosso, DuPont

South River Challenge

The goal is to reduce Hg levels in fish to acceptable levels for consumption

An approach to the problem:

- Determine the significant sources that result in elevated Hg concentrations in fish tissue
- Rank them in terms of significance and remediation feasibility/net benefit
- Select appropriate actions, implement and monitor

Conceptual System Model

Sediment and Floodplain Soils are a Potential Sources of Hg to System including:

- River channel sediments
- River banks
- Floodplain soils
- Mill pond and backwater sediments
- Wetland Sediments

Uncertainties

Water, Sediment and associated Hg

- What is the dynamic of water and sediment movement and sediment deposition in the South River?
- Do we have the same sediment balance today as twenty years ago? Fifty years ago?
- Based on current data and what is known about the system, can we recreate the current distribution of Hg in sediments?
- Which of the sediment environments contains mercury that is significant as a potential source of MeHg?

Complementary Approach

- Fluvial Geomorphology
 - Study landform changes through erosion and sedimentation - current and past conditions
 - “Particle Tracking”
 - Empirical grounding for numerical models
 - Qualitative and quantitative predictive capabilities
- Numerical Sediment Modeling
 - Understand historic and current hydrodynamics of the system and net sediment transport
 - Prediction capabilities to evaluate remedial alternatives including hybrid solutions
 - SW and Sediment transport tied to Hg transport
 - Modeling wetting and drying in the floodplain

Numerical Modeling Consultants

- Hydroqual, Inc.
 - TMDL/WASP 5 Modeling for Delaware River PCBs (current)
 - Numerous water quality projects and TMDL models
 - Floodplain Modeling of the Housatonic R.
- Limnotech, Inc. (LTI)
 - Modeling of Hudson R., Fox R./Green Bay for Regulatory Agencies
 - Everglades Hg Research Program - Planning Support
 - Mercury Screening Model for Lake St. Clair
 - Waukegan Harbor PCB Modeling and Exposure Assessment

Transitional Floodplain

N (m ⁻²)	D (m)	H (m)
0.14	0.266	20.4

-  Red maple swamp
-  Shallow emergent marsh
-  Shrub swamp
-  Transitional floodplain forest
-  Wet meadow

-  Agricultural Field
-  Black ash-red maple
-  Cultural grasslands
-  Deep emergent marsh
-  High-terrace floodplain forest
-  Red oak-sugar maple transition forest
-  Rich, mesic forest
-  Successional northern hardwoods

Hydroqual, Inc.

Vegetation Type

Red Maple Swamp

N (m ⁻²)	D (m)	H (m)
30	0.026	1.927

Shallow Emergent Marsh

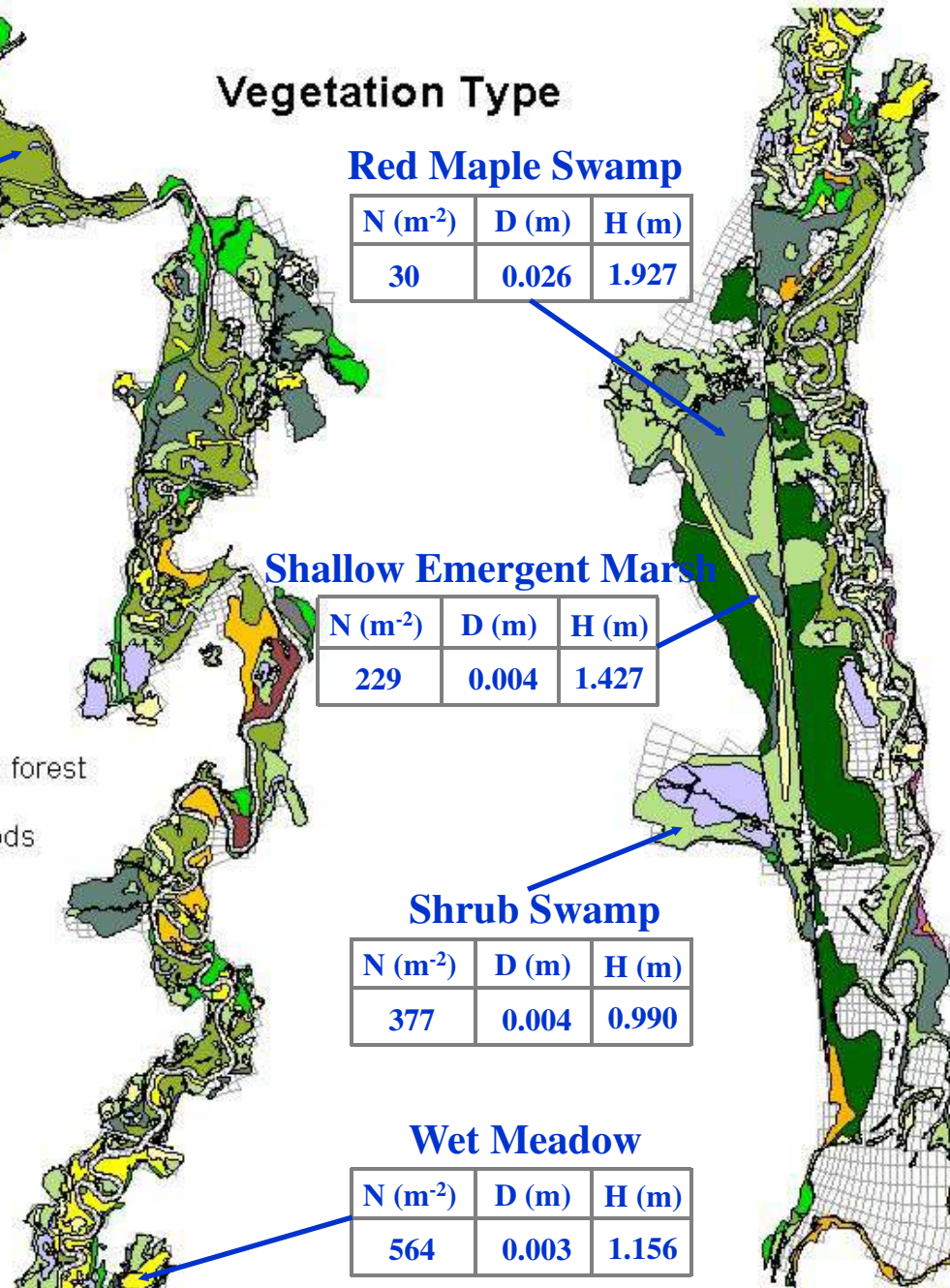
N (m ⁻²)	D (m)	H (m)
229	0.004	1.427

Shrub Swamp

N (m ⁻²)	D (m)	H (m)
377	0.004	0.990

Wet Meadow

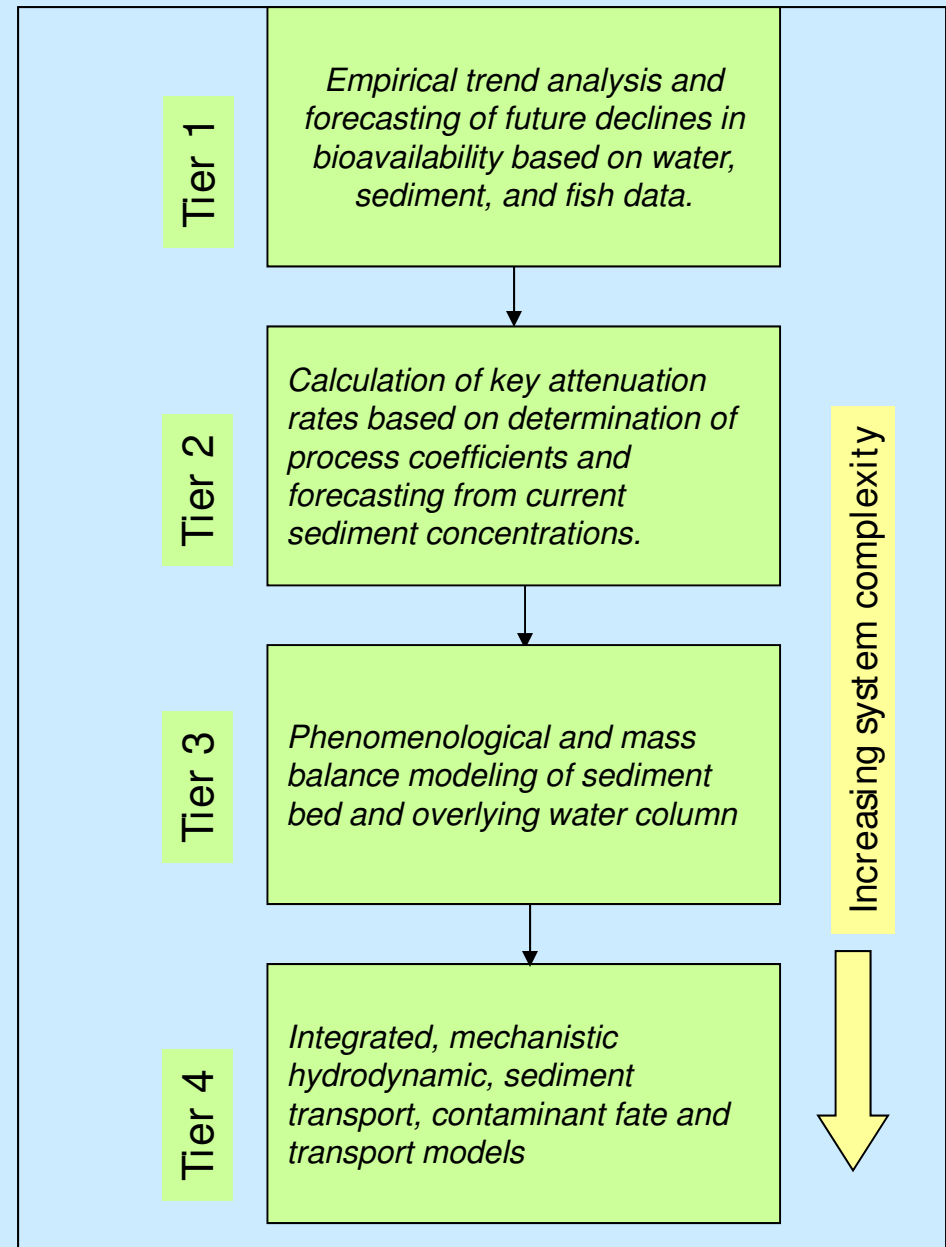
N (m ⁻²)	D (m)	H (m)
564	0.003	1.156



“Transport Modeling” (LTI)

Analysis Complexity Can Match the Site

- Tier 1: Empirical models of trends
- Tier 2: Attenuation rates, key process coefficients (development of conceptual model)
- Tier 3: Phenomenological and mass-balance modeling
- Tier 4: Mechanistic models of hydrodynamics, sediment transport, contaminant fate and transport



Recommended Next Step

- Request Proposal from Hydroqual, Inc.
 - What are the main processes that resulted in the current distribution of Hg (projection from 1920s to present and back)?
 - What significant data gaps exist that must be filled to answer this question?
 - Format proposal in phases
 - Work with Geomorphologist for “the other” perspective and to optimize data collection/evaluation

Geomorphology Reconnaissance

Jim Pizzuto, University of Delaware

- Preliminary Geomorphological evaluation underway
- Land-based one day tour of the river on March 16, 2004