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

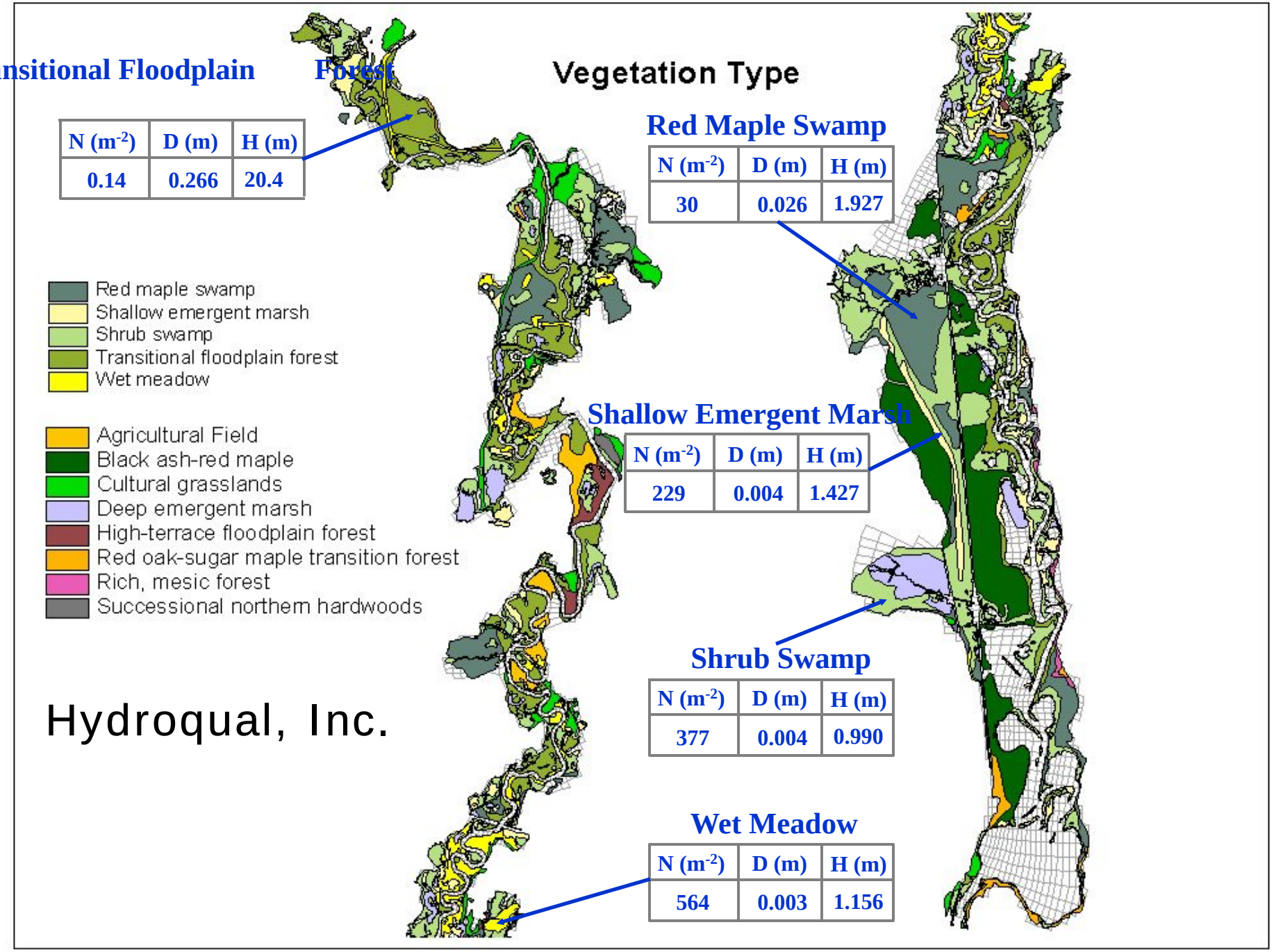
- What is the dynamic of water and sediment movement and sediment deposition in the South River?
- Do we have the same sediment balance today as twenty years ago? Fifty years ago?
- Based on current data and what is known about the system, can we recreate the current distribution of Hg in sediments?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

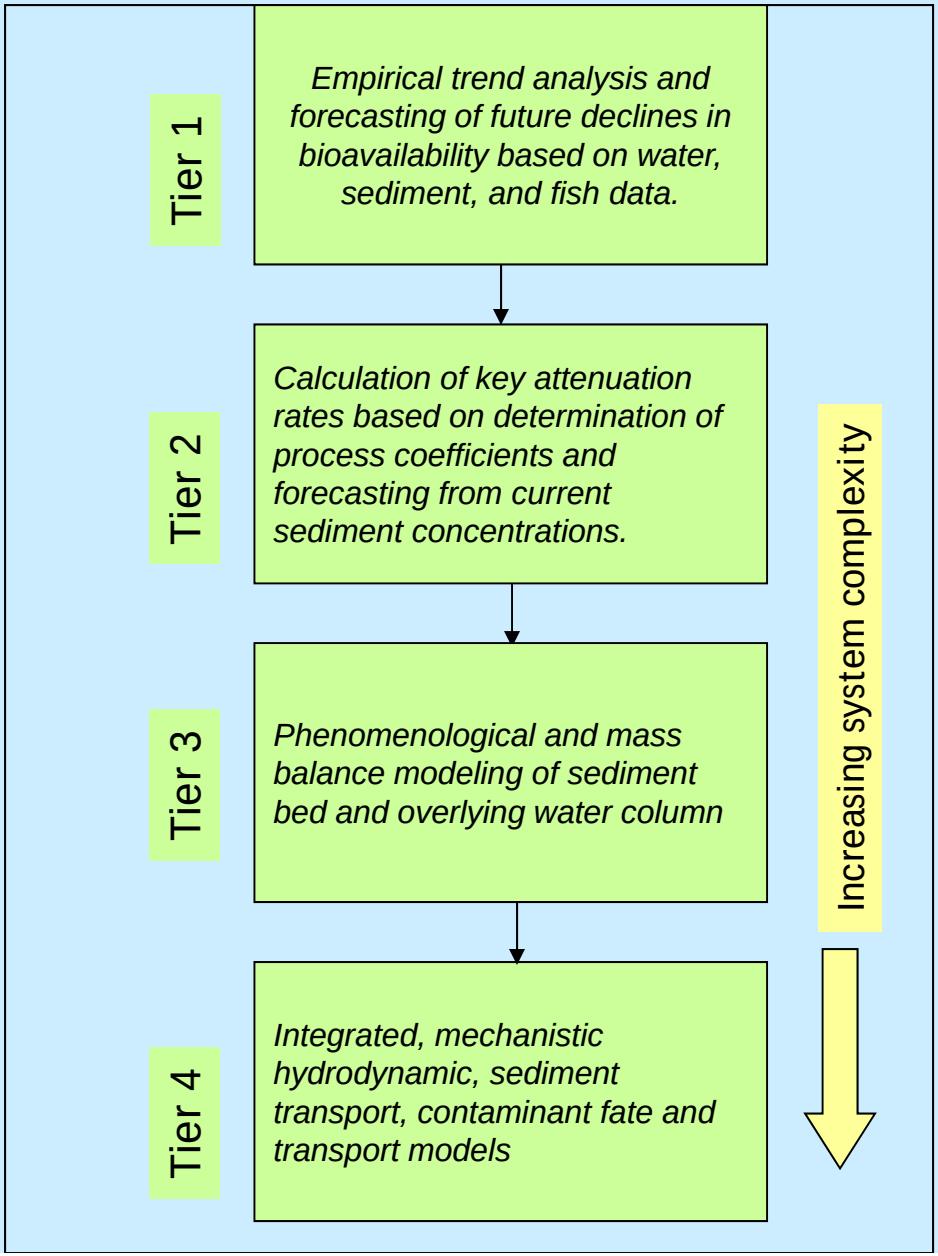
Numerical Modeling Consultants

- 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


Vegetation Type
Transitional Floodplain Forest
N (m-2) D (m) H (m)
0.14 0.266 20.4
Red Maple Swamp
N (m-2) D (m) H (m)
30 0.026 1.927
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
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
Hydroqual, Inc.

“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