Nutrient & Watershed Research at Atlantic Ecology Division, Narragansett

Understanding & Managing Environmental Change

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http://epa.gov/sciencematters/ecosystem/nutrients-gansett.htm

Regional Urbanization & Watershed Management

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Disturbance & Enhancement framework

Hypothetical questions from a new "watershed CEO".

• How did we get into this mess ?
• What is the current situation ?
• Where do we want to go ?

Natural Resources Sustainable Waters

Social Context

Human Outcomes

Environmental Governance Behavior

Historical Watershed Disturbances & Enhancements

•Physical
•Chemical
•Biological

Biophysical Context

Ecosystem Structure

Ecosystem Function

Social Science Research

Environmental Research

Drivers of Change
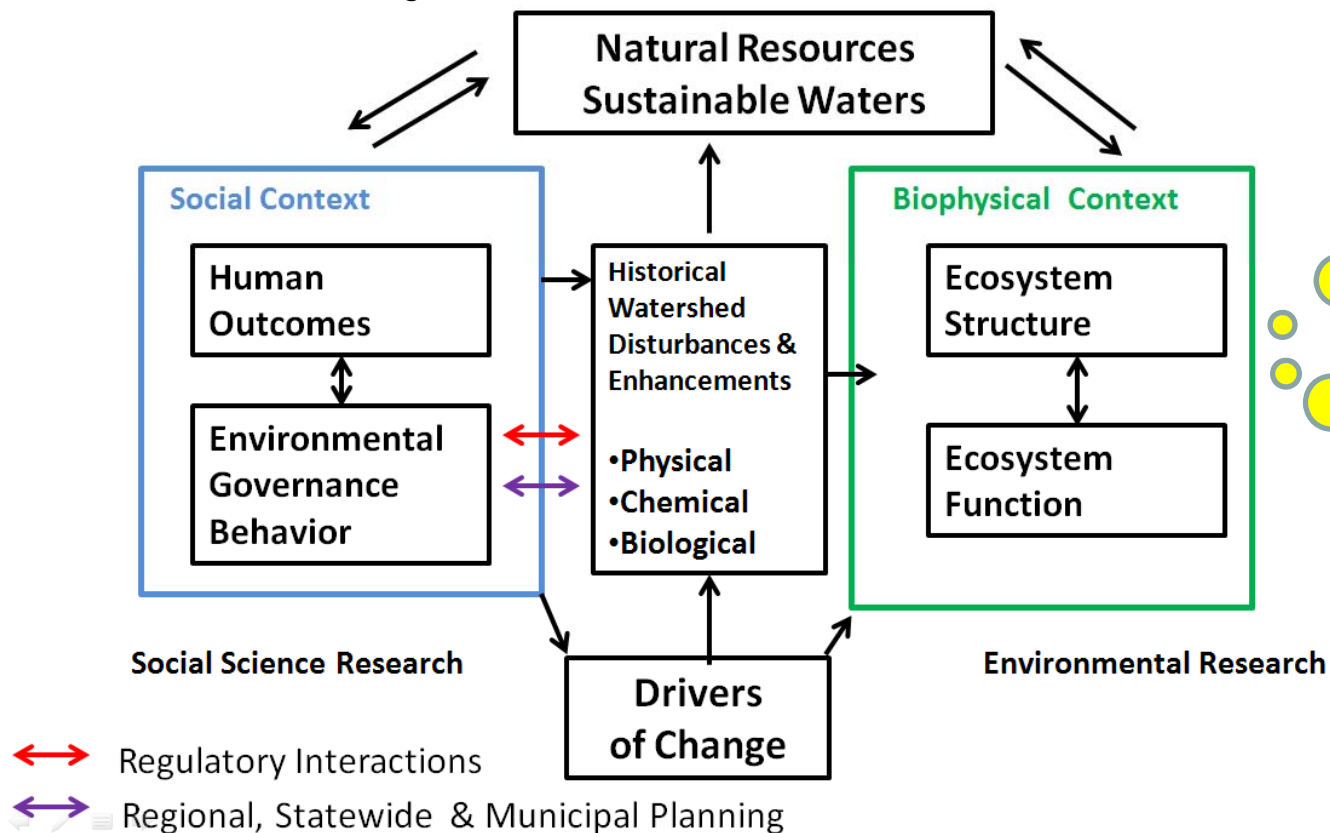
How can R&D results inform key nodes in environmental governance networks, at multiple scales ?

Can our R&D inform multi-media (air, land & water) & multi-scale policy adjustments that collectively can contribute more resilient solutions?
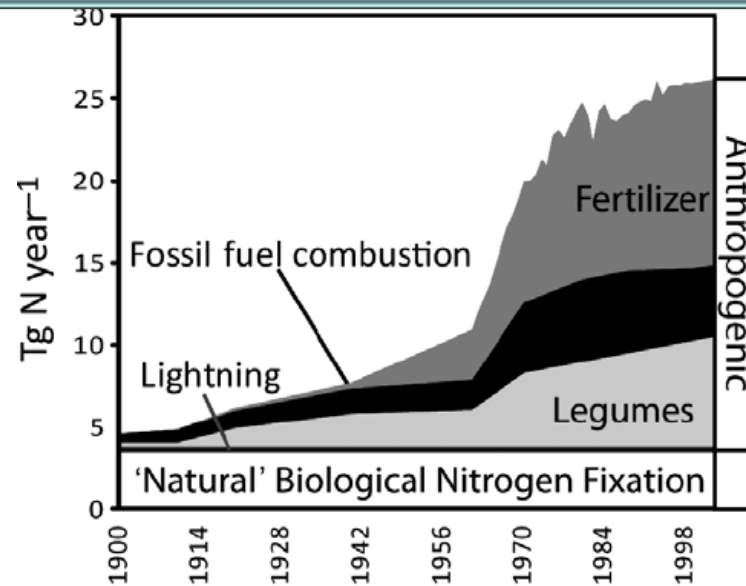
←→ Regulatory Interactions
←→ Regional, Statewide & Municipal Planning

2

History of nitrogen fixation in coterminous U.S.A, Steep nitrogen loading increases to Narragansett Bay begins around 1850 along with urbanization.
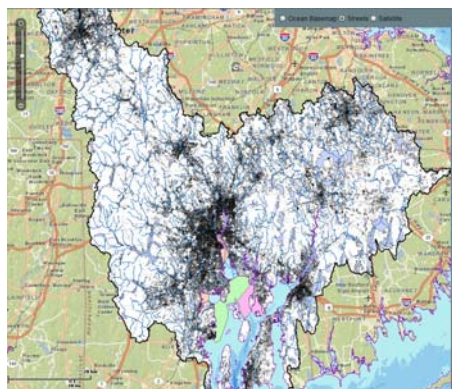
EPA www.epa.gov/research

5X ▲ TN

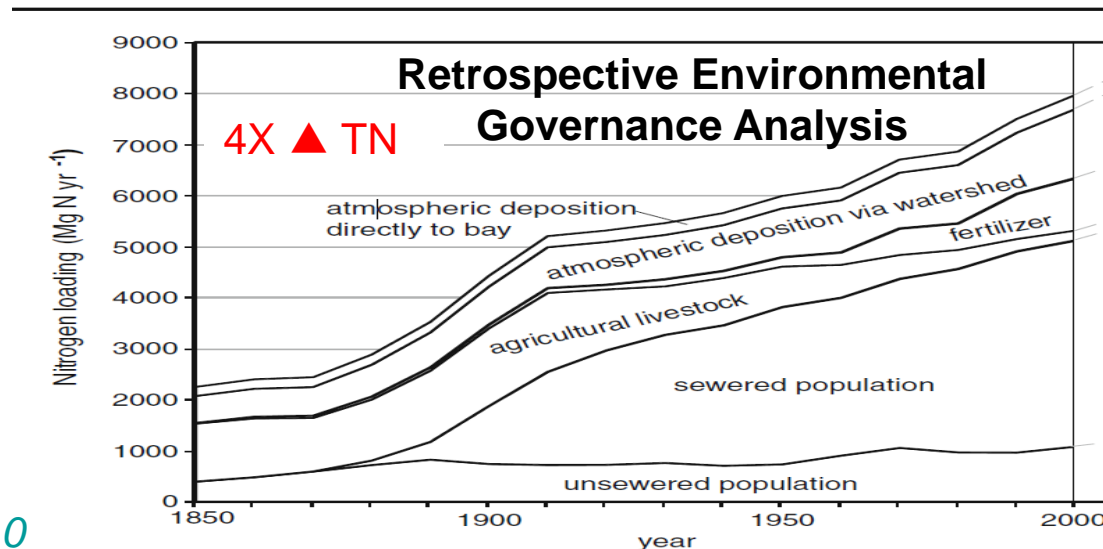**Trends in Nr Loading:** *Coterminous U.S.A.*
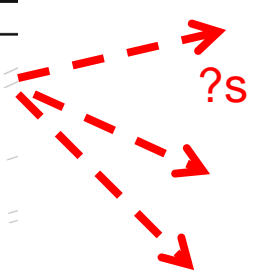
Compton et al. 2011 Ecology letters

Future Governance Decisions

?s

Narragansett Bay & Watershed
Vadeboncoeur et al. 2010

4X ▲ TN

Retrospective Environmental Governance Analysis

Use of Timeline JS to document governance history
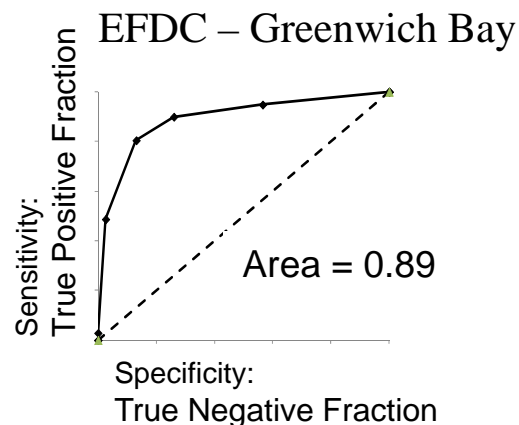
Episodic Hypoxia:
Observations & Model Results

- Low Dissolved Oxygen [DO] Observations from:
  1) moored instrumentation (2001 to present)

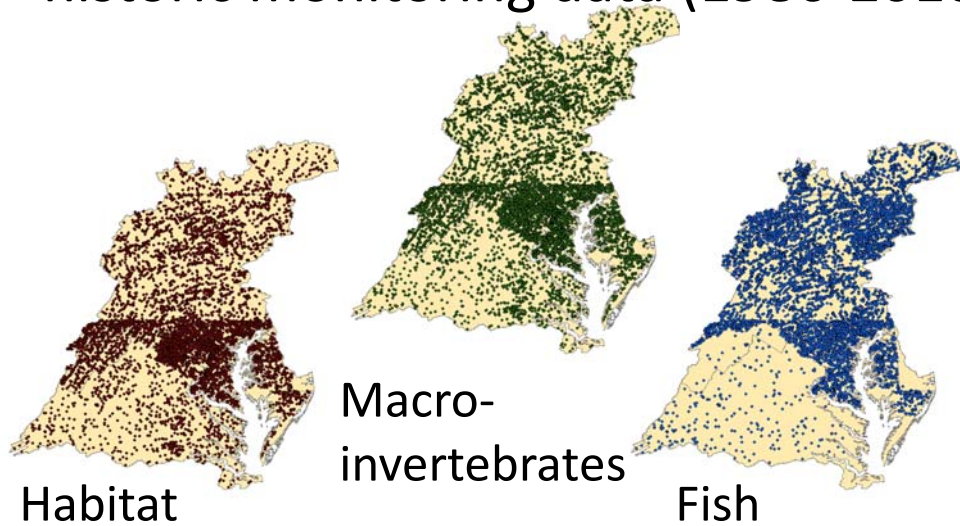- 2) concentrations of Mo in surficial estuarine sediments and sediment cores at sensitive locations

Greenwich Bay - 2004

Greenwich Bay - 2006
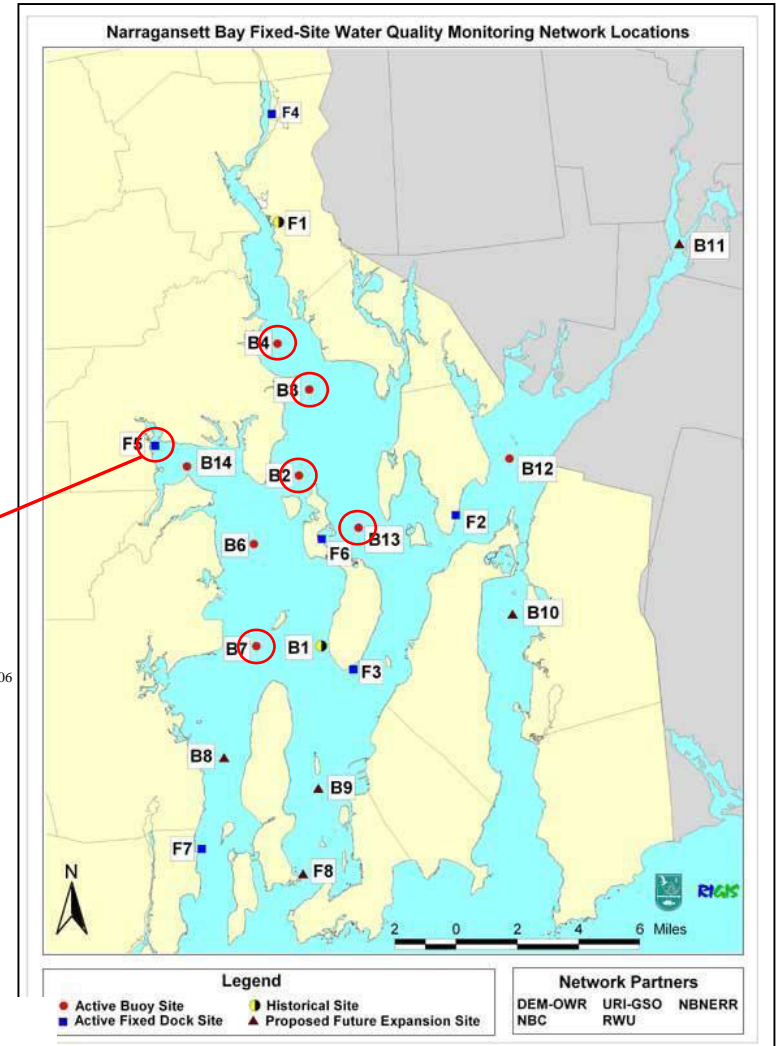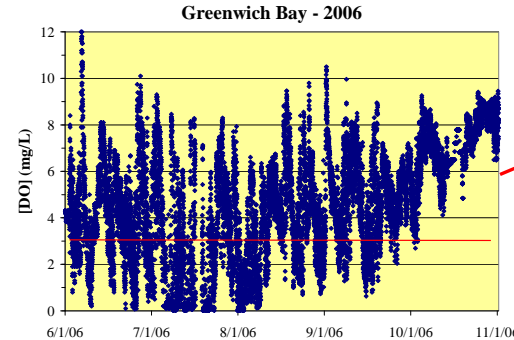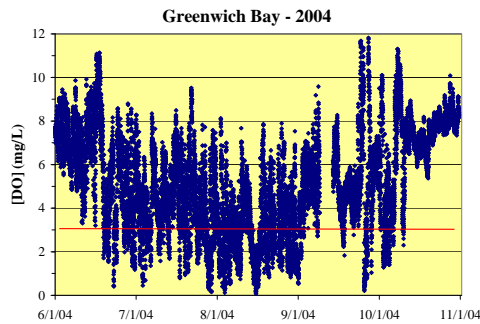
Modeling Contemporary [DO] < chronic & acute of 4.8 mg / l

Estuarine Water Qualtiy Model (EFDC)

• estimates the number of hypoxic days, at different locations and depths in the Bay.

• When coupled to EPA regulatory water quality model (WASP) we may get greater precision

EFDC – Greenwich Bay

Sensitivity: True Positive Fraction

Area = 0.89

Specificity: True Negative Fraction

Narragansett Bay Fixed-Site Water Quality Monitoring Network Locations

Legend
- Active Buoy Site
- Active Fixed Dock Site
- Historical Site
- Proposed Future Expansion Site

Network Partners
DEM-OWR   URI-GSO   NBNERR
NBC   RWU

Chesapeake Bay watershed
historic monitoring data (1986-2010)

Habitat

Macro-
invertebrates

Fish

Stormwater BMP inventory (in progress)

Predictive models of
urbanization effects and
moderating influence of natural
and constructed green
infrastructure for streams and
rivers in CB watershed

N. Detenbeck/S. Cox/J. Morgan - poster session

SSWR 4.2.B.4 Assessment of environmental outcomes of alternative growth scenarios (smart-growth/LID alternatives) to inform MD county-level planning in the Chesapeake Bay watershed GLB RARE <=> ORD GI project (IA w USGS)

WATERSHED

REGION
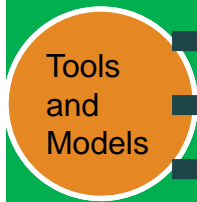
- Customize urban growth scenarios to reflect land protection and Smart Growth policies, priority objectives in two target MD counties;
- models with loose coupling to NCSG transportation models;
- Automate computation of environmental metrics on each of 100+ simulation runs produced for every scenario probability of environmental changes.
  – E.g.,Natural green infrastructure fragmentation, forest conversion, annual nitrogen, phosphorus, and sediment loads, stream community and habitat condition (w SSWR 4.2.B.1).

Tools and Models

Interagency agreement: USGS (P. Claggett)/EPA (N. Detenbeck)

WMOST: Watershed Management Optimization Support Tool

Problem: Helping communities reduce water resources risks in a cost-effective manner through an integrated water management approach

Response

- Developed decision support tool with user-friendly interface

  - Simultaneously explore management options for wastewater, drinking water, conservation, stormwater (green infrastructure)
  - Optimize options w respect to cost given target flows
  - Presented β-version to stakeholders in Region 1 workshop
  - Partnered with communities in tool demonstration pilots

- Version 2 in progress (Region 1 RARE project)

  - Hydrology module to automate import of USGS compiled long-term HSPF model outputs, evaluate mgt options over range of historic climate variability
  - BMP module linked w EPA SWMM model via SUSTAIN to simulate long-term performance
  - Flooding module to evaluate moderation of flood-associated risks and costs by green infrastructure
  - Designed to be compatible with EPA Region 1 OPTI-TOOL to optimize BMP selection for nutrient targets

- Future additions planned: Water Quality module
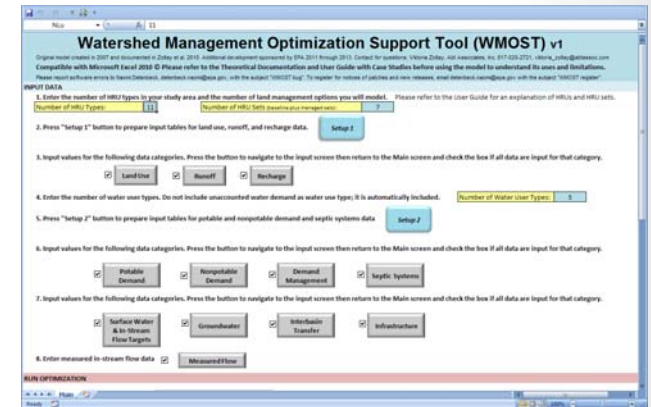
Impact

- Facilitate long-term cost-benefit analysis for green infrastructure

- Support implementation of integrated water management strategies

- Ability to evaluate green infrastructure role in community resilience to climate change

N. Detenbeck/
A. Morrison -
posters

Estuary Data Mapper

- Open-source (www.epa.gov/edm)

- User-friendly data discovery, visualization and access for coastal waters and watersheds

- Recent additions

  – Multi-media nutrient PS and NPS loads to estuaries and watersheds

  – Supporting data layers for development of potential seagrass habitat models to evaluate benefits of N load reductions (Narragansett Bay demo in review)

N. Detenbeck/M. tenBrink – poster session demo