Collaborative Potential between National Estuary Programs and Coastal EPA Laboratories

Presenters:

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Host: Bernice Smith

Environmental Protection Agency, Office of Water

National Estuary Program

Provide local stewardship to protect and restore water quality and ecological integrity in estuaries of national significance

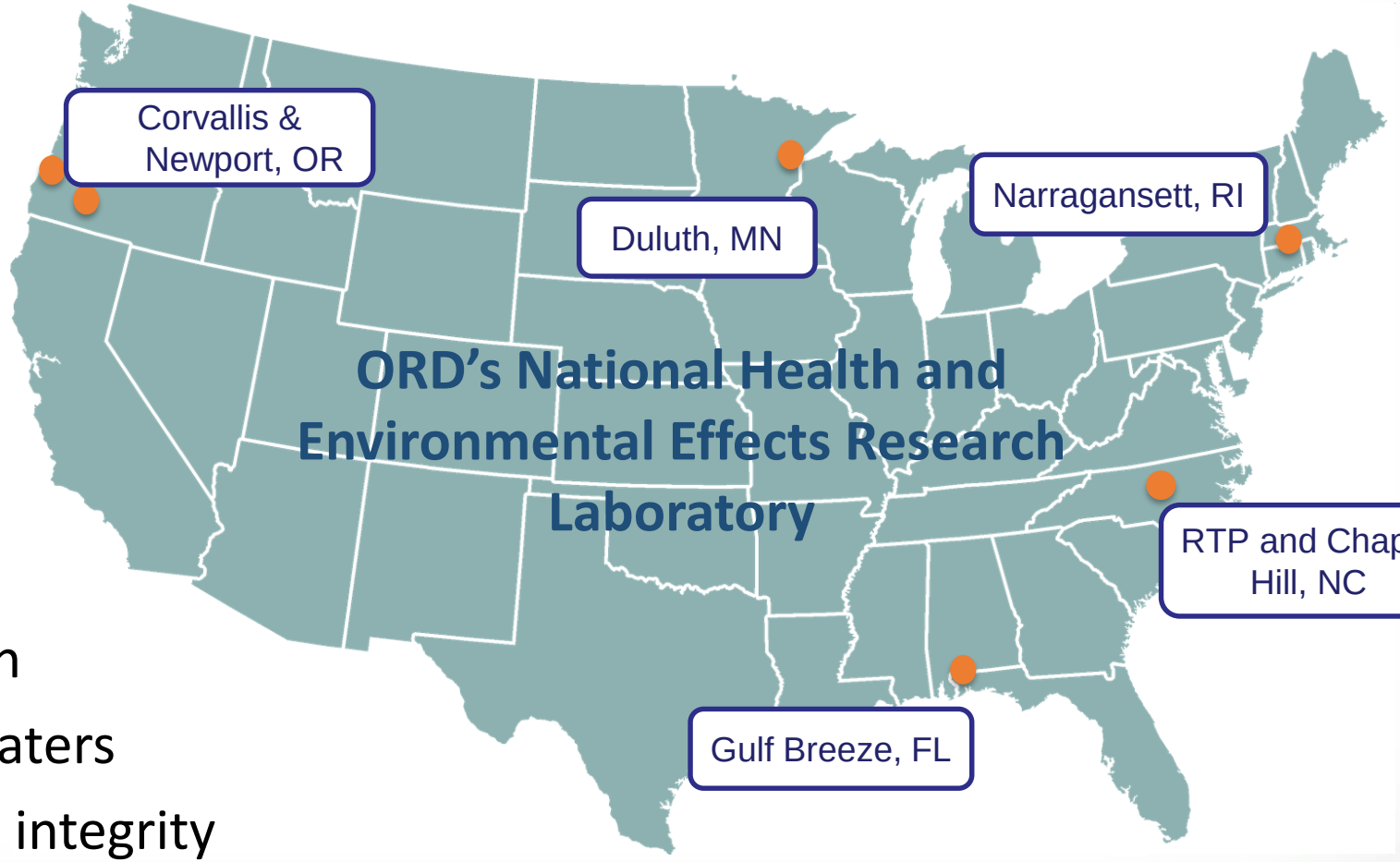
1987: Section 3.20 of U.S. Clean Water Act

2000: Estuaries and Clean Waters Act

NHEERL Division Locations

Protect Human Health and the Environment

- Chemical safety
- Preventing pollution
- Improving air quality
- Protecting public health
- Protecting America's waters
- Maintaining ecosystem integrity



Atlantic Ecology Division

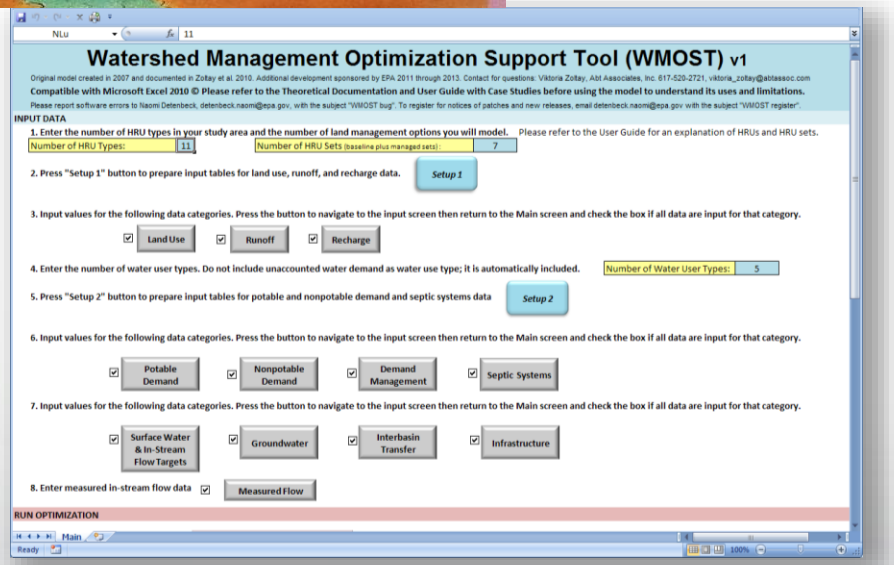
AED scientists identify and quantify the ecological effects of anthropogenic stressors on coastal waters and watersheds of the Atlantic seaboard

<u>Scientific expertise</u>

Coastal & watershed ecology
Marine ecotoxicology & geochemistry
Social sciences
Mechanistic & empirical modeling
Geospatial analysis & visualization
Computational ecology
Laboratory analytics

Water Management

Watershed Management Optimization Support Tool



- WMOST is a tool to inform planning-level assessments for:
  - stormwater management
  - wastewater management
  - drinking water quantity
  - Inter-basin water transfers
  - land conservation for water protection
- WMOST is an accounting tool (cost benefit analysis) for water quantity
  - evaluate integrated management practices
  - optimize costs while finding solutions
  - inform a range of decisions

Rapid Benefit Indicators

Evaluating Tradeoffs in Environmental Decisions

RBI is a method for developing & using non-monetary benefit indicators

- does not monetize benefits
- based on natural science & economic principles
- user-friendly & rapid to apply
- can be used to improve benefit transfers
- Identifies beneficiaries

RBI Helps users assess *benefits to people* when evaluating environmental projects

- Prioritization and funding decisions
- Social equity
- Longevity of service provision

Gulf Ecology Division

GED scientists assess ecological condition of coasts and estuaries, the causes of their decline, and future risks to environmental resources in the Gulf of Mexico and the Nation; develop criteria to protect aquatic systems; and evaluate the effects of environmental decisions on ecosystem benefits and human well-being.

<u>Scientific Expertise</u>

Decision Science

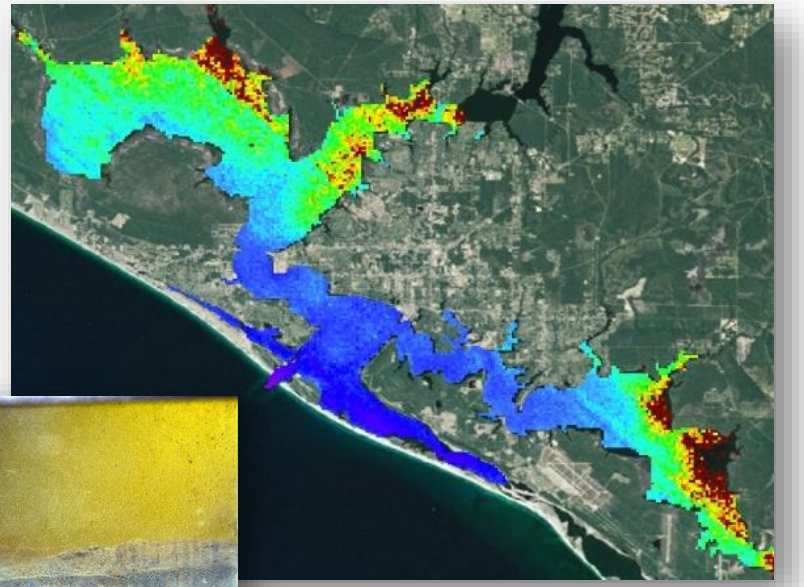
Ecosystem Services & Human Well-being

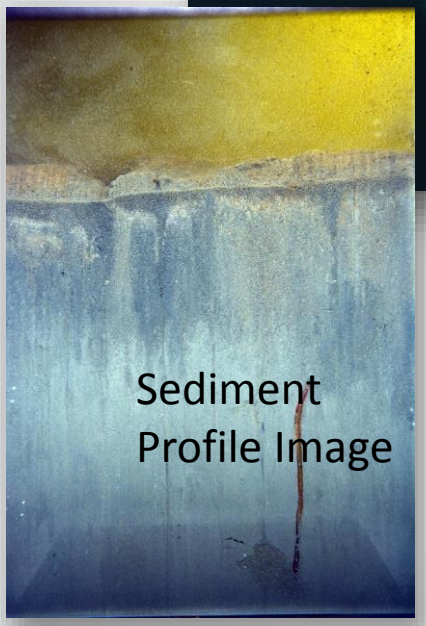
Hierarchical Toxicology

Coastal Ecosystem Modeling

Ecosystem Response & Evaluation

Assessing Water Quality





Multiple approaches at multiple scales

- State-of-the-art in-situ instrumentation for continuous water quality data acquisition
- Satellite imagery for water quality estimates of seagrass habitat
- Stable isotopes to identify sources of nitrogen
- Microbial indicators of nutrient/fecal pollution using genomics
- Sediment Profile Imagery to detect effects on benthic organisms
- Models simulating physical and ecological processes controlling Gulf of Mexica hypoxia

Ecosystem Benefits

Making ecosystem science useful to community decision makers

- Coordinated Case Studies including communities in the Gulf of Mexico and Puerto Rico
- Common elements across all sites
- Emphasis on Final Ecosystem Goods and Services (FEGS)
- Relation to public benefits and human health and well-being
- Linkage to community decision-making

Δ Ecosystems → Δ FEGS produced → Δ Well-being

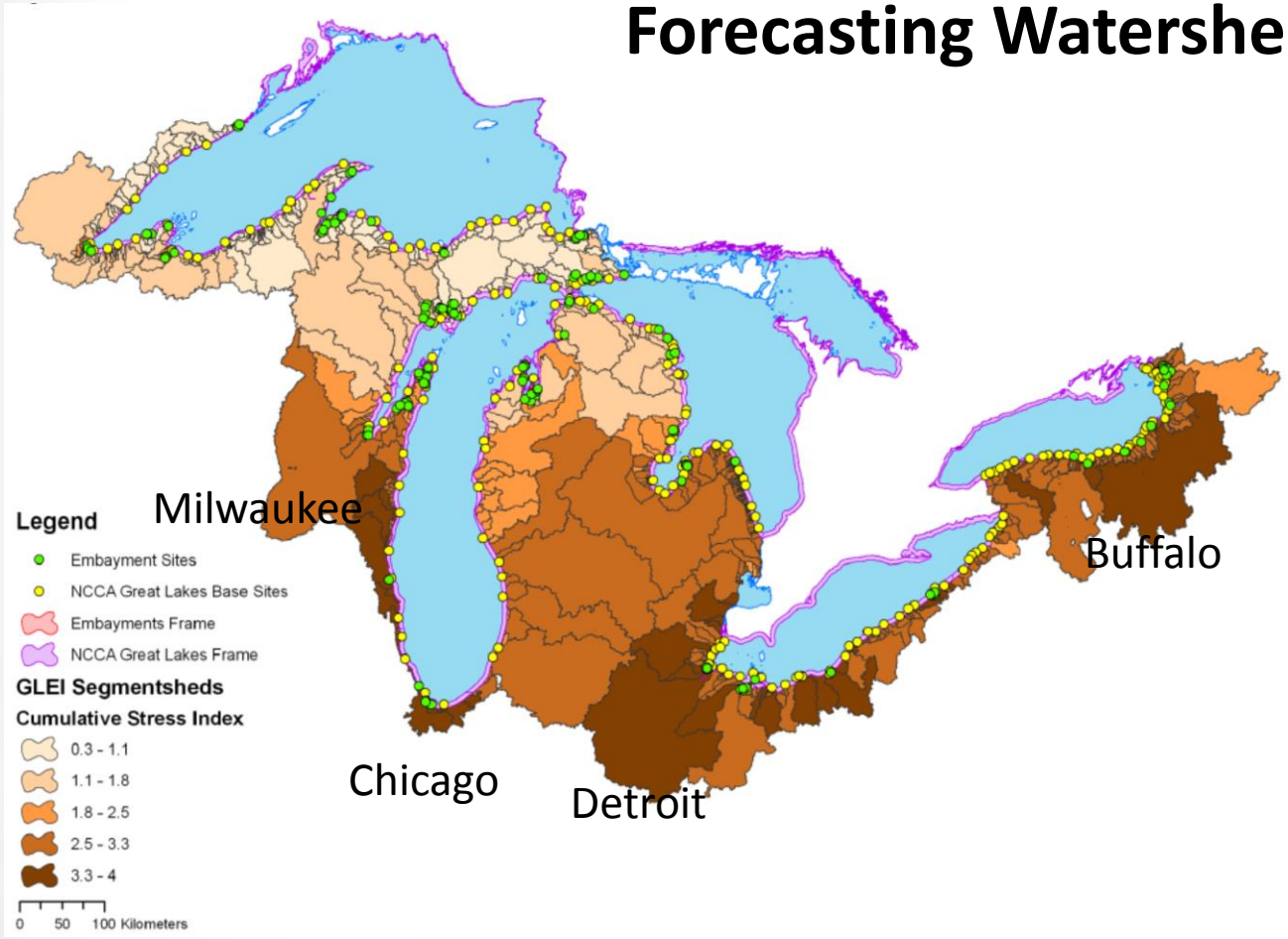
Mid-Continent Ecology Division

MED scientists offer strong leadership in ecotoxicology and freshwater ecology to predict and assess the effects of stressors in our Nation's freshwater ecosystems

<u>Scientific Expertise</u>
Systems Toxicology
Translational Toxicology
Ecosystem Services
Watersheds and Water Resources

Watershed Cumulative Stress Index

Forecasting Watershed Stress on the Great Lakes



- 207 indicators of watershed stressors in five domains
- Cumulative Stress Index for Water Quality
- Index is used to identify areas for protection and restoration
- Expanding application to other watersheds

Remediation, Restoration, Revitalization

R2R2R Framework for Contaminated Sites

- Characterize and quantify existing on-site EGS (ecosystem goods and services)
- Evaluate changes in EGS from alternative remediation and restoration activities
- Engage communities in developing public benefit metrics for revitalization

Before

After

Western Ecology Division

WED researchers perform research on terrestrial, freshwater, and coastal systems ecology, and developing tools to monitor and predict the connectivity and condition of these ecosystems and their ultimate contributions to human well-being nationwide

<u>Scientific expertise</u>

Terrestrial, freshwater and coastal ecosystems
Estuary and near-coastal risk assessment
Nutrient sources and effects on waterbodies
Ecotoxicology and modeling of chemical effects
Statistical designs for monitoring
Ecosystem benefits to human health and economy

Groundwater Management

Drinking water quality in Southern Willamette Valley

Agriculture fertilizer is the main source of high Nitrate in 20% of drinking water wells (80,000 people affected)

WED approach:

- Work directly with valley farmers to measure nitrate leaching from farmed land
- Identify alternative management practices
- Evaluate water quality benefits of improved management practices

Nutrient Source-Tracking

Regional Indicator of N-sources for West Coast Estuaries

Isotope sampling sites

- Excess nutrients is a primary cause of water quality impairment
- In estuaries there are both anthropogenic and natural sources of Nitrogen
- Tools developed to forecast N threshold exceedances
  - Model of water temperature and tidal NO_3 projects acute exceedances
  - Stable isotope analysis of macroalgae identifies N-sources causing chronic exceedances

Four great NEP/ORD collaborations

Partnership for the Delaware Estuary & Atlantic Ecology Division

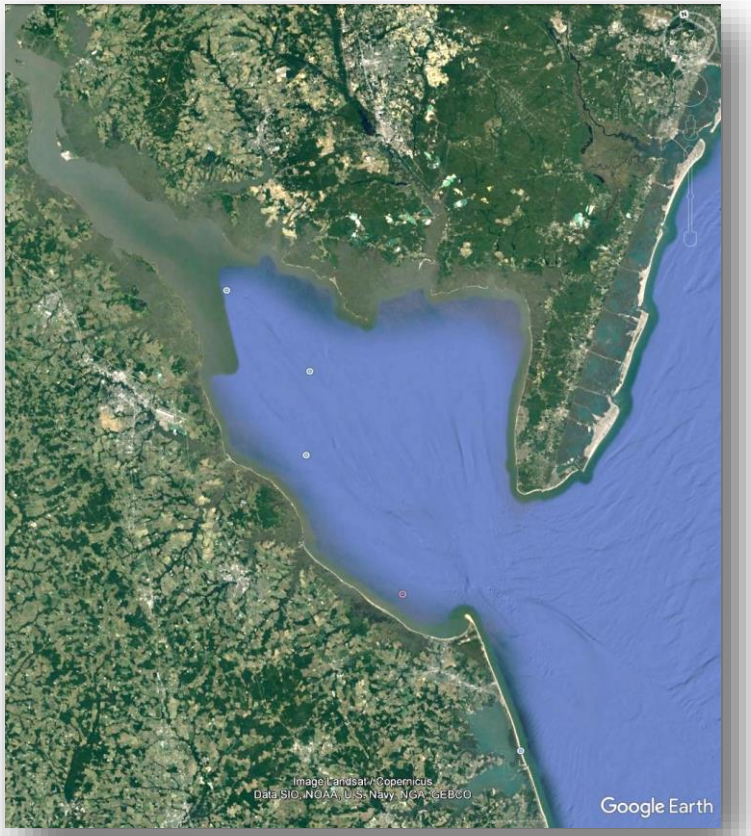
Tillamook Estuaries Partnership & Western Ecology Division

MBNEP, LCEP, TBEP, NBEP (BCG) & Gulf and Atlantic Ecology Divisions

San Juan Bay Estuary Program & Gulf and Atlantic Ecology Divisions

Issues, Science and Collaboration

Partnership for the Delaware Estuary & AED



What are the issues?

- The Delaware Estuary loses saltmarsh at a rate of ~ 1 acre per day
- Water Quality is a top concern for coastal managers:
  - Excess Nitrogen (eutrophication)
  - Excess Total Suspended Solids (turbidity)

What is the science and what are the solutions?

Science: Ribbed mussels provide:

- A physical barrier that binds the marsh
- Surface accretion
- Particulate N removal through filtration
- TSS removal through filtration

Restoration: Bio-based living shorelines:

- Coir logs and shell seeded with mussels
- PDE research, installed in Delaware Bay, RI and MA

Partnership for the Delaware Estuary & AED

What is the collaboration?

"Supportive and Engaging"

- Cross-estuary collaboration on basic science and restoration with living shorelines
- PDE field work with AED lab work
- Regional Applied Research Effort (RARE) funding source
  - ORD and EPA Region collaboration
  - Have included many NEP projects

Tillamook Estuaries Partnership & WED

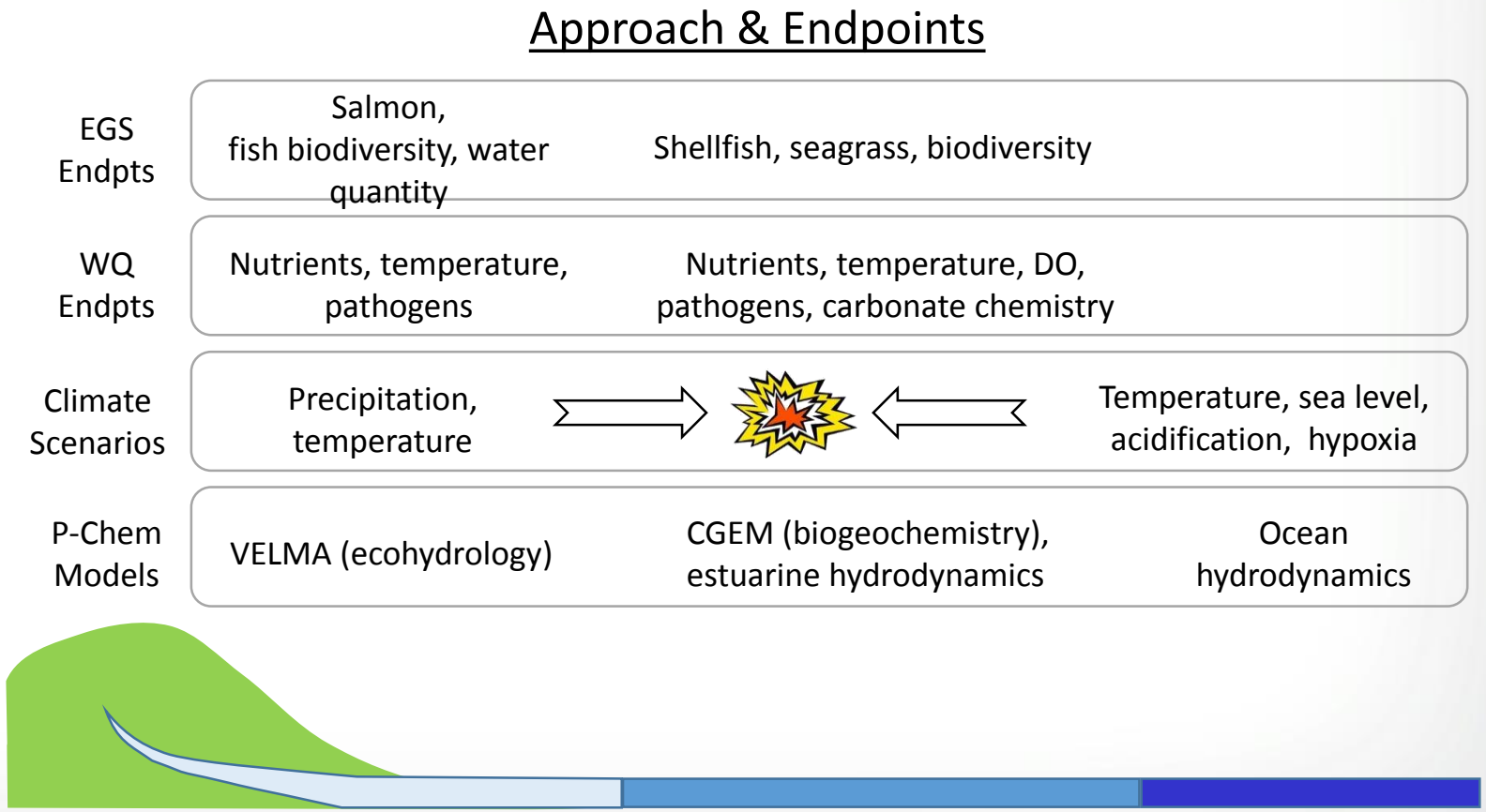
What are the issues?

- Effects of warming waters and coastal acidification on ecosystem processes and species, affecting seagrass, salmon, shellfish aquaculture and more
- Water Quality: excess nitrogen and bacteria
- Science for communicating with an engaged public

Tillamook Estuaries Partnership & WED

What is the science and what are the solutions?

- Watershed–estuary models
- Land use analyses
- Predictions of restoration benefits
- Climate scenarios with ocean acidification and water quality
- Links to Ecosystem Services



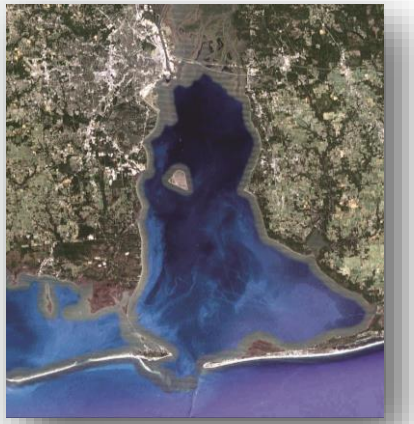
Tillamook Estuaries Partnership & WED

What is the collaboration?

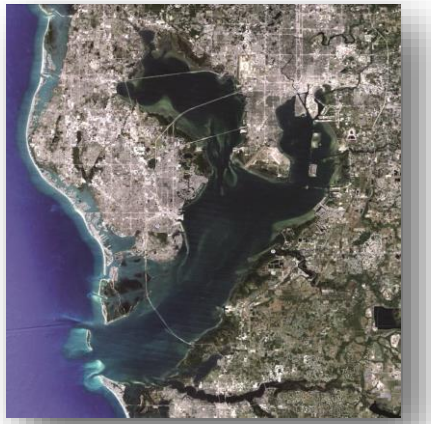
"Incredible"

- Shared goals from the TEP management plan
- Shared research: site selection, field assistance, data sharing, interpretation
- WED: Provides resources, analytics, modeling, and scientific work that TEP could not otherwise access
- TEP: outreach & liaison with community, stakeholders, other agencies and other collaborators
- TEP: Brings the science into communities and turns it into change on the local level

NEPs and the Biological Condition Gradient (BCG)

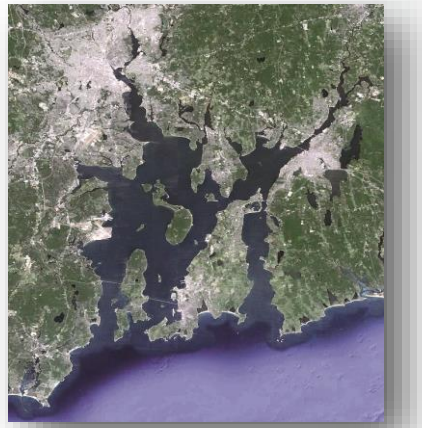


Mobile Bay



Tampa Bay

Lower Columbia River



Narragansett Bay

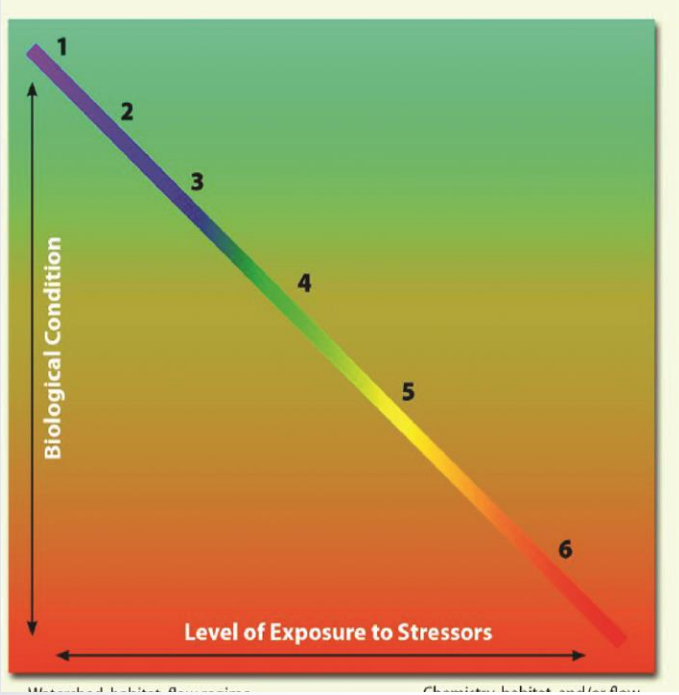
What are the issues?

Setting and tracking meaningful environmental targets

- Identifying valued biology
- Assessing biology consistently over locations and time
- Developing common goals
- Supporting actions towards goals

NEPs and the Biological Condition Gradient (BCG)

What is the science and what are the solutions?

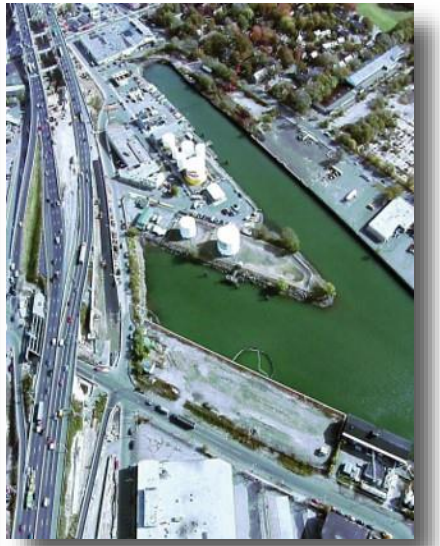


BCG is a set of tools from EPA Office of Water and ORD:

- A method to identify socially and ecologically important resources, then assess condition at six defined levels from minimally disturbed to severely altered
- A scientific approach to develop a shared vision and the targets needed to achieve it
- Guidance for workshops to engage the public and stakeholders in environmental decision-making

NEPs and the Biological Condition Gradient (BCG)

What is the collaboration?



NEPs and ORD engage on:

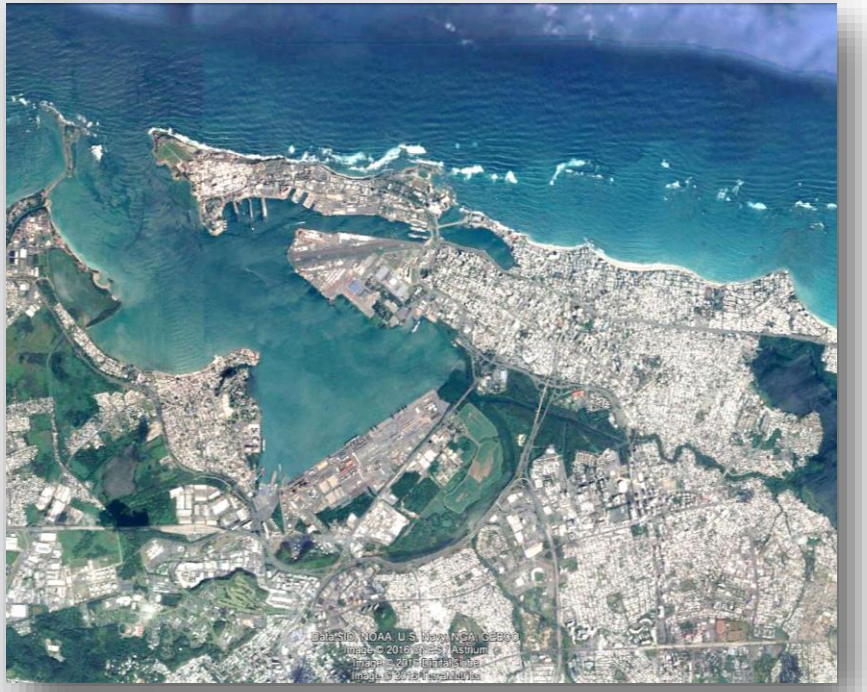
- Workshops to identify what the public values
- Shared visions based on 'What did we have – what do we have – what do we want'
- Habitat science: habitat mosaic changes over historic time, and other methods
- Methods to set targets then track and report progress
- Publications: EPA Report, Cicchetti and Greening 2011

"A motivated public is a powerful force in environmental protection"

→ ORD and OW are looking for more NEPs interested in BCG ←

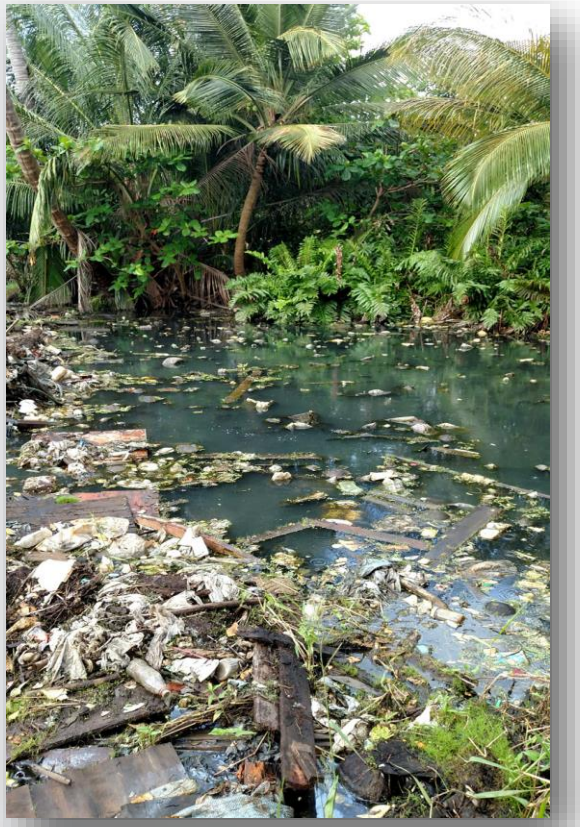
What are the issues?

Caño Martin Peña communities and larger San Juan Bay:



- Environmental justice and unhealthy conditions in communities around Caño Martin Peña
- Sewage, flooding, stormwater, stagnant water, nitrogen, mosquitos, disease, climate change, habitat loss, debris
- Urban setting of San Juan Bay: focus on nitrogen, human health, greenhouse gases, carbon sequestration, and loss of ecosystem services

What is the science and what are the solutions?



- Supporting the case to dredge Caño Martin Peña and restore flow
- Using stable isotopes to detect sewage sources
- Applying a Structured Decision Making framework to organize people and actions to improve San Juan Bay
- Clarifying connections between Ecosystem Services and human health in San Juan Bay, e.g., wetlands and urban green spaces vs disease

What is the collaboration?

- ORD: Resources, research, analysis, modeling, links to ecosystem services and human health, scientific support for significant and costly remediation and other actions
- SJBEP: Insights, inspiration, connections to the right people, local knowledge, boats, data, volunteers, links to partnerships with other management groups

"Incredibly Helpful"

Conclusion

Thank you very much—we look forward to new and continued collaborations!

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Next: Questions and discussion of next steps . . .