Translating Policy Decisions into Ecological Service Impacts for Cost Benefit Analysis - Ecosystem Functions to Ecosystem Services

Tampa Bay

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Placed Based Ecological Services Research: Tampa Bay
Human Stress

- More than 2.3 million people live in the three counties directly bordering Tampa Bay— Hillsborough, Manatee and Pinellas.
  - Expected to grow by nearly 19 percent by the year 2015, as approximately 500 people move to one of those three counties each week.

- Tampa Bay ecosystem represents a nearly perfect example of projected stress of human development on a natural ecosystem that is valued (economically, aesthetically, and culturally) in its present state.
Tampa Bay Reality Check

- Alternate Futures for Tampa Bay Region
- Scenario generation 2050
- Add 3.2 million people and 1.5 million jobs to the current landscape
The future of Tampa can look very different from what’s projected.
What will this do to the ecosystems we depend on?
Conceptual Mapping

- Conceptual maps defined the pathways from stressors to ecological services.
- Non-replacement stressors:
  - Nitrogen Loading
  - Phosphorus Loading
  - Mercury Loading
  - Atmospheric CO₂
  - Temperature
  - Precipitation
  - Sea Level
- Concept maps linked to ecological response function graphs and reference materials
Example Pathway

Production Function Graphs

Literature

Water Quantity → Flood Protection → Water Quality → Habitat/Refugia → CO2 Sequestration → Food/Fiber → Recreation

Ground Water Infiltration → Erosion

Primary Production → Secondary Production → Soil Organic Matter

Nitrogen Loading

Non-point Sources

Atmospheric Deposition

Point Sources

Climate Change

Population Change

62%

21%

12%
Complexity in CMaps - Interactions
Conceptual to Prediction Models

- Concept maps used to provide production function information for development of spatially and temporally dynamic SIMILE model.
- Links existing mechanistic models of each major ecosystem and their subcomponents.
- Modular nature facilitates future transfer to other regions.
- Internal aggregation of short time steps into common temporal scale.
- Spatial connectivity can be built in.
Translating Functions to Services

Seagrass Growth and Sediment Diogenesis Models

Temperature Modifier

Light Attenuation PAR

DO

Water Column N, P, and C Processes

Nutrient Loading Modifier

Surface Irradiance

Wang et al 1999
Ambrose et al 1993
Gregg and Carder 1990
Eldridge et al 2004
Adjustable Parameters and Outputs

Irradiance: Ozone, Humidity, Clouds
Nutrients: N and P Loading

Phytoplankton growth and Denitrification of products
Scales of Model Output

Water Column Processes

Bathymetry

Seagrass Processes
Progress and Upcoming Workshop

- Conceptual map frameworks completed.
- Initial literature search completed.
- Intensive literature review underway:
  - Seagrass
  - Wetlands
  - Urban Forest
- Workshop (January 2009)
  - Local Tampa Bay experts will refine C-maps and offer support for dynamic model formulation
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    - Judson

- **Tampa Bay Steering Committee:**
  - Headed by Tampa Bay Estuary Program and Tampa Bay Regional Planning Council.
Questions?

Skyway bridge across bay

Downtown Tampa

Hillsborough River Cypress

Little Manatee River

Alafia Banks Spoonbills