



Adapting Shorelines to Climate Change: Preserving Ecosystem Services



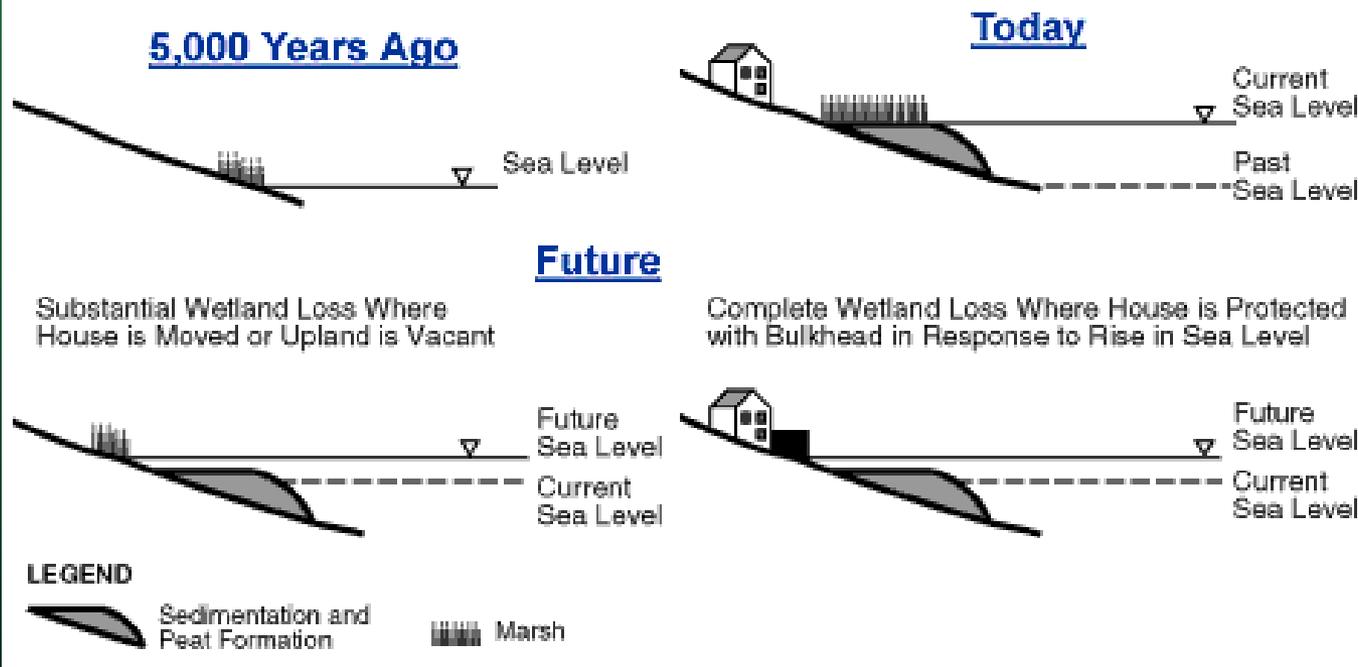
A New Era: Climate Change Is Increasing Erosive Forces

- Wind
- Waves & wakes
- Tidal action
- Ice
- Human disturbance
- Accelerated sea level rise
- Increased storm intensity due to climate change?
- Increased storm surge
- Increased flooding



Effects on Adjacent Habitats

Evolution of a Marsh as Sea Level Rises



Coastal marshes have kept pace with the slow rate of sea level rise that has characterized the last several thousand years. Thus, the area of marsh has expanded over time as new lands have been inundated. If in the future, sea level rises faster than the ability of the marsh to keep pace, the marsh area will contract. Construction of bulkheads to protect economic development may prevent new marsh from forming and result in a total loss of marsh in some areas.

Source: Titus, J.G. 1991. Greenhouse Effect and Coastal Wetland Policy, *Environmental Management* 15(1):39-58.



How will we manage shorelines & erosion in the future?

- Harden to reduce erosion?
- Construct dikes?
- Use “soft” engineering approaches?
- Allow shorelines to migrate landward?



“New ways of thinking about, talking about and acting on climate change are necessary if a changing society is to adapt to a changing climate.”

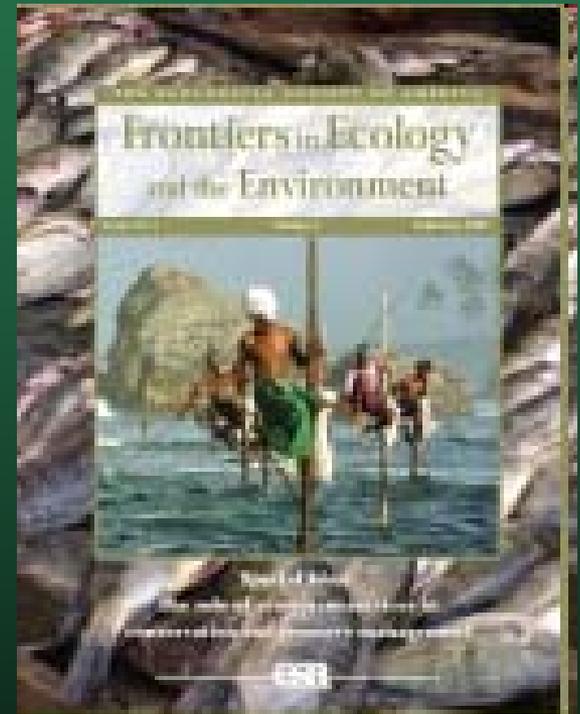
(Pielke Jr. et al. 2007. Lifting the taboo on adaptation. Nature 445: 597–598.)



Ecosystem Services

- The benefits provided to humans by naturally functioning ecosystems
- Nature's contributions to human well-being

See February 2009 issue of Ecological Society of America's *Frontiers in Ecology and the Environment*





Key Challenges

1. Develop sufficient scientific knowledge to back up our hypotheses of how and when services are delivered
2. Develop practical ways to bring these ideas into business practices and government policies.

Susan Ruffo, Peter M Kareiva (2009). Using science to assign value to nature. *Frontiers in Ecology and the Environment*: Vol. 7, No. 1, pp. 3-3



General Ecosystem Services of Tidal Shorelines

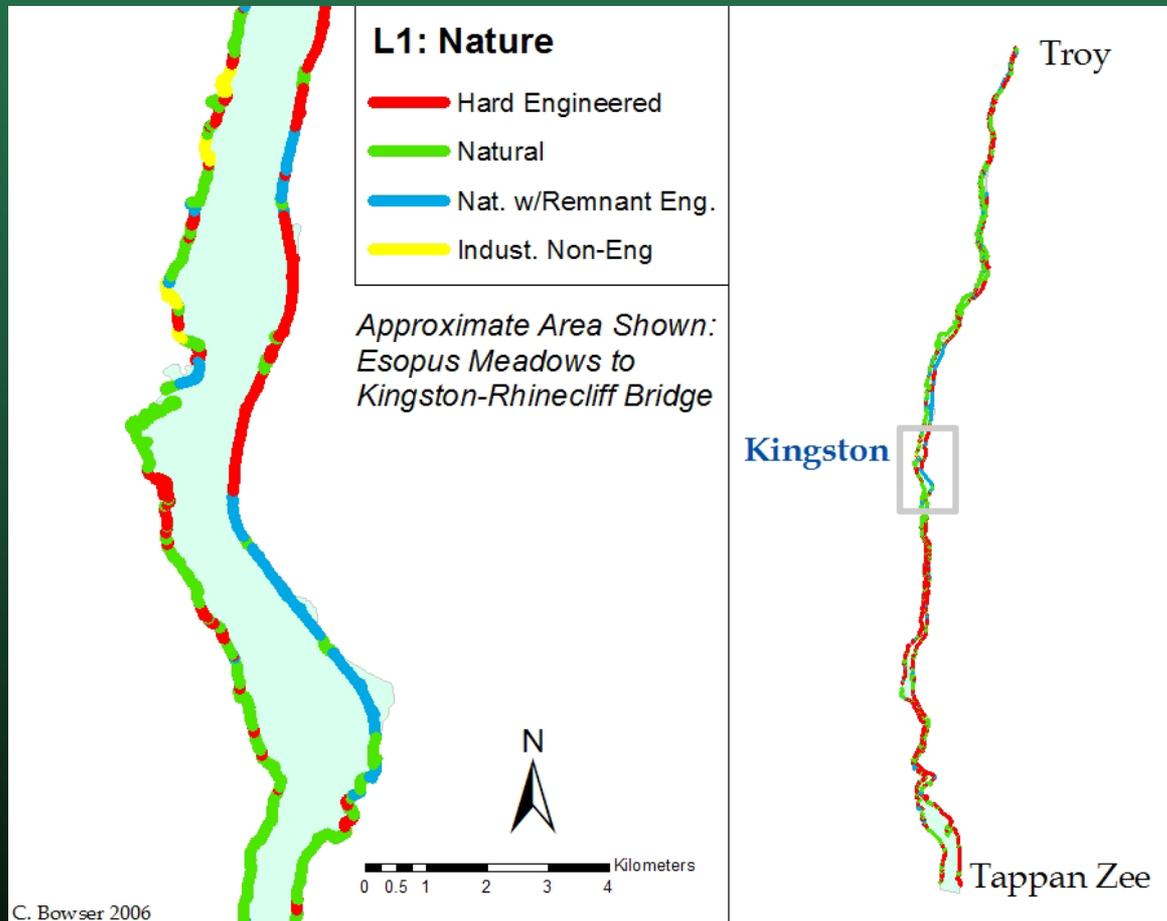
- Provide vital habitat
- Dissipate energy
- Regulate vital processes
- Serve as dispersal corridors
- Support high biodiversity and produce plants and animals



Dave Strayer. 2008. Ecology of freshwater shore zones, unpublished.



Hudson River Shoreline Classification and Inventory



Hudson River Tidal Shorelines

- Over 300 miles:
 - Natural 47%
 - Hard engineered 41%
 - Remnant engineered 12%





Developing scientific info about ecological services of Hudson River tidal shorelines

- Initial phase: 6 shoreline types: 3 natural, 3 engineered
- Examined fish and invertebrate production, as well as other ecosystem services

Funded by CICEET, Hudson River Foundation, and NYS



Preliminary Results: Fish

- More fish on sandy, vegetated beaches (forage fish)
- Highest diversity on the most structurally complex shoreline types.
- Lowest fish abundance & diversity are on vertical shoreline types (vertical sheet pile and seawalls)





Key Challenges

1. Develop sufficient scientific knowledge to back up our hypotheses of how and when services are delivered
2. Develop practical ways to bring these ideas into business practices and government policies.

Susan Ruffo, Peter M Kareiva (2009). Using science to assign value to nature. *Frontiers in Ecology and the Environment*: Vol. 7, No. 1, pp. 3-3



Challenges

- Technical challenges in ecosystem studies, economic analyses, and outreach
- Complex array of incentives, disincentives, policies and other factors guide erosion control
- Diverse stakeholders
- Decision-makers often focus on minimizing short-term costs
- Climate change unknowns



Identify alternatives to retain or enhance ecosystem services

Chesapeake Bay – Living Shoreline Treatments

(<http://www.vims.edu/features/research/living-shorelines.php>)



Short and Long-term Cost Calculations

- Forecast erosion control performance in context of sea level rise scenarios
- Consider broad array of costs:
 - Capital and operating costs
 - Impacts on adjacent upland properties
 - Impacts on public uses
 - Impacts on ecosystem services

\$\$\$



Engage Stakeholders and Shoreline Decision-Makers

- Property owners
- Experts and consultants
- Government regulators
- Policy and law makers



Link to Climate Change Adaptation Initiatives

- NYS Sea Level Rise Task Force
- Rising Waters
- Hudson Valley Climate Change Network
- NYS Ocean & Great Lakes Initiative
- NERRS initiatives
- Others TBD



Betsy Blair

Manager, Hudson River NERR

Manager, Hudson River Habitat Protection Program

NYS Department of Environmental Conservation

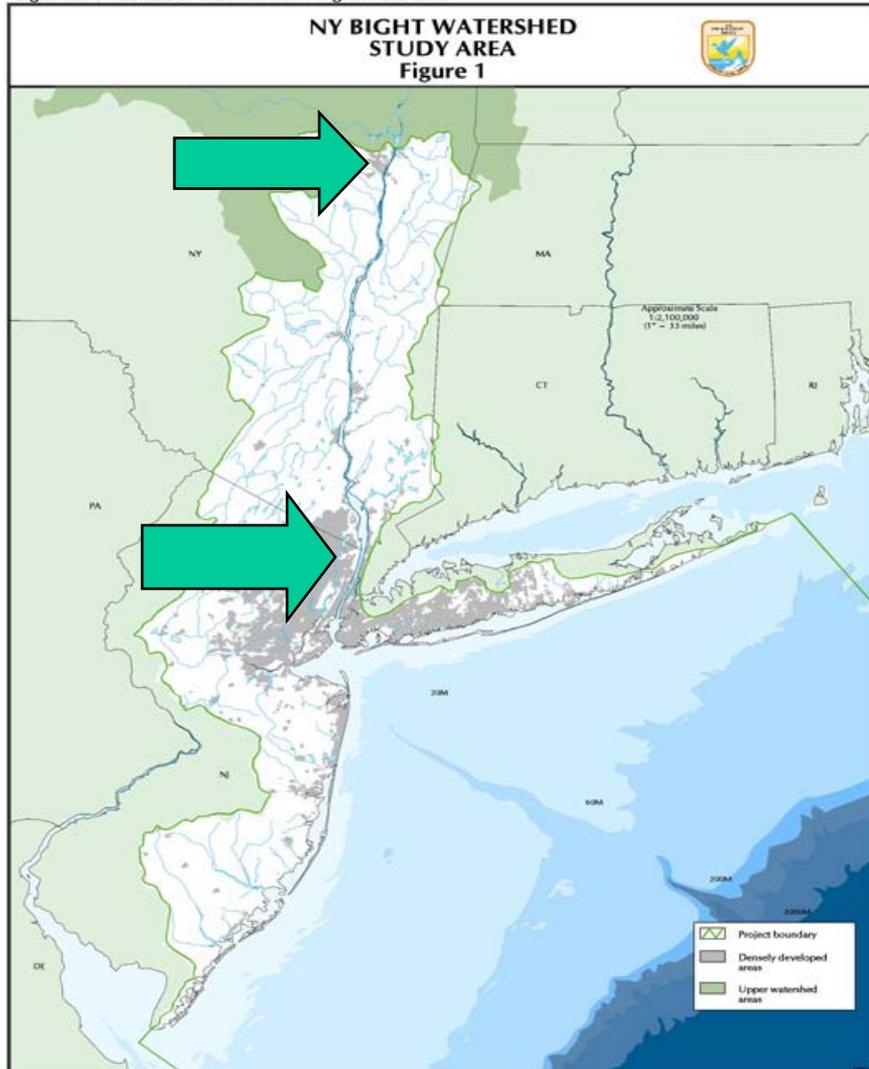
(845) 889-4745 x113

bablair@gw.dec.state.ny.us





Significant Habitats of the New York Bight Watershed



Geographic Scope

- Tappan Zee Bridge to Troy Dam

