CONSERVATION IN ACTION:

Science directs partners toward a sustainable future for the Great Marsh

Product: Hydro-MEM Model for Plum Island Estuary

Combining the Marsh Equilibrium Modeling approach with a hydrodynamic modeling approach, the Hydro-MEM model forecasts the evolution of marsh landscapes under different sea-level rise scenarios, with or without marsh restoration and storm surge factored in, to inform future management decisions with regard to system dynamics.

DEVELOPED BY:
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WHO IS USING HYDRO-MEM?
Wayne Castonguay, Executive Director of the
Ipswich River Watershed Association
Member of the Great Marsh Resiliency Partnership

HOW IS IT ADVANCING HIS WORK?
When Wayne Castonguay talks about the driving force behind the collaborative coastal resiliency work aligning 29 communities that surround the 20,000-acre Plum Island Estuary, or Great Marsh, in northeastern Massachusetts, he doesn't call it Hurricane Sandy. He calls it Sandy 1.

The Hydro-MEM model forecasts the evolution of the 20,000-acre Plum Island Estuary, also known as the Great Marsh, under different sea-level rise scenarios. *Credit: Matthew Kirwan/USGS*

"We started using that term as a way to remember that we need to keep doing more," explained Castonguay, executive director of the Ipswich River Watershed Association. "This work doesn't end with Sandy."

The work didn't start with Sandy, either. Two informal initiatives -- the Great Marsh Coalition (GMC) and the Parker-Ipswich-Essex Rivers Restoration Partnership (PIE Rivers) -- had been working to protect the marsh and the coastal watersheds that drain into it for years. The infamous 2012 hurricane that wreaked havoc on coastal communities along the eastern seaboard gave the work a new sense of urgency, however.

"When Sandy came along, we realized we had to up our game," said Castonguay. "We needed to do things more holistically in order to take our work to the next level to really move the needle for the Great Marsh."

Under the leadership of the National Wildlife Federation, GMC and PIE Rivers joined forces to form a new initiative called the Great Marsh Resiliency Partnership, involving 29 cities and towns, plus federal and state agencies, universities, and nongovernmental organizations.

As a founding organization of GMC and PIE Rivers, the Ipswich River Watershed Association has a lead role in two major aspects of the project: conducting an assessment of barriers to natural flow in the Great Marsh watershed and partnering with the National Wildlife Federation on a community-planning process to develop town-specific recommendations for increasing collective resiliency.

With scientific guidance from a dynamic salt marsh model, municipal task forces in each of the 29 towns in the Great Marsh region are determining the best actions to make their communities more resilient to sea-level rise. *Credit: PIE Rivers*

Although the project is built upon the bedrock of engaged citizens from the surrounding communities who have rallied around protecting this resource, research supported by the North Atlantic LCC has provided the scientific scaffolding to craft a solid plan.

With a Hurricane Sandy resiliency grant coordinated by the LCC, collaborators from Louisiana State University and the University of South Carolina coupled different modeling approaches to develop a biological-hydrodynamic model (Hydro-MEM) parameterized for Plum Island Estuary to forecast marsh responses to sea-level rise and storm surge connected to sea-level rise and altered marsh landscapes.

By simulating how sea-level rise will affect natural dynamics from hydrology to marsh growth rates, the model provides a scientific basis for actions that will sustain the entire system in the face of change.

"Can the marsh accrete? Can beaches migrate? Where does it make sense to use living shoreline approaches? In order to figure out how to enhance the resilience of the Great Marsh, we had to really understand the system," said Castonguay. "There has been a long history of trying things that ultimately did not work. This model provided the basis on which to develop interventions that would."

Another LCC-supported effort to inventory all beach armoring structures and inlet modifications from Maine to Virginia (featured in the case study on page 13) has also been essential to the task of assessing barriers to Great Marsh hydrology.

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"We analyzed the entire geography for intersections between municipal infrastructure and critical habitat and evaluated them for vulnerability to coastal change," explained Castonguay. "Based on all of that work, we pulled stakeholders from every single community into municipal task forces to figure out what they could do to make each town more resilient."

And that, said Castonguay, is the best evidence of the success of the partnership so far. After all, their work doesn't end with this storm.

"With the Sandy projects winding down, we are starting to think about how to implement recommendations, and that will come down to community buy-in," he said. "Making this about the towns has been central to the whole process and project from the beginning."

LEARN MORE:

- **Hydro-MEM Model Project:** http://www.northatlanticlcc.org/coastal-resiliency/projects/hydro-mem
- **Great Marsh Coalition:** http://greatmarsh.org
- **Parker-Ipswich-Essex Rivers Restoration Partnership:** http://pie-rivers.org
- **National Wildlife Federation:** http://www.nwf.org/
- **Ipswich River Watershed Association:** http://www.ipswichriver.org/
- **Great Marsh Resiliency Partnership:** http://greatmarshresiliency.org