National Centers for Coastal Ocean Science
Ecological Effects of Sea Level Rise

The Ecological Effects of Sea Level Rise (EESLR) is a multidisciplinary research program focused on providing a suite of science products to inform coastal managers of local coastal vulnerability and solutions to mitigate flood risk. This mission is achieved through integrated modeling to evaluate coastal vulnerability and risk under a suite of sea level rise, storm event, and protection scenarios. Priorities include:

- Advancement of predictive tools for sea level rise (SLR) and inundation effects through field-based studies and dynamic models;

- Evaluation of coastal community and ecosystem vulnerability to SLR and inundation under scenarios of shoreline condition and/or natural and nature-based feature (NNBF) use;

- Quantification of ecosystem services provided by NNBF for enhancing community and ecosystem protection from SLR, nuisance flooding, and acute inundation.

All EESLR research uses a collaborative science model, integrating stakeholder input to ensure relevancy, applicability, and value to coastal managers. Many projects have a principle investigator focused on stakeholder engagement and a management advisory team.

Program Impact

EESLR has focused on providing coastal managers, communities, and planners with the information and tools required to make informed decisions on vulnerability, adaptation, and protection to SLR and coastal flooding. From foundational projects in the Gulf of Mexico and North Carolina, EESLR products have informed and/or resulted in:

- Coastal vulnerability assessments in the Northeast, Mid-Atlantic, and Gulf of Mexico;

- Watershed management plans, land acquisition prioritization, and resource management;

- Techniques for higher accuracy marsh elevation obtained from Lidar.

In 2015 and 2016, EESLR greatly expanded its portfolio to additional regions and topical areas, with an enhanced focus on connections between communities and ecosystems. Expected outcomes from these projects include:

- Guidance on the value and effectiveness of NNBF on providing flood and habitat protection;

- Increased accuracy in future storm surge, wave run-up, and nuisance flooding vulnerability;

- Enhanced coastal resource sustainability through improved management plans and conservation.

Program at a Glance

Total Projects: 7

Focus
- SLR, storm surge, and flooding
- Scenarios of risk and vulnerability
- Natural and nature-based solutions
- Marshes, beaches, barrier islands, and communities

Products
- Ecological and socioeconomic vulnerability assessments
- Models and tools
- Mitigation and adaption scenarios

Targeted Users
- State and local planners and resource managers
- Staff and researchers at NERRs
- Federally protected area managers

Collaborators
- Academic institutions, The Nature Conservancy, state and federal agencies
- Sentinel Site Cooperatives

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Can changes in future land use increase storm surge flooding?
From erosion to urban development, storms to nuisance flooding, coastal areas are constantly changing. A collaboration between EESLR and LSU in the northern Gulf of Mexico demonstrated the need to move beyond "bathtub" approach for flood modeling to integrate dynamic biological and physical processes on the coasts. Through this dynamic approach, the team found some areas may experience 80% more flooding than predicted by bathtub models, while others experienced far less.
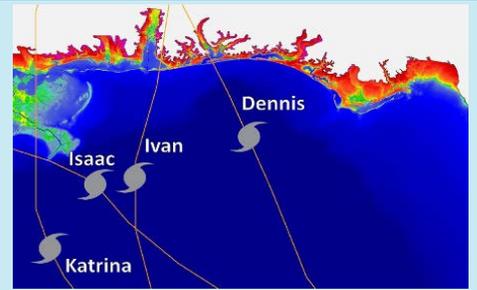
Active Projects

Improving marsh models in San Francisco Bay Region
The effects of sea level rise on marshes are often location specific. In partnership with the U.S. Geological Survey, we are improving predictions of these impacts through intensive field studies to provide managers with actionable information on marsh vulnerability at key sites across San Pablo and Suisun Bays.

Wave attenuation and marshes in North Carolina
Focused on southern Pamlico Sound, we have partnered with the University of North Carolina to understand and predict the combined effects of seas level rise, tides, and storms surge on marsh ecosystem services for shoreline protection.

Informing habitat management plans on Hawai'i
In collaboration with The Nature Conservancy and the Hawaii Sentinel Site Cooperative, we are evaluating sea level rise effects on coastal habitats along the west coast of Hawai'i. Results will guide updates to habitat management plans for this ecologically and culturally important region.

Dune and beach impacts in North Carolina
Development of an advanced tool to assess barrier island recovery and vulnerability from storms under a suite of SLR and management scenarios through a collaboration with Oregon State University. Application will focus on Cape Lookout National Seashore and managed beaches along Bogue Banks in North Carolina.

Ecosystem services and scenarios of natural and nature-based solutions in the Gulf of Mexico
Building on prior investments, we have partnered with Louisiana State University to apply coupled hydrodynamic and marsh models to evaluate the potential for natural and nature-based features to mitigate flood risk under multiple scenarios, and to quantify the economic and ecosystem value of these features.

Sediment management to enhance natural infrastructure and flood protection
Evaluation of sediment management scenarios on natural infrastructure (e.g., beaches) and resultant effects on coastal inundation vulnerability. This southern California project is a led by partners at the University of California, Irvine.

Tidal wetland adaptation and natural infrastructure in southern California
Led by The State Coastal Conservancy, we are building on a suite of priori research identify nature-based, sea level rise adaptation strategies for marshes in southern California through enhancements to a suite of coastal modeling platforms.