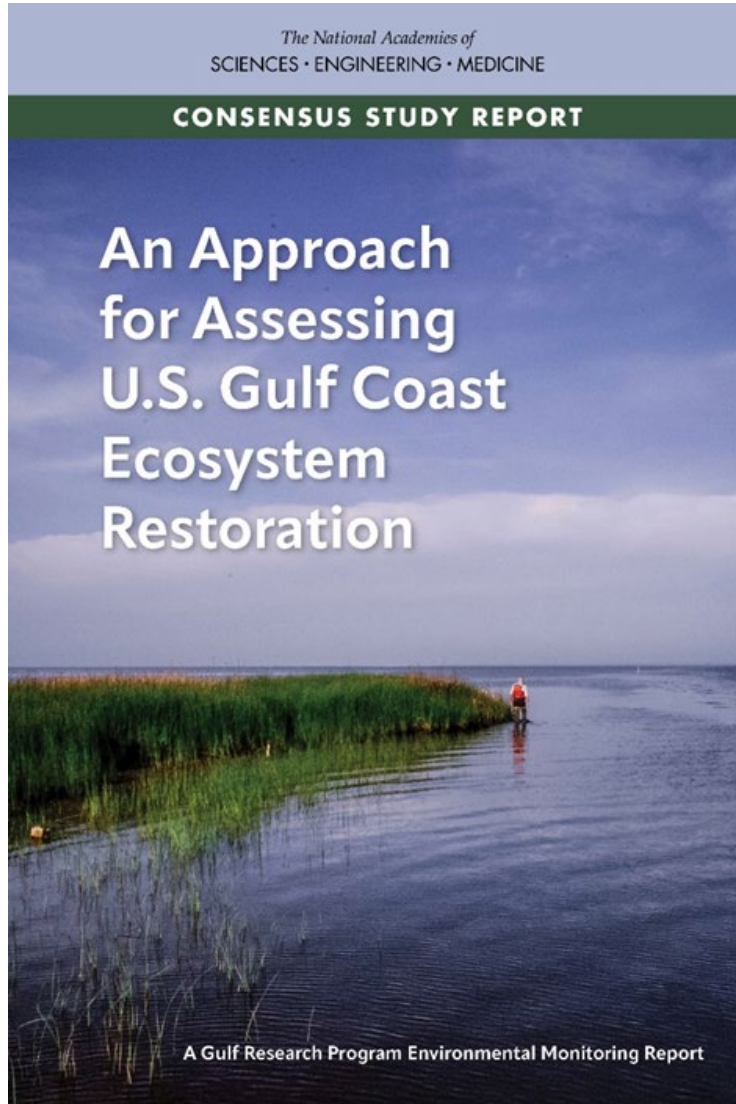
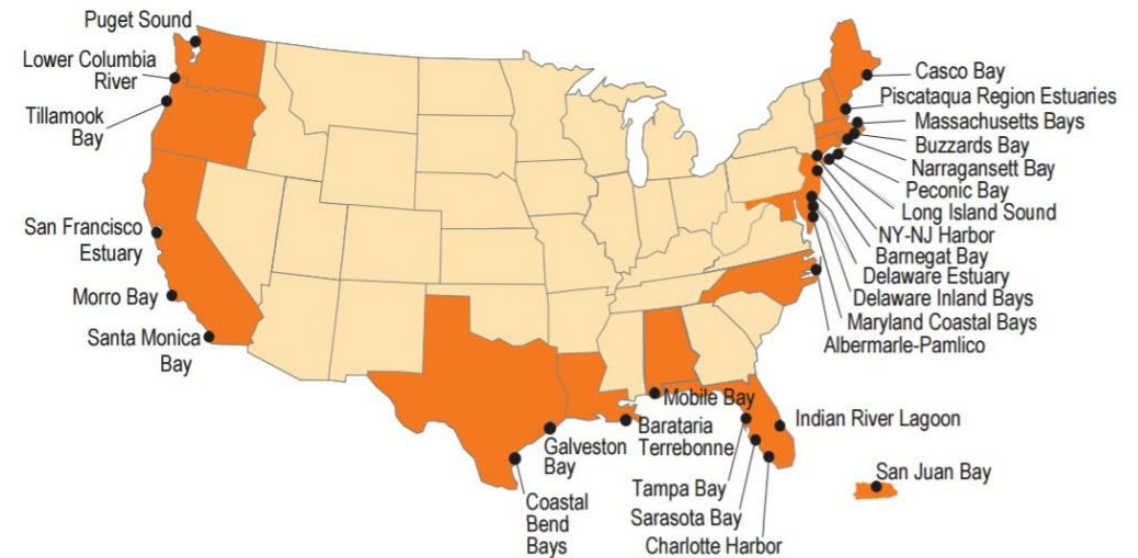


Perspective: Urban Seas and Coastal Oceans Research Priorities through a Coastal Resource Management Lens



CoastWisePARTNERS



Holly Greening, Tampa Bay Estuary Program (retired); CoastWise Partners (co-founder)

Near-Term Needs to Support an Urban Sea

System

HIGH-LEVEL PROCESSES OPERATING IN AN URBAN SEA SYSTEM

Drainage Basin, Port City, and Marine Sector

Each process can be modeled as a digital twin module.



Water quality improvement and ecological restoration efforts are centerpieces of local and regional coastal resource management

But are we moving the needle toward coastal environmental restoration and resiliency?



Research Needs

- **Large-scale, long-term changes** in coastal hydrology, water quality, and species range distribution are occurring in response to both natural and anthropogenic forces. Research is needed to **evaluate impacts** of these changes on local and regional restoration efforts.
- Assessment of cumulative effects of large-scale restoration is a developing research area and its **application to restoration implementation is urgently needed.**



Image: H Greening

Current Scientific Progress Towards Assessing Cumulative Effects

Cumulative effects of restoration are the additive, synergistic, and antagonistic effects of all restoration activities occurring within a defined setting (e.g., a watershed).

Approaches for Assessing Cumulative Effects of Restoration include:

- Developing conceptual models and hypotheses
- Evaluating antagonistic and synergistic effects
- Constructing Multiple Lines of Evidence



Image: USGS

Diefenderfer et al. 2022. Ten years of Gulf Coast ecosystem restoration projects since the Deepwater Horizon oil spill. Proceedings of the National Academy of Sciences 2022 Vol. 119 No. 38 e2213639119. <https://doi.org/10.1073/pnas.2213639119>

Synthesis and Monitoring

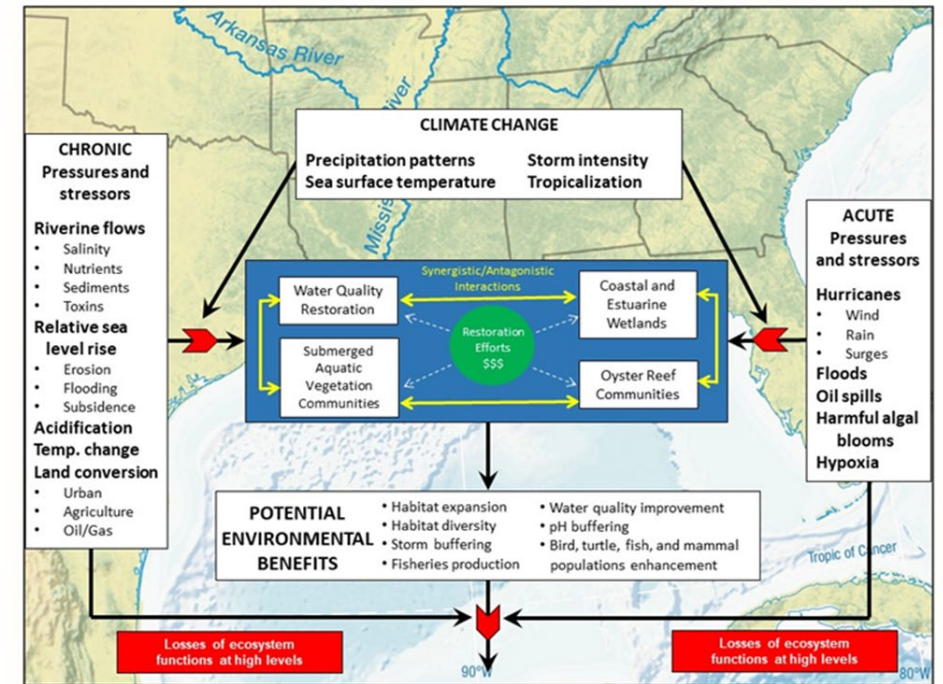
- **Synthesis efforts are urgently needed** to determine whether the many localized restoration efforts **have collectively improved coastal and estuarine ecosystems.**
- **A comprehensive monitoring database is needed for synthesis activities,** yet current data collection remains insufficient for regional synthesis.



Image: HRI

An Opportunity to Advance Coastal Oceans Research: Cumulative Impacts of an Unprecedented Large-Scale Experiment in an Urban Sea

- In 2010, the *Deepwater Horizon* (DWH) drilling rig exploded in the Gulf of Mexico. The resulting civil and criminal litigation led to over \$16 billion to be applied to economic recovery and environmental restoration-related activities in the Gulf region.
- 600 restoration efforts completed or underway. Half the funds are expended or committed.
- Many opportunities for research partnerships and cost-sharing; workforce development; engaging local communities.



Potential Research and Synthesis

Questions: GoM Ecosystem Restoration

Experiment

- How are changes in environmental conditions affecting coastal restoration efforts?
- What are the cumulative effects of multiple coastal restoration efforts at various scales?
- How can advances in monitoring technologies, including AI and remote sensing, be used to evaluate changes in environmental conditions?
- How should effective database development to support future research and modeling be designed and maintained?



Image: Brian Davis, MSU