SAGE

Systems Approach to Geomorphic Engineering

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SAGE

- Innovative Approach to Coastal Landscape Transformation
- Merging green and gray solutions, with a dash of wisdom
Early leaders influencing initiative:

- U.S. Army Corps of Engineers
- National Oceanic & Atmospheric Administration
- Federal Emergency Management Agency
- NGO’s – TNC, TCF
- Academic Community – URI, VIMS, UNO
The “Coastal Corps”

- **Flood & Coastal Storm Damage Reduction**
  - Not just erosion, also water levels and inundation
  - Infrastructure - nourished beaches, seawalls, tide gates, other …
  - Regional/comprehensive plans; Contingency planning, Planning Assistance
  - Hurricane evacuation planning

- **Navigation** – Channels, waterways, inlets; jetties, breakwaters, and other structures
  - Maintenance activities; sand/sediment resources
  - Addressing shoaling, debris, other from events

- **Ecosystem Restoration**
  - Restoring and protecting coastal habitat and ecological resources

- **Coastal Engineering and Science**
  - Producing knowledge and Technology for Integrated Solutions

- **Emergency Response**
Emerging Challenges

- Urbanization of coastlines
- Understanding the forcing functions and how they are varying and changing
- Funding/lack of federal funds/alternative financing mechanisms
- No Action or intervention – what is it that we can’t afford to not do?
- Set of Solutions that protect the economy, people and ecology
- Anticipate opportunities for hybrid engineering solutions
SAGE Goals

- Pursue and advance a large-scale comprehensive view of coastal landscape change
- Utilize integrated methodologies for coastal landscape transformation to slow/prevent/minimize mitigate impacts to coastal communities and shoreline

Blackwater National Wildlife Refuge
SAGE Goals:

- Understand likely potential impacts on people and nature along coastline
- Utilize a holistic approach linking ‘soft’ ecosystem-based approaches with ‘hard’ infrastructure approaches – hybrid coastal engineering
- Develop science, tools, demonstrations to inform best practices
- Ensure natural solutions are part of the toolbox
- Develop innovative techniques and solutions to aid in the adaption of our changing coastlines
SAGE Objective:

To provide people, property and the natural coastal environment:

• protection from weather and climate-related threats
• reduced impacts from coastal hazards
• actions and solutions that reduce risk
Understanding Essential Data Needs (Data, Science, Engineering)

- Geodetic data
- Geophysical data
- Coastal geomorphology
- Vegetative characteristics
- Water quality
- Topography, slope
- Datums
- Soil/beach characteristics
- Wave characteristics
- Bathymetry, water depth over plants
- Shoreline mapping
- Ecological resilience
Benefits of Natural Solutions

- Habitat protection and restoration
- Flood risk reduction
- Coastal storm damage reduction
Characteristics of SAGE-Informed Decisions

- Living shorelines
- Hybrid solutions (green and gray)
- Regional scales
- Sediment management on a regional scale and in conjunction with regulatory policies
- Anticipating temporal variations
- Landscape transformation with ecosystem adaptation
Why SAGE, Why Now?

- Shift in approach
- Cost prohibitive for hard solutions
- Sea Level Rise
- Loss of Coastal Wetlands
- Climate Change
- Increased frequency, size, and intensity of coastal storms
Some Notable Climate Work

- Working with USGCRP on the National Climate Assessment.
- Working with Mexico on their National Wetlands Inventory – includes climate change and sea level rise.
- Coordination with FWS Landscape Conservation Cooperatives (LLCs)
- Working with FWS led coastal conservation and climate change interagency workgroup
- Partnership with NatureServe on natural heritage data and vulnerability index.
- Active on interagency adaptation workgroups.
- Sea level change and vulnerability assessments.
Vulnerability Assessments & Coastal Change

USGS National Assessment of Coastal Vulnerability: insight into relative potential for coastal change from changes in sea level

- Already upgraded for use by Park Service at their locations

- Joint update underway with USACE, NOAA, and US Navy: planning tool to analyze where physical changes are most likely
Actionable Science for Sea-level Vulnerabilities

- **1986:** characterize observed trends
- **2000:** USACE planners consider potential for increased global sea-levels
- **2009:** use 3 scenarios
- **2011:** adds more recent science
- **2012:** project-scale adaptation engineering begins
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“Shore Protection”

- Shore protection contributes to storm damage reduction and coastal erosion mitigation.
- Storms cause flooding and wave damage, both of which can harm or destroy coastal property and habitats. Storm protection works reduce the impacts of these forces.
- Storms also create short-term erosion events. Natural recovery after the storm and seasonal fluctuations may not be in balance, which results in long-term erosion.
- Shore protection projects moderate the long-term average erosion rate of shoreline change from natural and man-made causes. Reduced erosion means a wider sediment buffer zone between the land and the sea, and, consequently, erosion mitigation translates into storm damage reduction from flooding and wave attack.
- The Corps uses a number of alternatives for shore protection, including different types of structural responses as well as non-structural ones. Combinations of these alternatives are often used together to achieve the most appropriate shore protection response for a certain coastal area.