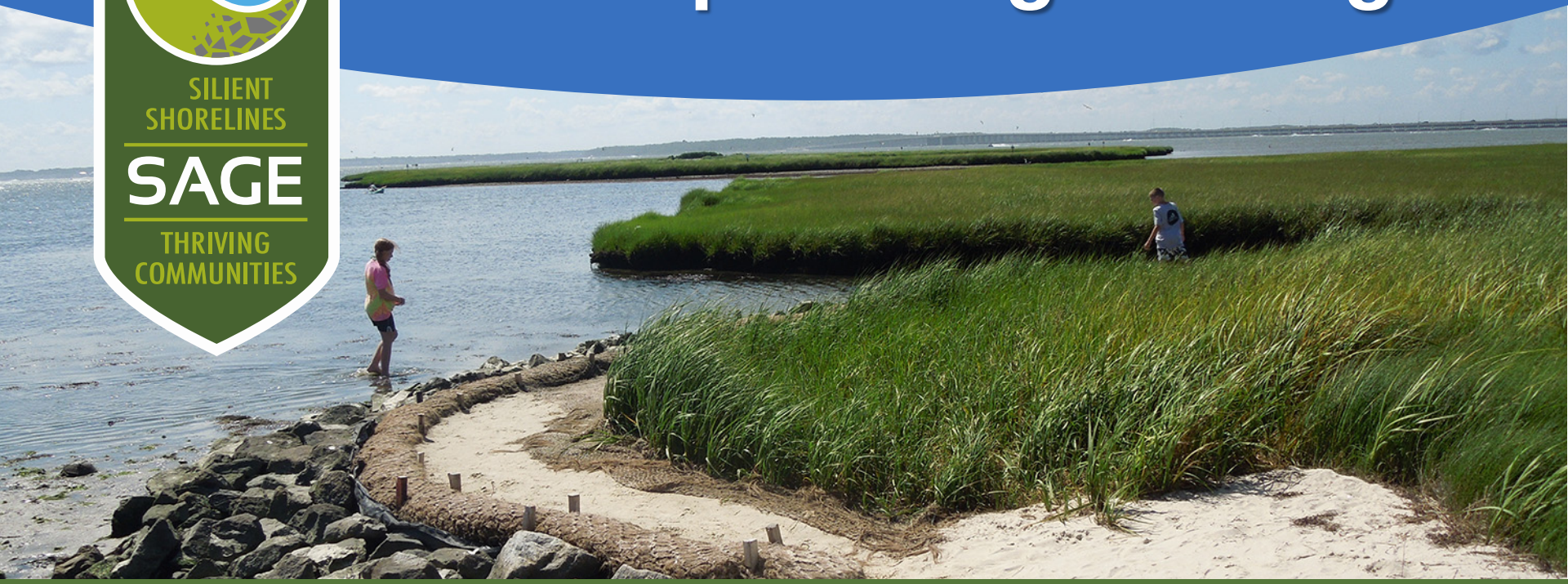
Systems Approach to Geomorphic Engineering

SILIENT SHORELINES
SAGE
THRIVING COMMUNITIES



Engineering With Nature

EWN

USACE - Institute for Water Resources & Engineer Research and Development Center

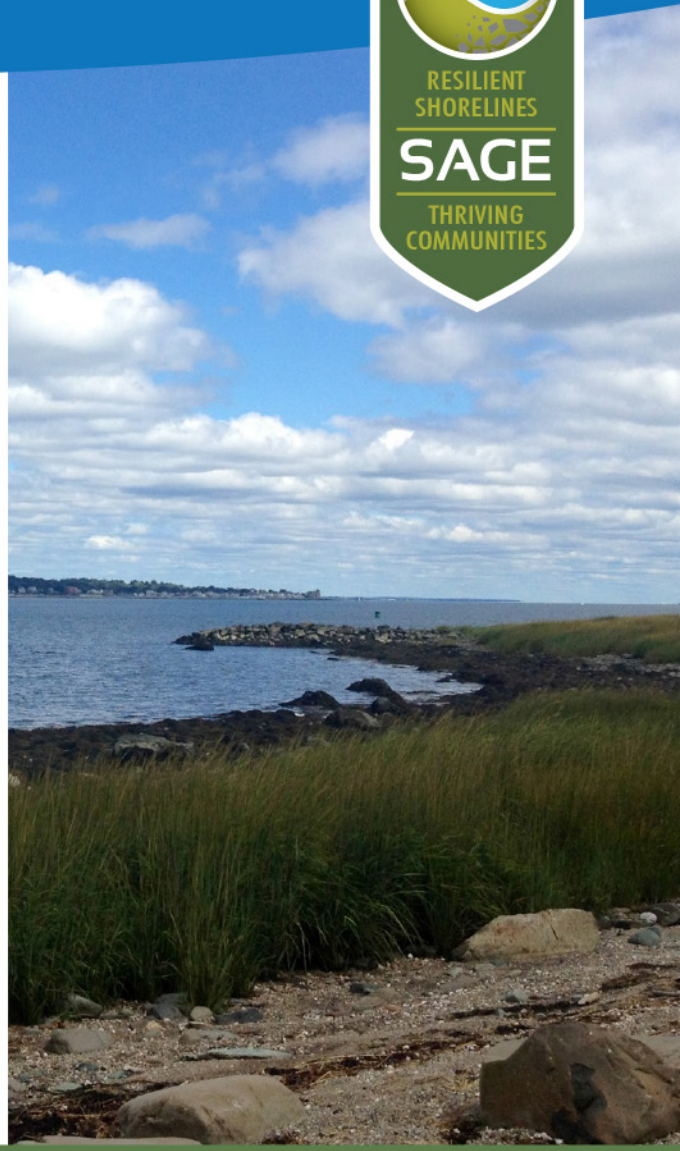
Building resilience

Resilience Requires:

- **Understand shoreline changes in the broad, regional context of natural systems**
- **Integrate green and gray solutions for coastal protection**
- **Multi-sector partnership to develop a systems approach to resilient shorelines**

SAGE Concepts

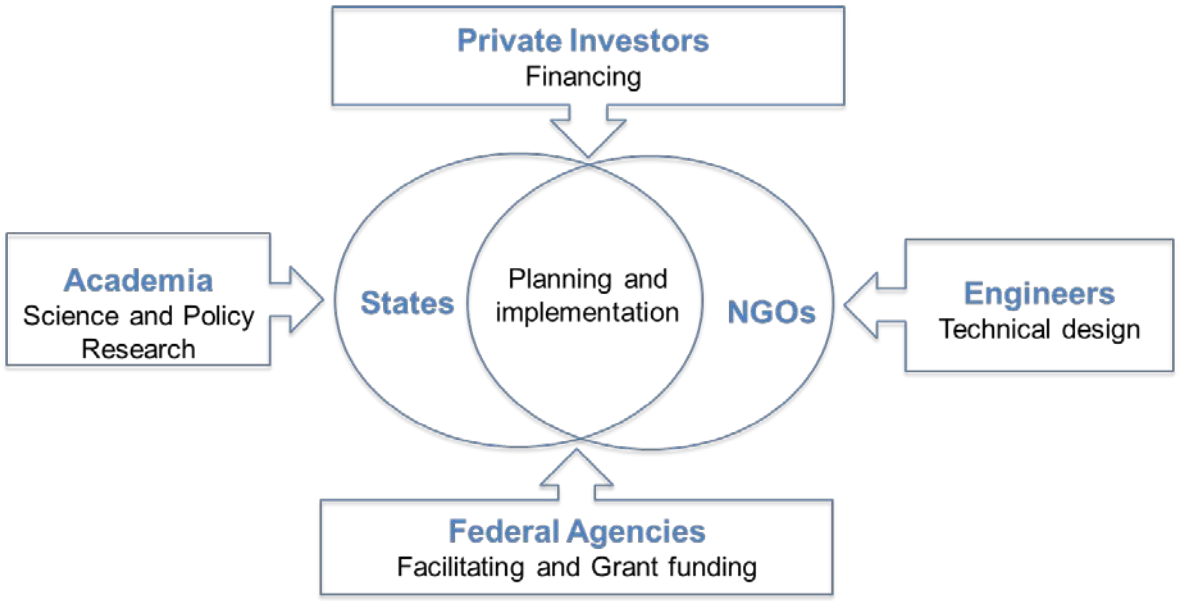
- ***SAGE*** **adapts the coastal landscape to address a wide array of changing conditions**
- ***SAGE*** **understands shoreline changes in the broad, regional context of natural systems**
- ***SAGE*** **builds partnerships among multiple sectors to research, plan, design, and fund projects that increase the resilience of coastal communities**



Who is SAGE

SAGE is a Community of Practice:

Collaborative effort between Federal and State agencies, non-governmental organizations, academia, and private business & engineering firms



SAGE Goals

- **Understand impacts on people and nature along coastlines**
- **Advance landscape-scale solutions for coastal resiliency**
- **Protect and enhance natural coastal features when appropriate**
- **Collaborate with both public and private sectors**
- **Develop innovative techniques and solutions to adapt coasts**
- **Share science, tools and demos to inform best practices**
- **Apply lessons learned both domestically and internationally**

What is SAGE doing?

Build partnerships in pilot regions and across national community of practice workgroups

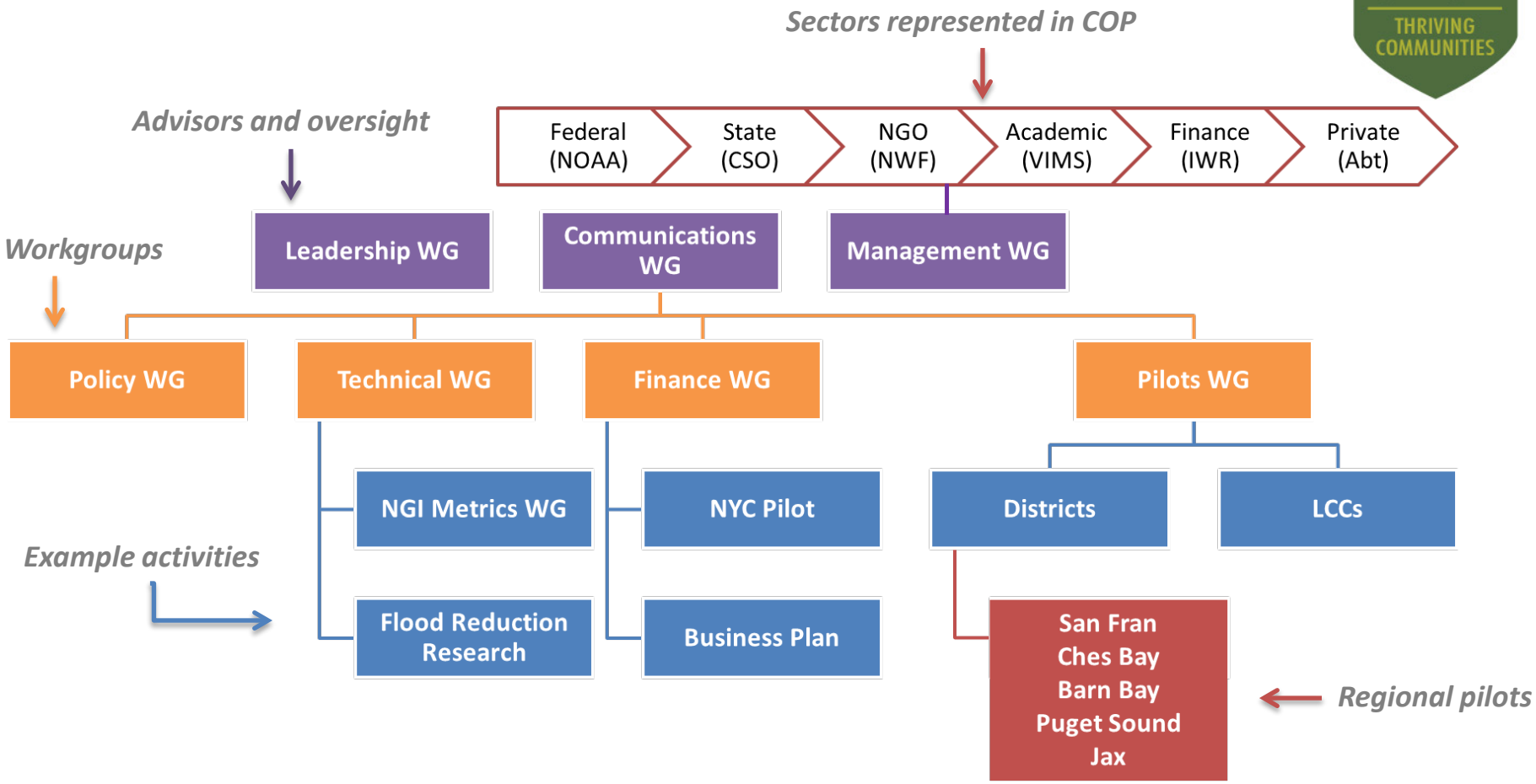
Compile, assess, and strengthen body of research on combined green and grey approaches

Provide tools to facilitate increased implementation of regional and green/grey approaches

Identify public and private financing mechanisms

Create communication processes and tools

SAGE Organization

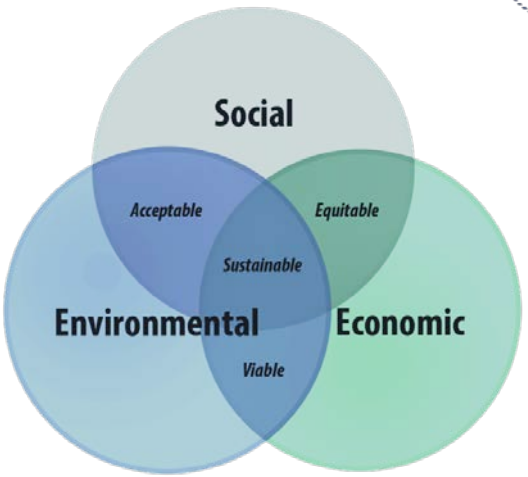


Engineering With Nature…

…the intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaborative processes.

Key Elements:

- Science and engineering that produces operational efficiencies
- Using natural process to maximum benefit
- Broaden and extend the benefits provided by projects
- Science-based collaborative processes to organize and focus interests, stakeholders, and partners



EWN Status

Engineering With Nature **initiative started within USACE Civil Works program in 2010. Over that period we have:**

- Engaged across USACE Districts (23), Divisions, HQ; other agencies, NGOs, academia, private sector, international collaborators
  - Workshops (>20), dialogue sessions, project development teams, etc.
- Implementing strategic plan
- Focused research projects on EWN
- Field demonstration projects
- Communication plan
- District EWN Proving Grounds established
- Awards
  - 2013 Chief of Engineers Environmental Award in Natural Resources Conservation
  - 2014 USACE National Award-Green Innovation

EWN Across USACE Missions

- Navigation
  - Strategic placement of dredged material supporting habitat development
  - Habitat integrated into structures
- Flood Risk Management
  - Natural and Nature-Based Features to support coastal resilience
  - Levee setbacks
- Ecosystem Restoration
  - Ecosystem services supporting engineering function
  - “Natural” development of designed features
- Water Operations
  - Shoreline stabilization using native plants
  - Environmental flows and connectivity

EWN “Proving Grounds”

- USACE Galveston, Buffalo, Philadelphia Districts
- EWN Proving Ground Kick-Off Workshops
  - October (SWG) and December (LRB) 2014; June 2016 (NAP)
  - District, Division, EWN Leadership Team
- Identify opportunities to implement EWN across current and future programs and projects
- Emphasis on solution co-development

Engineering Performance: Nature-Based Features

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
STORM INTENSITY, TRACK, AND FORWARD SPEED, AND SURROUNDING LOCAL BATHYMETRY AND TOPOGRAPHY

Dunes and Beaches

Benefits/Processes

Break offshore waves

Attenuate wave energy

Slow inland water transfer

Performance Factors

Berm height and width

Beach Slope

Sediment grain size and supply

Dune height, crest, width

Presence of vegetation

Vegetated Features: Salt Marshes, Wetlands, Submerged Aquatic Vegetation (SAV)

Benefits/Processes

Break offshore waves

Attenuate wave energy

Slow inland water transfer

Increase infiltration

Performance Factors

Marsh, wetland, or SAV elevation and continuity

Vegetation type and density

Oyster and Coral Reefs

Benefits/Processes

Break offshore waves

Attenuate wave energy

Slow inland water transfer

Performance Factors

Reef width, elevation and roughness

Barrier Islands

Benefits/Processes

Wave attenuation and/or dissipation

Sediment stabilization

Performance Factors

Island elevation, length, and width

Land cover

Breach susceptibility

Proximity to mainland shore

Maritime Forests/Shrub Communities

Benefits/Processes

Wave attenuation and/or dissipation

Shoreline erosion stabilization

Soil retention

Performance Factors

Vegetation height and density

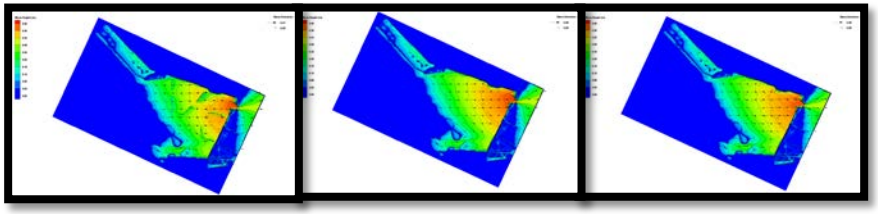
Forest dimension

Sediment composition

Platform elevation

Hamilton Wetlands
San Pablo Bay

- Beneficial use of dredged material to restore army air field to wetlands
- Dredged material was placed directly to contour wetland
- ERDC monitoring of new wetland to quantify waves, other physical processes and accretion
- ERDC modeling wave generation and dissipation, testing different shapes for barriers to fetch, comparing to other sites
- Plants will volunteer in tidal areas as sufficient accretion occurs



Linear Berms (As-Built) | No Berms (Control) | Mounds (ala Sears Pt.)

Questions?

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