

SAGE COMMUNICATIONS

Systems Approach to Geomorphic Engineering

Restore America's Estuaries 2014



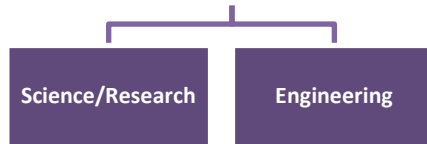
SAGE Community of Practice



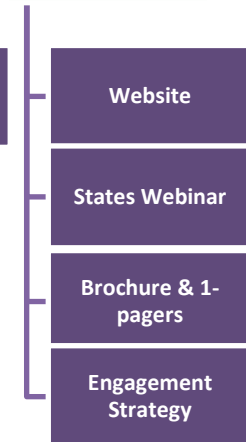
SAGE Leadership Team

SAGE Management Team

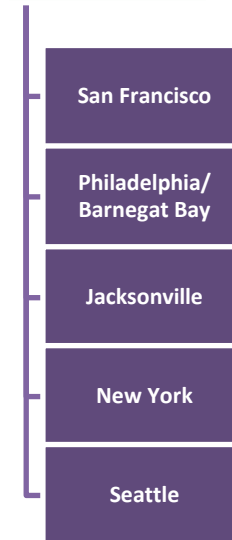
Funding



NNBF Metrics



Business & Finance Plan



Sectors

Work Groups

Activities

Key Components of SAGE Pilots/ Regional Demonstration



Building the Regional Community of Practice



Develop a regional coastal resilience plan



Identify funding sources to implement regional plans

Communication and Branding Tools



Developed by Leads and collaboration

Branding:

- Logo

- Color Ramp

Outreach:

- Fact Sheet

- Living Shorelines Brochure

- Website

- Powerpoint/ Webinar

- Frequently Asked Questions

Logo



Blues
Green / Sage Green/
Grey color ramp

Wave/
Shoreline
"Button"

Resilient Shorelines

Rocks

Acronym

Thriving
Communities



SYSTEMS APPROACH TO
GEOMORPHIC ENGINEERING

Our coasts are at risk. SAGE offers a solution.

What is SAGE?

SAGE, the Systems Approach to Geomorphic Engineering, is a community of practice dedicated to protecting our coastlines. Coastal areas are home to more than half of the U.S. population, rich in natural resources, and vital to our economy. Increasingly, shorelines are subject to intense storms, floods, loss of habitat, and sea-level rise.

SAGE promotes the use of both green (natural and nature-based) and gray (hard, structural engineering) approaches to make our coasts more resilient. Our systems approach addresses large areas of shoreline to foster thriving communities and flourishing natural ecosystems.

Who is involved?

SAGE is a collaborative effort among federal and state agencies, non-governmental organizations, academic institutions, and both private business and engineering firms. Initially envisioned by the U.S. Army Corps of Engineers, National Oceanic & Atmospheric Administration and Federal Emergency Management Agency, participation continues to grow.

Our partners include:

U.S. Army Corps of Engineers	The Nature Conservancy
National Oceanic & Atmospheric Administration	The Conservation Fund
Federal Emergency Management Agency	The Water Institute of the Gulf
American Society of Civil Engineers	University of Rhode Island
Center for Coastal Resources Management,	Coastal States Organization
Virginia Institute of Marine Science	...and more.

Goals & Principles

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

www.ccrm.vims.edu/sage



SYSTEMS APPROACH TO
GEOMORPHIC ENGINEERING



Fact Sheet Hot off the press!

Living Shoreline Brochure



GREEN - SOFTER TECHNIQUES

Small Waves | Small Fetch | Gentle Slope | Sheltered Coast

HOW GREEN OR GRAY SHOULD YOUR SHORELINE SOLUTION BE?

GRAY - HARDER TECHNIQUES

Large Waves | Large Fetch | Steep Slope | Open Coast

LIVING SHORELINE

COASTAL STRUCTURE

VEGETATION ONLY	EDGING	SILLS	BEACH NOURISHMENT ONLY	BEACH NOURISHMENT & VEGETATION ON DUNE	BREAKWATER	GROIN	REVETMENT	BULKHEAD	SEAWALL
 <p>Native plants</p> <ul style="list-style-type: none"> Disrupts wave energy Slows inland water transfer Increases natural storm water infiltration Provides habitat and ecosystem services Minimal impact to natural continuity and ecosystem processes Maintains aquifer/recharge/interflow and connectivity Flood water storage <p>Disadvantages</p> <ul style="list-style-type: none"> No storm surge reduction ability No high water protection Appropriate in limited situations Uncertainty of successful vegetation growth and competition with invasive 	 <p>Structure to hold the toe of existing or vegetated slope in place. Protects against shoreline erosion.</p> <p>Available For</p> <ul style="list-style-type: none"> Most areas except high wave energy environments <p>Vegetation/ Beach with Material Options</p> <p>(low wave only, temporary)</p> <ul style="list-style-type: none"> "Shovel" beaching Stakes/wood water transfer Decrease tubes Living reef (bryozoan/mussel) Rock gabion baskets <p>Benefits</p> <ul style="list-style-type: none"> Disrupts wave energy Slows inland water transfer Provides habitat and ecosystem services Disrupts wave energy Increases natural storm water infiltration Toe protection helps prevent wetland edge loss <p>Disadvantages</p> <ul style="list-style-type: none"> No high water protection Toe protection helps prevent wetland edge loss Uncertainty of successful vegetation growth and competition with invasive 	 <p>Parallel to existing or vegetated shoreline, reduces wave energy and prevents erosion. A stepped approach would allow habitat connectivity, greater food exchange, and better water front access.</p> <p>Available For</p> <ul style="list-style-type: none"> Most areas except high wave energy environments <p>Vegetation/ Beach with Material Options</p> <ul style="list-style-type: none"> Stone Sand breakwaters Living reef (bryozoan/mussel) Rock gabion baskets <p>Benefits</p> <ul style="list-style-type: none"> Disrupts wave energy Slows inland water transfer Provides habitat and ecosystem services Disrupts wave energy Increases natural storm water infiltration Toe protection helps prevent wetland edge loss <p>Disadvantages</p> <ul style="list-style-type: none"> No high water protection Toe protection helps prevent wetland edge loss Uncertainty of successful vegetation growth and competition with invasive 	 <p>Large volume of sand added from outside source to an eroding beach. Widens the beach and raises the dune to seaward.</p> <p>Available For</p> <ul style="list-style-type: none"> Low-lying oceanfront areas with existing sources of sand and sediment <p>Material Options</p> <ul style="list-style-type: none"> Sand <p>Benefits</p> <ul style="list-style-type: none"> Expands usable beach area Lower environmental impact than hard structures Flexible strategy Package with resilient dune Provides habitat and ecosystem services <p>Disadvantages</p> <ul style="list-style-type: none"> Requires continual sand resources for replenishment No high water protection Appropriate in limited situations Possible impacts to regional sediment transport 	 <p>Helps anchor sand and provide a buffer to protect inland area from waves, flooding and erosion.</p> <p>Available For</p> <ul style="list-style-type: none"> Low-lying oceanfront areas with existing sources of sand and sediment <p>Material Options</p> <ul style="list-style-type: none"> Sand with vegetation Can use straw/bamboo dune with Decompose tubes Rocky dune <p>Benefits</p> <ul style="list-style-type: none"> Expands usable beach area Lower environmental impact Flexible strategy Package with resilient dune Provides habitat and ecosystem services <p>Disadvantages</p> <ul style="list-style-type: none"> Requires continual sand resources for replenishment No high water protection Appropriate in limited situations Possible impacts to regional sediment transport 	 <p>Offshore structures intended to break waves, reducing the force of wave action and encourages sediment accretion. Can be floating or fixed to the ocean floor, attached to shore or not, and continuous or segmented. A jacked approach would allow habitat connectivity, greater food exchange and better water front access.</p> <p>Available For</p> <ul style="list-style-type: none"> Most areas except high wave energy environments often in conjunction with marshes <p>Material Options</p> <ul style="list-style-type: none"> Wood Armored Precast concrete blocks Living reef (bryozoan/mussel) Flow wave environment <p>Benefits</p> <ul style="list-style-type: none"> Reduces wave height and height Stabilizes wetland Can function like reef Economical in shallow areas Limited storm surge flood level reduction <p>Disadvantages</p> <ul style="list-style-type: none"> Expensive in deep water Can require water circulation behind/around floating breakwater is needed Can create navigational hazard Requires more land area Uncertainty of successful vegetation growth and competition with invasive No high water protection Can reduce water circulation Can create navigation hazard 	 <p>Perpendicular, projecting from shoreline. Interrupts water flow and beach moving parallel to the shoreline to prevent beach erosion and create waves. Return sand placed on beach.</p> <p>Available For</p> <ul style="list-style-type: none"> Coastlines with beach nourishment <p>Material Options</p> <ul style="list-style-type: none"> Timber Metal sheet piles <p>Benefits</p> <ul style="list-style-type: none"> Protection from wave toppers Materials and materials are adaptable Can be combined with beach nourishment projects to extend their life <p>Disadvantages</p> <ul style="list-style-type: none"> Broken or adjacent sites Can be detrimental to shoreline ecosystem (e.g. replace native habitat with rock and reduce natural habitat availability) No high water protection 	 <p>Lays over the slope of a shoreline. Protects slope from erosion and wind waves.</p> <p>Available For</p> <ul style="list-style-type: none"> Sites with pre-existing hardened shoreline structures <p>Material Options</p> <ul style="list-style-type: none"> Stone rubble Concrete blocks Cast concrete slab Rock-filled gabion basket <p>Benefits</p> <ul style="list-style-type: none"> Mitigates wave action Little maintenance Installable in-situ Minimal adjacent site impact <p>Disadvantages</p> <ul style="list-style-type: none"> No major flood protection Low maintenance Simple repair Loss of intertidal habitat Erosion of adjacent unreinforced sites Requires more land area May be damaged from being a sediment source to the system 	 <p>Parallel to the shoreline, vertical retaining wall. Intended to hold soil in place and allow for a stable shoreline.</p> <p>Available For</p> <ul style="list-style-type: none"> High energy settings and sites with pre-existing hardened shoreline structures. Accommodates working water fronts (e.g. docking for ships and ferries) <p>Material Options</p> <ul style="list-style-type: none"> Steel sheet piles Timber Concrete Composite carbon fibers Gabions <p>Benefits</p> <ul style="list-style-type: none"> Moderates wave action Manages tide level fluctuation Long lifespan Simple repair <p>Disadvantages</p> <ul style="list-style-type: none"> No major flood protection Erosion of adjacent unreinforced sites Loss of intertidal habitat May be damaged from being a sediment source to the system Requires more land area May be damaged from being a sediment source to the system Increases wave reflection 	 <p>Parallel to shoreline, vertical or sloped wall. Built on one side of wall to the same elevation as water on the other. Absorbs and limits impacts of large waves and directs flow away from land.</p> <p>Available For</p> <ul style="list-style-type: none"> Areas highly vulnerable to storm surge and wave forces <p>Material Options</p> <ul style="list-style-type: none"> Stone Rock Concrete Steel/aluminum sheet Steel sheet piles <p>Benefits</p> <ul style="list-style-type: none"> Prevents storm surge flooding Flexibly strong wave forces Shoreline stabilization behind structure Low maintenance needs Less space intensive horizontally than other techniques (e.g. vegetation only) <p>Disadvantages</p> <ul style="list-style-type: none"> Erosion of seaward seabed Disrupt sediment transport leading to beach erosion Higher up-front costs Visually obstructive Loss of intertidal zone Prevents upland from being a sediment source to the system Increases wave reflection May be damaged from overtopping seaward from waves

* Native plants and materials must be appropriate for current salinity and site conditions.

* Rock/ducks needs to be appropriately sized for site specific wave energy.

GRAY CAN BE GREENER: e.g., Living Breakwater using oysters to absorb/sediment to "shoreward" seawall using vegetation, alternative forms and materials

<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●</p>	<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●</p>	<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●●</p>	<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●●●</p>	<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●●●</p>	<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●●●</p>	<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●●●</p>	<p>Initial Construction: ●●●●</p> <p>Operations & Maintenance: ●●●●</p>
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Initial Construction: ● = up to \$1000 per linear foot, ●● = \$1001 - \$2000 per linear foot, ●●● = \$2001 - \$5000 per linear foot, ●●●● = \$5001 - \$10,000 per linear foot, Operations and Maintenance (yearly for a 50 year project life): ● = up to \$100 per linear foot, ●● = \$101 - \$500 per linear foot, ●●● = over \$500 per linear foot.

Lead: Catherine Alcoba USACE New York



SAGE WEBSITE COMING JANUARY 2015



US Army Corps of Engineers



FEMA

THE CONSERVATION FUND



The Nature Conservancy
Protecting nature. Preserving life.

THE UNIVERSITY OF RHODE ISLAND



Center for Coastal Resources Management
Virginia Institute of Marine Science

VIMS | WILLIAM & MARY
VIRGINIA INSTITUTE OF MARINE SCIENCE



THE WATER INSTITUTE OF THE GULF

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CoP Communications work group and website task group

SAGE Website

SAGE Website: Primary Elements



- Responsive Design: Resizes for various platforms
- Uses SAGE logo and color ramp
- Mission and Vision statements
- Defines CoP: What and Who
- SAGE Principals: SAGE Projects
 - Database
 - Map Viewer
- SAGE Regional Demonstration Projects
- Policy
- Science and Engineering
- Google search, Glossary

SAGE is a collaborative effort to develop innovative techniques and solutions to ensure the resiliency of our coastal communities and shorelines. Federal, State, and Local Agencies, non-governmental organizations, academic institutions, engineers, and private businesses are working together to:

- utilize natural ecosystems in conjunction with built infrastructure to protect coastal communities and shorelines
- broaden cost-benefit analyses that integrate green and gray infrastructure elements
- examine existing science, engineering, and policy activity both domestically and internationally
- identify strategies to better understand and validate best practices

PROJECTS

- **Searchable Project Database**
Multiple project types and sources
- **Interactive Map**
Projects with known locations
- **SAGE Pilot Projects**
Regional demonstration projects

News & Events

- November 1-6, 2014
7th National Summit on Coastal and Estuarine Restoration
- June 16, 2014
DOI Secretary Jewell Announces \$102 Million in Coastal Resilience Grants
- April 1, 2014
Living Shoreline Team Receives Funding to Develop Design Guidelines, Workshops to Preserve Alabama and Mississippi Coasts

Information about SAGE
Access and share information about SAGE

Policy
Find out more about relevant policies & regulatory issues

Science and Engineering
Technical guidance, research tools and other information

US Army Corps of Engineers, FEMA, The Nature Conservancy, THE UNIVERSITY OF RHODE ISLAND, NOAA, Center for Coastal Resources Management, VIMS, WILLIAM & MARY, THE WATER INSTITUTE OF THE GULF

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SAGE Website



Who's who:
Leadership,
Management,
Workgroups



PROJECTS

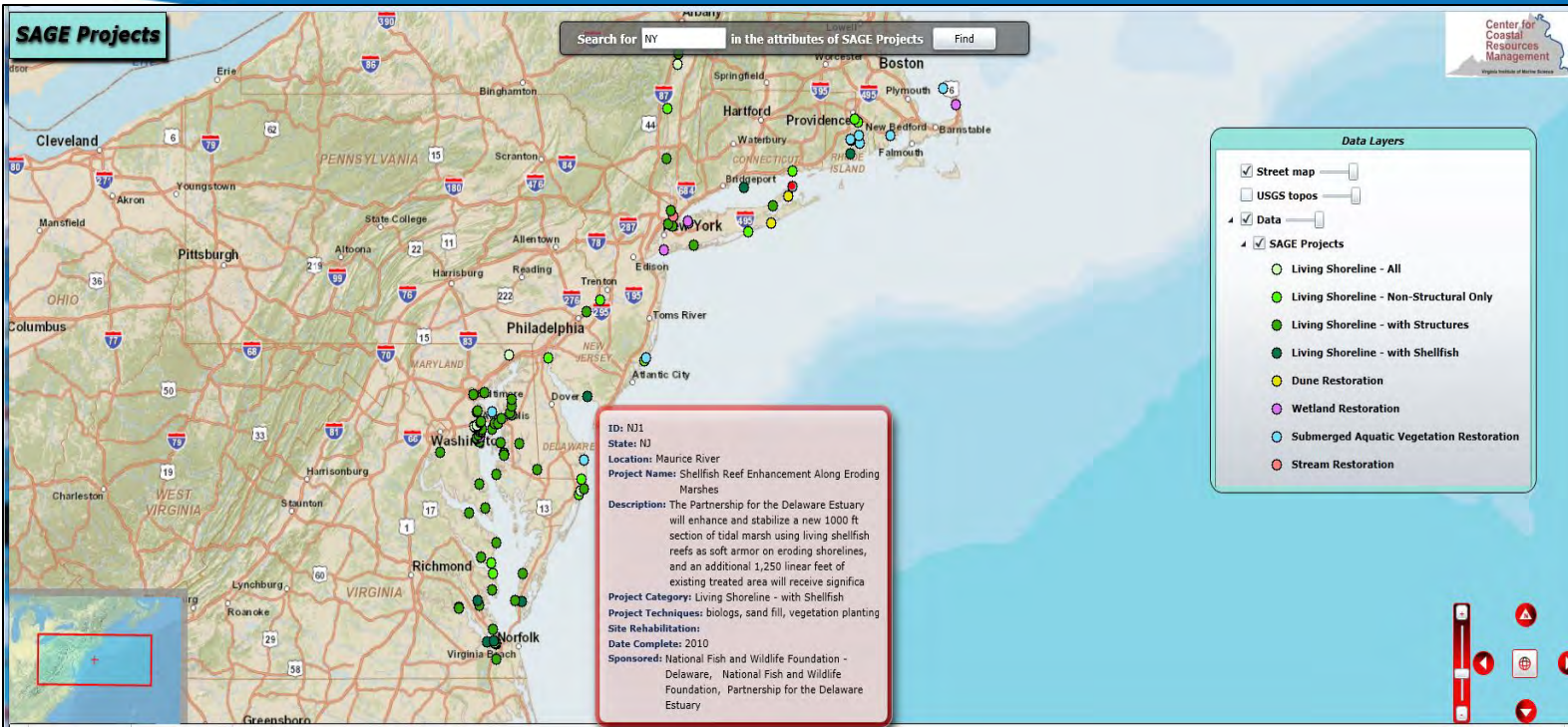
- **Searchable Project Database**
Multiple project types and sources
- **Interactive Map**
Projects with known locations
- **SAGE Pilot Projects**
Regional demonstration projects

- i** **Information about SAGE**
Access and share information about SAGE
- ✓** **Policy**
Policies and regulatory issues
- 🌐** **Science and Engineering**
Technical guidance, research tools and other information

Legislation
Regulations,
General Permits.....

Ecological research,
Engineering assessment,
Models, Decision
Tools.....

SAGE Website: Project Viewer



Projects from North Atlantic Comp Study

Developed Projects Classification by Type, Elements, and Site Rehabilitation

Float-over displays project detail

Additional regional data collection proceeding

Searchable Database



Systems Approach to Geomorphic Engineering

SAGE HOME ▾ ABOUT SAGE ▾ PROJECTS ▾ RESOURCES CONTACT

SAGE Searchable Project Database

Region

State

Project Type

Project Techniques

Site Rehab

Key Word

This searchable database contains multiple coastal resilience projects around the nation, including Living Shorelines for shoreline stabilization, habitat restoration, and floodplain management. Each project includes a variety of site, design, and partner information. The records can be searched using the pull-down lists or a Key Word search to find certain project names, partners, and other unique information.

This database was developed by SAGE partners at the US Army Corps of Engineers Institute for Water Resources and the Virginia Institute of Marine Science, College of William & Mary. Project records are collected from a variety of sources like the [NOAA Restoration Atlas](#), the [COPRI Living Shorelines Database](#), state and local agencies, watershed organizations, private foundations, and others.

Every attempt has been made to ensure that these data and the documentation are reliable and accurate. This database is provided with the understanding that the records are not guaranteed to be correct or complete, and conclusions drawn from the data set are the sole responsibility of the user. CCRM, VIMS, and any disclosed collaborative agency make no warranty, expressed or implied, as to the accuracy, completeness, or utility of this information, nor does the fact of distribution constitute a warranty. utility of this information, nor does the fact of distribution constitute a warranty.

Record ID	State	Project Category	Project Technique	Complete Date	Sponsor
MD15	MD	Living Shoreline-with structures	marsh & sill, sand fill, vegetation planting, debris removal	2010	American Recovery and Reinvestment Act
MD8	MD	Living Shoreline-with structures	sill, vegetation planting, debris removal	2006	Chesapeake Bay Trust/ design; DNR implementation
VA2	VA	Living Shoreline-Non-Structural Only	debris removal, salt marsh planting, riparian buffer planting	2009	Lafayette Wetlands Partnership, Chesapeake Bay Restoration Fund, Virginia Environmental Endowment, and donations came from the Colonial Place/Riverview and Larchmont Civic Leagues, Fellini's Restaurant and Adams Outdoor Advertising, Inc.
VA4	VA	Living Shoreline-with Structures	debris removal, sills, biologs, sand fill, salt marsh planting	2013	Chesapeake Bay Trust, City of Norfolk
VA8	VA	Living Shoreline-with Structures	Debris removal, salt marsh planting, sill	2013	Chesapeake Bay Trust Foundation

[Click Here To Export The Data into a CSV File](#)

SAGE Community of Practice



What's Next

- Engage Participation
 - How do you get involved?
 - Brown Bag conversations to follow this session
 - Sign-up Sheets- Email/ contact info
 - Consider Work Groups
- Website Launch in January 2015
 - Feed-back on Website content- Survey
 - Forum, List-serve?
- SAGE Projects compilation to expand to new regions
- SAGE Research Priorities