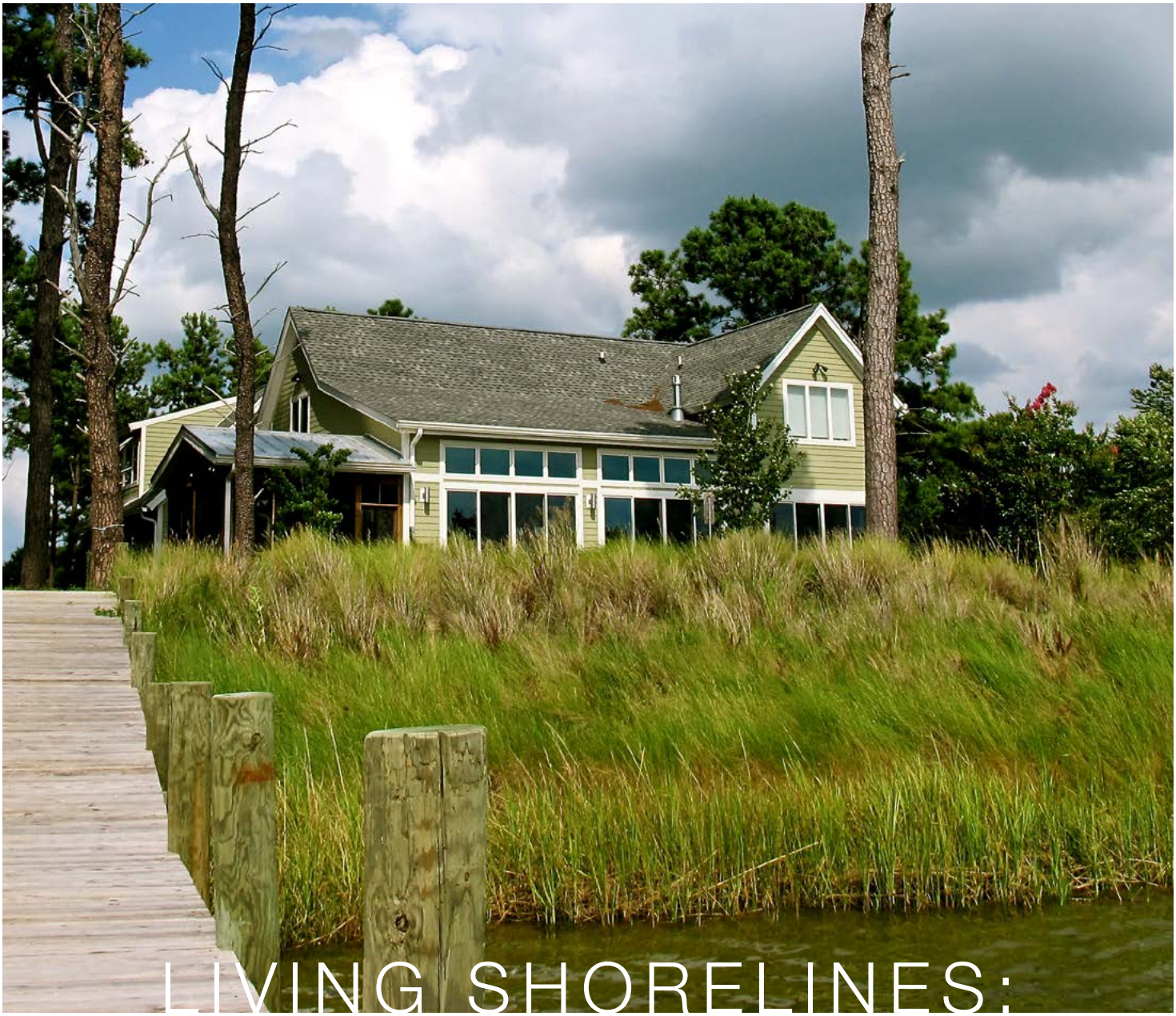

LIVING SHORELINES:

SOUND SCIENCE, INNOVATIVE APPROACHES, CONNECTED COMMUNITY

LIVING SHORELINES NATIONAL TECHNOLOGY TRANSFER MEETING AND REGIONAL WORKSHOPS
HARTFORD, CT, DECEMBER 1-2, 2015

A Summary Report
by
Restore America's Estuaries
and the
Connecticut Institute for Resilience and Climate Adaptation

RESTORE AMERICA'S ESTUARIES

CIRCA
Connecticut Institute for Resilience and Climate Adaptation

LIVING SHORELINES:

SOUND SCIENCE, INNOVATIVE APPROACHES, CONNECTED COMMUNITY

This event and report would not be possible without the hard work and talent of a lot of people.

SPECIAL THANKS GO TO...

Suzanne Simon (Restore America's Estuaries) and Jessica LeClair (Connecticut Institute for Resilience and Climate Adaptation) for their leadership from start to finish. Additional thanks go to Niki Pace (Mississippi-Alabama Sea Grant Legal Program) for her role as primary author of this report.

We also appreciate all the input and hard work of the steering committee, working groups, and volunteers. We literally could not have done this without you!

PHOTO CREDITS

Front and back covers: Tracy Skrabal
Above: Lee Anne Wilde

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EXECUTIVE SUMMARY

Our coasts are our homes. More than half of Americans reside in coastal zones across the United States. We live, work, and play here. And coastal resources and their impacts to our economy are vast. Yet, at the same time, the coasts face increasing development pressures combined with greater impacts from climate change. As more and more Americans are moving to the coasts, the impacts from erosion, nuisance flooding, sea-level rise, storm surge, and habitat loss are also rising.

The living shoreline community was born from this love of the coast. Realizing the importance of our coastlines and the need to protect and preserve these resources, coastal preservation efforts began exploring nature-based erosion control efforts as early as the 1970s. Over the years, living shorelines techniques have evolved through increased research into science, engineering, design, and adaptive management. Today's living shorelines community has grown significantly since those early days. By the 2000s, regional workshops were being held as practitioners worked to further the adaptation of living shorelines, improve the science supporting their success, and find regulatory approaches to encourage early adoption.

In 2015, Restore America's Estuaries (RAE) released the first national report on barriers to living shorelines projects and programs, entitled *Living Shorelines: From Barriers to Opportunities.* RAE brought together living shorelines experts with diverse geographic and technical backgrounds to evaluate the state of living shorelines at the national level. The report provided an overview of the current state of living shorelines activities while highlighting opportunities to further living shorelines practices already being done around the country. The report identified three major obstacles to broader use of living shorelines: (1) institutional inertia; (2) lack of a broader planning context; and (3) lack of an advocate. To address these obstacles, the report focused on four broad strategies, including: (1) education and outreach; (2) regulatory reform; (3) improved institutional capacity; and (4) public agencies as role models. Within each strategy, the report identified a number of specific and actionable recommendations for decision and policy makers. It was through the process of developing this report that the need for a national living shorelines meeting became apparent.

In an effort to unite a national living shorelines community, RAE and the Connecticut Institute for Resilience and Climate Adaptation(CIRCA) invited leaders of the living shorelines community from across the United States to the first ever national living shorelines conference entitled *Living Shorelines: Sound Science, Innovative Approaches, Connected Community.* The event was held December 1-2, 2015 in Harford, Connecticut. Representatives from federal and state agencies, researchers, Indian Country, academics, NGOs, and consultants came together for a national conversation on living shorelines in the United States. The two-day event was structured such that Day 1 included a national discussion on the state of living shorelines while Day 2 emphasized regional efforts with six concurrent regional breakout sessions (Northeast, Mid-Atlantic, Southeast, Gulf Coast, West Coast, and Great Lakes).

During the first day, discussions focused on the importance of shoreline protection to the insurance industry, innovations in science and technology, regulatory challenges and solutions, outreach and education efforts, and creative approaches to financing. Throughout the day, the role of insurance resurfaced as a mechanism for encouraging greater adoption of living shorelines. In particular, the National Flood Insurance Program's Community Rating System was touted as a means to encourage coastal communities to adopt open space preservation and natural shoreline protection in exchange for discounts on flood insurance policies.

Another common theme of the day was the need for greater long-term monitoring of living shoreline projects and unified metrics for monitoring. This point was reiterated across panels, and many noted that improved data would further efforts in permitting, outreach, and financing. In other words, the living shorelines community needs the data to back up their claims. Panelists highlighted several excellent examples of monitoring programs and long-term data, but theyare needed on a larger scale with unified metrics used across the country to allow for true comparisons between shoreline stabilization and protection options.

In addition, the Living Shorelines Academy was debuted. The Living Shorelines Academy is a joint effort by the U.S. Environmental Protection Agency (EPA),RAE, North Carolina Coastal Federation (NCCF), and the Southern Environmental Law Center (SELC). The Academy will include regional trainings as well as online training modules for both technical and non-technical audiences. In addition, the web-based components of the Academy will include a wealth of resources for living shorelines practitioners.

During the Regional Workshops held on the second day, attendees broke into six different regional groups. Each group tailored their day uniquely to focus on timely issues within their region. By incorporating the regional workshops into the overall event, attendees were able to maximize their participation by both networking on a national scale, while still connecting to the problems of their region. Though every region is different, common themes emerged. These included the need for increased contractor training and general outreach efforts, solutions to overcome regulatory challenges, maintenance requirements, unified metrics, an increased number of demonstration projects (both large and small scale) and creative approaches to financing. Many of these topics echoed conversations had during Day 1, illustrating the importance of bringing the living shorelines community together on a national level to share experiences and lessons learned across geographic boundaries.

By their very nature, summary reports cannot capture every detail of an event, particularly one that featured facilitated and group discussions. Please consult with the speakers and facilitators if you have questions or would like clarification. For your reference, presentations are available online at https://www.estuaries.org/living-shorelines-national-technology-transfer-and-regional-workshops.

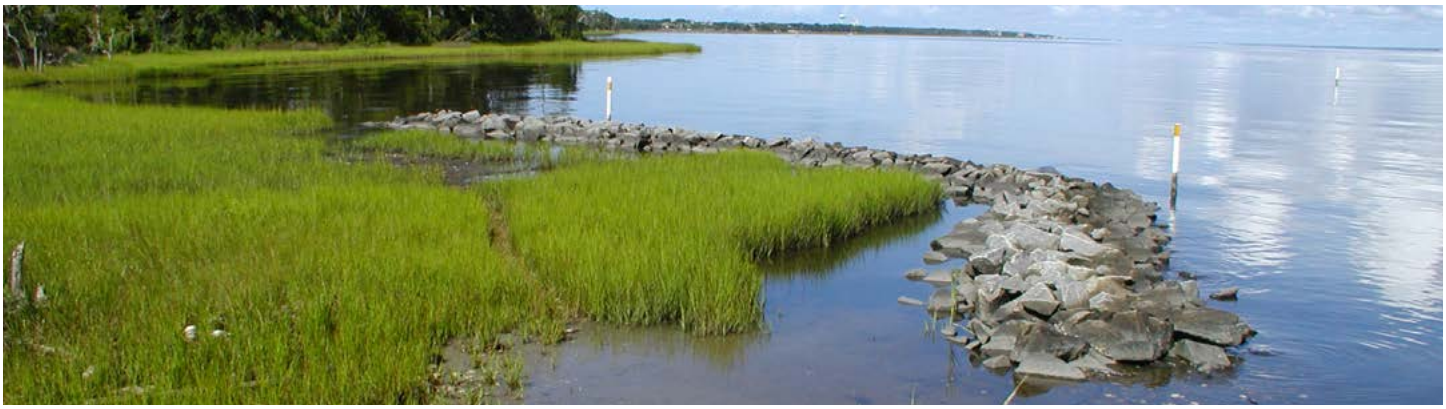


Image credit: Tracy Skrabal

1. WELCOME AND INTRODUCTORY REMARKS

SPEAKERS

Jeffrey Benoit, President, Restore America's Estuaries; Dr. James O'Donnell, Executive Director, Connecticut Institute for Resilience and Climate Adaptation; Rob Klee, Commissioner, Connecticut Department of Energy and Environmental Protection; Curt Spalding, Regional Administrator, U.S. Environmental Protection Agency

Jeffrey Benoit welcomed everyone to the first national gathering of the living shoreline community. He stated that the goal of this meeting was twofold: (1) to unite the living shorelines community and facilitate cross-regional sharing of knowledge, and (2) to advance the use of living shorelines as an accepted, preferred erosion control tool in the face of climate change and sea-level rise. In short, the conference organizers hoped this event would launch a national conversation about how to best manage our shorelines, examining the pros and cons of armored shorelines versus living shorelines.

To reach these goals, key questions were put to conference attendees. What is the state of the science? How can we make the use of living shorelines more common? Can the National Flood Insurance Program and the Community Rating System be tools for encouraging the use of living shorelines? How can homeowners be effectively educated on living shorelines? How do we overcome perplexing obstacles of construction and cost?

The definition of living shorelines was a point of consideration. For the purpose of this summit, the term "living shorelines" focuses on the larger concept, encompassing all techniques used to create more natural resilient shorelines as alternatives to unnatural hard structures.

Dr. James O'Donnell reflected on the role of Connecticut Institute for Resilience and Climate Adaptation (CIRCA) in promoting living shorelines in Connecticut. CIRCA is a partnership between the University of Connecticut and the Connecticut Department of Energy and Environmental Protection. CIRCA focuses on science, policy, and engagement. The mission of the Institute is to increase the resilience and sustainability of vulnerable communities along Connecticut's coast and inland waterways to the growing impacts of climate change and extreme weather on the natural, built, and human environment.

Connecticut actively promotes the use of living shorelines throughout the state. Climate change requires mitigation and reduction of greenhouse gas emissions. It also requires adaptation. In Connecticut, the coastline includes important infrastructure as well as critical ecosystems that both require protection. One of the challenges is balancing these two responsibilities as the state deals with impacts of sea-level rise.

Rob Klee discussed the importance of Connecticut's coast and the need to preserve Long Island Sound.Climate change is real. It is happening all around us. Connecticut is fortunate to have political leadersthat allow the state to be a leader on this issue. Connecticut has committed to an 80% reduction in greenhouse gas emissions from 2001 levels by 2050.

Connecticut is a small state, yet it has 600 miles of coastline. Exposure to storm surge is significant with $550 billion in assets at risk. The state is actively engaged in protecting these resources through partnerships with municipalities that are seeking solutions to these great challenges.

Curt Spalding discussed the interrelationship between climate change, stormwater management, and community prosperity through the lens of New England's resilience. Three factors are of particular significance: (1) a 75% increase in extreme rainfall since 1978, (2) sea-level rise impacts, and (3) high coastal population. New Englanders love the coast and more than half of the population lives in coastal communities.

Until recently, the concept of resilience was not well embraced in New England. However, events like Hurricanes Irene and Sandy woke people up to the reality of the situation and the need to improve resiliency. Communities have begun taking steps with support from the EPA. Actions include infrastructure mapping, vulnerability assessments, and local engagement. A database, Resilience and Adaptation in New England (RAINE), is being constructed as a publicly available tool for communities to share their approaches to shoreline issues. EPA National Estuary Programs are also working to evaluate and communicate what is at risk, while incorporating green infrastructure.

Spalding also discussed the Comprehensive Conservation Management Plan for Long Island Sound that requires incorporating consideration of vulnerability and resilience into all actions around the Sound. It is critical to get out into the communities and actually see how they are dealing with sea-level rise. Cape Cod is a good example. The Cape is actually moving as a result of erosion and altered sand migration patterns. The community chose to tackle this challenge through an updated §208 Area-WideWater Quality Management Plan, which embraces new technology and mapping science.

Image credit: Samish Indian Nation Department of Natural Resources

2. CREATING COASTAL RESILIENCE: WHAT'S AT RISK?

KEYNOTE SPEAKER:

Arlene Kern, Senior Vice President, Munich RE

The insurance industry has been studying climate change for many years. The impacts of climate change are now playing out as we encounter increasing extreme weather events and rising sea levels. Globally, reinsurance companies like Munich RE are paying close attention to these impacts as well as potential mitigation measures, like living shorelines.

Reinsurance begins with individuals who purchase insurance policies from a traditional insurance company, such as a homeowner's insurance policy. Those insurance companies then purchase reinsurance policies from a company like Munich RE. Reinsurance policies protect the insurance companies from large catastrophic events; research is increasingly revealing climate change to be a major threat to property damage, human health, and the resources that we rely on for day-to-day life like water, agriculture, and infrastructure.

Climate change is a reality. Greenhouse gas emissions are increasing as well as impacts associated with climate change (e.g. increased average temperature, sea-level rise, changes to precipitation patterns, etc.). Fourteen of the warmest years in recorded history have occurred since 1998. 2014 was the warmest year on record, until it was recently replaced by 2015. Likewise, global sea-level rise is occurring at an accelerated rate over the past two millennia. Between 1901 and 2010, global sea-level rose by 0.19 meters and scientists have 90% certainty that it will continue to rise through 2100, although the exact magnitude is still being determined. There have also been changes in precipitation patterns. For example, the last 12 months saw extreme precipitation events occur in New York, Massachusetts, Texas, and South Carolina. The frequency and intensity of climate impacts will increase, thereby increasing economic impacts. Loss trends already show signs of climate change impacts, with eight of the top ten losses occurring in the last ten years.

A look at hydrological events in the U.S. reveals an enormous risk to critical infrastructure and general well-being of coastal communities. The data show a clear trend towards increasing events. From 1980 to 2014, the U.S. experienced 450 loss events with a price tag of $98 billion, though only $16 billion was covered by insurance.

At the same time, U.S. populations along the coastline doubled between 1960 and 2008. However, the number of flood insurance policies from the National Flood Insurance Program has declined by 9.6% since 2009. With more than half of the nation's population living in coastal watershed counties, the largest insurance risk in the U.S. is linked to coastal storms. In 2012, the total value of insured Atlantic and Gulf coastal exposure totaled $10.6 trillion.

Reducing the risk to these populations is critical and can be achieved through a variety of approaches. Every dollar spent on disaster-risk mitigation and preparedness saves an average of $4 in future losses, according to a Federal Emergency Management Administration (FEMA) study. Enforcing stronger building codes would have decreased wind damage from Hurricane Katrina by 80%, saving $8 billion. Flood protection programs along the Mississippi River watershed have prevented more than $478 billion in flood damages.

Implementing resilient strategies now provides greater protection against hazards with a proven pay off – reduced loss of life and property following storm events. Natural green infrastructure, like living shorelines, will play an important role in mitigating these losses. Living shorelines are a win-win opportunity. They are highly effective in reducing carbon dioxide emissions and complement coastal resiliency.

The key to successful risk reduction is implementing resilience measures before events occur. Having nature-based infrastructure in place before the event occurs saves money in the long run. Hybrid approaches (e.g. combining green and grey approaches) should be considered, though priority to natural approaches should be given.

During the question and answer session, Kern addressed efforts that Munich RE is undertaking to encourage green infrastructure including investments in research and efforts by the company to become carbon neutral. Kern also stressed the importance of collaboration between local communities and larger companies to find ways to make small investments that improve long-term resiliency.

Image credit: Tracy Skrabal

3. SCIENCE AND ECOSYSTEM SERVICES

SPEAKERS

Dr. Rachel Gittman, Northeastern University; Dr. Joshua Moody, Partnership for the Delaware Estuary; Marilyn Latta, California Coastal Conservancy; Brian Majka, GEI Consultants, Inc.

MODERATOR

Dr. James O'Donnell, Connecticut Institute for Resilience and Climate Adaptation

Natural coastal habitats are key to long-term coastal resiliency and provide many resources on which humans rely. Recent innovations have been made in the field of living shorelines science. These advancements include technology, tools, best practices, data collection, and analysis. New data can further the promotion of living shorelines as a demonstrably viable alternative to hardened shorelines that bring many added benefits such as preservation of ecosystem services lost by armoring.

Dr. Rachel Gittman addressed the ecology and ecosystem services of living shorelines. NOAA research reveals that 14% of U.S. shorelines are hardened – approximately 23,000 kilometers – with seawalls, bulkheads, and other structures. Coastal habitats are vastly diverse and provide many ecosystem services, including those of value to humans. However, shoreline hardening causes significant ecological impacts. Over time, wave erosion destroys the intertidal habitat trapped between the water and the hardened structure. This loss of the habitat results in reduced nutrient cycling and reduced species richness, diversity, and abundance.

Erosion protection can be accomplished using natural approaches that preserve the intertidal habitat. Gittman presented one study in which two properties were examined following a storm event. (See graphic, next page.) Property A was protected by a bulkhead and Property B was protected

with a living shoreline. Following the storm, Property A suffered a collapsed bulkhead and ruined shoreline. Property B, which included a marsh sill, suffered no damage. A third property that used a vegetated living shoreline experienced no damage to the shoreline, and all vegetation was completely regenerated within a year. In both cases of living shorelines, no change in elevation occurred over the three-year study period.

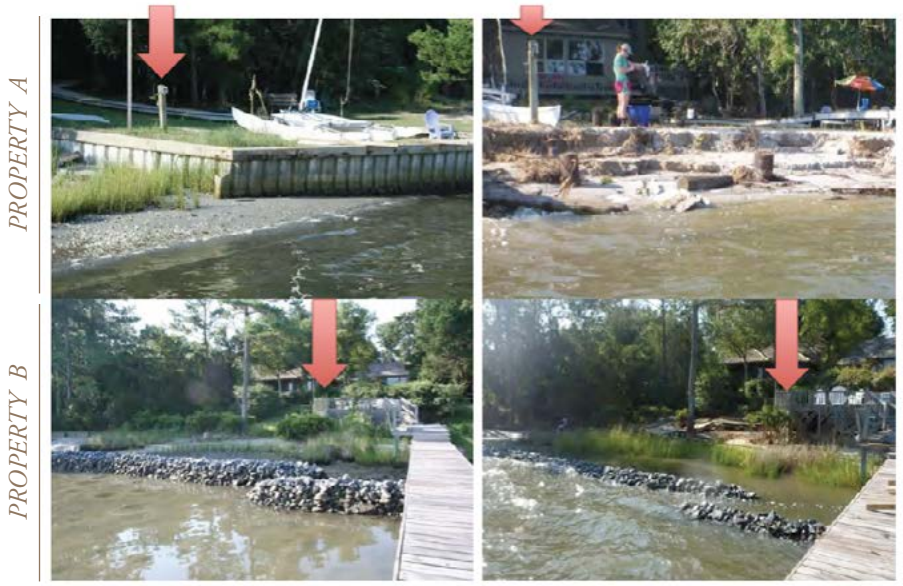


Image courtesy of Rachel Gittman.

Further evidence that living shorelines are viable protection structures: a recent study of worldwide data revealed that 58% of salt marshes were adding elevation at a rate greater than local sea-level rise. Oyster projects in North Carolina have been successful in growing the oyster reef as well. Behind the reef, sediment grows and is protected from erosion by the reef. A 2014 study revealed that the North Carolina oyster reef grew, on average, more than 1 centimeter per year. In other words, oyster reefs and marshes can keep up with and outpace sea-level rise, given adequate sediment levels and room to expand.

There are some tradeoffs to consider when designing a living shorelines project. For example, too much sediment will result in a high marsh but little fish habitat. On the other hand, high canal flow will result in less sediment and increased habitat. Every site is different and site design will depend on the resources in need of restoration at that location.

Dr. Joshua Moody discussed techniques, monitoring, and ecosystem services. The Delaware Estuary is losing coastal marsh at a rate of one acre per day. Moody has worked since 2007 to develop techniques to minimize this loss. Two techniques explored are bio-based designs using coir logs and hybrid breakwater structures.

Bio-based designs use coir logs to trap sediment over time. Once sufficient sediment is captured, the area behind the coir logs is planted with vegetation. As the plants stabilized, the coir logs break down and dissipate leaving behind a vegetated shoreline. This approach is best for low energy environments. Results show that erosion is slowed or stopped in many areas. The vegetated area enhances water quality and improves fish habitat. These installations do require long-term small-scale maintenance to stabilize the shore from runoff or ice.

Hybrid breakwater designs use oyster shell or a combination of shell and limestone to create a breakwater. Oyster castles and shell bags have both been used. Bio-based structures are then placed behind the breakwater. This design has led to increased oyster recruitment and improved biodiversity. Four sites have been installed since 2014, allowing one cycle of monitoring to be completed to date. The marsh systems have demonstrated good growth. When designing the structure, it is critical to use shellfish and vegetation that is appropriate for the area (e.g. use mussels instead of oysters depending upon the site). The mosaic of vegetative habitats is also important to consider.

In the context of monitoring, Moody stressed the need for a standardized framework for monitoring all living shorelines. This would allow researchers to assess the general effectiveness of a living shoreline and its ability to meet project goals. Standardized monitoring would also be useful in communicating success to funding and permitting agencies. Likewise, it would allow data to be shared with more consistency. For instance, data following Hurricane Sandy found that structures protected by hardened shorelines did not fare as well as those protected by natural shorelines. While these are excellent data for the living shorelines community, the data might be used more broadly if unified metrics were in place for evaluating all installations. Ultimately, the key to success is having all living shoreline experts work together to share information and improve permitting.

Marilyn Latta presented a West Coast perspective, focusing on nearshore linkage projects taking place in San Francisco, California. Though living shorelines are in their infancy in California, the City of San Francisco has incorporated living shoreline pilot projects into its San Francisco Bay Subtidal Habitat Goals Project. The overall goal of the project is to create biologically rich and diverse subtidal and low intertidal habitats, including eelgrass and oyster reefs, as part of a self-sustaining estuary system that restores ecological function and is resilient to changing environmental conditions.

Two locations were selected during the pilot process. Site

selection criteria included appropriate habitat, willing landowners, multiple locations, access for monitoring, and lot size. The two locations were broken into four plots in order to test multiple techniques. For oysters, two techniques were used: (1) Pacific oyster shell bags, and (2) "Baycrete" including reefballs, layer cake, oyster ball stack, and oyster blocks. For eelgrass transplanting, a bamboo stake transplant method was used.

To evaluate the results of the pilots, the project team estimated oysters in small quadrants, including three tidal elevations, north and south faces, and the rough surface area for each type of element. They found at the height of recruitment there were more than 3.8 million oysters. Currently, there are about 750,000 oysters. These changes are attributed to survival rates, annual recruitment fluctuations, and consumption as food by other species. The oyster reefs have also reduced wave energy approximately 30%.

Eelgrass densities consistently improved over time with peak density being recorded in the summer of 2015. Along with increased eelgrasss, researchers found increase in species use, with many species using the area for reproduction grounds – including shrimp, oyster, goby, and nudibranch. Wading birds and black oystercatchers have also responded well to the installations.

Several recommendations have come out of the pilot projects. These include:

- Add habitat structure on mudflat to quickly attract many species, including those rare and valuable;
- Plant eelgrass early in the growing season;
- Co-locate eelgrass and oyster reefs to maximize invertebrate and fish use;
- Use shell bags to maximize native oyster recruitment;
- Keep experimenting with Baycrete designs;
- Consider accretion around reefs in future designs – don't waste valuable shell at base;
- Do not fret about reef subsidence, even in unconsolidated sediment; and
- Test more locations, additional designs, to further evaluate wave attenuation potential.

Brian Majka shared results of living shoreline projects in the Great Lakes. He began his discussion with an overview of the Great Lake system. The Great Lakes make up 95% of U.S. surface fresh water supply and 18% of the supply worldwide. Lake Superior alone could cover North and South America in one inch of water. The Lakes combined include 10,210 miles of shoreline. Michigan has more miles of shoreline than any state but Alaska. The region is also home to 35 million people. Studies reveal that 30-50% of coastal wetlands in the region have been lost.

Several different ecosystem types can be found throughout the Great Lakes. These include coastal marshes and embayments, sandy shorelines and open coasts, dune bluffs, Lake Superior sandstone cliffs, and drowned river mouths (also called "lacustrine estuaries"). The waters are all geologically connected but they function very differently.

Over time, the land-water interface has been largely disconnected. Major stressors include waves, ice scour, and longshore drift of sediment. These impacts have been compounded by invasive species, nutrients, turbidity, contamination, and dredge and fill activities.

These natural forces and processes become problematic when accelerated by human activities. Various living shorelines techniques have been employed to deal with these complex issues. Techniques include the following:

- Gentle slopes that deflect ice while accommodating water level fluctuations;
- Sills;
- Wooden ribs for ice deflection;
- Wooden ribs with stone and native shrubs;
- Dune bluff stabilization with native plants and coconut material; and
- Designed gaps for wildlife passage across the land-water interface.

In summary, it is important to give plants a safe place to become established when reconnecting land with the water. Ice sheets five to ten feet thick can break themselves along the shore by using ribbed surfaces along with plantings. The best way to address and accommodate climate change is to give a shoreline the longest and gentlest slope possible.

During the Question and Answer session, the panel fielded several questions.

What recommendations does the panel have for dealing with herbivores, particularly horses, disturbing a site?

- The panel recommended constructing a physical barrier until the project and plantings are established. Salvaging existing established vegetation when installing the project can also help. That vegetation will do well right away and act as an anchor for new plantings.

What is the possibility of living shorelines on more open oceans to protect homes?

- Latta suggested sand dune restoration to address beach erosion and noted the importance of establishing vegetation.
- Majka noted the importance of balancing the risk with the ecology. In some instances, a hybrid structure may be needed.
- Gittman pointed out the challenges North Carolina is facing in this context. Beach nourishment is not working in the long-term as newly placed sediment continues to wash away after deposition. At a certain point in time, retreat may need to be considered. The shoreline is a dynamic system that migrates. This needs to be part of the conversation when we plan future developments near the shore.

What design resources are you looking to when designing your project?

- Majka pointed to the many design manuals now available and encouraged combining the manuals with information about failures and successes of various systems. Take into consideration the natural ecosystem that would be in place without human interference.
- Latta suggested making partnerships with consulting firms, graduate students, and universities.
- Gittman noted that trial and error is always a part of the process.
- Moody suggested that people take advantage of local knowledge, as people who spend time in systems often have useful insight.

Image credit: Tracy Skrabal

4. POLICY, PERMITTING, AND REGULATION

SPEAKERS

Bill Sapp, Southern Environmental Law Center (SELC); Niki Pace, Mississippi-Alabama Sea Grant, University of Mississippi School of Law; Bill Lesser, Federal Emergency Management Agency; John Torgan, The Nature Conservancy

MODERATOR

Mark Jaworski, CH2M HILL

Living shorelines practitioners frequently comment that permitting can be a challenge. Projects must comply with federal, state, and sometimes local laws that can vary greatly among different regions of the country. During this panel, speakers discussed the current state of the law, efforts to evolve the process to become more living shorelines compatible, and ways that federal programs like the National Flood Insurance Program can provide incentives for local governments to embrace living shorelines in their communities.

Bill Sapp discussed the role of federal regulation, with particular emphasis on permitting by the U.S. Army Corps of Engineers (USACE). Through the Clean Water Act, the USACE regulates activities in wetlands. Essentially all living shoreline projects are subjected to USACE permitting and oversight in one way or another. USACE district offices frequently use Nationwide Permit 13 (NWP 13) for Bank Stabilization to permit bulkheads, while living shorelines must undergo more rigorous individual permitting processes. The end result – it is often a lot easier to permit a bulkhead than a living shoreline. This dynamic needs to change in order to facilitate greater utilization of living shorelines techniques.

There are different permitting approaches that can be pursued. For instance, in Maryland and other states, state officials worked with the district USACE to develop a statewide General Permit (GP) for living shorelines. Other

states, like Alabama and Mississippi have worked with the USACE to develop Regional GPs for living shorelines. These permits serve as an alternative to individual permits when permitting living shorelines and can simplify the process. Another approach, and one that SELC is currently pursuing, is to sue the USACE. Last year, SELC initiated litigation challenging use of NWP 13 in Georgia. The lawsuit is currently ongoing though a ruling may be seen by spring 2016.

Yet another opportunity for reform is available during the NWP reauthorization. NWPs must be reauthorized every five years, and during this time, the USACE takes comments from the public about the use of the NWPs and ways to reform those permits. The NWP is entering a reauthorization period and the public comment period will begin in 2016. During this time, living shoreline advocates have an opportunity to comment on, and offer alternative solutions to, the use of NWP 13 for bulkheads. One approach that is being discussed in the community is the creation of a new NWP for living shorelines. This approach would help streamline living shorelines at the federal level.

Advocates are encouraged to weigh in on these two issues during the reauthorization comment period, which is expected to occur in spring 2016. The public can provide comments objecting to the use of NWP 13 to permit bulkheads during the reauthorization period. They may also encourage the USACE to adopt an NWP that favors the use of living shorelines over hardened structures.

Niki Pace focused on state and local government regulation of living shorelines. Pace began by encouraging attendees to review RAE's report Living Shorelines: Barriers to Opportunities, which highlights the need for regulatory reform and provides the reader with a good primer of the issues discussed during this session.

Continuing the conversation about NWPs, states have an opportunity to restrict the use of NWPs within their jurisdiction through the Coastal Zone Management Act (CZMA). The CZMA allows participating states to review federal practices for consistency with their state laws. This is commonly referred to as "consistency review." During this process, a state may object to the use of an NWP if it feels the permit's conditions are not consistent with the state's coastal program goals. States have used this strategy to limit use of NWPs within their jurisdictions. In addition, states can also add conditions to the NWP that will apply to any project permitted within that state's jurisdiction. These may include additional provisions to protect water quality or habitat, for example.

Turning to state-based issues, one of the unique features of coastal properties is the shifting of the property line through accretion, erosion, and other processes. This makes management of coastal properties unlike landlocked areas. In the case of waterfront property, the state is generally your waterward property-owning neighbor. That is, through the public trust doctrine, the state generally holds title to all submerged lands below the tide line (either mean high tide or mean low tide, depending on the state). The public trust doctrine allows the state to manage this property for the benefit of the public with emphasis on uses like navigation, recreation, and fishing. As a result, living shoreline projects often require permission from the state to place materials on the water bottoms. This adds another layer to permitting living shoreline projects in many states.

Some states have more aggressively regulated in favor of living shorelines. Maryland is the poster child for this movement, having adopted a statewide policy that favors living shorelines over hardened structures in 2008. However, other states are moving in this direction. Several states, including Virginia, have worked with the USACE to develop statewide general permits for living shorelines. In addition, Virginia has reformed state and local regulations to be in line with the new general permit.

Another opportunity to promote the use of living shorelines lies with local governments. Local governments have authority to adopt land use regulations that protect the public health, safety, and welfare. Wetland buffers have long been recognized as falling within this legal authority. Increasingly, local governments are using this approach to favor living shorelines over hard structures, particularly in states that lack a comprehensive approach. Communities in South Florida and Hawaii have both employed this strategy. Moreover, Maryland had many local government policies favoring living shorelines before the state adopted the 2008 law, illustrating the influence local regulation can have in swaying state policy.

In short, be aware of state policies in your jurisdiction. Also, consider working with local governments that may be friendly towards living shorelines. A local policy can lead to a groundswell that eventually turns into state policy.

Bill Lesser discussed the ways that living shorelines can be promoted through the National Flood Insurance Program (NFIP)'s Community Rating System (CRS). The CRS is a voluntary program available to communities participating in the NFIP. The CRS provides reduced flood insurance premiums in communities where floodplain management practices exceed the minimum requirements of the NFIP.

The CRS has three goals:

1. Reduce and avoid flood damage to insurable property;
2. Strengthen and support the insurance aspects of the NFIP; and
3. Foster comprehensive floodplain management.

The CRS program utilizes a class scale to determine the discount, ranging from 1 to 10, where Class 1 communities receive the highest discount on flood insurance premiums. As of October 2015, 1,368 communities were participating in the CRS program.

Activities that receive points under the CRS are detailed in the CRS Coordinator's Manual. Of the various activities available, there are several that may be of interest to a community utilizing living shorelines. These include credits for: open space; open space that is preserved or restored to its natural state; natural shoreline protection and restoration; Natural Floodplain Functions Plan within a Floodplain Management Plan; and outreach projects that emphasize protection of natural floodplain functions. Under the Natural Shoreline Protection Credit, there are two types of programs that qualify for credit. These are: (1) programs to protect channels and shorelines in the natural state (i.e., regulations that govern development), and (2) programs that restore channels and shorelines to natural state (i.e., green bank stabilization).

When working with a community that participates in the CRS program, include outreach on how living shorelines may improve the CRS score. An improved CRS score can translate into money saved for the citizens of their community.

John Torgan provided additional comments about the need to promote nature-based restoration. He reiterated the need for clean and consistent regulatory programs that offer incentives. Where these programs and incentives exist, the living shorelines community needs to raise awareness of the opportunities. He encouraged the development of a menu of options that considers definitions, metrics, and sustainable practices that could be used when planning a project.

Image credit: Tracy Skrabal

5. LUNCH SESSION: EPA PERSPECTIVES AND LIVING SHORELINES ACADEMY DEBUT

SPEAKERS

John Goodin, Wetlands Division, U.S. EPA; Tracy Skrabal, North Carolina Coastal Federal (NCCF) (on behalf of Ana Zivanovic-Nenadovic, NCCF)

MODERATOR

Todd Miller, NCCF

John Goodin kicked off the lunch discussion by reminding attendees of the critical importance of wetlands. The Status and Trends of Wetlands in the Coastal Watersheds of the Conterminous United States reveals that coastal watersheds are losing roughly 80,000 acres of coastal wetlands per year, far outpacing the national level of wetland loss. This report is a joint effort by the U.S. Fish and Wildlife Service (FWS) and NOAA. The FWS, NOAA, National Resources Conservation Service, USACE, U.S. Geological Survey, Federal Highway Administration, and EPA formed an interagency work group to reverse this trend. In particular, the work group focuses on engaging the public to highlight the importance of wetlands and the need to protect and restore this important resource.

The group conducted a series of coastal wetland reviews across the U.S., looking at specific stressors. The workgroup developed recommendations to increase the quality and quantity of coastal wetlands. Recommendations included the following: remove regulatory barriers; increase outreach efforts; incorporate the impacts of climate change; conduct training for contractors; and increase support for the National Estuary Programs. This effort evidences the importance of interagency efforts. Having all groups working together may improve efficiency when tackling challenges like regulatory barriers to living shorelines.

Tracy Skrabal debuted the new Living Shorelines Academy (LSA). The LSA is a resource aimed at promoting the exchange of information, research, training modules, and policies and practices to advance the use of living shorelines.

The LSA seeks to advance the science, policy, and practice of living shorelines. Goals of the LSA include: increase the overall abundance of wetlands; develop and provide targeted outreach to living shoreline professionals; provide information about living shoreline options and benefits for waterfront landowners; and enhance collaboration among governmental agencies, researchers, and the private living shorelines community.

The LSA online component will include training modules for both technical and non-technical audiences. It will also house a mapped and searchable national database of living shoreline projects. Primary and peer-reviewed secondary literature will be available in a searchable database, as will a listing of living shoreline professionals. Existing living shoreline resources will be catalogued. The NCCF is currently soliciting information for the various databases as well as overall feedback.

The site will also feature a Living Shoreline Forum to promote an ongoing exchange of ideas. The Forum will build upon the Living Shoreline Forum established by Southern Environmental Law Center (SELC), which will be migrated and integrated into the LSA.

The learning modules, *Living Shorelines, Living Coasts,* will be a two-part feature. One module will focus on educating property owners and other non-technical parties about the benefits of living shorelines. The second module is created with design and construction professionals in mind and can also be used by permitting agencies and regulators. This second module will provide more technical detail.

Partners for this project include the U.S. EPA, RAE, NCCF, and SELC.

Image credit: Della Barbato

6. OUTREACH, EDUCATION, AND ENGAGEMENT

SPEAKERS

Tracy Skrabal, North Carolina Coastal Federation; Dr. Jon Miller, Stevens Institute of Technology; Juliana Barrett, Connecticut Sea Grant; Jeff DeQuattro, The Nature Conservancy Gulf of Mexico Program

MODERATOR

Curt Johnson, Save the Sound

The living shorelines community encompasses a variety of constituencies and stakeholders. Tailoring engagement and messaging to a target audience can go a long way towards meaningful involvement. Innovations and approaches that inform, educate, and engage the community from a variety of perspectives are discussed below.

Tracy Skrabal began the session with a look at outreach efforts in North Carolina. When asking the question "Who needs to be educated/engaged?" the list abounds with various audiences and stakeholder groups – a sentiment repeated throughout the day. Venues for training can be equally varied. Classrooms, online, professional conferences, private consultations, news media, and field training all provide opportunities to provide outreach on living shorelines.

In North Carolina, training efforts have focused on regulators, waterfront property owners, policy makers, landscapers, consultants, realtors, and contractors. Since 2011, the North Carolina Coastal Training Program has hosted 11 workshops on living shorelines – reaching more than 530 coastal decision makers.

Several lessons were learned through this training process. First, it is essential to provide ample workshop opportunities for a variety of audiences. Additionally, offering continuing education units whenever possible is a useful incentive to attract professional attendees. Always tailor the message to the audience. Whenever possible, vary the training venue and mechanism. Attendees enjoying getting outside and seeing a

living shoreline installation.

There are several North Carolina based living shoreline resources available online from the North Carolina Department of Environment and Natural Resources. Other resources include RAE's report, *Living Shorelines: From Barriers to Opportunities,* released in 2015. In addition, RAE's upcoming National Summit on Coastal Restoration and Management, to be held Dec 1-15, 2016 in New Orleans, will be another opportunity to share living shoreline resources.

Dr. Jon Miller highlighted living shoreline outreach efforts in New York and New Jersey. One project discussed was the *Hudson River Sustainable Shorelines Project.* The goal of this project was to develop science-based recommendations for shore zone management along the Hudson River that would preserve or enhance ecological functioning while also meeting engineering needs. The project used an advisory panel to guide the research. The team conducted a literature review and cost analysis. They also examined physical forces and forensics. Ultimately, the team developed a physical assessment protocol for use in the region. These results were shared with various user groups including: experts and consultants, government regulators, policy and law makers, municipal officials, property owners, and advocates.

Another project, the *Coastal Green Infrastructure Research Plan for New York City* sought to use ecological strategies in an urbanized environment. The team conducted a literature review. A variety of green infrastructure was considered including wetland/maritime forest, reefs, breakwater islands, channel shallowing, eco-bulkheads, and living shorelines. The research also took into consideration aspects like sediment budgets, regulatory policies, and impacts of wake and ice on the system. The results yielded a strategic technique based research evaluation.

Miller also discussed the *New Jersey Living Shorelines Initiative.* The New Jersey Department of Environmental Protection (NJDEP) created a living shorelines working group and the state adopted a living shorelines general permit (GP 24) that allows fill up to the 1977 tidelands line. Engineering guidelines were developed with three primary objectives: (1) provide guidance to engineers and regulators on the engineering components of living shoreline design; (2) provide a common starting place to ensure consistency with the living shorelines general permit; and (3) reduce the number of potential failures due to poor design and/or construction. The work group is currently working on metrics and monitoring protocols.

In addition, the NJDEP received a National Fish and Wildlife Foundation grant to work with communities to develop ecologically based, natural hazard mitigation resources. The project includes conducting outreach and education, providing direct assistance to communities, monitoring and assessing projects, and engaging youth. Results will be circulated at the conclusion of the project.

Juliana Barrett shared a Connecticut perspective to living shorelines outreach. According to Barrett, the ideal outreach will lead to consistent messaging about living shorelines and develop a community of coastal property owners who are aware of and suggest living shorelines to their consultants. However, living shorelines outreach faces barriers such as the psychology surrounding hard structures (i.e., that they "guarantee" protection) and general familiarity with hard structures. To overcome these barriers, examples of what works and what does not, including monitoring and data to support the findings, are needed. Outreach tailored to different audiences is also critical.

As part of the University of Connecticut's Climate Adaptation Academy, several living shorelines workshops were held. The workshops included a broad range of audiences though event planners recognize a need to include additional landscape architects. Two workshops have been held with a third currently being planned.

Work is also underway to develop a Living Shoreline Story Map for Connecticut's coastline. The project will look at beach enhancement, marsh enhancement, marsh hybrid designs, and beach hybrid designs. The website allows the user to use a map to determine what type of living shoreline is suitable in their area and should be available in 2016.

Throughout these efforts, several ways to improve living shoreline outreach were identified. These include: develop common terminology; highlight the scientific evidence of lost ecosystem services when hard structures are used, including the impacts of sea-level rise; and appeal to social values like ecosystem services, tourism, economics, and property values.

Jeff DeQuattro offered examples of work The Nature Conservancy (TNC) is doing in the Gulf of Mexico region. TNC is working with engineering firms to form partnerships for elevating the visibility of green and natural infrastructure. The goal is to have engineers and ecologists working together from the beginning of a project on a step-by-step process to address coastal erosion at a particular site. Working together early on in the process increases the likelihood that the suite of options identified will include hybrid and green solutions.

TNC also performs outreach through mobilization of volunteers. Per one example, more than 500 volunteers showed up to help install and plant a living shoreline. By engaging the community in the process, the collective awareness is raised, creating advocates that then take messages back into their neighborhoods.

During the question and answer session, the speakers shared a few final suggestions for improving outreach on living shorelines. One suggestion was to target realtors. Educated realtors can be living shorelines advocates if they understand the value living shorelines can add to a property. A living shoreline can be a selling point, especially for high-end properties. A second suggestion to improve outreach is to advance the knowledge of cost. In many situations, hard structures have high initial costs while living shorelines have lower initial costs and small maintenance costs. Property owners should understand this dynamic so that they can make more-informed decisions.

Image credit: Tracy Skrabal

7. VALUATION AND INNOVATIVE FINANCING

SPEAKERS

Dan Nees, University of Maryland Environmental Finance Center; Michael Curley, Environmental Law Institute; Nick Shufro, United Nations Office for Disaster Risk Reduction & PricewaterhouseCoopers; Moderator Jonathan Stone, Save The Bay – Narragansett Bay

This session examined ways that the living shorelines community can – and must – evolve its current approach to valuing living shorelines.

Dan Nees kicked off the discussion by pointing to an important innovation in the living shorelines community: people are beginning to see the value in living shorelines. Utilities are beginning to connect the value of living shorelines to stormwater management and flooding. Living shorelines can help a community manage water in these contexts, and that has value.

Increasingly, communities are coupling flood management with clean water management, creating a role for green infrastructure. However, perception is key. You cannot engage the private sector unless the community first recognizes the value of living shorelines. When installing living shorelines, clear attainable goals need to be set so that the project can be clearly evaluated. Advocates need to make the argument that putting in a living shoreline will treat storm water and that requires adequate data. Unless utility managers see the connection, the utilities are unlikely to fund the project.

Ways to overcome financing barriers include using social media to connect living shorelines and their value to a utility and/or community. Coupling storm water management with climate change and resiliency may help a small community see the value of green infrastructure. In addition, communities should be encouraged to develop water resource plans that include living shorelines.

Michael Curley focused on the role of Clean Water Act State Revolving Funds and other alternative strategies for funding living shorelines. According to Curley, the fund is currently worth $55 billion in net assets that could be leveraged into $1 trillion in financing. These are not grants but rather low-interest loans.

In Staten Island, funds are being used as part of a "Rebuild by Design" project that incorporates living shorelines to address wave action. The overall project cost is $72 million, of which $60 million is for the living shoreline project and $12 million is for community involvement. The community engagement funding can be used to install revenue producing items like parking and kayak rentals to help pay back the loan. Another project is dealing with the construction of a power plant and a green levee. By finding other sources of revenue for the power plant, funds can be redirected to pay for the green levee.

Another option includes a broad-based state tax. Maryland passed a tax on persons with septic systems, colloquially referred to as the "flush tax." This option requires political will but is likely the most secure source of financing. Other sources include charging for permits in city parking – giving local residents a discount while charging more to tourists. A state could also impose a higher sales tax along coastal counties and use that increased tax revenue to fund green infrastructure projects in the geographic region.

Special districts, like a living shoreline preservation district, can be accomplished through local land use regulation. Under this scenario, the city would collect the additional taxes from the preservation district and that money would be used to pay off a bond over years. For smaller projects, a city may consider a sponsorship program created through state revolving funds.

Nick Shufro turned the discussion to engagement with the private sector. Shufro framed this discussion through the new United Nations Alliance for Risk-Sensitive Investments program (ARISE). The ARISE program is looking at effective management of disaster risk and opportunities through global partnerships. One focus area of ARISE is the effort to increase access to optimal and sustainable disaster insurance to the wider global community, particularly in emerging economies.

The Global Assessment Report on Disaster Risk Reduction is a biennial global assessment of disaster risk reduction and comprehensive review and analysis of the natural hazards that are affecting humanity. Based on this report, the average cost of disasters to the world is $315 billion, an almost 100% increase in two years. The UN recognizes that "the more governments, UN agencies, organizations, businesses, and civil society understand risk and vulnerability, the better equipped they will be to mitigate disasters when they strike and save more lives" – Ban Ki-moon, UN Secretary General. To achieve this goal, there needs to be a clear business case for investing in prevention rather than just response. Ways to engage the private sector in tangible, concrete projects and actions also need to be developed.

Turing to the private sector role, the Sendai Framework for Disaster Risk Reduction makes several recommendations. These include recruiting private sector financial institutions and financial regulators to:

- Integrate disaster risk management, including business continuity into business models and practices through disaster-risk-informed investments; and
- Actively participate in the development of normative frameworks and technical standards that incorporate disaster risk management.

Recognizing that there are many different players with varied motivations, ARISE found that we need an "all hands on deck" approach. Climate change is not always an operative term. Timing can be an issue. Resiliency values are not always well understood. Innovative strategies exist but reinsurers may tend to follow, rather than lead, with new approaches.

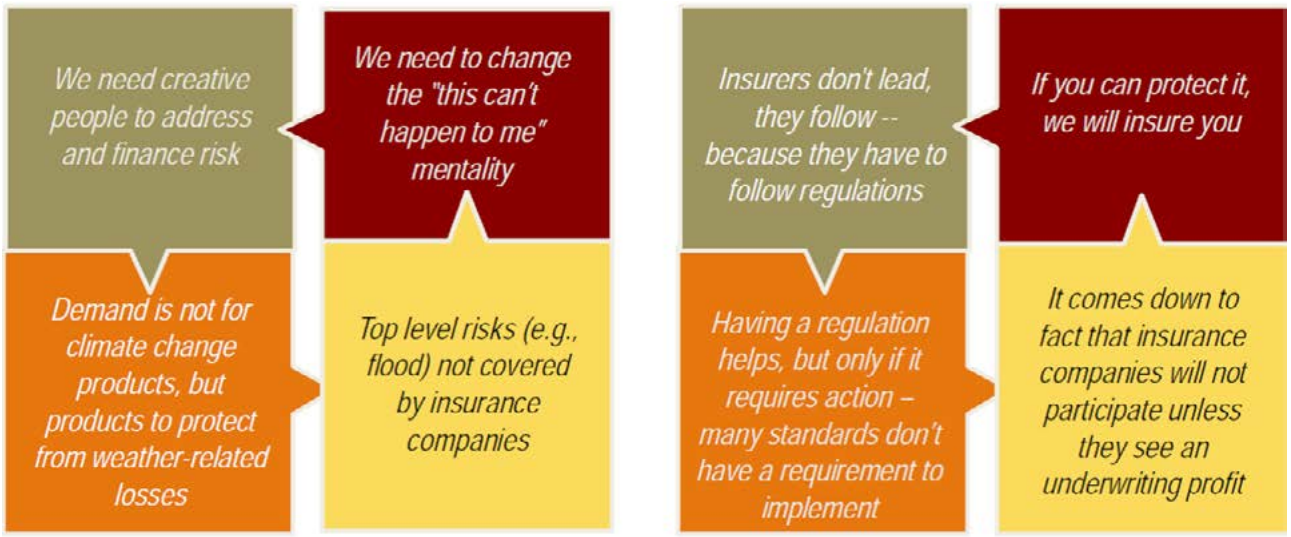


Image credit: Nick Shufro, ARISE

Image credit: Samish Indian Nation Department of Natural Resources

8. REGIONAL WORKSHOPS

On the second day of the summit, regional workshops were held that allowed participants to focus on issues specific to their local living shorelines community. The regional groups consisted of the Northeast, Mid-Atlantic, Southeast, Gulf Coast, West Coast, and Great Lakes.

The regions were given flexibility to address their challenges while keeping in mind four overarching questions:

- What are the biggest barriers you face in your region in terms of implementing living shoreline projects and programs?
- How can these barriers be addressed or overcome?
- What resources and approaches are needed to make this happen? What approaches have worked?
- How should the living shorelines community advance and move forward?

Each group took a unique approach to their workshop goals and agenda, creating a truly localized space for sharing ideas and challenges across the region. The workshop outcomes are discussed below.

NORTHEAST

The Northeast workshop included the states of Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, and New York. Representatives from Nova Scotia, Canada, were present, as well. The group chose to focus their session on a discussion of living shorelines techniques being used in the Northeast, followed by breakout sessions focused on barriers, solutions, and recommendations for moving forward.

SPEAKERS

Varoujan Hagopian, GEI Consultants, Inc.; John Ramsey, Applied Coastal Research and Engineering, Inc.; Rebecca Haney, Massachusetts Office of Coastal Zone Management; Anamarija Frankic, Green Harbors Project

MODERATOR

Jennifer Mattei, Sacred Heart University

FACILITATORS

Caitlin Chafee, Rhode Island Coastal Resources Management Council; Julie Stein, HDR, Inc.

SESSION 1

OVERVIEW OF PRIMARY LIVING SHORELINES TECHNIQUES IN THE NORTHEAST

Varoujan Hagopian focused his discussion on salt marshes. He explained that developing a successful living shoreline design required, at a minimum, experienced engineers, landscape architects, scientists, ecologists, regulators, and experienced contractors. If the design process is well implemented, it will yield the best results.

Creating new salt marsh and restoring existing marshes are essential to the region. Living shorelines are a good option for salt marsh restoration in areas of low to moderate wave energy. A healthy salt marsh reduces up to 50% of incoming wave energy within the first 15 to 20 feet of area and up to 95% over its 150 to 200 foot length. A typical salt marsh consists of four zones: (1) mudflats, (2) low salt marsh, (3) high salt marsh, and (4) coastal field and forest. Salt marshes are diverse ecosystems that provide spawning beds for a variety of marine life. Marshes also improve water quality in two ways: (1) through the uptake of nutrients, filtration, denitrification, and sediment retention; and (2) by providing habitat for 80% of breeding bird populations.

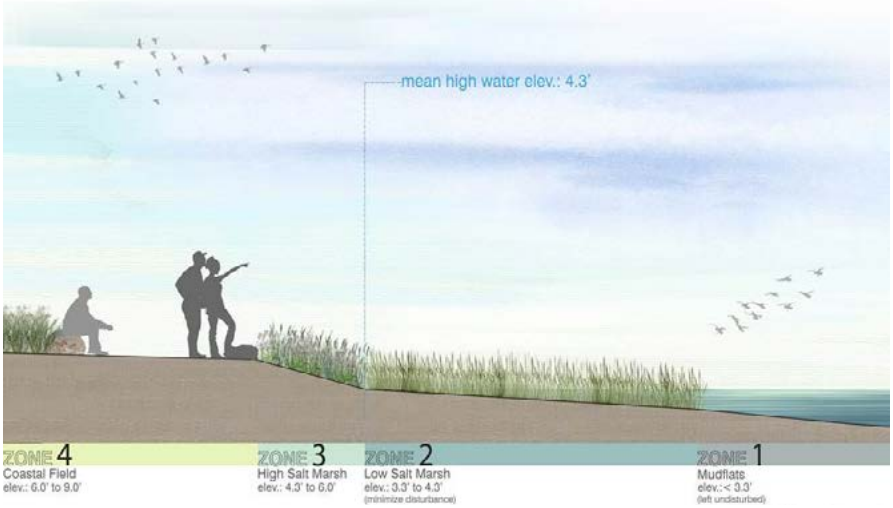
Many factors guide the design process, including site grading, control of erosion, and soil. For salt marsh designs, the maximum slope should not exceed 5:1 and slopes with lower ratios perform best. For low marsh, the lowest grade should be six inches above the local daily mean low watermark and up to the local average daily mean high watermark. For high marsh, the grade should start from average local daily mean high watermark up to the extreme local mean high watermark.

Hagopian also discussed recent projects including the Port Norfolk Remediation along the Neponset River in Boston, Massachusetts. An existing old timber sea wall and loading platform was replaced with a living shoreline and coastal marsh. In Nantucket, Massachusetts, a living shoreline is being used as part of a coastal bank restoration project. The bank had suffered severe erosion in a moderate wave energy environment. The embankment restoration and living shoreline installation included toe protection, prevention of overtopping, protection of the flanks, and slope correction.

John Ramsey discussed dune restoration and beach nourishment in the context of living shorelines. The main goal of a living shoreline is to mimic nature, meaning that the dune profile would change before, during, and after a storm. An example of this is the change of seasons in Humarock Beach, Massachusetts. In the summer, the profile is a sandy, gravelly beach. In the winter, the profile changes and the gravel gets exposed while the sand is pulled offshore. There is also a steeper slope in the winter.

The key to dune nourishment and artificial dune creation is shoreline protection and provision, along with the use of compatible sediments. An artificial dune is a shoreline protection option where a new mound of compatible sediment is built along the back of the beach, seaward of the area to be protected. Dune nourishment provides shoreline protection by adding compatible sediment to an existing due. Vegetation loss on a dune located close to the water should be expected after large storm events. For areas with no natural sediment supply, it is important to have enough volume of nourishment for artificial dunes to last over time. This will require working with both the geology and the wave/storm surge characteristics of an area of shoreline to design a good dune.

Armoring changes the lateral movement of sediment, thereby affecting its flow to nearby dunes. On a large scale this can



Graphic provided by Varoujan Hagopian

cause dune overtopping and overwashing. Thus, adjacent armoring needs to be taken into consideration during the planning process. Mixed sediment dunes may be appropriate and necessary for some locations (e.g., sand, cobble, and gravel dune at Mann Hill Beach Scituate, MA; sand, gravel, and cobble berm at Winthrop Beach in Winthrop, MA). This type of artificial dune may be called a cobble berm when larger sized gravel and cobble materials are used.

Rebecca Haney shared her knowledge of bioengineering on coastal banks. Bioengineering refers to the use of dead plant materials strategically combined with living plants to provide rapid stabilization of a landform. The success depends on appropriateness of site for bioengineering, as well as design, maintenance, and monitoring.

There are many vegetation considerations to review when understanding the site. When considering vegetation, there are several guidelines to keep in mind:

- Salt-tolerant plants with extensive roots hold soils;
- Plant diverse mix of native species appropriate for site conditions;
- Address invasive species;
- Plant vegetation in the spring for best results;
- Temporary irrigation may be needed to ensure success; and
- Vegetation is most appropriate where there is dry beach at high tide.

Natural fiber blankets can be used to stabilize soils devoid of vegetation, allowing new plants to get established. These are usually placed on bare soil and plants are planted into the blanket. Establishing a stable slope is key. This may require the landowner to regrade and pull the slope back. Use salt-tolerant seed mix and scatter it on bare soil. It is important to only use blankets made of only natural fibers. Blankets can be anchored in small trenches at the bottom and top of the slope. The blankets should be installed perpendicular to the bank slope.

Coir rolls are another useful way to protect and improve vegetation. When using coir rolls, cover the rolls with natural fiber blankets and sand. Then plant a diverse community of native, salt-tolerant vegetation. Use a high-density roll at the toe (probably consisting of some synthetic material) and lower-density rolls above. Duckbill anchors anchored in compacted sediment is recommended. True bio-engineering requires doing everything to ensure rolls are held in place (e.g., careful vegetation planting and careful placement of specific rolls in the right places).

Runoff control is also an important part of the restoration process. Runoff can be a major cause of erosion and needs to be thoroughly considered in the coastal slopes. As much as possible, remove or reduce impervious surfaces. Also, it is important to redirect runoff away from the shoreline (regrading can sometimes help). The other recommendations for managing runoff include minimizing maintained lawn areas, installing salt-tolerant erosion control vegetation, limiting irrigation, and using swales and rain gardens.

Recommended practices to maximize effectiveness include:

- Establish stable slope without extending further seaward;
- Address invasive plants with care;
- Use creative techniques on steep slopes to prevent destabilization;
- Avoid filter fabric behind rolls or in coir bags;
- Use best practices for cable and crimp materials; and
- Monitor, maintain, and adjust as needed.

With all these practices put into place one can successfully help restore the coastal banks. For more information on design practices to maximize effectiveness, see Massachusetts's Coastal Zone Management's Stormsmart Coasts website (http://www.mass.gov/eea/agencies/czm/program-areas/stormsmart-coasts/).

Anamarija Frankic reflected on the role of shellfish in living shorelines projects, beginning with the Wellfleet Harbor oyster reef restoration project. There, the oyster reef restoration has been designated as "no take areas", giving the project additional protection from harvesting. The project included recycling shells and placing cultch (from New Bedford, MA) for natural oyster spat to settle. Spat was placed on shells in areas that lacked natural oyster population. The biggest challenge in this project was permitting. Once underway, the project was very successful in terms of supporting oyster development. For example, between 2011 and 2013, the oyster habitat grew to two acres, and after three seasons, there were 5.8 million oysters.

There are feedback loops between salt marsh, shellfish beds, oyster reefs, and eelgrass beds. They cannot be resilient alone. Thus, practitioners should start working together to think of species that can be established together in living shoreline projects. Symbiosis needs to occur in urban harbors, to support human services in the built environment and to support ecological services in the natural environment.

IDENTIFYING BARRIERS

At the conclusion of the presentations, the attendees broke into small groups to identify existing barriers. After lists of barriers were generated, the attendees voted on the top five barriers to focus on during the remaining sessions. The five barriers selected were: (1) maintenance; (2) design techniques and standards; (3) professional training; (4) regulatory and permitting; and (5) performance data.

SESSION 2

SOLUTIONS AND RESOURCES NEEDED

Maintenance. Maintenance has been a problem at sites because people install living shorelines and leave the product alone with no upkeep. Possible solutions to this problem include:

- Adaptive management;
- Permit conditions that require monitoring and maintenance;
- Incorporating maintenance costs into the overall cost of the project, and making people more aware that the project requires maintenance;
- Transferring monitoring requirements to a regional or comprehensive body, particularly for long-term efforts;
- Having specific funding for maintenance will improve the willingness to continue with the care of the property; and
- Using bonds and escrow accounts for stewardship to fund maintenance may remove the financial barrier.

Design Techniques and Standards. Design techniques can be a barrier to bioengineering projects. It is essential to design new and unified techniques and standards between disciplines. Possible solutions to this barrier include:

- Create design guidance with input from field practitioners;
- Create guidance that informs technique selection and options;
- Examine regional planning and regional responsibility for feasibility;
- Collaborate between state and local officials;
- Know when to encourage and require strategic retreat; and
- Develop design and engineering considerations and guidelines for future climate conditions as the world climate is changing.

Professional Training. Contractor training is a key need in the living shoreline community. Possible solutions to this barrier include:

- Develop new and broaden existing collaborative training across all disciplines, including:
  - o Contractors (e.g., design and standards guidance);
  - o Regulators (e.g., permit analysis and bioengineering design guidance);
  - o Local officials; and
  - o Land use professionals;
- Create a certification process for living shorelines practitioners; and
- Combine training across disciplines to reduce costs and facilitate peer-to-peer learning.

Regulation and Permitting. Regulation and permitting constraints are major barriers to living shorelines adoption. Possible solutions that may improve the permitting process include:

- Include incentives for living shorelines;
- Use the permitting process to either require or encourage collaboration with practitioners from other disciplines if they are not meeting their permit requirements, such as using regulation to require certification of the practitioner by submitting the plan;
- Put legislation in place to create good policy. For example, Maryland has a policy that living shorelines should be a prioritization requirement. This new legislation should intend, encourage, and enable restoration as a priority and not just a development;
- Improve the process for working with Nationwide Permit 13 (NWP 13) and state and regional GPs; New England states use regional general permits;
- Include regional perspective in regulatory design and enforcements, such as adjacent shoreline treatment effects;
- Account for cumulative impacts;
- State and local officials should have the same evaluation standards, especially when permitting happens on both levels;
- Flexibility should be allowed on federal level for funding and other regulations, such as FEMA;
- General permitting, or certificate of permission, should

be allowed for minor modifications without the need for additional permitting. This should be something similar to what already exists for structural protection permitting;

- Maintenance and monitoring requirements should be included in the permitting condition and should be enforced;
- Sufficient staff should be provided in order to more efficiently implement regulations and permitting;
- Regulations should be enacted that support retreat or no building;
- Cost sharing with entities such as local erosion control boards should be considered; and
- Local zoning regulation changes should be considered to support living shorelines.

Performance Data. These are a barrier because people believe there are not enough case studies that demonstrate how effective these work. Possible solutions include:

- Creation of standard protocols for monitoring, such as quality control;
- Utilization of the Living Shorelines Academy for access to information on existing living shorelines databases in the United States;
- Increased data to support valuation of natural benefits of living shorelines;
- Looking to privately-owned living shorelines projects as case study examples; and
- Increased funding for case study development.

SESSION 3

RECOMMENDATIONS FOR MOVING FORWARD

Maintenance. Outreach should be conducted targeting implementers and practitioners encouraging the early inclusion of maintenance considerations in the planning and permitting process. Through this process, a contractor would include the cost of maintenance in the project estimate. Grant funding should be sought for this outreach effort. Furthermore, guidance is needed on how maintenance requirements can be incorporated into permit applications. Securing matching grants or other funding opportunities to carry out maintenance would also be helpful for implementation. In addition, cost-sharing for erosion control through the use of entities such as Erosion Control Boards should be considered. Incentivizing monitoring, or reporting requirements in exchange for a maintenance permit could be useful. One example of this would be a requirement that an applicant show continuous maintenance for a Certificate of Permission.

Designs, Techniques, and Standards. One way of ensuring good designs, techniques, and standards is to have a list of specific materials that are allowed for use under a general permit. A technical guidance memorandum for practitioners, such as design guidance and metrics would help determine whether living shorelines are appropriate at a particular site. Sharing designs and technique advice across the community would be extremely helpful. For example, the Stevens Institute, Wilkinson Ecological Design, and the Living Shoreline Academy are all great sources to view and share project results. In addition, Maryland's living shorelines policy may serve as a helpful guide when determining specific designs, techniques, and standards.

Professional Training. Professional training can be conducted in learning labs and workshops, possibly through a third party such as a university. Pilot programs for consultants and volunteer landowners may also be useful training outlets. Furthermore, funding for outreach and regional collaboration would help further professional training opportunities. Integrating with existing training programs such as those provided by NOAA, National Estuarine Research Reserve (NERR) Coastal Training Program, National Estuary Program, FEMA, Sea Grant, and others may also further training options for interested professionals.

Regulatory and Permitting. Developing specific criteria for what qualifies under the general permit, including what materials are allowed, would facilitate permitting. A way to update the permit over time based on lessons learned should also be sought. Cost sharing for erosion control through the use of Erosion Control Boards should also be implemented. In addition, having a monitoring plan in place as part of the permit process is critical along with recognizing local zoning changes.

Performance Data. Case studies are needed. Cost and effort information are needed on the maintenance of living shorelines. Additionally, research on the expense of erosion-specific insurance is also needed.

SUMMARY OF HABITAT-SPECIFIC BARRIERS AND SOLUTIONS

During the Northeast Workshop, attendees divided into habitat type groups: dunes and beaches, salt marshes, shellfish reefs, and coastal beach engineering. For each habitat type barriers to living shorelines projects were discussed, as well as potential solutions.

Dunes and Beaches. The top five barriers for dunes and beaches living shorelines projects were identified as: financing, maintenance, ownership, site conditions, and permitting. Possible solutions to overcome these barriers are diverse. One action that may alleviate cross-barrier impediments may be interagency coordination and improved communication between agencies. In terms of financing, more funding should be dedicated for these types of projects, in lieu of fees. With regards to encouraging maintenance at a site, regulators may require that maintenance plans be mandatory in project proposals. Well-executed maintenance of engineered beaches can lead to funding from FEMA, which may provide additional funding for maintenance. Additionally, certain permit considerations may be included, such as issuing bonding requirements for maintenance. Ownership may also be a barrier, and should be taken into consideration. Landowners may have limited liability and enforcing the public trust may be difficult. Site conditions, may present barriers and opportunities, though with ocean zoning one should look for a site where there would be suitable sources for sediment. Overlay districts where multiple property owners can fund a project and collaboration with dredging projects to get a source of sediment may also be useful to advance the use of living shorelines. Finally, permitting may be a barrier. An alternatives analysis should be considered as a required part of the planning and design process. Site-specific modeling should be performed with data collected and provided for the permit community to use when making permit determinations.

Salt Marshes. The top five barriers discussed for salt marsh living shorelines projects were: lack of data and standards, the lack of funding, wave energy challenges, private property/homeowners reluctance to implement living shorelines, and federal and state permitting issues. To overcome the lack of data and standards, the living shorelines community operating in the Northeast should collaborate and convene its shared knowledge. The living shorelines community would also benefit from ecosystem service data on captured values and cost and benefit analysis. To solve the barrier of funding needs, the group recommended exploring Community Development Block Grant opportunities as well as mitigation banking opportunities that involve in-lieu fee programs. Additionally, it was noted that adding user fees and/or tax incentives may encourage more funding for living shoreline projects. Credit tracking, along with green banking and environmental damage credits, may also alleviate funding-driven barriers. When discussing wave energy as a barrier, more studies should be performed exploring the impacts and effects on living shorelines applications. To overcome this barrier, it would be helpful to keep track of what was tried, what failed, and what was successful in a project in order to create design guidelines that will lead to successful projects. To solve the barrier of federal and state regulatory permitting issues, it would be useful to develop a regulatory framework promoting pilot projects. Teams within Coastal Zone Management Programs could be created to assist permittees with obtaining permits. In summary, the group recommended that the living shorelines community develop and advance guidelines that encourage building living shorelines that utilize existing leadership, along with increased funding.

Shellfish Reefs. For shellfish-based living shorelines projects, the top five barriers identified during the session were: permitting, site conditions, competing uses, sources and materials, and education. In terms of overcoming permitting barriers, the group noted a need for multi-level education among regulators and practitioners. Marine protected areas could be established to resolve some challenges with site conditions and competing uses. Several suggestions were made for improving education on this topic, including: use of collaborative teams to cross-pollinate knowledge of various design approaches; engagement of volunteers as an educational mechanism; participation in the Living Shorelines Academy; and greater engagement of media publications.

Coastal Beach Engineering. The top five challenges identified were: the need for maintenance protocols, design and technique guidance, professional training, permitting and regulation, and performance data. Permitting and regulatory hurdles were also identified. The group determined that potential solutions included the many concepts already covered in the other discussions.

MID-ATLANTIC

The Mid-Atlantic workshop brought together the states of New Jersey, Delaware, Pennsylvania, Maryland, and Virginia. This region began with an examination of current barriers facing the Mid-Atlantic living shorelines community. State specific presentations were followed by facilitated discussions of top barriers, potential solutions, and a framework for moving forward.

SPEAKERS

Karen Duhring, Virginia Institute of Marine Science (VIMS); Bill Shadel, Shadel Environmental; Capt. Al Modjeski, American Littoral Society; Andrew Howard, Delaware Department of Natural Resources and Environmental Control; Bhaskar Subramanian, Maryland Department of Natural Resources; Christine Tombleson, VIMS

FACILITATOR

Jessica Grannis, Georgetown Climate Center

SESSION 1

Session 1 began with a summary of previous Mid-Atlantic Living Shoreline Summits held in 2006 and 2013, followed by a panel that examined main successes and ongoing implementation barriers by state. Finally, a breakout group discussion generated a list of barriers by general topic.

Karen Duhring set the stage by reflecting on the current status of the Mid-Atlantic living shorelines community. Alternative shoreline stabilization techniques are not new to the Mid-Atlantic region. Efforts to use vegetation to stabilize shorelines had been used as early as the 1970s. Such methods were the start of what became known as "living shorelines."

By 2005, this new term, and its practice, was helping to reinvigorate an interest in "low impact stabilization." This was spurred by new data showing the impacts of hardening on the environment (loss of species, habitat loss, wetland loss, etc.) and the amount of shoreline already hardened. The Mid-Atlantic States, led by Maryland and Virginia, organized the 2006 Living Shorelines Summit. The summit hosted 175 participants and produced peer-reviewed proceedings that helped provide good linkages and collaborators among states. In 2007, the National Academies of Science released a seminal report, *Mitigating Shore Erosion along Sheltered Coasts.* The report remains a good primer for learning about shoreline protection and living shorelines.

By 2013, it was decided that a new summit should be organized to discuss the work that had been done since the 2006 Summit. The 2013 Mid-Atlantic Living Shoreline Summit was held in December 2013 in Cambridge, Maryland. The objective was to assess the current practices and highlight the advances over the intervening years. All of the presentations were videoed and many were posted to YouTube allowing everyone to join in on the conversation. (A list of the videos with links can be found at https://www.estuaries.org/mid-atlantic-living-shorelines-summit-presentation-videos.) The top priorities coming out of the 2013 Summit were: more research, more basic monitoring, the idea that ecologists and engineers must work together, and the need for an enhanced online living shorelines presence.

Since 2013, there have been significant advances in living shorelines in the Mid-Atlantic:

- In New Jersey, a GP was authorized to allow for habitat creation and enhancement along the shoreline. They also completed guidelines for engineering living shorelines.
- In Delaware, a statewide living shoreline committee was instituted. The Partnership for the Delaware Estuary is piloting new methods for designing living shorelines.
- Maryland enacted a statewide living shoreline law, requiring that living shorelines be used for shoreline stabilization in the state unless a waiver is granted. The state has also successfully administered financial and technical aid.
- In Virginia, a GP for non-structural living shorelines has been created with a version allowing more structural living shorelines (sills, etc.) in progress. They have also created low interest loan programs. They are also making it possible to allow living shorelines to provide credits under a Total Maximum Daily Load (TMDL) agreement. They are creating a landscape professional certification course to try to incorporate living shoreline practices across different occupational fields.

Collectively, the region has done well in fostering partnerships and a community of practice and in providing outreach and educational opportunities for the public.

But there are many challenges ahead: Is hardening viewed as a negative? When will living shorelines be the norm and the rule and not the exception? Are partnerships productive? Is money spent wisely? How do we get the most out of our time and energy? Do regulatory incentives and outreach have the desired effects? Are there enough qualified professionals to meet the demand? What are we learning from demonstration sites?

Following this recap, a brief overview of living shoreline barriers in each state was provided.

Bill Shadel and **Capt. Al Modjeski** jointly presented the **New Jersey** perspective. New Jersey revised its regulations and produced a general permit to allow habitat creation activities. There are many living shoreline advocates in the state, including: Partnership for the Delaware Bay Estuary, Barnegat Bay Partnership, American Littoral Society, and others. After Hurricane Sandy, more funding was made available to do restoration projects.

However, barriers to living shorelines in New Jersey still persist. These include:

- Permitting:
  - o A given agency as a whole may want to advance living shorelines, but the individual permit reviewer may be unaccustomed to living shorelines and has different interpretation.
  - o State versus federal regulations: the two regulatory systems do not complement each other and require different permits, increasing the time and complexity.
- Flexibility and adaptation:
  - o How do we show that a project was successful? In New Jersey, if a site is failing and needs another procedure or technique outside the bounds of the permit, there is little flexibility to allow it under current regulations.
  - o Need to make permit requirements adaptable to climate change shifts (e.g. time of year restrictions).
- Shellfish restrictions: New Jersey does not allow the use of shellfish in poor water quality areas that are closed to harvesting for fear someone will harvest them and get sick. This practice limits what techniques can be used.
- Seasonal restrictions on dredging.
- Resource value trade-offs: How do you decide if an existing mudflat is more or less valuable compared to a restored marsh?
- Need for restoration targets: What is our goal? Recreating historical conditions? Maximize ecosystem services? Viability? Cost?

Andy Howard provided an update of living shorelines in **Delaware.** Two barriers are frequently encountered: (1) How to convince landowners not to harden; and (2) How to provide resources that support the use of living shorelines. In an effort to address concerns, Delaware has installed a number of demonstration projects to get the public interested. Delaware is also conducting marine contractor trainings. A Story Map of projects is currently in development. For funding, the state currently has a cost share program to help fund projects (up to $5,000) but lacks a permanent funding source. In addition, extensive monitoring on existing projects is being done to show how well the living shorelines are doing.

Christine Tombleson shared an overview of living shoreline activities in **Virginia,** which has a living shorelines law that encourages their use but has no real requirements. VIMS is working to encourage living shorelines. A living shoreline GP is now available for non-structural living shorelines with a structural living shoreline GP in the works. In Virginia, local wetland boards regulate development in tidal wetlands. Those boards approve 90% of the permits submitted. Only 10-15% of these permits are for living shoreline projects. Basically, the boards approve permits as proposed whether for hard structures or living shorelines.

A survey of residents showed that contractors are the most trusted source when determining shoreline stabilization projects. Essentially, property owners follow contractor recommendations. As a result, contractors need to understand that living shorelines projects can be effective and, in turn, they can provide assurance to property owners, who want to ensure the safety and security of their property.

More monitoring is necessary so that contractors and residents will have more confidence that a living shoreline will accomplish their goals. Another hurdle is the limited number of living shoreline design professionals in the state. In addition, many property owners do not realize at the outset of their decision making that living shorelines need maintenance and they view this as an additional cost. The key solution to many of these challenges is increased training for contractors, who can then more effectively communicate with property owners about their options.

Bhaskar Subramanian gave an update of **Maryland's** efforts. Maryland's definition of living shoreline is a technique that minimizes erosion and maintains coastal processes. Living shorelines have been pioneered in Maryland since the 1970s. Maryland passed the Living Shorelines Protection Act of 2008. However, regulations to implement the law did not take effect until 2013. The law provides the regulatory agency with a strong foundation to promote alternative shoreline erosion control measures. The state has also provided project selection criteria to assist in the process. Projects in Maryland have evolved from early large sills well above mean high tide to low profile sills used today.

Maryland has learned some guiding lessons along the way. For instance, each site is unique. The project needs to balance shoreline protection with habitat protections as well. Maryland has also experienced successes, such as increased collaboration between agencies. Suggestions for overcoming barriers include: mapping products and models, building demonstration projects, pre-application permitting meetings, literature reviews, and dialogue and discussions. However, persistent challenges remain, including efforts to move away from the cookie-cutter approach to more site-specific designs. Greater consistency among regulators is also needed. Moving forward, Maryland would benefit from more buy-in from contractors, construction of larger scale projects, and inclusion of living shorelines in coastal resiliency planning.

IDENTIFYING BARRIERS

A breakout group discussion generated a list of barriers by general topic. Many different ideas, programs, successes, challenges, and barriers were discussed. After group discussion and voting, two priority topic areas were identified through this process: outreach and education and monitoring. Once these two focus areas were selected, the Mid-Atlantic group turned their attention to developing approaches to improving these areas, as well as identifying resources that would be needed to accomplish these goals.

SESSION 2

APPROACHES AND RESOURCES NEEDED

The discussion session focused on approaches that could help alleviate the two high-priority barriers. Numerous suggestions and real-life examples of successes and challenges were provided. There was agreement that monitoring results and outreach and education should be closely linked. The group decided various types of monitoring are needed, ranging from typical project-specific case studies to program and landscape level scales. Long-term funding sources are also needed to support monitoring programs. A lot of ideas were generated for collaborative project information sharing, including investigating how data are being collected and stored currently, plus how this information can be retrieved to inform multiple outreach objectives.

The outreach objectives included positive reinforcement for permitting agencies and individuals to validate their decisions that support living shorelines, especially those made with some uncertainty or skepticism. Using monitoring information to reveal and illustrate different sector values and to support flexibility and experimentation were also considered important. Linking monitoring with outreach and education also allows for coupling living shoreline programs with floodplain management CRS and TMDL water quality goals. Another benefit from a more robust monitoring-outreach link is to highlight the return on investment at small level and ecosystem scales for accountability and for generating interest in funding and continuing living shoreline initiatives.

There was also a recognition that outreach is most effective when structured and delivered to separate target sectors (e.g. marine contactors, local governments, general public, etc.), yet the values and perceptions of each sector are not well understood. Adding social scientists and their expertise, particularly in relation to a marketing strategy, to the living shorelines community is needed. This objective was included in recommendations from the previous 2006 and 2013 Summits, but has yet to be achieved.

SESSION 3

FRAMEWORK FOR MOVING FORWARD

The regional group chose to focus efforts on four broad objectives to advance the conversation:

- Identify regional recommendations for advancing living shorelines;
- Identify actions states can take to advance living shorelines;
- Identify opportunities for leveraging innovative public-private partnerships; and
- Identify opportunities for regional collaborations.

Several possibilities were explored. For instance, there needs to be greater coordination between state and federal permitting agencies to improve the overall process and enhance communication. Science and research should play a greater role in informing permit decisions, such as positive reinforcement feedback for scientifically-sound decisions. At the community level, individuals need to be educated on how living shorelines work and the benefits they provide. A bulkhead tax could be used to fund mitigation work. In addition, the group recognized the need to involve many different disciplines and professions to accomplish these goals. Potential partners include NGOs, universities, land trusts, community leaders, realtors, K-12 educators, recreational users, tourists, and fishermen. The Living Shorelines Academy will provide a good umbrella under which the regional living shorelines work could continue to grow, especially if it includes resources for collaborative monitoring program development and social science research, in addition to contractor education and training.

SOUTHEAST

The Southeast region included North Carolina, South Carolina, Georgia, and Florida's Atlantic Coast. The session focused on ways to encourage property owners to embrace and implement living shorelines projects.

SPEAKERS

Kristine Cherry, Governor's South Atlantic Alliance; Thomas F. Ries, Scheda Ecological

FACILITATORS

Bill Sapp, SELC; Lisa Schiavinato, North Carolina Sea Grant; Kristine Cherry, Governor's South Atlantic Alliance

SESSION 1

OVERVIEW, INTRODUCTION, AND LESSONS LEARNED

Kristine Cherry kicked things off with a brief overview of the workshop context. Through the workshop, participants have been asked to consider ways to encourage private property owners to invest in living shoreline approaches.

Thomas Ries shared lessons learned from public-private partnerships. There have been many lessons learned in the Southeast, but still opportunities to improve. There are five pillars that will lead to our success in making the Southeast great: outreach, funding, training, permitting, and viewshed.

Outreach needs to be expanded. Improving the outreach to the community includes creating demonstration projects, educating people, and developing public/private partnerships. These partnerships would include conservation easements and maintenance agreements. The education portion would educate homeowners on their options. This education can address the overarching perception that hard stabilization is safer and more secure, concerns about liability, habitat benefits, and the function of existing structures such as docks and ramps.

The key to overall success with this project would be funding for the outreach programs. There are many opportunities for funding the demonstration projects and education through grants, although this would involve some volunteer components. There is a lack of cost-share programs and also a lack of clear cost estimates and comparisons to alternatives.

Training is also needed for the contractors, regulators, and other professionals that work in the Southeast. This is imperative to the success of the project. By training those who work on the sites, we can better assure that the projects are protecting the environment and that the workers are well educated about the regulations and procedures that need to be followed. Understanding that each site is unique is important too. One cannot train for every possible situation, but training will help with making knowledgeable decisions.

Permitting is also an important key to the project. There are many issues with permitting on the federal, state, and local levels. These different permitting levels include USACE, state agencies, and local authorities.

SESSION 2

FOCUS AREAS

The following focus areas were identified as ways to advance the living shorelines community:

- Encourage comments to USACE on NWP 13;
- Educate regulated community on NWP changes;
- Advocate for regulator resources;
- Identify new business models for contractors; and
- Public education.

SESSION 3

FRAMEWORK OF ACTIONS AND PRIORITIES

Encourage comments to USACE and educate regulated communities about NWP 13. The NGO community would lead this action but participation by others is encouraged such as contractors, academia, homeowners, and municipalities. Action items include:

1. Explanation of the impacts of proposed changes;
2. Assemble toolkits for Living Shoreline Forum (before and after pictures, FAQ to address myths, letters to editor, and press release);
3. Spread the word to advocacy groups to use the toolkits to develop action alerts for comments to USACE;
4. Request before and after pictures, including before and after storms (such as bulkhead failure versus living shoreline) and before and after living shoreline construction;
5. Request audience joins Living Shoreline Forum;
6. Connect with other advocacy groups; and
7. Follow up with specific, targeted commenters.

Potential costs and resources needed are staff time from NGOs to conduct analysis and communications efforts.

Advocate for Regulator Resources. The challenge identified was that regulators have limited resources to meet expanding demand from homeowners for living shorelines. Advocating for increased resources for regulators to support timely

evaluation and permitting of living shorelines may make it easier and more attractive for homeowners to pursue living shorelines. This action will vary by state but will again be led by the NGO communities with participation from state agencies, local regulators, and legislators. Action items include:

1. Cost analysis;
2. Meet with regulators; and
3. Meet with legislators.

Potential costs are cost analysis, hiring a lobbyist, and personnel.

Identify New Business Models for Contractors. NGOs and academia will lead this effort, partnering with marine contractors, attorneys, and economists. Action items include:

1. Contact academic experts;
2. Share ideas and models for success (from Solar industry, carbon, stormwater); and
3. Conduct analysis of feasibility and legal requirements and evaluation.

One way to maximize resources would be to partner with the academic community to take this on as a graduate project. Resources needed include model industry representatives.

Public Education. The opportunity identified here is the ongoing relationship that can be established between contractors and homeowners to build low-cost approaches to implementing living shorelines. Again, NGOs would lead this effort, while working with contractors, engineers, and realtors. Action items include:

1. Develop trifold pamphlet with pictures, description of costs, persuasive approach; and
2. Develop a 20-slide PowerPoint presentation to show property owners the benefits of living shorelines.

Potential costs are preparation of strong graphics, printing, and staff time. Personnel would be needed to lead the project.

GULF OF MEXICO

This region included Texas, Louisiana, Mississippi, Alabama, and Florida's Gulf Coast. The session began with a discussion of potential funding opportunities to further living shorelines arising out of the Deepwater Horizon oil spill. Then the workshop focused its attention on challenges in the region and opportunities to overcome those challenges.

SPEAKERS

Debbie DeVore, U.S. Fish and Wildlife Service; Facilitators: Lee Anne Wilde, Galveston Bay Foundation; Matt Chasse, National Oceanic and Atmospheric Administration; Niki Pace, Mississippi-Alabama Sea Grant; Martha Gruber, Tampa Bay Watch; Chris Boyd, Troy University; Rick Harter, Ecology and Environment, Inc.; Jeff DeQuattro, The Nature Conservancy

SESSION 1

THE DEEPWATER HORIZON SETTLEMENT PROCESS AND THE GULF OF MEXICO ALLIANCE

Debbie DeVore began the day with an overview of the Deepwater Horizon oil spill funds, highlighting opportunities to further living shorelines. The multiple avenues of funding create a complex situation where numerous entities are responsible for distributing these funds. This includes the five Gulf States, the RESTORE Act Science Program, the National Fish and Wildlife Foundation (NFWF) Gulf Environmental Fund, the North American Wetlands Conservation Council, Centers for Excellence in each state, and the National Academy of Sciences Gulf of Mexico Program.

Using the Deepwater Horizon Project Tracker, DeVore walked the group through several projects and the funding sources. Funding derived directly from legal proceedings against BP include three sources. First, Natural Resource Damage Assessment funds totaling $8.1 billion are aimed at restoring resources impacted by the spill. Money can be used for projects that restore natural resources as well as the loss of human use. Second, the RESTORE Act will return $5.2 billion in Clean Water Act penalties to the Gulf Coast region for restoration. That money can be used for environmental and economic restoration projects as well as research activities. Finally, NFWF is overseeing the distribution of $2.5 billion for projects like barrier islands and river diversions in Louisiana and natural resource projects in the other four states.

There are several different restoration approaches included in the overall Gulf ecosystem restoration plan that may include living shoreline opportunities. For instance, one goal is to create, restore, and enhance coastal wetlands. Within this goal are subactions related to placement of dredge materials and construction of breakwaters. Another goal focuses on oyster habitat restoration. Sub-actions under this goal specifically identify construction of living shorelines and placement of cultch in nearshore and subtidal areas. Finally, the goal of restoring and enhancing submerged aquatic vegetation includes using wave attenuation devices. All of these areas represent opportunities to seek funding for implementation of living shorelines in the Gulf region.

Another important player in Gulf restoration efforts is the Gulf of Mexico Alliance (GOMA). The mission of GOMA is to enhance the ecological and economic health of the Gulf of Mexico through increased regional collaboration. GOMA focuses on six priorities, one of which is habitat restoration. The Habitat Restoration Team (HRT) has identified several focus areas for future efforts including living shorelines. The living shorelines focus area is designed to:

> *"develop and disseminate information and tools for the planning and implementation of living shorelines projects, specifically restoring vegetated shorelines and/or placing rock or other materials in a way that preserves natural coastal processes and enhances shoreline habitats while addressing erosion, to Gulf Coast stakeholders interested in alternatives to traditional armoring for shoreline protection and restoration."*
>
> *(GOMA Action Plan III)*

Four actions related to living shorelines have been identified in the GOMA Governor's Action Plan III:

- Directly advance and coordinate the development of living shoreline information, project planning, and implementation tools;
- Work with federal and state agencies to facilitate implementation of living shoreline options as the generally preferred, least damaging, and practicable alternative to traditional shoreline armoring for erosion protection;
- Develop recommendations for standardized metrics of living shoreline projects to ensure consistent monitoring of projects; and
- Coordinate the transfer of living shoreline information and tools to Gulf stakeholders, including resource managers, federal and state agencies, contractors, and homeowners.

The GOMA HRT is currently working to develop clear objectives, action steps, and performance measures to further these actions.

SESSION 2

IDENTIFY TARGETED BARRIERS AND POTENTIAL SOLUTIONS

The overview was followed with a brainstorming session during which numerous barriers where discussed. The Gulf group chose to focus on the following topics:

- Property owner interest;
- Permitting;
- Contractor training and availability; and
- Monitoring.

SESSION 3

MOVING FORWARD

Property Owner Interest. To improve the potential for landowner interest, the working group recommends exploring the idea of cost sharing or other incentive-based programs. For example, funding can be obligated to a local non-governmental organization (or other applicable entity) that can work with individual landowners at a local level to investigate, develop, and execute living shoreline projects.

Permitting. Persistent regulatory hurdles were discussed, including the scrutiny applicants experience to obtain permits for living shoreline projects. Ideas to increase communication and understanding between applicants and regulators were discussed. Specifically, the working group members proposed strategic and coordinated conversations with state and federal regulatory agencies – initially focusing on the supervisory level staff. Additional work may also include professional training workshops to further educate and relay the ecology and science behind living shorelines with project managers. The group also discussed ways to help partners in Texas potentially pursue a GP for living shorelines, including information transfer from states that have successfully attained them. Lastly, the group supports the idea of providing comments in favor of the proposed Living Shoreline NWP during the upcoming reissuance period.

Contractor Training and Availability. This conversation centered on a primary topic of the lack of experienced contractors. However, the recommendations address a two-fold issue – training for contractors and the anticipated need for additional qualified companies in light of the potential coastal restoration projects funded by RESTORE, NFWF, or other sources. The group discussed ways to identify and reach out to local contractors to make them aware of the potential for doing living shoreline work and the need for additional capacity, including equipment. They also agreed that further discussion is needed to explore potential training and/or certification opportunities. They plan to pursue conversations with RAE to explore options to include contractors in the 2016 National Summit on Coastal Restoration and Management in New Orleans and the possibility of an invitational living shorelines field trip. Other partners for local training opportunities include Extension, Sea Grant programs, NERRs, GOMA, and TNC.

Monitoring. The group also talked about the need for a suite of universal metrics to monitor living shoreline projects across the Gulf. Some efforts exist already, and there also appears to be the potential to learn even more from the Deepwater Horizon Early Restoration process. The group recommended that a gap analysis be performed to see what efforts exist and what might be missing. A multi-disciplinary stakeholder group should then be established to identify targeted next steps, including further assessment of appropriate metrics (if needed) and how monitoring protocols may be incorporated into projects. There is also a need for secured funding to pilot the implementation and use of these universal metrics on existing living shoreline projects.

WEST COAST

The West Coast regional breakout included the states of Washington, Oregon, and California. Representatives from other regions of the U.S. also joined the group. The group took a less structured approach to their workshop. They used this opportunity to come together, share ideas, lessons learned, and identify common areas for advancing the living shoreline community along the West Coast.

The group began by discussing the role of monitoring. It was agreed that the future success of living shorelines will depend on good monitoring. In Seattle, parts of Puget Sound have been filled to create industrial land. Now shoreline managers in the area are using or considering soft techniques to replace eroding harder bank lines. This approach can be less expensive than armoring. There may also be less risk of failure because the soft techniques get stronger over time rather than degrading like hard shorelines. Monitoring these shorelines remains very important. The group discussed urban shorelines owned by the Port of Seattle. The Port will be needing mitigation for proposed shore redevelopment and wants to explore living shorelines.

NOAA has conducted studies on watersheds as well as shorelines. Watersheds are an important part of restoring natural sediment flow to the shore. If natural source functions are created, the resulting positive outcomes are extraordinary.

Ecosystem benefits are another important aspect of living shorelines. A number of projects in San Francisco are focused on the ecosystem benefits of restoring shoreline, with less emphasis to date on erosion protection benefits. One of these projects on shoreline restoration is currently the largest living shoreline project taking place in California.

In Washington, there has been a lot of citizen participation, gaining community awareness. In less urbanized areas, there is more difficulty moving projects forward, however, due to lower community interest. In Washington, willing landowners have donated land for projects in fresh water areas and some marine ecosystems for Green Shores for Homes. This is a voluntary effort by landowners but the organization is exploring opportunities to incentivize this process.

Another issue discussed was grey infrastructure. Is there a way to incorporate some green components to grey infrastructure that will increase the natural habitat? Are there ways to encourage homeowners to make the grey structures less harmful to the environment?

Communities on the West Coast have varying levels of experience with use of dredged materials. For example, the San Francisco Bay area is coming up with new options for dredge disposal, some of which will be used for restoration. Challenges with small islands were also discussed in the context of use of dredged materials. Often, these small islands can be rocky and mostly uninhabited but can provide habitat for wildlife. Dredge materials may be a way to extend the islands. This approach would provide storm protection while creating habitat. However, there are permitting challenges.

Another challenge is managing sediment throughout a watershed. This can be increasingly challenging with the presence of dams that alter the sediment flow. This can cause changes down at the bottom of the watersheds, and those impacts are an important aspect in a lot of the problems that coasts nationwide. One approach is to focus on smaller watersheds that may be easier to manage.

Social investment and social impact investment are opportunities to move the conversation forward. A common

way to mitigate for a bulkhead in Washington is to dump a mix of sand and gravel (also known colloquially as "fish mix" or "habitat mix") in front of the bulkhead. The challenge with landowners and contactors is the "one size fits all" approach. It is important to look at each site individually. Sites vary greatly and the same approach will not work the same way because of differences in elevation, geomorphology, wave action, etc.

The challenge goes beyond simple restoration and putting things back the way they once were. Humans, as a society, want their environment to be appealing and aesthetically pleasing, including spaces that can be used and enjoyed.

GREAT LAKES

The Great Lakes region is comprised of Michigan, Minnesota, Illinois, Indiana, Ohio, Pennsylvania, and New York. The group held an interactive, less-structured work session during which barriers were identified, solutions were brainstormed, and strategies for implementation were explored.

The Great Lakes region is a very unique area, ecologically. It is a place where industry meets and works with conservation, but the region is also home to the largest supply of fresh water in the world. Open spaces are limited and highly desired in urban areas like Chicago, Detroit, and Buffalo, but the region also has vast open spaces in Northern Michigan, Wisconsin, and Minnesota. The industrial legacy of the Great Lakes has left long-standing impacts of hardened shorelines and contaminated sediments. However, these same impacts have also resulted in funding sources, through programs such as the EPA Great Lakes Legacy Act (http://www.epa.gov/great-lakes-legacy-act) and the federal Great Lakes Restoration Initiative, or GLRI (http://greatlakesrestoration.us/), which has funded $300-$500 million worth of restoration projects annually since 2010.

Common challenges include policy and permitting, the need for more outreach, and funding. The group agreed that matching funds are critical. By matching state and federal money, a snowball effect can be created that leads to more funding overall.

Some of the biggest barriers in the region are invasive species. The presence of Asian Carp is a major threat to the Great Lakes fishery. The presence of this invasive fish is preventing greater restoration in some instances for fear of introducing them to new watersheds.

In some areas, habitat conversion presents challenges to restoration and implementation for living shorelines projects. Due to existing impacts from urbanization, restoration of a given area back to its initial state would be difficult, so hybrid management plans are often the best option. In other areas, habitats have completed converted. For example, sandy beaches no longer occur in Buffalo, NY. Rather, they have transitioned and become habitat for wading birds.

Permitting is very state specific. Although you do not need a USACE permit for non-navigable waters, state regulations may still apply. Going from a bulkhead to a living shoreline may require fill to build a slope which can be challenging to permit under state regulations against putting fill into lakes. However, regulatory agencies in the region have recognized the importance of living shorelines, and groups such as the Wisconsin Department of Natural Resources and the Michigan Department of Environmental Quality have adopted policies to encourage or sometimes require the use of living shorelines. Additionally, the Buffalo USACE District has assumed a leadership role and is ahead of many other USACE districts when it comes to living shorelines permitting and science.

Binational issues with Canada must also be considered, as the shared border can create difficulties in permitting and land management through sometimes conflicting goals. To help address these issues, the International Joint Commission (IJC) was formed. (http://www.ijc.org/en_/)

The region also discussed challenges to encouraging private landowners to install living shorelines. Incentives could be used to motivate property owners. Also, having small, scattered installations across various properties does have the same impact as a collective approach. Although there is money for green infrastructure, there is very little funding available for monitoring. In some cases, a mistrust of government can impact how open a property owner may be to using what may be seen as a "new" approach. Suggestions for overcoming this mistrust include working on a community level with local officials and neighborhood associations. This can create local champions. Additionally, the economic value of habitat restoration equals higher property value for restored areas. The GLRI has funded over $1.5 billion in Great Lakes restoration since 2010, and is expected to be a continued source of restoration funding in the future.

Likewise, localized demonstration projects can increase public education and raise awareness. The more people learn about the benefits of living shorelines, the more likely they will be to start adopting the technique. Issues remain over long-term maintenance. The local communities may not maintain projects installed by the state. However, community based projects tend to see greater local responsibility for the long-term viability and upkeep of the project. The key is a strong outreach program. This can inspire citizens to embrace the project. Also translating personal benefits can encourage support – How does the project protect your property? Will

it reduce your insurance? These aspects can motivate local groups.

Another challenge is management practices and land use planning for changing lake levels, which may fluctuate up to five feet over twenty-year cycles, affecting navigation when low and affecting the integrity of shoreline structures when high. The Great Lakes Compact (https://www.greatlakes.org/Page.aspx?pid=526) currently prohibits the export of Great Lakes water outside of the watershed, but there are concerns that as water becomes more and more scarce, fresh water may become federal property. Water conservation is already a big concern in Chicago. Since it flows into the Mississippi River, every drop of water is accounted for and used for drinking water. The city uses a credit-based system of water conservation.

There is a need to move past demonstration projects and begin applying large-scale projects that compete with hardened structure in the Great Lakes region. This approach may allow for additional money in offset credits from carbon emitting industries. This involves the use of voluntary carbon emissions controls – the idea that if a company exceeds a projected emission of carbon they will buy credits by funding wetland restoration. Through this system, carbon credits can be accessed as a source for funding living shorelines projects.

In summary, the industrial legacy of the Great Lakes altered the hydrologic regime and benthic community, imposing a large obstacle to complete full-scale living shoreline projects. Hybridized living shoreline projects would be more effective considering the highly urbanized cities. Invasive species constrain the objectives of living shorelines and can add extra costs for monitoring and maintenance. Awareness and public outreach need to increase to engage communities. Finding ways to access and utilize money that is indirectly available for funding is also critical.

Image credit: Tracy Skrabal

9. REGIONAL WORKSHOPS SUMMARIES, GENERAL FINDINGS, AND CONCLUDING REMARKS

REGIONAL WORKSHOPS SUMMARIES AND GENERAL FINDINGS

A representative from each of the regional workshops gave a brief "wrap-up" summary of the group's findings. While the reports from the workshops reflected the respective findings and conversations, a number of common themes emerged:

- **A strong commitment to continuing dialogue** within the living shorelines community, both regionally and nationally, to develop a community of practice and increase communication across sectors;
- **The need to convene in person on a regular basis** to share lessons learned and develop solutions for barriers (e.g. the RAE-TCS Summit in December 2016, which will feature a living shorelines track and workshop);
- **Innovation is required in outreach and education** in order to educate an entire spectrum of stakeholders, including property owners, regulators, contractors, and consultants, via targeted materials and approaches for each group;
- **Monitoring should be included in permit requirements** and funding made available specifically for that aspect in order to more accurately assess functionality and get feedback on how to improve project designs and siting;
- **Creation of design techniques, standards, and metrics across disciplines;**
- **Increase efficiency of permit review,** including the adoption of NWPs, GPs, and RGPs specific to living shorelines; and
- **Creative incentives and funding** need to be implemented, including cost-share approaches and public-private partnerships.

CONCLUDING REMARKS

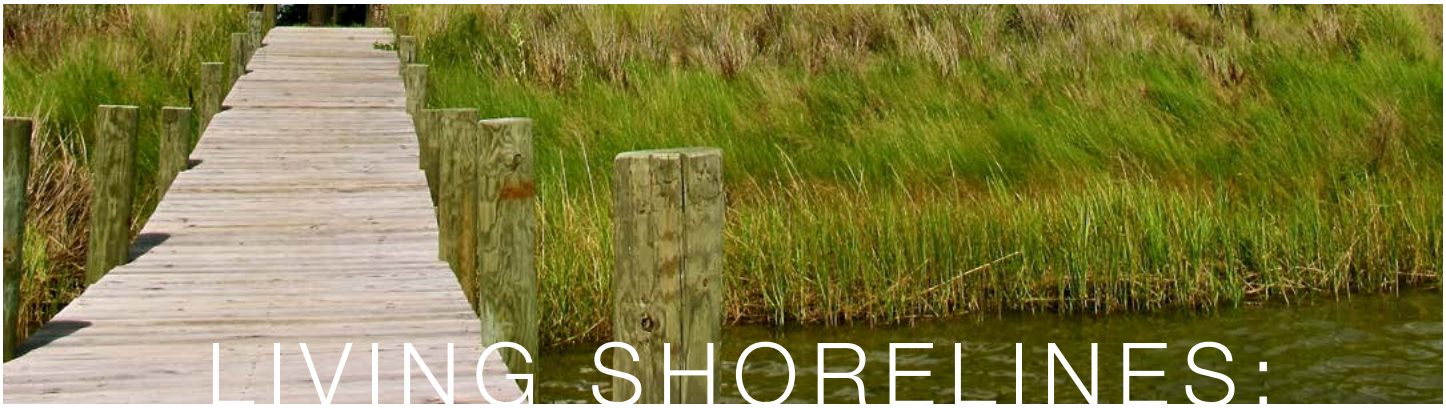
SPEAKER

Lou Chiarella, Assistant Regional Administrator for Habitat Conservation, NOAA Fisheries, Greater Atlantic Regional Fisheries Office

Living shorelines offer many benefits. They protect land from erosion, while providing ecosystem functions and social benefits. Living shorelines can also become more stable over time and have outperformed hardened shorelines during storm events. During this national meeting, common themes have emerged. These include:

- Regional differences;
- Habitat tradeoffs;
- Permitting; and
- Secondary benefits of living shorelines.

NOAA believes that living shorelines have a valuable role to play in protecting the diversity of our shorelines. Current living shorelines efforts by NOAA include NOAA's Habitat Blueprint and NOAA's Guidance for Considering the Use of Living Shorelines.



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