COASTAL SERVICES

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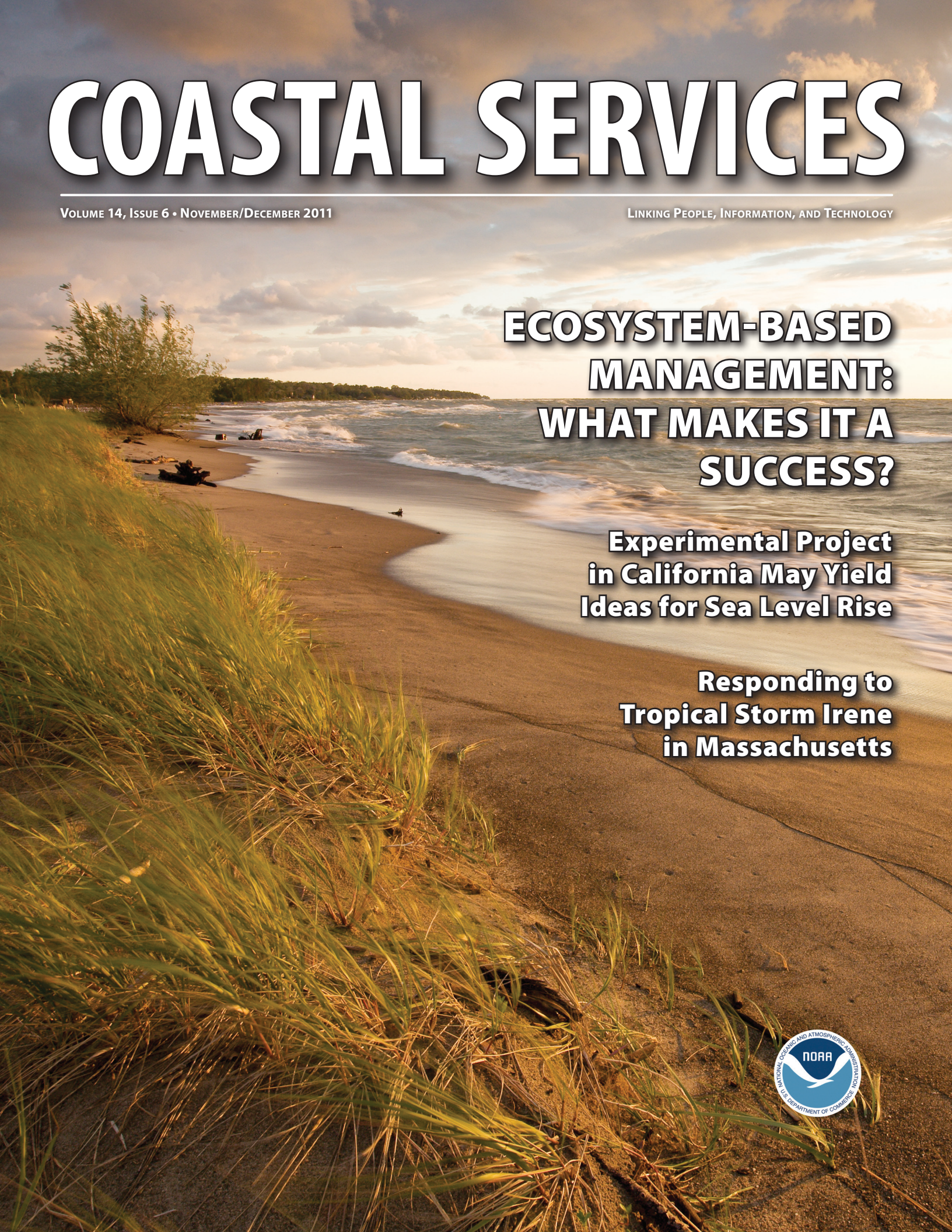
Linking People, Information, and Technology



ECOSYSTEM-BASED MANAGEMENT: WHAT MAKES IT A SUCCESS?

Experimental Project in California May Yield Ideas for Sea Level Rise

Responding to Tropical Storm Irene in Massachusetts

From the Director

Ecosystem-based management has long been cited as a solution to the combination of human activities on land, along the coasts, and in the ocean that are affecting marine ecosystems. But implementing it is not always easy.

Knowing the characteristics that make up a successful ecosystem-based management effort can serve as a guide for coastal resource managers as they work to implement an ecosystem-based management process.

The cover story of this edition of *Coastal Services* looks at the findings of an Ohio researcher who set out to discover the key management characteristics that are important to success. His top-10 list of requirements should prove useful for managers in evaluating and improving existing projects and starting new initiatives.

In this edition, readers can find information on an experimental underwater retaining wall called a "sill," recently constructed at a California estuary, that could be a model for coastal resource managers looking for ways to address impacts of sea level rise.

Our writers look at the role coastal managers in Massachusetts have in that state's emergency management response efforts and the tool they have developed that enables trained users to document near-real-time coastal storm damages.

Technology is also the focus of an article on a North Carolina research project that evaluated how anglers might use their personal cell phones to text information about their fishing trips, and what they caught, directly into a computer database.

For those looking for information on how social science tools and methods are being used to address the nation's coastal issues, I would encourage you to attend the first Social Coast Forum, being held February 15 to 16, 2012, in Charleston, South Carolina.

Sponsored by the NOAA Coastal Services Center, this event will enable participants to get help using social science in tackling a coastal issue, share a social science success or failure, and learn about social science tools or job aids. For more information, go to *www.csc.noaa.gov/socialcoastforum/*.

I look forward to seeing you there! ❖

Margaret A. Davidson

The mission of the NOAA Coastal Services Center is to support the environmental, social, and economic well being of the coast by linking people, information, and technology.

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News and Notes

Updating Aerial imagery and Benthic Data for a California Bay and Estuary

Humboldt Bay and the nearby Eel River Estuary on California's north coast comprise an ecosystem of nearly 50 square miles that nurtures hundreds of bird, fish, and invertebrate species. Until two years ago, resource managers were frustrated by a scarcity of low-tide photo imagery that could shed light on the conditions of the ecosystem's mudflats, salt marsh, eelgrass meadows, and other features. High-quality baseline information on the bay's habitats had not been collected since 1970.

By early 2010, that frustration had turned into anticipation with the release of full-color, digital aerial photographs and benthic habitat maps of the bay and estuary.

With funding from the NOAA Coastal Services Center, in partnership with California Sea Grant, the California Coastal Conservancy, Humboldt Bay Harbor District, and the National Weather Service Forecast Office in Eureka, California, a geosciences company was hired to collect GIS-compatible images in June 2009, creating the first detailed (.5-meter resolution) inventory of the area's intertidal and subtidal bottom habitats.

"With this information we can monitor habitat trends and changes, adapting our management strategies with different scenarios and conditions in mind," says Susan Schlosser, a marine advisor with California Sea Grant, who led the imagery and mapping project spearheaded by the multi-partner Humboldt Bay Initiative.

More than 20 organizations, academic institutions, businesses, and government agencies have used the images and maps to conserve habitat, monitor rare species, craft aquaculture plans, and devise ways to minimize the effects of sea level rise. The imagery is also being used to update National Wetlands Inventory maps.

One of those using the images is Paula Golightly, a biologist and coordinator for the U.S. Fish and Wildlife Service's Coastal Program and a participant in the Humboldt Bay Initiative.

"Work conducted by Humboldt Bay National Wildlife Refuge has shown that the invasive plant species *Spartina densiflora* has expanded onto mudflats around Humboldt Bay, which may impact the bay's use by migratory shorebirds and other species," Golightly says. "The photo imagery, combined with work in the field, will help our coastal program, the refuge, and other local partners to better monitor the species, as efforts to eradicate it have been initiated."

> *"With this information we can monitor habitat trends and changes, adapting our management strategies with different scenarios and conditions in mind."*
>
> *Susan Schlosser, California Sea Grant*

Schlosser foresees other benefits, too. The mapped sloughs and drainage network will aid those making restoration plans or assessing water control structures. And the habitat maps, she notes, allow for trend analysis and a better understanding of the mechanisms of change. ❖

To obtain these benthic data, visit www.csc.noaa.gov/digitalcoast/data/benthiccover/download.html. For the photo imagery, visit www.csc.noaa.gov/digitalcoast/data/highresortho/download.html. To learn more, contact Susan Schlosser at (707) 443-8369 or sschlosser@ucsd.edu.

Experimental Restoration Project in California May Yield Management Ideas for Sea Level Rise

An experimental underwater retaining wall called a "sill" was recently constructed at a California estuary to slow fast tidal currents that were causing tidal scour and marsh dieback. Early results indicate that the project is a success—and could be a model for coastal resource managers looking for ways to address similar impacts caused by rising sea level.

"One of the findings was that in order to stop this trend, fairly substantial actions were required."

Bryan Largay, Elkhorn Slough National Estuarine Research Reserve

"To our knowledge, a sill has never been used for this purpose before," says Bryan Largay, tidal wetland project director at Elkhorn Slough National Estuarine Research Reserve, a 1,700-acre tidal salt marsh inland of Monterey, California.

The project is the result of more than six years of study by more than 100 scientists, resource managers, and conservationists participating in the Elkhorn Slough Tidal Wetland Project, a collaborative, ecosystem-based management effort. The group looked at the habitat changes that tidal scour and marsh dieback were causing in the estuary and then designed the sill as a cost-effective solution.

"What's happening here looks a lot like the sea level rise that is predicted to happen over the next 50 or 60 years," Largay says. "The hope is we can be considered a long-term monitoring site for detecting the effects of climate and sea level rise on estuaries."

Too Much, Too Fast

The problems in the estuary began in 1947 after the construction of a stable inlet with jetties at the mouth of the estuary. Increased currents began washing fine mud from the tidal channels.

In the 1980s tides were returned to Parsons Slough, a large branch of the estuary once reclaimed for agriculture, which had subsided by several feet. When the tides returned, the amount of water in the system increased, accelerating the currents further. Over the past 60 years, the estuary gradually eroded, deepening from about 5 to 10 feet, to 20 to 30 feet.

One of the effects was that the elevation of mean high water rose by about a foot over the past 60 years. The additional water in the system drowned marshes, causing them to die back. As a result, the estuary has lost 15 to 20 percent of its marshes—about 150 acres total, Largay says.

The impacts of excess water experienced at Elkhorn Slough are not unlike predicted impacts of sea level rise on marsh environments. The Intergovernmental Panel on Climate Change 2007 report suggests that by 2080, sea level rise could convert as much as 33 percent of the world's coastal wetlands to open water.

Critical Habitat

Wetlands provide critical habitat for many species, play a key role in nutrient uptake, serve as the basis for many communities' economic livelihoods, provide recreational opportunities, and protect local areas from flooding.

Elkhorn Slough is a diverse ecosystem hosting 340 bird, 550 marine invertebrate, and 102 fish species—two dozen of which are listed as rare, threatened, or endangered—and is a designated Globally Important Bird Area.

Research shows that some offshore species, such as sole, flounder, and halibut, also rely on the estuary's waters during their early development. Moss Landing Harbor, located at the entrance to the slough, is one of the state's most active fishing ports.

Grappling with the Issues

Realizing that the erosion and marsh dieback would only get worse, the reserve initiated the Tidal Wetland Project in 2004 by bringing together prominent scientists, managers, regulatory agency staff members, and local community leaders.

"We brought a couple of dozen people to the table for about 30 all-day meetings where we grappled with what was going on, what we thought was causing it, the impacts not only to the environment but to the surrounding communities, and what could be done about it," Largay says. "One of the findings was that in order to stop this trend, fairly substantial actions were required."

Complicating the situation was the concern that reducing the tidal flushing in the estuary would cause water quality problems because of excess nitrogen in area runoff.

Finding the Solution

The project team came up with three potential solutions for reducing tidal energy, Largay says. "We needed to either create a long, narrow sinuous channel, create a bottleneck at the mouth of the estuary, or elevate the land to restore Parsons Slough."

Adding enough sediment to Parsons Slough to restore tidal marsh would have cost $50 million, Largay says. Constructing a sill that acts as a "speed bump" at the mouth of Parsons Slough to slow the flow of the tide and reduce erosion was the most efficient and lowest risk approach.

With a $4.5 million grant from NOAA through the American Recovery and Reinvestment Act, construction of the 200-foot-wide and 10- to 15-foot-tall sill started on November 10, 2010, and was completed in February. The structure is two to five feet below water at low tide.

Environmental monitoring during the construction of the sill ensured that area wildlife species were unharmed.

The engineering, permitting, and construction of the structure—which is in an already-disturbed area near an existing railroad bridge—were all conducted under rigorous scrutiny from regulators and the local community.

Environmental monitoring ensured that wildlife species were unharmed. Long-term monitoring will continue for a number of years.

Early Results

Early monitoring indicates the project is a success. The sill is working to slow the flow of the slough's waters, and there is also no evidence of water quality problems.

Long term, the sill is expected to prevent thousands of cubic yards of sediment from washing into the bay each year. The additional sediment is anticipated to rebuild seven acres of tidal marsh around Parsons Slough.

Largay notes that the project also created or saved approximately 107 jobs through contracts and direct hires.

While Largay is "very pleased with how everything came together" and believes that others will be able to use the lessons Elkhorn Slough is learning from the project, he emphasizes that a sill is "not a solution to every problem. It needs to be thoroughly evaluated."

He adds, "Better planning in advance rather than coming in to build a structure to counter the effects decades later is really the way to go. The big lesson was that advance planning of potential environmental impacts is key to good management." ❖

For more information on the Elkhorn Slough Tidal Wetland Project, go to www.elkhornslough.org/tidalwetlandproject/. You may also contact Bryan Largay at (831) 234-1177 or bryan@elkhornslough.org.

Photo courtesy of Elkhorn Slough Foundation

ECOSYSTEM-BASED MANAGEMENT:
What Makes It a Success?

What are the characteristics that make up a successful ecosystem-based management effort? An Ohio researcher who recently set out to discover the answer to that question has come up with the top 10 requirements for effective ecosystem management.

"Planning is the straightforward part of managing an ecosystem," says Greg Wilson, associate vice president for research at Kent State University. "Implementation is the difficult part because that's where you need to have all these pieces in place for success."

To determine the key management characteristics that are important to success, Wilson surveyed aquatic ecosystem managers in Lake Erie, Puget Sound, Tampa Bay, Chesapeake Bay, and the Baltic Sea, all of which have adopted an ecosystem-based management approach.

"I think there are lessons to learn from the successes and struggles in these systems that can be applied more broadly," says Wilson, who received funding from the Ohio Sea Grant College Program to conduct the research for his doctoral dissertation.

"It provides a lot of insights and guidance, or suggestions for people struggling with implementing ecosystem-based management," says Jeff Reutter, director of Ohio Sea Grant.

More Accurate Reflection

Ecosystem-based management has long been cited as a solution to the combination of human activities on land, along the coasts, and in the ocean that are affecting marine ecosystems.

"For many years, we managed systems one species or one element at a time," Reutter says, "but more and more we're learning you have to manage the entire ecosystem."

"Ecosystem-based management is a more accurate reflection of the real world," Wilson says. "Obviously, people are having a big impact on these systems, and resource management decisions based on science have economic, political, and social implications. All of that needs to be taken into consideration."

> *"It provides a lot of insights and guidance, or suggestions for people struggling with implementing ecosystem-based management."*
>
> *Jeff Reutter, Ohio Sea Grant*

As more managers implement an ecosystem approach, Reutter says, studies like Wilson's "will help us know what works and what doesn't work and will allow us to hone in on and replicate those characteristics that make ecosystem-based management a success."

Survey Process

Wilson conducted a Web-based survey of ecosystem managers of various types in the five aquatic ecosystems he was studying.

Respondents included aquatic scientists, fisheries managers, watershed managers, and those focused on the entire ecosystem. They worked for a variety of organizations, including government agencies, universities, businesses, and nongovernmental organizations.

Survey questions focused on the respondents' involvement in ecosystem-based management, their area of focus, their perceptions of how the process was working in their area, and whether it was implemented voluntarily or was legislatively mandated. There were also questions about the condition of the ecosystem they were working in.

The survey was sent out to 985 people and had a 35 percent completion rate.

Public Engagement

According to survey results, the most important element of managing an ecosystem is public engagement.

"Environmental appreciation, even though it's difficult to measure, is an important factor in management. If people aren't up on the science or don't have a direct connection, they're not likely to get involved and help preserve the ecosystem," Wilson says.

He adds that "once the public is engaged and they become more educated about what is going on in their system, it helps people get on the same page, and it enables the process to move faster."

There were a range of scores for public engagement in the five ecosystems studied. Tampa Bay received the highest marks, and Lake Erie received lower marks than expected.

Reutter notes, "We saw across the board that there's still a pretty significant level of education that needs to be done."

As a result of the survey, he's renewing Sea Grant's focus on explaining to people why Lake Erie needs to be managed as an ecosystem.

"What this really points out is that managing any of these resources has to start way up in the watershed," Reutter says. "We can't manage Lake Erie from Lake Erie, or the Chesapeake Bay from the Chesapeake Bay. We have to have a management plan that focuses on the entire watershed and that informs all the users within that watershed what we're trying to accomplish and how their particular action impacts the entire watershed."

Differences in Perspectives

Wilson categorized respondents in several ways to see if they had different perspectives of how ecosystem-based management was working. Across all the ecosystems, he found significant differences among groups of stakeholders about how successful they perceived the initiative.

Managers in government agencies and the watershed and ecosystem fields generally viewed ecosystem-based management as a success, but aquatic managers and those in academic and business fields didn't agree.

"That's an interesting insight," Reutter says. "How might your background and profession change your opinion on whether ecosystem-based management is working or not? Again, that clearly shows the need for a lot more education and outreach."

Size Matters

Another finding was that implementing ecosystem-based management in a large system is more difficult than doing so in a smaller one.

"This does provide some suggestions as to why ecosystem-based management worked better in certain locations," Reutter says. "Some of it is simply the size and the complexity of the ecosystem."

What was unexpected was that voluntary efforts were equally as effective as those that were legislatively mandated.

"I expected to see much more success for the regulatory programs," Reutter says. "This may suggest that the best way for industries to avoid regulation is to take a lot of voluntary action to solve problems and avoid the need to be regulated."

He adds, "There's tremendous logic in the elements that the survey found make up successful ecosystem-based management. The bottom line for us as managers is to focus on those 10 things and ask ourselves how we're doing and how we can improve." ❖

For more information on the Ecosystem-Based Management Survey, contact Greg Wilson at (330) 221-7296 or greg.wilson@kent.edu.

THE TOP 10 CHARACTERISTICS OF SUCCESSFUL ECOSYSTEM-BASED MANAGEMENT:

1. Public engagement
2. Strong leadership
3. Communication among stakeholders
4. Incentives for collaboration
5. Cross-boundary facilitators
6. Clear, measurable goals
7. Science-based decisions
8. Legislative mandates sometimes needed
9. Adaptive management
10. Sustainable funding

Photo of Lake Erie's Kelleys Island by Art Weber and courtesy of Ohio Sea Grant College Program

Responding to Tropical Storm Irene Part of the Job for Coastal Managers in Massachusetts

No longer a hurricane but still packing a punch, Tropical Storm Irene struck Massachusetts on August 28 after roaring up the Eastern Seaboard. While many areas were hit much harder by the storm, coastal resource managers were a part of the state's emergency management response efforts—a role they've been fulfilling since 1978.

"We as coastal managers recognize that the information collected during a storm event is also very valuable for longer-term planning and hazard mitigation efforts," says Julia Knisel, coastal shoreline and floodplain manager for the Massachusetts Office of Coastal Zone Management. "It's not a reach to have coastal managers involved in this effort."

In addition to manning the Emergency Operations Center, or "bunker," during hazardous events—which can include hurricanes, blizzards, terrorist threats, and inland flooding—the coastal program has also worked to develop a Web tool that enables trained state and local officials, as well as citizens, to document near-real-time coastal storm damages.

Damage reports generated by the StormReporter Web tool are provided to the Massachusetts Emergency Management Agency, NOAA National Weather Service, and other agencies to inform decisions about deploying state and federal resources and issuing National Weather Service storm advisories.

The coastal program's involvement in emergency response is important "given all the coastal development that has occurred in Massachusetts in recent decades," says Joe Pelczarski, Massachusetts Coastal Zone Management regional planner. "The threat is greater than ever before, and a direct hit from a major hurricane is likely to put thousands of people at risk and cause many millions in damage."

Assessing Irene

While Tropical Storm Irene brought the worst flooding in centuries to upstate New York and Vermont, in Massachusetts the storm dumped torrential rains and sent streams over their banks, eroded portions of the shoreline with pounding waves, destroyed a road, and topped trees and power lines, but caused no serious coastal damage.

"We're fortunate that Irene had weakened some before it got to Massachusetts," says Pelczarski.

At the request of the Massachusetts Emergency Management Agency, the coastal program activated the Rapid Response Coastal Storm Damage Assessment Team (storm team) to assess coastal damage from the storm.

Thirty-five members of the volunteer storm team mobilized at first light on August 29 to assess the level of damage to natural resources, harbors, infrastructure, and structures along the coastline and share their findings using the StormReporter Web tool.

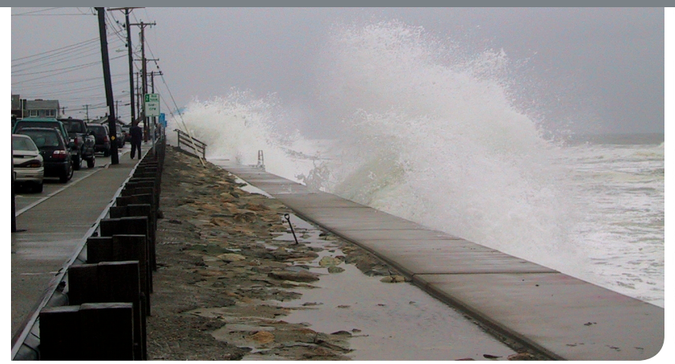
> *"The threat is greater than ever before, and a direct hit from a major hurricane is likely to put thousands of people at risk and cause many millions in damage."*
>
> *Joe Pelczarski, Massachusetts Coastal Zone Management*

Standardization

The coastal program partnered with the National Weather Service and the national StormSmart Coasts Network to develop StormReporter in 2009 in order to standardize data collection and assist the storm team in reporting damages.

Pelczarski, who serves as the Executive Office of Energy and Environmental Affairs' representative in the state emergency "bunker," received 204 electronic reports following Irene regarding damage observations at specific locations.

A recently updated version of StormReporter enables trained users to document near-real-time coastal storm damages.



Emergency Responsibilities

The coastal program has helped staff the state's Emergency Operations Center, which is in a civil defense-built bunker, since a record blizzard hit the state in February 1978, Pelczarski says.

Shortly afterwards, the governor wrote an executive order establishing emergency responsibilities within the state—and included the recently designated coastal program, now housed in the Executive Office of Energy and Environmental Affairs.

During emergency events, Pelczarski coordinates the office's communications and response activities within the bunker.

Evolution

The storm team came into being in the aftermath of a major hurricane and two nor'easters that struck the state in 1991 and 1992. These storms included Hurricane Bob in 1991, a category 2 storm on the Saffir-Simpson scale that caused nearly $40 million in damage in the state, and the famous "Perfect Storm" of October 30, 1991, which sank the swordfish boat *Andrea Gail* that was later depicted in a best-selling novel and movie.

Using telephones and flip charts, volunteer storm team members began providing preliminary damage assessments, which enabled the state to better focus its resources during response and recovery, Pelczarski says.

Evolving from using phones to emailed reports to the revamped Web-based StormReporter, the storm team can now use smartphones and other handheld electronic devices to almost instantly submit detailed coastal storm damage reports and photographs.

Expanding Range

With support from the Northeastern Regional Association of Coastal Ocean Observing Systems, StormReporter has been expanded so that it can be used to record coastal storm damage observations across New England.

StormReporter is supported by an easy-to-use social networking-type interface, similar to Facebook, Knisel says. Users create a profile on the national StormSmart Coasts website to access the tool, and can quickly check boxes related to the storm damage they are documenting and upload photos.

Knisel says the storm team and other users will receive detailed training to ensure they are comfortable using the new version of the tool. Local beach teams and citizens interested in reporting coastal storm damages in their communities will now be able to use the tool, which will improve data collected about minor to moderate weather events.

"Once we develop a longer-term archive of data, we'll really be able to start analyzing it and drawing some trends regarding those areas that are most susceptible to damage," Knisel says. "We'll be able to use the data to support local decisions regarding permitting and planning."

She adds, "This definitely could be expanded across the country. The only thing that would need to be modified is the types of observations on the form. Other states might need to really tailor it to their oceanfront shoreline." ❖

To view StormReporter, go to http://stormreporter.stormsmart.org, register for a new account if you have not already connected with the StormSmart Coasts Network, and join the StormReporter group for your state. For more information on the Massachusetts Office of Coastal Zone Management's role in state emergency management operations, contact Joe Pelczarski at (617) 626-1234 or joe.pelczarski@state.ma.us. Questions about StormReporter should be directed to Julia Knisel at (617) 626-1191 or julia.knisel@state.ma.us.

Photos by and courtesy of Massachusetts Rapid Response Coastal Storm Damage Assessment Team

Turning Cell Phones into Science Tools in North Carolina

Could cell phones be used as citizen science tools that include more fishermen in the resource management process? This question was at the heart of a two-part North Carolina research project that evaluated how anglers might use their personal cell phones to text catch-and-effort information directly to a computer database.

"It's an experiment to see if there's a mechanism where everyone could submit fish data electronically," says Scott Baker, fisheries specialist with the North Carolina Sea Grant Extension Program. "This has appeal because cell phones are already accessible by 85 percent of the population."

The RecText pilot project with charter boat captains and follow-up testing with tournament fishermen found that texting was an effective tool for collecting simple data with a clear protocol from an engaged group, but it was less useful in the distracting tournament environment.

"It's a first step," Baker says. "We're spawning ways to look at using cell phones as a tool as opposed to simply a communications device."

Creating Opportunity

Baker says he often hears recreational and commercial fishermen complain about the survey methods and numbers that federal and state fishery managers use to determine regulations.

"There's a lot of unease," he says. "It's worth exploring additional ways to collect that data and ways to engage the industry. Using cell phones seemed like a simple approach that would give everyone the opportunity to participate."

Pilot Effort

In 2008, Baker and software developer Ian Oeschger received a Sea Grant mini-grant to conduct a pilot study with six charter boat captains in the Wilmington area. The captains used prepaid mobile phones to text their day's catch using a special code to Twitter—then, a little-known online text-messaging service. The real-time submissions allowed Baker to tally and monitor data as they came in.

"It worked out really well with just six people reporting," Baker says. "There were very few errors, even though two of the captains had never texted before."

Tournament Testing

With additional funding from the North Carolina Coastal Recreational Fishing License fund, Baker and his project team expanded the RecText electronic-reporting framework and tested it at four king mackerel tournaments in 2009 and two in 2010.

Having thousands of tournament anglers as potential data collectors meant that purchasing prepaid phones was out, as was using Twitter because of the registration required. The data-collection process was tweaked so that any personal cell phone capable of text messaging could be used.

At each tournament, the RecText team conducted a quick "how-to" course, staffed educational tents, and talked up RecText at pre-tournament dinners and during registration. And, there was the promise of a cash prize for texting the catch-and-effort information.

At four tournaments, RecText survey kits were randomly distributed. At two events, tournament directors included the kits in each captain's bag. In all, RecText kits were on board 967 boats.

Fishermen were encouraged to report information on kept and released fish as well as information about their trip even if no fish were caught. "This was an unbiased way to get everyone to report," Baker says.

Challenges

Having fishermen text in the midst of a hectic tournament was challenging, Baker says.

Problems encountered included discrepancies in fish lengths reported by anglers versus those taken by tournament officials. A considerable number of typographical errors were made, and if fishermen didn't catch fish big enough to weigh in for the competition, there was often no way to validate their reports.

> *"This has appeal because cell phones are already accessible by 85 percent of the population."*
>
> *Scott Baker,*
> *North Carolina Sea Grant*

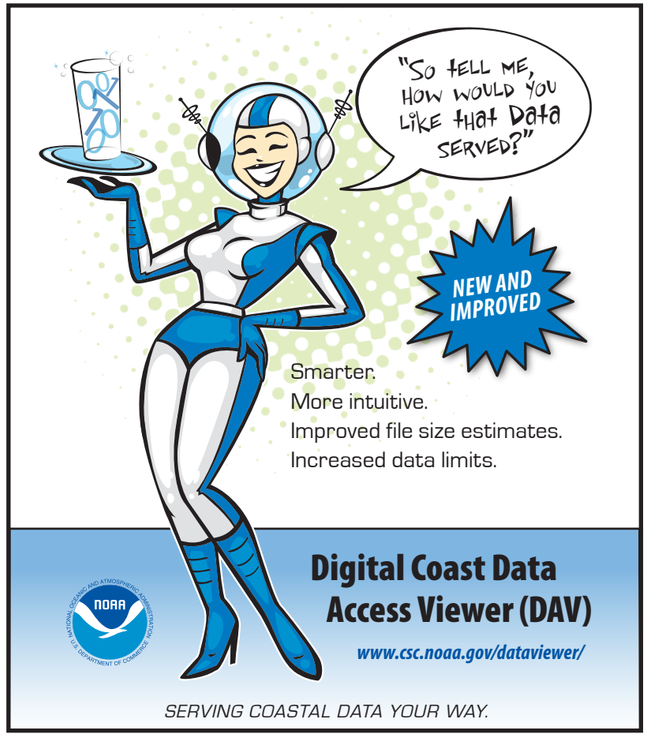
Catching On

Baker's ideas, however, are catching on. His text-messaging method could be folded into the design and testing phase of a NOAA-funded pilot project in Massachusetts. Maryland resource managers have replicated the RecText method for commercial crabbers to report their harvest, and a pilot project is underway in Texas to test the use of smartphones for reporting by for-hire fishing captains.

Still, Baker says the approach may be a little ahead of its time. "We found that cell phone use for detailed science data collection may be limited, but as more and more users get familiar with texting, and smartphone applications and platforms are developed, there may be ways to eliminate errors."

He adds, "It's possible that texting for data collection will only get better as younger folks move into middle age." ❖

To see the RecText reporting site, go to www.rectext.org. For more information, contact Scott Baker at (910) 962-2492 or bakers@uncw.edu.



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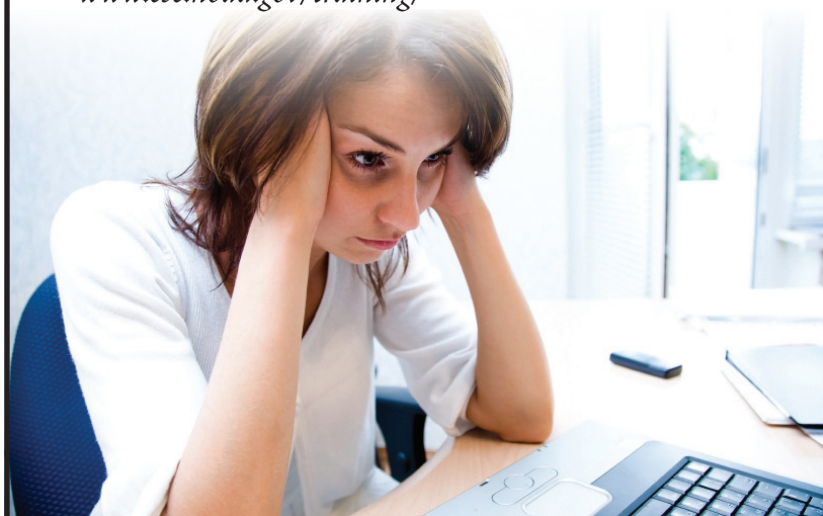
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