



# Science Communication and Coastal Resiliency

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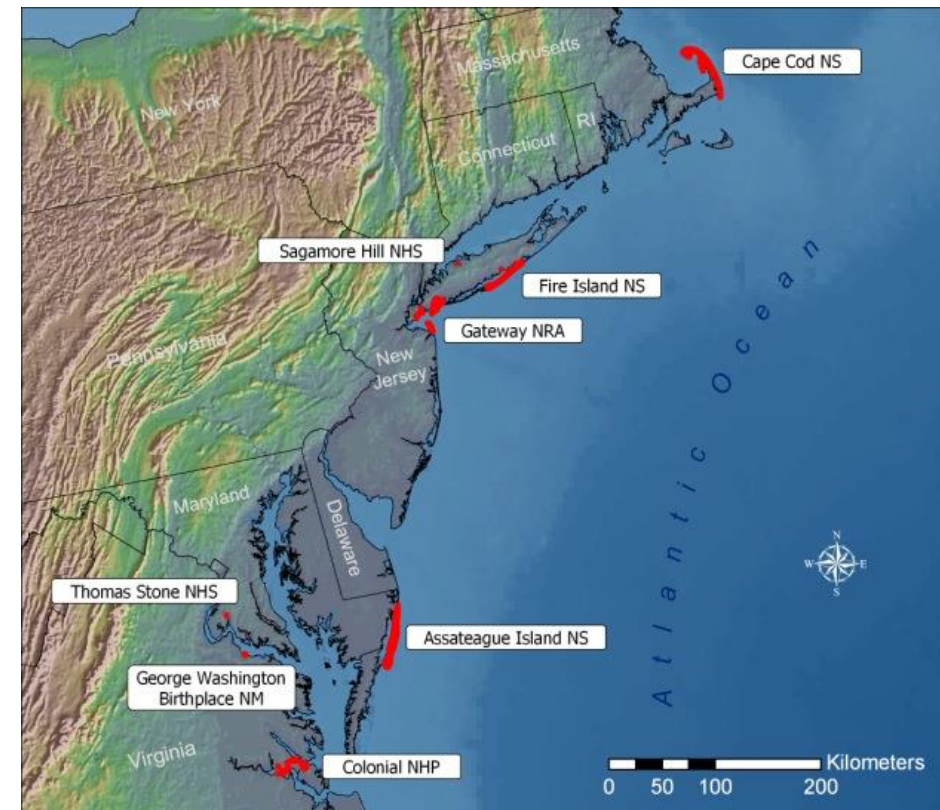
**<sup>2</sup>Northeast Coastal and Barrier Network, National Park Service**

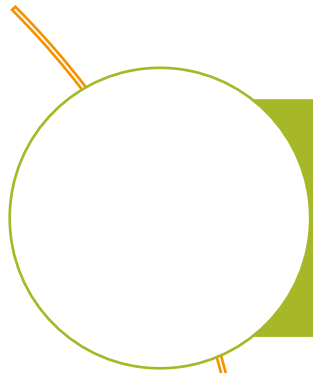


# SCIENCE COMMUNICATION AND COASTAL RESILIENCY:

Building Social-Ecological Resilience through Communication Research and Outreach in Northeast Coastal and Barrier Network Parks Post-Hurricane Sandy

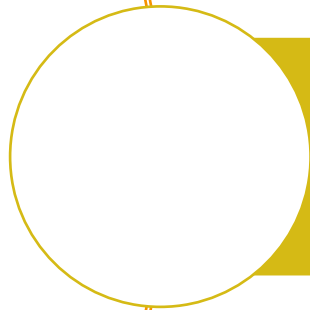
- Northeast Coastal and Barrier Network.
  - One of 32 National Park Service Inventory & Monitoring Networks
  - Facilitates collaboration, information sharing, and economies of scale in natural resource monitoring.
- Focus is on three parks that were hard hit by Hurricane Sandy in October 2012:
  - Fire Island National Seashore
  - Gateway National Recreation Area
  - Assateague Island National Seashore
- Larger Cooperative Agreement between the Coastal Barrier Network and URI Environmental Data Center.
- Funding from August 2014-September 2016.





## Resilience and Communication

- A little bit of theory and background



## Science Communication Outreach

- Content delivery



## Science Communication Research

- Media discourse analysis

# RESILIENCE AND COMMUNICATION

- **Resilience** is the **capacity to deal with change** and continue to develop.\*
- **Social-ecological systems** are **linked systems of people and nature**. The term emphasizes that humans must be seen as a part of, not apart from, nature.\*
- **Ecosystem resilience** is a measure of how much disturbance (like storms, fire or pollutants) an ecosystem can handle without shifting into a qualitatively different state. It is the **capacity of a system to both withstand shocks and surprises and to rebuild itself if damaged**.\*
- **Social resilience** is the ability of **human communities to withstand and recover from stresses**, such as environmental change or social, economic or political upheaval.\*
- **Adaptive Management** Learning through doing with with less rigid policy and management structures.



## Communication

- Public Engagement
- Informing Policy
- Manager Learning
- Scientific Understanding

## Adaptive Management

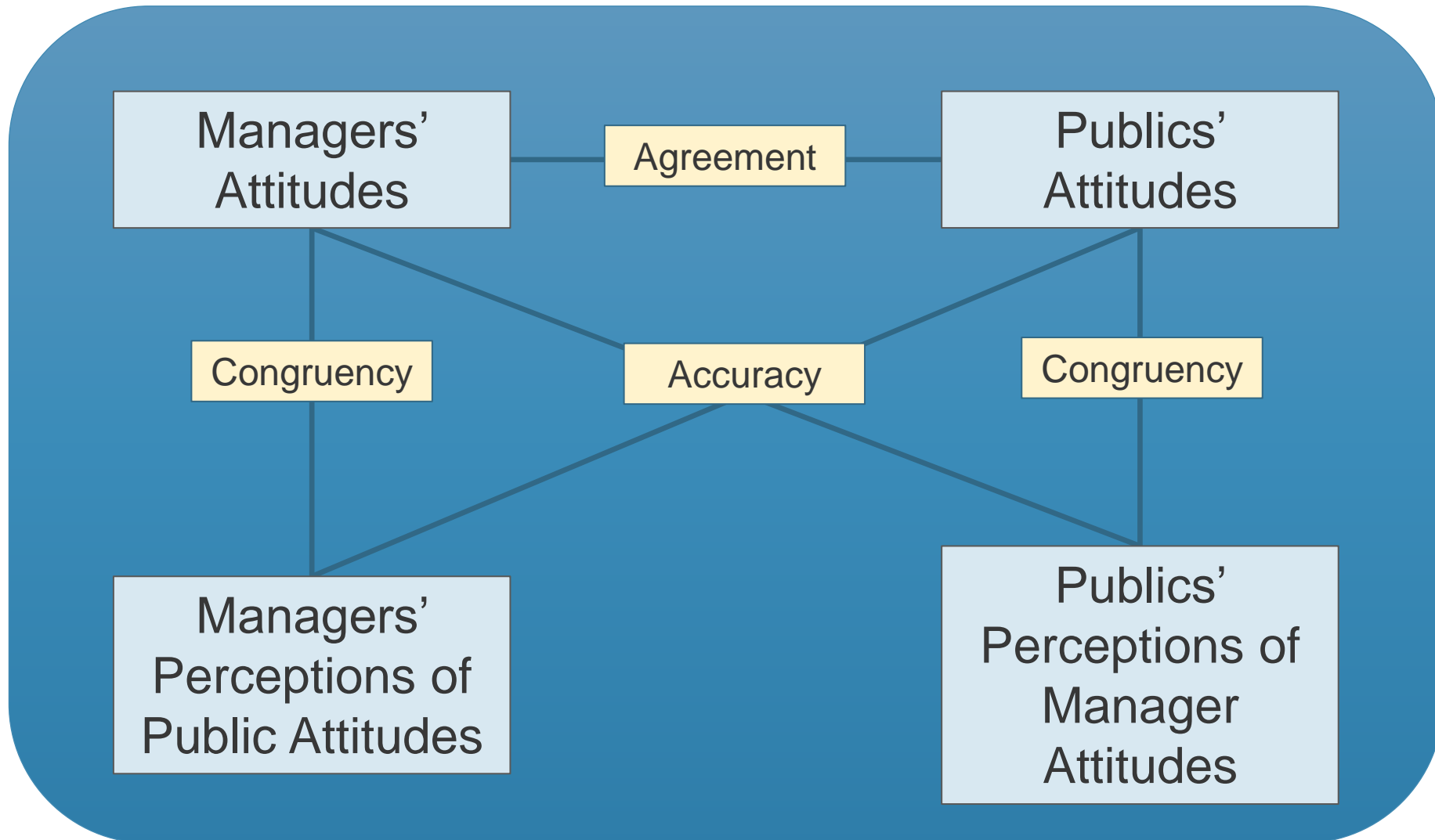
## Resilience

# RESILIENCE AND COMMUNICATION

- National Park Service Commitment to Civic Engagement (Director's Order 75A)
  - **Institutionalize a civic engagement philosophy** and vision that will help ensure the relevance of NPS resources and programs to people, as well as ensure NPS responsiveness to diverse public viewpoints, values, and concerns.
  - Provide a framework for successfully **engaging the public in our work and activities** to instill a sense of ownership in the NPS mission and provide valuable information from a variety of sources within and outside the Service.
  - Provide guidance and direction on reasonable and effective means to **involve the public in decisions** at the park and program level.



# COORIENTATION MODEL



Modified from Connelly and Knuth (2002) (after McLeod and Chaffee 1973)

# Models for Public Understanding of Science (Gross 1994)

## Deficit Model

- Problem of public understanding is public ignorance
- Information Delivery Problem: Public just needs more information to make the right decision
- One-way flow of information
- Assumes a passive public that explicitly trusts in science
- “Facts will speak for themselves”





# Models for Public Understanding of Science (Gross 1994)

## Deficit Model

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Problem: Public just needs more information to make the right decision
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## Contextual Model

- Considering the audience
- Many factors influence decisions, values
- Existing understanding of systems
- Interaction between science and public
- Two-way flow of information
- Active public whose trust must be gained
- Joint creation of science and local knowledge

# FORMS OF PUBLIC INVOLVEMENT

## PUBLIC RELATIONS

- Building public support

## PUBLIC EDUCATION

- Disseminating information

## PUBLIC INPUT

- Collecting information

## PUBLIC INTERACTION

- Two-way communication

## PUBLIC PARTNERSHIP

- Securing advice and consent

Passive



Active

# SCIENCE COMMUNICATION OUTREACH

- Creating resource briefs, photo stories, lesson plans, researcher profiles, and interactive and static maps that communicate storm impacts and resilience and highlight the output of park-funded research.
- Map-based portal for sharing information on monitoring and research in the Network.
- Target audiences: general public, NPS employees, and funders.

Fire Island National Seashore

Northeast Coastal and Barrier Network  
Northeast Region  
National Park Service  
U.S. Department of the Interior

## Barrier Islands:

Shifting sands provide protection and habitat




Fire Island is a barrier island, a long deposit of sand running parallel to the coast. By providing a buffer from the strong wind and waves that accompany storms, this barrier island protects the places we live in and love both on and off the island, including the seventeen communities within the park, the southern coast of Long Island, and the salt marshes and tidal flats of Great South Bay.

### Rising and Falling Dunes

Barrier dunes grow high and steep as dune grasses trap blowing sand. But during large storms, waves and wind flatten the dunes into formations called **overwash fans** (right).

Overwash fans make the island temporarily wider and provide fertile ground for new salt marshes on the shore side of the barrier. Over time, the island narrows as wind rebuilds dunes higher and steeper, until the next storm forms new overwash fans. Then the process repeats.

Through the movement of sand, all barrier islands are constantly rolling over themselves, traveling closer and closer to the inland shore.



This photo, taken just after Hurricane Sandy, shows Fire Island's dunes blown back onto the inner barrier in overwash fans. All photos courtesy National Park Service.

Northeast Coastal and Barrier Network  
Northeast Region  
National Park Service  
U.S. Department of the Interior  
science.nature.nps.gov/IMUnits/rechn/index.cfm

**SEaComm**  
Science Education and Outreach  
An equities, coordination, compilation, data management and change monitor of staff and other coastal park education and outreach services  
Task Agreement #13AC00071 of Cooperative Agreement Number PHS02021



In response to the devastation of the U.S. Atlantic coast by Hurricane Sandy, in October 2012, the federal government awarded funding to NPS for research on the resilience of coastal communities. State-of-the-art survey equipment, made available through this funding, will deliver the most precise and accurate elevation measurements possible and will advance ongoing and new research on coastal resilience. NPS photo/J. Lynch.

## WHAT IS ELEVATION DATA?

A location's height above sea level is called its elevation. Elevation data are calculated using either a standard reference point (a "geodetic datum") or measurements from local tide gauges ("tidal datums"). Researchers measure the elevation of specific points along our coastlines and gather this data to create sophisticated maps of current elevation.

Left: Hurricane Sandy's impact on Gateway National Recreation Area. Blue areas were underwater during Sandy's storm surge. Credit: Gateway National Recreation Area GIS Office.

Above: LIDAR image of the Old Inlet breach at Fire Island National Seashore caused by Hurricane Sandy. Color imagery shows post-storm elevation. Credit: Environmental Data Center, University of Rhode Island.

## WHY DO ELEVATION MAPS MATTER?

Using elevation maps, researchers can illustrate the on-the-ground impacts of future sea level rise and storm surge scenarios, so that coastal communities can make more informed decisions about development and emergency response.

### Examine past damage

- map the impact of storm surges on natural and built environments
- assess damage to sensitive natural and economic resources
- clarify priorities for protection and restoration

### Model future scenarios

- map likely damage from storms and sea level rise
- forecast flooding and water flow at precise points, like highways or hospitals
- predict impacts on coastal habitats and wildlife

### Plan effective storm response

- monitor change in vulnerable coastal areas
- inform local governments about predictable shoreline changes
- contribute to the creation of sound protective strategies in coastal zones

## HOW DO RESEARCHERS MAP OUR COASTS?

**Tide Gauges.** Measure sea level through complex instruments located along our coasts. Essential for creating accurate elevation maps.

**Precision Global Positioning System (GPS) Receivers.** Provide measurements of height, accurate to within centimeters, that scientists use to map the topography of the coast.

**Light Detection and Ranging (LIDAR) Instruments.** Emit laser light pulses from airplanes; pulses are reflected back to sensors to measure the elevation of the ground or water below. Provide rapid elevation mapping over large areas.

**Aerial Photographs.** Allow researchers to observe changes to coastlines.

National Park Service and University of Rhode Island staff carry rover units through Aquaticus Island National Seashore. These rovers communicate with GPS base stations to record elevation data in park salt marshes. Credit: Environmental Data Center, University of Rhode Island.

## WHY DO WE NEED TIDE GAUGES?

Depending on the tide, even roads and homes that are currently 10 feet above local sea level could be underwater in a 14-foot storm surge like the one some areas experienced with Hurricane Sandy. Tide gauges record information about the precise patterns of rising and falling tides up and down our coastlines. Without data from tide gauges, researchers would not be able to make predictions about storm impacts in specific communities. Hurricane Sandy damaged or destroyed 73 tide gauges on the U.S. east coast, leaving researchers with critical information gaps. Replacement of these gauges is necessary for accurate measurement of the vulnerability of coastal resources to inundation (rising water from sea level rise and storm surges).

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# SCIENCE COMMUNICATION OUTREACH

- Fire Island- Otis Pike Breach
  - Hurricane Sandy (October 29, 2012) resulted in three breaches on Fire Island.
  - Two were filled in within 2 months of the storm.
  - One breach, located in the Otis Pike High Dune Wilderness Area, remains open and has been the subject of intense debate about what course of action to take.





# SCIENCE COMMUNICATION OUTREACH

- Slider map- Breach in Otis Pike Wilderness Area created by Hurricane Sandy.

**Otis Pike Breach**  
Old Inlet Pre- and Post-Hurricane Sandy

DRAFT

**Breach at Old Inlet in Otis Pike Wilderness Area of Fire Island National Seashore**

Hurricane Sandy ripped through Fire Island on October 29, 2012 with high winds and a storm surge that scoured out a breach—or a cut through the barrier island—at Old Inlet connecting the Great South Bay and the Atlantic Ocean.

Here are aerial photos of Old Inlet before and after the breach. The image on the left is Pre-Sandy (2010) while the image on the right is Post-Sandy (2013). The Post-Sandy images shows both the breach and extensive overwash.

Data Source:  
New York State Orthimagery (2010 and 2013)  
(<https://gis.ny.gov/gateway/mpj/webserv/webserv.html>)

**Legend**  
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**Legend**  
No legend      No legend



# SCIENCE COMMUNICATION RESEARCH



Newsday (March 14, 2013)

- RESEARCH QUESTIONS
  - What arguments do supporters and opponents of the breach mobilize?
  - What sorts of ecosystem services and disservices do they represent?
- METHODS
  - Media Discourse Analysis
  - Staff and Key Informant Interviews

# SCIENCE COMMUNICATION RESEARCH

Jørgensen, Dolly, and Brigitta Renöfält. "Damned if you do, dammed if you don't: debates on dam removal in the Swedish media." *Ecology and Society* 18.1 (2013): 18.

- Examine ways proponents and opponents of four contentious dam removal projects in Sweden frame the services provided by two contrasting ecosystems--an existing dam and the potential stream without a dam
- Media discourse analysis: 41 newspaper articles, comments on those articles
- Findings: “**(P)ublic opposition is not based on knowledge deficiency**, where more information will lead to better ecological decision-making, as is sometimes argued in dam removal science; it is instead a case of **different understandings and valuation of the environment and the functions it provides.**”



Credit: Håkon Söderberg. <http://phys.org/news/2013-02-controversial-founded-conflicts.html>

**Table 1.** Summary of the arguments used to support and oppose the removal of four dams in Sweden in media coverage of the conflict, categorized by the frame type invoked.

| Frame                | Alby                             |                                                      | Hallstahammar                                                 |                                      | Tallåsen                             |                                                          | Orsa                              |                                                        |
|----------------------|----------------------------------|------------------------------------------------------|---------------------------------------------------------------|--------------------------------------|--------------------------------------|----------------------------------------------------------|-----------------------------------|--------------------------------------------------------|
|                      | Support                          | Oppose                                               | Support                                                       | Oppose                               | Support                              | Oppose                                                   | Support                           | Oppose                                                 |
| Provisioning         | Fish migration routes†           | Loss of pedestrian access; too little water for fish | Increase biological diversity; fish migration†                | Loss of pedestrian access            | Fish migration†; improve biotope     | Negative effects of plants/ animals in riparian zone     | Nationally important species      | Loss of productive river bottom and shallow bays       |
| Regulating           | Risk of dam failure at high flow | High flow without dam unsafe for children            | -                                                             | Dams are a damage protection measure | Less problems with property flooding | -                                                        | -                                 | Creeks and small streams will dry up                   |
| Cultural: recreation | -                                | Loss of bathing place                                | Possible to introduce trout; stone pillars remain for fishing | -                                    | Increase in angling and tourism      | Loss of fish farmed for stream stocking; less recreation | Sport fishing; outdoor recreation | Salmon and grayling can migrate with current structure |



# SCIENCE COMMUNICATION RESEARCH

| Name                                                                                                                                             | Nodes | Referenc | Created On     | Created | Modified On    | Modified |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|----------------|---------|----------------|----------|
| [WESTCHESTER WEB]                                                                                                                                | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| A call to close Old Inlet breach; FINS says it's closing on its own - Schumer calls press conference in Patchogue with Bellone                   | 0     | 0        | 2/19/15 1:34 P | KCH     | 2/19/15 1:58 P | KCH      |
| A forum for the present and the future - Superstorm Sandy the topic of discussion at annual Summit                                               | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| A gun club lost in the breach                                                                                                                    | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| A kayak ride on the new 'Old Inlet'                                                                                                              | 0     | 0        | 2/19/15 1:34 P | KCH     | 2/19/15 1:58 P | KCH      |
| After Sandy, assessing the damage - Newsday                                                                                                      | 0     | 0        | 3/17/15 2:39 P | KCH     | 3/17/15 2:38 P | KCH      |
| After superstorm Sandy, Liers look to the future - Newsday                                                                                       | 0     | 0        | 4/16/15 1:24 P | KCH     | 4/16/15 1:24 P | KCH      |
| After Saving Fire Island Line of Defense Is                                                                                                      | 0     | 0        | 4/16/15 4:13 P | KCH     | 4/16/15 4:13 P | KCH      |
| Aljazeera_102813                                                                                                                                 | 0     | 0        | 5/22/15 2:25 P | KCH     | 5/22/15 2:25 P | KCH      |
| Amphibious Vehicle to Aid in Shoreline Research                                                                                                  | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| Anglers singing praises about the blues - Newsday                                                                                                | 0     | 0        | 4/16/15 1:54 P | KCH     | 4/16/15 1:53 P | KCH      |
| Another call to close Old Inlet breach                                                                                                           | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| As the world turns* Sandy's impact on Long Island's ecosystem                                                                                    | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| AsburyPark_052714                                                                                                                                | 0     | 0        | 5/22/15 2:19 P | KCH     | 5/22/15 2:19 P | KCH      |
| AsburyPark_072814                                                                                                                                | 0     | 0        | 5/22/15 2:25 P | KCH     | 5/22/15 2:25 P | KCH      |
| At hearing, residents critique Suffolk storm response - Newsday                                                                                  | 0     | 0        | 4/16/15 1:16 P | KCH     | 4/16/15 1:15 P | KCH      |
| Barrier Beaches of Long Island breached by hurricane to be fixed (Video)                                                                         | 0     | 0        | 2/19/15 1:34 P | KCH     | 2/19/15 1:58 P | KCH      |
| BC-WEA-SANDY-FIREISLAND*ND - national (300 words),0319 Fire Island 'devastated' by Sandy (EDITORS* This story may not be used on websites)       | 0     | 0        | 2/19/15 1:34 P | KCH     | 2/19/15 1:58 P | KCH      |
| Bellone recalls 'people helping each other' after Sandy - Newsday                                                                                | 0     | 0        | 4/16/15 1:16 P | KCH     | 4/16/15 1:15 P | KCH      |
| Bellone* Fire Island 'has been devastated' - Newsday                                                                                             | 0     | 0        | 3/17/15 2:39 P | KCH     | 3/17/15 2:38 P | KCH      |
| BELLPORT_BAY_watchers_Group_aims_to_restore                                                                                                      | 0     | 0        | 5/22/15 2:51 P | KCH     | 5/22/15 2:51 P | KCH      |
| Bishop Urges Federal Assistance in Barrier Island Breach Near West Hampton Dunes                                                                 | 0     | 0        | 2/19/15 1:34 P | KCH     | 2/19/15 1:58 P | KCH      |
| Bishop_LaValle_Thiele_Throne-Holst_Applau                                                                                                        | 0     | 0        | 4/16/15 4:13 P | KCH     | 4/16/15 4:13 P | KCH      |
| Boardwalk empire lost - Smith Point and Davis Park among the hardest hit beachfront areas SMITH POINT                                            | 0     | 0        | 2/19/15 1:34 P | KCH     | 2/19/15 1:58 P | KCH      |
| Breach at Old Inlet still divides some residents                                                                                                 | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| Breach_Through_Fire_Island_Also_Divides_Opin                                                                                                     | 0     | 0        | 4/16/15 4:13 P | KCH     | 4/16/15 4:13 P | KCH      |
| Breaches from Sandy to be filled in - Newsday                                                                                                    | 0     | 0        | 4/16/15 1:16 P | KCH     | 4/16/15 1:15 P | KCH      |
| Brown tide hits Great South Bay marine life - Newsday                                                                                            | 0     | 0        | 4/16/15 1:54 P | KCH     | 4/16/15 1:53 P | KCH      |
| Brown tide returns, threatening shellfish - Newsday                                                                                              | 0     | 0        | 4/16/15 1:54 P | KCH     | 4/16/15 1:53 P | KCH      |
| C Schumer Calls On National Park Service To Immediately Allow Army Corps To Close Final Breachcaused By Sandy -Breach Puts Homes Along South Sho | 0     | 0        | 2/19/15 1:34 P | KCH     | 2/19/15 1:58 P | KCH      |
| Capital budget questioned, passed - Councilman Senft questions future costs                                                                      | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| Chemistry in real time - Students examine the science behind New Old Inlet                                                                       | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:58 P | KCH      |
| Correction*                                                                                                                                      | 0     | 0        | 2/19/15 1:33 P | KCH     | 2/19/15 1:33 P | KCH      |
| Cuomo Breaches near Moriches Inlet to be closed                                                                                                  | 0     | 0        | 5/22/15 3:45 P | KCH     | 5/22/15 3:45 P | KCH      |
| Debate Mounts Over Whether To Close Breach On Fire Island - CBS New York                                                                         | 0     | 0        | 5/22/15 3:48 P | KCH     | 5/22/15 3:48 P | KCH      |

- DEVELOPED DATABASE
  - 194 articles
  - Local, regional, and international sources
- CODING
  - Develop code
    - Pro, Con, Neutral
    - Ecosystem Services (Supporting, Provisioning, Regulating, Cultural)
    - Themes (Climate change, dynamic systems)
  - Norming code
  - Coding the text
- ANALYSIS
  - Who is making which arguments?
  - Through time
  - Across scales (local, regional, international)
  - Using an ecosystem services framework informative?

## Flood Protection



"The National Parks Service needs to drop any objections and allow for the final breach in Fire Island to be closed to protect homeowners in Sayville, Patchogue, Bellport, Mastic and all along the south shore of Long Island," Schumer said. "The equipment to close the breach is already in the area, so NPS needs to allow the Army Corps to move forward immediately. To do otherwise would be to put thousands and thousands of homes at risk." *Newsday*, 11/12/2012

## Water Quality



"The land and water have also undergone major changes, some bad and some good. One of the biggest issues post-Sandy is the breach in the barrier beach at Old Inlet. At this time, the breach is still open and is allowing much needed clean ocean water into the eastern part of Great South Bay." *Fire Island Tide*, 5/24/2013

## Dynamic System



"The Army Corps of Engineers, which has already closed the two larger cuts in the barrier island, is prepared to close the one in the part of the Fire Island National Seashore known as the Otis Pike High Dune Wilderness. That would be a mistake. Let nature take its course." *Newsday*, Editorial, 2/3/2013

# CONCLUSIONS

- Outreach
  - Provide timely content to take advantage of the opportunity to educate the public about coastal storm impacts and sea level rise
  - Communicate progress and findings to NPS employees, policy-makers, and funders
  - Map-based framework for sharing information
- Research
  - Contribute understanding environmental communication in urban wilderness and coastal systems
  - Help managers prepare for the next event
    - Be prepared for the kinds of arguments people will make
    - Nuanced way of presenting information



Funding Source:

Acquisition, Coordination, Compilation,  
Data Management and Change Analysis of LiDAR and Other  
Geospatial Data Collected Pre- and Post-Hurricane Sandy  
Task Agreement P13AC00875 of Cooperative Agreement  
Number P09AC00212

**SEAcomm**  
university of rhode island  
society, ecology & communication laboratory

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