

# Communicating Risk: how people respond to coastal storm warnings

by Nancy Balcom

Some people are diehards...as in fans of some team or another, that is. Actor Bruce Willis starred in a series of “Diehard” films which tested his limits in surviving various evil machinations. Still others are diehards when it comes to facing severe coastal storms. They prepare to shelter in place, protect their property, and, hopefully, survive. Not all people are diehards when it comes to storms, but how people react to storm warnings and make the decision to stay or to go was the focus of a two-year social science research effort supported by the Connecticut, New York, and New Jersey Sea Grant programs.

In late October 2012, “Superstorm” Sandy traveled up the Atlantic coast and came ashore in the tri-state region. In her wake, she left 117 people dead, billions of dollars in property and business losses, and thousands of lives shattered. While evacuation orders were in place, there was still significant loss of life in flooded homes. Why didn’t or couldn’t people leave for safe shelter?

“We were not expecting the worst...Hurricane Irene didn’t really do much damage at all...we were told to evacuate at our door and we chose to stay...”  
(from interviews conducted by S. Moran *et al.*, 2015, SUNY-CESF.)

In 2013, the three Sea Grant programs, through NOAA National Sea Grant, were awarded Sandy Supplemental funds appropriated by Congress under the Disaster Relief Appropriations Act of 2013. The funds were used to mount a collaborative, jointly-managed social science research effort to investigate how people obtain storm warning reports and information, what factors influence decisions to heed or not heed the warnings, and how storm warnings can be made more effective. Ten research projects were competitively funded at institutions from Yale University to Mississippi State University as part of the Coastal Storm Awareness Program (CSAP) (*For more information see <http://nyseagrant.org/csap>*).

A Program Steering Committee was established that enabled both the researchers and Sea Grant staff to benefit from the expertise and feedback of individuals working for the NOAA National Weather Service, local and state emergency management, and environmental protection. Two “all hands” meetings were held, one to acquaint all of the PIs and foster potential inter-project collaborations and one to share and discuss the collective results.

“Know your audience” is important to successful messaging, yet this can be complicated when the same message is perceived differently by groups of individuals. Based on an analysis of risk perception



One strong message from Sharon Moran and William Peace’s research project was that the rights of disabled persons and service animals need to be addressed in evacuation planning. Photo credit: Peg Van Patten.



Governor Malloy and others survey damage from Tropical Storm Irene in 2011. Photo credit: Office of Gov. Dannel P. Malloy.

and other factors, Jennifer Marlon and her colleagues at Yale grouped people into five categories. The “First Out” are anxious and eager to leave if a hurricane is forecast, while on the other end of the spectrum the “Diehards” feel confident they are prepared to ride the storm out at home and typically will not evacuate. In the middle are the “Constrained”, the “Optimists” and the “Reluctant”. Those who are constrained recognize the risks and are willing to leave, but face barriers such as health issues or pets that limit their options on where they can go. Optimists doubt the storm will actually materialize or be as bad as predicted but are willing to evacuate, while the Reluctant prefer to remain at home but will leave if ordered to evacuate. Each of these groups has a different reaction to storm warnings. Recognize yourself?

People used a broad array of communication platforms to obtain reports and information on Sandy. Television and Internet were primary sources, but social

media like Twitter and Facebook were also important, as were radio and cell phone apps. John Edwards and his team at Mississippi State documented shifts in how people obtained information throughout storm Sandy, moving away from television and the Internet towards radio and face-to-face conversations as power outages increased. This underscores the need for official storm messages to be issued through many media platforms to ensure that before, during, and after a storm people have the means to get current, accurate, and relevant information.

No matter how people followed the progress of Sandy, the researchers identified several factors that strongly influenced the decisions people made with respect to the storm and evacuation. The factors included both the source and format of the warnings, previous

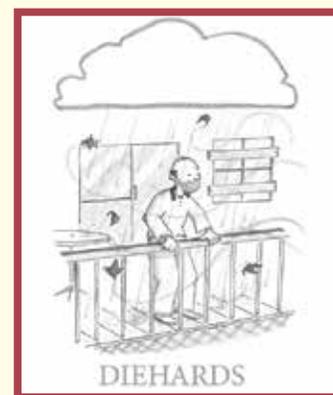
experience with coastal storms, and demographics. People seem to trust different sources of storm information—they recognized the NOAA National Weather Service as the authoritative source of weather information but expected and preferred to receive its information from more local sources. Local or state officials, television news reports, and family, friends, and neighbors were all key sources of information.

The Marlon study clearly indicates that if you want people to listen to evacuation orders, then have local fire fighters or police issue them, since they have the greatest likelihood of being listened to by all five population groups. Christa Farmer and her team at Hofstra University found that actions taken by local

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## HURRICANE ATTITUDE SEGMENTS

<b>First Out</b> 21%	Anxious and eager to leave if a hurricane is in the forecast
<b>Constrained</b> 14%	Aware of risks & willing to evacuate but face barriers
<b>Optimists</b> 16%	Doubt that a hurricane will occur but willing to evacuate
<b>Reluctant</b> 27%	Reluctant to evacuate but will leave if ordered to
<b>Diehards</b> 22%	Confident they can safely ride out hurricanes at home



Jen Marlon from Yale used a survey analysis to group respondents from the Connecticut coastal flood zone in five groups of attitudes and behaviors.

Illustration Credit:  
©Chris Cater.

From J. Marlon et al., 2015, Yale University

fire departments or police, such as going door to door or evacuating their own families, can have a greater influence on residents than just the evacuation order itself. In addition, emergency managers interviewed by Cara Cuite and her colleagues at Rutgers indicated they may use scare tactics or guilt to drive home the message that at some point during the storm, it may become too dangerous for first responders to rescue someone who fails to evacuate as advised.

In contrast, Ricardo Daziano and his colleagues at Cornell and Edwards both determined that family, friends, neighbors, local TV news, or The Weather Channel played major roles in influencing evacuation decisions, more so than government agencies or officials.

A second factor influencing evacuation decisions is the warning format. The key take-home message here is that the word “voluntary,” used in combination with evacuation orders, was determined to be completely ineffective by both Cuite and Daziano. Very few people seriously consider evacuating when it is promoted as a voluntary measure. In contrast, using the word “mandatory” with evacuation orders gets people’s attention. “We would advise against using the word ‘voluntary’ in any evacuation messaging,” Cuite said. Daziano found that compliance was likely to be 24X greater when “mandatory evacuation” was used. He also found that the majority of those interviewed were less likely to evacuate under a voluntary evacuation order, compared to having no evacuation order

in effect at all. Other format-related findings included providing precise “what-to-do” instructions linked to the community level and emphasizing practical reality such as “the shower and toilet won’t work” (from researchers Hogan Carr at Nurture Nature Center and Farmer).

Laura Hoven and her research team at Columbia University documented a shift from what people surveyed actually did during Sandy (27% ignored a mandatory evacuation order) to what they predicted doing in the future (83% would evacuate under voluntary orders and 100% under mandatory orders). Marlon found that one in five coastal residents living in Evacuation Zone A (closest to the water) and facing a Category 2 hurricane would evacuate without an official notice, whereas six in ten said they would evacuate if officially ordered.

Evacuation orders or flood warnings are rather meaningless if people don’t know where they live, relative to the scope of those orders or warnings. Some may leave their homes unnecessarily, while others who need to leave remain at home. And do people actually know where those evacuation signs lead? In 2013, New York City revised its hurricane evacuation zones and initiated a “Know Your Zone” campaign with maps to help familiarize residents with these changes. Connecticut coastal communities need something similar, given that Marlon determined that 70% of coastal Connecticut residents surveyed don’t know if they live in an evacuation zone and 74% have never seen a local evacuation map.

The New Jersey shore suffered the most severe winds and surf from Hurricane Sandy and the most damage from the storm, estimated at 30 billion.



Hurricane Sandy: Atlantic City, NJ, 2012: Tom Mihalek, Reuters

The terminology used in storm warnings plays an important role in determining whether the risk conveyed is understood by the general populace to whom the warning is directed. Hoven found that few people had any concept of what the term “storm surge” means; some envisioned a tsunami. The NOAA National Weather Service has recently begun to characterize storm surge as “height of the water above ground level” which will hopefully help people visualize and understand what is meant by future storm surge warnings.

A third factor, previous experience with coastal storms, also had a strong influence on how people reacted to storm warnings for Sandy. Hoven found that while the most important factor in a decision TO evacuate during Sandy was the family’s personal safety, the most important factor in a decision NOT to evacuate was previous experience.

Sharon Moran and her SUNY team

also found that people who evacuated during Irene in 2011, when it turned out not to be necessary, made the decision not to evacuate for Sandy. This decision had tragic consequences for some families. *No storm is ever the same as previous ones.* Cliff Scherer and his team at Cornell and Gabrielle Wong-Parodi and her team at Carnegie Mellon both found that previous experience also hinders or colors a person’s ability to conceptualize just how bad a storm can be. People can only imagine the worst storm they have ever experienced.

Previous experience also affected people’s ability to feel comfortable leaving their homes. Moran documented experiences of disabled residents from Sandy-affected areas, finding that key factors in decisions to shelter in place included concerns about accessibility to a new location, transportation, lack of confidence that a shelter could accommodate their specific needs, and a lack of real-time updates on shelter status. The Americans with Disabilities Act addresses a civil rights issue and communi-

ties need to include the disabled in conversations on local storm preparation. In New York City, a 2011 federal class action lawsuit resulted in a deal that calls for upgrading disaster centers to accommodate 120,000 disabled people by September 2017. Another significant barrier is that people will not leave their pets behind, underscoring the need for more pet-friendly shelters in communities.

An interesting question arising from research by Scherer, Marlon, and Farmer is, how will future evacuation behavior be affected by new requirements that homes in vulnerable coastal areas be flood compliant? Will compliance make people more, or less, inclined to evacuate? Scherer’s team found that some people felt that if their financial risk was minimized with safer, flood compliant homes, they would be more likely to leave, while others indicated if their homes were safer, they would be less likely to leave



(from interviews by Wong-Parodi)

**“When they said it was going to be a really bad storm, I envisioned the worst I had experienced. I didn’t have a vision for worse than what I experienced...I don’t know what kind of information they could have shared that would have said ‘beyond your imagination level!’”**

This storm-damaged house in the Fenwick community of Old Saybrook CT is being raised with a flow-through foundation for better storm resilience. Photo Credit: Nancy Balcom.

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Aerial views of the damage caused by Hurricane Sandy to Casino Pier on the New Jersey coast, taken during a search and rescue mission by 1-150 Assault Helicopter Battalion, New Jersey Army National Guard, Oct. 30, 2012. Photo credit: U.S. Air Force, Master Sgt. Mark C. Olsen

during future storms. Definitely a conundrum.

The last framing question for CSAP focused on ways to improve future warnings to make them more actionable. Hogan Carr analyzed how emergency personnel, broadcast meteorologists, and the public responded to and interpreted National Weather Service briefing materials and coastal storm surge forecast and warning products. Based on the feedback they received, the research team recommended ways to improve the verbal and graphic clarity of these materials and shared best practices for the use of the briefing materials. These recommendations were shared with the three NOAA National Weather Service meteorologists serving on the CSAP Program Steering Committee.

New tools and websites were generated by the CSAP effort. The Edwards team filtered and geocoded images shared by Twitter users during Hurricane Sandy, and verified their locations with Google Street View. They then

developed a software application that facilitates two-way communication between emergency managers and the public. The researchers envision its usefulness in helping local emergency managers identify priority response areas in their communities through Twitter images in near real-time. They did point out that they were not encouraging people to deliberately put themselves in danger to take pictures during storms.

Sandy Supplemental funding provided Sea Grant with the opportunity to improve our understanding of people's perceptions of, and responses to, coastal storm risk communications. Storm-related communications should be issued over many media platforms to maximize accessibility to critical information before, during, and after severe storms. Evacuation decisions are influenced by factors including source and format of any warnings, previous experience, demographics, and possibly going forward, by how safe or flood compliant a home is. Storm warnings and

related information can be made more understandable and actionable by improving their visual and graphic clarity, using simple terms, and including community-specific instructions. Coastal residents need to be firmly aware of the location of their homes relative to flood and evacuation zones in their community.

The collective results of the Coastal Storm Awareness Program social science research will be integrated into Sea Grant outreach programs for relevant audiences, including the Diehards among you. Hopefully, what has been learned can be put to use to influence future storm communications and response behaviors, with the ultimate goal of saving lives during severe weather events.

#### **ABOUT THE AUTHOR**

Nancy Balcom is Associate Director of Connecticut Sea Grant.