

# Coping with threats from hurricanes, wildfires and rising sea levels

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As sea levels continue to rise and more severe storms, like Hurricanes Maria and Michael, threaten coastline communities, local leaders need to assess the hazards and vulnerabilities of their locale. Risk assessment and risk mitigation practices can be beneficial in creating adaptation plans and making mitigation decisions for coastal communities. As scientists ponder the possibility of category six hurricanes, previous disaster prevention plans are no longer adequate for current threats from severe weather.

Recent disasters from severe weather events across the globe stress the urgency for cities to adapt to these hazards, but there is considerable debate about which adaptation techniques actually reduce vulnerability. Tom Logan, M.Sc., University of Michigan, and his collaborators used a coupled tsunami-inundation and land use change model to show that hard-adaptive measures, such as building seawalls, can inadvertently increase long-term vulnerability to natural events. They also found that increasing hazard awareness, by educating the community, can reduce vulnerability.

The results of the study, "Neglecting behavioral feedbacks in quantitative [risk assessment](#) can lead to maladaptation to natural hazards," challenge existing hazard adaptation practice and highlight that ignoring the dynamic feedbacks, such as urban development and evolving risks, can alter the assessment of whether strategies are effective or not.

Flood risks threaten cities worldwide and [climate change](#) will only exacerbate the situation. However, making decisions aimed at reducing flood damages means communicating challenging ideas to decision-makers and the general public. Tamsin Lyle, M.Eng., MRM, P.Eng., Ebbwater Consulting Inc., and her team have been working with the City of Vancouver to communicate to city staff and stakeholders the issues about flood, flood risk and risk tolerance, all of which have been changing with the [climate](#). During her presentation, "Risk communication was hard enough when climate was stationary," Lyle will be sharing some of the lessons learned about what worked in terms of effectively communicating their message.

"Some of the tools that we developed and will be presenting push boundaries in terms of coupling flood impacts and likelihoods with non-stationary climate hazards," states Lyle. "We have added a third dimension to traditional ideas and methods. This was effective at showing how flood mitigation actions work over time."

There has been abundant evidence that psychological mechanisms such as motivated reasoning might discourage certain segments of the population from paying attention to climate change-related information. Janet Yang, Ph.D., University of Buffalo, and her team of researchers conducted a series of experiments in which messages were designed to highlight the impact of climate change in the U.S. or in a distant country, as well as messages about climate change's impacts on familiar objects, such as coffee, or on an unfamiliar disease, such as babesiosis.

The study, "Using psychological distance as a framing strategy to communicate about climate change," examined whether these messages influenced American adults' risk perceptions and emotional responses to climate change, as well as their support for climate mitigation policies and intentions to engage in pro-environmental behaviors. Yang found that highlighting climate change impacts that were far away and

unfamiliar forced individuals to rely more heavily on their political ideology. Narrowing the distance of the impact, however, was effective in reducing ideological polarization.

"Cultivating the sense of closeness is even more critical when strong issue-specific values are yet to be formed in segments of the population," states Yang. "Therefore, scholars need to identify more effective strategies to narrow the psychological distance of important social issues."

Despite scientific claims, news headlines have been riddled with speculation and discussion concerning the relationship between human-driven climate change and the increasing frequency of extreme weather events. Rachel Dryden, M.Sc., Carnegie Mellon University, and her team of researchers conducted a study, "Public perceptions of climate attribution," that explores when and how lay people attribute extreme weather events to climate change. Frequency, severity and type of event were all considered factors that influenced people's judgements.

"This study uses a novel application of psychophysics to address human perception of extreme events as it relates to climate change," states Dryden. "It could also be used as a predictive tool in anticipating how people may react to future extreme weather events. The results could also inform the evaluation of alternative warning or media-reporting strategies for climate attribution of extreme weather events."

Drawing on theories of reconstructive memory and cultural theory, Gisela Böhm, University of Bergen, and her team of researchers studied how people understand and tell stories about climate change in order to reveal how these stories are shaped by people's fundamental values and beliefs. The questions addressed by this study, "Motivated reconstruction of memory: How worldviews shape the recollection and communication of climate change narratives," include, (1) Do people remember

information differently depending on whether that information is consistent or inconsistent with their views? (2) Do people tell climate stories differently depending on whether the listener shares or opposes their views?

Louisiana's Comprehensive Master Plan for a Sustainable Coast is a 50-year plan for reducing flood risk and preventing land loss, with six billion dollars allocated towards nonstructural flood risk reduction measures such as elevating homes, floodproofing commercial properties and buying out high-risk assets through voluntary acquisitions. However, the plan is only in the early stages of development with regards to an implementation strategy and setting mitigation standards.

David R. Johnson, Ph.D., Purdue University, and his team of researchers have identified strategies for implementing the plan options that will perform well over a wide range of future conditions and improve upon the expected risk reduction of similar projects. The study, "Robust funding allocations for nonstructural flood risk mitigation in Louisiana's coastal zone," has the potential to improve the cost effectiveness of investments in flood protection, increasing the resilience of coastal communities against hurricanes.

Predicting future flood risks, and therefore planning to protect communities from future floods, can be difficult due to fluctuations in the size and number of flood events per year, and sea level rise. The City of Vancouver is facing a projected sea level rise of one meter by 2100 and must determine how to implement appropriate mitigation measured in time to protect the floodplain. A presentation titled "[A sea-level](#) rise adaptation planning framework for Vancouver, British Columbia" by Christian Beaudrie, M.Eng., Ph.D., Compass Resource Management, Ltd., investigates the use of novel risk elicitation methods and risk timing tools to help city planners understand what assets and communities are at risk, to identify what level of risk is acceptable, and

to determine when risks will reach unacceptable levels, allowing ample time for protections to be put in place.

For communities not faced with imminent flood risks, a different extreme weather event threatens to destroy communities: wildfires. Over the past several decades, wildfire events have increased in frequency, extent and intensity, and have lengthened the wildfire season in some locations. Research conducted by Alison Cullen, Sc.D., and Harry Podschwit, University of Washington, assessed the likelihood of multiple synchronous large wildfires, which strain management capacity, and its spatial variability across the U.S.

The study, "Past patterns and trends in simultaneity of very large wildfires: Implications for risk management," explores national and regional preparedness levels which support decision-making about levels of readiness prior to and during the season. They also examined characteristics associated with incident prioritization of actively burning fires. This work will provide statistical insights regarding the historical characteristics of simultaneous wildfire activity and provide a launching point for future scientific research.

Provided by Society for Risk Analysis

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