

Sandy and urban systems, infrastructure and vulnerabilities

Hurricane Sandy made landfall on the New Jersey shore just south of Atlantic City on October 28, 2012 and became one of the most damaging storms to strike the continental United States. Sandy impacted cities throughout the Atlantic seaboard and the eastern US. The storm's reach even extended to Chicago, Illinois where it generated 20 foot waves on Lake Michigan flooding the city's Lake Shore Drive. While it is not possible to attribute Sandy's unusual meteorological character to climate change (e.g. it was a vast storm generating tropical force winds out across hundreds of miles and was reclassified from a hurricane to a post-tropical nor-easter as it made landfall and joined with a massive front cold descending from the north), its strength and resulting impact was certainly enhanced by the fact that the waters of the Atlantic Ocean near the coast were roughly 5 degrees F above normal and that the region's coastline is experiencing increasingly rapid sea level rise - some of which can be attributed to a warming climate.

Sandy caused significant loss of life, tremendous destruction of property and critical infrastructure, and disruption of daily life in one of the most vulnerable yet wealthiest and best-disaster prepared coastal region of the United States. The New York-New Jersey metropolitan area with millions of coastal zone residents even had a dry run for a major hurricane event last year when Hurricane Irene swept through the area, doing little damage to the coast but further alerting local and state officials about the need to be ready for a huge storm. The death toll from Sandy in the extended metropolitan region now exceeds 100, the damage estimates including direct and indirect economic losses will be likely in the 100s of billions of dollars, and at its peak the storm cut electrical power for more than five million customers.

The death and injury, physical devastation, many-day power, heat, and water outages, and gasoline shortages and cascade of collapses from Sandy's impact reveal what happens when the complex, integrated systems upon which urban life depend arrested and fail. One example is what occurred when a Consolidated-Edison electricity distribution substation in lower Manhattan ceased operation at approximately 9:00pm on Monday evening when its flood protection barrier (although designed to be 1.5 feet above the 10 foot storm surge of record from Hurricane Donna in 1960) was over topped by the 14 foot storm surge. As the substation stopped functioning, it immediately caused a system wide loss of power for over 200,000 local customers. This event with other planned and unplanned outages resulted in much of Manhattan below 34th street to be without electrical power for four or more days. The power outage revealed a diversity of vulnerabilities within the immediate affected area and the wider region. Residents in the numerous high rise apartment buildings were left without heat and lights but also without elevator service and water (which must be pumped to upper floors). The outage shuttered businesses in office towers and in on-the-ground store fronts and stalled subway lines below the street causing the local and regional economy great disruption. With public transportation out of service, people wanting to get to Manhattan soon resorted to using private cars resulting in massive gridlock and traffic jams on the city's streets.

Sandy also has highlighted the vast differences in vulnerabilities across the extended metropolitan region. Communities and neighborhoods on the coast were obviously most vulnerable to the physical impact of the record storm surge. Many low-to-moderate income residents live in these areas and suffered the damage or loss of their homes leaving tens

of thousands displaced or homeless. Unlike more distant coastal tourist towns, the homes in these places are now year-round permanent residences. These losses are complicated by the fact that much of the critical infrastructure in these communities and neighborhoods including roads, electrical cables and gas pipelines also were severely damaged or totally destroyed. The unseasonably cold autumn temperatures in the days following Sandy caused further concern of exposure because of those hundreds of thousands of residents still without lights and heat. As a specific sub-population, the elderly and infirm were shown to be highly vulnerable especially those living in the coastal evacuation zone and those on upper floors of apartment buildings left without elevator service. These individuals had limited adaptive capacity because they could not easily leave their residences.

Even with the extensive devastation, the effect of the storm would have been far worse if the climate resilience strategies in the region were not in place. The City of New York and the Metropolitan Transportation Authority, for instance, worked aggressively to protect life and property by stopping the operation of the city's subway before the storm hit and moving the train cars out of low lying flood prone areas. At the height of the storm surge, all seven of the city's East River subway tunnels flooded. Catastrophic loss of life would have resulted if there were subway trains operating in the tunnels when the storm struck. The storm also fostered vigorous debate among local and state politicians, other decision-makers and stakeholders about how best to prepare the region for future storms especially given the likelihood that this type of event will become more frequent with climate change, particularly in the context of accelerating sea level rise. New York State Governor Cuomo and New York City Mayor Bloomberg both publically stated that the storm and its impact was evidence of climate change. The merits of a storm surge barrier and other hard infrastructure features as well as soft adaptation approaches such as policies to shift more of the risk burden to coastal property owners or to place restrictions on rebuilding have been discussed in the local media. The product of these discussions and any resulting actions are yet to be determined.

William Solecki
Department of Geography & CUNY Institute for Sustainable Cities - Hunter College
wsolecki@hunter.cuny.edu
917 301 4985 mobile and text
695 Park Avenue
New York, NY 10065 USA