



5 Growing Threats to America's Cities

Federal Investments in Resiliency Needed in the Face of Extreme Weather

By Matt Kasper and Daniel J. Weiss January 23, 2014

Weather events have been dominating the news recently thanks to the “polar vortex” that caused record cold temperatures across the nation. But just a few months ago, the news was filled with other events: record rain and flooding in Colorado; destructive tornadoes in Oklahoma; widespread drought in the Southwest; and the sluggish recovery from Superstorm Sandy in New Jersey. Unlike the record cold, however, these extreme weather events are becoming more commonplace.

CAP has identified five growing extreme weather threats to American cities:

- Heavy precipitation and floods
- Droughts
- Heat waves
- Tropical storms combined with sea-level rise
- Severe thunderstorms

These catastrophic events are taking lives, destroying businesses, and draining the federal treasury. A CAP analysis from last year found that there were 25 extreme weather events in 2011 and 2012 alone that caused more than \$1 billion in economic damages. Combined, these events took 1,100 lives and caused \$188 billion in economic losses.¹ Moreover, federal taxpayers spent a total of \$136 billion in fiscal years 2011–2013 to help communities recover from weather events—or \$400 per household per year.²

The frequency of such destructive and billion-dollar extreme weather events grew from an annual average of fewer than two events per year in the 1980s to an annual average of more than nine events from 2010 to 2012.³ While 2013 was less extreme in the United States compared to 2011 and 2012, scientists increasingly warn that a warming planet will bring about more extreme weather events. The Fifth Assessment Report of the U.N. Intergovernmental Panel on Climate Change, or IPCC, released last year, cautioned that the effects of climate change will continue to worsen due to higher projected atmospheric levels of carbon pollution.⁴

Responding to extreme weather events—rebuilding and repairing damages—and preparing for future extreme weather will be expensive. In fact, a CAP report from October concluded that ignoring climate change linked to extreme weather is essentially an “unfunded mandate” on American cities because they are forced to spend scarce dollars recovering from and preparing for these damaging occurrences.⁵

Investments in community resilience, however, save lives and taxpayer dollars. A study for the Federal Emergency Management Agency, or FEMA, estimated that every \$1 invested in community resilience will reduce disaster damages by \$4.⁶ What’s more, a groundbreaking CAP study from June found that in FY 2011–2013, federal taxpayers spent \$6 on disaster cleanup for every \$1 spent on community resilience.⁷ The federal government should estimate the total price tag of investments needed to better prepare communities for extreme weather, and should also propose a reliable source of federal revenue to invest in community resilience and reduce damages.

In this issue brief, we detail the five growing threats to cities that their residents and officials must address in the coming years, the cities that are taking action, and what the federal government can do to not only help mayors and city managers but also lessen the burden for American taxpayers.

The five growing threats

More Americans are living in cities now than a decade ago, according to U.S. Census data.⁸ These places are the engines of significant economic growth, because of large businesses serving as hubs of financial activity and local officials solving big issues. Cities also face the daunting task of becoming better prepared and more resilient to future extreme weather events, which are predicted to become more frequent and/or ferocious.

Heavy precipitation and floods

Due to rising air and water temperatures, extreme rainfall will become more frequent, and scientists predict that the frequency of heavy rainstorms will also increase. Because the air is carrying more water vapor than it used to, the moisture can be tapped by storm systems to yield rain or snow extremes, creating floods. As a result, many more U.S. cities are at risk.⁹ In fact, the consulting firm AECOM published a report for FEMA, predicting that areas at risk of flooding in the United States would increase 45 percent by 2100, largely because of climate change, with projected changes in population growth also creating factors for floods.¹⁰

Flooding can cause a range of health impacts, including death and injury, contaminated drinking water, hazardous material spills, and increased populations of disease-carrying insects.¹¹ Additionally, flooding can damage a city's infrastructure, causing even more economic hardships.

In 2010, the city of Nashville, along with other towns in Tennessee and Kentucky, was devastated after a heavy rainfall caused catastrophic flooding. On the first two days of May in 2010, 13.53 inches of rain fell in Nashville, setting not just six-hour, twelve-hour, one-day, and two-day records but also breaking the rainfall record for the entire month of May in the city's history.¹² The flooding caused damages in excess of \$2 billion in Nashville alone, according to the National Oceanic and Atmospheric Administration.¹³

One year later, beginning in May, historic rainfall coupled with record snowfall over portions of the Rocky Mountains in Montana and Wyoming triggered the Missouri and Souris River basins to flood and wreak havoc in many cities throughout North Dakota, South Dakota, Nebraska, Iowa, and Missouri.¹⁴ The waters didn't start to subside until September while causing more than \$2 billion in total damages, according to FEMA.¹⁵

In September 2013, heavy rain and disastrous flooding occurred in Colorado, taking lives, damaging houses and roads, and displacing thousands of people. The total economic cost from the floods is estimated to exceed \$1 billion after accounting for damages to homes, roads, bridges, and other infrastructure.¹⁶

Sacramento officials understand the importance of being prepared and investing in projects to stay resilient. Besides New Orleans, the Sacramento region has the greatest flood risk of any major urban area in the United States.¹⁷ As such, billions of dollars have been spent on levees to protect residents along both sides of the Sacramento and American rivers, as a levee breach could cause deaths and cripple the economy for 1.4 million people in the metro area.¹⁸

However, Sacramento is currently experiencing "weather whiplash" due to the American River's water levels being at a historic low. The severe case of extreme flood and then drought has also occurred elsewhere in the country, particularly in the Midwest and South.¹⁹ Sacramento officials are urging residents and businesses to reduce water usage by as much as 30 percent, while the U.S. Bureau of Reclamation has cut water releases from Folsom Dam into the river to prolong water supply for the Sacramento area.²⁰

Droughts

Threats to water supply sustainability in the coming decades puts many U.S. cities at risk. As the temperature rises, more moisture evaporates from the land and water sources, and combined with widespread drought conditions, cities will be forced to adapt and become resilient. From 2000 through 2012, roughly 30 percent to 70 percent of the U.S. land area experienced conditions that were at least abnormally dry at any given time. In 2012, the United States experienced the driest conditions in more than a decade, and during the latter half of 2012, more than half of the U.S. land area was covered by moderate or greater drought.²¹

Cities in Texas have been dealing with drought conditions and low water reservoirs for the past few years. In Central Texas, the Highland Lakes, crucial reservoirs for Austin, experienced inflows that were the lowest in history, and will likely have to cut off water for agriculture this year if the lake conditions do not improve soon. What's worse, this will be the third year of severe drought in a row.²² When droughts occur, temperatures are often higher than they were in past decades, so the effects of the drought are magnified by the higher evaporation rates.²³

Texas is not alone. The water level in Lake Mead, the primary water supply for Las Vegas, is expected to drop by up to 25 feet over the next year, according to federal officials.²⁴ This could lead to water levels at Lake Mead dropping below one of Las Vegas's two intake valves, which would jeopardize the city's water supply.²⁵ An \$800 million project to construct a third intake is in the works.²⁶

The Las Vegas Valley Water District, one of seven agencies that make up the Southern Nevada Water Authority, has been aiming to curb water use in the Las Vegas metro area and achieve a 199 gallons per capita per day goal by 2035. Since the drought response plan was first developed in 2002, Southern Nevada has reduced its water demand from about 314 gallons per capita per day to about 219 gallons per capita per day as of 2012.²⁷ A \$200 million project to remove residential turf has helped.²⁸ Nevertheless, a \$15 billion pipeline project that would bring water from eastern rural Nevada to Las Vegas is an option that is currently being debated.²⁹

Heat waves

A heat wave is defined as a period of several days to weeks of abnormally hot weather.³⁰ A 2010 study by the National Academy of Sciences reported that the hottest days of each year globally are now hotter since recordkeeping began in 1880.³¹ Indeed, over the past decade in the United States, the number of new record highs recorded each year has been twice the number of new record lows—a signature of a warming climate and a clear example of its impact on extreme weather.³²

According to the Centers for Disease Control and Prevention, 660 people die nationwide from heat waves each year on average, making it the leading cause of weather-related mortality in the country.³³ In 2006, a brutal heat wave that spread throughout most of the United States was responsible for or contributed to the deaths of 140 people in New York City alone.³⁴ What's more, scientists predict heat waves will kill about 10 times more people in the eastern United States in 45 years than they did at the turn of this century.³⁵

Phoenix—the nation's 13th-largest metropolitan area, with 4.3 million people living in a hot desert—knows all too well about the dangers of heat waves. The city already records more days over 100 degrees than any other major U.S. city, and climate models predict Phoenix will get even hotter.³⁶ But these challenges present city officials with the opportunity to explore new strategies to become more resilient to changing conditions.

One policy that is underway is the “Tree and Shade Master Plan”—a plan to cover 25 percent of the city with shade trees by 2030. The city's Parks and Recreation Department hopes to achieve 25 percent tree canopy coverage by 2030.³⁷ This increased coverage will lessen the “heat island” effect, which will also help reduce the amount of energy required to cool the city. And trees in Arizona have a documented benefit-cost ratio of \$2.23—\$2.23 in economic benefits for every \$1 invested—demonstrating the important role this can play within the economy.³⁸

City officials are also encouraging developers to build smarter. Residential buildings can become more energy efficient with dual-paned windows and courtyards that allow the breeze to move through, cooling the building down.³⁹

Tropical storms combined with sea-level rise

Scientific research indicates that extreme weather events such as hurricanes and tropical storms are going to become more intense while lasting longer, ultimately causing more damage to coastal cities.⁴⁰ Scientists point to higher ocean temperatures as the reason behind the stronger storms, since warm ocean temperatures are a storms' source of energy.⁴¹

At the same time, rising sea levels will amplify the destruction that storms cause because of the storm surge.⁴² The surge is the water level rise generated by the storm in addition to the tide—or baseline water level. Sea levels rise because warmer water takes up more room than cold water (thermal expansion). Melting glaciers and polar ice caps contribute to the problem by adding more water into the oceans.⁴³ Some climate scientists predict that the global sea level could rise as much as three feet by the end of this century, while other research points to five feet.⁴⁴

The devastating Superstorm Sandy is an example of what can occur when a coastal storm causes a massive surge exacerbated by the increase in sea level. A study by the U.S. Geological Survey found that the sea level on a stretch from Cape Hatteras, North Carolina to north of Boston is rising four times faster than the global average.⁴⁵ Therefore, with the sea level rising at an alarming rate, the water ended up nine feet above normal at the southern end of Manhattan during the storm.⁴⁶ In total, the storm caused approximately \$65 billion in damages.⁴⁷

Major storms that occur in the Pacific Ocean and hit cities on the West Coast will also be destructive, specifically in the Los Angeles area. A report by the University of Southern California recently found that a storm combined with the rising sea could inflict \$410 million of damage to buildings in Los Angeles.⁴⁸ The city's vital infrastructure is in particular harm's way; the report highlights critical roads, highways, the city's two coastal power plants, and two wastewater treatment plants that will be vulnerable to storms.⁴⁹ Additionally, the Port of Los Angeles, which contributes more than \$63 billion to California's economy and receives 40 percent of all U.S. imports, is also highlighted in the study as a critical coastal infrastructure that could experience damage from storms, unless steps are taken to make it more resilient.

New York City's comprehensive rebuilding and resilience strategy, PlaNYC, identifies actions to rebuild and strengthen communities hit by Superstorm Sandy and to increase infrastructure and building resilience. The city will also work with utilities and regulators to implement smart-grid technologies to enable real-time assessments of system power outages. With public and private partnerships, the city will expand building efficiency and is installing new sewer infrastructure. PlaNYC will cost \$19.5 billion to implement, with roughly half of the funds coming from the federal government.⁵⁰

The cost of helping coastal cities prepare for the impacts of sea-level rise is daunting, but the cost of inaction is far higher. In partnership with a Dutch consulting firm, Fugro Atlantic, Norfolk, Virginia identified more than \$1 billion in potential resilience projects, such as seawalls and the action of elevating homes—more than the city's total annual operating budget.⁵¹ However, the economic impact of sea-level rise and storms on this city is estimated to be as high as \$25 billion in the next century.⁵²

Severe thunderstorms

Severe storms, which are becoming the new normal, are a consequence of warmer air and surface water temperatures. Over the past 30 years, average temperatures for the planet have continued to increase;⁵³ in fact, the first decade of this century was the hottest decade recorded since recordkeeping began in the 1880s.⁵⁴

According to Tom Karl, director of the National Climatic Data Center, “heavy and extreme precipitation events often associated with thunderstorms and convection are increasing and have been linked to human-induced changes in atmospheric composition.”⁵⁵

As for tornadoes, scientists predict that warmer winters and an earlier arrival of spring due to a warming climate could move the tornado season earlier.⁵⁶ But tornado data going back to 1950 does not show an increasing trend in strong tornadoes in recent decades. A warming climate could potentially lead to an increase in tornadoes, but it could also decrease them by a decreasing wind shear.⁵⁷

So while the jury is out on this topic, thunderstorms and tornadoes do occur, and U.S. cities can better prepare themselves and rebuild smarter.

In 2013, tornadoes and severe storms occurred in many states but hit Oklahoma especially hard. A massive, mile-wide “supercell” tornado ravaged Moore, Oklahoma, a suburb of Oklahoma City, destroying homes and businesses and taking the lives of 25 people.⁵⁸ The tornado was on the ground for more than 40 minutes. Cities were without power and counties were declared disaster areas.⁵⁹

A similar extreme weather event occurred in 2007 when a tornado hit Greensburg, Kansas. The tornado killed 13 people and destroyed 95 percent of the town’s structures, causing \$250 million in damages.⁶⁰ Today, however, the town is the world’s leading community in LEED-certified buildings per capita, and renewable energy powers the entire community.⁶¹ Government entities such as USDA Rural Development, FEMA, and the National Renewable Energy Lab, along with corporations providing financial resources, made the resilient rebuilding efforts possible.

An agenda for action

Scientists are warning us that the destruction and damage from extreme weather will worsen in the coming years. It is therefore essential the following agenda be achieved:

- **First, federal, state, and local governments need information to help them plan future infrastructure investments, as well as adopt budgets that realistically reflect the risks posed by these five growing threats.** Yet governments are walking in the dark because there is no national estimate or projection of federal disaster spending, nor the investments in preparedness essential to reduce damages and recovery costs. And the taxpayers who finance this disaster relief have a right to know

too. CAP's recent issue brief, "States of Denial," was the first comprehensive estimate of states' disaster-recovery receipts for FY 2011 and 2012. No such analysis exists for other years, as best we can determine.⁶²

- **Second, federal legislators and officials must understand the cost of protecting people and businesses from future extreme weather events.** There is not a credible, comprehensive assessment of communities' future costs to reduce the damages from floods, tropical storms and sea-level rise, droughts, heat waves, and severe thunderstorms or tornadoes. The price tag for this work will likely add up to hundreds of billions of dollars, but the federal government simply does not know. Federal legislators and officials must understand the cost of protecting people and businesses from future extreme weather events.
- **Third, once a comprehensive assessment of costs is completed, a dedicated revenue source for federal investments in community resilience must be identified.** Another CAP analysis identified only \$22 billion in federal resilience investments from FY 2011–2013, compared to \$138 billion in disaster-recovery funds—\$1 for prevention for every \$6 dedicated to cleanup and restoration.⁶³ What's more, many states and communities lack the funds to adequately protect their residents from extreme weather events. Research prepared for FEMA estimated that every \$1 invested in community resilience reduces disaster damages by \$4.⁶⁴ Resilience investments will save lives and protect businesses, and they will also save taxpayers money by reducing future federal disaster-recovery expenditures.

The federal government must address the knowledge gaps about our expenditures for federal disaster relief and investments in community resiliency, identifying federal revenue sources to increase resiliency investments and protect cities throughout the United States. Without addressing these needs, cities will be left vulnerable to extreme weather damages and the resulting economic hardships.

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Endnotes

- 1 Daniel J. Weiss and Jackie Weidman, "Going to Extremes: The \$188 Billion Price Tag from Climate-Related Extreme Weather," Center for American Progress, February 12, 2013, available at <http://www.americanprogress.org/issues/green/news/2013/02/12/52881/going-to-extremes-the-188-billion-price-tag-from-climate-related-extreme-weather/>.
- 2 Daniel J. Weiss and Jackie Weidman, "Disastrous Spending: Federal Disaster-Relief Expenditures Rise amid More Extreme Weather" (Washington: Center for American Progress, 2013), available at <http://www.americanprogress.org/issues/green/report/2013/04/29/61633/disastrous-spending-federal-disaster-relief-expenditures-rise-amid-more-extreme-weather/>.
- 3 Daniel J. Weiss, Jackie Weidman, and Stephanie Pinkalla, "States of Denial: States with the Most Federal Disaster Aid Sent Climate-Science Deniers to Congress" (Washington: Center for American Progress, 2013), available at <http://www.americanprogress.org/wp-content/uploads/2013/09/StateDisasterSpending-2.pdf>.
- 4 U.N. Intergovernmental Panel on Climate Change, "Climate Change 2013: The Physical Science Basis" (2013), available at http://www.ipcc.ch/report/ar5/wg1/#.UtQUZ_RDuSo.
- 5 Fran Sussman, Cathleen Kelly, and Kate Gordon, "Climate Change: An Unfunded Mandate" (Washington: Center for American Progress, 2013), available at <http://www.americanprogress.org/issues/green/report/2013/10/28/78158/climate-change/>.
- 6 Multihazard Mitigation Council, "Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities" (2005), available at www.nibs.org/resource/resmgr/MMC/hms_vol2_ch1-7.pdf.
- 7 Daniel J. Weiss and Jackie Weidman, "Pound Foolish: Federal Community-Resiliency Investments Swamped by Disaster Damages" (Washington: Center for American Progress, 2013), available at <http://www.americanprogress.org/wp-content/uploads/2013/06/FedResilienceSpending.pdf>.
- 8 Lisa Lambert, "More Americans move to cities in past decade-Census," Reuters, March 26, 2012, available at <http://www.reuters.com/article/2012/03/26/usa-cities-population-idUSL2E8EQ5AJ20120326>.
- 9 Adam Voiland, "In a Warming World, Storms May Be Fewer but Stronger," NASA Earth Observatory, March 5, 2013, available at <http://earthobservatory.nasa.gov/Features/ClimateStorms/page2.php>.
- 10 AECOM, "The Impact of Climate Change and Population Growth on the National Flood Insurance Program Through 2100" (2013), available at http://www.aecom.com/deployedfiles/Internet/News/Sustainability/FEMA%20Climate%20Change%20Report/Climate_Change_Report_AECOM_2013-06-11.pdf.
- 11 U.S. Environmental Protection Agency, "Climate Impacts On Human Health," available at <http://www.epa.gov/climatechange/impacts-adaptation/health.html> (last accessed January 2014).
- 12 Dr. Jeff Masters, comment on "Flooding Death Toll in Southeast U.S. floods rises to 24: oil slick moving little," Dr. Jeff Masters' WunderBlog, comment posted May 4, 2010, available at <http://www.wunderground.com/blog/JeffMasters/comment.html?entrynum=1474>.
- 13 National Oceanic and Atmospheric Administration, "Record Floods of Greater Nashville: Including Flooding in Middle Tennessee and Western Kentucky, May 1-4, 2010" (2011), available at http://www.nws.noaa.gov/os/assessments/pdfs/Tenn_Flooding.pdf.
- 14 National Oceanic and Atmospheric Administration, "The Missouri/Souris River Floods of May - August 2011" (2012), available at http://www.nws.noaa.gov/os/assessments/pdfs/Missouri_floods11.pdf.
- 15 Ibid.
- 16 Bruce Kennedy, "Colorado Flood Damage Could Exceed \$1 Billion" MSN Money, September 16, 2013, available at <http://money.msn.com/now/post-colorado-flood-damage-could-exceed-dollar1-billion>.
- 17 Greenwise Joint Venture, "Mayor Kevin Johnson Selected for President Obama's Task Force on Climate Preparedness and Resilience," Press release, November 1, 2013, available at <http://greenwisejv.org/mayor-kevin-johnson-selected-for-president-obamas-task-force-on-climate-preparedness-and-resilience/>.
- 18 Matt Weiser and Phillip Reese, "What if a superstorm strikes Sacramento? Flooding danger puts the capital at risk of a disaster worse than Sandy," *The Sacramento Bee*, November 18, 2012, available at <http://www.sacbee.com/2012/11/18/4994108/what-if-a-superstorm-strikes-sacramento.html>.
- 19 Jeff Masters, "Weather Whiplash Strikes Again: Extreme Drought To Flood In Georgia," Climate Progress, May 6, 2013, available at <http://thinkprogress.org/climate/2013/05/06/1969531/weather-whiplash-strikes-again-extreme-drought-to-flood-in-georgia/>.
- 20 Richard Chang, "American River flows at lowest level in 21 years," *The Sacramento Bee*, January 12, 2014, available at http://www.sacbee.com/2014/01/12/6064471/american-river-flows-at-lowest.html#mi_rss=Latest%20News.
- 21 U.S. Environmental Protection Agency, "Climate Change Indicators in the United States: Drought," available at <http://www.epa.gov/climatechange/science/indicators/weather-climate/drought.html> (last accessed January 2014).
- 22 Lower Colorado River Authority, "LCRA asks state for permission to cut off agricultural water in 2014 if lake conditions don't improve significantly," available at <http://www.lcra.org/water/drought/> (last accessed January 2014).
- 23 Stephan Lacey, "Warming-Enhanced Texas Drought Is Once In 500 or 1,000 Years ... Basically Off the Charts," Says Climatologist," Climate Progress, November 30, 2011, available at <http://thinkprogress.org/climate/2011/11/30/378412/texas-drought-historic-off-the-charts-says-state039s-climatologist/>.
- 24 Conor Shine, "More Water Being Choked Off From Ground Stricken Lake Mead," *Las Vegas Sun*, August 16, 2013, available at <http://www.lasvegassun.com/news/2013/sep/16/more-water-being-choked-drought-stricken-lake-mead/>.
- 25 Terrell Johnson, "Dwindling Colorado River Forces First Ever Cuts in Lake Powell Water Releases," *The Weather Channel*, August 20, 2013, available at <http://www.weather.com/news/science/environment/drought-lake-powell-lake-mead-climate-change-20130818>.
- 26 Conor Shine, "Emergency Lake Mead Intake Project Gets Green Light," *Las Vegas Sun*, September 26, 2013, available at <http://www.lasvegassun.com/news/2013/sep/26/emergency-lake-mead-intake-project-gets-green-light/>.
- 27 Las Vegas Valley Water District, "Conservation Measures," available at https://www.lvwwd.com/conservation/drought_measures.html (last accessed January 2014).
- 28 Joanna M. Foster, "Sin City Runs Dry: Drought in the Land of Fountains," Climate Progress, August 16, 2013, available at <http://thinkprogress.org/climate/2013/08/16/2474451/sin-city-water/>.
- 29 Ibid.
- 30 National Oceanic and Atmospheric Administration, "National Weather Service: Glossary," available at <http://w1.weather.gov/glossary/index.php?letter=h> (last accessed January 2014).

- 31 National Academy of Sciences "Advancing the Science of Climate Change" (2010), available at <http://nas-sites.org/americasclimatechoices/sample-page/panel-reports/87-2/>.
- 32 Claudia Tebaldi, Gerald A. Meehl, and Julie M. Arblaster, "Contributions of natural and anthropogenic forcing to changes in temperature extremes over the U.S." (Boulder, CO: National Center for Atmospheric Research, 2013), available at http://www.agci.org/dB/PDFs/07S1_GMeehl%20climate%20forcing.pdf.
- 33 Centers for Disease Control and Prevention, "Heat Waves," December 14, 2009, available at <http://www.cdc.gov/climateandhealth/effects/heat.htm>.
- 34 Richard Pérez Peña, "Heat Wave Was a Factor in 140 Deaths," *The New York Times*, November 16, 2013, available at http://www.nytimes.com/2006/11/16/nyregion/16heat.html?_r=1&.
- 35 Jianyong Wu and others, "Estimation and Uncertainty Analysis of Impacts and Future Heat Waves on Mortality in the Eastern United States," *Environmental Health Perspectives* 122 (1) (2014), available at <http://ehp.niehs.nih.gov/wp-content/uploads/122/1/ehp.1306670.pdf>.
- 36 Peter O'Dowd, "Scorching Phoenix Plans for and Even Hotter Future," NPR, August 14, 2012, available at <http://www.npr.org/2012/08/14/158776471/scorching-phoenix-plans-for-an-even-hotter-future>.
- 37 City of Phoenix, "Tree and Shade Master Plan" (2010), available at http://phoenix.gov/webcms/groups/internet/@inter/@dept/@parks/documents/web_content/071957.pdf.
- 38 Ibid.
- 39 O'Dowd, "Scorching Phoenix Plans for and Even Hotter Future."
- 40 U.S. Environmental Protection Agency, "Climate Change Indicators in the United States," available at <http://www.epa.gov/climate/climatechange/science/indicators/weather-climate/index.html> (last accessed January 2014).
- 41 Ibid.
- 42 Joe Romm, "NOAA: Warming Driven Sea Level Rise To Make Sandy-Type Storm Surges the Norm on the East Coast," *Climate Progress*, September 5, 2013, available at <http://thinkprogress.org/climate/2013/09/05/2578431/noaa-sea-level-rise-sandy-storm-surge-norm-east-coast/>.
- 43 Ibid.
- 44 U.N. Intergovernmental Panel on Climate Change, "Climate Change 2013"; Martin Vermeer, Mahé Perrette, and Stefan Rahmstorf, "Testing the robustness of semi-empirical sea level projections," *Climate Dynamics* 39 (3-4) (2012), available at <http://www.ask-force.org/web/Global-Warming/Rahmstorf-Testing-Robustness-Semi-Empirical-Projections-2012.pdf>.
- 45 U.S. Geological Survey, "Sea Level Rise Accelerating in U.S. Atlantic Coast," Press release, June 24, 2012, available at http://www.usgs.gov/newsroom/article.asp?ID=3256&from=rss_home.
- 46 Grace Muller, "The Stats Are In: Superstorm Sandy Totals," *AccuWeather.com*, November 1, 2012, available at <http://www.accuweather.com/en/weather-news/sandy-statistics-rain-wind-snow/876665>.
- 47 National Oceanic and Atmospheric Administration, "Billion Dollar Weather/Climate Disasters," available at <http://www.ncdc.noaa.gov/billions/> (last accessed January 2014).
- 48 Phyllis Grifman and others, "Sea Level Rise Vulnerability Study for the City of Los Angeles" (Los Angeles: University of Southern California Sea Grant Program, 2013), available at http://www.usc.edu/org/seagrant/research/SeaLevel-Rise_docs/hires_pdfs/City%20of%20LA%20SLR%20Vulnerability%20Study%20FINAL%20Summary%20Report%20Online%20Hyperlinks.pdf.
- 49 Ibid.
- 50 Arpita Bhattacharyya and Kathleen Kelly, "How Climate Resilience Boosts Metro Areas and the Economy" (Washington: Center for American Progress, 2013), available at <http://www.americanprogress.org/issues/green/report/2013/10/22/77660/storm-ready-cities/>.
- 51 Kiley Kroh, "A Slow-Motion Disaster: One Community's Fight To Save Itself From Climate Change," *Climate Progress*, September 25, 2013, available at <http://thinkprogress.org/climate/2013/09/25/2666791/slow-moving-disaster/>.
- 52 Ibid.
- 53 Ezra Klein, "You can't deny global warming after seeing this graph," *Wonkblog*, July 9, 2013, available at <http://www.washingtonpost.com/blogs/wonkblog/wp/2013/07/09/you-cant-deny-global-warming-after-seeing-this-graph/>.
- 54 Union of Concerned Scientists, "Is Global Warming Linked to Extreme Weather?," June 17, 2011, available at http://www.ucsusa.org/global_warming/science_and_impacts/impacts/global-warming-rain-snow-tornadoes.html.
- 55 Joe Romm, "Tornadoes, Extreme Weather, and Climate Change Revisited," *Climate Progress*, May 21, 2013, available at <http://thinkprogress.org/climate/2013/05/21/2040221/tornadoes-extreme-weather-and-climate-change-revisited/>.
- 56 Brad Johnson, "Poisoned Weather: Global Warming Helped Fuel Killer Tornadoes," *Climate Progress*, March 8, 2012, available at <http://thinkprogress.org/climate/2012/03/08/439053/poisoned-weather-global-warming-helped-fuel-killer-tornadoes/>.
- 57 Romm, "Tornadoes, Extreme Weather, and Climate Change Revisited."
- 58 "More Okla. Tornado Death Toll Rises" *The Weather Channel*, August 5 2013, available at <http://www.weather.com/news/moore-okla-tornado-death-toll-rises-20130805>
- 59 Romm, "Tornadoes, Extreme Weather, and Climate Change Revisited."
- 60 KWCH.com, "Greensburg Marks 6 Years After Devastating Tornado," May 4 2013, available at http://articles.kwch.com/2013-05-04/tornado_39031979.
- 61 "The City of Greensburg, Kansas," available at <http://www.greensburgks.org/> (last accessed January 2014).
- 62 Weiss, Weidman, and Pinkalla, "States of Denial."
- 63 Weiss and Weidman, "Pound Foolish."
- 64 Multihazard Mitigation Council, "Natural Hazard Mitigation Saves."