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Preparing for the Inevitable: US Climate Change Preparation

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**Preparing for the Inevitable:
US Climate Change Preparation**

David Ernenwein

Introduction

The global climate is changing. Data on sea level, global temperature, snow cover and presence of greenhouse gases in the atmosphere make it clear that since the Industrial Revolution the world has been getting warmer. Sea levels are rising, average temperatures are increasing and snow and ice cover have diminished.¹ Debate has long raged over whether human activity has affected this trend or if it is merely part of natural climate cycles. This debate is meaningless because regardless of cause, Earth's climate is changing and it will affect human civilization. The question of cause is therefore irrelevant and politicians should instead be focused on how to react to this new reality. The modern world is not isolated from nature and depends on rainfall and weather patterns to survive just as certainly as did its predecessors. The difference now is that modern humans can predict and respond to these impacts in ways never before possible, allowing well prepared societies to get ahead of the climate and rapidly adapt.

The United States just endured the hottest year since record keeping began in 1895. Heat waves scorched the typically mild eastern states while western and southern states suffered crop killing droughts. It also suffered through a storm season that caused more than \$90 billion worth

¹ Intergovernmental Panel on Climate Change ("IPCC"). (2007). *Climate Change 2007: Synthesis Report Summary for Policymaker*. (pp. 3-4). Geneva: IPCC. Retrieved from http://ipcc.ch/publications_and_data/ar4/syr/en/spm.html.

of damage.² It is easy to simply call it a bad year and rebuild, but 2012 was not an aberration. As the climate continues to change, years like 2012 will become commonplace. It is dangerous and irresponsible to ignore this trend, proven by the climate disasters like Superstorm Sandy and Hurricane Katrina. Fortunately, there are relatively simple precautions and investments that can prevent climate change from becoming a climate disaster. It just takes the foresight and political will to implement new policies.

This paper will begin by outlining the most widely accepted climate change scenario the United States is facing based on the Fourth Assessment Report by the Intergovernmental Panel on Climate Change (IPCC). Then the climate threats that the US is facing will be demonstrated by the 2012 storm season, specifically Superstorm Sandy and the Duluth flooding. In every case, failures in planning and/or implementation of a disaster prevention policy were directly responsible for the damage. In absence of good, farsighted policy difficult circumstances became disasters. This paper will argue that climate related natural disasters do not need to happen and that planning and foresight can mitigate or eliminate the damage caused by a changing climate.

The Intergovernmental Panel on Climate Change

The IPCC is the scientific arm of the UN Framework Convention on Climate Change and is tasked with monitoring scientific findings on climate change and reporting on developments in the study and understanding of climate change. Rather than conduct any independent research, the IPCC: "...reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change."³ Therefore the IPCC report are a consensus view of the scientific data on the cause and impacts of climate

² Smith, M. (2013, January 9). *NOAA: 2012 broke U.S. heat records*. Retrieved January 9, 2013, from CNN.com:<http://www.cnn.com/2013/01/08/us/extreme-weather/index.html?iref=allsearch>.

³ IPCC. (2007). *Organization*. Retrieved November 20, 2012, from <http://www.ipcc.ch/organization/organization.htm>.

change from the entire scientific community instead of a single body. This serves to eliminate bias and policy driven analysis in favor of scientific accuracy. The belief is that by aggregating the total scientific research on climate change, the IPCC reports balance both ends of the scientific and political spectrum and produce a scenario that is reasonable to all scientists. The IPCC is therefore considered the ultimate authority on climate change and most government scientists base their projections on IPCC data.⁴ Considering that these scientists are providing the initial data, it makes sense to accept the IPCC analysis. This gives significant legitimacy to their evaluations and therefore will be the scientific basis for this paper.

It is important to note that the scenarios outlined by the IPCC are only considered accurate in the short run to 2050 and the long run until the end of the 21st century.⁵ The IPCC acknowledges that this is a relatively short timeframe, however it is also the most accurate forecasting horizon and the most practical policy making timeframe. Both science and politics could dramatically change over the next century making speculation beyond the IPCC projections misleading and inaccurate. Therefore, it is better to focus on making the best possible policy solutions for the immediate future rather than worrying about their impact on the future of climate change.

The IPCC Report

According to the 2007 Fourth Assessment Synthesis Report of the IPCC, the impacts of climate change will be felt globally and unequally. The average global temperature is expected to rise by 0.2^o C per decade based observed trends. By the end of the 21st century the average

⁴ NOAA. (2012, August 21). *Global Warming Frequently Asked Questions: Introduction*. Retrieved December 14, 2012, from <http://www.ncdc.noaa.gov/cmb-faq/globalwarming.html>.

⁵ Intergovernmental Panel on Climate Change. (2007). *Synthesis Report*. Retrieved November 17, 2012, from Intergovernmental Panel on Climate Change Fourth Assessment Report: http://ipcc.ch/publications_and_data/ar4/syr/en/main.html. p. 44.

global temperature will have increased between 1.8-4.0 ° C. Average ocean surface temperature will increase between 0.6 ° and 4.0 ° C accompanied by an average sea level rise between 0.18-0.59 meters, with potential to rise dramatically depending upon the rate of glacial and icecap melting and could potentially be as great as 7 meters.⁶ These numbers by themselves may not seem especially high, but it is important to remember that this is an average over the entire globe. A 2 ° C rise in Phoenix will make very little difference to an already scorched climate but it could have monumental effects in Anchorage. Satellite imaging recently showed that sea levels are rising unequally globally. Some areas are experiencing seas several inches below normal while others have rising a foot or more.⁷ Not all areas are experiencing the same effects, but all parts of the globe are being affected.

The northern hemisphere is projected to warm to a greater degree than along the equator or southern hemisphere. By the end of the 21st Century latitudes above 10 ° N will warm 3.5-7 ° C, those between 10 ° N and 10 ° S will warm 2-6 ° C, and below 10 ° S will see 0.5-5.5 ° C increase in average yearly temperature.⁸ Additionally precipitation patterns are expected to change with an average increase of up to 20% from 1980 to 1999 levels for latitudes above 45 ° N, between 10 ° N and 10 ° S and below 50 ° S. Those latitudes in between, especially around the Mediterranean Sea and Sahara Desert will experience a similar decrease in yearly precipitation.⁹

Water availability and river levels will similarly change due to fluctuations in regional rainfall and runoff patterns. The Bay of Bengal region, northern China, eastern Africa and the Arctic region will see increases of 20-40% in water availability, while the Mediterranean, South

⁶ IPCC, *Synthesis Report*, p. 45.

⁷ Amos, J. (2012, September 24). *Satellites trace sea level change*. Retrieved 13 2012, October , from <http://www.bbc.co.uk/news/science-environment-19702450>.

⁸ IPCC, *Synthesis Report*, P. 46.

⁹ Ibid, p. 47.

Africa, the southwest United States and the Persian Gulf will see the largest decreases of 15-40%.¹⁰ The Arctic ice sheet is anticipated to contract and may disappear in the coming century. Extreme weather incidents will also increase in intensity, though ambiguity exists on their change in frequency.¹¹ There exists great uncertainty about what exactly causes storms such as hurricanes to form. Climate scientists know that hurricanes only form when the water temperature is at least 26.5 ° C or 79.7 ° F under conditions of high humidity but the process and combination of events that lead to the convection which forms hurricanes are unknown.¹² Hurricanes make landfall more frequently than in previous centuries, but whether that is because of increased formation or simply better reporting is unknown. It was not until 1965 that satellite imaging allowed accurate detection of hurricanes. Prior to that, forecasters had to rely either on ships sighting storms or storms making landfall. As a result scientists do not know how many hurricanes should form in an “average” year.¹³ However, given that average air temperature and ocean surface temperature are increasing and both have been linked to hurricane formation, it is probable that the future holds more hurricanes rather than fewer.

Climate Change in the United States

The Pacific Northwest and the Northeast can expect increased rainfall while the Southwest will see increased drought and heat waves.¹⁴ The winter snowpack will decrease, leading to winter flooding throughout the Mountain West.¹⁵ Extreme precipitation will become more common, leading to increased flooding. At the same time, tropical storm activity will

¹⁰ Ibid, p. 49.

¹¹ IPCC, *Synthesis Report*, p. 46.

¹² Thomas R. Knutson, *Global Warming and Hurricanes*, Geophysical Fluid Dynamics Laboratory/NOAA. Nov. 28,

²⁰ <http://www.gfdl.noaa.gov/global-warming-and-hurricanes> (accessed Dec. 3, 2012).

¹³ Knutson, 2012

¹⁴ IPCC, *Synthesis Report*, 47.

¹⁵ Ibid, 52.

increase.¹⁶ The effect on the Midwest and South is somewhat ambiguous because while their average temperature will certainly rise, their weather patterns are variable enough now that projection is impractical. However, what is certain is that whatever weather patterns develop will be more extreme than current norms with infrequent heavy precipitation replacing smaller more frequent storms across the United States.¹⁷ Therefore the US faces a twin threat of heavy storm damage from precipitation events and tropical storms. This threat will get worse over the coming century. Therefore, planning and mitigation efforts need to be enacted sooner rather than later.

Scientific Ambiguity and Policy Inaction

One of the traditional objections to action on climate change the cause and severity of climate change are too ambiguous to take action. To some extent this is true. Preparing for the wrong problem is as dangerous as not preparing at all. The IPCC¹⁸ and the US National Oceanic and Atmospheric Administration¹⁹ (NOAA) acknowledge that the atmosphere is extremely complex and they cannot be certain as to the exact causes and results of atmospheric changes. Despite this uncertainty, the data from which both organizations are working is clear and unambiguous and points to a changing atmosphere and climate. The NOAA and its partner organizations have been monitoring atmospheric composition for decades and have detected measurable and dramatic increases in carbon dioxide (CO_2) since monitoring began.²⁰ The National Weather Service records show that since its inception in 1870 average yearly

¹⁶ Ibid, 53.

¹⁷ IPCC, *Synthesis Report*, p. 53,55.

¹⁸ IPCC, *Synthesis Report*, p. 27.

¹⁹ NOAA, 2012

²⁰ Trans, P. (2012, December). *Trends in Atmospheric Carbon Dioxide*. Retrieved December 3, 2012, from Earth Systems Research Laboratory NOAA: <http://www.esrl.noaa.gov/gmd/ccgg/trends/>

temperature has increased by 0.6 ° C and the trend is accelerating.²¹ Climate scientists also know that atmospheric carbon levels and global temperatures fluctuate as part of natural climate cycles, and that it appears that Earth entered a warming trend prior to the industrial revolution.²²

Therefore ambiguity should cease to be an excuse not to act on climate change. Scientists may neither be certain of how climate change is happening nor of how severe it is going to be, be they *are* certain that it *is* happening. Therefore governments need to prepare to deal with climate change.

Storm Damage Comparison

2012 was one of the most destructive for storm damage in US history. The popular belief is that 2005 was the worst recorded season, which is true of the hurricane season, but it may not be true of the entire storm spectrum. True, 2005 was the most active hurricane season to date and caused more than \$120 billion in damage,²³ but in terms of total storm activity and damage 2012 was at least as bad for the US. This is because in addition to hurricane damage, the most spectacular of which was Superstorm Sandy in October 2012, there was also extensive damage caused by non-tropical storms over the course of the year. What is more significant however is that the storm damage delivered by the 2005 hurricane season came because of planning failures rather than the lack of planning that was at the heart of the 2012 damage. As discussed below, Midwestern flood damage from a devastating summer 2012 rain system and the destruction seen in the Mid-Atlantic from Superstorm Sandy were caused by a lack of preparation for storms of the magnitude they experienced. New Orleans was devastated by a failure to adequately improve

²¹ Kennedy, C. (2009, October 21). *Carbon Dioxide: Earth's Hottest Topic is Just Warming Up*. Retrieved December 2, 2012, from ClimateWatch Magazine: <http://www.climatewatch.noaa.gov/article/2009/carbon-dioxide-earths-hottest-topic>.

²² Ibid, from charts and discussions.

²³ NOAA. (2006, April 13). *"NOAA Reviews Record-Setting 2005 Atlantic Hurricane Season"*. Retrieved January 3, 2013, from NOAA Magazine: <http://www.noaaneews.noaa.gov/stories2005/s2540.htm>.

and maintain defenses that should have worked during Hurricane Katrina. The failures of policymakers to act on known problems compounded by improper management of flood prevention systems were the root of the Katrina disaster. In contrast the 2012 disasters were the result of policymakers making no preparations for the disasters that affected them despite the known risks. As these events become more commonplace, such lapses will be unacceptable.

Hurricane Katrina: Flawed Defenses and Poor Management

On August 29, 2005 Hurricane Katrina made landfall in Louisiana as a Category 4 hurricane²⁴ with wind speeds in excess of 175 mph.²⁵ Powerful winds coupled with heavy rain drove powerful storm surges which caused widespread damage across the Gulf Coast. A storm surge of between 10 and 16 feet breached the city's levees, meant to protect against storm surges, and flooded 80% of the city.²⁶ The levee failure was significant and widespread. Between wind and flood damage it is estimated that the Gulf suffered at \$108 billion in damage directly from Katrina, of which around \$70 billion was centered on New Orleans.²⁷ In addition to the storm damage, 1,833 total people died with 1,577 dead in the New Orleans area.²⁸ Tens of thousands were left homeless and millions were without power for weeks following the disaster.²⁹ It was a nationally traumatic event.

However, Katrina did not have to be as bad as it was. While there was heavy storm damage across the storm's path, damage was greatest in New Orleans where the levees broke. Had that not happened, Katrina would be remembered as a powerful and destructive storm but

²⁴ Knabb, R. D., Rhome, J. R., & Brown, D. P. (2005, December 20). *Tropical Cyclone Report: Hurricane Katrina: 23–30 August 2005*. Retrieved October 23, 2012, from National Hurricane Center: http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf, p. 7.

²⁵ Ibid, p. 17 measured via conversion from knots. 1 knot (kt) = 1.15077945 miles per hour (mph)

²⁶ Ibid, p. 9.

²⁷ Ibid, p. 13.

²⁸ Ibid, p. 11.

²⁹ Ibid, p. 12.

not an apocalyptic monster. Consider what happened in Mississippi: Towns were completely annihilated and many beachfront communities were swept into the ocean by the storm. Further inland the rain and wind caused extensive damage, leaving many towns completely cutoff from the outside and without supplies.³⁰ The storm would cause over 200 deaths in Mississippi, most of which was attributable to the storm surge.³¹ Damage from the storm's rain and wind was very high, but it was not as high as the storm surge. Alabama, where the storm surge was not as severe suffered significantly less damage. Therefore it is reasonable to assume that had the levees held as designed, then New Orleans would have been spared.

The levees failed for a number of reasons, but it took a precise combination of missteps coupled with bad luck to produce the disaster. Many of the in-city levee breaches are attributable to being overtopped by the storm surge, but many others failed before being overtopped. In contrast, many of the outer walls were not breached at all.³²

Investigations after the disaster showed that the levee system suffered from design flaws aggravated by poor maintenance and neglect. The levees were not adequate for the storm and the pumping stations that may have prevented breaching were not running.³³ Overtopping is the term for water sloshing over the top of a seawall or levy. This can erode and fatally weaken the levy. Overtopping is expected in a large storm, but the New Orleans levees were not protected from this which led to the breaches.³⁴ Most levies are armored and hardened to resist overtopping but the New Orleans levies, especially the inland canals, were not, a problem of which the city was

³⁰ *Mississippi Coast Areas Wiped Out*. (2005, September 1). Retrieved November 24, 2012, from CBS News: http://www.cbsnews.com/2100-500487_162-810916.html?pageNum=2

³¹ Knabb, Rhome and Brown 2005 p. 11.

³² *Ibid*, p. 9.

³³ Andersen, C. F., & et al. (2009, June 24). *The New Orleans Hurricane Protection System: What Went Wrong and Why*. Retrieved November 24, 2012, from American Society of Civil Engineers Hurricane Katrina External Review Panel.: <http://web.archive.org/web/20080624204644/http://www.asce.org/files/pdf/ERPreport.pdf> p.66

³⁴ *Ibid*, p.vi.

aware.³⁵ There were failures in both the design and construction of the entire defense scheme for New Orleans, which the Army Corp of Engineers who built the levees admitted.³⁶ The 17th Street Canal was constructed on soil that was unsuitable and there were questions of its strength being overestimated prior to Katrina.³⁷ The walls used for most of the city's internal floodwalls were not strong enough and were not designed with a storm of Katrina's strength in mind. The majority were earthen walls that were far weaker than other types due to development up to the levee walls.³⁸ While Katrina's power was unexpected, levees are normally designed to withstand forces well outside their stated tolerances as a contingency plan for a storm as strong as Katrina.³⁹ The New Orleans levees did not live up to their intended strength.

Despite this, had the city's pumping stations been in operation, the design flaws might not have mattered. Had the pumps kept the water levels low enough then many of the breaches would not have occurred. However, failures in station placement and design left most of the pump stations inoperable and inaccessible during and after the storm when the automatic systems failed. They were either placed directly in the path of flood waters, leading to their demise when the levies broke, or were too elevated above the flood to actually fight the flood.⁴⁰ Those few stations that were working in the flood zones were designed to deal with storm runoff and could make no significant impact on the floodwaters. The system was not capable of dealing with the disaster.⁴¹ Ultimately New Orleans was doomed because design flaws in its hurricane defense

³⁵ Ibid, p. 66.

³⁶ Walsh, B. (2006, April 6). *Corps chief admits to 'design failure'*. Retrieved October 25, 2012, from Times Picayune:<http://www.nola.com/news/t-p/frontpage/index.ssf?/base/news-5/1144306231230500.xml>

³⁷ (Andersen & et al, 2009), p. 47-48.

³⁸ Ibid, p. 20.

³⁹ Ibid, p. 19-21.

⁴⁰ Ibid, p. 32.

⁴¹ Ibid, p. 59.

and failure to address these flaws insured that when the storm broke through the outer defenses disaster was the only option.

These flaws were known to policymakers and engineers, but were never acted upon.⁴² The defenses were considered an afterthought at most and were never improved or redesigned as evidence emerged about the changing risk to the city.⁴³ The Lake Pontchartrain defenses were designed to withstand 100mph winds, but the National Weather Service's standard hurricane parameters for the New Orleans coast predicted average wind speeds of 101-110mph.⁴⁴ The defenses were never fixed, even as the NWS predicted increased hurricane strength in 1979.⁴⁵ Officials had also been warned about increased sea levels threatening the existing defenses. Again, they did nothing.⁴⁶ If at any point a policymaker had acted on the warnings then the flaws could have been corrected and disaster averted. This was a policy failure, not a natural disaster.

Hurricane Katrina was a powerful and devastatingly destructive storm. What made it a city killer was poorly planned city defenses and an inadequate maintenance budget and a lack of improvements and upgrades to the defenses.⁴⁷ This will contrast to the damage from Superstorm Sandy which resulted from a lack of appreciable defenses.

Superstorm Sandy: Failure to Plan is Planning to Fail

Superstorm Sandy came ashore near Atlantic City, New Jersey on October 29, 2012 with 90mph wind speeds.⁴⁸ Previously having hit Cuba the storm turned north into the Atlantic where it was expected to dissipate and disappear. Once a hurricane makes landfall it typically breaks up

⁴² (Andersen & et al, 2009), p. 61-63.

⁴³ Ibid, p. 65-67.

⁴⁴ Ibid, p. 65.

⁴⁵ Ibid, p. 66.

⁴⁶ (Andersen & et al, 2009), p. 67-68.

⁴⁷ Ibid, p. 70-71.

⁴⁸ Brown, D. (2012, October 30). *Hurricane Sandy Discussion Number 31 (Report)*. Retrieved January 5, 2013, from NationalHurricane Center: <http://www.nhc.noaa.gov/archive/2012/a118/a1182012.discus.031.shtml?>

and becomes a heavy rainstorm instead of anything destructive. The convection currents that define hurricanes cannot be sustained over land, and the winds generated by this convection cause the majority of hurricane damage. Once convection is disrupted it is difficult to restart, and since the conditions for hurricane strengthening are not often found in the Atlantic above Florida⁴⁹ and so Sandy was written off by the US. However Sandy absorbed an Atlantic low pressure system and strengthened back into a hurricane⁵⁰, which earned it the media dub of Superstorm Sandy. It then turned back towards the US where it caused heavy damage in New York and New Jersey, with the associated effects of the Atlantic storm it absorbed being felt in New England, Maryland and Pennsylvania. New Jersey was hardest hit, with damage estimated at \$29.4 billion where tens of thousands of homes were damaged.⁵¹ New York City suffered heavy flooding damage from the storm surge⁵² which shut the Port of New York down for several days following Sandy.⁵³ Total damage from the storm is estimated to approach \$80 billion.⁵⁴ If the economic loss caused by the closure of the nation's largest port and the New York Stock Exchange as well as the lost productivity from the shutdown of the world's financial hub, the total loss may reach into the hundreds of billions.

⁴⁹ Knutson, 2012

⁵⁰ Pasch, R., & Cangialosi., J. (2012, October 29). *Hurricane Sandy Discussion Number 28 (Report)*. Retrieved January 5, 2013, from National Hurricane Center: <http://www.nhc.noaa.gov/archive/2012/al18/al182012.discus.028.shtml?>

⁵¹ Talanova, J., & Iaboni., R. (2012, November 24). *NJ Governor Puts Damage at \$29.4 Billion*. Retrieved November 25, 2012, from CNN.com: <http://www.cnn.com/2012/11/23/us/new-york-sandy-recovery/index.html?iref=allsearch>

⁵² Reuters. (2012, November 1). *Eqecat sees Sandy insured losses up to \$20 billion in U.S.* Retrieved November 3, 2012, from Reuters: <http://www.reuters.com/article/2012/11/01/us-storm-sandy-losses-idUSBRE8A00V62012110>

⁵³ *Hurricane Sandy Update – Port of New York and New Jersey remains closed.* (2012, November 2). Retrieved November 3, 2012, from <http://www.afm.ltd.uk/hurricane-sandy-update-port-of-new-york-and-new-jersey-remains-closed/>

⁵⁴ Smith, M. (2013, January 29). *A Month of Outrage Later, Senate Passes Sandy Relief*. Retrieved February 20, 2013, from CNN.com: <http://www.cnn.com/2013/01/28/politics/senate-sandy/index.html?iref=allsearch>

The immediate impact of Superstorm Sandy is not as dramatic as Hurricane Katrina; no cities were flooded or thousands left stranded for news crews to report on, but it is at least as devastating because the damage in New Jersey was all property destruction. New York and neighboring states also suffered property damage from flooding and some houses were destroyed by the wind, but it did not compare to the complete destruction seen in New Jersey where tens of thousands were left homeless.⁵⁵ The New York Metro may have flooded, the dramatic security camera footage of which made excellent news on all the networks, but once the waters receded it was relatively easy to rebuild. However, the damage in New York City did not need to happen in the first place. The problem in New York was the storm surge, which was 12 feet in some areas.⁵⁶ The city lacked any defenses other than the coastal embankments, which directly led to the damage. The same is true in New Jersey. Had storm defenses like those in New Orleans been in place, the damage from Sandy would have been minimal.⁵⁷

Furthermore, much of the New Jersey damage was the result of a flaw in the building code. Most states and municipalities in the US use a variation of the International Building Code, which creates standardized requirements for construction companies. Many states and cities use this code as the default and add their own regulations on top of the standardized codes. This allows states and cities with specialized needs to ensure that builders are not overly inconvenienced, since most politicians want to encourage growth in their jurisdictions. The International Code has hurricane regulations, but they are rather vague and are more like suggestions than actual regulations. The Florida basic code is very specific about making

⁵⁵ Talanova & Iaboni, 2012

⁵⁶ *Superstorm Sandy blamed for at least 11 U.S. deaths as it slams East Coast.* (2012, October 29). Retrieved November 2, 2012, from <http://news.blogs.cnn.com/2012/10/29/hurricane-sandy-strengthens-to-85-mp/>

⁵⁷ Burke, S. (2012, November 2). *Sandy Destruction Didn't have to Happen.* Retrieved November 4, 2012, from <http://amanpour.blogs.cnn.com/2012/11/02/urban-planner-on-sandy-rebuilding-to-prevent-destruction/?iref=allsearch>

buildings strong enough to survive hurricanes.⁵⁸ It specifies that builders use certain bracing methods and materials that are specifically designed to resist hurricanes. There is even an appendix that deals solely with hurricane preparation.⁵⁹ New Jersey's code mentions hurricanes and the IBC rules regarding building in at risk zones, but does not go into detail.⁶⁰ Had New Jersey's codes been up to the standards of Florida's the property destruction would have been minimized. Florida is often hit by hurricanes but never suffers damage on the scale that New Jersey did from just one storm. New Jersey was in a hurricane zone, hurricanes have hit the region before, and but no precautions were taken. This lesson is not lost on either New Jersey governor Chris Christie or New York governor Michael Bloomberg, who has pledged to rebuild with adequate defenses and preventative measures in place.⁶¹ Whether or not this pledge will/can be followed through on has yet to be seen.

Duluth Flooding

The summer of 2012 was a difficult time for many Americans. While the Northeast suffered under a massive heat wave, Duluth, Minnesota and surrounding areas suffered some of the worst flooding in their history.⁶² Beginning June 19th and lasting until the 20th torrential downpours flooded a large area around Duluth. The floodwaters overwhelmed riverbanks and the regional drainage systems could not cope. Bridges and roads were washed away and

⁵⁸ *Bulk US Building Codes*. (2008, August 29). Retrieved January 8, 2013, from "The Florida Building Code." <https://bulk.resource.org/codes.gov/>

⁵⁹ *Ibid*, "The Florida Test Protocols for High-Velocity Hurricane Zones."

⁶⁰ *Ibid*, "The New Jersey Building Code."

⁶¹ Steve Almasy, S. (2012, December 7). *Bloomberg says NYC will rebuild with climate change in mind*. Retrieved December 7, 2012, from <http://www.cnn.com/2012/12/06/us/new-york-bloomberg-climate/index.html?iref=allsearch>

⁶² *US hit with flooding and record heat*. (2012, June 20). Retrieved December 2, 2012, from <http://www.cnn.com/video/#/video/bestoftv/2012/06/21/exp-duluth-flooding-and-northeast-heat.cnn>

residents were stranded.⁶³ The flood took more than a week to recede. Now while it is true that this was an unusual storm and that this could have happened anyway, it is instructive about what can be expected as climate change progresses. Minnesota sits in the region where more and heavier precipitation is expected, and therefore storms of the June 19th intensity will be more common.⁶⁴ This storm caused extensive damage because the infrastructure could not cope with the downpour. The drainages and canals intended to prevent such floods were within a few hours.⁶⁵ Therefore, Duluth should be a wakeup call to all governments in the path of climate change to get ready. Had the city and surrounding counties recognized that they were likely to see increased storm activity and built more and better drainage systems, the damage could have been prevented. Make no mistake, it behooves policymakers to prevent these disasters rather than clean them up and the only way to accomplish that will be to recognize the reality of climate change and to take appropriate steps.

Preparation Trumps Reaction

After the intellectual challenge of accepting climate change as a reality, policymakers will need to deal with the sticker shock of disaster preparation. The improvements to the New Orleans hurricane defenses post-Katrina cost \$14 billion, which Bloomberg notes is not within New York's budget at the moment despite his desire to emulate them.⁶⁶ Infrastructure projects always have high upfront costs and this often proves an insurmountable barrier when policymakers are considering projects. Given the widespread governmental belt tightening, it seems like disaster preparation is a far off dream. However, consider the alternative. The flood

⁶³ *Minnesota, Wisconsin residents cope with deadly flooding.* (2012, June 22). Retrieved December 2, 2012, from CNN.com: <http://www.cnn.com/2012/06/22/us/midwest-flooding/index.html?iref=allsearch>

⁶⁴ IPCC Synthesis Report, 55

⁶⁵ "Minnesota, Wisconsin Residents Cope With Deadly Flooding," 2012

⁶⁶ Almasly, 2012

defenses cost \$14 billion. Cleaning up Katrina cost ten times, more than \$150 billion and Sandy will cost five times that amount, \$80 billion.⁶⁷

It is cheaper in the long run to invest in disaster prevention than it is to pay for the damage. It is unwise to put together a fire department after your house is on fire and the same is true of weather disasters. If policymakers get ahead of these problems now not only will they prevent catastrophe, improved infrastructure will provide economic benefits. Insurance premiums should decline as the risk to threatened areas decreases and people and businesses will be more likely to move to well protected areas than vulnerable ones. This is a policy decision where everyone can win. It just takes a small intellectual adjustment to attain. When you weigh the cost of these improvements against the cost of inaction, then disaster preparation is an extremely cheap proposal.

Conclusion

Climate change is underway and it will impact the entire globe. It will not be felt equally and some areas will suffer from increased destructive storms. However, this does not mean that there will be a corresponding increase in natural disasters. The worst natural disasters in recent history could have been avoided if effective policies had been enacted and implemented prior to those disasters. Despite the high upfront costs that such preparations invariably have, their benefits in terms of spending on disaster relief make them extremely worthwhile. Adequate drainage plans, seawalls and levees, bridge and road improvement and strengthening and proper disaster response plans will all serve to minimize the impact of extreme weather events. The country cannot avoid climate change, so the time is now to prepare. We need not see another Katrina as long as we plan ahead and make the necessary adjustments.

⁶⁷ Almas, 2012

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