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Fear and Flooding In Jersey City

By

Eli Jacobson

A Thesis

Presented to the Graduate and Research Committee

In Candidacy for the Degree of

Master of Arts

In

Environmental Policy Design

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Table of Contents

List of Tables.....	vii
List of Figures.....	viii
Abstract.....	1
Introduction.....	2
Background.....	4
Literature Review.....	10
Methods.....	20
Results.....	23
Discussion.....	38
Conclusion.....	47
Appendix.....	52
Vita.....	63

List of Tables

Table 1.	7
Table 2.	26
Table 3.	27
Table 4.	28
Table 5.	29
Table 6.	30
Table 7.	31
Table 8.	32
Table 9.	33
Table 10.	33
Table 11.	34
Table 12.	36
Table 13.	37
Table 14.	40
Table 15.....	42
Table 16.	43
Table 17.	45

List of Figures

Figure 1.....	4
Figure 2.....	5
Figure 3.....	8
Figure 4.....	9
Figure 5.....	11
Figure 6.....	21
Figure 7.....	25

Abstract

The frequency of high-intensity flooding events has increased over the last decade, causing significant impacts in coastal urban areas. Concurrently, urban areas in the coastal United States are significantly increasing in population, rendering these areas more vulnerable to the severe impacts of flooding events. This study looks at the ways directly experiencing a serious storm impacts a person's perceptions of flooding risk and support for flood mitigation and other environmental policies. Interviews with 12 public officials at the state and local levels and a survey of 120 residents of Jersey City indicated how being impacted by Hurricane Sandy shaped residents' expectations for future flooding and concern for the future of the community. While respondents as a whole (those directly affected by the storm and those not) were largely supportive of environmental policies, older residents and homeowners – those who had more to lose from flood damage and those likely to bear more of the cost of repairs – were likely to be more concerned about future storms' negative impacts on individuals and the city as a whole.

Introduction

Environmental events - including hurricanes and storm surges - have increased in severity, significantly impacting coastal urban areas. Concurrently, coastal regions of the United States are experiencing a steady expansion of urban development. According to the US Census, 29% of the United States' population, or 94 million people, lived in counties adjacent to our coastlines (Atlantic Ocean, Pacific Ocean or Gulf Mexico) in 2016 (Cohen, 2018). These changes, while concentrated in urban areas, are distributed on all coastlines: In Harris County, Texas, the total population has increased by 35% between 2000 and 2016, adding a stunning 1.2 million residents (Houston Chronical, 2018). This county contains Houston, which recently endured the severe economic and social impacts of Hurricane Harvey in August 2017. Currently, the National Hurricane Center claims that Hurricane Harvey has caused roughly \$125 Billion of damage to the impacted communities of Texas and Louisiana (NOAA, NHS, 2019); similar to Hurricane Katrina, the calculated cost of damage will surely increase over time due to rebuilding delays and claim approval lag time. Yet Harris County and Houston have continued developing, even after the enduring impacts of Hurricane Harvey:

One in 5 new homes permitted in Houston in the year after Hurricane Harvey is in a flood plain — some on prairie developed for the first time after the storm — even as new rainfall data showed existing flood maps understate the risk posed by strengthening storms. (Houston Chronical, 2018, ¶1)

It is interesting that a community – one that is still in the process of re-building - would make decisions to carry out new construction at all.

This example- among others - raises an important question: How does a significant flooding event impact a person's perception of flood risk and opinion about various flood mitigation policies?

Using Jersey City, NJ, and its experience with Hurricane Sandy (2012) as a case study, this research project analyzed residents' opinions about and support for flood mitigation policies and limits placed on development in flood sensitive areas. Further, I analyzed how these opinions and levels of support were impacted by residents' own experiences with the storm. From this information, I considered how a person's opinion towards a significant flooding event changed after an extended period of time.

In order to answer the questions above, the approach to research consisted of three tools:

1) I developed a 30-question survey that assessed impacts that a respondent could attest to in a Yes/No, multiple choice, or likert question format (Appendix A). The following is a sample list of questions:

- Were you impacted by Hurricane Sandy?
- Did you or someone you know face the decision between rebuilding or moving in response to Hurricane Sandy?
- In any flood you've experienced, what was the most damage your home incurred?
- Please rank the following ways you were impacted by Hurricane Sandy: (Loss of power, flooding in home, ability to get to work etc.)

2) Following questions that assessed immediate impact, the survey presented the respondents with a series of questions were aimed at determining how Hurricane Sandy influenced respondent's opinions about the threat of future storms, and the kinds of policies or actions they think local and state officials should take.

3) In addition to the survey, I interviewed 12 public officials (at the local and state level) about the impacts of Hurricane Sandy and how the event influenced current building codes as well as development and flood mitigation policies.

Background

Hurricane Sandy caused the second-highest amount of economic damage among all cyclones in the last 120 years, exceeded only by Hurricane Katrina, which holds the record for the most economic damage in the United States (Solecki et al, 2017).

Hurricane Sandy caused at least \$65 billion worth of damage in the United States alone and impacted 24 States (FWS, 2019). Among all the countries impacted by Hurricane Sandy at least 233 were killed; 72 of these deaths were in the United States (Blake 2013). In municipalities adjacent to the Raritan Bay in the New York metropolitan area (Figure 1), 90% of homes were impacted by flooding (Blake 2013). According to the Associated Press and NORC, two-thirds of residents in areas impacted by Hurricane Sandy lost power and 44% of residents lost heat (Tompson, 2018)



Figure 1. Raritan Bay in the New York Metropolitan area (Stoffer and Messina)

Of the 3.94 million people in Manhattan during the day, roughly 1.61 million are workers that are commuting from outside of Manhattan (Moss and Qing, 2012). Preceding Hurricane Sandy, New York Governor Andrew Cuomo declared a state of emergency

and shut down the Metropolitan Transportation Authority, closing all subway trains, buses and rail lines in New York City (NYS, 2012).

In Hudson County, which is in New Jersey across the Hudson River from Manhattan, all the Port Authority Trans-Hudson (PATH) train stations were closed for at least two weeks, forcing Manhattan-bound commuters to either work from home or endure several extra hours in their commute. The World Trade Center PATH was closed for 4 weeks and the Hoboken PATH was closed for 3 months. Closure of these stations was catastrophic for New Jersey and New York residents as the New York City MTA reports that 80% of commuters during rush hour rely on these forms of public transportation. On an average weekday, the PATH system serves 241,725 riders, and the Hudson-Bergen Light Rail (HBLR) serves roughly 25,000 riders (City of Jersey City, 2014).



Figure 2. PATH rail lines serving commuters from Hudson County, New Jersey (The Port Authority of New Jersey and New York)

Across all states impacted by Hurricane Sandy, 346,000 homes incurred damage and 70 drinking water systems as well as 80 wastewater treatment plants were impacted by power loss and associated damages (NJ DEP, 2015). In the state of New Jersey alone, “40,500 primary residences and 15,600 rental units sustained severe or major damage...another 19,505 properties experienced minor damage” (Abramson et. al.,

2015, p. 6). By 2013, a staggering 8.7 million cubic yards of Hurricane Sandy debris were removed, costing some municipalities several million dollars (FEMA, 2013).

Jersey City Background and Impacts From Hurricane Sandy

In 2012, Jersey City had a population of 258,303, a roughly 30,000 increase from its population in 1992 (US Census). In 2012 alone, Jersey City establishments and manufacturers were responsible for \$2.2 billion in retail sales, \$3.3 billion in wholesale sales and \$745.3 million in shipments (Office of The Mayor, 2014). Between 2012 and 2017, the population in Jersey City increased to 270,753, continuing the growth trend of year previous despite the devastating impacts of Hurricane Sandy. The greater New York City economy is growing at an incredibly fast pace, achieving a 3.0% increase in Gross City Product in 2018, which is the strongest annual growth rate the city has experienced in 3 years (NYC Comptroller's Office, 2019). This growth is driving development throughout the region and especially in Jersey City, which is host to regional transportation infrastructure that facilitates interstate travel of persons and goods:

Jersey City's regional rail and highway links for the movement of people and goods include the National Docks Secondary freight rail line, the Newark Bay Extension of the New Jersey Turnpike (I-78), the two western portals to the Holland Tunnel, New Jersey highway routes 440, 1&9 Truck, and 139, four PATH stations, 13 Hudson-Bergen Light Rail stations, and ferry docks. (City of Jersey City, 2014, p.3)

Prior to Hurricane Sandy, Jersey City was undergoing several different construction projects. In 2012, Jersey City had the most construction in the state of New Jersey, authorizing \$391 million worth of work, a substantial amount "for new dwellings" (State of New Jersey, 2012, p. v). Since 2001, Jersey City has ranked in the top 20 municipalities in the state with the most new housing. In Table 1 below, note how Jersey City has

ranked first or second nearly every year in the decade leading up to Hurricane Sandy (State of New Jersey, 2012).

Authorized Housing in Newark and Jersey City, 2001-2012					
Year	Newark		Jersey City		All New Jersey
	Authorized Units	Rank	Authorized Units	Rank	Authorized Units
2012	266	14	618	2	15,270
2011	180	13	700	1	11,882
2010	169	18	249	11	11,885
2009	285	4	1,132	1	11,145
2008	289	6	1,468	1	16,338
2007	927	2	2,765	1	25,948
2006	2,125	2	2,578	1	31,709
2005	2,611	2	3,778	1	39,688
2004	1,702	2	2,156	1	39,254
2003	1,730	1	969	2	35,171
2002	1,223	1	907	2	34,589
2001	1,066	2	2,009	1	35,680

N.J. Department of Community Affairs, 5/7/13

Table 1. Number of authorized housing units in Jersey City and Newark by year (From the State of New Jersey, 2012). Of the 12 years shown above, Jersey City had authorized the development of the most housing units in the state for 8 years.

The 14.9 square miles of land that is Jersey City hosts an ever-growing population of residents and a set of highly-used interstate transportation systems on land and water. The significant residential development and economic growth are taking place right next to the Hudson River, which opens up to the Atlantic Ocean. At the Goldman Sachs Building, the tallest building in New Jersey and host to several companies in Jersey City's financial district, the Base Flood Elevation is 9 feet (FEMA Flood Map Service Center). Areas like Jersey City's downtown and financial district are vulnerable to the risk of flooding, which has been widely observed over the last decade, and is expected to increase in intensity. Wong-Parodi et. al. (2017) reports that "Storms and floods are the most frequent and costly weather-related disasters in the US, accounting for 71.1% of the damage caused by extreme weather events between 1980 and 2011" (Wong-

Parodi et. al., 2017, p. 183). The number of weather and climate disasters that have surpassed \$1 Billion in damages has significantly increased in recent years (See Figure 3).

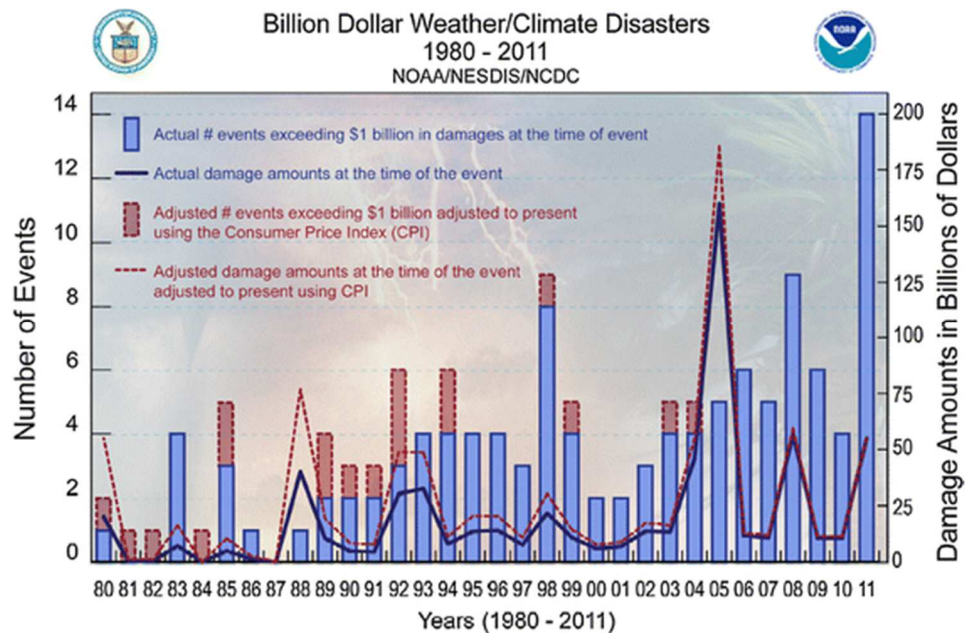


Figure 3. Weather/Climate Disasters that surpassed \$1 billion in damage (NOAA). Between 1980 and 2000, there was only 1 year in which 6 or more actual events exceeded \$1 Billion in damages. Between 2000 and 2011 alone, there were 4 years in which weather/climate disasters exceeded \$1 Billion in damages.

Jersey City is divided into 5 wards, which vary widely in terms of their building type, street layout, utility infrastructure and geography (See Figure 4). All of the wards border either the Hackensack or Hudson Rivers, with the exception of Ward C, which is landlocked. Ward A, whose borders are adjacent to both the Hackensack and Hudson Rivers, incurred the most damage (in dollars) among homeowners (City of Jersey City, 2014). The most damage incurred by renting households was in the Hudson-facing wards (A, F and E); not surprising given that newer rental buildings comprise the overwhelming majority of housing in these areas (City of Jersey City, 2014).

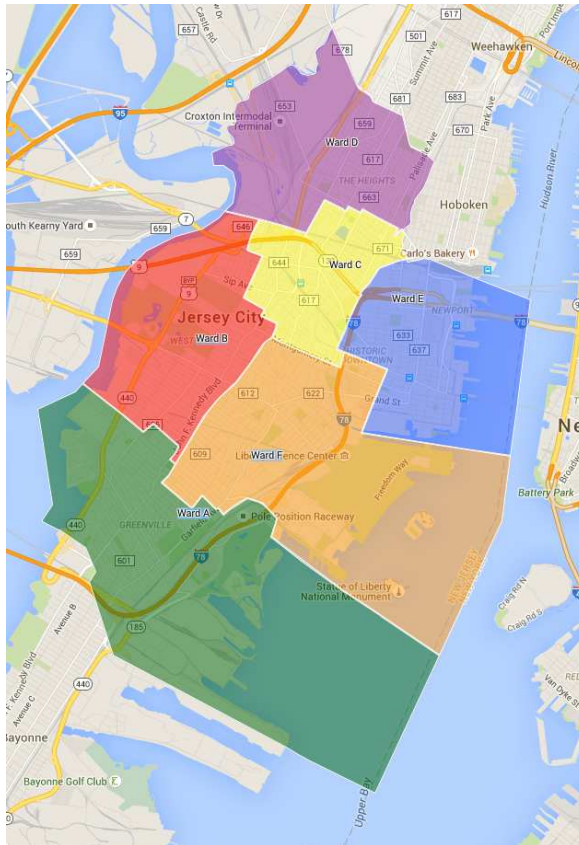


Figure 4. Map of Jersey City By Ward
(Mattern and Schober, 2015)

The “Sandy Recovery Strategic Planning Report”, released by Jersey City, notes that 3,688 acres, or 39% of Jersey City’s land area, was inundated by floodwater and 15,000 tons of debris were removed in the aftermath of Hurricane Sandy. High water marks were at elevation 10.4 feet at the Exchange Place PATH station (in Ward E), 11.0 feet at Lincoln Park (in Ward B), and at 11.9 feet at Liberty State Park (in Ward A). After the hurricane, 75% of Jersey City lost power, “which was not restored for many residents for more than a week” (City of Jersey City, 2014, p.7). In the week following Sandy, there was a chilly Nor’Easter, during which residents without power were also without heat. Overall, \$12,337,900 in damage was incurred among tax rateable properties in Jersey City (City of Jersey City, 2014).

Literature Review

Environmental risks facing the communities in which a growing number of Americans live are rising, and natural disasters stand to cause more and more damage in these areas in the years ahead. Yet the seriousness of this danger has yet to prompt the public to act at a scale commensurate with the risk (Casagrande et al. 2017). How could this change in a way that might proactively influence local policymaking? Here, I highlight how other researchers have addressed the question of how people form opinions that influence decision-making in relation to environmental risk.

On a national scale, opinions about environmental policy are known to be impacted by natural and economic events. Gallup has periodically published survey data gathered on public opinion towards climate change, significant environmental events (including floods and hurricanes) and how these topics are influenced by economic conditions. Individuals appear to choose between supporting environmental priorities and personal economic priorities that can have immediate impacts to their families.

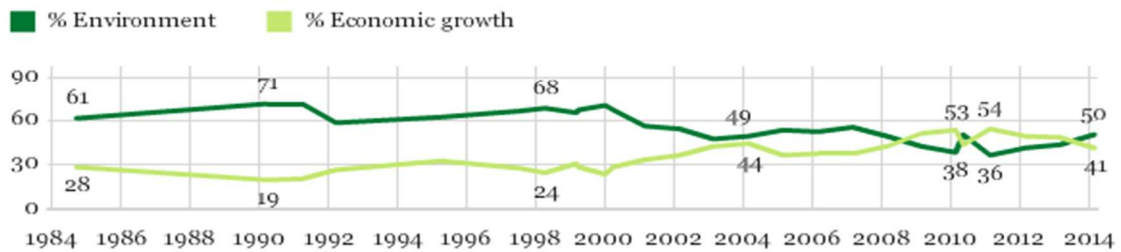
In 2014, Gallup released the research article “Americans Again Pick Environment Over Economic Growth” in which survey results indicated that “Americans are more likely to say protection of the environment should be given priority, even at the risk of curbing economic growth” (Gallup, 2014, ¶1). The authors also mentioned that ever since 2009, Americans had generally “prioritized economic growth over the environment”, except after significant events impacting the environment like the BP oil spill (Gallup, 2014, ¶1).

Gallup’s research suggests that environmental concern increases as financial issues ease, or when a policy shock event occurs:

Americans tend to give environmental concerns higher priority when the economy is healthy than when it is ailing, and in recent decades the U.S. economy was arguably its strongest in late 1999 and early 2000. (Gallup, 2015, ¶7)

Prioritizing Environmental Protection vs. Economic Growth, 1984-2014

With which one of these statements about the environment and the economy do you most agree --
[ROTATED: protection of the environment should be given priority, even at the risk of curbing economic growth (or) economic growth should be given priority, even if the environment suffers to some extent]?



GALLUP

Figure 5. Trend of public opinion regarding balance between environmental and economic concerns. (Gallup, 2014)

In Figure 5 above, note a sharp increase in the dark-green trendline (% Environment) and a decline in the light-green trendline (% Economic growth) in 2010, around the time of the BP oil spill. This occurred even as economic issues were taking priority as the recession began in 2008.

In a 2018, researchers Leiserowitz et al. (2018) conducted a survey to determine how concerned Americans were about global warming. They found that 69% of Americans are somewhat or very worried about global warming, and 46% of Americans claim that they have personal experiences of being impacted by global warming (Leiserowitz, 2018). This research was conducted in the wake of several major flooding events including Hurricanes Florence , Harvey and Maria. In comparison to the Gallup article mentioned above, it appears that enduring a significant flooding event increases an individual's concern for environmental issues, whereas a long period of time without these events causes a Americans to prioritize economic issues. For example, note

Figure 5, in which Environmental Protection (dark green) takes priority over Economic Growth (light green) in the beginning of 2010 (for the first time in the 30-year trend line), which is right around the time of the BP Oil Spill. The study by Leiserowitz et al. (2018) supports the claim that major environmental events increase an individual's concern for future environmental events immediately after devastating events have just occurred.

From this nationally-based research, I can deduce that Americans prioritize environmental concerns when economic issues are not significant or in the aftermath of events like Hurricane Sandy. When both environmental and economic impacts are present, how long will the environmental events remain salient? This research aims to understand how these broad-based trends played out in Jersey City post-Sandy.

In “Connecting earth and sky: Persuading climate skeptics through analogy”, Benjamin Gray considered the possibility of using the heightened number of earthquakes caused by Oklahoma's increased wastewater injection activity “as an analogy” to persuade climate change skeptics (Gray, 2018, p.297). Gray notes that climate skeptics may not be open to understanding other opinions (or even reconsidering their own) because they feel psychologically distant from climate change issues:

Psychological distance is a concept for measuring how close to the self a person perceives an event to be in terms of the event's likelihood of happening, the length of time until it might happen, the geography it might happen in, and whether the people it might happen to are like the observer or not. (Gray, 2018, p.294)

A rational individual is not likely to have concerns over a type of risk that he or she has never endured – or is psychologically distant from. After experiencing a flooding event and the associated impacts, though, an individual is likely to re-calibrate his or her expectations surrounding the risks associated with future events. In this way, enduring

an event is likely to influence an individual's future perceptions of risk and, as a result, support for mitigation policies.

Rudman et al. (2013) tests this concept of psychological distance in "When Truth Is Personally Inconvenient." For this study, the authors interviewed college students, most of whom had lost power for up to six weeks and many of whom had trouble reaching campus or lost their homes, about how the impacts of Hurricane Sandy affected their willingness to support a 'green politician' before and after the storm. Specifically, the researchers wanted to know:

Did this inconvenience- and in some cases, adversity- create a teachable moment, spurring more favorable implicit attitudes toward a green politician or explicit belief in anthropogenic climate change? (Rudman et. al., 2013, p. 2291)

Before Hurricane Sandy, participants chose the 'traditional' candidate over the green candidate, yet participants who were impacted by Hurricane Sandy chose the green candidate during the second round of assessments (Rudman et. al., 2013). This finding suggests that participants became more concerned with the impacts of flooding following Hurricane Sandy. Just as the theory of psychological distance suggests, after the students endured the impacts of Hurricane Sandy, their personal values and concerns changed, and this shift strongly influenced their increased willingness to support a candidate who could minimize the impacts of future flooding through environmental policy.

Like Rudman et al. (2013), another recent research project conducted a survey in five severely impacted New Jersey and New York communities to understand the types of "stress and crisis conditions" that homeowners faced during and after Hurricane Sandy (Solecki et al., 2017, p.140). These data were used to determine how the immediate

responses of homeowners to Hurricane Sandy displayed their resiliency, as well as to identify what triggers changed residents' perception of risk. The authors defined change as "a suite of adjustments potentially punctuated by a transition in which the dominant system structure of the community in question can transform" (Solecki et al., 2017, p.140). In Gray's terms, these two research projects (Solecki et al. and Rudman et al.) analyze which impacts from Hurricane Sandy diminish the "psychological distance" between the individual and the event, catalyzing a change in opinion towards more flood mitigation policies, acceptance of government support following flood events and concern for negative impacts on personal finances and wellbeing.

Similarly, Binder et. al. (2015) conducted interviews of residents in Oakwood Beach and Rockaway Park, NY to understand what factors impacted a resident's decision to rebuild or relocate after Hurricane Sandy. They sought to understand "why homeowners who are given the option of pursuing a buyout choose to pursue or reject that option" (Binder et. al., 2015, p.182). One of their findings was that decision-making was subject to the experiences endured on a community and individual level. For example, many communities in New Jersey and New York did not experience flooding damage, but went without power for several weeks. Binder, Baker and Barile note the following in their research:

...differences in the experience of the storm were important in the participants' responses related to exposure. When asked, for example, whether they ever felt their life was in danger during Sandy, residents of Oakwood Beach who answered affirmatively referenced the floods, while residents of Rockaway Park more frequently cited the fires (Binder et. al., 2015, p.185)

From the passage above, respondents from different case study locations experienced different types of impacts from Hurricane Sandy. Different impacts could elicit different response patterns to policy choices. Jersey City wards greatly vary in land-use types,

elevation and population density, and greatly varied in their degree of damage from Hurricane Sandy. I can expect that, similar to Binder et. al., different impacts might have different influences over opinion.

Wong-Parodi et al. (2017) conducted a qualitative study that included a collection of 14 interviews of New Jersey residents from four coastal communities impacted by Hurricane Sandy. This study sought to determine impacts that influenced how people view personal flood preparedness, social support, and where the responsibility of community preparedness lies (with the individual or with government). In this study, respondents took most of the blame for incurring property damage because of their choice to live in a waterfront property:

You live in a coastal town so it's kind of expected that if you can afford to live near the ocean you have to know that there's certain risks - Participant 3 (Wong-Parodi et. al., 2017, p.186)

Why do opinions on personal versus government responsibility differ between the respondents in the Wong-Parodi et. al. and Solecki et. al surveys? This resident points out that the disparity might be linked to the choice of individuals to own property in areas with high flood risk. Residents living on beachfront properties assume higher chances of risks associated with flooding and hurricanes and therefore take more responsibility for the consequences. Analyzing Jersey City residents' survey responses based on owning versus renting a property may provide some clarity to this contradiction in the existing literature (See Methods Section, below).

In Wong-Parodi et al., respondents saw “state and local authorities as sharing responsibility, mentioning tasks such as providing information, creating building codes and making sure they are enforced” (Wong-Parodi et al., 2017, p. 187). Respondents

were quoted lauding their neighbors for contributing to the cleanup and communication efforts, strengthening the sense of community among residents.

In “Perceptions of severe storms...,” authors Burger and Gochfeld sought to understand respondents’ “perceptions of relationship between severe storms, sea level rise, climate change and ecological barriers by a vulnerable environmental justice population” (Burger et. al., 2014, p.1261). The researchers found age to be a significant factor in determining whether respondents considered flooding to be the result of sea-level rise. The older the respondents, the more likely they were to agree that “flooding was due to sea level rise” and that “damage was due to loss of salt marshes” (Burger et. al., 2014, p.1265).

They also found that loss of electricity was a significant factor in predicting responses towards “storms will come more often” (Burger et. al., 2014, p.1266). All respondents in the study had lost electricity for up to and over 2 weeks. Three quarters (75%) of Jersey City residents lost power after Hurricane Sandy and electricity was not restored in many areas of the city for more than a week (City of Jersey City, 2014). Given the theory of psychological distancing, I can expect parallel responses between Burger et. al.’s study and my own because of the similar power outage situations endured by Jersey City residents.

In “The Social and Cultural Construction of Risk: Issues, Methods, and Case Studies”, Covello and Johnson also address a similar question of why some risks “... believed by some individuals and groups...(are) tolerable or acceptable”, but “unacceptable to others” (Covello, 1987, p.vii). It is impossible for people to be concerned about all risks, which means they have to “selectively choose risks for attention” (Covello, 1987, p.viii). That said, they found that “any factor that makes a risk unusually memorable or

imaginable--such as a recent disaster--may distort risk perceptions” (Covello, 1987, p.x). This finding provides a platform for researchers to utilize when identifying which impacts were the most significant, as these impacts might be the factors that distort risk perception, as Covello describes; thus, diminishing the psychological distance between the individual and the reality of the event.

Severson and Coleman point out that many climate advocacy groups have failed to properly communicate climate science because they assume that if someone has all the facts, “they will update their beliefs accordingly” (Severson, 2015, p.1278). However, perceptions about environmental issues appear to be rooted in a person’s previous experiences and values. These experiences and values influence the weights an individual places on “empirical, moral, and economic consequences” of supporting certain policies, preventing an effective one-size-fits-all approach (Severson, 2015, p.1279). Severson and Coleman also mention that if residents do not perceive the importance of significant issues, they are very unlikely to support policies that undertake the issues, especially if these policies are costly.

Communicating the true risks of damaging environmental events requires that policymakers and political leaders carefully choose which words and phrases they use to describe potential impacts. Juanchich and Sirota were able to quantify how an individual conceptualizes terminology that researchers often used to display the imminence of future events: “The probabilities typically perceived by recipients for ‘unlikely,’ ‘possible,’ and ‘certain’ were much higher than the frequencies of the outcomes they qualified... ‘possible’ conveys a 50% probability, yet participants predicted that an outcome that had a 10% frequency was ‘possible’” (Juanchich and Sirota, 2017, p.387). These results indicate a wide disparity between the definition of terms describing the

imminence of a future event and how respondents use these terms to describe when they think the next event will be.

Enduring a natural disaster forces communities to confront the balance between economic, social and environmental values. In other words, it prompts individuals to reflect and discuss how the community reacted, what they could have done differently leading up to the event, what they can do differently in the future to elicit a higher state of preparedness, and what the community is willing to sacrifice in order to better protect itself from future flood events.

Contrasting public attitudes can support either a “business as usual” approach or a more “progressive” stance. Business as usual implies simply continuing coastal development, or considers more of the same to be worth the costs that community members will be forced to pay in the long term when they face another significant flood event. This stance would be equivalent to rebuilding after Hurricane Sandy in the same way as before or continuing to develop in flood sensitive areas, without incorporating any experiences or warnings from Hurricane Sandy into future programs or policies. In a progressive stance, residents consider the upfront costs of strict flood mitigation and development policies to be worth the long-term benefit of preventing major damage during the next significant flood event. This stance would be equivalent to recognizing the impacts endured by Hurricane Sandy, then using the information to reform policies and programs in a way that mitigates the impacts of future flooding events.

The studies above display a transition among respondents who have endured significant flooding events from business as usual to a progressive stance. Recall Rudman et. al., in which the respondents’ set of values (and ultimately voting patterns) shifted to support

environmental policies after enduring a significant flooding event. In the research above, regardless of studies' different methods and project goals, the concept of psychological distance becomes apparent after results report a significant change in decision-making patterns after a flooding event. Similar to the role it played in the broadest and most localized research cited, psychological distance could play a role in explaining the decision-making patterns among my own respondents. Overall, this concept could serve as a platform for explaining how experiencing a flooding event can influence an individual's transition in decision-making from business as usual to a more progressive stance, as individuals weigh the importance of economic versus environmental priorities (or facilitate the understanding of how the two kinds of issues could blend).

Methods

This analysis of the experience of Jersey City residents during Hurricane Sandy is based on interviews of 12 public officials and surveys of 120 residents. Public officials included publicly appointed directors and hired specialists. These individuals provided information on pre- and post-Sandy development policies, impacts endured during the storm, and the opinions voiced by their constituents. Information from these conversations were reinforced by residents' own feedback on the impacts from Hurricane Sandy, and their opinions about future storms and possible flood mitigation strategies.

All officials were interviewed using the same set of questions. To gain background information, interviewees were asked to describe:

- the responsibilities of their office
- the responsibilities of their position
- both the office's and person's role during Hurricane Sandy recovery efforts
- how the impacts of Hurricane Sandy influenced the person's role

Officials held different positions at different levels in government: in local Jersey City offices, the federal Environmental Protection Agency (EPA) Region 2 office, the New Jersey Office of Coastal and Land Use Planning, and the Hoboken Office of Sustainability.

Following the standard questions, the participants were asked to give their feedback on the research project and questions they would be interested in asking their constituents through the project's survey. I discovered, too, that the public officials were well-equipped to create and recommend their own survey questions. Since most of them were Jersey City residents during Hurricane Sandy (and have been since 2012), they

were more well-versed in the significant impacts of the storm and related policies. Thus, I focused on developing questions with the public officials during the interviews. This approach yielded strong participation among interviewees because they were interested in hearing the results of a survey if their questions were used.

I developed a basic set of questions - prior to the interviews - that I aimed to build on, then added new questions based on the ideas and needs of my interviewees. For example, one of the questions I asked interviewees was: "What were the three most significant impacts to residents caused by Hurricane Sandy?" (see Figure 6). I used the responses from interviewees to develop answer choices and likert statements on my survey.

What were the three most significant impacts to residents of Jersey City caused by Hurricane Sandy?	
Please rank the following ways you were impacted by Hurricane Sandy: • Loss of Phone Communication • Loss of Power • Street Damage • Inability To Access Basic Needs • Ability To Get To Work • Flooding In Home	Likert I was able to communicate with my neighbors during/after Hurricane Sandy. I was able to get food and other supplies in the days after Hurricane Sandy. Likert: We should limit or restrict development in flood-prone areas

Figure 6. Development of survey questions. I asked interviewees what they thought the three most significant impacts of Sandy were, then used their responses to develop survey questions.

The final survey to residents of Jersey City contained 30 questions with multiple choice, likert formats (i.e. Strongly Agree, Agree, Disagree, Strongly Disagree, Don't Know), and 1 open-ended response at the end (for respondents to add any additional information). Questions addressed respondents' demographic and socioeconomic characteristics,

experience during Hurricane Sandy, and opinions on future flood risk and various flood mitigation policies. For example, questions assessed respondents' willingness to support (1) development restrictions in flood zones; (2) restoration of natural wetlands and/or (3) government buyouts of homes after a flood to decrease Jersey City's vulnerability to extreme events in the future (Appendix A). Some policies, such as supporting the restoration of natural wetlands, would require minimal effort on an individual's part, while others, such as accepting a buyout, would require significant effort. Such questions focused on policy support could then be reviewed against respondents' willingness to support these actions in response to their experiences (or lack thereof) with Hurricane Sandy. This enabled me to assess both an individual's support for particular policies and the amount of effort they would be willing to take in response to a flood event.

Survey

The survey was administered in person and by mail. The three in-person sites for the survey included the Hamilton Park Farmers Market (15 responses), the Van Vorst Park Farmers Market (16 responses) and a meeting of the Hamilton Park Neighborhood Association (22 responses). A link to the survey was also mailed to 7,500 Jersey City residents. A total of 80 people who received this letter completed the survey electronically.

I conducted data analysis by reviewing descriptive statistics for all variables and producing a series of crosstabs and Pearson Correlations. Using these tools, I was able to determine which variables played the most influential role in determining an individual's opinion towards future flood risks and flood mitigation policies. All analysis was conducted using SPSS and STATA.

Results

The 12 public officials interviewed highlighted the most significant impacts, as they saw them, of Hurricane Sandy, described their position's responsibilities before, during and after the storm, how often they engage with constituents their own and personal experiences with the storm. Almost all interviewees responded that power outages, flooding, lack of transportation and street damage were among the most significant impacts of Hurricane Sandy. Among the City Council members, responses concerning how they could best prepare for a future flooding event were directly related to the core issues facing their individual Wards. Ward E, for example, has significant population density along the Hudson River because of new high-rise buildings, and this Councilmember stressed the need for improved evacuation protocols. Others focused on Wards with older power grids, pushing for more interactions among neighbors and the installment of landline phones to prepare for the days immediately after a future flooding event and widespread power outages.

Among non-elected city officials, there was support for strategies involving: (1) Communication and awareness among residents through city events and organizations (information tables at farmers' markets and community gatherings etc.) and (2) More communication and shared procedures between Wards and state agencies during a flooding event. Almost all officials from this group of interviewees both regularly attend public meetings and are involved in some aspect of flood policy and planning at the local level.

I interviewed two officials at the state level, who both recalled the most significant impacts of Hurricane Sandy as being related to the inability of communities to recover

and rebuild in a reasonable amount of time. Interviewees mentioned that the simultaneous loss of financial resources at the individual, local and state levels was a major contribution to the extended delay in repairs. The top-down position responsibilities of these interviewees is a possible reason for why their answers and recommendations were centered around the state and federal financial resources.

In all, 120 people responded to the survey from the three different launches: the Hamilton Park/Van Vorst Farmers' Markets (23%), the mail launch (59%) and a resident council meeting (18%). Since both Farmers' Markets and the resident council meeting took place in Ward E, the distribution of respondents by Ward was not even. Over 40% were from Ward E, and the remaining Wards contributed 5-12% of respondents each. The average respondent had lived in their current home for 9.3 years and had been a resident of Jersey City for 13.4 years. The median response for current home and residency durations were 5 and 11 years, respectively; the mode for both questions was 1 year (responses in which residents indicated <1 year were re-coded to 1 year).

Roughly half of respondents (49.5%) owned their primary residence and 50.5% rented their primary residence, indicating slightly more renters. Gender among respondents was uneven, with 40.2% males, 57.0% females and 2.8% indicating "Other" or "Prefer not to answer." The vast majority (70.5%) of respondents had obtained a Bachelor's Degree or higher and 94% had attended college. Two-thirds (66.3%) of respondents had an annual income of \$100,000 or more, 22.1% made \$50,000-\$99,000, 16.9% made 25,000-\$49,999 and 9.1% made \$24,999 or less; 7.8% of respondents indicated that they did not know their annual income. The average age was 41 years old, the mode was 28 years old, with a minimum and maximum of 18 and 80 (see Figure 7 for the percent breakdown by age).

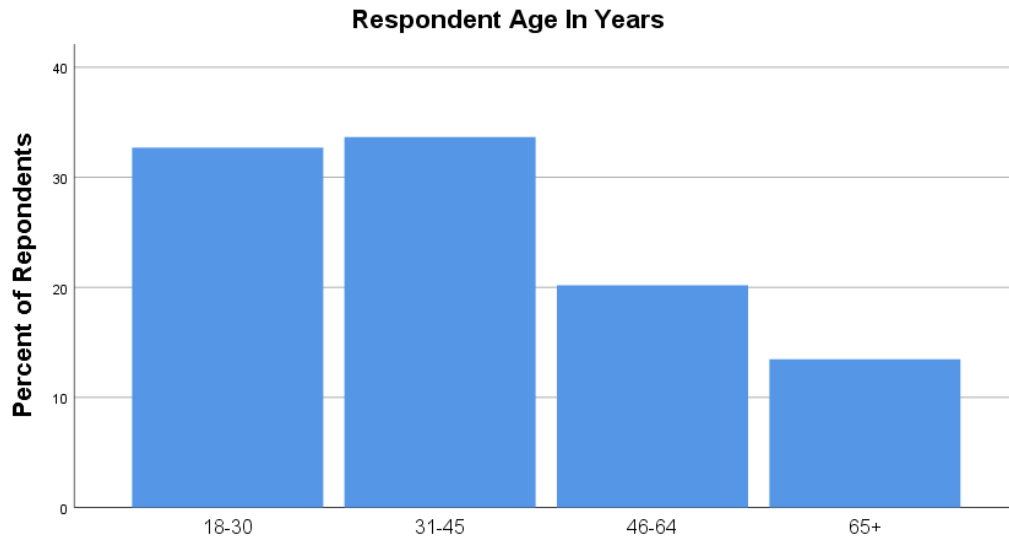


Figure 7. Percent breakdown of respondents by age. Most respondent were in the 18-30 and 31-45 age groups.

Overall older respondents (primarily 65+) were more concerned about the likelihood of future flooding, and the impacts that these events could have on their personal finances and safety as well as the overall wellbeing of Jersey City. Every respondent who was 65 or older indicated that it was “Likely” or “Possible” that they would be impacted by flooding within the next 15 years. In contrast, only half of the respondents between 18-30 responded with “Likely” or “Possible” to the same question (Table 2).

			How likely do you think it is that you will be otherwise impacted by flooding in the next 15 years?				Total
			Likely	Possible	Unlikely	Impossible	
Age	18-30	Count	4	8	9	3	24
		% within Age	16.7%	33.3%	37.5%	12.5%	100.0%
	31-45	Count	8	11	2	0	21
		% within Age	38.1%	52.4%	9.5%	0.0%	100.0%
	46-64	Count	5	5	5	1	16
		% within Age	31.3%	31.3%	31.3%	6.3%	100.0%
	65+	Count	3	5	0	0	8
		% within Age	37.5%	62.5%	0.0%	0.0%	100.0%
Total	Count	20	29	16	4	69	
	% within Age	29.0%	42.0%	23.2%	5.8%	100.0%	

Table 2. Crosstabulation between age of respondents and how likely it is that they will be impacted by flooding within the next 15 years. The word “Otherwise” is added because the previous question asked how likely respondents think they will experience flooding in their homes in the next 15 years.

Jersey City Functions

The survey provided a list of municipal functions in Jersey City and asked respondents to rate how often they utilize them on the following scale: (0) Very Often, (1) Often, (2) Rarely, (3) Never.

	PATH Train	Hudson-Bergen Light Rail	NJ Transit Bus	Public Parks In Jersey City	Hudson River Waterfront Walkway
Very Often	52.2%	10.0%	15.2%	44.3%	26.7%
Often	26.1%	15.5%	6.3%	25.2%	31.0%
Rarely	19.1%	46.4%	40.2%	25.2%	31.9%
Never	2.6%	28.2%	38.4%	5.2%	10.3%

Table 3. Percent breakdown for how often respondents use different types of functions in Jersey City. Of the functions assessed, PATH Train, Public Parks and the H.R. Waterfront Walkway yielded the most use.

Respondents were asked if they were impacted by Hurricane Sandy in a Yes/No format; I did not provide a definition for “impact”, leaving it to the discretion of the respondent. If the respondent answered “Yes”, they also answered a set of questions evaluating their experience with Hurricane Sandy. A roughly equal number of respondents answered yes and no to this question (51% were impacted, 49% were not).

The first of these questions assessed the impacts that my interviewees answered as the most significant. They were asked to rate the impacts as “Severe”, “Moderate” or “Little To No Impact”. After data collection, I created a separate data set with these responses that merged the “Severe” and “Moderate” responses to determine if simply experiencing these impacts influenced opinions towards different flood mitigation policies. Tables 4 and 5 provide descriptive statistics on the 12 impacts assessed. In these tables, the mean is equivalent to the sum of all responses to a question in number format (“Severely

Impacted”=0 and “Little To No Impact”=2). If the mean is closer to 0, then most respondents were “Severely Impacted;” if the mean is closer to 2 then most respondents endured “Little To No Impact”.

	N	Minimum	Maximum	Mean	Std. Deviation
Loss of Power	41	0	2	.41	.591
Loss of Phone Communication	41	0	2	.85	.853
Street Damage (Trees and Powerlines Down)	40	0	2	1.17	.747
Structural Damage To Residence (e.g. Tree Falling on Home)	39	0	2	1.72	.647
Flooding In Home	40	0	2	1.53	.716
Lack of Transportation	41	0	2	.88	.927
No Heating/Cooling In Home	40	0	2	.95	.904
Ability To Get Gas For Car	41	0	2	1.12	.900
Ability To Get To Work	41	0	2	1.02	.851
Ability To Live In Home	40	0	2	1.40	.744
Ability To Access Food Or Other Basic Needs	41	0	2	1.27	.708
Please rank the following ways you were impacted by Hurricane Sandy: - Mold (Toxins) Or Dampness In Home	39	0	2	1.74	.498
Valid N (listwise)	39				

Table 4. Mean for ways Jersey City residents were impacted by Hurricane Sandy. The scale from 0-2 ranges from 0- “Severely Impacted” to 2- “Not Impacted”. A mean of less than 1 shows a severe to moderate impact. More respondents experienced secondary impacts like power loss than were actually flooded.

From the means of the original dataset (Table 4), I can deduce that the three most significant impacts endured by respondents during Hurricane Sandy were Loss of Power, Loss of Phone Communication and Lack of Transportation; Street Damage, No Heating/Cooling and Ability To Get To Work were also significant. I focus on these impacts to determine if enduring them influenced willingness to accept certain types of flood mitigation policy, using crosstab charts and correlation tests.

Please rank the following ways you were impacted by Hurricane Sandy:			
	Severe Impact	Moderate Impact	Little To No Impact
Loss of Power	63.4%	31.7%	4.9%
Loss of Phone Communication	43.9%	26.8%	29.3%
Street Damage	20.0%	42.5%	37.5%
Structural Damage To Residence	10.3%	7.7%	82.1%
Flooding In Home	12.5%	22.5%	65.0%
Lack of Transportation	48.8%	14.6%	36.6%
No Heating/Cooling In Home	42.5%	20.0%	37.5%
Ability To Get Gas For Car	34.1%	19.5%	46.3%
Ability To Get To Work	34.1%	29.3%	36.6%
Ability To Live In Home	15.0%	30.0%	55.0%
Ability To Access Food Or Other Basic Needs	14.6%	43.9%	41.5%
Mold (Toxins) Or Dampness In Home	2.6%	20.5%	76.9%

Table 5. Percent breakdown of how respondents were impacted by Hurricane Sandy. Loss of power, phone communication and transportation were the three most significant impacts to the respondents.

From the percent breakdown of impacts endured by respondents in Table 5, I can get a closer look at the respondents who indicated any impact (combination of severe and moderate impact) versus the variables in which a majority of respondents were not

impacted at all. Table 5 shows that at least 60% of respondents were severely or moderately impacted by “Street Damage,” “No Heating/Cooling In Home” and “Ability To Get To Work”.

I also analyzed how residents’ experience with Hurricane Sandy impacted their concerns for future flooding and support for “efforts to minimize flood risk”. Tables 6 and 7 provide statistics for how or whether enduring Hurricane Sandy increased concerns for future for flooding, providing results to determine the answer to my research question. The mean for all three questions was roughly 1.00, indicating agreement for all three variables.

	N	Minimum	Maximum	Mean	Std. Deviation
My experience during and immediately after Hurricane Sandy increased my concerns about future flooding. *	41	0	4	1.02	.987
My experience during and immediately after Hurricane Sandy increased my support for efforts to minimize flood risk. *	41	0	4	1.07	.959
How likely do you think it is that you will be otherwise impacted by flooding in the next 15 years?	74	0	3	1.08	.918
Valid N (listwise)	34				

Table 6. Ways that Hurricane Sandy impacted concerns for future events. The scale for the “My experience...” questions ranges from 0- “Strongly Agree” to 4- “Strongly Disagree”. The scale for “How likely...” ranges from 0- “Likely” to 3- “Impossible”.

Table 6 shows that all 3 variables relating to concerns about future flooding achieved a mean of slightly over 1.00. This indicates that most respondents “Strongly Agree” or

“Agree” that they are concerned about future flooding and that Hurricane Sandy increased their support for ways to minimize flood risk.

	Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
My experience during and immediately after Hurricane Sandy increased my concerns about future flooding.	31.7%	46.3%	12.2%	7.3%	2.4%
My experience during and immediately after Hurricane Sandy increased my support for efforts to minimize flood risk.	26.8%	51.2%	12.2%	7.3%	2.4%

Table 7. Percent breakdown of how a respondent's experience during and immediately after Hurricane Sandy influenced future concerns and broad support for efforts to minimize flood risk.

Table 7 displays the percent breakdown of two questions assessing Hurricane Sandy's impact on the respondents' concerns and support for minimizing flood risk. Both questions yielded high agreement among respondents, with at least 75% of respondents answering “Strongly Agree” or “Agree.”

In Table 8 (below), I did a crosstabulation analysis between “Were you impacted by Hurricane Sandy?” and respondents' perceived likelihood of being impacted by a flood within the next 15 years. This illustrates the degree to which residents' concern for future flooding depends on whether or not they endured Hurricane Sandy.

			How likely do you think it is that you will be otherwise impacted by flooding in the next 15 years?				Total
			Likely	Possible	Unlikely	Impossible	
Were you impacted by Hurricane Sandy?	Yes	Count	13	15	5	1	34
		%	38.2%	44.1%	14.7%	2.9%	100.0%
		Sandy_Impact					
	No	Count	9	15	11	5	40
		% within	22.5%	37.5%	27.5%	12.5%	100.0%
		Sandy_Impact					
Total		Count	22	30	16	6	74
		% within	29.7%	40.5%	21.6%	8.1%	100.0%
		Sandy_Impact					

Table 8. Crosstabulation between residents who were impacted by Hurricane Sandy and how likely respondents felt they would be impacted by flooding within the next 15 years (Sandy_Impact).

Table 8 shows that respondents who were impacted by Hurricane Sandy were more likely to expect to be impacted by a future flood within the next 15 years (Sandy_Impact). Roughly 82% of respondents who were impacted by Hurricane Sandy indicated that it is likely they will be impacted by flooding in the next 15 years, whereas 60% of respondents who were not impacted by Hurricane Sandy responded in the same fashion.

I then asked all respondents to evaluate how a future flood could negatively affect their finances, emotional well-being, health, safety and future of the community. Respondents indicated they felt a future flood would most likely impact the future of Jersey City and, to a lesser degree, their own sense of safety, emotional well-being and household finances (see Tables 9 and 10).

	N	Minimum	Maximum	Mean	Std. Deviation
Your Household Finances	107	0	2	1.07	.797
Your Emotional Well-Being	104	0	2	1.07	.741
Your Physical Health	105	0	2	1.18	.782
Your Safety	106	0	2	.99	.762
The Future of Your Community	105	0	2	.77	.823
Valid N (listwise)	101				

Table 9. Means for how concerned residents were that a future flood could affect the person and community. The scale from 0-2 ranges from 0- "Very Concerned" to 2- "Not Concerned At All".

Table 9 shows that for 4 out of 5 variables relating to specific concerns about future flooding achieved a mean of roughly 1.00. This indicates that most respondents are "Somewhat Concerned" that a future flood could impacts the variables we assessed. All 4 of the variables with a mean close to 1.00 were related to personal wellbeing. The variable with the lowest mean, indicating that it yielded the most concern from respondents, was "The Future of Your Community". This is very interesting because previous studies indicated that individuals are most concerned with issues that impact their personal well-being rather than that of the whole community.

How concerned are you that a future flood could negatively affect each of the following?			
	Very Concerned	Somewhat Concerned	Not Concerned At All
Your Household Finances	27.4%	39.6%	33.0%
Your Emotional Well-Being	24.0%	45.2%	30.8%
Your Physical Health	22.9%	36.2%	41.0%
Your Safety	29.2%	42.5%	28.3%
The Future of Your Community	47.1%	30.8%	22.1%

Table 10. Percent breakdown on how concerned respondents are that a future flood could negatively affect individual and community values. The Future of Your Community elicited almost double the amount of concern than the other variables, assessed individual (rather than community) values.

Table 10 provides a percent breakdown of these same variables relating to specific concerns in response to future flooding. Among variables relating to personal wellbeing, respondents were most concerned with their safety (with 29.2% being “Very Concerned”) and were least concerned about a future flood impacting their physical health (with 41.0% “Not Concerned At All” about this possibility).

Crosstab analysis revealed that residents who indicated that they were impacted by Hurricane Sandy were more concerned that a future flood could pose the impacts assessed. Of those impacted by the storm, 29.4% felt it is likely that they will experience flooding in their home within the next 15 years, more than three times the percentage of those who were not impacted by Sandy (7.7%) (see Table 11).

			How likely do you think it is that you will experience flooding in your home in the next 15 years?				Total
			Likely	Possible	Unlikely	Impossible	
Were you impacted by Hurricane Sandy?	Yes	Count	10	8	15	1	34
		% within Sandy_Impact	29.4%	23.5%	44.1%	2.9%	100.0%
	No	Count	3	11	20	5	39
		% within Sandy_Impact	7.7%	28.2%	51.3%	12.8%	100.0%
Total		Count	13	19	35	6	73
		% within Sandy_Impact	17.8%	26.0%	47.9%	8.2%	100.0%

Table 11. Crosstabulation between residents who were impacted by Hurricane Sandy and how likely respondents felt they would be impacted by flooding in the home within the next 15 years.

Finally, I assessed the respondents’ willingness to support certain types of flood mitigation policies. The statements in Tables 12 and 13 were presented in a likert format, and ranged from broad statements about decision-making, to specific actions that an individual or the government should take. Most participants agreed with restoring natural

wetlands, more local planning, and the restricting of development in flood-prone areas. All three of these variables had a mean between 0.40-0.48 and over 90% of responses were somewhat or strongly agree (Tables 12 and 13). Also significant is the agreement that development becomes unreasonable if the cost to repair after a flood or hurricane becomes too high. I received the least support for raising home elevation to reduce insurance rates and prevent future flood damage; 60.5% of participants somewhat or strong disagreed (Table 13). This indicates that participants are likely to agree with statements in which individual action is not required.

	N	Minimum	Maximum	Mean	Std. Deviation
If a major flood damaged my home, I would consider moving to an apartment on a higher floor to reduce the danger from future flooding.	46	0	3	.91	.839
If a major flood damaged my home, I would consider elevating my home to reduce the danger from future flooding and/or lower my insurance rates.	38	0	3	1.84	1.175
We should reduce the risk of flooding by building levees or flood walls.	91	0	3	.81	.698
We should minimize damage caused by flooding through local planning, zoning, and ordinances.	98	0	3	.43	.626
We should limit or restrict development in flood-prone areas.	98	0	3	.48	.707
We should reduce the risk of flooding by restoring natural wetlands.	93	0	3	.40	.610
After a damaging flood, the government should buy flooded homes at market value from homeowners willing to sell and prohibit any future building on those sites.	87	0	3	1.01	.896
Instead of waiting for a damaging flood, the government should buy homes now at market value from homeowners willing to sell and prohibit any future building on those sites.	81	0	3	1.31	1.056
Development becomes unreasonable if the cost to repair after a flood or hurricane becomes too high.	52	0	3	.56	.698
Valid N (listwise)	0				

Table 12. Means for flood mitigation strategies and policies that were given to residents. The scale for these questions ranges from 0- "Strongly Agree" to 3- "Strongly Disagree".

How well do you agree with the following statements about managing flood risk?				
	Strongly Agree	Agree	Somewhat Disagree	Strongly Disagree
If a major flood damaged my home, I would consider moving to an apartment on a higher floor to reduce the danger from future flooding.	32.6%	50.0%	10.9%	6.5%
If a major flood damaged my home, I would consider elevating my home to reduce the danger from future flooding and/or lower my insurance rates.	18.4%	21.1%	18.4%	42.1%
We should reduce the risk of flooding by building levees or flood walls.	34.1%	51.6%	13.2%	1.1%
We should minimize damage caused by flooding through local planning, zoning, and ordinances.	63.3%	31.6%	4.1%	1.0%
We should limit or restrict development in flood-prone areas.	62.2%	29.6%	6.1%	2.0%
We should reduce the risk of flooding by restoring natural wetlands.	66.7%	26.9%	6.5%	0.0%
After a damaging flood, the government should buy flooded homes at market value from homeowners willing to sell and prohibit any future building on those sites.	32.2%	41.4%	19.5%	6.9%
Instead of waiting for a damaging flood, the government should buy homes now at market value from homeowners willing to sell and prohibit any future building on those sites.	27.2%	32.1%	23.5%	17.3%
Development becomes unreasonable if the cost to repair after a flood or hurricane becomes too high.	53.8%	38.5%	5.8%	1.9%

Table 13. Percent breakdown on how respondents answered to a set of flood mitigation policy choices on a likert scale.

In the next section, I will discuss the variables that had the most influence over a respondent's willingness to support these statements about flood mitigation policy.

Discussion

This study seeks to determine how experiencing a significant environmental event impacts a person's opinion about flood mitigation policy. Within that, it identifies the most significant impacts over a person's opinion and also explores whether enduring an event was influential several years after the occurrence. These findings could be used for insights in developing a discourse to frame conversations about the importance of flood mitigation policy, and how future planning can protect collective interests and goods.

Survey results showed that respondents who directly experienced impacts did not respond to flood mitigation policy choices in a different manner than respondents who were not impacted. I originally predicted that the results of my project would display that experiencing an event such as Hurricane Sandy - in a coastal city with limited occurrences of natural disasters - would produce a dataset of responses on the tail ends of the likert questions with impacted residents either indicating "Strongly Agree" or "Strongly Disagree" to questions because of the extreme impacts they endured. Furthermore, I predicted that data of this sort would produce strong Pearson Correlations between enduring Hurricane Sandy and any of the policy questions. Yet, as explained below, I found no such correlation.

When running Pearson and Spearman correlations between enduring Hurricane Sandy and all of the questions assessing willingness to accept flood mitigations policies, I found no significant correlations (See Table 14 (and note that a significance [Sig. 2-Tailed] of 0.05 or less is considered a strong correlation but anything 0.10 or less is still noteworthy of mentioning)). Regardless of impact by Hurricane Sandy, there was concordance among all residents for different types of local planning efforts and broad flood mitigation

policies, such as restricting development in flood-prone areas, or minimizing damage through planning and zoning. Residents who indicated they were impacted by Hurricane Sandy tended to have stronger opinions (i.e. more responded on polar ends of likert chart whereas non-impacted residents were likely to just “Agree” or “Disagree”). However, these marginal differences are not in themselves found to be a primary driver of public attitudes. Other demographic factors (e.g. age, years in Jersey City) played a more significant role in attitude formation. I interpret this to indicate that the salience of impacts of an event diminishes over time to the point that those impacted and not impacted show similar tendencies.

		Were you impacted by Hurricane Sandy?
How likely do you think it is that you will be otherwise impacted by flooding in the next 15 years?	Pearson Correlation Sig. (2-tailed) N	.260 .025 74
If a major flood damaged my home, I would consider moving to an apartment on a higher floor to reduce the danger from future flooding.	Pearson Correlation Sig. (2-tailed) N	-.039 .797 46
If a major flood damaged my home, I would consider elevating my home to reduce the danger from future flooding and/or lower my insurance rates.	Pearson Correlation Sig. (2-tailed) N	-.230 .303 22
We should reduce the risk of flooding by building levees or flood walls.	Pearson Correlation Sig. (2-tailed) N	.079 .512 72
We should minimize damage caused by flooding through local planning, zoning, and ordinances.	Pearson Correlation Sig. (2-tailed) N	-.029 .800 77
We should limit or restrict development in flood- prone areas.	Pearson Correlation Sig. (2-tailed) N	-.008 .946 77
We should reduce the risk of flooding by restoring natural wetlands.	Pearson Correlation Sig. (2-tailed) N	.082 .491 73
After a damaging flood, the government should buy flooded homes at market value from homeowners willing to sell and prohibit any future building on those sites.	Pearson Correlation Sig. (2-tailed) N	.091 .459 69
Instead of waiting for a damaging flood, the government should buy homes now at market value from homeowners willing to sell and prohibit any future building on those sites.	Pearson Correlation Sig. (2-tailed) N	.056 .659 65
Development becomes unreasonable if the cost to repair after a flood or hurricane becomes too high.	Pearson Correlation Sig. (2-tailed) N	.128 .366 52

Table 14. Pearson Correlations between enduring Hurricane Sandy and the flood mitigation strategies and policies that were given to residents. A significance of 0.05 or less is considered a strong correlation.

It may be that my main survey launch (via mail) did not target populations with the most extreme impacts, while the papers described in my literature review focused on concentrated impact areas. My survey population was spread out over the whole city. In addition, I did not limit responses based on the extremity of the impacts endured. The case studies I reviewed were all in smaller communities in which almost everyone endured significant trauma (i.e. financial and emotional impacts from flooding and lack of resources).

While my data did not reveal a significant correlation between enduring Hurricane Sandy and flood mitigation policies, it yielded agreement for these kinds of policies among all of my respondents. My respondents rarely disagreed on statements advocating for flood mitigation policies, and the impacted residents usually responded in agreement about 10% more than those who were not impacted. In other words, there was such overwhelming support for flood mitigation policies in general in this research setting that the impacts of the storm did not matter when it came to approving such policies.

All of the papers cited in my literature review collected data within 5 years of Hurricane Sandy. It is possible that over time, strong opinions towards significant environmental opinions begin to diminish; this might be especially true in New Jersey, where an event like Hurricane Sandy has not occurred in almost seven years.

Recall the two Gallup articles from the literature review whose results insinuated that Americans choose environmental prioritization, when economic issues are not significant. I questioned how opinions would change when both environmental and economic impacts are present (Table 15). My results displayed a strong correlation

between concern that a future flood will negatively affect personal finances and the likelihood that a future flood will impact them within the next 15 years. This was the closest I came to explicitly asking residents if their concern about the impacts of future flooding were motivated by finances. I found a moderately strong correlation between these two variables, indicating a concern for both environmental and economic issues.

		How concerned are you that a future flood could negatively affect each of the following? - Your Household Finances
How likely do you think it is that you will be otherwise impacted by flooding in the next 15 years?	Pearson Correlation	.311**
	Sig. (2-tailed)	.007
	N	73

Table 15. Pearson Correlation between concern for future floods to impact household finances and how likely respondents felt they would be impacted by flooding in the home within the next 15 years.

Surprisingly, the variable yielding the most correlations with policy choices was about concern over the future of the community (see Table 16 below).

		The Future of Your Community
How likely do you think it is that you will be otherwise impacted by flooding in the next 15 years?	Pearson Correlation Sig. (2-tailed) N	.359** .002 72
We should minimize damage caused by flooding through local planning, zoning, and ordinances.	Pearson Correlation Sig. (2-tailed) N	.240* .019 95
Instead of waiting for a damaging flood, the government should buy homes now at market value from homeowners willing to sell and prohibit any future building on those sites.	Pearson Correlation Sig. (2-tailed) N	.277* .014 78

Table 16. Pearson Correlation between concern for future floods to impact the future of their community and how likely respondents felt they would be impacted by flooding in the home within the next 15 years.

Based on the Gallup article cited above, I predicted that individual concerns – like household finances and personal safety- would take precedence over all other issues. However, respondents chose “The Future of Your Community” as the variable they were most concerned about in the event of a future flood. Table 16 shows that responses displaying concern for the community are highly correlated to responses demonstrating concern for future flooding and support for two different types of flood mitigation policies.

Another variable correlation supporting this point was housing tenure (own versus rent), and how likely owners versus renters were to think a flood would impact them within the next 15 years and to support two policy variables. Owners tended to support more types

of flood mitigation policies and the possibility that a future flood could impact them. This aligns with Covello's theory from above, that enduring an impact that makes an event "unusually memorable" strongly influences opinions towards risk perception (Covello, 1987, p.x). In the case of housing tenure, the memorable part of the event would be enduring the high costs of repair from flooding damage.

Since most of my respondents were in Jersey City's Ward E, I can assume that many of the renters from this ward reside in high-rise and high-amenity apartment buildings (given the nature of the housing stock in this area). One interpretation is that renters are not responsible for any property damage. In alignment with Covello's theory, these respondents were probably not impacted by the costs of repair after flood damage and therefore, did not join in the concern of future flooding events like the homeowners.

This finding is similar in reasoning to my final correlation, which identifies alignment between years in Jersey City and individual-impacting policy choices. My results display that the longer a respondent has resided Jersey City, the more willing they are to take individual actions in response to the impacts of a future flood (Table 17).

From this data, I can confirm some of the results from the literature, which argue that a person's finances play a significant role in his or her concern over environmental issues. However, when the impacts of an environmental issue include financial hurdles and inconvenience to a person's daily routines, people are more likely to support flood mitigation policies that require individual effort.

		Age Merged	Years In Current Home Merged	Years In JC Merged	Own Rent
If a major flood damaged my home, I would consider moving to an apartment on a higher floor to reduce the danger from future flooding.	Pearson Correlation	.329*	.013	-.062	-.182
	Sig. (2-tailed)	.033	.931	.682	.226
	N	42	45	46	46
If a major flood damaged my home, I would consider elevating my home to reduce the danger from future flooding and/or lower my insurance rates.	Pearson Correlation	.305	.370*	.328*	-.166
	Sig. (2-tailed)	.071	.022	.044	.372
	N	36	38	38	31
We should limit or restrict development in flood-prone areas.	Pearson Correlation	-.212*	-.196	-.259*	.259*
	Sig. (2-tailed)	.041	.055	.011	.013
	N	93	97	97	91
Development becomes unreasonable if the cost to repair after a flood or hurricane becomes too high.	Pearson Correlation	-.333*	-.058	-.113	-.059
	Sig. (2-tailed)	.020	.688	.429	.681
	N	49	51	51	51

Table 17. Crosstabulation between flood mitigation strategies and policies that were given to residents and a series of variables assessing the length of residency, age and property owners in Jersey City.

I can also deduce from Table 17 that age played a significant role in influencing a respondent's answering patterns and yielded strong correlations to 3 out of the 4 policy variables in Table 17. Recall Table 2, which shows a percent breakdown between age and how likely respondents think they will be impacted by flooding within the next 15 years: The table demonstrates that older residents were much more likely to display concern for future impacts of flooding. I found a similar trend among the length of time

respondents have owned their residences. Only age, years owning a property, and years in Jersey City seemed significantly correlated to policy variables. From this data, it seems that the more observations of flooding events someone has had throughout their lifetime (age) and the more experience someone has owning property (years owning property) are strong influences over a respondent's opinion towards flood mitigation policies. In other words, a lifetime of experiences in the same community - rather than the experience from one single flooding event - had the strongest influence over opinion.

Conclusion

The purpose of this study was to determine how the impacts of significant environmental events influence a person's opinion towards different types of flood mitigation policy. I conducted this research by interviewing city officials to determine the most significant impacts of Hurricane Sandy, then surveyed residents of Jersey City. I found that all residents, regardless of enduring Hurricane Sandy, were in favor of limiting developing in flood-prone areas to prevent future impacts of flooding in Jersey City. While there were a few moderately strong relationships between enduring Hurricane Sandy and concern for future flooding, there was no significant correlation between enduring the direct impacts of Hurricane Sandy and support for any of the specific flood mitigation policies.

However, variables including age, years lived in Jersey City and owning versus renting a home correlated with policy variables that required individual actions. These results are consistent with Gallup (2015), which suggests that the threat of environmental impacts will diminish as the memory of the event fades. That said, the correlating variables listed above suggest that investment in the community (i.e. older and long-term home-owners) have the most concern and the strongest willingness to accept flood mitigation policies. This argument is strengthened by the correlation between concern for the future community and the policy variables in the figure above.

Interview Protocol For Future Studies

The interview protocol I developed to assess the impacts of Hurricane Sandy and the reactions at multiple levels of government proved to be very successful in collecting data as well as engaging policymakers. Through these interviews, I learned ways in which researchers could provide policymakers with meaningful communications and establish long-term relationships for future studies. I was able to stay in contact with interviewees throughout the whole research process by working on specific questions they proposed

during the interviews, then incorporating those questions into the survey. That way, in addition to providing individuals interviewed with a copy of my results, I can also provide them with customized information on how respondents answered questions that interviewees collaborated on. I highly recommend it to be used in future studies that require engagement of policymakers at multiple levels of government.

Public Communication of Results

A primary goal of this research is to develop a discourse for communicating flood mitigation policy and related environmental issues in a way that can be understood by the general public. There is a large body of work within environmental policy that is written in an esoteric fashion, using terms or concepts without sufficient explanation for a reader without a policy orientation to understand. This defies the overarching theme of environmental policy, which is to conduct research that bridges the gap between scientists, policymakers and the general public (Casagrande et al. 2017). Consequently, this work is being presented at a Jersey City Council meeting as well as a meeting with staff from the Mayor's Office. Beyond communications with city officials, this research also strives to communicate with any interested person in the hopes of informing the opinions of residents to ensure that those opinions are considered in future policymaking at the local level. While the results of this survey do not statistically sample the current demographics in Jersey City, the methodology created yielded significant correlations within the population included. I hope that future projects use my methodology and variables as insights for their own methodology with a number of respondents that is statistically representative of the local population. I hope the variety of impacts and opinions assessed in this research speaks to the importance at resident assessment of environmental policy at the local level.

List of References

“About Us.” MTA - Transportation Network, web.mta.info/mta/network.htm.

Abramson, David et. al. “The Hurricane Sandy Place Report: Evacuation Decisions, Housing Issues and Sense of Community.” Rutgers University Community Repository, Apr. 2015,

“A Year After Hurricane Sandy: New Jersey Recovery By The Numbers.” A Year After Hurricane Sandy: New Jersey Recovery By The Numbers | FEMA.gov, FEMA, www.fema.gov/news-release/2013/10/25/year-after-hurricane-sandy-new-jersey-recovery-numbers.

“Billion-Dollar Weather and Climate Disasters: Overview.” National Centers For Environmental Information, NOAA, www.ncdc.noaa.gov/billions/.

Binder, Sherri Brokopp, et al. “Rebuild or Relocate? Resilience and Postdisaster Decision-Making After Hurricane Sandy.” *American Journal of Community Psychology*, vol. 56, no. 1-2, 2015, pp. 180–196., doi:10.1007/s10464-015-9727-x.

Blake, Eric, et al. “Tropical Cyclone Report Hurricane Sandy .” <https://www.nhc.noaa.gov>, 12 Feb. 2013, www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf.

Burger, Joanna, and Michael Gochfeld. “Concerns and Perceptions Immediately Following Superstorm Sandy: Ratings for Property Damage Were Higher than for Health Issues.” *Journal of Risk Research*, vol. 18, no. 2, 2014, pp. 249–265., doi:10.1080/13669877.2014.896401.

Casagrande, D.G., E. C. Jones, F. S. Wyndham, J. R. Stepp & R. Zarger. 2017. *Ecomyopia in the Anthropocene*. *Anthropology Today* 33(1):23-25.

Cohen, Darryl T. “60 Million Live in the Path of Hurricanes.” The United States Census Bureau, 29 Aug. 2018, www.census.gov/library/stories/2018/08/coastal-county-population-rises.html.

Covello, Vincent, and Branden Johnson. *The Social and Cultural Construction of Risk: Issues, Methods, and Case Studies*. D. Reidel Publishing Company, 1987.

“Evacuation, Decisions, Housing Issues, and Sense of Community.” NJ Adapt, Apr. 2015, rucore.libraries.rutgers.edu/rutgers-lib/47318/record/.

Gray, Benjamin J. “Connecting Earth and Sky: Persuading Climate Skeptics through Analogy.” *The Extractive Industries and Society*, vol. 5, no. 2, 2018, pp. 293–296., doi:10.1016/j.exis.2018.03.004.

“Governor Cuomo Declares State of Emergency in New York in Preparation for Potential Impact of Hurricane Sandy.” Governor Andrew M. Cuomo, New York State, 29 Sept. 2014, www.governor.ny.gov/news/governor-cuomo-declares-state-emergency-new-york-preparation-potential-impact-hurricane-sandy.

“Hurricane Costs.” Hurricane Costs, Office For Coastal Management, coast.noaa.gov/states/fast-facts/hurricane-costs.html.

Israel, Brett. “The Biggest Natural Disasters of 2010.” LiveScience, Purch, 28 Dec. 2010, www.livescience.com/10938-biggest-natural-disasters-2010.html.

Jones, Jeffrey. “In U.S., Concern About Environmental Threats Eases.” Gallup.com, Gallup, 25 Mar. 2015, news.gallup.com/poll/182105/concern-environmental-threats-eases.aspx.

Juanchich, Marie, and Miroslav Sirota. “Supplemental Material for How Much Will the Sea Level Rise? Outcome Selection and Subjective Probability in Climate Change Predictions.” *Journal of Experimental Psychology*, Dec;23(4):386-402. doi: 10.1037/xap0000137. Epub 2017 Aug 17.

Kahan, Dan. “Fixing the Communications Failure.” *Nature*, vol. 463, no. 7279, 2010, pp. 296–297., doi:10.1038/463296a.

Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Ballew, M., Goldberg, M., & Gustafson, A. (2018). *Climate change in the American mind: December 2018*. Yale University and George Mason University. New Haven, CT: Yale Program on Climate Change Communication.

Mattern, Shannon, and Jon Schober. “Map Critique: Jersey City.” *Maps as Media Fall 2015*, 2015, www.wordsinspace.net/mapsmedia/fall2015/2015/10/27/map-critique-jersey-city/.

Mccright, Aaron M., and Riley E. Dunlap. “Cool Dudes: The Denial of Climate Change among Conservative White Males in the United States.” *Global Environmental Change*, vol. 21, no. 4, 2011, pp. 1163–1172., doi:10.1016/j.gloenvcha.2011.06.003.

Morris, Mike, and Matt Dempsey. “Even after Harvey, Houston Keeps Adding New Homes in Flood Plains.” *HoustonChronicle.com*, *Houston Chronicle*, 5 Oct. 2018, www.houstonchronicle.com/news/houston-texas/houston/article/Even-after-Harvey-Houston-keeps-adding-new-homes-13285865.php.

Moss, Mitchell, and Carson Qing. *The Dynamic Population of Manhattan*. New York University - Wagner, Mar. 2012, wagner.nyu.edu/files/rudincenter/dynamic_pop_manhattan.pdf.

Nisbet, M. C., and C. Mooney. “SCIENCE AND SOCIETY: Framing Science.” *Science*, vol. 316, no. 5821, 2007, pp. 56–56., doi:10.1126/science.1142030.

“NYC Quarterly Economic Update.” *Comptroller.nyc.gov*, NYC Comptroller’s Office, Bureau of Budget, Feb. 2019, comptroller.nyc.gov/reports/new-york-city-quarterly-economic-update/.

Office of the Mayor. “Sandy Recovery Strategic Planning Report.” *City of Jersey City*, Aug. 2014.

PATH Partial Service Restoration, The Port Authority of New Jersey and New York, www.panynj.gov/path/path-rail-system-map.html?KeepThis=true&TB_iframe=true&height=305&width=445.

Rudman, L A, et al. "When Truth Is Personally Inconvenient, Attitudes Change: the Impact of Extreme Weather on Implicit Support for Green Politicians and Explicit Climate-Change Beliefs." *Current Neurology and Neuroscience Reports.*, U.S. National Library of Medicine, 1 Nov. 2013, www.ncbi.nlm.nih.gov/pubmed/24058064.

Service, U.S. Fish and Wildlife. "Hurricane Sandy Recovery | U.S. Fish and Wildlife Service." *About The Storm*, 6 Mar. 2019, www.fws.gov/hurricane/sandy/about.html.

Severson, Alexander W., and Eric A. Coleman. "Moral Frames and Climate Change Policy Attitudes." *Social Science Quarterly*, vol. 96, no. 5, 2015, pp. 1277–1290., doi:10.1111/ssqu.12159.

"Region II Coastal Analysis and Mapping." FEMA Flood Map Service Center , Federal Emergency Management Agency, msc.fema.gov/.

Solecki, William, et al. "Extreme Climate Events, Household Decision-Making and Transitions in the Immediate Aftermath of Hurricane Sandy." *Miscellanea Geographica*, vol. 21, no. 4, 2017, pp. 139–150., doi:10.1515/mgrsd-2017-0029.

Stoffer, Phil, and Paula Messina. "Raritan Bay." *GEOLOGY AND GEOGRAPHY OF NEW YORK BIGHT*, www.geo.hunter.cuny.edu/bight/raritan.html.

Swift, Art. "Americans Again Pick Environment Over Economic Growth." *Gallup.com*, Gallup, 20 Mar. 2014, news.gallup.com/poll/168017/americans-again-pick-environment-economic-growth.aspx.

Tompson, Trevor, et al. "Resilience in the Wake of Superstorm Sandy." *Law Enforcement and Violence: The Divide between Black and White Americans Issue Brief | APNORC.org* | APNORC.org, 2013, www.apnorc.org/projects/Pages/resilience-in-the-wake-of-superstorm-sandy.aspx.

"The New Jersey CONSTRUCTION REPORTER: 2012 Annual Report." *Official Site of The State of New Jersey*, 2012, www.state.nj.us/dca/divisions/codes/reporter/2012yearly/cr_annual_2012.pdf.

"U.S. Census Bureau QuickFacts: Jersey City City, New Jersey." *Census Bureau QuickFacts*, United States Census Bureau, www.census.gov/quickfacts/jerseycitycitynewjersey.

Wong-Parodi, Gabrielle, et al. "Plans and Prospects for Coastal Flooding in Four Communities Affected by Sandy." *Weather, Climate, and Society*, vol. 9, no. 2, 2017, pp. 183–200., doi:10.1175/wcas-d-16-0042.1.

Appendix A

Jersey City Resident Survey

You are invited to participate in a survey about flooding in Jersey City being conducted by Lehigh University. The survey will take 15 minutes or less to complete. You must be 18 years old or older to participate in this study. Your participation is voluntary. Please take as much time as you need to read this information sheet, and know that you may take time to discuss the survey with your family or friends.

PURPOSE OF THE STUDY

We are asking for your feedback as part of a research study on the impacts of Hurricane Sandy to Jersey City residents.

Continuing to the next page of this online survey will constitute consent to participate in this research project. **POTENTIAL RISKS AND DISCOMFORTS**

There are no anticipated risks to your participation. Should you feel uncomfortable about responding to some questions, please feel free to skip them.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

You will not directly benefit from your participation in this research study. However, participation will give you the opportunity to voice your opinions.

PAYMENT/COMPENSATION FOR PARTICIPATION

You will not receive any payment for your participation in this research study.

POTENTIAL CONFLICTS OF INTEREST

The investigators of this research do not have any financial interest in the conditions or improvements being studied.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. The information collected about you will be coded using a fake name (pseudonym) or initials and numbers, for example abc-123, etc. You will not be asked to provide any identifiable information and no part of your conversation with the research team will be recorded.

When the results of the research are published or discussed in class presentations or conferences, no information will be included that would reveal your identity.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be part of this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you are reluctant to answer and still

remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

ALTERNATIVES TO PARTICIPATION

Your alternative to participation is to not participate.

RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have any questions about your rights as a study subject or you would like to speak with someone independent of the research team to obtain answers to questions about the research or in the event the research staff cannot be reached, please contact the Lehigh University Office of Research and Sponsored Programs at 610-758-2985 or nac314@lehigh.edu.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact the Principal Investigator:

Eli Jacobson Environmental Initiative Lehigh University elj217@lehigh.edu
610-758-1221

In what county and town do you reside?

The following questions pertain to your residence in Jersey City.

Please identify which Ward your residence is located in (refer to the map below if you don't know).

- Ward A
- Ward B
- Ward C
- Ward D
- Ward E
- Ward F
- I am unable to identify which Ward my residence is located in

How many years have you lived in your current home?

How many years have you lived in Jersey City?

Do you own or rent your primary residence?

What kind of residence do you live in?

- Single Family Home
- Duplex House
- Apartment Building - 1 To 4 units
- Apartment Building - 5 To 10 units
- Apartment Building - 11 To 19 units
- Apartment Buildings - 20 Or More Units

If applicable, what floor is your residence located on?

- Ground Level
- First Floor
- 2nd Floor Or Above
- Not Applicable

How often do you use the following?

- PATH Train
- Hudson-Bergen Light Rail
- NJ Transit Bus
- Public Parks In Jersey City
- Hudson River Waterfront Walkway (Boardwalk facing Lower-Manhattan)
- Hudson Mall
- My Local Grocery Store

Do you carry flood insurance?

- Why do you carry flood insurance? Check all that apply.
- I want to protect the investment in my home
- It's affordable
- It's required for my mortgage
- My risk of flooding is high
- Someone I trust recommended it
- FEMA assistance after a flood is inadequate
- I don't have enough savings to pay for flood damage
- I tend to insure everything I can
- Other:
- Don't know

Why do you NOT carry flood insurance? Check all that apply.

- It's too expensive
- I thought it was already included in my standard homeowner's insurance
- It's a government intrusion in my life
- My risk for flooding is low
- It's not available in my community
- I didn't know it was available
- It's not necessary because FEMA provides assistance after a flood
- I have enough savings to pay for flood damage
- Other
- Don't know

Were you impacted by Hurricane Sandy?

Do you know anyone who was impacted by Hurricane Sandy?

Did you or someone you know face the decision between rebuilding or moving in response to Hurricane Sandy?

In any flood you've experienced, what was the most damage your home incurred?

- Less Than \$4,000 In Damage
- \$4,000-\$24,999 In Damage
- \$25,000-\$99,999 In Damage
- \$100,000 Or More In Damage
- Don't Know

Please rank the following ways you were impacted by Hurricane Sandy:

- Loss of Power
- Loss of Phone Communication
- Street Damage (Trees and Powerlines Down)
- Structural Damage To Residence (e.g. Tree Falling on Home)
- Flooding In Home
- Lack of Transportation
- No Heating/Cooling In Home
- Ability To Get Gas For Car
- Ability To Get To Work
- Ability To Live In Home
- Ability To Access Food Or Other Basic Needs
- Mold (Toxins) Or Dampness In Home
- Exposure To Chromium Or Other Toxins From Industrial Processes

Please indicate whether you agree or disagree with the following statements:

- The city responded effectively to Hurricane Sandy within the first 48 hours.
- The city has responded effectively to the impacts of Hurricane Sandy over the last 5 years.
- I was able to communicate with my neighbors during/after Hurricane Sandy.
- I felt that I had adequate information on evacuation procedures before/during Hurricane Sandy.
- I was able to get food and other supplies in the days after Hurricane Sandy.
- I would oppose flood mitigation policies that block my view of or access to the rivers.
- My experience during and immediately after Hurricane Sandy increased my concerns about future flooding.
- My experience during and immediately after Hurricane Sandy increased my support for efforts to minimize flood risk.

How likely do you think it is that you will experience flooding in your home in the next 15 years?

How likely do you think it is that you will be otherwise impacted by flooding in the next 15 years?

How concerned are you that a future flood could negatively affect each of the following?

- Your Household Finances
- Your Emotional Well-Being
- Your Physical Health
- Your Safety
- The Future of Your Community

How well do you agree with the following statements?

- Floods are occurring more frequently as they used to.
- I get warned about a flood in time to take action.
- My risk of flooding is worse than the risk people in other places face from other kinds of disasters.
- If you know what you are doing, you don't have to be afraid of flooding.
- My community leaders are capable of managing flood risk.
- I can rely on friends and neighbors to help me during a flood.
- My opinion matters in local and state government decisions about managing flood risk.

How well do you agree with the following statements?

- If a major flood damaged my home, I would consider moving to an apartment on a higher floor to reduce the danger from future flooding.
- If a major flood damaged my home, I would consider elevating my home to reduce the danger from future flooding and/or lower my insurance rates.

How well do you agree with the following statements about managing flood risk?

- We should reduce the risk of flooding by building levees or flood walls.
- We should minimize damage caused by flooding through local planning, zoning, and ordinances.
- We should limit or restrict development in flood-prone areas.
- We should reduce the risk of flooding by restoring natural wetlands.
- After a damaging flood, the government should buy flooded homes at market value from homeowners willing to sell and prohibit any future building on those sites.
- Instead of waiting for a damaging flood, the government should buy homes now at market value from homeowners willing to sell and prohibit any future building on those sites.

How well do you agree with the following statement?

- Development becomes unreasonable if the cost to repair after a flood or hurricane becomes too high.

Which describes the people who live in your home?

Please select all that apply.

- Live Alone
- Two Or More Adults
- Children
- Elderly Or Disabled

Describe the people who live in your home? Please select all that apply.

- Work Full Time
- Work Part Time
- Student
- Unemployed
- Retired
- Other Or Don't Know:

What is the highest level of education you have attained?

- Less Than 12th Grade (No Diploma)
- High School Graduate Or GED
- Some College But No Degree
- Associate Degree In College
- Bachelor's Degree
- Master's Degree
- Doctorate / Professional Degree
- Don't Know

In what year were you born?

What is your gender?

- Male
- Female
- Other
- Prefer Not To Answer

Which of the following represents your annual household income in 2017?

- Less than \$25,000
- \$25,000 to \$49,999
- \$50,000 to \$99,999
- \$100,000 to \$199,999
- \$200,000 to \$399,999
- \$400,000 or more
- Don't know

Thank you for taking the time to respond. Please feel free to share any information or experiences you have that relate to the questions we addressed in the survey.

Appendix B

I interviewed the following people:

- James Solomon - Councilman
- Mira Prinz-Arez - Councilwoman
- Denise Ridley - Councilwoman
- Joyce Watterman - City Council President
- Patrick Stamato - Director of Public Works
- Raymond Meyer - City Code Official
- Alycia Cohen - City Environmental Specialist
- Katherine Lawrence - Office of Sustainability
- Brittany Rose Kelly - MUA (Municipal Utilities Authority) Project Manager
- Stephen Cea - Director of Public Housing
- Jennifer Gonzalez - Hoboken Office of Sustainability
- Douglas Pabst - EPA Flood Specialist

The following questions were asked to each interviewee:

1. Tell me about your professional experience leading up to your current role.
2. What are the general responsibilities of your current role? Your office?
3. Are there ways for the public to give their input about city projects that are developed in your office?
4. Has general public opinion changed at all in the time you began assessing it for your current role? How, if so? What events caused this change?
5. In your opinion, what were the most significant impacts to residents caused by Hurricane Sandy? Were you a resident at the time?
6. Tell me about the impacts that events like Hurricane Sandy might have had on the policies, projects and protocols that go through your office.

Questions Regarding My Project

1. After explaining: What do you think about the goal behind my project? What do you think the outcome will be?
2. Are there any questions you -as an individual- would be interested in asking these participants?
3. 3) Are there any questions - that I could ask- that would help develop better policies and projects within your office?

Appendix C

Respondent Survey Letter

The letter below was mailed to 7,500 addresses in Jersey City, NJ. With the exception of one stratified sample of 1,000 respondents, the addresses were randomized. We bought the respondents from MSG (Marketing Systems Group). The letters were printed and mailed by the Lehigh University Printing and Mailing Services.

Dear Jersey City Resident,

Researchers at Lehigh University are conducting a study **to understand how city residents in coastal areas are impacted by significant environmental events (i.e. hurricanes, flooding etc.)**. You have been selected to participate in a short online survey. Direct experience with these types of events –like Hurricanes Sandy or Irene– are not required to complete the survey and provide your input.

The survey will take about **15 minutes to complete**. In appreciation for your time, we will enter you in a raffle for a **\$100 Amazon gift card** if you complete the survey by **December 20th**. To take the survey, please type the following link into your web browser's address bar or scan the QR code below.

The survey address is go.lehigh.edu/jerseycity

Your responses will help improve local and state flood mitigation policies. Our research team has conducted several interviews with Jersey City council members, heads of city departments, and regional representatives of related federal agencies to design this survey. Upon the completion of this project, we will communicate the results back to these policy personnel. All information we share will be anonymous. **This is your opportunity to directly influence public policy!**

If you have questions or concerns regarding this study you are encouraged to contact Lehigh University's Office of Research and Sponsored Programs at 610-758-2985 or elj217@lehigh.edu. All reports or correspondence will be confidential.

Thank you for your time.

Sincerely,
Dork Sahagian
Professor of Earth and Environmental Sciences
Lehigh University
Environmental Policy Program

Appendix D

Informed Consent Given To Interviewees

Assessing Impact of Significant Environmental Events On Attitudes Towards Mitigation Policies

You are invited to participate in a research study, made possible by the Lehigh University Pyramid Foundation and conducted by graduate students and faculty. You must be 18 years old or older to participate in this study. Your participation is voluntary. Please take as much time as you need to read this information sheet.

PURPOSE OF THE STUDY

We are asking for your professional input as part of a research study on the impacts that significant environmental events –like Hurricane Sandy- had on the daily life of Jersey City residents.

Your full name printed and signed at the end of this form will constitute consent to participate in this research project.

PROCEDURES

You will be asked questions based on your experience as a professional working in Jersey City. The duration of the interview will be based on the overlapping availabilities of both yourself and the interviewer.

POTENTIAL RISKS AND DISCOMFORTS

There are no anticipated risks to your participation. Should you feel uncomfortable about responding to any questions, please feel free to notify the interviewer, and the question will be skipped.

POTENTIAL BENEFITS TO SUBJECTS AND/OR TO SOCIETY

You will not directly benefit from your participation in this research study. However, participation will give you the opportunity to voice your opinions about environmental policy and potentially influence future city policies.

PAYMENT/COMPENSATION FOR PARTICIPATION

You will not receive any payment for your participation in this research study

POTENTIAL CONFLICTS OF INTEREST

The investigators of this research do not have any financial interest in the conditions or improvements being studied.

CONFIDENTIALITY

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law.

PARTICIPATION AND WITHDRAWAL

You can choose whether to be part of this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer

any questions you are reluctant to answer and still remain in the study. The investigator may withdraw you from this research if circumstances arise which warrant doing so.

ALTERNATIVES TO PARTICIPATION

Your alternative to participation is to not participate.

RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have any questions about your rights as a study subject or you would like to speak with someone independent of the research team to obtain answers to questions about the research or in the event the research staff cannot be reached, please contact the Lehigh University Office of Research Integrity at 610-758-2871 or inirb@lehigh.edu.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please feel free to contact the Principal Investigators.

ELI JACOBSON
eli.sustainability@gmail.edu

EDUCATION

- MA** Lehigh University, Environmental Policy Design Anticipated May 2019
Teaching Assistantship and Pyramid Fellowship Recipient
- BS** Binghamton University, Environmental Studies May 2017

SKILLS

Water Quality Measurements: pH, conductivity, flow meters, and collection of sensors using a YSI 6600

Computer: Microsoft Office Software, Qualtrics Survey Programming, Linux/Unix, Drupal, SPSS. STATA

RESEARCH AND WORK EXPERIENCE

- Graduate Assistant - Office of Sustainability** | Lehigh University 2018
- Manage data collection, input and communication of sustainability metrics for the submission of Lehigh University's annual sustainability report and Scope 3 Greenhouse Gas Emissions Inventory (SIMAP)
 - Oversee a team of 8 undergraduate students to collect food expenditure data from dining services for the Real Food Challenge to determine the percent of expenditures that qualify as "Real Food" (local, organic, humane etc.)
 - Communicate with several departments and offices on campus for the acquisition of data and work with them on ways to elicit faculty/staff participation to improve the campus' carbon footprint
- Dissertation** | Lehigh University 2018
Advisor: Dork Sahagian
- Develop a mixed-method project that assesses the relationship between enduring a significant environmental event and forming opinions about flood mitigation policies in coastal urban areas
 - Launch a survey to residents in Jersey City about Hurricane Sandy experiences (case study) to generate findings for the initial research question
 - Reach out to 40 public officials at multiple levels of government to gain a rounded understanding of Hurricane Sandy's impact in coastal urban areas, policies enacted in response and question recommendations for the survey
- Independent Research** | Binghamton University 2016-2017
Advisor: Robert Holahan
- Formulated a study to analyze interstate transportation systems regulated by the PANYNJ as common-pool resources

- Compiled data from state agencies and PANYNJ to produce a linear relationship between increased residential development in Jersey City, public transportation fares, and heightened allocation of funds towards maintenance/repairs

Annis Water Resources Institute REU | Muskegon, MI 2016

- Recorded levels of sediment erosion using a system of horizontal staves in stream sites that displayed a valid representation of the entire watershed
- Collected experiment data and assisted the lab team with NSF-funded projects including Muskegon Lake Long-Term Monitoring, Project Clarity: Macatawa Restoration, and Bear Lake Restoration

NCA&T Earth Science REU | Greensboro, NC 2015

- Researched the societal and environmental impacts of hydraulic fracturing processes in NY, NC, and PA
- Developed a two pronged survey with 50+ questions to determine a person's ecological opinions, political identification, and original opinion towards hydraulic fracturing

TEACHING EXPERIENCE

Teaching Assistant - Environmental Studies | Lehigh University 2017-2018

- Facilitated and graded class discussions on interdisciplinary environmental issues
- Contributed towards the development of class content, including important concepts, discussion questions and quiz questions

Teaching Assistant - Environmental Studies | Binghamton University 2015

- Taught two- 15 student- laboratory sections of Environmental Studies 101: The Environment and Man/Woman: An Ecological Perspective
- Designed lesson plans and field labs on topics including agriculture, forestry, nutrition, public health and interdisciplinary relationships

EXTRACURRICULAR ACTIVITIES

Lehigh University Jazz Ensemble | Jazz Drums 2017-2018

Binghamton University Jazz Ensemble | Jazz Drums 2015-2017

New Jersey All Shore Jazz Band | Jazz Drums 2012-2013