Establishing Baseline and Comparative Frameworks of Flood Risk Awareness, Adaptation, & Mitigation in Troy & Kingston (Phase III)

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Abstract

In 2019, the CaRDI-based team accomplished two main objectives. (1) We designed a household survey questionnaire for implementation in Troy and Kingston. We finalized the survey instrument and identified the sampling design in consultation with the Hudson River Estuary Program and Cornell's Survey Research Institute (the survey was implemented in late spring 2020, with a delay due to the COVID-19 pandemic). (2) The team has also analyzed data from focus group discussions and interviews and presented initial results from qualitative work at four conferences. Qualitative data analysis activities have included coding of focus group and interview transcripts, analyzing and contextualizing core themes in participants' statements about flood risk and resilience measures, presenting initial findings for feedback, and starting to compose a journal article. These analyses have raised questions about flood insurance and attitudes toward local government that we have incorporated into the household survey questionnaire. Based on this work the research team has secured federal and state funding in 2020 to expand our work to other locales.

Three Summary Points of Interest

- **Household survey designed for implementation in Troy & Kingston, with over-samples of floodplain areas;**
- **Analysis of focus group and individual interviews, with findings reported a conference presentations;**
- **Analyses to date have leveraged efforts to secure funding for expanding in work in other locales 2020-2023.**

Keywords

Flood risk, sea level rise, Hudson River, climate migration, risk perception, household survey, outreach, adaptation, mitigation, trust in government, flood insurance

<u>Policy implication statement</u>

This work seeks to inform new and improved outreach approaches to more effectively engage community residents and policymakers on the topic of flood risk, resiliency, and mitigation strategies.

Introduction

The eastern US coast, including inland estuarine areas, has experienced an increase in severe weather impacts in recent years. The Hudson River is rising with the sea. Scientists project river levels to rise up to 10" by the 2020s and up to 27" by 2050 (NYS Sea Level Rise Task Force 2010 and Rosenzweig, 2012). Higher sea levels worsen flooding and put coastal and estuarine communities at risk. People, businesses and governments located in high risk areas are increasingly confronted with the question of what to do in anticipation or in response. Many will try to adapt, using a variety of strategies, in order to stay in place. But increasing frequency and cost of damage also raises the probability of "climate migration", the planned or unplanned move to what are perceived as lower risk locations. This is important to consider at many levels, e.g. individual, neighborhood, and community. Our on-location collaborators at the Hudson River Estuary Program (Estuary Program) confirm that they currently have few resources and even less relevant research-based information to offer their constituencies on the subject of climate-based relocation and migration. Trends in federal policy only enhance the benefits of considering local, regional and state roles in planning for climate change. Such planning includes explicit climate disaster and hazard mitigation planning, but also more comprehensive forms of community planning.

Based on knowledge from existing literature about general responses to environmental risk, our research assesses Hudson River Valley residents' perceptions of near/longer term vulnerabilities, their perceptions of local government responsiveness, how this varies by income and access to other resources, and factors they weigh in decisions to migrate or adapt in place. A better understanding of these will be critical for many NYS coastal and estuarine communities as they anticipate, plan for, and are subjected to more frequent disruptive climate driven events related to sea-level rise and related flooding.

New York's Community Risk and Resiliency Act, signed into law in 2014, specifically requires the state to update science based sea-level rise projections at five year intervals. It is already clear that higher sea levels will worsen flooding and put coastal and estuarine communities at risk. People, businesses and governments located in high risk areas are increasingly confronted with the question of what to do in anticipation or in response and highlights the need to consider local and state roles in both climate disaster response and more proactive planning. Moreover, the uneven distribution of costs and benefits at the subnational level clearly influences national policy: for example, implementation of the national Biggert Waters National Flood Insurance Reform Act of 2012 was slowed due to strong regional resistance to its financial and political implications (National Research Council, 2015). In many ways, our knowledge of the psychological and socioeconomic effects of policy-supported relocation are in their infancy. For example, one recent study on post-Sandy Staten Island buyouts paid close attention to the location and well-being of residents who participated in the buyout. The author cautions that at least this relocation (buyout) policy has not, as intended, reduced resident vulnerability as broadly defined: "overall vulnerability, measured in terms of exposure and social vulnerability, increased for 321 of the 323 buyout participants considered by this study". (McGhee, 2017). More specifically, while only a few residents moved somewhere that increased their "exposure" vulnerability, all but a few moved to areas with a higher social vulnerability index as measured in particular by higher concentrations of the elderly and/or of poverty.

Conceptualizing risk and adaptation

Our work draws upon the long history of US and global scholarship into the role of risk factors, direct and mediated, in responses to resident perceptions, behaviors, residential preferences and migration behaviors. At least since the appearance of Wolpert's (1966) "stress-threshold" model and its explicit invocation of "danger-security" stressors, researchers have been concerned with the role of noneconomic worries in moving plans and noted the premium that urban dwellers, in particular, place on mobility to escape from peril (Little, 2006). Risk and fear can degrade property values (Hipp, Tita, and Greenbaum, 2009; McClelland, Schulze, and Hurd, 1990; Runge et al., 2000), prompt urban homeowners to seek suburban refuge (Bayoh, Irwin, and Haab 2006; Cullen and Levitt, 1999), and scatter employers while prodding working families to relocate or lose their jobs (Stehr, 2006). More abstractly, accumulating risk and disamenities may heighten "topophobia," or fear of place (Janz, 2008), and stoke the yearnings of city dwellers burdened with "stage fright" (Janz, 2008) for the security they associate with lower-profile, lower-density places (Low, 2003; Newman and Hogan, 1981).

In order to devise effective strategies to mitigate some level of risk and to adapt to risk that remains, it is important to understand both the risk itself and localized perceptions about risk. For decades, researchers have been studying risk perception, devising strategies to disentangle the often-complex assessments of risk, or of what is, in fact, "risky", and what levels of concern and response different kinds of risk evoke. The fields of behavioral economics and decision research have been profoundly shaped as this research has evolved (Kahneman, 2011). Policy makers have also increasingly paid attention to the lessons of research (Thaler and Sunstein, 2008). Those involved in health and safety promotion, for example, have sought this information in order to ascertain how people recognize and react to hazards in the hopes of improving education and communication strategies for risk management (Slovic, 1987). Because "individuals do not always share the same perception about the meaning and the underlying causes of different risks… understanding how the risk perception affects risk-coping and adaptation strategies is [becoming] increasingly important" (Iwama et al., 2016: 94-95).

Researchers often categorize risk perception on more than one dimension. For example, the UN Office for Disaster Risk Reduction (UNISDR, 2009) has classified risk as: (1) the likelihood of an outcome, and (2) the potential consequences or losses that accrue following an event. In a meta-analysis of risk perception and behavior, Brewer and colleagues (2007) examined the relationship between belief about disease risk and its relationship to vaccination on dimensions similar to the UNISDR's: (1) the likelihood of being harmed and (2) the severity of the apparent threat, along with a third: (3) apparent susceptibility to harm. The meta-analysis concluded that all three were important predictors of behavior.

In inquiries pertaining specifically to climate change-related risk, one line of research has assessed the ways in which people feel psychologically distant (geographically, socially, and temporally) from or proximate to climate risk (Spence, Poortinga, and Pidgeon, 2012). Similarly, Iwama et al. (2016) have examined place-specific contextual information, along with social, psychological, cultural factors, and the availability and sources of information concerning risk. All of these factors are potentially important in determining the likelihood that members of the public will engage in more sustainable future-oriented behavior (Spence, Poortinga, and Pidgeon, 2012); and they are likely to

be critical in the development of effective adaptive responses to potential threats.

Like risk perception, adaptive responses to climate-related risks are often classified in the literature on multiple, often overlapping dimensions. For instance, adaptation has been classified as (1) reactive or anticipatory; (2) technological, behavioral, managerial, or policy-implementing; (3) autonomous or planned; characterized by (4) protection, retreat, or accommodation; and focused (5) in the public or private sector; and (6) on human or natural systems (Francisco, 2008; IPCC, 2001; UNFCCC, 2006). Examples of adaptive responses that are anticipatory, that work on human systems, and operate through the public sector could include developing early warning systems, building dykes, and devising new building codes. Examples of technological adaptations can include those that protect (dykes, seawalls), retreat (setback zones, relocation), and accommodate (early warning systems, hazard insurance, upgraded drainage systems, desalination projects) (UNFCC, 2006).

Leiserowitz (2006) has argued that theorists generally believe that individual decisions about climate-related risk and adaptation are made cognitively and are less influenced by emotion or affect. He has found, however, that fundamental worldviews very much affect both the ways in which risk is understood by the American public, and the ways in which public policy solutions to climate change are prioritized. In addition, an individual's adaptive response to a perceived threat is likely to be influenced by whether or not available solutions are thought likely to be effective (and likely to produce greater benefits than costs, as in an evacuation, for example). Responses may also depend on whether or not certain options are open to individuals or groups, or are seen as within their capacity to act (Eiser et al., 2012). Our research considers both environmental risk and potential adaptation in New York State, with a particular focus on perceptions of risk *and* perceptions of local government responsiveness to risk.

Migration, risk, and response

Migration as a response to environmental risk has been at the center of work by many authors including Hunter (2005); Mueller, Loomis, and González-Cabán (2009); Petersen (1958); and Wolpert (1966). In relatively recent work, McLeman and Hunter (2010) highlight a number of important dimensions that shape the extent and nature of climate induced migration: environmental causes that include an array of both pushes and pulls; temporal dimensions that range from short term to permanent relocations; spatial dimensions including localized, intraregional, and interregional migration patterns; and the choice set of possible adaptations of which permanent migration, in polar contrast to "nonmigration", is often an option of "last resort". Myers et al. (2008) are among those who have highlighted the role of social vulnerability in post disaster migrations in the US -- they conclude that outmigration has correlated most strongly with the proportion of disadvantaged populations and the extent of housing damage.

Although extensive future displacement from flooding events is considered likely by numerous climate scholars, many "reject the deterministic view that directly links climate change to mass migration. Instead, they recognize that the linkages are complex and operate through social, political, economic, and demographic drivers, with migration being just one of many possible adaptations to environmental change" (Fussell, Hunter, and Gray, 2014: 182; McLeman and Hunter, 2010). Similarly, a recent review of the literature by Hunter et al. (2015) argues that sociologists can add to the base of knowledge

concerning the relationship between migration and environmental conditions by focusing on "issues of inequality, perceptions, and agency". Their review affirms that there is a growing consensus in this literature that a) migration is often a household strategy to diversify risk, b) decisions are influenced by household composition, and c) that household migration choices depend significantly on individual characteristics; social networks; and historical, political, and economic contexts.

In view of conflicting perspectives within the risk response, residential mobility, and migration literatures (Bickers, Salucci, and Stein, 2006; Goldhaber, Houts, and Disabella, 1983; Hunter, 2005; Regoeczi, 2002; Sunstein, 2003), Kay et al. (2010) have proposed that responses to risk can be organized through the competing psychodynamic lenses of salience and resilience (many factors other than risk can dominate location decisions; cf. De Jong and Sell, 1977; Lu, 1999; Bonanno, 2005; Sheppard et al., 2006), stress/risk aversion (most populations are risk averse, particularly in the face of "fearsome" events, cf. Halek and Eisenhauer, 2001; Palsson, 1996; Sunstein and Zeckhauser, 2008), and stability: when people feel vulnerable, the importance of affiliation (Rofe, 1984), connectedness (Reich, 2006), and sticking to familiar routine (Kunreuther et al., 2002) increases.

We draw on the literature on climate change related risk assessment and adaptation, and on field observations, focus group interviews and key informant interviews to address questions such as the following: (1) how are people who live in flood-prone communities experiencing gradual change on a regular basis and dramatic events on an occasional basis? (2) What changes, if any, are they making to prepare for ongoing or worsening conditions? Is out-migration one of the changes they currently envision making? (3) What steps are being taken at the local level to reduce risk for community members, and what do local officials report as their greatest accomplishments and challenges when it comes to gradual environmental change, as well as to more abrupt events? A better understanding of these and other questions are critical for many New York State communities as they plan for more frequent disruptive climate change-related events, and the potentially significant impacts of induced migration. Our long term goals are to conduct a systematic assessment of multiple New York State places facing climate risk, and to develop recommendations for more effective adaptive responses.

Our work in 2019 focused on fully researching and designing a survey to gather data to examine the extent to which past experiences with "similar" risks, trust in government, and social norms affect risk perception and a variety of anticipatory/preparedness risk management activities. We will also assess interacting effects among these factors. In collaboration with the Hudson River Estuary Program, we also measure attitudes toward a set of typical intervention scenarios involving varying degrees of policy or collective action aimed at flood (1) resistance (e.g., hard infrastructure), (2) accommodation (e.g., loans to homeowners with insurance premium offsets), and (3) retreat (property buy-outs). We draw on relevant psychometric literature highlighting significant risk characteristics, recent efforts to theorize response behavior in relation to social identity theory, and sociological risk literature that foregrounds issues of governance, public trust, and democracy

Our research questions primarily focus on: risk perception/concern; adaptation (risk mitigation actions); and housing, insurance, and risk perception.

Risk perception/concern:

- What sociodemographic factors are associated with greater or lesser perceived flood risk AND concern about flooding?

- Do people who express different levels of concern about flooding (or perceived flood risk) consult different sources of information about flooding and other concerns?
- How does concern about flood risk rank relative to other concerns?
- How does perception of flood risk (and flooding concern) related to (spatially distributed) measures of flood exposure (past flooding, FEMA maps, etc)?
- How does trust or confidence in different levels of government (local, state, national), as well as various information sources influence risk perception?

Adaptation (Risk mitigation actions):

- What factors affect risk mitigation behaviors (purchasing insurance, home modifications, migration)?
- Does perceived flood risk AND flood concern influence intentions to move away?
- How does concern about flood risk rank relative to other concerns?
- How does past experience of floods influence intentions to move away? [For within community or outside community, or both?]
- How do these influences rank relative to other factors that influence moving decisions?

- Does perception of other people taking risk mitigation actions better explain risk mitigation actions than risk perception?
- How does collective social capital affect individual risk mitigation actions?
- How does trust in institutions affect likelihood of taking risk mitigation actions?
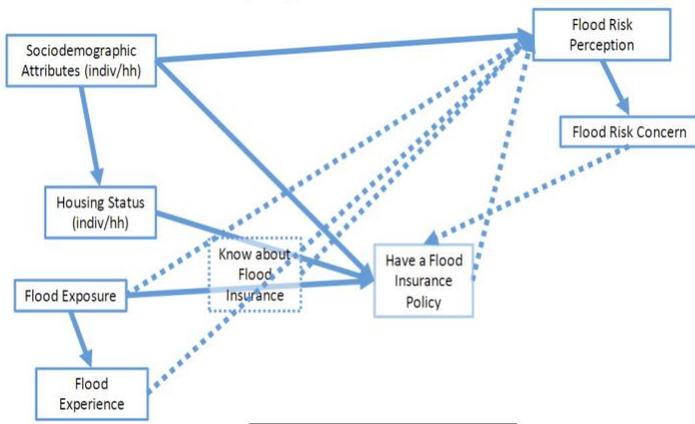- How does the cost or difficulty of actions shape these relationships?
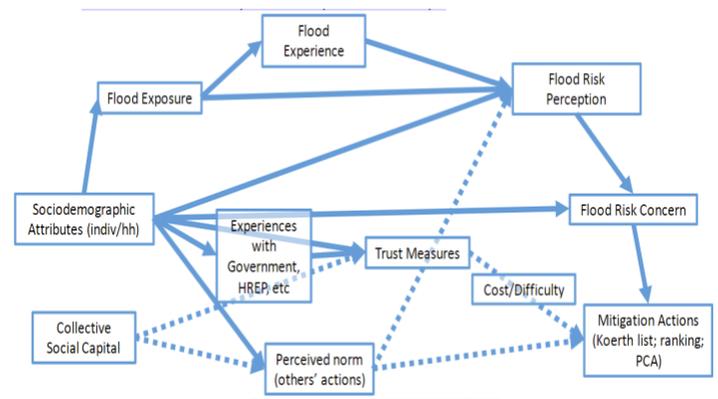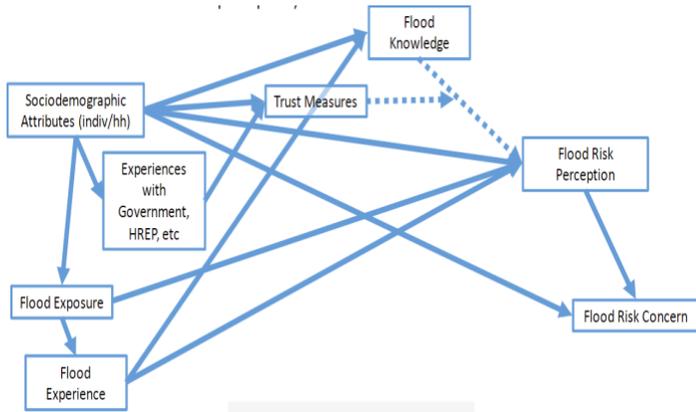
Housing, Insurance, and Risk Perception:

- How do housing status (owner, renter) or encounters with the flood insurance system influence flood risk perception and concern?
- Do these factors mediate the effects of other variables on flood risk perception and flooding concern?
- Can we better understand insurance purchase as a response to risk concern or an event that fosters risk perception or concern?

Methods

During 2019 we were fully focused on developing a robust survey instrument designed to more fully explore and measure community member awareness, attitudes, knowledge, behavior and practices pertaining to flood risk. Many of the survey questions were informed by prior surveys on related topics such as Rutger's *Forest and Climate Change Perceptions* (2016), an NSF/Stanford/ Oregon State University survey on tornado risk perception (2014), a Miami/Houston air pollution and flood risk survey (2012), among others.

The survey was developed initially to provide baseline information for the Estuary Program in advance of the Estuary Program commencing outreach programming in Troy. However the survey also has the potential to provide information valuable for more intensive targeting and intervention efforts. Implementation would serve several purposes, including at least: a) provide a baseline measurement of attitudes, knowledge, etc. prior to any significant Estuary Program programming, b) provide information that would be useful in guiding initial implementation of planned the Estuary Program programming efforts, and c) serve as the core of an instrument that could be used for program evaluation purposes in future years to determine if the attitudes, knowledge,

etc. of different kinds of city residents has changed, either due to programmatic interventions of the Estuary Program and other organizations, or for other reasons.

The survey was developed for implementation in both Troy and Kingston, NY, allowing us to not only continue building upon our work in Troy, but also provide an opportunity to compare our indicators of interest to those in another city. While the City of Troy has had no formal flood risk programming to date, the City of Kingston has received significant Estuary Program and other systematic efforts to engage the community around flood risk, adaptation, mitigation, and other related issues. The ability to compare and contrast the results from these two locations will not only provide a richer analytical framework for our research questions, but will potentially yield additional insights into the impact and appropriate methods of outreach programming. We collaborated with the Estuary Program as we finalized the survey instrument with Cornell's Survey Research Institute.

The survey will be implemented by the Survey Research Institute at Cornell University. In our two distinctive but deliberately paired flood prone Hudson River cities, questionnaires will be mailed to a random sample of 225 households, stratified with an added oversample of 150 residences within the 100-year floodplain defined by the Federal Emergency Management Administration, to ensure an adequate sample of flood-vulnerable households.

We append the survey instrument to this report. Please note that further work on the instrument was done in early 2020 as the COVID-19 pandemic spread. Due to this unique and influential context, we redesigned the survey to incorporate parallel measures of COVID-19 risk perception and behavior. We plan to measure predictors of concern and response behavior derived from relevant literature. The framework for many of our COVID-19 related survey questions benefited from several

other surveys on health risk, behavioral changes related to COVID-19 perceived risk, etc.

We will test hypotheses, with special attention to risk interactions, on how self-reported perceptions and responses vary between two risks that share and differ across key psychometric and sociological constructions in their risk profiles.

Results, Policy Implications, etc.

The survey has gone out into the field in early 2020. The next phase report for 2020 will include the survey data analysis, discussion, and policy implications.

Outreach Comments

Ongoing funded research on flood resilience. Strong engaged connections through partnerships with practitioner communities and boundary spanning organizations/institutions (CaRDI/WRI/OEI at Cornell; Hudson River Estuary Program, CCE & EDEN in field). Active participants in campus (the Einaudi Center Working Group on Disasters) and national (new CONVERGE affiliated COVID-19 group on extreme weather events) research

This effort is part of a collaboration with the Hudson River Estuary Program. This collaboration includes planned workshops with local government agencies and community organizations to interpret and disseminate results. While such plans are currently on hold in 2020, we intend to hold these meetings when conditions permit, in person or remotely as appropriate. These partnerships establish a foundation for disseminating results and working with agencies involved in risk management to interpret findings and translate them into policies to address public health and flood risk concerns

Student Training

Sarah Alexander is a PhD student in the graduate field of Development Sociology. She has been a fully integrated team member through all phases of the project to date. Sarah made major contributions to qualitative analysis and questionnaire design up to the day before her parental leave commenced in December 2019. She also obtained coaching as she prepared to present findings at conferences and is a co-author on forthcoming publications related to this work. She has rejoined the project team as of summer 2020 as she finished her dissertation work.

Conference Presentations

- April 10, 2019, Robin Blakely-Armitage and David Kay –"Resources & Connections: Flooding, Risk Perception and Community Resiliency", Presented at Cornell Cooperative Extension System Conference 2019: Seeds of Change, April 10, 2019.

- April 15, 2019, Sarah Alexander –"Flood Risk and Resilience: Moving the Needle on Research and Outreach", Presented at the National Sustainability Summit, Tampa.

- July 12, 2019, David Kay –"What CARDI is learning about community and individual responses to the changing risks of flooding", Presented at the UN's High Level Political Forum on Sustainable Development, NYC.

- August 9, 2019, Sarah Alexander –"Flood Risk Awareness and Concern in the Hudson River Valley", Presented at the 2019 Rural Sociological Society Annual Meetings, Richmond, Virginia.

Additional final reports related to water resource research are available at http://wri.cals.cornell.edu/news/research-reports

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Appendix

Survey Instrument (finalized early 2020)