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## *The Socioeconomic Implications of Changing Flood Risk in the Hudson/Mohawk Watersheds: Phase II, 2018*

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*Photo: John Carl D'Annibale, Albany Times Union, 1/8/18*

## Abstract

This project seeks to provide valuable insights to inform local outreach strategies around flood risk, adaptation and mitigation. The multi-phase, multi-year project includes developing a better understanding of (1) the dimensions of flood *risk* in a estuarine system – critical with climate change related impacts, (2) how *perceptions* of flood risk are related to adaptation and mitigation strategies, (3) how *responses* to risks vary from one community to another, and (4) how varying perceptions of risk should inform/influence outreach strategies at the local level. The work to date has been focused on our central goal of developing an understanding of the social landscape of flood risk and risk perception in the target cities -- honing in on Troy, NY as our initial in-depth point of exploration. The 2018 work included four focus groups and several interviews in Troy, strengthening our campus-based flood risk working group, presentations at conferences and workshops, the organization of a state-wide conference at Cornell focused on flood risk and community resiliency, two publications, and the development of a set of preliminary survey questions for implementing in the next phase of the project in 2019.

## Three Summary Points of Interest:

- Based on our work to date, we find that perception of, as well as concern about, flood risk may be influenced by: sociodemographic factors, past flood experience, consultation of different information sources, exposure to other risks, established measure of flood exposure, and trust in local institutions and information sources.
- Based on our work to date, we find that the decision to move/migrate as a response to flooding (along with taking other flood risk mitigation actions) may be mediated by: factors that affect risk mitigation behaviors (purchasing insurance, home modifications, etc); perceived flood risk and flood concern; the relative salience of flood risk relative to other risks, past experience of floods; collective social capital, capacity and networks; trust in institutions; and the cost, difficulty, and/or opportunity cost of taking action.
- Based on our work to date, and moving forward, we expect to find a relationship between housing status (owner, renter), and encounters with the flood insurance system to influence flood risk perception and concern. We seek to better understand whether insurance purchase is a response to risk concern or an event that fosters risk perception or concern.

## Keywords

Flood risk, resiliency, flood risk outreach, flood insurance, climate migration, risk perception, flood adaptation, flood mitigation

## Policy implication statement

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

*(note: This project builds on prior work, therefore our introduction remains similar to last year's)*

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 (HREP) confirm that they currently have few resources and even less relevant research-based information to offer their constituencies on this subject. 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).

## 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,

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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

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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) (UNFCCC, 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

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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. Our research examines these and the above-mentioned dimensions of risk and response in the state of New York.

## Our Contribution

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 initial 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.

This is an on-going project with the Cornell Water Resources Institute and the Hudson River Estuary Program. Last year’s Phase I exploratory work focused on our central goal of developing an understanding of the social landscape of flooding risk and perception, and implications for outreach by the Hudson River Estuary Program and others. In addition to continuing this exploration in Phase II in 2018 with focus groups and interviews, we developed a set of survey questions intended to measure community member awareness, attitudes, knowledge, behavior and practices pertaining to flood risk.

## Methods

In 2018 we held four focus groups (two in May, two in September) with residents of the City of Troy. In addition, several interviews with experts in the areas of flood insurance and resiliency planning were conducted. We hired Rev.com to transcribe the recordings of the focus group dialogues.

Another key focus in our Phase II work in 2018 was the design of modules and questions for a possible survey to be implemented the following year. HREP signaled interest in developing flood resiliency

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outreach programming in Troy in the near future. In order to measure the impact of any single or sustained programming intervention, it is ideal to have a pre and post intervention comparison. Based on our focus groups, interviews, literature review, and other research, we have developed a set of survey questions intended to measure community member awareness, attitudes, knowledge, behavior and practices pertaining to flood risk. While initially attentive to Troy, possible adaptation for use in other communities could also be considered.



## Results & Discussion

The information gathered in the focus groups, interviews, additional literature review and other research, builds upon prior findings, underscoring the importance of several key topical areas:

- Flood exposure
  - FEMA map category
  - Past flood experience
- Housing status: resident homeowner, renter, landlord
  - Commercial property owners
- Flood insurance
  - whether respondent has flood insurance
  - type, level of coverage
  - Experiences with flood insurance: requirement or cost as impediment to buying or selling property
- Relationships with government
  - Personal experience with government actions
  - Level of trust in government
  - Relationships with agencies and organizations like HREP
- Individual or household attributes
  - Demographics
  - Education
  - income levels
- Community attributes
  - economic, demographic conditions
  - housing availability, condition, affordability

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- presence, strength, spread of membership in community organizations
- Outcomes
  - Awareness/concern
    - Awareness of information about flood risk
    - Salience of flood risk relative to other concerns
  - Individual or household actions
    - structural changes on home
    - moving
    - intentions around doing these in the future
  - Opinions on possible government interventions around flooding

## Policy Implications

Intended general outcomes are increased awareness, especially within groups already concerned with climate change and/or long term planning, of the potential significance of dislocation and climate induced migration on individuals in at risk communities, on different community neighborhoods, and on the communities as a whole. In recent years there have been numerous articles in the popular press which point to the intersecting environmental, social and economic challenges experienced by communities due to climate change-related flooding (e.g., "My Drowning City is a Harbinger of Climate Slums to Come" (Eubanks, 2016); "When Rising Seas Transform Risk into Uncertainty" (Jarvis, 2017); "Where should you live to escape the harshest effects of climate change?" (Bromwich, 2016). Indeed, these stories highlight the disproportionately negative impacts borne by people of lower socioeconomic status, the dilemmas facing fiscally

stressed local governments, and the often constrained set of options available to residents and policymakers alike. We anticipate the incorporation of new insights on perception around climate risks, dislocation and migration to be incorporated into education, community planning, and emergency response procedures and plans.

## Cornell's Flood Resiliency Working Group

The Cornell flood resiliency group (FRWG) is a collection of academic faculty, staff, graduate students and outreach professionals interested in learning from each other's work in on flood risk and community resiliency in New York State. The group represents a variety of fields, including development sociology, engineering, urban planning, natural resources, and landscape architecture to examine the interdisciplinary nature of flood risk, adaptation, mitigation, and associated issues. The connection with this group has been valuable to the WRI/HREP project, has informed our methods, our framing of issues, and connections to local partners.

The FRWG continued to meet in 2018, with meetings organized by the CaRDI project team. Two working group members presented on their work (Shorna Allred, Natural Resources and Brian David, Landscape Architecture) in February and May, respectively. We then turned our focus to planning the October *Community Development Institute*, a collaboration involving many of the working group members (see more detail below). This project team, including WRI and HREP staff, were a core component of this effort.

## Student Training

In addition to working with Erin Fenton during the summer months, for the past two years we have had

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the benefit of working with Cornell graduate student Sarah Alexander (Department of Development Sociology, PhD candidate). Sarah has been instrumental in researching background documents, organizing focus groups, analyzing results, conducting interviews, developing survey questions, writing project updates, and has represented the project team in many other capacities.

## Publications

CaRDI worked with a WRI intern (Erin Fenton) during the summer of 2018. In order to probe perceptions of climate and weather-related risk and influences on relocation or migrations plans, Lindy Williams had included several questions in the 2016 Cornell National Social Survey (CNSS). We worked with Erin to analyze the survey data, focusing on three of those survey questions:

1. Do you think the climate (or the overall pattern of weather) where you live now is something that increases or decreases the quality of life in your community?
2. What level of influence do you think weather or climate-related issues could have on whether you move to a new location over the next ten years?
3. What type of weather or climate-related factors would be the most likely to cause you to move away from your current residence?

Based on the survey data analysis, the following publication was produced: [\*Perceptions of Risk and Behavior: Climate Change & Weather-Related Relocation\*](#) CaRDI Research & Policy Brief Series, Issue 82/ November 2018. By Erin Fenton, David Kay & Robin Blakely-Armitage.

## Conferences & Presentations

In June, David Kay & Robin Blakely-Armitage presented on this WRI-funded work at the National Association of Community Development Extension Professionals annual meeting in Cleveland, Ohio: [\*The Uneven Social Landscape of Flood Risk: Implications for Outreach & Decision-Making.\*](#)

In October, David Kay and Brian Rahm presented *Flood Risk & Resiliency – Cornell University Resources for NYS* at the *Upstate Inspired: Connecting Planners, Creating Places*, Annual Upstate NY Chapter American Planning Association conference, Ithaca NY, October 5, 2018.

A major effort in 2019 CaRDI and WRI partnered to host the [\*2018 Community Development Institute, Flood Risk & Community Resiliency\*](#) October 11-12, on Cornell's campus. Pre-institute coverage appeared in the Cornell Chronicle. The event featured presentations from researchers, practitioners, policymakers and others from New York State, focused on topics such as policy responses, collaborative strategies, financing resilience, tools and technical resources, outreach strategies, climate change communication, and examples of community-based flood risk research. Over 100 people attended, and the majority of the FRWG members were presenters and/or moderators. The partnerships with WRI and HREP on this project and other efforts were invaluable to the success of this conference.

## Future Focus and Next Steps

As part of our work in Phase II in 2018, we developed a set of survey questions intended to more fully explore and measure community member awareness, attitudes, knowledge, behavior and

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practices pertaining to flood risk. The survey was developed initially to provide baseline information for HREP in advance of commencing outreach programming in Troy, but 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 HREP programming, b) provide information that would be useful in guiding initial implementation of planned HREP programming efforts, and c) serve as the core of an instrument that could be used for program evaluation purposes in future years to determine how HREP interventions might have affected the attitudes, knowledge, etc. of different kinds of city residents.

We have received funding for 2019 to implement this survey. We proposed surveying *both* Troy and Kingston during 2019. This will allow 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 HREP 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.

Our survey will consist of a random sample of households across both cities. Addressing concern from HREP that surveys have been employed in Kingston in two of the last three years, it should be emphasized that we will be surveying a

representative sample of *residents*, not city officials in their formal roles. Because this is a *sample*, it is unlikely that the same residents would be surveyed in multiple cases.

We are currently collaborating with HREP as we finalize the survey instrument with Cornell's Survey Research Institute, and will prepare a final report based on the survey results in late 2019. The appendix of this document contains a DRAFT version of our survey. Please note that this survey not only addresses the key issues of interest to us and HREP (flood risk exposure, awareness and perception of flood risk, trust and reliance on local government and non-governmental organizations for information about flood risk), but we are also interested in attachment to place, past/current/anticipated adaptation and mitigation strategies, such as moving/migration, and the potential impacts of migration on sending and receiving communities. The following list represents a broader set of research questions that we seek to answer in this project and through other complementary efforts:

1. How does past experience of floods influence intentions to move away? [For within community or outside community, or both?]
2. How does perceived flood risk AND flood concern influence intentions to move away?
3. How do these influences rank relative to other factors that influence moving decisions?
4. What factors affect other mitigation behaviors (purchasing flood insurance, making home additions or modifications...)
5. What are overall levels and ranges of perceived risk of flooding? (of one's own home, one's neighborhood, the city overall)

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

7. How does perception of flood risk (and flooding concern) relate to (spatially distributed) measures of flood exposure? (past flooding, FEMA maps, etc.)

8. Do housing status (owner, renter) or encounters with the flood insurance system mediate the effects of other variables on flood risk perception and flooding concern?

9. Do people who express different levels of concern about flooding (or perceived flood risk) consult different sources of information about flooding and other concerns?

10. How does concern about flood risk rank relative to other concerns?

11. To what extent are residents of neighborhoods with low flood exposure open to or concerned about in-migration of people from flood-affected neighborhoods?

12. How do respondents tend to rank different potential interventions aimed at reducing flood risk or impacts? (e.g. wall, artificial wetlands, buy-outs...)

13. How do socioeconomic and demographic attributes, levels of trust in government and environmental organizations, experience of flooding, and other factors shape support for intervention overall and for particular interventions?

The survey will not only be valuable to HREP's efforts and contribute to our growing understanding of flood risk perceptions and actions, but will serve as an important first step, as a "proof of concept," in laying the foundation for similar analyses and work in communities throughout the Hudson River Valley. We will seek additional funding from other sources (ex. NYS Sea Grant) to expand on this work in the future.

After finalizing the survey instrument in consultation with HREP and conducting pre-testing, we plan to implement the survey in mid-late summer of 2019. Data will be cleaned, coded and delivered by fall and we will begin analysis at that time. We will meet with HREP staff after preliminary, pilot findings are available, to discuss and decide on additional analyses of interest. We propose writing and publishing a *Research & Policy Brief* in collaboration with HREP staff based on some of the survey findings. We will work with our campus-based flood risk working group to explore preliminary findings as well. We will work with HREP staff to develop a brief report on potential implications of the survey findings for outreach programming and to identify further areas of focus.

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

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### *Literature Cited*

- Bayoh, I., E.G. Irwin, and T. Haab. 2006. "Determinants of Residential Location Choice: How Important Are Local Public Goods in Attracting Homeowners to Central City Locations?" *Journal of Regional Science* 46(1):97–120.
- Bickers, K.N., L. Salucci, and R.M. Stein. 2006. "Assessing the Micro-Foundations of the Tiebout Model." *Urban Affairs Review* 42(1):57–80.
- Bonanno, G.A. 2005. "Resilience in the Face of Potential Trauma." *Current Directions in Psychological Science* 14(3):135–38.
- Brewer, N.T., G.B. Chapman, F.X. Gibbons, M. Gerrard, K.D. McCaul, N.D. Weinstein. "Meta-analysis of the relationship between risk perception and health behavior: the example of vaccination." *Health Psychology* 26 (2), 136.
- Bromwich, J. 2016. Where should you live to escape the harshest effects of climate change? *New York Times*, October 20, 2016. <https://www.nytimes.com/2016/10/20/science/9-cities-to-live-in-if-youre-worried-about-climate-change.html>
- Cullen, J.B. and S.D. Levitt. 1999. "Crime, Urban Flight, and the Consequences for Cities." *The Review of Economics and Statistics* 81(2):159–69.
- De Jong, G.F. and R.R. Sell. 1977. "Population Redistribution, Migration, and Residential Preference." *Annals of the American Academy of Political and Social Science* 429(1):130–144.
- Eiser, J. R., Bostrom, A., Burton, I., Johnston, D. M., McClure, J., Paton, D., van der Pligt, J. & White, M. P. (2012). Risk interpretation and action: A conceptual framework for responses to natural hazards. *International Journal of Disaster Risk Reduction*, 1, 5-16.
- Eubanks, V. (2016). My Drowning City is a Harbinger of Climate Slums to Come. *The Nation*, August 29, 2016. <https://www.thenation.com/article/low-water-mark>
- Francisco, H. (2008). Adaptation to Climate Change: Needs and Opportunities in Southeast Asia. *ASEAN Economic Bulletin*, 25(1), 7-19.
- Fussell, E., Hunter, L. M., & Gray, C. L. (2014). Measuring the Environmental Dimensions of Human Migration: The Demographer's Toolkit. *Global Environmental Change : Human and Policy Dimensions*, 28, 182–191.
- Goldhaber, M.K., P.S. Houts, and R. Disabella. 1983. "Moving after the Crisis." *Environment and Behavior* 15(1):93–120.
- Halek, M. and J.G. Eisenhauer. 2001. "Demography of Risk Aversion." *Journal of Risk and Insurance* 68(1):1–24.
- Hipp, J.R., G.E. Tita, and R.T. Greenbaum. 2009. "Drive-bys and Trade-ups: Examining the Directionality of the Crime and Residential Instability Relationship." *Social Forces* 87(4):1777–812.
- Hunter, L.M. 2005. "Migration and Environmental Hazards." *Population and Environment* 26(4):273–302.
- Hunter, L. M., J. K. Luna, and R. M. Norton. 2015. Environmental Dimensions of Migration, *Annual Review of Sociology* 41:377–97.

## Title

IPCC (Intergovernmental Panel for Climate Change). (2001). "Climate Change: Impacts, Adaptation and Vulnerability". Contributions of Working Group II to the 3rd Assessment Report of the IPCC.

Iwama, Allan Yu, Batistella, Mateus, Ferreira, Lúcia da Costa, Alves, Diogenes Salas, & Ferreira, Leila da Costa. (2016). Risk, Vulnerability, and Adaptation to Climate Change: An Interdisciplinary Approach. *Ambiente & Sociedade*, 19(2), 93-116. <https://dx.doi.org/10.1590/1809-4422ASOC137409V1922016>

Janz, B. 2008. "The Terror of the Place: Anxieties of Place and the Cultural Narrative of Terrorism." *Ethics, Place and Environment* 11(2):191–203.

Jarvis, B. 2017. "When Rising Seas Transform Risk into Uncertainty." *New York Times*, April 18, 2017, <https://www.nytimes.com/2017/04/18/magazine/when-rising-seas-transform-risk-into-certainty.html>

Kahneman, D. 2011. *Thinking, Fast and Slow*. Farrar, Straus and Giroux.

Kay, D., C. Geisler and N. Bills. 2010. Residential Preferences: What's Terrorism Got to Do with It? *Rural Sociology* 75(3), 2010, pp. 426–454

Kunreuther, H., R. Meyer, R. Zeckhauser, P. Slovic, B. Schwartz, C. Schade, M.F. Luce, S. Lippman, D. Krantz, B. Kahn, and R. Hogarth. 2002. "High Stakes Decision Making: Normative, Descriptive and Prescriptive Considerations." *Marketing Letters* 13(3):259– 68.

Leiserowitz, A. "Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values." *Climate Change* 77 (1-2), 45-72.

Little, S. 2006. "Twin Towers and Amoy Gardens: Mobilities, Risks and Choices." Pp. 121–33 in *Mobile Technologies of the City*, edited by M. Sheller and J. Urry. New York: Routledge.

Low, S. 2003. *Behind the Gates: Life, Security and the Pursuit of Happiness in Fortress America*. New York: Routledge.

Lu, M. 1999. "Do People Move When They Say They Will? Inconsistencies in Individual Migration Behavior." *Population and the Environment* 20(5):467–88.

McClelland, G.H., W.D. Schulze, and B. Hurd. 1990. "The Effect of Risk Beliefs on Property Values: A Case Study of a Hazardous Waste Site." *Risk Analysis* 10(4):485–97.

McGhee, D. 2017. Were the post-Sandy Staten Island buyouts successful in reducing national vulnerability? Nicholas School of the Environment, Duke University MS.

McLeman, R. A. and Hunter, L. M. (2010), Migration in the context of vulnerability and adaptation to climate change: insights from analogues. *WIREs Clim Change*, 1: 450–461.

Mueller, J., J. Loomis and A. González-Cabán. 2009. "Do Repeated Wildfires Change Homebuyers' Demand for Homes in High-Risk Areas? A Hedonic Analysis of the Short- and Long-Term Effects of Repeated Wildfires on House Prices in Southern California." *Journal of Real Estate Finance and Economics* 38:155–72.

Myers, C.A., T. Slack, and J. Singelmann. 2008. "Social Vulnerability and Migration in the Wake of Disaster: The Case of Hurricanes Katrina and Rita." *Population and Environment* 29:271–91.

## Title

- National Research Council. 2015. Affordability of National Flood Insurance Program Premiums Report 1, National Academies Press, Washington, D.C.
- New York State Sea Level Rise Task Force Report to the Legislature. 2010. See [http://www.dec.ny.gov/docs/administration\\_pdf/slrffinalrep.pdf](http://www.dec.ny.gov/docs/administration_pdf/slrffinalrep.pdf)
- Newman, P. and T. Hogan. 1981. "A Review of Urban Density Models: Toward a Resolution of the Conflict between Populace and Planner." *Human Ecology* 9(3):269–303.
- Palsson, A. 1996. "Does the Degree of Relative Risk Aversion Vary with Household Characteristics?" *Journal of Economic Psychology* 17:771–87.
- Petersen, W. 1958. "A General Typology of Migration." *American Sociological Review* 23:256–266.
- Regoeczi, W.C. 2002. "The Impact of Density: The Importance of Nonlinearity and Selection on Flight and Fight Responses." *Social Forces* 81(2):505–30.
- Reich, J. 2006. "Three Psychological Principles of Resilience in Natural Disasters." *Disaster Prevention and Management* 15(5):793–98.
- Rofe, Y. 1984. "Stress and Affiliation: A Utility Theory." *Psychological Review* 91(2):235–250.
- Rosenzweig, C. 2012. Updated climate projections to ClimAid. Responding to Climate Change in New York State: Synthesis Report. Columbia Center for Climate Systems Research. 2012.
- Runge, C.F., M.T. Duclos, J.S. Adams., B. Goodwin, J.A. Martin, R.D. Squires, and A.E. Ingerson. 2000. "Public Sector Contributions to Private Land Value: Looking at the Ledger." Pp. 41–62 in *Property and Values: Alternatives to Public and Private Ownership*, edited by C. Geisler and D. Daneker. Washington, DC: Island Press.
- Sheppard, B., G.J. Rubin, J.K. Wardman, and S. Wessel. 2006. "Terrorism and Dispelling the Myth of a Panic Prone Public." *Journal of Public Health Policy* 27(3):219–45.
- Slovic, P. 1987. "Perception of Risk." *Science* 236 (4799), 280-285.
- Spence, A., Poortinga, W. and Pidgeon, N. (2012), *The Psychological Distance of Climate Change*. *Risk Analysis*, 32: 957–972.
- Stehr, S.D. 2006. "The Political Economy of Urban Disaster Assistance." *Urban Affairs Review* 41(4):492–500.
- Sunstein, C.R. 2003. "Terrorism and Probability Neglect." *Journal of Risk and Uncertainty* 26(2):121–35.
- Sunstein, C.R. and R. Zeckhauser. 2008. *Overreaction to Fearsome Risks*. Harvard University Law School Program on Risk Regulation RWP08–079. Retrieved March 31, 2009 ([http://ksgnotes1.harvard.edu/Research/wpaper.nsf/rwp/RWP08-079/\\$File/rwp\\_8\\_079\\_zeckhauser.pdf](http://ksgnotes1.harvard.edu/Research/wpaper.nsf/rwp/RWP08-079/$File/rwp_8_079_zeckhauser.pdf)).
- Thaler, R. and C. Sunstein. 2008. *Nudge*. Yale University Press.
- UNFCCC, (United Nations Framework for Climate Change Convention). (2006). *Technologies for Adaptation to Climate Change*. Adaptation,

**Title**

Technology and Science Programme of the UNFCC Secretariat.

UNISDR – UNITED NATIONS OFFICE FOR DISASTER RISK REDUCTION. (2009). Global Assessment Report on Disaster Risk Reduction: Risk and poverty in a changing climate. Geneva, Switzerland: UNISDR.

Wolpert, J. 1966. "Migration as an Adjustment to Environmental Stress." *Journal of Social Issues* 22(4):92–102.